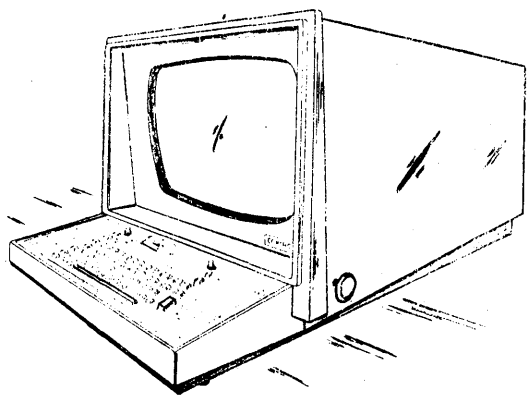
CONTROL DATA®

DISPLAY STATION

CC505-A,B



- General Description
- Operation and Programming
- Installation and Checkout
- Theory of Operation
- Diagrams
- Maintenance
- Maintenance Aids

CONTROL DATA CORPORATION

HARDWARE REFERENCE/CUSTOMER ENGINEERING MANUAL

DISPLAY STATION
CC505-A,B
HARDWARE REFERENCE/CUSTOMER ENGINEERING MANUAL

SECTIONS IN THIS MANUAL:

Section I —— General Description
Section II —— Operation and Programming
Section III —— Installation and Checkout
Section IV —— Theory of Operation
Section V —— Diagrams
Section VI —— Maintenance
Section VII —— Maintenance Aids

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back of this book

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Display Station

CC505-A, B

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B-0-0	Reprinted with Revision (11-26-68)
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FOREWORD

CONTROL DATA Equipments CC505-A and CC505-B are modularized Entry and Display Stations (referred to hereafter as Display Stations) which provide basic data inquiry and retrieval functions.

Visual aids included in this manual are signal waveforms and a Display Station schematic diagram containing important signal waveforms and voltage levels. These provide the trained customer engineer with a useful tool.

The only difference between the two Display Stations is the input power requirement; Type A requires 105- to 125-volt ac, 47- to 400-hertz, 1.25-ampere power and type B requires 210- to 250-volt ac, 47- to 400-hertz, 0.63 ampere power.

This manual contains information necessary for operating and maintaining the Display Station. There are seven sections as follows.

Section I, General Description — gives the functional and operational description, physical description, and electrical data.

Section II, Operation and Programming — lists all operating controls, operating procedures, and programming information.

Section III, Installation and Checkout — describes crating and uncrating, physical limitations, power requirements, cabling and connectors, cooling requirements, environmental considerations, mounting procedures, test procedures, and specific checkout instructions.

Section IV, Theory of Operation — presents general and detailed functional descriptions of the equipment.

Section V, Diagrams — contains all applicable schematic and interconnection diagrams.

Section VI, Maintenance — provides maintenance, troubleshooting, parts removal and installation procedures, and repair instructions.

Section VII, Maintenance Aids — contains card placement charts, circuit card diagrams, fuse data, timing charts, and a list of common malfunctions with possible causes and corrections.

For parts information on the Display Station, refer to the following publication:

CC505-A,B
Display Station
Parts Data Book
Publication No. 82128800

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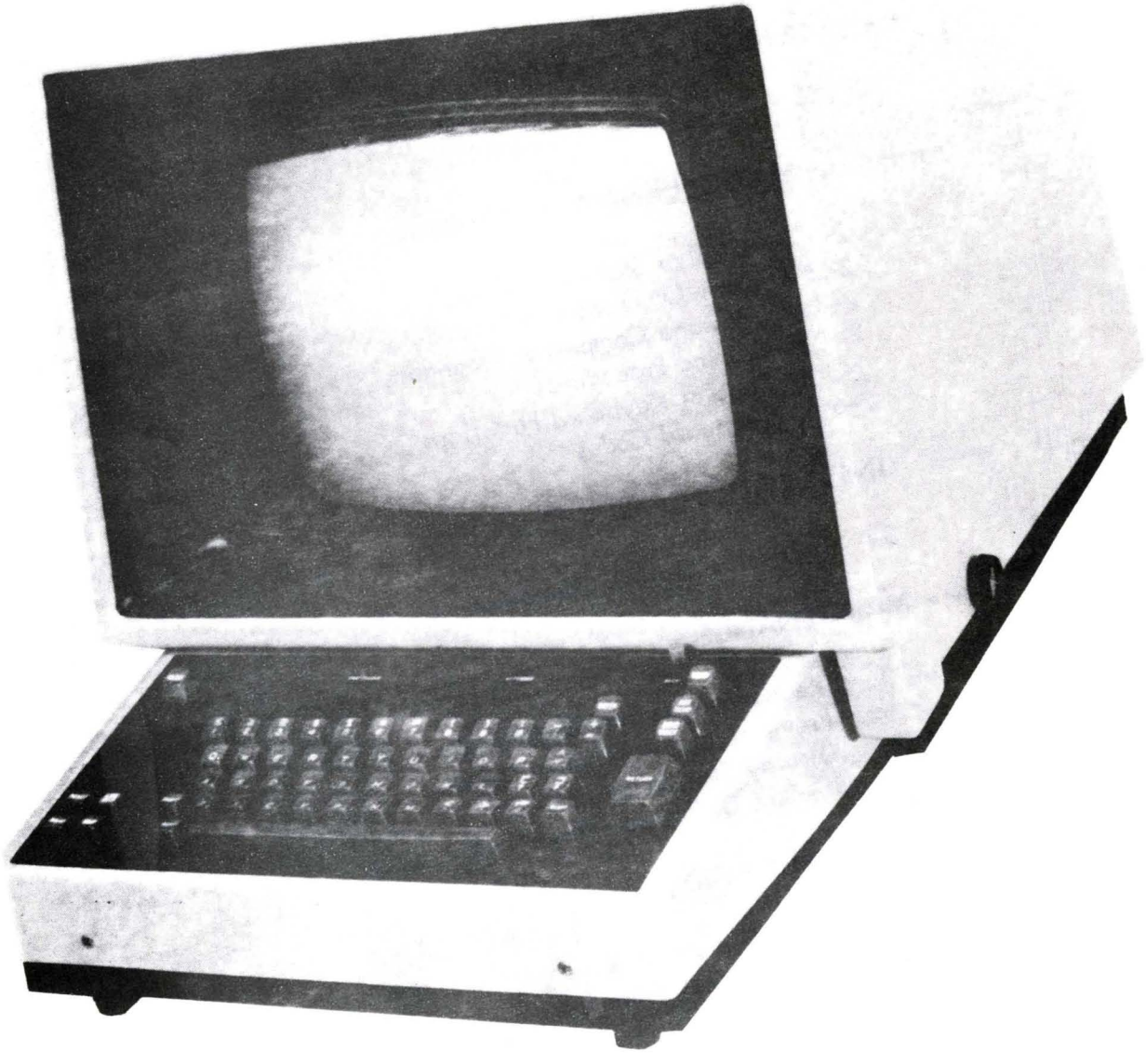


Figure 1-1. Display Station

SECTION I

GENERAL DESCRIPTION

The Display Station described herein provides basic data inquiry and retrieval functions in a remote terminal configuration. Figure 1-1 shows the Display Station.

The Display Station is composed of two main assemblies. An alphanumeric keyboard assembly enters data into the system and controls its destination. The monitor assembly contains deflection circuitry, voltage-generating circuitry, and a crt for visual display of the keyboard-generated data. Any response from the central processing site (data source) is also displayed. Remote-site processing logic, symbol-generating logic, and a display memory are contained in the Equipment Controller.

Display screen data is refreshed at a rate greater than 50 cycles per second. Symbol intensity, adjustable by the operator, is sufficient for viewing under normal lighting conditions. The crt has a diagonal measurement of 14 inches with a nominal 6-inch-high by 8-inch-wide viewing area. Viewing area and symbol size adjustments may be made within the Display Station. Symbol size is normally 0.25 inches high by 0.12 inches wide.

Display format (an Equipment Controller function mentioned here only for reference) is either 20 lines of 50 symbols per line or 13 lines of 80 symbols per line.

FUNCTIONAL DESCRIPTION.

The following description refers to Display Station application in a remote terminal configuration. Equipment Controller functions are explained, where necessary, to clarify Display Station operation.

Depressing a keyboard key transmits a 7-bit symbol code to the Equipment Controller. The code for each symbol selected on the keyboard is stored in the Display Station buffer memory and the symbol is displayed on the crt.

As a message is composed, an entry marker appears where the next symbol is to be displayed. The entry marker forms part of the underline chain which appears

as a broken line across the crt. As the entry marker advances across the crt, the underline chain decreases in length. The underline chain indicates how much typing remains on that line. Both the entry marker and the underline chain, therefore, are useful for message composition, editing, error correction, etc.

Once a message is complete, the operator may transmit either the entire message or a selected portion thereof by using one of two methods. In block mode of operation, the entire message content transmits to the data source (under control of the data source) when the SEND key is depressed. This causes the symbol (Δ) to appear at the current entry marker position and the entry marker to reset to the upper left corner of the crt. As each word is read by the data source, the entry marker advances until it reaches the symbol (Δ). The entry marker stops one symbol position to the right of this point. In line mode, the line indicator denotes which line of information begins transmission. In this mode of operation, the entry marker, instead of being reset to the upper left corner of the crt, is reset to the beginning of the line indicated by the line indicator. Transmission then takes place as in block mode except that transmission begins from the line indicated by the line indicator.

Depress the AUX SEND key to obtain a printed copy of the displayed message. This results in the display of the symbol (') at the current entry marker position. The entry marker then resets to the upper left corner of the crt. Data transmission begins at the upper left corner of the crt and ceases when the entry marker reaches the end of print symbol ('). The keyboard locks out during this operation.

ENVIRONMENTAL DATA.

The Display Station is situated on top of the Equipment Controller next to the control panel. For specified performance, observe environmental limitations listed in table 1-1.

TABLE 1-1. ENVIRONMENTAL CONDITIONS

CONDITION	OPERATIONAL (Normal, Standby, and Maintenance)	NONOPERATIONAL (Transit and Storage) (Note 1)
Temperature	+65 F to +100 F	-65 F to +160 F
Relative Humidity	40 to 60%	10 to 90% (Note 2)
Altitude	8,000 feet	12,000 feet

Note 1 — packed for shipment.

Note 2 — includes condensation in the form of moisture or frost.

PHYSICAL DESCRIPTION.

Physical construction of the Display Station incorporates latest recognized features in engineering, convenience, and safety to operating personnel. The unit is 17-3/4 inches wide, 28-1/2 inches deep, and 16-5/8 inches high and it weighs 80 pounds.

The exterior consists of a crt screen for data viewing and a keyboard consisting of control keys for command signals and data entry.

Each of the assemblies in the Display Station is interchangeable without major readjustment. Analog circuits may need to be readjusted after replacement of circuit cards or components. All parts bearing the same manufacturer's part number are electrically, mechanically, and functionally interchangeable. The unit is designed and constructed to permit ready access to all modules and to have a normal service life of at least 10 years, operating 24 hours a day, 7 days per week, with reasonable maintenance and replacement of parts.

ELECTRICAL DATA.

Two types of Display Stations are available. One model requires 105- to 125-volt ac, 47- to 400-hertz, 1.25-ampere power. The other model requires 210- to 250-volt ac, 47- to 400-hertz, 0.63-ampere power. Nominal heat dissipation is 465 Btu per hour.

SECTION II
OPERATION AND PROGRAMMING

This section explains all Display Station operator controls. Display Station keyboard functions and data inquiry procedures explained in this section refer to the use of the Display Station in a typical remote terminal configuration. Equipment Controller functions are explained, where necessary, to clarify Display Station operation. Section VI, Maintenance, explains maintenance adjustments.

CONTROLS.

NOTE

The ON/OFF/INTENSITY control disables the SHIFT key but does not disable any lower case symbols or functions. The characters are stored in memory but are not displayed on the Display Station crt.

The ON/OFF/INTENSITY control (on the lower right side of the Display Station) applies power to the Display Station. Further rotation adjusts symbol intensity. Actuation of Display Station keyboard keys enters data into the Equipment Controller and classifies whether a displayed message is intended for printout or data source. Table 2-1 explains Display Station controls. Figure 2-1 shows the keyboard configuration.

TABLE 2-1. DISPLAY STATION CONTROLS

NAME	TYPE	FUNCTION
CLEAR	Key	Clears all data from the crt and Equipment Controller memory; resets entry marker and line indicator to upper left corner of crt.
RESET	Key	Resets entry marker to upper left corner of the crt; does not affect data.
LINE SKIP	Key	Advances entry marker to the beginning of the next line; does not affect data or the line indicator.

TABLE 2-1. DISPLAY STATION CONTROLS (CONT)

NAME	TYPE	FUNCTION
SHIFT	Key	Puts keyboard in uppercase mode while depressed.
BKSP	Key	Causes entry marker to move back one symbol position without affecting data at that position.
SKIP	Key	Advances entry marker one symbol position without affecting data at that position.
REPT	Key	Continuously writes a selected symbol on the display when the REPT key and a symbol key are depressed simultaneously. If a function key is depressed along with the REPT key, the function will be repeated with the exception of RESET, AUX SEND, SEND, CLEAR, and INT.
SPACE	Key	Advances entry marker one symbol position, storing a space code at that position.
RETURN	Key	Inserts carriage return code and symbol (-), and advances entry marker to beginning of next line. All data to the right of the symbol is erased from the crt and display memory.
SEND INDEX	Key	Advances the line indicator to the next line without affecting data or the entry marker. This key is not used in the block mode.
AUX SEND	Key	Output to a printer can be initiated at the Display Station by depressing the AUX SEND key. An E2 code is sent into display memory and the associated symbol (') is displayed at the current entry marker position. The entry marker then resets to the upper left corner without affecting data.
INT	Key	Allows operator to intervene during on-line operation. Communication between the Equipment Controller and data source is interrupted, the keyboard is released, and the operator can begin a new operation.

TABLE 2-1. DISPLAY STATION CONTROLS (CONT)

NAME	TYPE	FUNCTION
SEND	Key	Depressing the SEND key initiates a condition allowing the transmission of a displayed message, or a portion thereof, to the data source. If the block mode of operation is used, an E1 code is inserted into the display memory and the associated symbol (Δ) appears at the current entry marker position. The entry marker then repositions to the upper left corner of the crt. This begins the transmission of the displayed data which continues until an E1 code is reached. In line mode, where the line indicator is used, an E1 code is inserted into the display memory when the SEND key is depressed and the symbol (Δ) appears at the current entry marker position. Transmission then takes place as in block mode with the exception that, upon completion of on-line operation, the line indicator and entry marker are repositioned to the beginning of the next line.
ALERT	Indicator/ Pushbutton	In the attended mode, an alert message activates the ALERT indicator and audible alarm. The ALERT audible alarm may be turned off by depressing the ALERT indicator/pushbutton or the SEND key. The ALERT audible alarm is not activated again until another alert message is received. In unattended mode, the ALERT audible alarm is deactivated.
ATTENDED/ UNATTENDED	Switch and Indicator	Controls the remote terminal response to an alert message. The ALERT audible alarm can be activated only while the ATTENDED/ UNATTENDED switch is in the ATTENDED position. The UNATTENDED indicator is illuminated when a reply to the read message is received. This indicator is deactivated by switching the ATTENDED/UNATTENDED switch to the ATTENDED position.
ON/OFF INTENSITY	Switch and Potentiometer	Controls application of power to the Display Station. Further rotation increases crt display intensity.

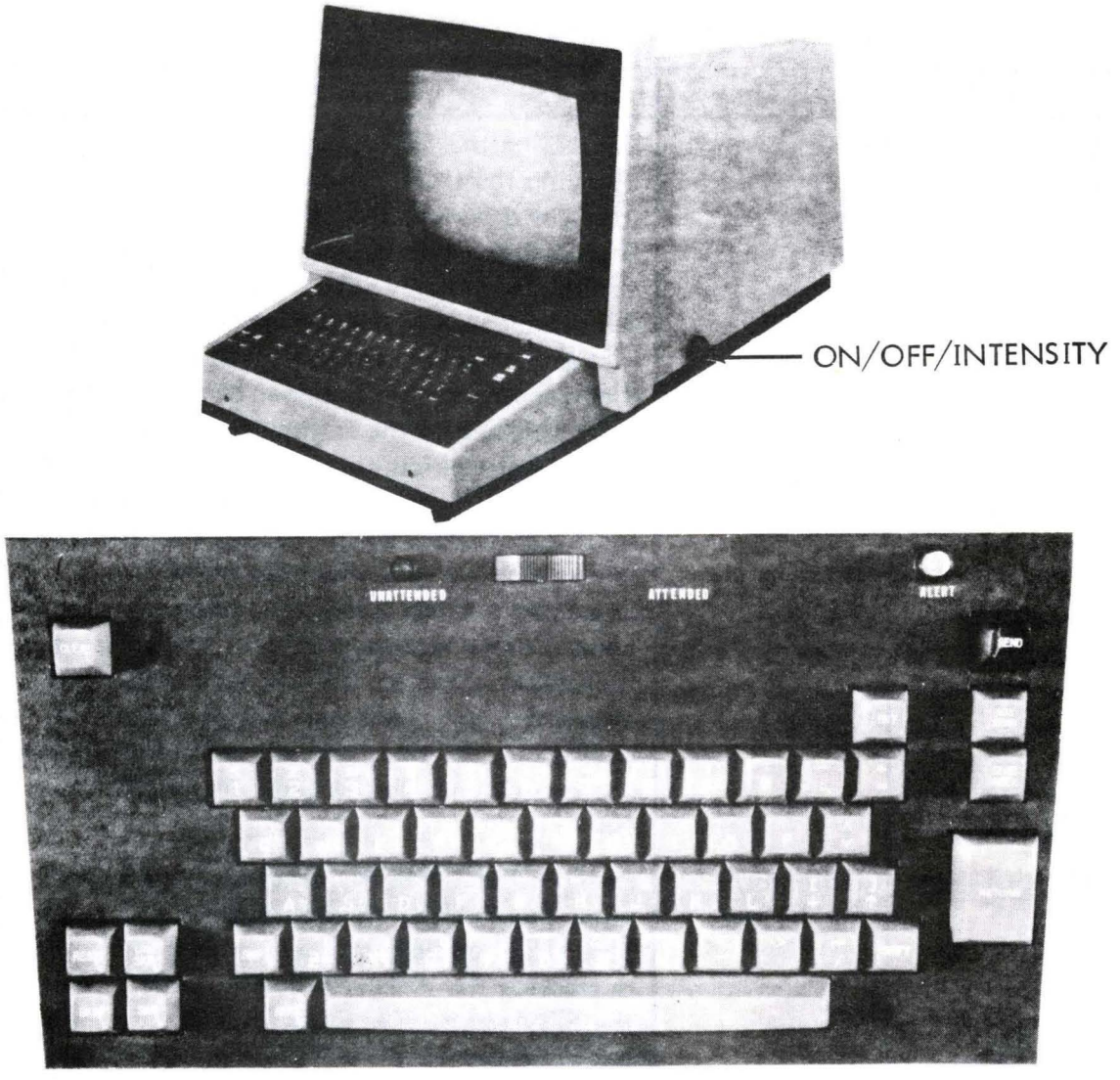


Figure 2-1. Display Station and Keyboard

KEYBOARD LOCKOUT.

The keyboard is inoperable (locked out) during the following operations.

(1) SEND key has been depressed and the desired type of write message has not been received for display on the crt.

(2) Receipt of a write message ending with an E2 or E3 code and a write message designated for display on the crt has not been received.

(3) SEND key is depressed when the ATTENDED/UNATTENDED switch is in the UNATTENDED position.

The keyboard may be unlocked by (1) depressing the INT key which unlocks the keyboard immediately after the next write/acknowledge message sequence (unless the message ends with an E2 code), (2) depression of the MAN REL switch in the Equipment Controller, and (3) operation of the ATTENDED/UNATTENDED switch to ATTENDED position after a formal unattended mode.

OPERATING PROCEDURES.

Following paragraphs explain Display Station turn-on/turn-off, message composing, and editing procedures, and special keyboard functions.

TURN ON/TURN OFF.

Turn-on/turn-off procedures are listed in table 2-2.

TABLE 2-2. TURN-ON/TURN-OFF PROCEDURES

PROCEDURE	OPERATION
Turn On	Rotate the ON/OFF/INTENSITY control to the ON position. After a 30-second warmup period, rotate the ON/OFF/ INTENSITY control until the marker chain, located on the upper data line, is visible.
Turn Off	Rotate the ON/OFF/INTENSITY control to the OFF position.

MESSAGE COMPOSING.

Table 2-3 lists the recommended procedure for composing a message.

TABLE 2-3. MESSAGE COMPOSING PROCEDURE

STEP	OPERATION	DESCRIPTION
Compose	Compose a message by depressing various symbol keys on the keyboard.	Each key depression causes its associated code to be sent to the display memory which causes the symbol to be displayed on the crt at the current entry marker position.

MESSAGE EDITING.

Table 2-4 lists the associated editing procedures used in composing a message.

TABLE 2-4. EDITING PROCEDURES

STEP	OPERATION	DESCRIPTION
Reset	Depress RESET key.	The entry marker repositions to the upper left corner of the crt. Data is not affected by this operation.
Return	Depress RETURN key.	A carriage return code is sent to the display memory and a carriage return symbol (⌐) is displayed at the current entry marker position. The underline chain then moves to the next line. All data from the carriage return symbol to the end of the line is erased.
Line Skip	Depress LINE SKIP key.	The underline chain moves to the next line. In effect, a carriage return operation is performed without display of a carriage return symbol. Remaining data on the line is not erased.
Shift	Depress SHIFT key.	When two symbols share a key, depressing the SHIFT key enables the upper symbols. The SHIFT key has no effect on single-symbol keys.
BKSP	Depress BKSP key.	Depressing the BKSP key causes the entry marker to move back one symbol position. Data is not affected by this operation.
Skip	Depress SKIP key.	Depressing the SKIP key advances the entry marker one symbol position. If the entry marker is at the end of a line, it repositions to the beginning of the next line. If the entry marker is at the end of the last line, it repositions to the first symbol position of the first line of data. Data is not affected by this operation.

TABLE 2-4. EDITING PROCEDURES (CONT)

STEP	OPERATION	DESCRIPTION
Rept	Depress REPT key.	The REPT key is used in conjunction with other keys. It initiates repeated action. All keys work with REPT except RESET, AUX SEND, CLEAR, and INT. All keys repeat at the same rate except LINE SKIP, SEND INDEX, and RETURN, which repeat at a slower rate.
Space	Depress Space bar.	Depressing the Space bar sends a space code to the display memory at the current entry marker position. The previous symbol is erased in memory and on the crt and the entry marker advances one position.

