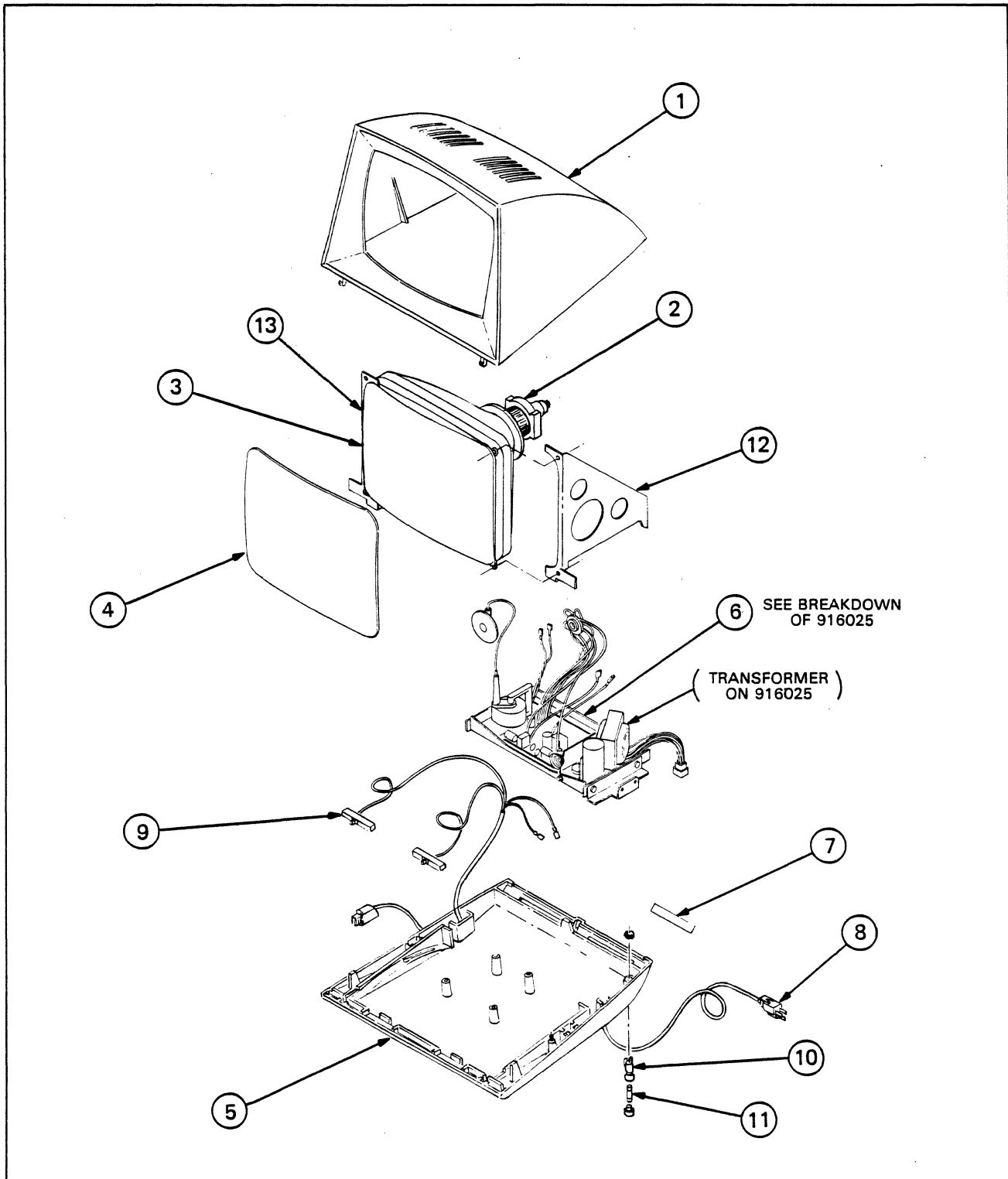


August, 1983

Addendum to ADM 42 Maintenance Manual  
Document No. DP3090982F01  
Motorola Service Manual  
and  
Parts List



*ADM 42 Monitor Assembly. Motorola Only.*

MONITOR ASSY ADM 42 MOTOROLA

129779-1 MONITOR ASSY, MOTOROLA WITHOUT HOUSING  
(Includes Items # 2, 3, 6, 13, 14.)