SPECIAL KEYBOARD FUNCTIONS.

Table 2-5 lists special keyboard functions used in conjunction with other keyboard controls.

TABLE 2-5. SPECIAL KEYBOARD FUNCTIONS

STEP	OPERATION	DESCRIPTION
Send Index	Depress SEND INDEX key.	Operator controls the position of the line indicator with the SEND INDEX key. Each depression causes the line indicator to advance one line and, upon reaching the last line, to reposition it back to the first line. The entry marker is not affected.
Aux Send	Depress AUX SEND key.	Operator initiates message printout by depressing the AUX SEND key. An E2 code is sent to the display memory and the associated symbol (') is displayed at the current entry marker position. The underline chain then resets to the upper data line without affecting data. The line indicator is not used. Data then transfers from the display memory

TABLE 2-5. SPECIAL KEYBOARD FUNCTIONS (CONT)

STEP	OPERATION	DESCRIPTION
		to the printer memory; this transfer begins at the upper left corner and ends at the E2 code. The keyboard locks out at this time.
Int	Depress INT key.	Depressing the INT key aborts any automatic read or print communications between the data source and the Equipment Controller. Communications are interrupted at a certain point in their sequence. The keyboard is released after the abort occurs.
Send	Depress SEND key.	Depressing the SEND key sets a condition allowing transmission of a displayed message to the data source. An E1 code is sent to the display memory and its associated symbol (Δ) is displayed at the current entry marker position. The underline chain resets to the upper data line. If the line indicator is used, the underline chain repositions to the data line preceding the line indicator. Data transfers with the entry marker advancing one symbol position at a time. Transfer terminates at the E1 symbol.
Alert	Indicator lights and alarm sounds upon receipt of an alert message.	Upon receipt of an alert message from the data source, the ALERT light and audible alarm are activated. Depressing the ALERT pushbutton or the SEND key deactivates the alarm. Depressing the SEND key disables the ALERT light. The ALERT audible alarm is not activated again until another alert message is received.
Attended/ Unattended	Depress ATTENDED/ UNATTENDED switch.	In the unattended mode, the ALERT light and audible alarm are disabled. The ATTENDED/UNATTENDED switch controls the remote terminal response

TABLE 2-5. SPECIAL KEYBOARD FUNCTIONS (CONT)

STEP	OPERATION	DESCRIPTION
		to an alert message. Placing the switch in the ATTENDED position enables the ALERT light and audible alarm. Placing the switch in the UNATTENDED position disables the ALERT audible alarm and indicator. Placing the switch in the ATTENDED position also deactivates the UNATTENDED indicator. In the UNATTENDED position, an alert message causes a pseudo setting of the SEND key. This transmits a single data word read message (ending in code E1) to the data source in response to a poll.
Clear	Depress CLEAR key.	Depressing the CLEAR key removes all data from the display memory and the crt.

KEYBOARD CODES.

Table 2-6 lists keyboard codes associated with the Display Station. The first column lists the symbol and the second column lists the associated code.

TABLE 2-6. KEYBOARD CODES

SYMBOL OR FUNCTION	CODE
A	61
B	62
C	63
D	64
E	65
F	66
G	67

TABLE 2-6. KEYBOARD CODES (CONT)

SYMBOL OR FUNCTION	CODE
H	70
I	71
J	41
K	42
L	43
M	44
N	45
O	46
P	47
Q	50
R	51
S	22
T	23
U	24
V	25
W	26
X	27
Y	30
Z	31
1	01
2	02
3	03
4	04
5	05
6	06
7	07

TABLE 2-6. KEYBOARD CODES (CONT)

SYMBOL OR FUNCTION	CODE
8	10
9	11
0 (Zero)	12
=	13
≠	14
≤	15
%	16
[	17
Space	00
/	21
]	32
, (Comma)	33
(	34
↱	35
≡	36
- (Minus)	40
^	37
v	52
$	53
*	54
↑	55
↓	56
>	57
+	60
<	72
. (Period)	73

TABLE 2-6. KEYBOARD CODES (CONT)

SYMBOL OR FUNCTION	CODE
)	74
≥	75
▮ (Parity Error)	76
;	77
:	20
- (Carriage Return)	101
Δ (Send)	102
' (Aux Send)	140

SECTION III

INSTALLATION AND CHECKOUT

This section contains crating and uncrating instructions, physical limitations, power requirements, cabling information, cooling requirements, environmental considerations, and mounting procedures for installation. This section also contains test procedures, initial starting procedures, and checkout information.

CRATING INSTRUCTIONS.

Place the prefabricated base on a table and place a 4-foot by 8-foot section of 4-mil polyethylene over the base. With the hood removed, place the monitor unit in the base over the plastic sheet. Remove the magnetic shield from the crt and place it in a plastic bag and seal it. Now put the shield in front of the black heat sink of the deflection assembly. Cut a suitable section of polyethylene foam and place over the printed circuit cards on the deflection and secure the foam with filament tape to the chassis. Place a wooden form over the crt base and strap it to the chassis. Fasten the crt base to the wooden base with masking tape. Cut slots in the plastic sheeting at the four corners of the base and run copolymer strapping under the base at the rear of the chassis and around the chassis and base, directly under the face of the crt. Place the hood on the unit. Coil the power cord in 6-inch loops and secure with tape. Place the cord against the rear panel and pull up the polyethylene sheet to cover the whole unit and secure with tape. Make up cardboard carton and place over monitor and base, taking care not to knock off any external controls; ie, ON/OFF/INTENSITY switch or the fuse located in the rear of the unit. Use copolymer strapping to hold cardboard carton to the base. Refer to figure 3-1.

UNCRATING INSTRUCTIONS.

Remove all packing materials and keep them if reshipment is anticipated. Ascertain that an electromagnetic shield has been packed and also the five analog cards. As mentioned above in the crating instructions, the crt is shipped with the Display Station. Check the crt to make sure it has arrived in good condition. Ascertain that all mounting hardware is securely fastened. Remove the crt socket

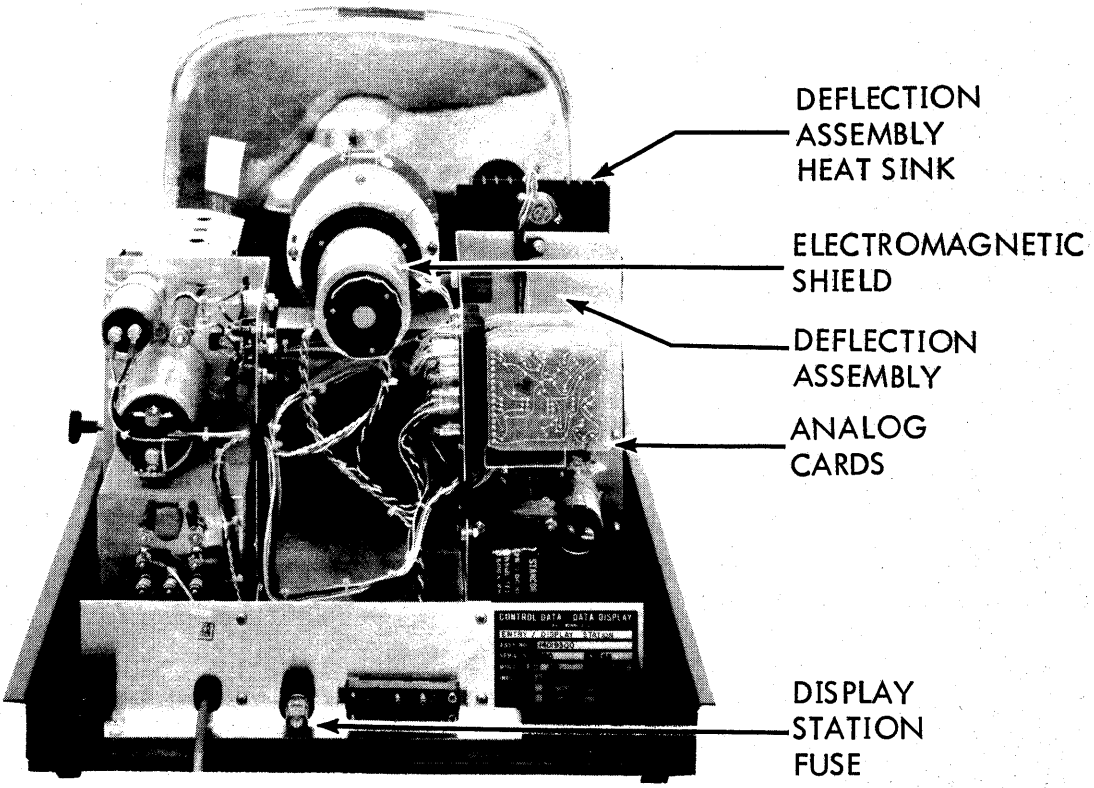


Figure 3-1. Display Station Interior View

and install the electromagnetic shield. The shield is in place when the end is flush with base of crt yoke. Replace crt socket. Check the fuseholder to see if it contains a 2-ampere slo-blo fuse.

CAUTION

Place the ON/OFF/INTENSITY control in the OFF position before connecting power to the Display Station to prevent damage to the crt phosphor.

Refer to figure 3-1 when following uncrating instructions. Install the cards according to the following procedure using figure 3-2 as a reference.

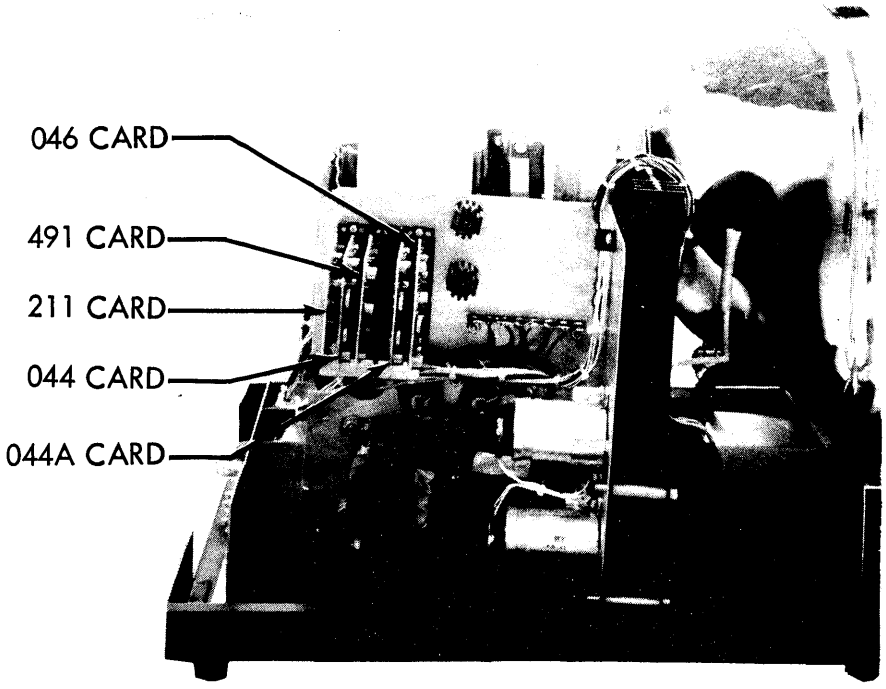


Figure 3-2. Display Station Card Location

NOTE

Refer to Section VI of this manual for card adjustment procedures.

(a) Plug the 491 card (voltage regulator) into jack location J2B.

(b) Plug the 046 card (diddle amplifier, pulse shaper) into jack location J1A.

(c) Plug the 044A card (vertical deflection) into jack location J1B.

(d) Plug the 044 card (horizontal deflection) into jack location J3A.

(e) Plug the 211 card (video amplifier) into jack location J3B.

Plug the a-c power cord into a convenience wall outlet. There is a Display Station available for either 115-volt operation or 230-volt operation. Power is applied through the fuse at the rear of the Display Station and the ON/OFF/INTENSITY switch at the right side.

POWER REQUIREMENTS.

One Display Station requires 105- to 125-volt, single-phase, 1.25-ampere, 60-hertz power. The other Display Station requires 215- to 240-volt, single-phase, 0.63-ampere, 50-hertz power.

CABLING.

Table 3-1 lists Display Station connector pin numbers and the signal carried on each wire. The cable consists of four coaxial lines and 21 twisted-pair wires. Unlisted pin numbers are not used.

TABLE 3-1. DISPLAY STATION CONNECTOR

PIN NO.	SIGNAL
1	Data Bit 2^0
2	Data Bit 2^1
3	Data Bit 2^2
4	Data Bit 2^3
5	Horizontal (Coaxial Line)
7	Vertical (Coaxial Line)
8	Data Bit 2^4
9	Data Bit 2^5
10	Data Bit 2^6
11	Clear
12	Strobe
13	Repeat
14	Function Strobe
15	Send Index
16	Interrupt
18	Ground

TABLE 3-1. DISPLAY STATION CONNECTOR (CONT)

PIN NO.	SIGNAL
19	Ground
20	Ground
21	Ground
22	Ground
23	Ground
24	Alarm Disable
25	Alert Light
26	Attended/Unattended Light
27	Attended/Unattended Switch
34	Alert Audible Alarm
38	Video (Coaxial Line)
40	Diddle (Coaxial Line)

COOLING REQUIREMENTS.

There are no special cooling requirements for the Display Station. It is designed to operate at room temperature. Refer to table 1-1.

ENVIRONMENTAL CONSIDERATIONS.

There are no special environmental conditions to consider when installing the Display Station.

CHECKOUT.

To start the Display Station, follow the procedures listed below to ensure that the Display Station will not be damaged and that it is operating properly. Equipment Controller power must be on.

(a) Ensure that a 2-ampere fuse is in the fuseholder located at the rear of the Display Station.

(b) Ensure that the ON/OFF/INTENSITY switch is in the OFF position.

(c) Check to see that the five analog cards are in their proper locations.

(d) Apply power to the Display Station by turning the ON/OFF/INTENSITY switch to the ON position.

(e) Rotate the ON/OFF/INTENSITY switch clockwise until the entry marker is visible.

(f) Depress the CLEAR key to clear all data from the display memory and crt. This resets the underline chain to the upper data line of the crt.

SECTION IV

THEORY OF OPERATION

The Display Station is a modularized computer communication device consisting of a keyboard and a crt. The keyboard provides a means of entering data into the equipment and controlling its destination. The monitor assembly provides a means of displaying data from the Equipment Controller or the data source through the Equipment Controller. Figure 4-1 is a block diagram of Display Station functions. Refer to Section V for the Display Station interconnection diagram.

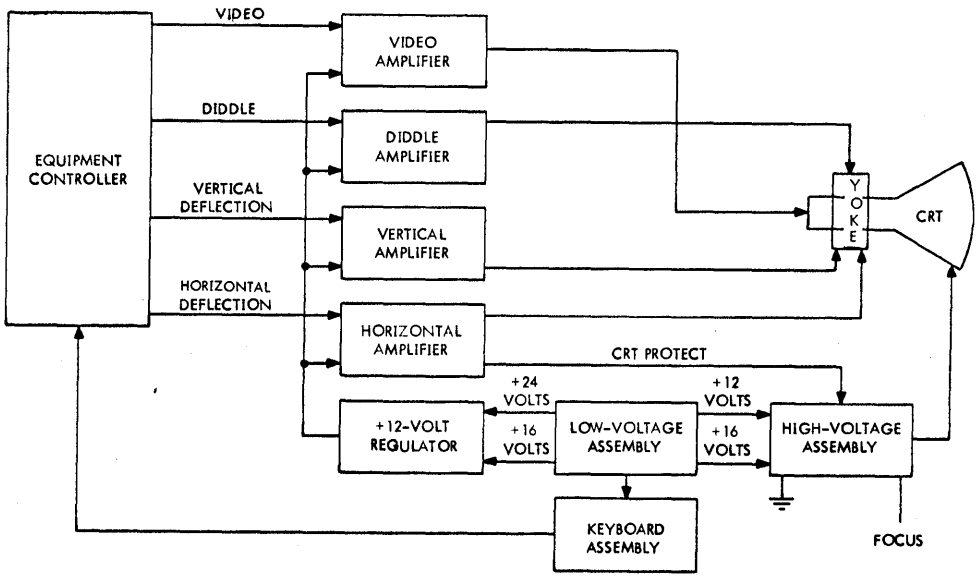


Figure 4-1. Display Station Block Diagram

MONITOR ASSEMBLY.

Deflection signals and a video signal from the Equipment Controller are the monitor deflection assembly inputs. Deflection assembly outputs vary the magnetic field of the yokes on the crt to position the crt electron beam. A high-voltage assembly generates voltages necessary for intensity control, crt post accelator, and focus and screen electrodes. A low-voltage assembly generates low-potential voltages necessary for the deflection assembly, high-voltage assembly, crt filament, and the keyboard assembly.

CATHODE RAY TUBE.

The Display Station contains a 14-inch rectangular, electromagnetically-deflected crt. Changing the magnetic field of a two-section yoke, located on the neck of the crt, positions the crt beam. Pulses applied to the crt cathode unblank the beam. The yoke closest to the front of the crt controls horizontal and vertical beam positioning. Horizontal signals generate a yoke current ramp during the time the crt beam makes one horizontal trace. A vertical yoke current ramp moves the crt beam down one line at the end of each horizontal trace. The yoke at the rear of the crt places a vertical sawtooth (diddle pulses) on the horizontal sweep. The two sections of the yoke are necessary because diddle pulses occur at a much higher frequency than horizontal and vertical signals.

LOW VOLTAGE.

The Display Station low-voltage assembly supplies a-c voltage to the crt filaments and d-c voltage to the high-voltage assembly, deflection assembly circuit cards, final yoke driving amplifiers, and Display Station keyboard relays. A voltage regulator card, final amplifiers, and associated circuitry in the low-voltage assembly regulate the +12-volt d-c voltage. Refer to figure 5-4.

Power input to the low-voltage assembly is 120 volts, 60 hertz, 3 wire, single phase, through a 2-ampere fuse located at the rear of the Display Station and the ON/OFF switch on the right side of the Display Station. A secondary winding of the low-voltage assembly transformer provides 6.3 volts ac for the crt filament. A +16-volt secondary winding provides current for the high-voltage power supply, keyboard relays, and +12-volt regulator circuitry. A +24-volt input, obtained with an additional secondary winding, is required for +12-volt regulation. The 491 voltage regulator card, final amplifiers in the deflection assembly, and associated circuitry in the low-voltage assembly regulate card voltage.

NOTE

A Display Station is available which uses a 230-volt, 50-hertz, 3-wire, single-phase power input.

HIGH VOLTAGE.

The Display Station high-voltage assembly is a dc-to-dc converter with a power consumption of approximately 12 watts. The low-voltage assembly provides

input power requirements (+12 volts dc and +16 volts dc). An input is also received from horizontal deflection amplifier card 044 in the deflection assembly. This signal prevents crt electron bombardment damage when the horizontal and vertical sweep signals are absent.

Figure 4-2 is a simplified representation of the high-voltage assembly. Figures 5-1 and 5-7 show more detailed illustrations.

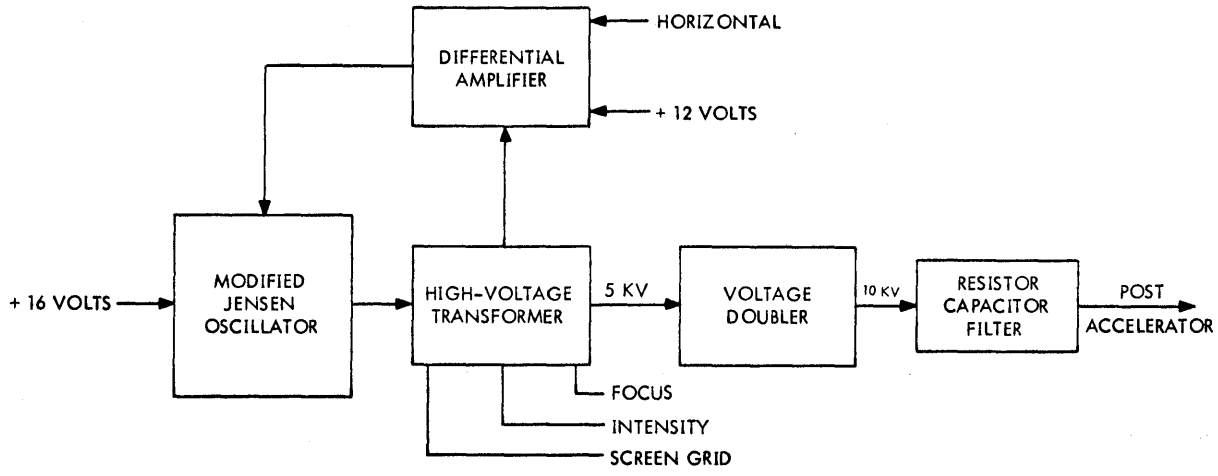


Figure 4-2. High-Voltage Assembly Simplified Block Diagram

The +16 volts dc provides power necessary to begin and sustain oscillations in the Jensen oscillator (R1, Q1, Q2, T2, R2, C1, and R4). Oscillations are maintained by Q3 conduction and the subsequent charging of capacitor C2 to a level of approximately +8 volts. This voltage is felt on Q1 and Q2 collectors through T2 primary. This results in Q1 and Q2 being forward biased with a resulting current flow being felt by saturable transformer T1. With the transformer being wired in a positive feedback manner, the collapsing field (upon reaching saturation) will result in driving Q2 into conduction and shutting Q1 off. The Jensen oscillator, therefore, is kept in operation by the building up and collapsing of the field around T2 and transistors Q1 and Q2 alternately conducting and not conducting. The oscillations continue until capacitor C2 is discharged. A balance pot. adjusts conduction balance for transistors Q1 and Q2; a feedback pot. assures proper transformer saturation. These adjustments are described in Section VI.

Jensen oscillator output is applied to high-voltage transformer T2. Current passes through T2 primary each time Q1 or Q2 conducts and thereby induces 5000 volts into the secondary winding. The secondary is tapped to provide filament voltages for V1 and V2 (part of the voltage doubler circuit), screen-grid and focus voltages, and the input signal for the differential amplifier.

The 550 volts tapped off the secondary is applied directly to the crt for screen grid voltage, and through a series of resistors (one of which is adjustable) for focus control. Focus voltage is adjustable for a range of 60 to 340 volts by R16.

Voltage doubling is accomplished by V1, V2, R12, R13, C5, and C7. R19, C7, and capacitance of the crt coating filter the 10-kv output. R14 is a bleeder resistor to discharge C7 when Display Station power is turned off. As stated previously, the 5000-volt input to the voltage doubler is taken from the secondary of T2. This voltage (in the form of a sine wave) is felt at capacitor C5. Each cycle of the 5-kv signal builds up a constant voltage reference line until 5 kv is reached (figure 4-3).

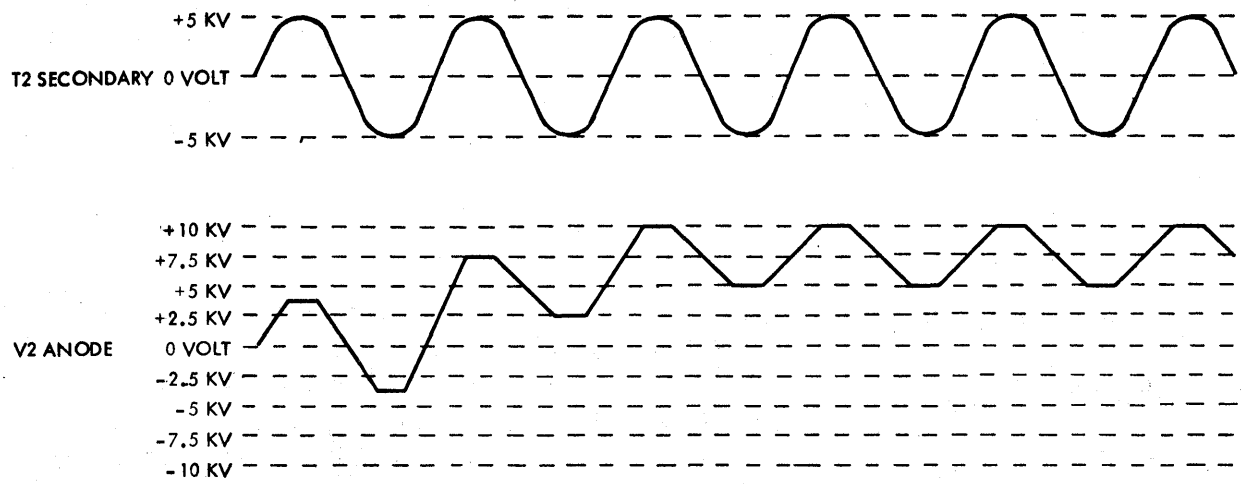


Figure 4-3. Voltage Doubling Steps

A 5-kv signal "rides" on the 5-kv reference line. This stepping action is accomplished by C5, the resistance in the core of transformer T2, and diode V1. The doubling effect takes place in the circuit composed of V2 and C7 in the same manner as the V1 circuit. However, the output of this circuit is 10 kv without a

superimposed signal. R19 and C7 filter out ripple and provide the crt post accelerator with a constant 10-kv source.

A 3-turn winding on transformer T2 senses the flux change of the transformer and feeds this change into the differential amplifier. The flux will vary as the load on the supply changes. The change induces voltage into the differential amplifier. The amplifier senses this voltage change and, in turn, increases or decreases supply voltage to maintain a constant 10-kv output to the post accelerator.

The induced voltage is half-wave rectified by CR5 and filtered by C4. Potentiometer R11 varies this voltage to the base of Q6. This potentiometer is the high-voltage adjustment. Refer to Section VI to make this adjustment.

The differential amplifier consists of transistors Q5 and Q6. CR4 maintains a constant 2.4 volts to base of Q5. Q6 conduction determines Q5 emitter voltage. As Q6 conducts more, the voltage drop across R10 results in increasing emitter/base bias of Q5. The resulting decrease in conduction of Q5 reduces the voltage drop across R9. A direct relationship, then, is established between the 3-turn winding of T2 and the voltage drop across R9.

The voltage dropped across R9 controls Q4 conduction. As voltage across R9 increases, output of Q3 decreases resulting in a less positive potential on capacitor C2. As stated previously, in the explanation of the Jensen oscillator, the charge on C2 determines conduction of oscillator transistors Q1 and Q2.

Loss of horizontal or vertical signals from the Equipment Controller results in crt damage through electron bombardment on the crt face. This happens if high voltage is maintained. R6, R7, C3, CR2, and CR3 are employed to prevent this.

The horizontal amplifier provides a negative signal to CR3. Signal amplitude is sufficient to negatively charge C3. The negative potential provides a reverse bias condition for CR2.

Losing the horizontal signal removes the reverse bias condition of CR2. Removal of this bias drives Q4 to saturation, cuts off Q3, and removes oscillator power.

DEFLECTION.

The deflection assembly (figure 5-3) in the Display Station controls crt beam positioning and unblanking. It contains amplifiers for amplifying and shaping video, horizontal, vertical, and diddle signals received from the Equipment Controller. It also has circuitry for regulating voltages supplied to the amplifiers from the low-voltage assembly. Outputs of the horizontal and vertical amplifiers connect to the yoke toward the front of the crt. Diddle amplifier output feeds into the yoke towards the rear of the crt. Video amplifier output connects to the crt cathode. Figure 3-2 shows 044, 044A, 046, 211, and 491 card locations in the Display Station. Refer to figures 4-4 through 4-8 for card schematic and assembly layout diagrams.

044 Card, Horizontal Deflection Amplifier.

The 044 card is located in jack location J3A. A general description and theory of operation follow. Refer to figure 4-4.

The horizontal amplifier controls the horizontal deflection coil driver which allows a linear sawtooth of current to flow through the horizontal deflection coils. One sawtooth of current through the deflection coils moves the electron beam from the left to right on the display monitor screen. The electron beam returns to the left side of the screen during sawtooth retrace. The 044 card contains horizontal gain and linearity controls for manual adjustment of the current waveform. Procedures for adjusting these controls are in Section VI. The initial sawtooth waveform is supplied to the 044 card from a ramp generator in the Equipment Controller.

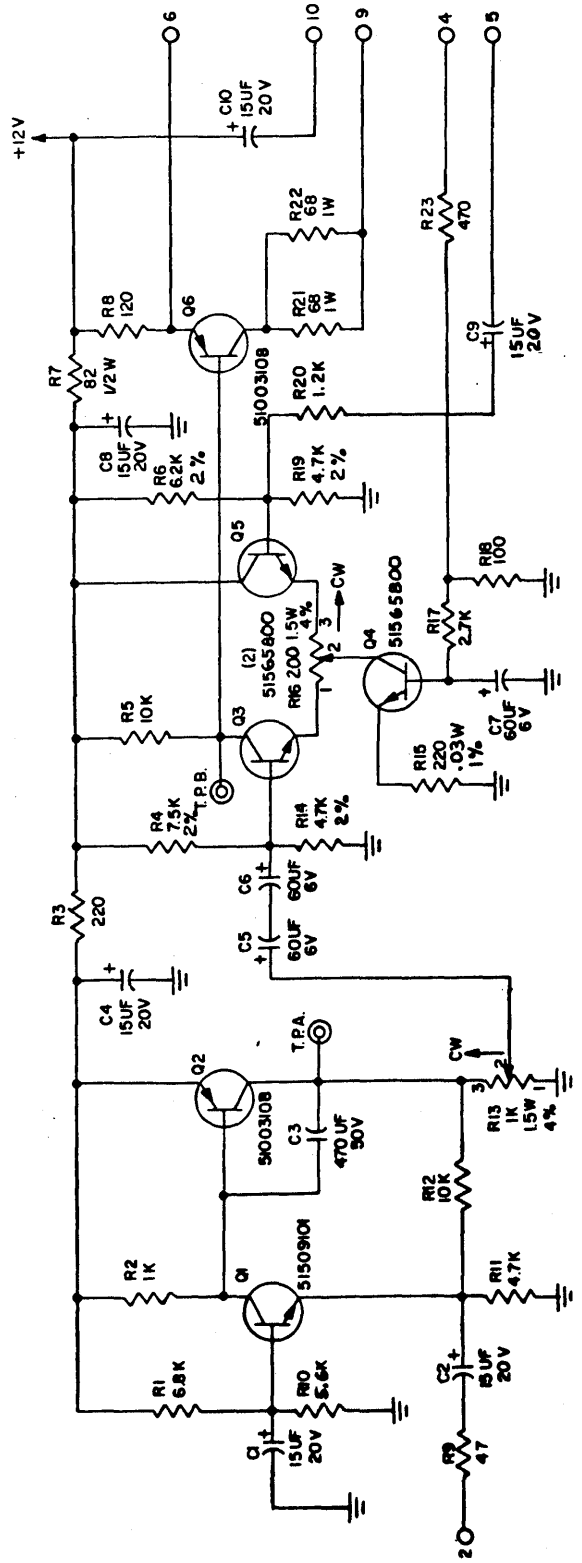
The input at pin 2 is a sawtooth wave with a range of approximately 5 volts. This sawtooth at the emitter of Q1 is amplified and applied to the base of Q2 causing emitter collector current to increase at a ramp rate. Q2 collector current flowing through R13 (horizontal gain control) develops a positive ramp voltage at test point A. Negative feedback from the Q2 collector to the Q1 emitter tends to fix the two-stage amplifier gain.

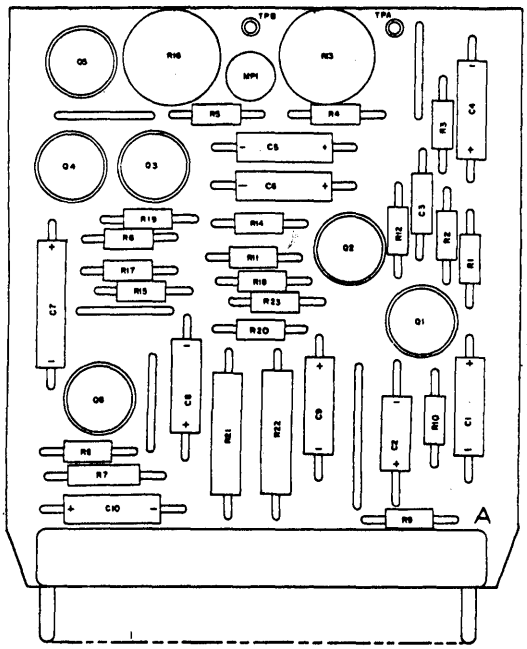
Potentiometer R13 output is coupled into Q3 base, amplified and inverted, and direct coupled to Q6 base from Q3 collector. Q6 is an emitter follower which drives the horizontal deflection coil driver transistor in the deflection assembly. Pin 5 inputs a feedback sawtooth voltage to the 044 card from the deflection assembly.

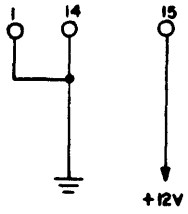
The feedback is required to produce a nonlinear voltage ramp which is needed to give a linear current ramp through the deflection coil. Potentiometer R16 determines the effect feedback will have on the linearity of the output voltage range.

A trapezoid voltage waveform across the deflection coils is required to produce a linear sawtooth of current through the coils. The required trapezoid is produced at Q6 emitter. Q6 is cut off just before the end of retrace and begins to conduct just after the trace begins.

The trapezoid is inverted in the deflection assembly by the deflection coil driver transistor and appears across the deflection coils as a positive trapezoid waveform. The end result is a linear rise of current through the horizontal deflection coils and the electron beam moves across the screen from left to right at a constant scanning rate.

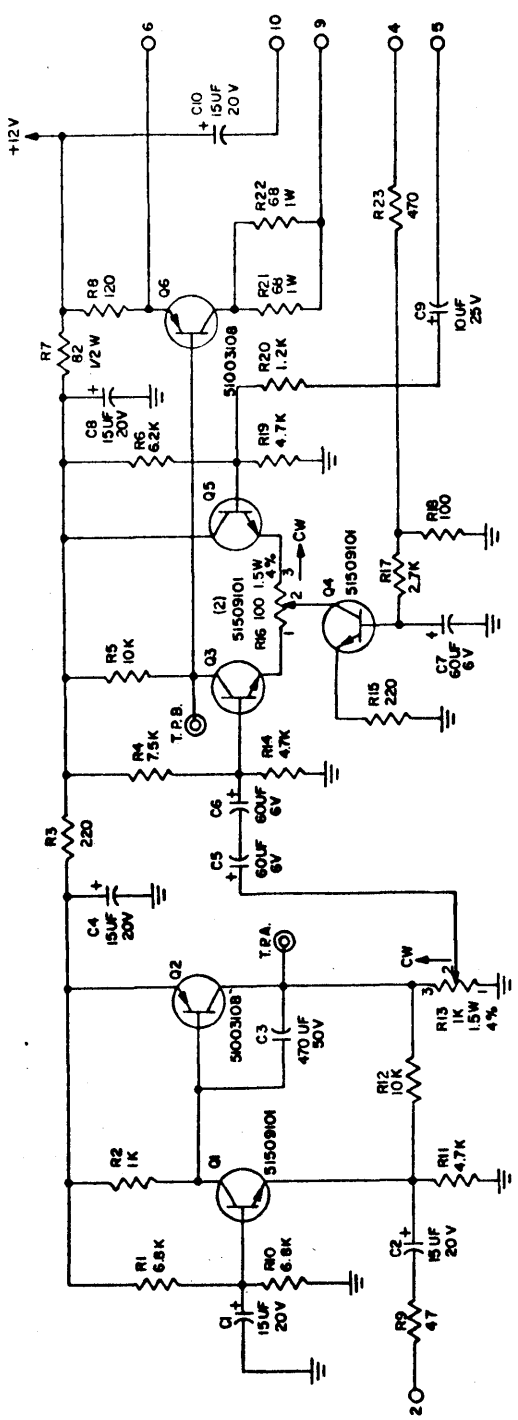


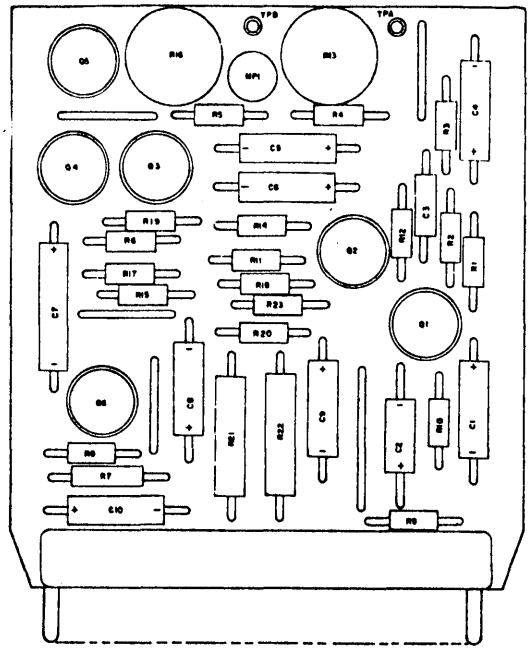


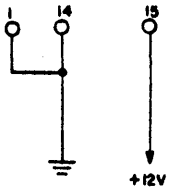


Horizontal Deflection Amplifier

REV. B/B
PART NO. 90000399
CARD TYPE 044 SERIES A







Horizontal Deflection Amplifier

REV. A/A
PART NO. 90000399
CARD TYPE **044**

044A Card, Vertical Deflection Amplifier.

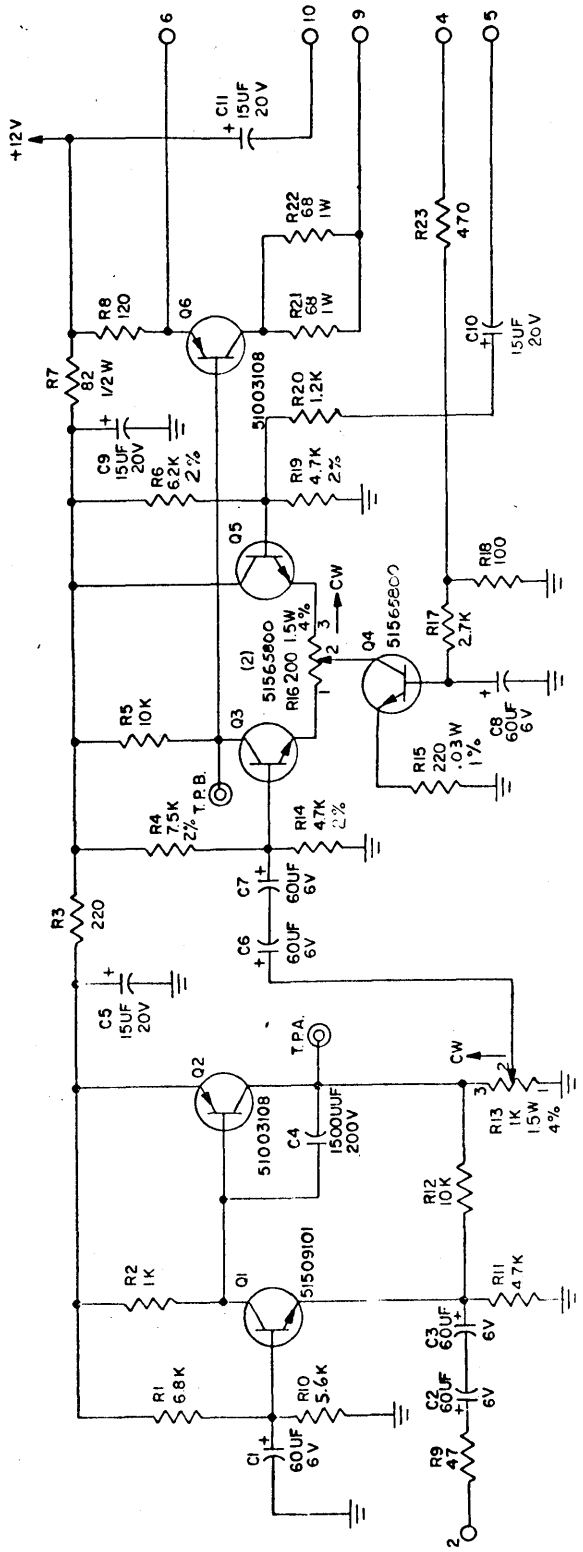
The 044A card is located in jack location J1B. A general description and theory of operation follow. Refer to figure 4-5.

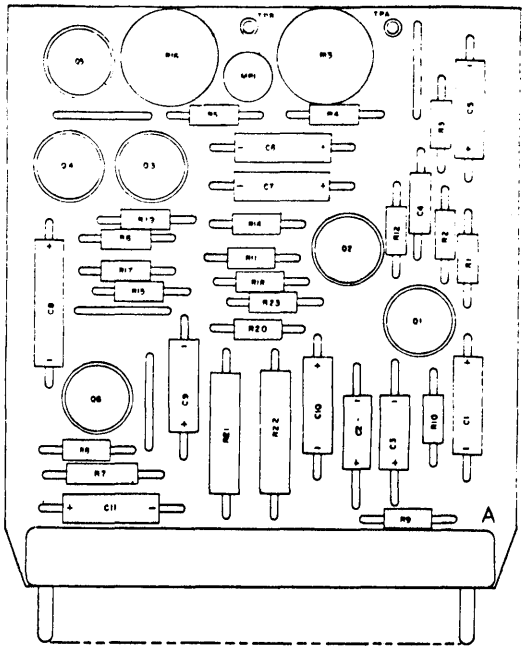
The vertical amplifier controls the vertical deflection coil driver which allows a step ramp current to flow through vertical deflection coils. The ramp current through the coils moves the electron beam down one line at the end of each horizontal line. After a full page, the electron beam repositions at the top of the crt and is ready to trace the next frame. A vertical step current ramp from the Equipment Controller is the 044A card input. The card output drives the vertical deflection coil driver which allows current to flow through the vertical deflection coils.

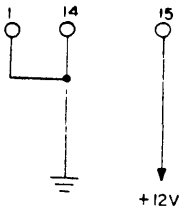
Pin 2 input is a sawtooth wave of approximately 5-volt amplitude coupled to the emitter of Q1. As each step makes Q1 emitter less positive, Q1 conducts more and outputs an amplified staircase causing Q2 emitter collector current to increase and develop a positive staircase voltage across amplitude control R13 at test point A. Negative feedback from Q2 collector to the Q1 emitter tends to keep the vertical step ramp output amplitude constant, thereby compensating for input ramp amplitude variations. Transistor Q3 amplifies and inverts the step ramp and drives emitter follower Q6. Q6 emitter is the 044A card output at pin 6 and is direct coupled to the vertical deflection coil driver transistor in the deflection assembly.

The circuit configuration is comprised of Q3, Q4, and Q5. A different amplifier maintains vertical linearity. Q5 base receives a feedback voltage from the deflection assembly. This feedback produces a nonlinear voltage ramp which provides a linear current ramp through the deflection coil. Potentiometer R16 determines the effect feedback will have on output voltage linearity. Potentiometer R13 is the vertical gain control.

One cycle of step ramp current through the vertical deflection coils, therefore, moves the electron beam one full page and returns the beam to the top of the page to begin the next cycle.