ITEM	PART NUMBER	DESCRIPTION	QTY.
1.	131369-001	Housing, ADM 42 Cover Mon.	1
2.	919005	Yoke, ADM 42 Motorola	1
3.	919002	CRT, Tube Std. Motorola 15"	1
	919006	CRT, Tube Green Motorola 15"	1
4.	819062	Panel, Face	1
5.	131369-002	Housing, ADM 42 Base Mon.	1
6.	916025	Monitor base plate Assy with Transformer (see brake down on following pages)	1
7.	129497-49	Nameplate UL	1
8.	129455-9	Power cord 115V	1
9.	129839-1	Cable Assy, Monitor w/Resistors	1
	129839-11	Cable Assy, Monitor w/Res + Extra Length	1
10.	840005	Fuse Holder	1
11.	840013	Fuse 1.5 amp slo-blo 115V	1
12.	129708-5	Mounting bracket, CRT left	1
13.	29708-6	Mounting bracket, CRT right	1

MONITOR BASE PLATE ASSY, MOTOROLA

916025 Monitor base plate Assy, Motorola  
(Complete with Transformer)

PART NUMBER	DESCRIPTION	LOCATION	QTY.
916985	Transformer, Power	T1	1
905356	Cap. 4500 50V Lytic	C101	1
910525	Transistor 7675 24V Reg	Q101	1
916023	Flyback Assy, H. F. XFMR	T402	1
905707	Cap .22 10% 50V Poly	C102	1
905304	Cap 100 mfd 10V Lytic	C103	1
905037	Cap 120 pfd 5% 100V cer	C201, 401	2
905357	Cap 22 mfd 35V Lytic	C202, 310	2
905038	Cap 0.1 mfd 80-20% 100V cer	C203, 301, 303, 311, 402, 424	6
905016	Cap .01 mfd 80-20% 100V cer	C204, 206, 414	3
905358	Cap 68 mfd 100V Lytic	C205	1
905359	Cap 100 mfd 50V Lytic	C302	1
905039	Cap .005 mfd 20% 500V cer	C207, 423	2
905704	Cap 0.15 mfd 10% 100V poly	C304	1
905708	Cap 0.1 mfd 10% 100V poly	C305, 306	2
905002	Cap 33 pfd 10% 500V cer	C308	1
905360	Cap 1500 mfd 25V Lytic	C312	1
905040	Cap .001 mfd 10% 500V cer	C314, 403, 404, 714	4
905041	Cap .0027 mfd 20% 100V cer	C405	1
905007	Cap .01 mfd 20% 1KV cer	C406	1
905316	Cap 1.0 mfd 50V Lytic	C407	1
905709	Cap .033 mfd 10% 200V poly	C408	1

**MONITOR BASE PLATE ASSY, MOTOROLA (cont'd)**

PART NUMBER	DESCRIPTION	LOCATION	QTY.
905042	Cap 2200 pfd 2% 100V cer	C409	1
905361	Cap 100 mfd 16V Lytic	C410	1
905362	Cap 4.7 mfd 35V Lytic	C411	1
905018	Cap .01 mfd 80-20% 50V cer	C412	1
905043	Cap .0022 mfd 10% 50V cer	C413	1
905363	Cap 220 mfd 10V Lytic	C415	1
905710	Cap .0091 mfd 5% 1200V poly carb	C416	1
905044	Cap 470 pfd 10% 500V cer	C418	1
905711	Cap 1.0 mfd 10% 200V poly	C419	1
905712	Cap .0033 mfd 10% 200V poly	C420	1
905713	Cap .001 mfd 10% 600V poly	C421	1
905714	Cap 0.47 mfd 10% 600V poly	C422	1
908026	Diode 91A12 Rectifier, Silicon	D101, 102, 103, 104	4
908027	Diode 2054 Gen. Purpose	D105, 201, 301, 302, 303, 401, 402, 403, 404, 405, 501, 502	12
908028	Diode 91A02 Rectifier, Silicon	D304	1
908029	Diode 4921 Damper 800V	D406	1
908030	Diode D1K Silicon	D407	1
908031	Diode 75B02 Fast Recovery 200V	D408	1
908032	Diode 73B06 Fast Recovery 600V	D409	1
808006	Diode 1N5231B Zener	VR101	1
913024	IC Opt Ampl T3F	IC101	1
840015	Fuse 2.5A 3AG	F101	1
128348-6	IC 7406 6-Inverter	IC201	1
913025	IC TDA1170S Vert Processor	IC301	1
129467-123	IC 74LS123 Dual Retrigr	IC401	1

MONITOR BASE PLATE ASSY, MOTOROLA (cont'd)

PART NUMBER	DESCRIPTION	LOCATION	QTY.
128348-555	IC NE555V Timing	IC402	1
917036	Coil 4.7 uh (Peaking)	L201	1
917037	Coil Horiz. Size	L401	1
917038	Coil Horiz. Linearity	L402	1
910526	Trans. 3026 Reg Driver	Q102, 202	2
910527	Trans. A2J Video Driver	Q201	1
910528	Trans. 3007 Horiz. Driver	Q401	1
910529	Trans. 7696 Horiz. Output	Q402	1
903605	Res 220 ohm 5% 1W	R104	1
901027	Res 10K ohm +24V Adj Var.	R107	1
903718	Res 100 ohm 5% 2W (Standup)	R110	1
903609	Res 82 ohm 5% 1W	R111	1
903850	Res 1.2K ohm 10% 5W	R210	1
901028	Res 250K ohm Var. Control	R212	1
903045	Res 270K ohm 1/4W	R214	1
901030	Res 100K ohm Var. (Vert hold)	R310, 315	2
901031	Res 100K ohm Var. (Vert Size)	R312	1
903037	Res 121K ohm 1% 1/8W	R313	1
903039	Res 274K ohm 1% 1/8 W	R314	1
903567	Res 1.0 ohm 10% 1/2W	R323	1
903611	Res 3.9 ohm 5% 1W	R326	1
901032	Res 200K ohm Var. (Horiz. Delay)	R402	1
903600	Res 68K ohm 10% 1W	R411	1
903040	Res 15.4K ohm 1% 1/8W	R416	1
901033	Res 20K ohm Var. (Horiz. Hold)	R418	1
903559	Res 82 ohm 1% 1/2W	R421	1