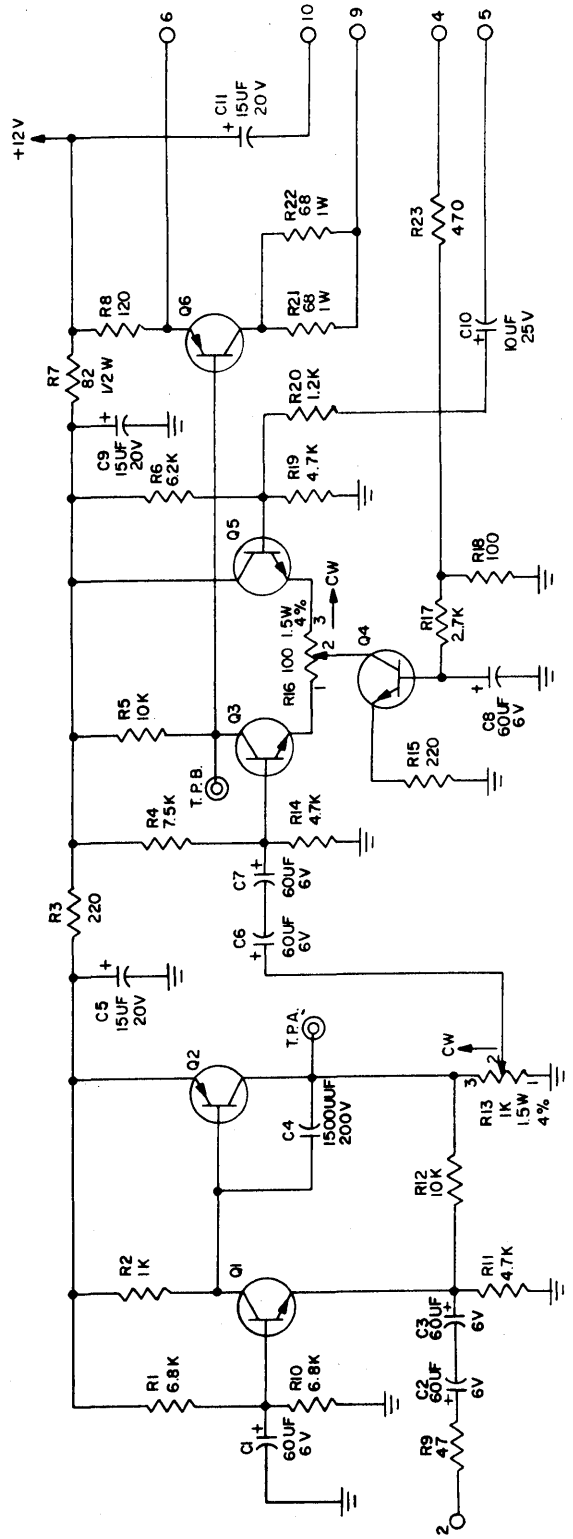


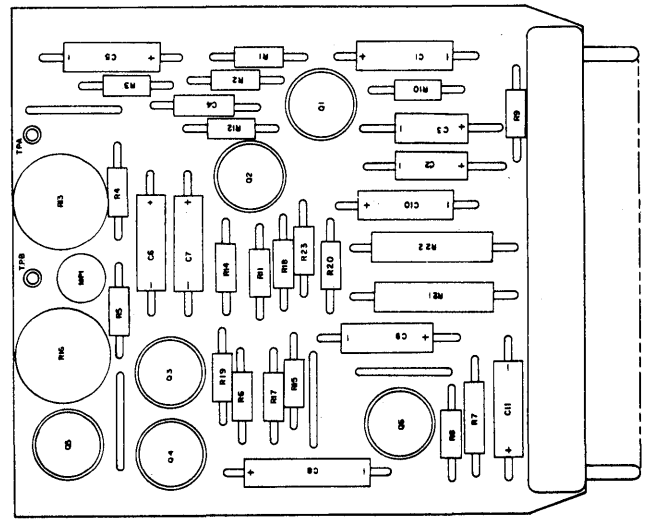




Vertical Deflection Amplifier

REV. B/B
PART NO. 90000402
CARD TYPE 044A SERIES A





Vertical Deflection Amplifier

REV. A/A
PART NO. 90000402
CARD TYPE **044A**

046 Card, Diddle Amplifier and Pulse Shaper.

The 046 card is located in jack location J1A. A general description and theory of operation follow. Refer to figure 4-6.

The diddle amplifier shapes, peaks, and integrates a square waveform from the Equipment Controller and drives a diddle yoke driver transistor. The diddle yoke driver forces a sawtooth current to flow through the diddle yoke coil every 2.4 microseconds. As a result, a sawtooth waveform is impressed on each horizontal line every 2.4 microseconds as the electron beam moves across the crt.

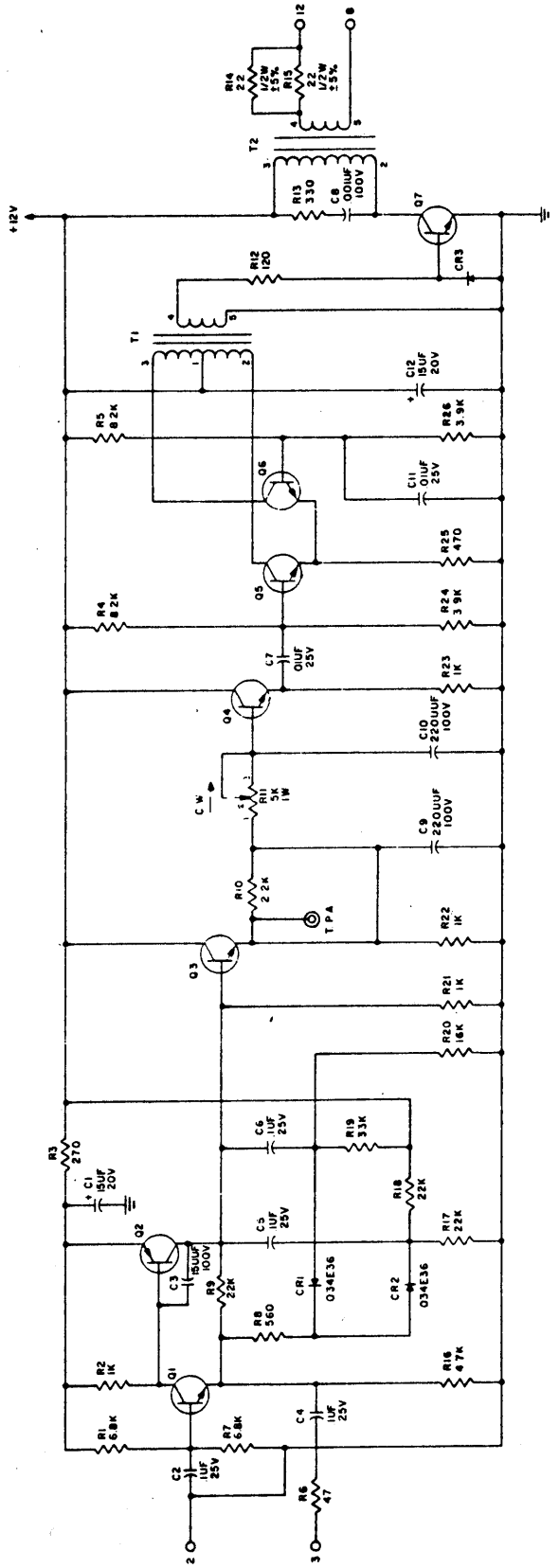
The input to pin 3 of the 046 diddle amplifier card from the Equipment Controller is a positive-going signal with a range of approximately 5 volts. This input pulse causes Q4 to alternately conduct more and less. The output of Q4 is applied to Q1 which causes Q1 to alternately conduct more or less. Thus, the actions of Q4 and Q1 cause the input signal to be amplified.

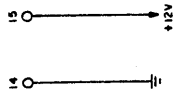
Emitter collector current in Q1 through R18 develops a positive-going pulse on the base of Q5. Q5 then is forward biased into conduction and develops a positive-going square wave output on its collector. The output of Q5 is coupled into an integrator circuit comprised of R6, R7, R14, and C2. This integrator circuit shapes the square wave into a sawtooth waveform which drives the next amplifier transistor, Q6. Potentiometer R14 is a phase control provided for manual adjustment of the sawtooth waveform. Video unblanking pulses are timed to occur during the rise time of the diddle sawtooth waveform. The diddle phase control adjusts the slope of the diddle waveform to ensure unblanking at the proper time. This is necessary to produce symbols of the proper shape and proportion.

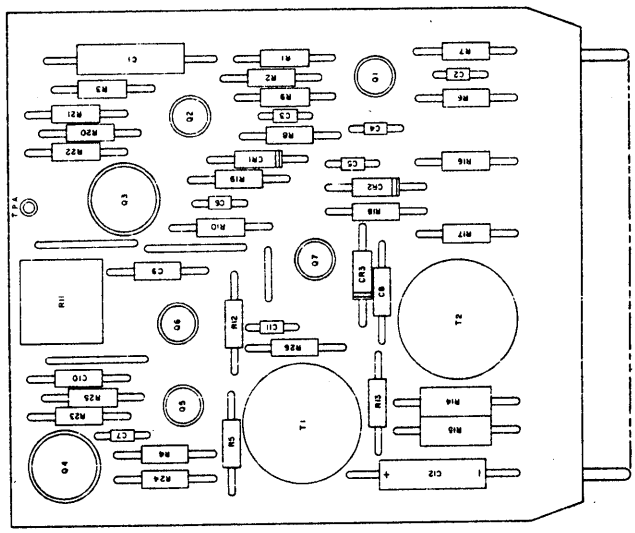
Current amplifier Q6 drives Q2. Q2, in turn, amplifies the sawtooth wave and drives output transistor Q3. Circuits CR1, R24 and CR2, R25 are dampening circuits which prevent negative signals from appearing on the bases of Q5 and Q3, respectively.

A dampening network comprised of C5 and R12 diminishes oscillations in the primary of output transformer T1. The output is taken from pin 12 of the 046 card. This sawtooth current waveform output is required to drive the diddle yoke driver transistor. A diddle amplitude control, mounted on the deflection assembly chassis, provides vertical symbol size. This control associated with the diddle yoke driver transistor which is located on a heat sink on the same chassis.

Each horizontal scanning line becomes a symbol-sized raster as a result of the diddle modulation of the electron beam as it moves across the crt. These horizontal rasters are not visible when the crt intensity control is adjusted for normal operation.

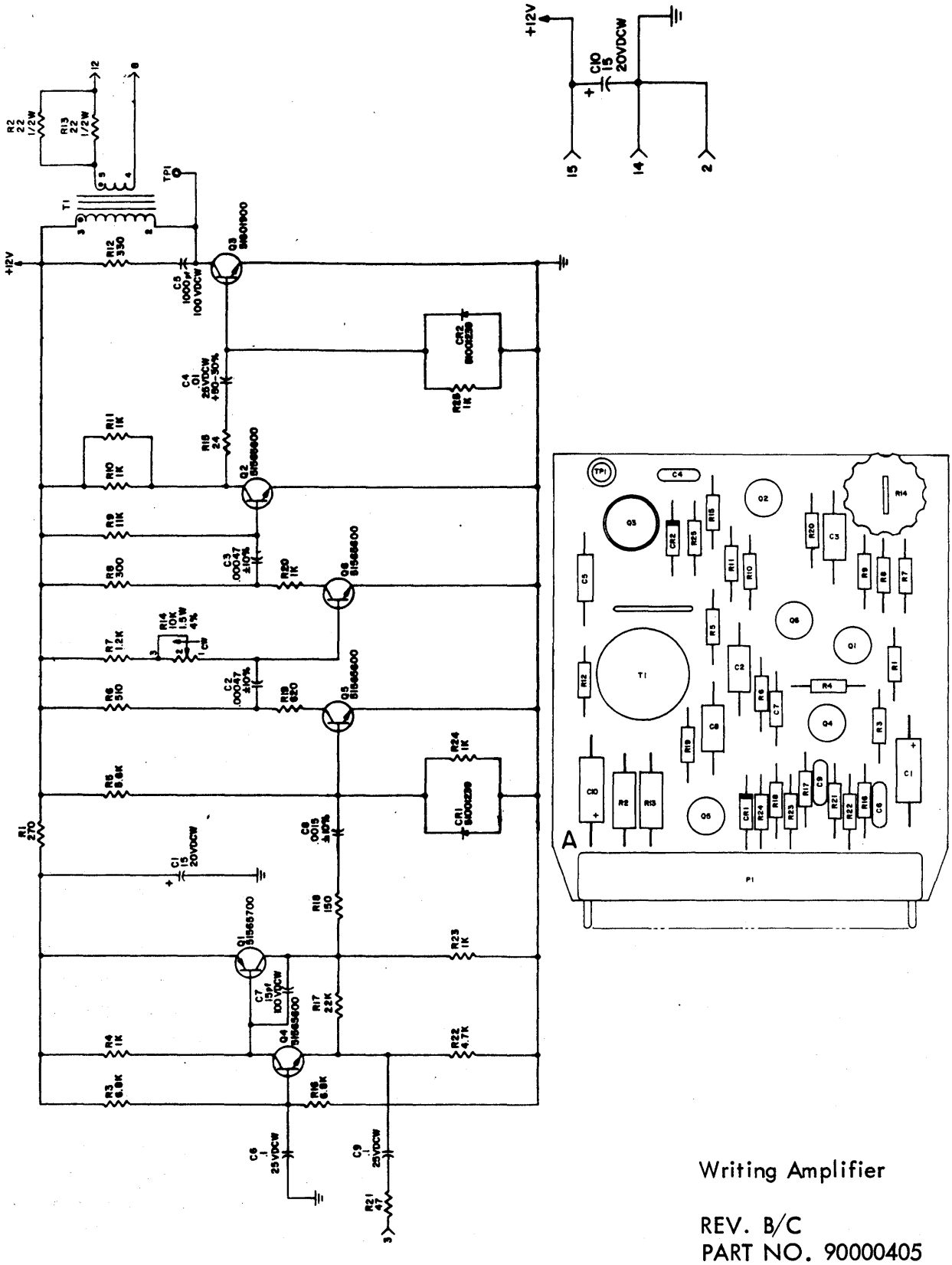






Diddle Amplifier and Pulse Shuper

REV. A/B
PART NO. 90000405
CARD TYPE **046**



Writing Amplifier

REV. B/C
PART NO. 90000405
CARD TYPE **046**

211 Card, Video Amplifier.

The 211 card is located in jack location J3B. A general description and theory of operation follow. Refer to figure 4-7.

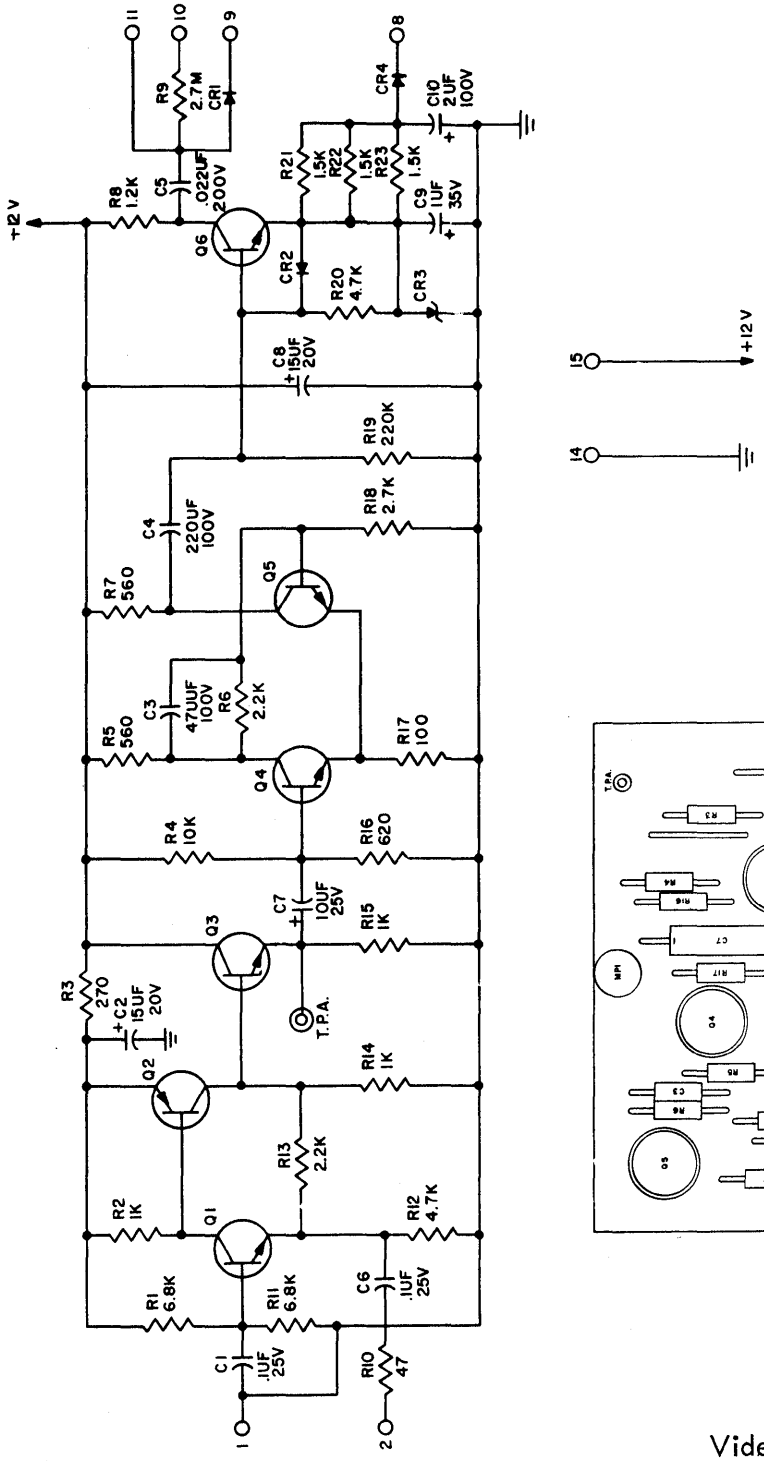
The video amplifier unblanks the crt to produce visible symbols at the proper time. Video unblank pulses are fed into the video amplifier from the Equipment Controller. The video amplifier shapes, amplifies and applies unblank pulses to the crt to unblank the electron beam for 100 nanoseconds each pulse.

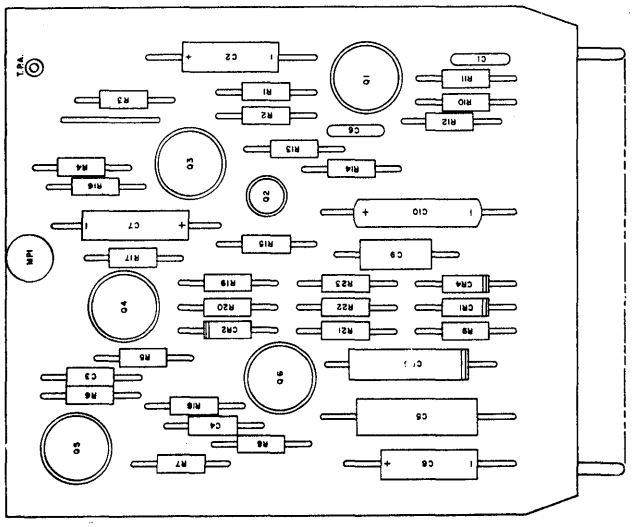
A train of video pulses for each symbol transmits from the Equipment Controller to video amplifier card input pin 2. The pulses are negative-going 100-nanosecond pulses. Emitter follower transistor Q3 is driven by Q1 and Q2, a grounded base configuration. R3 and C2 filter the supply voltage for the preamplifier section. This eliminates regenerative feedback. The preamplifier has a fixed gain which is set at a high value and causes Q2 to be driven into saturation ("flat tops" video pulses).

The output of Q2 is a positive video pulse. Emitter follower Q3 is driven by the positive-going pulse from Q2. Q3 output is a positive pulse across R15 at test point A. Transistor Q4 is used as a pulse peaker. Because of circuit and stray capacitance, the leading edge of high frequencies of the pulse attenuates causing slow rise time. Capacitor C3 passes high frequencies to Q5 base and attenuates lows. Due to bias conditions on Q4 and Q5, a pulse in excess of 6 volts placed on the base of Q4 allows Q4 to conduct. Q4 conduction results in the cutting off of Q5 which causes a positive voltage pulse on the collector of Q5. The circuit of Q4 and Q5 is a Schmitt Trigger configuration.

At horizontal retrace time, the horizontal deflection coil field collapses. This collapsing field induces a voltage of negative polarity that is connected to CR4 cathode. Therefore, CR4 is forward biased and conducts charging C9 and C10 negative with respect to ground. CR3 is a 16-volt Zener diode which clamps the charge on C9 at negative 16 volts. This negative 16 volts on the emitter of Q6 and positive 12-volt collector supply provide 28 volts emitter collector supply voltage on transistor Q6. The positive video pulse on the base of Q6 causes this transistor to conduct producing a 28-volt negative pulse at output pin 11. The negative video pulse connects to the crt cathode and unblanks the electron beam for 100 nanoseconds.

Pin 9 connects diode CR1 to the center arm of the intensity control potentiometer. CR1 clamps the crt bias at the voltage determined by the position of the bias potentiometer. Pin 10 connects the 2.7-megohm resistor to the intensity control voltage divider and provides a high impedance signal path from cathode to ground.





Video Amplifier

REV. B/B
PART NO. 90000408
CARD TYPE **211**

491 Card, Voltage Regulator.

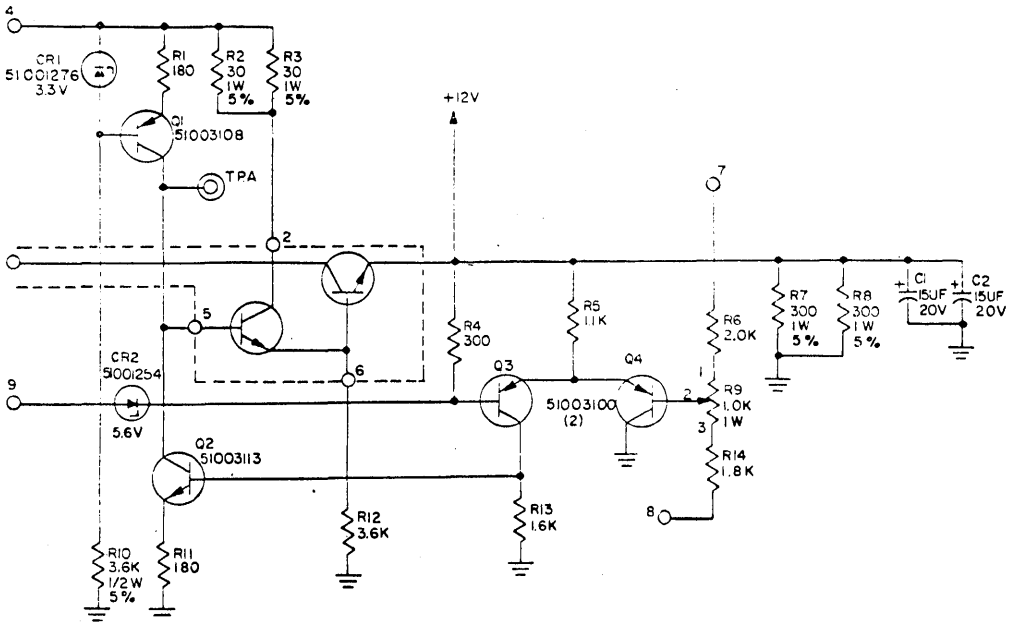
The 491 card is located in jack location J2B. A general description and theory of operation follow. Refer to figure 4-8.

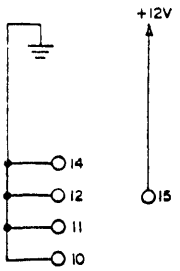
The Display Station requires deflection currents varying from no load conditions to full load conditions of up to approximately 4 amperes. Deflection currents of this magnitude normally cause unregulated low-voltage power supply to decrease when load current increases and increase when load current decreases. The 491 card (+ 12-volt regulator) is designed to satisfy the changing current requirements of the Display Station and to maintain the constant + 12 voltage required for proper biasing and operation of the vertical deflection amplifier, horizontal deflection amplifier, diddle amplifier and pulse shaper, and video amplifier.

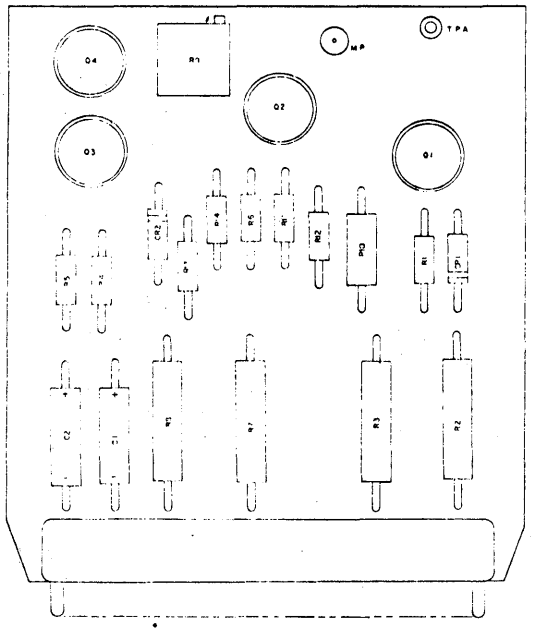
Transistor Q2* is a series or current regulator. Q1* controls the emitter-to-collector current of Q2. Q1 provides forward bias for Q1. Transistors Q2, Q3, and Q4 amplify changes in voltage developed across voltage divider R6, R9, and R14. Potentiometer R9 adjusts the forward bias on Q4 for proper voltage output. The amplified change in voltage controls Q2 emitter collector current which is also load current. Resistors R7 and R8 provide a minimum load current through Q2. When load current increases, supply voltage tends to decrease.

This decrease in voltage across R9 appears on Q4 base. Transistor Q4 requires positive voltage on its emitter. A decrease or less positive base voltage forwards bias Q4 causing emitter collector current to increase. Increased current through R5 emitter resistor causes a voltage drop (less positive) on Q3 emitter. Zener diode CR2 maintains a + 5.6-volt bias on Q3 base. The less positive voltage on Q3 emitter causes Q3 to conduct less. Voltage across R13, developed by Q3 collector current, becomes less positive. Q2 conducts less. Q2 collector voltage increases, biasing Q1 in a positive direction. An increase in Q1 emitter current develops a more positive bias voltage across R12 which, in turn, lets Q2 conduct more current to the load which compensates for increased load current and allows output voltage to remain at a constant + 12 volts regulated.

* Located on deflection assembly chassis







Regulator
12 Volts

REV. B/B
PART NO. 90000411
CARD TYPE **491**

KEYBOARD ASSEMBLY.

A type 7BQD keyboard card is the only keyboard subassembly. Keyboard outputs feed symbol and function codes to the Equipment Controller. The keyboard card is divided into three sections (switch and relay, diode encoder, and line filter) for ease of explanation.

SWITCH AND RELAY.

Figure 5-9 (sheet 1) shows the switch section of the keyboard card. Shift relay K1 is shown on sheet 2 of figure 5-9. K1 is actuated by SHIFT switches S51 and S52 which furnish +16 volts through resistor R2. Depressing any one of the keyboard switches furnishes ground through resistors R3 and R1 to the diode encoder portion of the keyboard card.

As an example, assume that switch S42 (symbols 5/%) has been depressed. The switch contact swings from position 2 to position 3, placing ground on the associated line to the diode encoder. Note on the schematic that keyboard ground comes from the bottom left and then goes to the top, passing through the switches sequentially. If more than one switch is depressed at the same time, therefore, the switch closest to the grounding point is selected.

DIODE ENCODER.

The diode encoder is shown in figure 5-9 (sheet 2). Following is a description of diode encoder operation which is a continuation of the sequence of events originated by depressing switch S42.

The presence of ground on S42 input line to the diode encoder causes the 2^0 line to activate through CR9. This signal also activates the 2^2 line through CR72, resulting in octal code 05 being sent to the Equipment Controller and the associated symbol to appear on the crt. Depressing the SHIFT switch in conjunction with S42 energizes relay K1 which permits uppercase operation. When K1 is energized, data lines 2^1, 2^2, and 2^3 are activated by CR71, CR72 and CR103 respectively. As a result, octal code 16 is sent to the Equipment Controller and the associated symbol is displayed on the crt.

The strobe bus line is activated whenever a switch is depressed. The strobe line is also fed to the Equipment Controller.

LINE FILTER.

The line filter consists of the 2.2-microfarad, 20-volt capacitors tied to each of the function and symbol bus lines feeding the Equipment Controller. The line filter, primarily, eliminates noise which may affect the crt display.

Due to energy stored in the interconnecting cables, noise spikes are generated upon keyboard switch contact closure. Energy is stored because of the effective capacitance to ground of the cables. Line filtering prevents fast discharge of line capacity which eliminates noise at the source and prevents noise spikes from affecting the crt display.

SECTION V

DIAGRAMS

Schematic and interconnection diagrams for the Display Station are contained in this section. Figures 5-2 and 5-3 are monitor assembly interconnection diagrams. Following these diagrams are schematic diagrams for the various Display Station assemblies as well as the alarm and lights interconnection diagram. Section IV contains card schematics and Section VII contains the card placement chart.

A	—	DRAWING RELEASE	3-2-79		
B	3812	SEE ECO	6-15-79		
C	3912	SEE ECO	6-27-79		
D	4653	SEE ECO	2-17-81		
E	5720	" "			

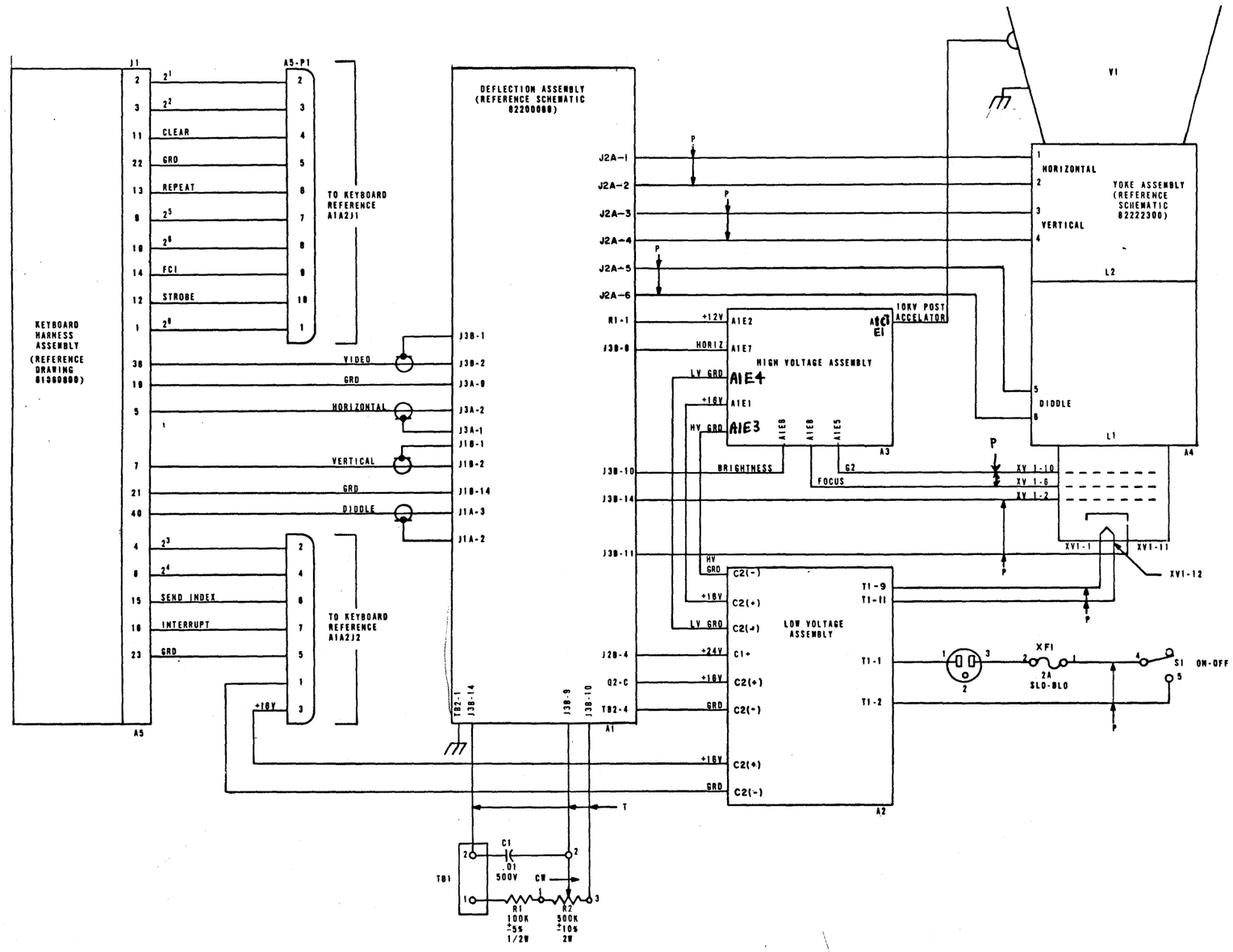


Figure 5-2

UNLESS OTHERWISE NOTED ALL CIRCUITS ARE LOCATED ON PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DES

REFERENCE DRAWING: WT 61034400	DRAFTSMAN: J. MASSEY	DATE: 10-24-07	INTERCONNECTION DIAGRAM 115 V MONITOR ASSEMBLY
COMPONENTS EXCEPT AS NOTED	CHECKER:		DATA DISPLAY DIVISION
TOL / VALUE / SIZE	ENGINEER:		PRODUCT / SIZE: D / DRAWING NUMBER: 82235200 / REV: E
RES. OHMS	APPROVED:		CROSS REF. NO. / SHEET OF
CAP. uf			

82128500

5-5/6

A	—	DRAWING RELEASE			
B	3812	SEE ECO			
C	3912	SEE ECO			
D	4653	SEE ECO			
E	5620				

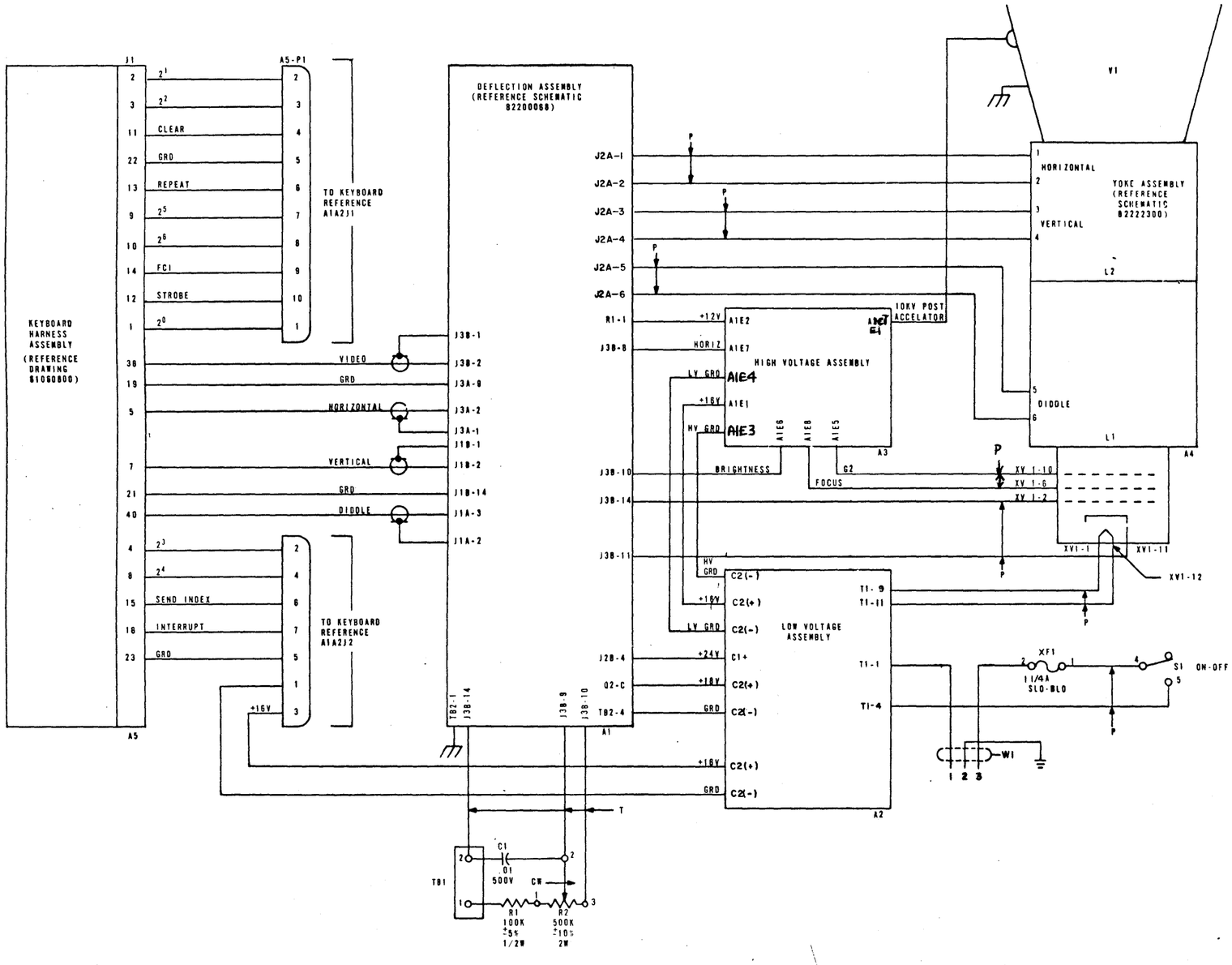


Figure 5-3

UNLESS OTHERWISE NOTED ALL CIRCUITS ARE LOCATED ON PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DES

REFERENCE DRAWING	DRAFTSMAN	DATE
WT 61060700	J. MASSEY	10-4-67
	CHECKER	
	ENGINEER	
	APPROVAL	

COMPONENTS EXCEPT AS NOTED

	TOL	VALUE	SIZE
RES		OHMS	
CAP		uf	

DATA DISPLAY DIVISION

INTERCONNECTION DIAGRAM 220V MONITOR ASSEMBLY

PRODUCT

CROSS REF NO

SIZE D

DRAWING NUMBER 82236300

REV E

SHEET OF

82128500

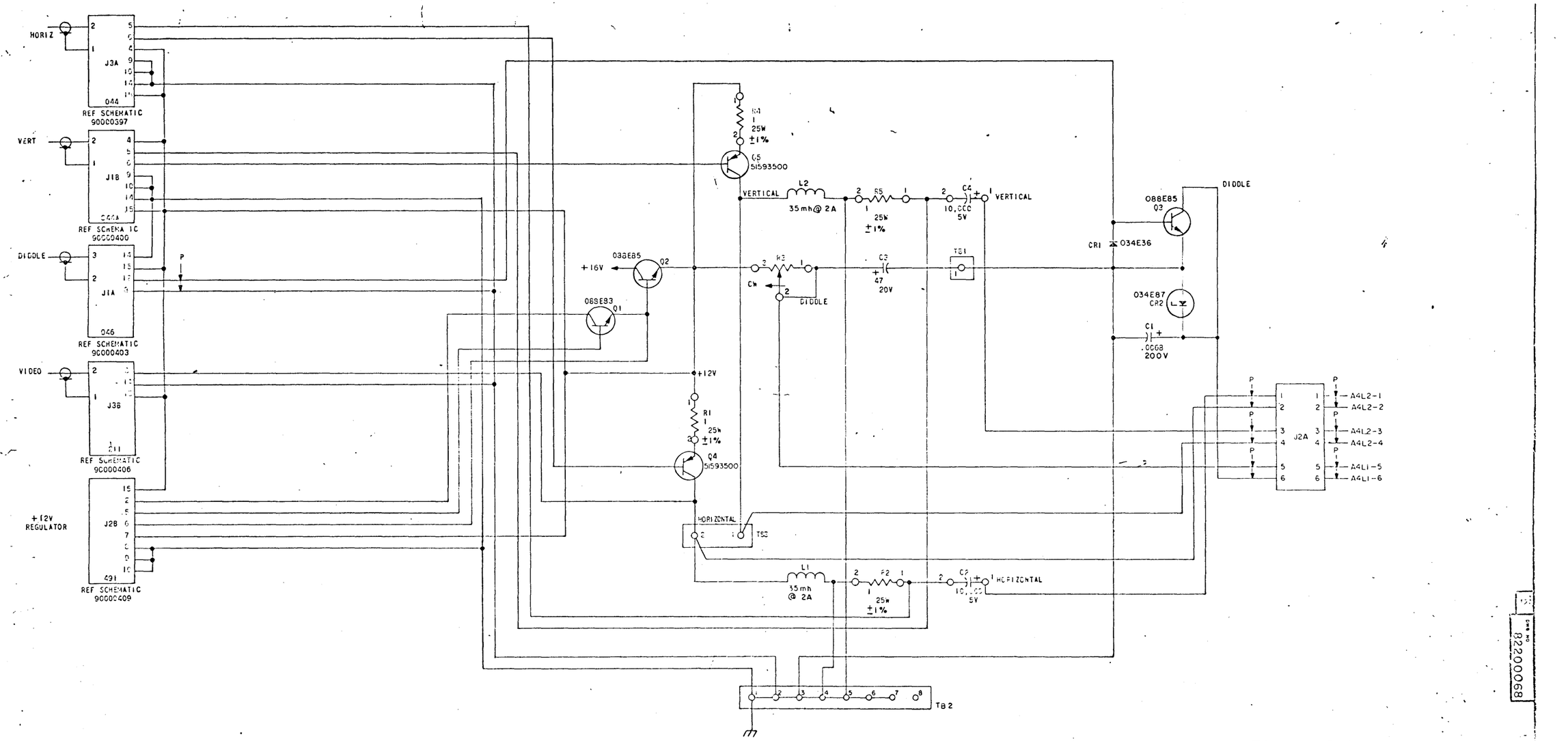


Figure 5-4
SCHEMATIC DIAGRAM
DEFLECTION ASSEMBLY

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN;
FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).

REFERENCE DRAWINGS	DEFLECTION ASSEMBLY 61000119
COMPONENTS EXCEPT AS NOTED	TOL / VALUE / SIZE
RESISTORS	± OHMS
CAPACITORS	± UF
DRAFTSMAN	E MINK 10-18-66
TITLE	SCHEMATIC DIAGRAM DEFLECTION ASSEMBLY
DATA DISPLAY, INCORPORATED SAINT PAUL, MINNESOTA	
CONTROL	PROJECT OR PRODUCT 211 DISPLAY STATION
DRAWING NUMBER	82200068
PAGE	

D 3812 C 2004 B 2021 A — ECO — DATE 10-22-66

DWG NO 82200068

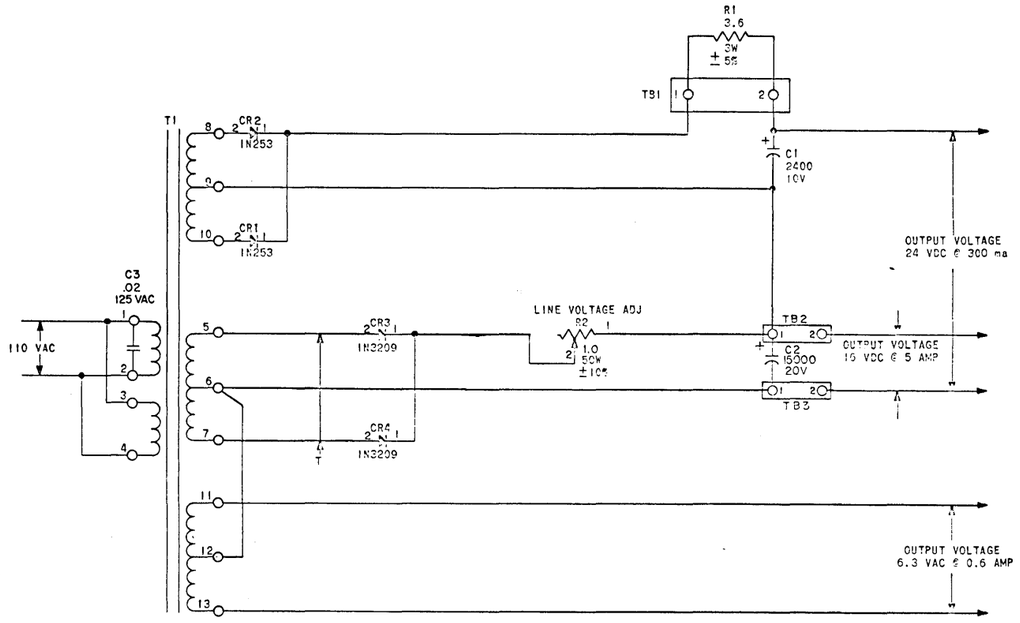
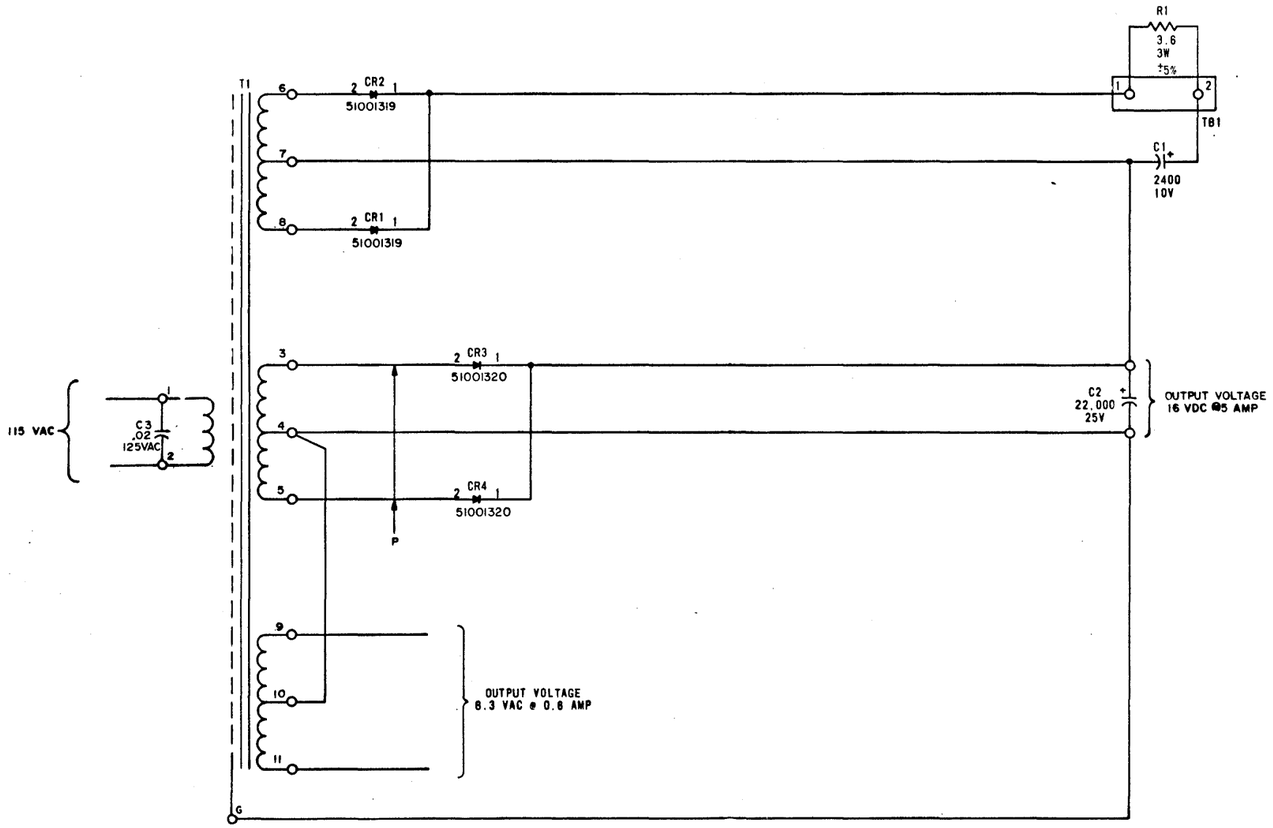


Figure 5-5
SCHEMATIC DIAGRAM,
LOW-VOLTAGE ASSEMBLY
(115 VOLTS - 60 HERTZ)

REV	CO	DESCRIPTION	DRFT	DATE	CHKD	APP
A	——	DRAWING RELEASE				
B	4463	SEE ECO				
C	4653	SEE ECO				



NOTE:

This diagram represents Low Voltage Assemblies in Monitors built after serial number 700.