**MONITOR BASE PLATE ASSY, MOTOROLA (cont'd)**

PART NUMBER	DESCRIPTION	LOCATION	QTY.
903573	Res 1.8 ohm 10% 1/2W	R426	1
903571	Res 3.3 ohm 5% 1/2W	R427	1
903612	Res 330K ohm 10% 1W	R428	1
901034	REs 2M Var (Focus)	R429	1
916984	Transformer, Horiz. Driver	T401	1
128533-301	Res 300 ohm 5% 1/4W	R101	1
128533-101	Res 100 ohm 5% 1/4W	R102, 407	2
128538-302	Res 3K ohm 5% 1/2W	R103, 109	2
903548	Res 1.8K ohm 5% 1/2W	R105	1
128533-123	Res 12K ohm 5% 1/4W	R106	1
128533-122	REs 1.2K ohm 1/4W 5%	R108	1
128533-470	Res 47 ohm 5% 1/4W	R202, 203, 209, 301, 401, 423	6
128533-560	Res 56 ohm 5% 1/4W	R204	1
903033	Res 56K ohm 5% 1/4W	R205	1
128533-391	Res 390 ohm 5% 1/4W	R206, 217, 425	3
903043	Res 5.6K ohm 5% 1/4W	R207, 306	2
903044	Res 3.3 ohm 5% 1/4W	R208, 321, 405	3
903502	Res 470 ohm 5% 1/2W	R211, 215	2
128533-223	Res 22K ohm 5% 1/4W	R218	1
128533-104	Res 100K ohm 5% 1/4W	R219, 409, 410, 430	4
128533-332	Res 3.3K ohm 5% 1/4W	R305, 408, 413	3
128533-222	Res 2.2K ohm 5% 1/4W	R307	1
128533-183	Res 18K ohm 5% 1/4W	R308	1
128533-154	Res 150K ohm 5% 1/4W	R311	1
128533-433	Res 43K ohm 5% 1/4W	R316	1

MONITOR BASE PLATE ASSY, MOTOROLA (cont'd)

PART NUMBER	DESCRIPTION	LOCATION	QTY.
128533-823	Res 82K ohm 5% 1/4W	R317	1
128533-224	Res 220K ohm 5% 1/4W	R318	1
128533-822	Res 8.2K ohm 5% 1/4W	R319	1
128533-333	Res 33K ohm 5% 1/4W	R320	1
128533-103	Res 10K ohm 5% 1/4W	R322, 406	2
129471-152	Res 1.5K ohm 5% 1/2W	R324, 420	2
128533-472	Res 4.7K ohm 5% 1/4W	R403	1
128533-102	Res 1K ohm 5% 1/4W	R404, 415	2
128533-273	Res 27K ohm 5% 1/4W	R412	1
128533-393	Res 39K ohm 5% 1/4W	R414	1
128533-473	Res 47K ohm 5% 1/4W	R417	1
128533-271	Res 270 ohm 5% 1/4W	R419	1
903038	Res 2.7 ohm 5% 1/4W	R422	1
128533-102	Res 1K ohm 5% 1/4W	R424	1
903572	Res 56K ohm 10% 1/2W	R431, 432	2
128533-102	Res 1K ohm 5% 1/4W	R435	1
128533-561	Res 560 ohm 5% 1/4W	R502	1





# MOTOROLA

## GENERAL INFORMATION

The monitors described herein are fully transistorized (except CRT) and applicable for displaying alphanumeric characters. The MDS3000, MDS3003 series monitors use a 12-inch CRT and the MDS4000, MDS4003 series monitors use a 15-inch CRT. Each monitor accepts a TTL non-composite video, with separate TTL horizontal and vertical sync pulses. Additional inputs include optional TTL StepScan, and/or optional +24VDC to operate the monitor.

A universal power transformer permits operating the monitor from 120, 220 or 240 volts AC, 50/60 Hz. A built-in regulated power supply provides operating voltages of +24V, +13V and +5V.

Input and output connections for the monitor are made through a standard 10-pin edge connector, (or optional 20-pin connector) on the circuit card. Inputs consist of non-composite video, horizontal sync, vertical sync, and signal ground. The optional TTL level StepScan and +24VDC are also connected to the monitor via the 10-pin edge connector. Three pins on the edge connector are also provided for alternate interconnecting of the remote brightness control.