Figure 5-5A

REFERENCE DRAWING		DATA DISPLAY DIVISION	TITLE SCHEMATIC DIAGRAM, LOW VOLTAGE ASSEMBLY
ASSEMBLY, 6115630O			
WT, 6115640O		FIRST USED ON	
		DWN A. GIGLIANO 5-15-69	
COMPONENTS, EXCEPT AS NOTED		CHKD	CODE IDENT 15920 / DRAWING NO 82262500
TOLERANCE / VALUE / RATING		ENGR	
RES — OHMS		MFG	
CAP — uf		APPR	SCALE / CROSS REF NO / SHEET 1 OF 1

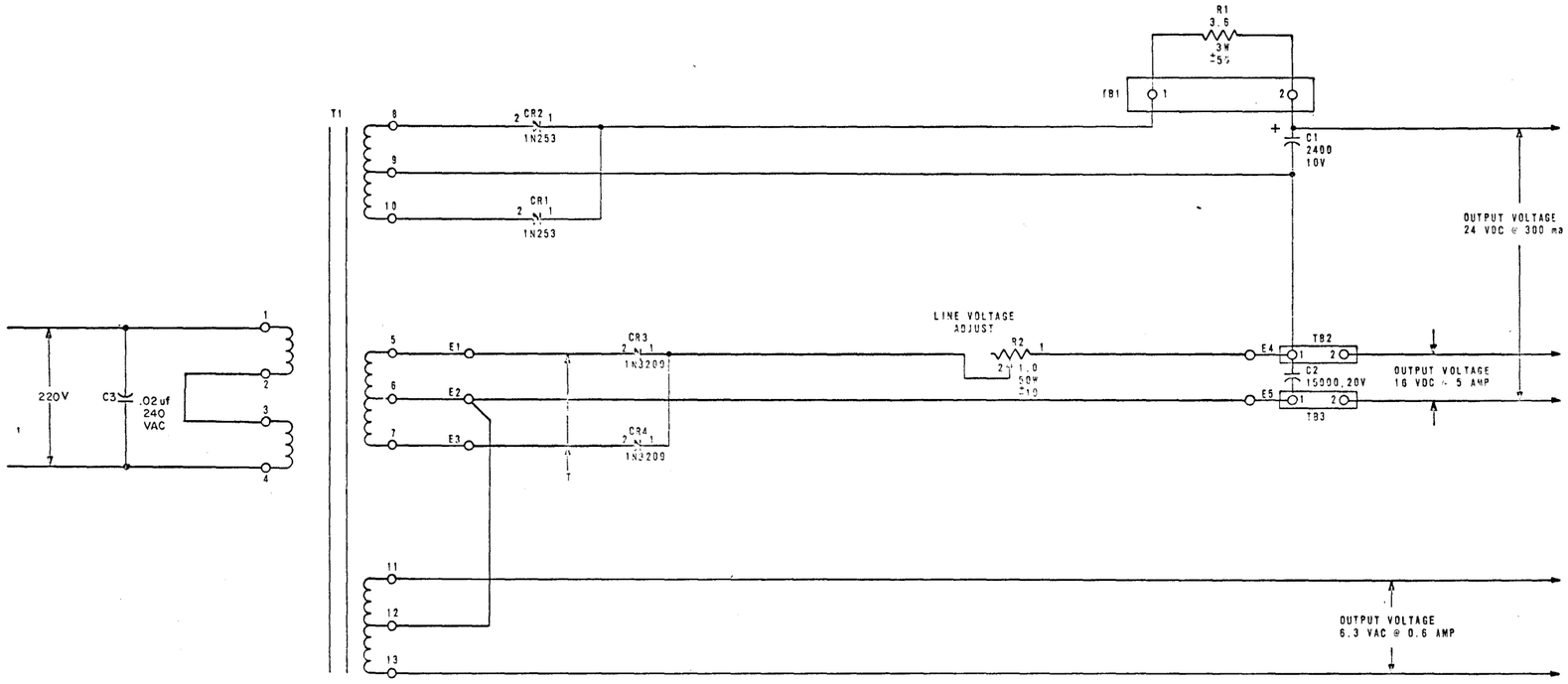


Figure 5-6
SCHEMATIC DIAGRAM,
LOW-VOLTAGE ASSEMBLY
(230 VOLTS - 50 HERTZ)

REV	CO	DESCRIPTION	DRFT	DATE	CHKD	APP
A	——	DRAWING RELEASE	-	5/69	CE	DLL
B	4463	SEE ECO	D	12-3-73	CE	[illegible]
C	4653	SEE ECO	[illegible]	1-17-78	CE	[illegible]

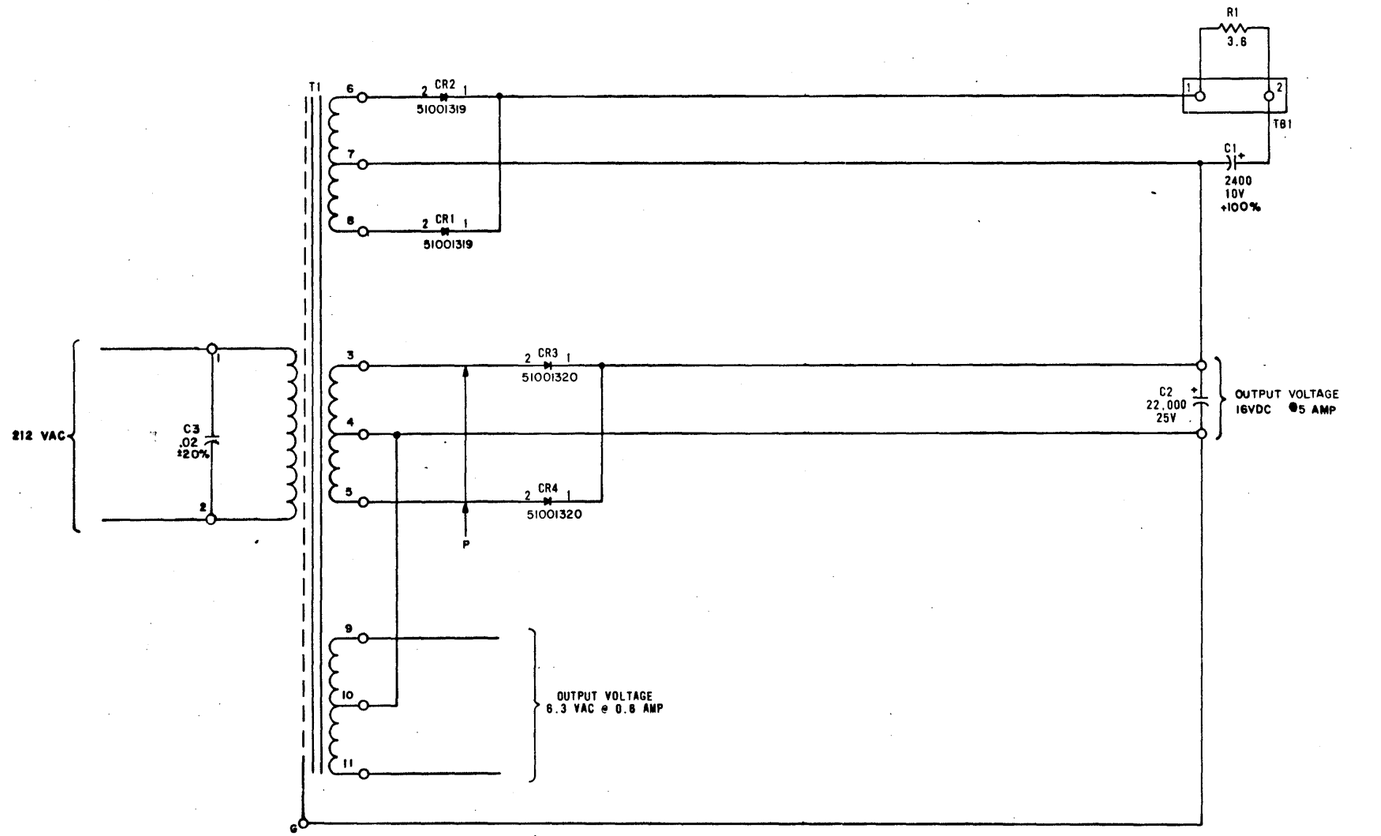
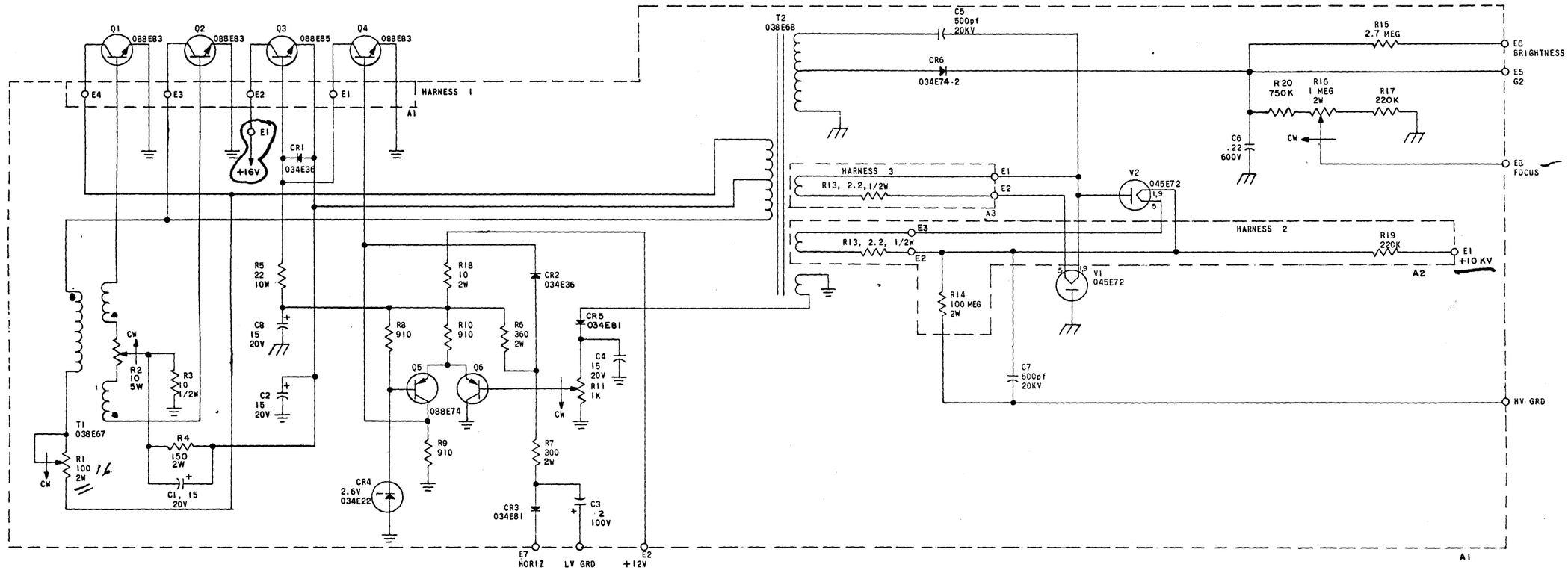


Figure 5-6A

NOTE:

This diagram represents Low Voltage Assemblies in Monitors built after serial number 700.

REFERENCE DRAWING	CONTROL DATA DISPLAY DIVISION	TITLE
ASSEMBLY, 61158000		SCHEMATIC DIAGRAM,
WL. 61158100	FIRST USED ON	LOW VOLTAGE ASSEMBLY (50HZ)
	DWN R. ACKLAND 5-15-69	
	CHKD	CODE IDENT 15920 DRAWING NO 82263500
COMPONENTS EXCEPT AS NOTED	ENGR	
TOLERANCE / VALUE / RATING	MFG	SCALE CROSS REF NO SHEET 1 OF 1
RES ± 5% OHMS 3W	APPR	
CAP +100%-10% uf 240V		

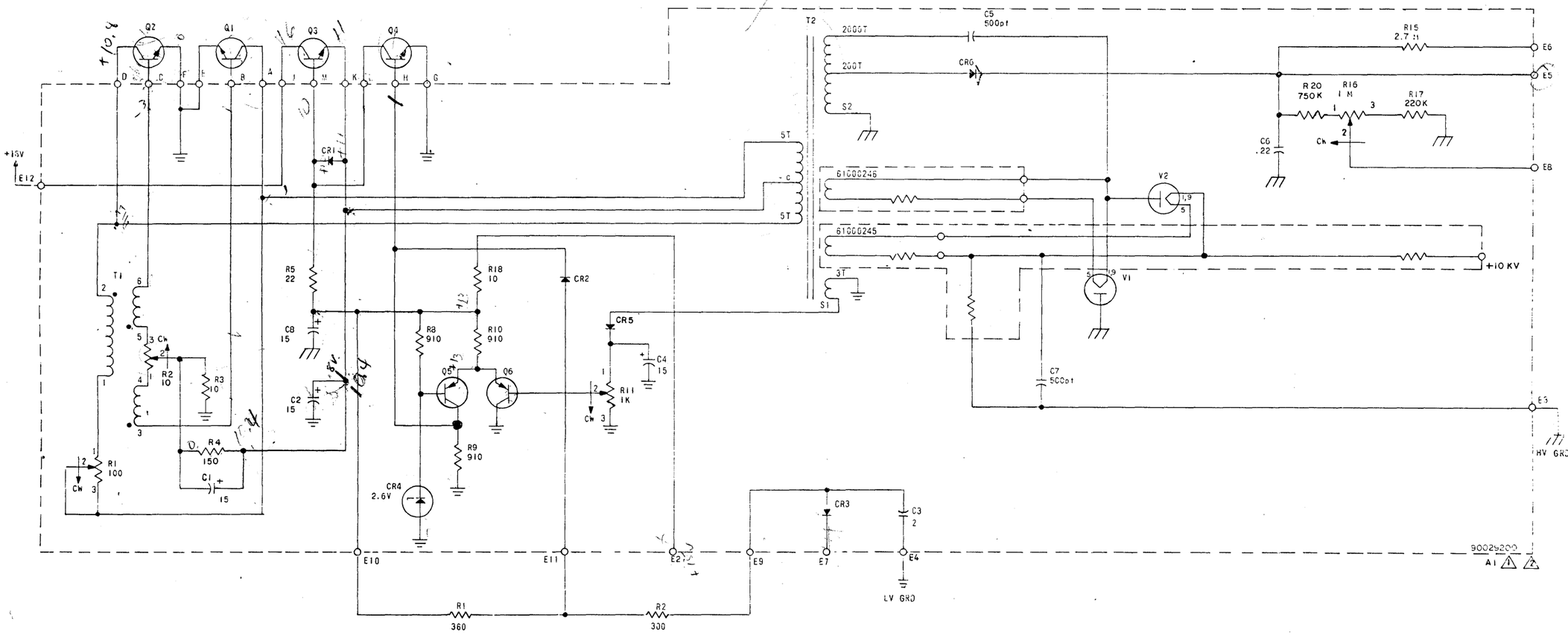


NOTE

This diagram represents high-voltage assemblies manufactured before May 12,1969

Figure 5-7
SCHEMATIC DIAGRAM,
HIGH-VOLTAGE
ASSEMBLY

DWG NO. 82200070 REV C



NOTE:

This diagram represents High Voltage Assemblies built after May 12, 1969 (with Heat Sink Modification) i. e. Resistors R1, and R2 mounted externally on a heat sink.

NOTE

1. R6. R7 R12. R13. R14. R19. Q1 Q2. Q3 & Q4 ARE NOT USED
2. COMPONENT DESIGNATIONS & VALUES ARE FOR REFERENCE ONLY.

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S)

Figure 5-7A

REFERENCE DRAWINGS	
HIGH VOLTAGE ASSEMBLY	
HIGH VOLTAGE ASS'Y, WL	
COMPONENTS EXCEPT AS NOTED	TOL / VALUE / SIZE
RESISTORS	± 5% / OHMS / 1/2 W
CAPACITORS	± / UF /
DRAFTSMAN	DATE
CHECKED	
ENGINEER	
APPROVAL	
APPROVAL	
TITLE	SCHEMATIC DIAGRAM HIGH VOLTAGE ASSEMBLY
DATA DISPLAY, INCORPORATED SAINT PAUL, MINNESOTA	
CONTROL / PROJECT	
DRAWING NUMBER	82261900
PAGE	

82261900

REVISIONS						
REV.	E.C.O.	ZONE	DESCRIPTION	DATE	CHK'D	APP'D

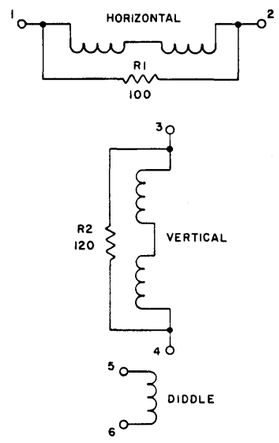
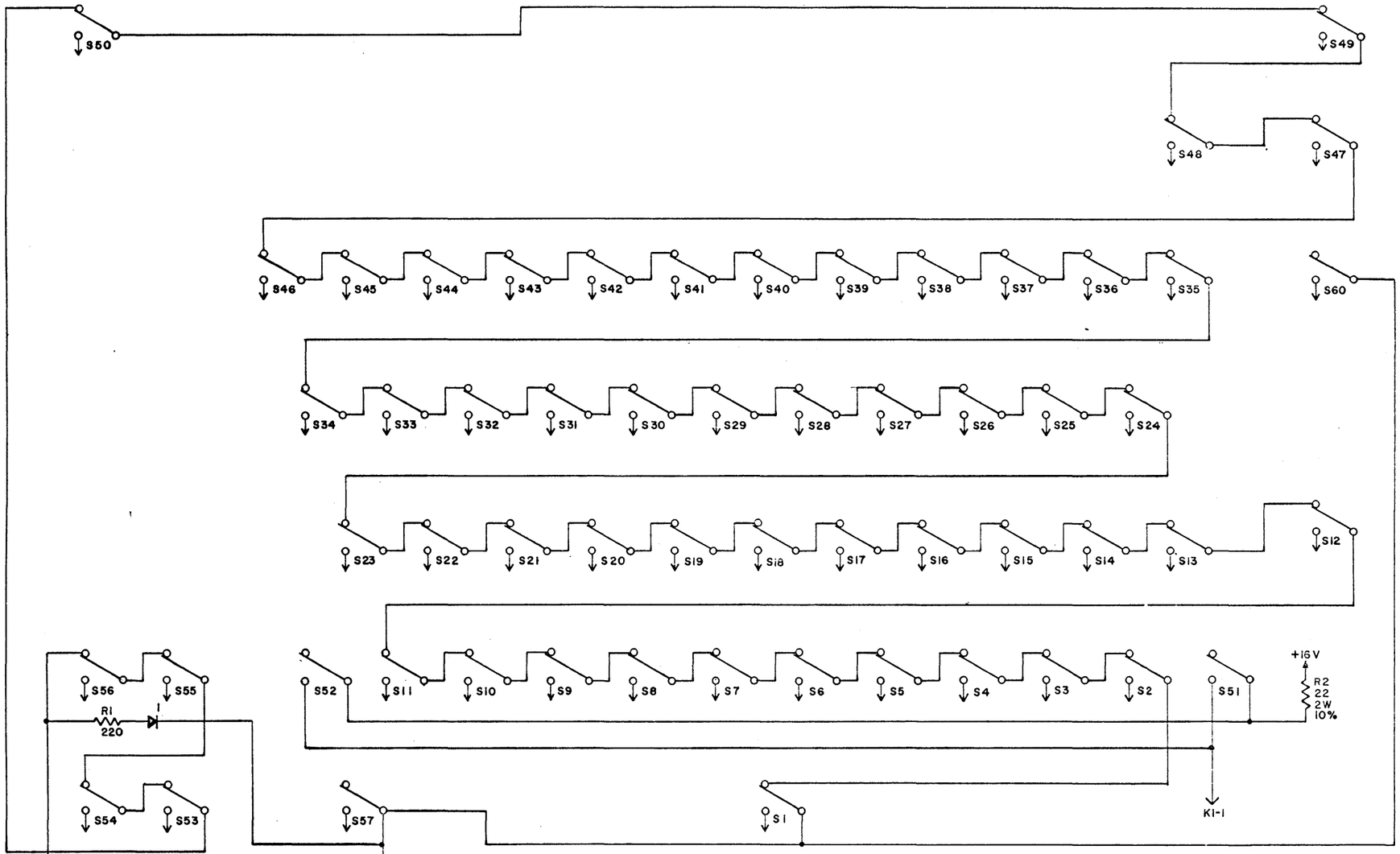


Figure 5-8
SCHEMATIC DIAGRAM,
YOKE ASSEMBLY

82222300

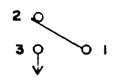
REVISIONS					
REV	E.C.O.	DESCRIPTION	DATE	CH'K'D	APP'D
A	2738	SEE SHEET 2	5/16/66	[illegible]	[illegible]



ALL SWITCHES ARE 51007248.
UNLESS OTHERWISE SPECIFIED ALL DIODES ARE 51598400.