Circuitry consists of two stages for non-composite video amplification, one integrated circuit for vertical sync and deflection processing, five stages for horizontal sync and deflection processing, and a three stage regulated power

## SERVICE MANUAL

### MDS3000, 3003 SERIES (12-INCH)

### MDS4000, 4003 SERIES (15-INCH)

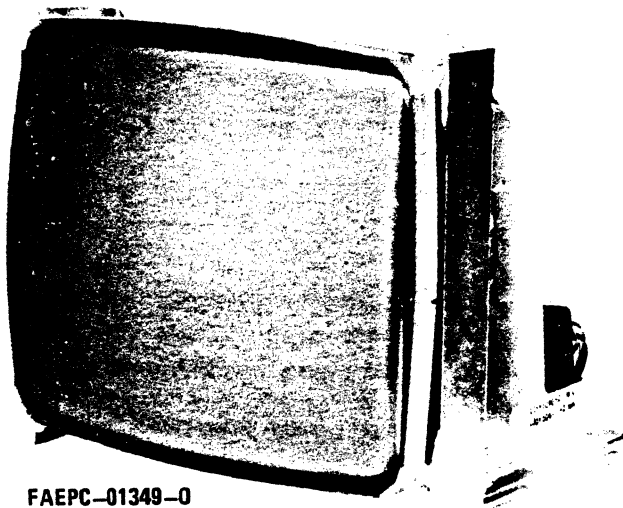
## CRT DISPLAY MONITORS

### StepScan™

 **MOTOROLA**

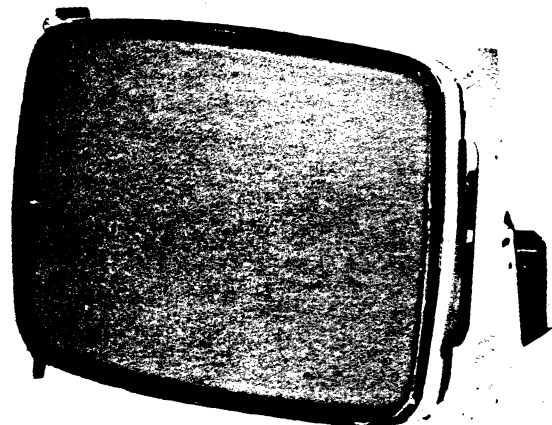
supply. All models also contain dynamic focusing and spot kill circuitry.

One etched circuit card is utilized, which contains all necessary circuitry. Components are mounted on the top of the circuit card and plated copper foil on the bottom. Schematic reference numbers are printed on the top and bottom of each circuit card to aid in the location and identification of components for servicing. All standard operating/adjustment controls are mounted in a convenient manner on the circuit card.



FAEPC-01349-0

Model MDS4000, MDS4003 Series (15" CRT)



Model MDS3000, MDS3003 Series (12" CRT)



## MOTOROLA INC.

### Display Systems

## SAFETY WARNING

**CAUTION: NO WORK SHOULD BE ATTEMPTED ON AN EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.**

1. **SAFETY PROCEDURES** should be developed by habit so that when the technician is rushed with repair work, he automatically takes precautions.

2. A **GOOD PRACTICE**, when working on any unit, is to first ground the chassis and to use only one hand when testing circuitry. This will avoid the possibility of carelessly putting one hand on chassis or ground and the other on an electrical connection which could cause a severe electrical shock.

3. Extreme care should be used in **HANDLING THE PICTURE TUBE** as rough handling may cause it to implode due to atmospheric pressure (14.7 lbs. per sq. in.). Do not nick or scratch glass or subject it to any undue pressure in removal or installation. When handling, safety goggles and heavy gloves should be worn for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from ground to anode or use a well insulated piece of wire. When servicing or repairing the monitor, if the cathode ray tube is replaced by a type of tube other than that specified under the Motorola Part Number as original equipment in this Service Manual, then avoid prolonged exposure at close range to unshielded areas of the cathode ray tube. Possible danger of personal injury from unnecessary exposure to X-ray radiation may result.

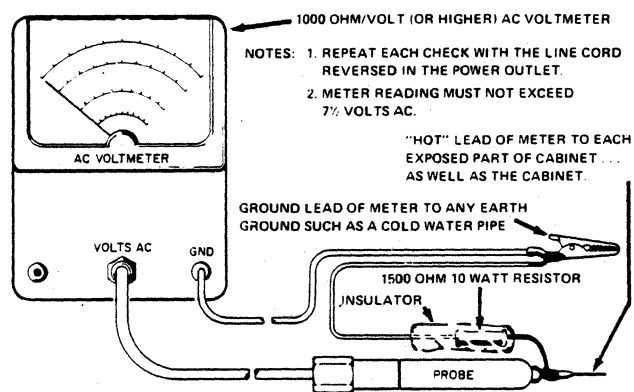
4. An **ISOLATION TRANSFORMER** should always be used during the servicing of a unit whose chassis is connected to one side of the power line. Use a transformer of adequate power rating as this protects the serviceman from accidents resulting in personal injury from electrical shocks. It will also protect the chassis and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

5. Always **REPLACE PROTECTIVE DEVICES**, such as fishpaper, isolation resistors and capacitors and shields after working on the unit.

6. If the **HIGH VOLTAGE** is adjustable, it should always be **ADJUSTED** to the level recommended by the manufacturer. If the voltage is increased above the normal setting, exposure to unnecessary X-ray radiation could result. High voltage can accurately be measured with a high voltage meter connected from the anode lead to chassis.

7. **BEFORE RETURNING A SERVICED UNIT**, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. **DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.**

In addition to practicing the basic and fundamental electrical safety rules, the following test, which is related to the minimum safety requirements of the Underwriters Laboratories should be performed by the service technician before any unit which has been serviced is returned.



Voltmeter Hook-up for Safety Check

A 1000 ohm per volt AC voltmeter is prepared by shunting it with a 1500 ohm, 10 watt resistor. The safety test is made by contacting one meter probe to any portion of the unit exposed to the operator such as the cabinet trim, hardware, controls, knobs, etc., while the other probe is held in contact with a good "earth" ground such as a cold water pipe.

The AC voltage indicated by the meter may not exceed 7½ volts. A reading exceeding 7½ volts indicates that a potentially dangerous leakage path exists between the exposed portion of the unit and "earth" ground. Such a unit represents a potentially serious shock hazard to the operator.

The above test should be repeated with the power plug reversed, when applicable.

**NEVER RETURN A MONITOR** which does not pass the safety test until the fault has been located and corrected.

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**\* NOTE:** A service schematic diagram and electrical/mechanical parts list for the basic MDS-Series CRT monitors is not included in this manual; instead, it accompanies this manual as a separate sheet, Motorola Part No. 68P25253A84.

For users of unique variations of the MDS-Series CRT monitors, however, order the schematic diagram by its complete model number.

## SPECIFICATIONS

### DISPLAY

- **MDS3000** — 12" diagonal measure
- **MDS4000** — 15" measured diagonally, 14" diagonal viewable area
- 110° deflection angle
- 3 x 4 aspect ratio
- P4 phosphor standard (other EIA phosphors available)
- T band U.L. implosion protection
- Direct etch and PPG optional
- **Standard Display Size:** (MDS3000) 8.5 x 6.0, (MDS4000) 10.0 x 7.5
- Capable of displaying over 3400 characters.

### VIDEO PERFORMANCE

- **Resolution:** 1200 lines center, 950 lines corners (P4 phosphor)
- **Bandwidth:** within 3 dB, 10 Hz to 30 MHz is typical.

### PERFORMANCE FEATURES

- **StepScan™:** Stepped vertical scanning option provides an increased capacity display at any horizontal frequency, thus conserving bandwidth and in many cases, eliminating the need for a higher frequency clock for increased performance.
- **Dynamic Focus:** Excellent corner focus is achieved by supplying dynamic voltage to the focus element of the cathode ray tube.