NOTES:

1. UNLESS OTHERWISE SPECIFIED, NUMBERS "1" THRU "198" ARE TO BE PREFIXED WITH DIODE REFERENCE DESIGNATION CR.
2. ALL DIODES ARE POLARIZED IN THE DIRECTION SHOWN UNLESS OTHERWISE SPECIFIED.



PIN LOCATIONS
TYPICAL (58 PLACES)
PIN 3 DESTINATION SHOWN ON SHT 2

RECORD OF REVISION STATUS OF EACH SHEET												
SHEET	REVISION											
1	A											
2	A											

Figure 5-9
SCHEMATIC DIAGRAM,
7BQD CARD
(SHEET 1 OF 2)

REVISION					
A	2738	C2-C14; .0015 WAS 2.2			

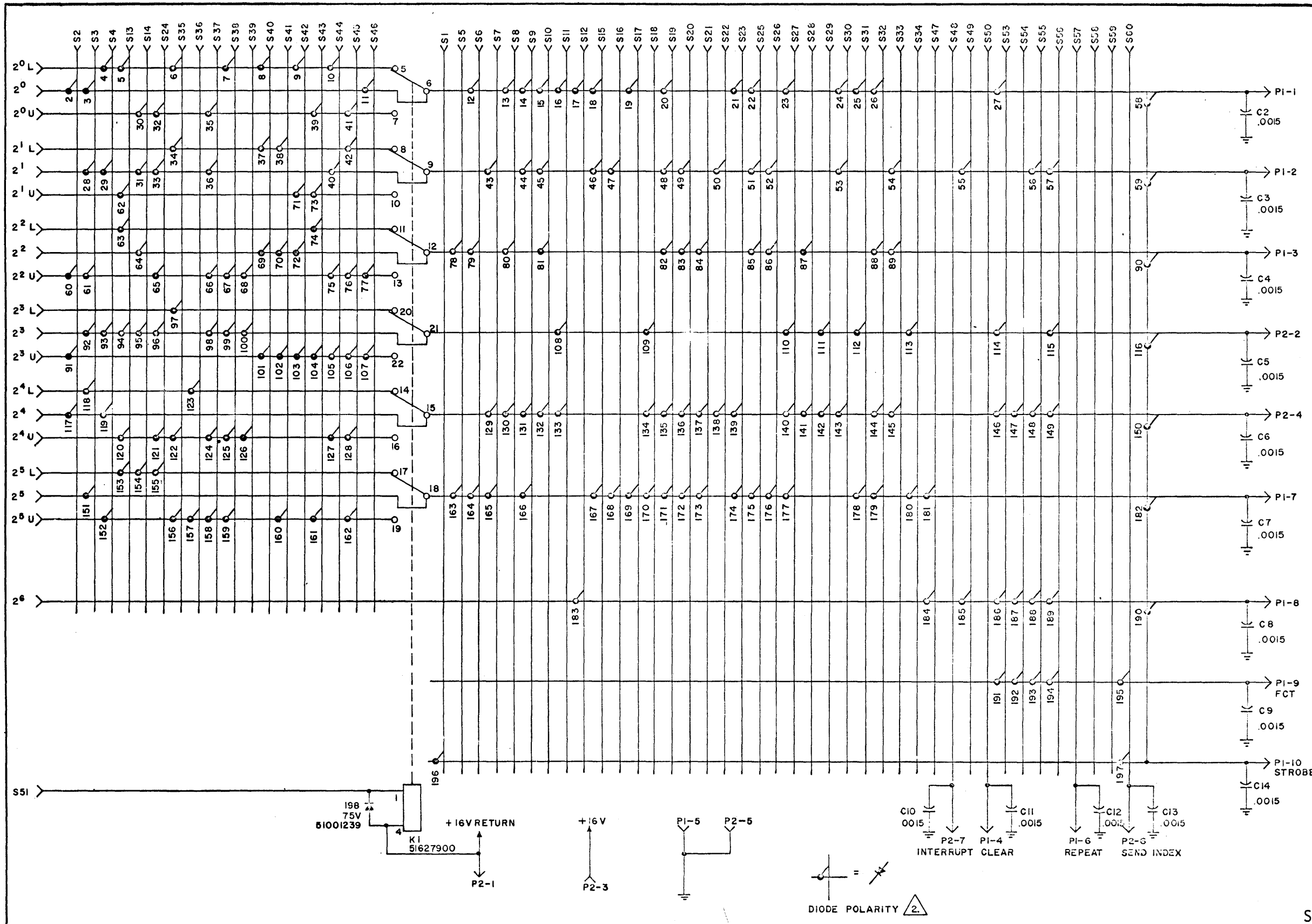


Figure 5-9
SCHEMATIC DIAGRAMS,
7BQD CARD
(SHEET 2 OF 2)

REVISIONS						
REV	E.C.O.	ISSUE	DESCRIPTION	DATE	CHK'D	APPR.
A	2599		ADDED ITEM 11, K1	3/21/69	MK	GPK
B	2738		REMOVED + SIGN FROM C2-C14	5/21/69	MK	GPK

STROBE

GROUND

P1

P2

PIN 1

XK1
K1

7BQD

NOTES:

1. FOR SCHEMATIC DIAGRAM SEE 90004344
2. FOR LIST OF MATERIALS SEE L/M 90004346
3. UNLESS OTHERWISE SPECIFIED, NUMBERS 1 THRU 198 ARE TO BE PREFIXED WITH DIODE REF DESIGNATION CR.
4. ALL DIODES ARE POLARIZED IN THE DIRECTION SHOWN UNLESS OTHERWISE SPECIFIED.
5. REFERENCE DESIGNATIONS ARE FOR REF ONLY AND DO NOT APPEAR ON PART.
6. APPLY "ASSY 90004346" 1/8 HIGH IN AREA SHOWN.
7. CR1 TO BE POLARIZED IN DIRECTION SHOWN.

Figure 5-9A

TITLE	CARD ASSEMBLY, 7BQD
SIZE	D
DRAWING NUMBER	90004346

90004346 B

82128500

5-29/30

REV.	E.C.O	DESCRIPTION	DATE	CHK'D	APP'D
A	—	DRAWING RELEASE	3-7-69	[illegible]	[illegible]
B	4543	SEE ECO	4/2/73	[illegible]	[illegible]

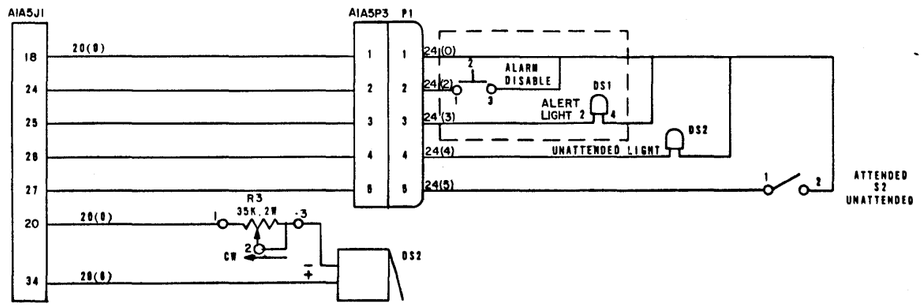


Figure 5-10

UNLESS OTHERWISE NOTED ALL CIRCUITS ARE LOCATED ON
PARTIAL REF DES ARE SHOWN: FOR COMPLETE DES PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DES

REFERENCE DRAWING	DRAFTSMAN	DATE
14023300	JMASSEY	10-25-7
14026500	CHECKER	
WT 61060800	ENGINEER	
COMPONENTS EXCEPT AS NOTED	Design	

	TOL	VALUE	SIZE
RES.			
CAP.			

DATA DISPLAY DIVISION

PRODUCT	SIZE	DRAWING NUMBER	REV.
CROSS REF NO.	D	82235300	B
		SHEET 1 OF	

INTERCONNECTION DIAGRAM ALARM AND LIGHTS

82128500

5-31/32

SECTION VI

MAINTENANCE

The Display Station is designed and constructed to be virtually maintenance free. Preventive and corrective maintenance procedures described in this section improve usefulness and extend the service life of the unit. Corrective maintenance should be performed only by experienced display equipment personnel. Photographs and waveforms are used to a great extent to provide the Display Station operator with as many aids as possible for proper control adjustment, troubleshooting, etc.

Section VII contains the card placement chart. Display Station schematic and interconnection diagrams are in Section V. Section VIII contains parts data which lists all replaceable electrical parts.

TEST EQUIPMENT REQUIRED.

Table 6-1 lists all recommended test equipment (not furnished) for properly maintaining the Display Station.

TABLE 6-1. RECOMMENDED TEST EQUIPMENT

ITEM	DESCRIPTION
Multimeter	Simpson 269, Type 2, or equivalent
High-Voltage Probe	No. 0119, 16 kv, or equivalent
Blocking Capacitor	Plastic Capacitors, Inc., OF 200-502, 0.005 microfarad, 20 kv
Oscilloscope	Tektronix, Type 545A, or equivalent
X 10 Probes (two)	Tektronix, or equivalent

The oscilloscope should have dual-trace and external-triggering facilities allowing comparison of two traces while using a third pulse for a trigger. Signals used within the Display Station range from 20 milliseconds to 100 nanoseconds. The blocking capacitor, which couples the oscilloscope to the high-voltage section, prevents high-voltage damage to the oscilloscope.

PREVENTIVE MAINTENANCE INDEX (PMI).

The preventive maintenance index (table 6-1A) should be followed to maintain optimum performance and prevent equipment failure. The index lists recommended procedures, times performed, and associated item designations. Item designations refer to procedural steps following the table. If a preventive maintenance procedure indicates a fault, refer to the corrective maintenance portion of this section.

TABLE 6-1A. PREVENTIVE MAINTENANCE INDEX

WEEKLY 150 hrs.	MONTHLY 500 hrs.	QUARTERLY 1500 hrs.	ITEM	MAINTENANCE PROCEDURES
	X		1	Cleaning
	X		2	Visual Inspection
	X		3	Mechanical Inspection
	X		4	Operational Checks
	X		5	Inspect and Optimize Quality
		X	6	+12-volt check
		X	7	+16-volt check
		X	8	+10KV check

PREVENTIVE MAINTENANCE PROCEDURES (PMP).

WEEKLY PROCEDURES

No weekly preventive maintenance.

MONTHLY PROCEDURES

1. Cleaning
   a. Turn power off.
   b. Dust Display Station exterior panels and hardware with a damp lint-free cloth.

c. Remove hood.

d. Thoroughly clean interior of Display Station with a vacuum cleaner (do not damage wiring or components).

e. Clean the keyboard.

(1) Remove the front screws on the keyboard cover.
(2) Remove the keyboard cover.
(3) Disconnect the six-pin connector.
(4) Remove the four screws securing the keyboard card assembly to the frame.
(5) Remove the two connectors on the keyboard card assembly.
(6) Remove the four screws on the top metallic plate and lift it off.

NOTE

Recommend the use of cleaning agent MS 180, part number 12210068, manufactured by the Miller Stephenson Chemical Company.

CAUTION

Never use sandpaper or abrasive papers to clean keyboard or switch contacts. If this has been done in the past corrosion problems will continue in the future. Avoid any skin contact with the printed circuit board or its components.

(7) Remove the keyboard card assembly and thoroughly wash all contacts with a recommended Freon spray. Apply the spray liberally to all the switch contacts in the process.

(8) Reassembly the keyboard.

(f) Replace hood.

2. Visual Inspection

a. Turn power off.

b. Ensure that all the cables and wires are free from any insulation breakdown or other damage.

c. Check all mechanical components for damage or any loose mounting hardware.

d. Check for foreign objects such as bits of wire or solder.

e. Check the electronic components for deterioration signs such as burnt capacitors and resistors.

3. Mechanical Inspection

a. Turn power off.

b. Verify the correct mechanical operation of switches (return the switches to their normal operating position).

4. Operational Checks

a. Connect the Display Station to an operational module that provides memory and control logic for the display.

b. Turn power on.

c. Fill the display screen with data originating from the data source.

d. If the display quality is good go on to the next step.

e. If the display quality needs correction, refer to the corrective maintenance portion of this section for the necessary adjustment procedure.

5. Inspect and Optimize Display Quality

a. Turn power on.

b. Check: does the pattern display meet the raster size requirements.

(1) The 50 by 20 format = 6 inches by 8 inches.
(2) The 80 by 13 format = 5 inches by 9 inches.

c. If the raster size is correct, proceed to the next step.

d. If the raster size is not correct refer to the corrective maintenance portion of this section for the necessary adjustment procedure.

QUARTERLY PROCEDURES.

1. +12 Volt Check

   a. Switch multimeter to 40-volt range.

   b. Turn Display Station power on and allow a 5-minute warmup.

   c. Measure between pin 1 of R1 on the deflection assembly (callout 12, figure 6-1) and ground for +12 volts. Tolerance is ± 3 percent.

   d. Failure to obtain a reading within the tolerance warrants corrective action immediately. Perform the +12 volt adjustment routine defined in the corrective maintenance portion of this section.

2. +16 Volt Check

   a. Switch multimeter to 40-volt range.

   b. Turn Display Station power on and allow a 5-minute warmup.

   c. Measure the voltage from the positive terminal of capacitor C2 (callout 17, figure 6-1) and ground for +16 volts. Tolerance is ± 1 volt.

   d. Failure to obtain a reading within the tolerance warrants corrective action immediately.

3. +10-KV Check

WARNING

The presence of high voltage is dangerous to personnel.
Use extreme caution when making this check.

a. Switch multimeter to 1600-volt range.

b. Use high voltage probe.

c. Turn Display Station power on and allow a 5-minute warmup.

d. Monitor the high voltage at the post accelerator anode of the crt. This voltage should be 10KV. Tolerance is ± 500 volts.

e. Failure to obtain a reading within the tolerance warrants corrective action immediately. Perform the +10KV (post accelerator adjustment) routine defined in the corrective maintenance portion of this section.

CORRECTIVE MAINTENANCE.

This portion contains adjustment procedures for properly maintaining the equipment, diagnostic procedures, and cathode ray tube remove/replace procedures.

ADJUSTMENTS.

Maintenance adjustments in the Display Station consist of voltage adjustments, crt display adjustments, and alert audible alarm volume control. Normal adjustment of each maintenance control is made during initial installation of the equipment. These adjustments should not need resetting unless a component is replaced or display deterioration occurs. Table 6-2 lists Display Station adjustment controls and potentiometers (pot's.). Figure 6-1 shows the location of these controls.

TABLE 6-2. DISPLAY STATION ADJUSTMENTS

CALLOUT	ADJUSTMENT
1	Low-voltage output (+12 volts)
2	Vertical gain
3	Vertical linearity
4	Diddle pulse amplitude
5	Diddle pulse phase
6	Horizontal linearity
7	Horizontal gain
8	High-voltage feedback
9	High-voltage balance
10	Focus
11	Yoke adjustment setscrew
12	Low-voltage test point
13	Pincushion distortion corrector
14	Centering
* 15	Low-voltage output (+16 volts)
16	High-voltage assembly
17	Capacitor C2
18	Alert audible alarm volume control

* Display Stations below serial number 700 only.

Following paragraphs describe Display Station adjustment procedures and the test equipment required to perform each adjustment. Before performing these adjustments, ascertain that proper deflection signals are being received from the Equipment Controller. These signals are shown in figure 6-2.

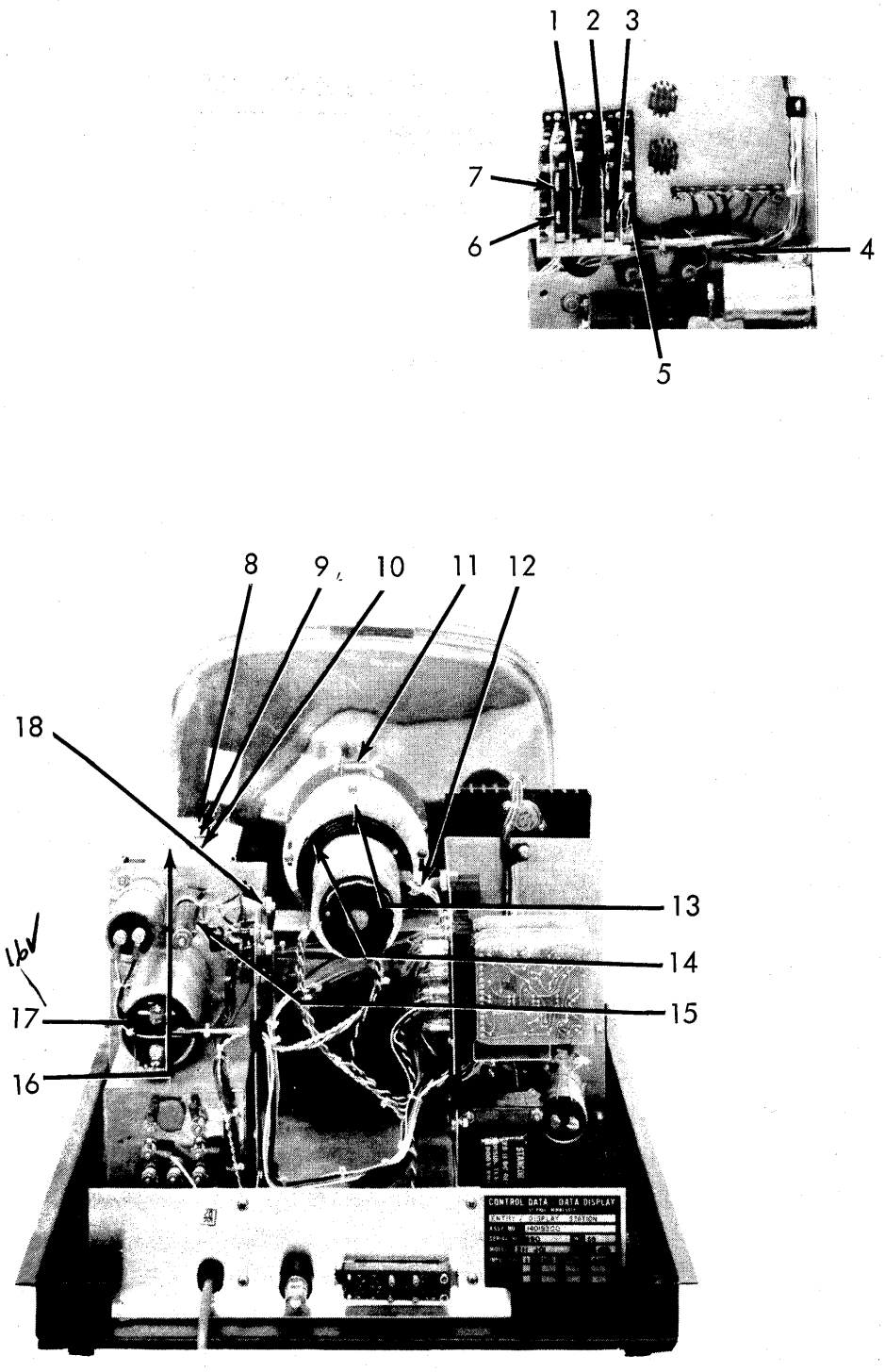


Figure 6-1. Display Station Adjustment Points

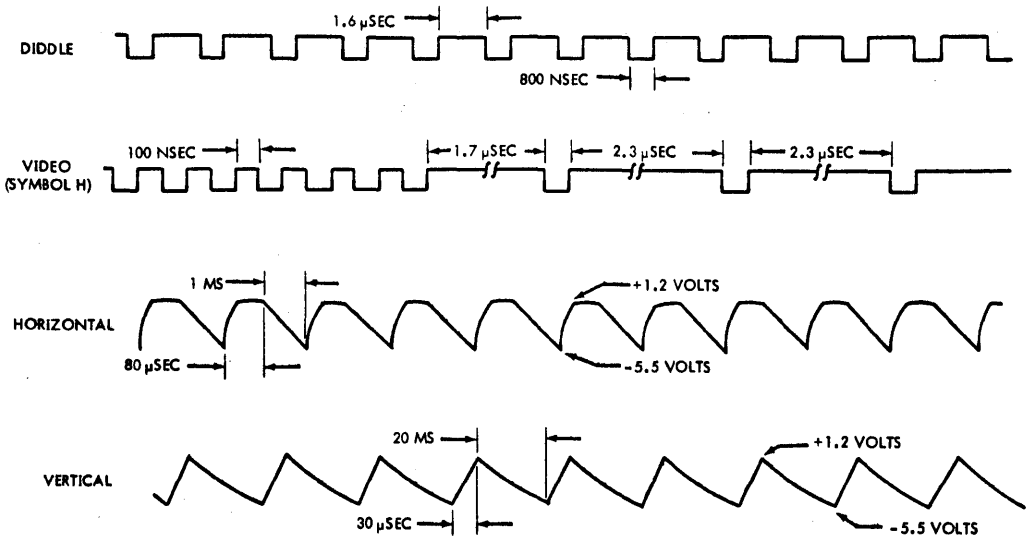


Figure 6-2. Deflection Input Waveforms

Adjustments, except where specified in the procedure, are best performed without any symbols displayed on the crt. Depressing the CLEAR key on the keyboard removes all symbols except the underline chain.

WARNING

High voltages are present in the Display Station. Observe applicable safety precautions and procedures.

NOTE

Numbers in parentheses refer to callouts on figure 6-1.

Low-Voltage Output (+12 volts).

Test equipment required:

- Multimeter

(a) Turn on Display Station power. Allow the unit to warm up for approximately 5 minutes.

(b) Adjust the potentiometer (1) on the 491 card in card location J2B so that voltage as measured between pin 1 of R1 on the deflection assembly (12) and ground is +12 volts. Tolerance is ±3 percent.

NOTE

For following procedures, rotate the ON/OFF/ INTENSITY control so that a raster is visible on the crt.

Vertical Gain and Linearity.

(a) Adjust the upper pot. (2) on the 044A card in location J1B so that top and bottom edges of the raster are approximately 6 inches apart. For 80 by 13 display format, the top and bottom edges should be adjusted for an approximate separation of 5 inches.

NOTE

It may be necessary to adjust the diddle amplitude pot. (4) to obtain equal spacing.

(b) Adjust the lower pot. (3) on the 044A card in location J1B for equal spacing between each horizontal line.

Horizontal Gain and Linearity.

(a) Adjust the upper pot. (7) on the 044 card in location J3A so that left and right edges of the raster are approximately 8 inches apart. For 80 by 13 display format the left and right edges should be adjusted for an approximate separation of 9 inches.

(b) Using the keyboard, generate the symbol H across one complete horizontal line.

(c) Adjust the lower pot. (6) on the 044 card in location J3A for equal spacing of symbol H vertical legs across the complete horizontal line. Misalignment of horizontal linearity causes unequal spacing of diddle pulses which results in symbol distortion.

Diddle Pulse Amplitude and Phase.

(a) Clear the display.

(b) Adjust R3, the diddle pulse amplitude pot. (4) for a diddle height of approximately 1/4 inch. This height should be measured at the center of a horizontal line.

(c) Enter an H at the upper left of the screen and backspace, placing the entry marker under the H. Adjust the pot. (5) on the 046 card in location J1A to correctly phase the diddle with the video. The marker should be set at the bottom of the diddle ramp with the symbols centered on the diddle.

Low-Voltage Output (+16 volts.)*

Test equipment required:

- Multimeter

(a) Turn Display Station power on and allow 5 minutes for warmup.

(b) With the multimeter, measure the voltage from the positive terminal of capacitor C2 (17) to ground. This reading should be +16, ± 1 volt dc.

NOTE

Line voltage (115 or 230 volts) should be monitored when this adjustment is made and a proportional compensation of the setting should be made if the line voltage is off. For example, if line voltage is 110 volts, set +16 volts, to about +15.3 volts.

*This adjustment is applicable to Display Stations with serial numbers up to 700 or those below serial number 700 where R2 has not been removed.

(c) If the reading deviates from +16 volts, turn the Display Station off and adjust the slide on resistor R2 (15).

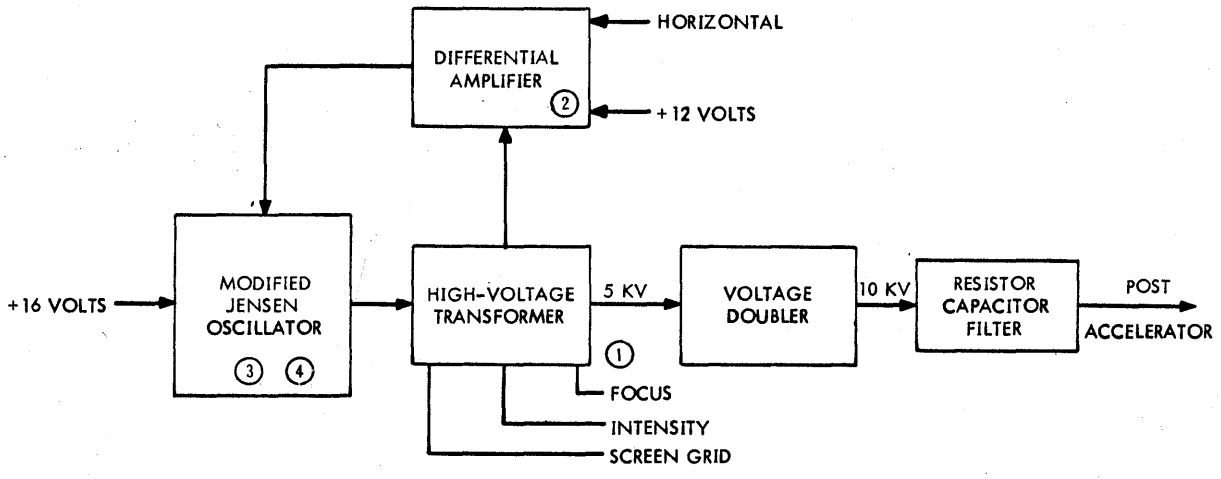
(d) If an adjustment was necessary, recheck the +12-volt adjustment (procedure 1).

High-Voltage Output

Test equipment required:

- Multimeter
- Oscilloscope
- Blocking Capacitor
- Two X 10 Probes

Adjustments in the high-voltage section are divided into three basic areas; 10-kv post accelerator adjustment, balance and feedback adjustments, and focus adjustment. These three areas are shown in the simplified block diagram of the high-voltage assembly (figure 6-3).



NOTES:

1. Focus adjustment
2. 10-kv post accelerator adjustment
3. Balance adjustment
4. Feedback adjustment

Figure 6-3. High-Voltage Adjustments

10-KV (Post Accelerator) Adjustment.

NOTE

To gain access to pot. R11, remove the printed circuit board from the high-voltage assembly (16). Position and insulate the board to prevent high-voltage arcing. R11 is a thumbscrew pot.; it should be adjusted with an insulated screwdriver. USE EXTREME CARE WHEN MAKING THIS ADJUSTMENT.

Using a high-voltage probe, monitor the high voltage at the post accelerator anode of the crt. This voltage should be 10 kv, ± 500 volts. If the high voltage is not within tolerance, adjust pot. R11 (located within the high-voltage power supply assembly) until it is set at 10 kv. Check the low-voltage adjustments before proceeding with this adjustment.

Balance and Feedback.

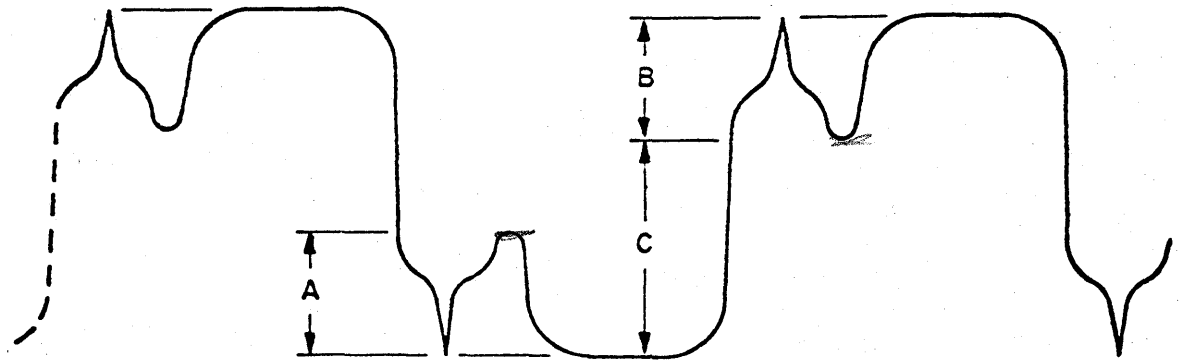
Check these adjustments after making a high-voltage adjustment. Refer to figure 5-7 when making these adjustments.

NOTE

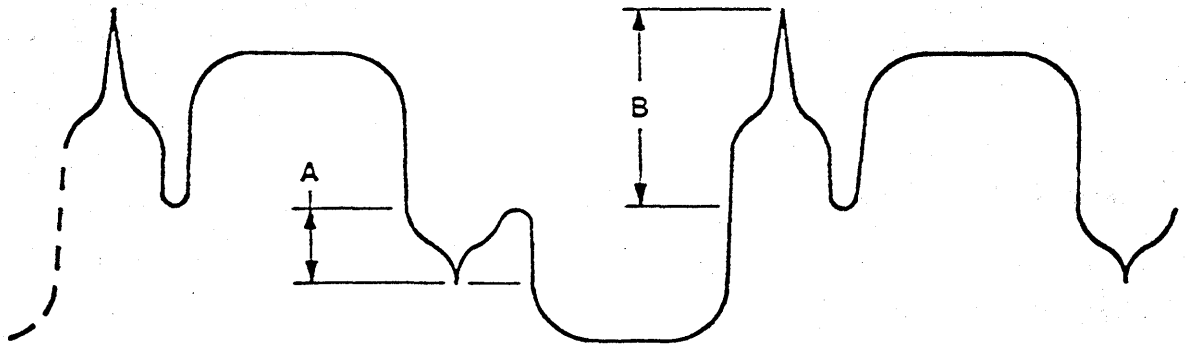
Balance and feedback adjustments interact. Because of this interaction, it may be necessary to repeat these adjustments to obtain the desired waveform shown in figure 6-4.

(a) With an oscilloscope, monitor the signal on the collector of transistor Q1 or Q2. Refer to figure 8-9 for the location of Q1 and Q2. The mounting screws are the actual collector test points. Adjust balance pot. R2 (9) until the positive and negative spikes on Q1 or Q2 are of equal amplitude.

(b) With the oscilloscope connected as in step (a), adjust the feedback pot. R1 (8) until the positive and negative spikes are the same amplitude as the basic square wave.



BALANCE SET CORRECTLY - A EQUALS B
FEEDBACK SET CORRECTLY - SPIKE AMPLITUDE EQUALS SQUARE WAVE AMPLITUDE
B + C = 10 VOLTS



BALANCE SET INCORRECTLY - A DOES NOT EQUAL B
FEEDBACK SET INCORRECTLY - SPIKE AMPLITUDE DOES NOT EQUAL SQUARE WAVE AMPLITUDE

Figure 6-4. High-Voltage Power Supply Waveforms

Focus.

(a) Using the keyboard, type a complete raster of various symbols.

(b) Turn the intensity down to a level where the individual dots making up the symbols are discernible.

(c) While observing the dots in various locations, adjust focus pot. R16 (10) until the dots over the entire screen are the smallest size possible.

Raster Alignment.

If crt raster lines are not parallel to the bezel around the crt, perform the following steps:

(a) Increase crt intensity until a raster is visible.

(b) Loosen the yoke adjustment setscrew (11) until the yoke can be turned by hand.

(c) Rotate the yoke until the raster is parallel to the crt bezel.

(d) Tighten the yoke adjustment setscrew.

Pincushion Distortion Corrector.

The pincushion distortion corrector (13) compensates for geometric distortion of the crt raster. The corrector consists of a ring, containing four magnets, fastened to the front of the yoke assemblies used. The pincushion adjustment available varies with the yoke assemblies. The four magnets are individually adjustable on some yokes while on other types they are not.

If the raster is distorted, perform the following steps:

(a) Loosen the setscrews holding the corrector to the yoke.

(b) Rotate the corrector clockwise or counterclockwise, whichever corrects the distortion.

(c) Tighten the setscrews.

If a small amount of distortion still exists and the correction magnets are individually movable, perform the following steps:

(a) Loosen the screws on the selected magnet.

(b) Slide the magnet within the ring to correct distortion.

(c) Tighten the magnet mounting screws.

NOTE

Before loosening the screws which hold each magnet, determine if the magnet is glued in place. If it is glued, it may not be possible to move the magnet without breaking it.

Centering.

Mechanical centering consists of adjusting two ring magnets located on the back of the deflection yoke (14). Rotating these rings moves the raster up and down as well as left and right. Rotate the centering rings until the raster is centered.

Alert Alarm Volume Control.

The alert alarm is set at the factory; however, it is possible to reset the control. Turning it clockwise increases the volume and turning counterclockwise decreases the volume.

DIAGNOSTIC PROCEDURES.

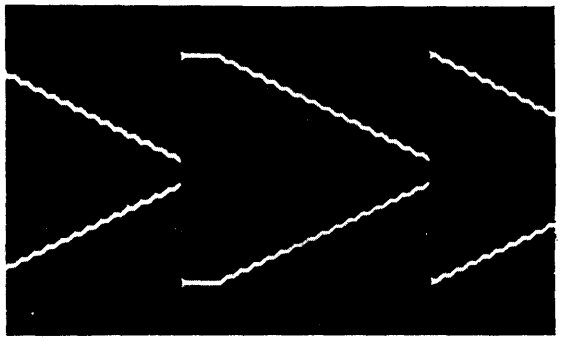
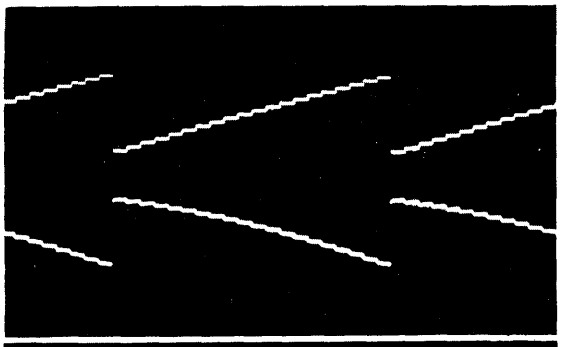
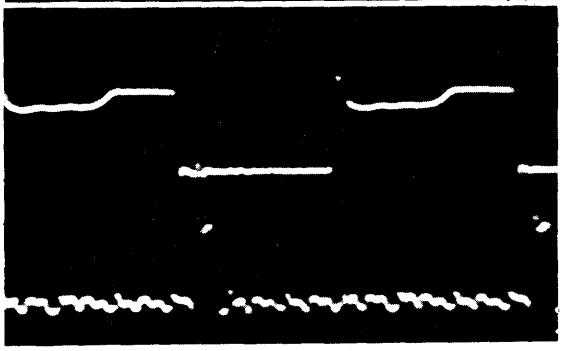
Use the following aids to isolate a suspected Display Station failure.

- Is the unit plugged in?
- Is the unit turned on?
- Is the ON/OFF/INTENSITY control turned up?
- Is there a raster?
- Is the fuse blown?
- Is there high voltage?
- Is there low voltage?
- Is the horizontal deflection circuitry operating?

- Are horizontal and vertical deflection signals being received?
- Are diddle pulses being received?
- Are video signals present?
- Is the keyboard generating correct symbols?

Table 6-3 shows typical horizontal deflection, vertical deflection, diddle, and video waveforms.

TABLE 6-3. TYPICAL DEFLECTION WAVEFORMS

SIGNAL (CARD) LOCATION TEST POINT	SCOPE SETTING	WAVEFORM
Horizontal (044) J3A TPA J3A TPB	VOLTS/CM 5 TIME/CM .2 MILLISEC VOLTS/CM 2 TIME/CM .2 MILLISEC	
Vertical (044A) J1B TPA J1B TPB	VOLTS/CM 5 TIME/CM 5 MILLISEC VOLTS/CM 2 TIME/CM 5 MILLISEC	
Diddle (046) J1A TP1 Video (211) J3B TPA	VOLTS/CM 20 TIME/CM .5 µSEC VOLTS/CM 5 TIME/CM .5 µSEC	

Constant or solid failures may be readily diagnosed; however, it may be necessary to use voltage margins, temperature variations, or vibration (applied with caution) in isolating intermittent conditions.

REMOVE AND REPLACE PROCEDURES.

Use the following procedure for removing and installing the 14-inch rectangular crt in the Display Station.

WARNING

Handle crt carefully since they are dangerous to the person and expensive to replace. Wear proper safety aids, ie, safety glasses, rubber gloves, and an apron. Avoid jarring, scratching, or thermal shock. Do not set a crt face down on anything except a soft, flat, clean surface.

CRT Removal Procedure.

(a) Turn off the Display Station and disconnect power.

(b) Remove the top cover from the Display Station.

(c) Discharge aquadag coating of crt by grounding it.

(d) Check high-voltage discharge at crt post accelerator with a voltmeter. This safely removes any residual charge.

(e) Disconnect the crt post accelerator lead.

(f) Disconnect the crt socket.

(g) Remove the electromagnetic shield from the crt neck.

(h) Loosen the strap around the front of the crt.

(i) Carefully slide the crt forward, making sure the crt neck clears the yokes. Do not handle crt by grasping the neck.

(j) Place the crt in a carton or packing container.

CRT Installation Procedure.

The crt installation procedure is the reverse of the crt removal procedure, omitting step (c).

SECTION VII

MAINTENANCE AIDS

This section contains data necessary to support maintenance of the Display Station. It includes fuse information, the card placement chart, and a table listing keyboard switches and their respective symbols and/or functions.

FUSE.

For 115 Volt Display Stations the fuse, F1, is 2-ampere, 3AG slo blo. 230 Volt Display Stations use a 1.25-ampere, 250V, type MDX.

CARD PLACEMENT CHART.

The card placement chart (table 7-1) is a sequential tabulation of card locations. Its primary function is to indicate the type of card in each location.

TABLE 7-1. CARD PLACEMENT CHART

CARD LOCATION	CARD TYPE	FUNCTION	PART NO.
A1A1 or J1A	046	Diddle amplifier and pulse shaper	90000405
A1A2 or J1B	044A	Vertical amplifier	90000402
A1A4 or J2B	491	Voltage regulator	90000411
A1A5 or J3A	044	Horizontal amplifier	90000399
A1A6 or J3B	211	Video amplifier	90000408

CARD DIAGRAMS.

A schematic diagram and assembly layout on each card type is shown in figures 4-2 through 4-6. The assembly layout shows where each component is physically

located on the card. Each figure gives the card assembly part number. Use this number and the card type when referring to parts data or when ordering a replacement card.

Figure 7-1 shows a typical card schematic and associated 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.

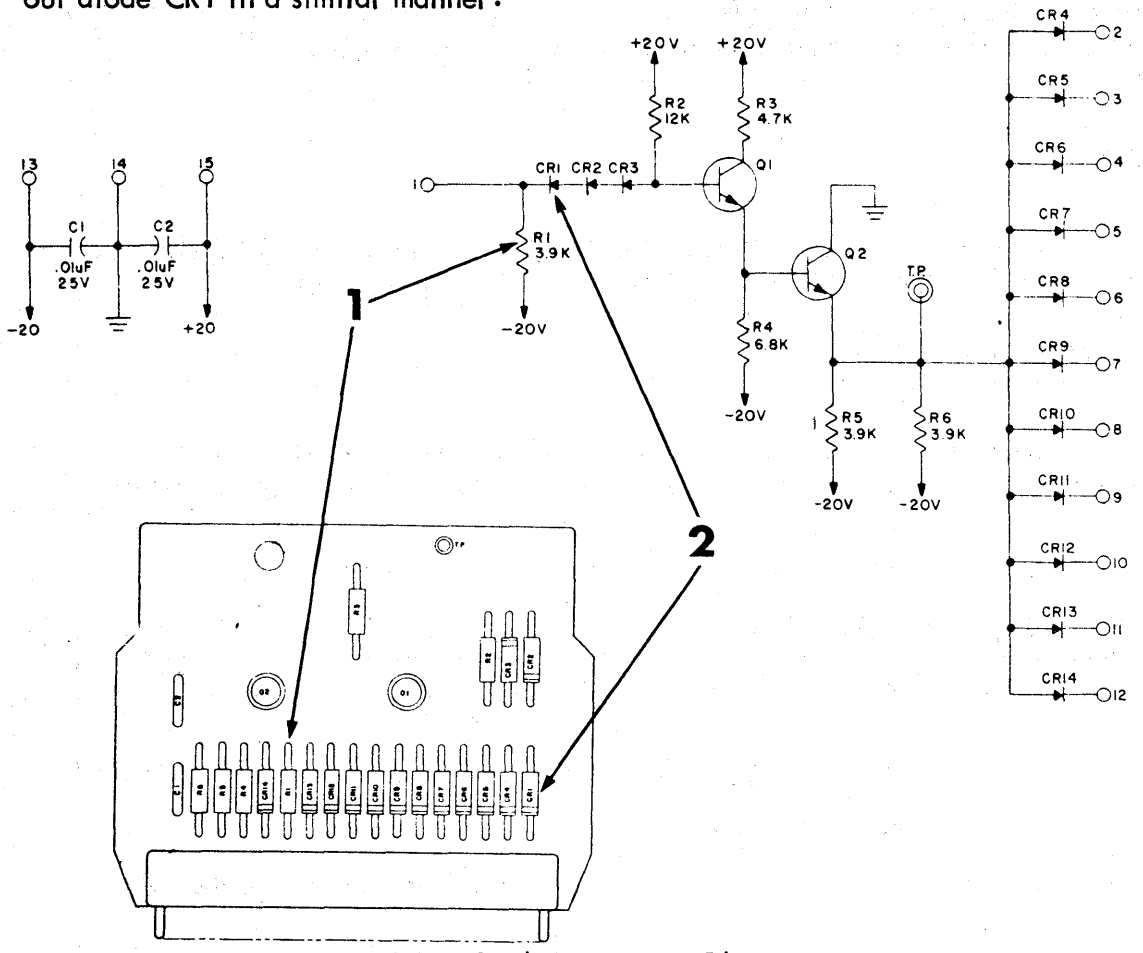


Figure 7-1. Card Component Identification

SWITCH SYMBOLS.

Table 7-2 cross-references keyboard switches and their respective symbols displayed and/or functions performed.

TABLE 7-2. SWITCH SYMBOLS/FUNCTIONS

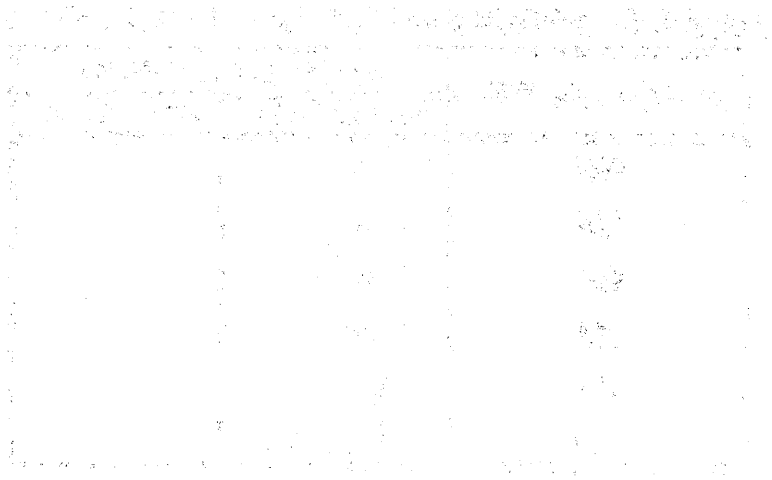
SWITCH NUMBER	SYMBOL/FUNCTION	
	LOWERCASE	UPPERCASE
S1	Space	
S2		↱
S3	.	>
S4	,	<
S5	M	
S6	N	
S7	B	
S8	V	
S9	C	
S10	X	
S11	Z	
S12	Return	
S13	↑	]
S14	↓	[
S15	L	
S16	K	
S17	J	
S18	H	
S19	G	
S20	F	
S21	D	
S22	S	
S23	A	
S24	v	^
S25	P	
S26	O	

TABLE 7-2. SWITCH SYMBOLS/FUNCTIONS (CONT)

SWITCH NUMBER	SYMBOL/FUNCTION	
	LOWERCASE	UPPERCASE
S27	I	
S28	U	
S29	Y	
S30	T	
S31	R	
S32	E	
S33	W	
S34	Q	
S35	=	+
S36	:	-
S37	ø	;
S38	9	)
S39	8	(
S40	7	≠
S41	6	*
S42	5	%
S43	4	$
S44	3	≡
S45	2	≥
S46	1	≤
S47	Aux Send	
S48	Inter	
S49	Send	
S50	Clear	
S51	Shift	
S52	Shift	

TABLE 7-2. SWITCH SYMBOLS/FUNCTIONS (CONT)

SWITCH NUMBER	SYMBOL/FUNCTION	
	LOWERCASE	UPPERCASE
S53	Skip	
S54	Bksp	
S55	Line Skip	
S56	Reset	
S57	Rept	
S60	Send Index	



COMMENT SHEET

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