### SYNCHRONIZATION

- **Horizontal:** 15.7 kHz  $\pm$  500 Standard; 18.7 kHz  $\pm$  500 optional
- **Vertical:** 47 to 63 Hz
- **Horizontal Blanking:** 11 uSec minimum (for scanning frequency of 15.7 kHz). 10 uSec minimum (at 18.7 kHz). Time includes retrace and delay.
- **Vertical Blanking:** 800 uSec (includes retrace and video delay)

### INPUT SIGNALS

- **Horizontal:** 4 to 32 uSec, input TTL compatible, positive-going (negative optional), 4.0V PP  $\pm$  1.5
- **Vertical:** 50 to 1400 uSec, input TTL compatible, positive (negative optional), 4.0V PP  $\pm$  1.5
- **Video:** positive white, input termination 470 ohms  $\pm$  5%, 2.5 - 5.0V PP  
Composite video input with DHHS protection circuit optionally available.

### POWER INPUT

- 120/240V AC (105-135), 50/60 Hz, 65VA max.
- 24V DC optional

### INTERCONNECT TO CUSTOMER SYSTEM

- 10 pin edge connector standard
- 20 pin ribbon cable optional

### CONTROLS

- **Internal:** Horizontal size, horizontal video centering, brightness, focus, vertical hold, vertical size, vertical linearity. (All controls adjustable from top or back of unit).
- **External:** Brightness (as an operator control).
- Optional contrast control available.

### GEOMETRY (Pin & Barrel)

- Sides equal less than 1% of height.
- Top and bottom equal less than 1% of width.

### LINEARITY

- Character height or width will not vary  $\pm$ 7% from the average character size.
- Adjacent characters will not vary more than 5%.

### ENVIRONMENT

- **Operating Temperature:** 0° to +55°C
- **Storage Temperature:** -40°C to +65°C

**Note:** CRT's with bonded etched panels should not be subjected to storage or operating temperatures above 50°C

- **Operating Altitude:** 10,000 ft. max.

Designed to comply with DHHS Radiation Performance Standards and U.L. specifications.

\*In a continual effort to upgrade our standard products as new technological advances are made, specifications are subject to change without notice.

### — NOTE —

This manual is up-to-date and correct as of the printing date.

**— CAUTION —**  
NO WORK SHOULD BE ATTEMPTED ON ANY EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.

# SERVICE NOTES

## BLOCK/SCHEMATIC DIAGRAMS

Refer to Figure 1 for a functional view of an MDS-Series Display Monitor in block form. It will help in becoming familiar with the overall schematic diagram, which accompanies this manual as a separate service sheet (Motorola Part No. 68P25253A84).

## ELECTRICAL/MECHANICAL PARTS LISTS

A complete listing of field replaceable parts in alphanumeric sequence is included on the back of the accompanying schematic diagram.

## CIRCUIT TRACING

Component reference numbers are printed on the top and bottom of the circuit card to facilitate circuit tracing. In addition, top (component) and bottom (solder) view drawings are included for convenient viewing of the circuit card. Transistor elements are identified as follows:

E – emitter, B – base, and C – collector

## COMPONENT REMOVAL

On the circuit card, component removal requires the use of a "desoldering" iron, carefully applied to pre-

vent lifting of the foil from the circuit card. An iron with a temperature controlled heating element is recommended to reduce the possibility of card damage. Use latest recommended desoldering procedures. The nozzle of the solder extracting gun should be inserted directly over the component lead which is heated only long enough to melt the solder and draw it away. This should leave the component lead free of the circuit card.

## POWER TRANSISTOR REPLACEMENT

When replacing transistors Q101 (+24V Reg.) or Q402 (Horiz. Output), use the following information and observe all precautions:

1. There are no plug-in sockets; instead, two (2) screws are soldered from the bottom of the circuit card to protrude up through the circuit card and its bracket. The transistors are secured with two (2) nuts each on the top of the circuit card bracket, which also serves as a heat sink.
2. When replacing a transistor, silicone grease (Motorola Part No. 11M490487) should be applied evenly to the top of the heat sink (circuit card bracket) and bottom of the transistor. In addition, be sure a mica insulator is positioned properly between the transistor and heat sink.

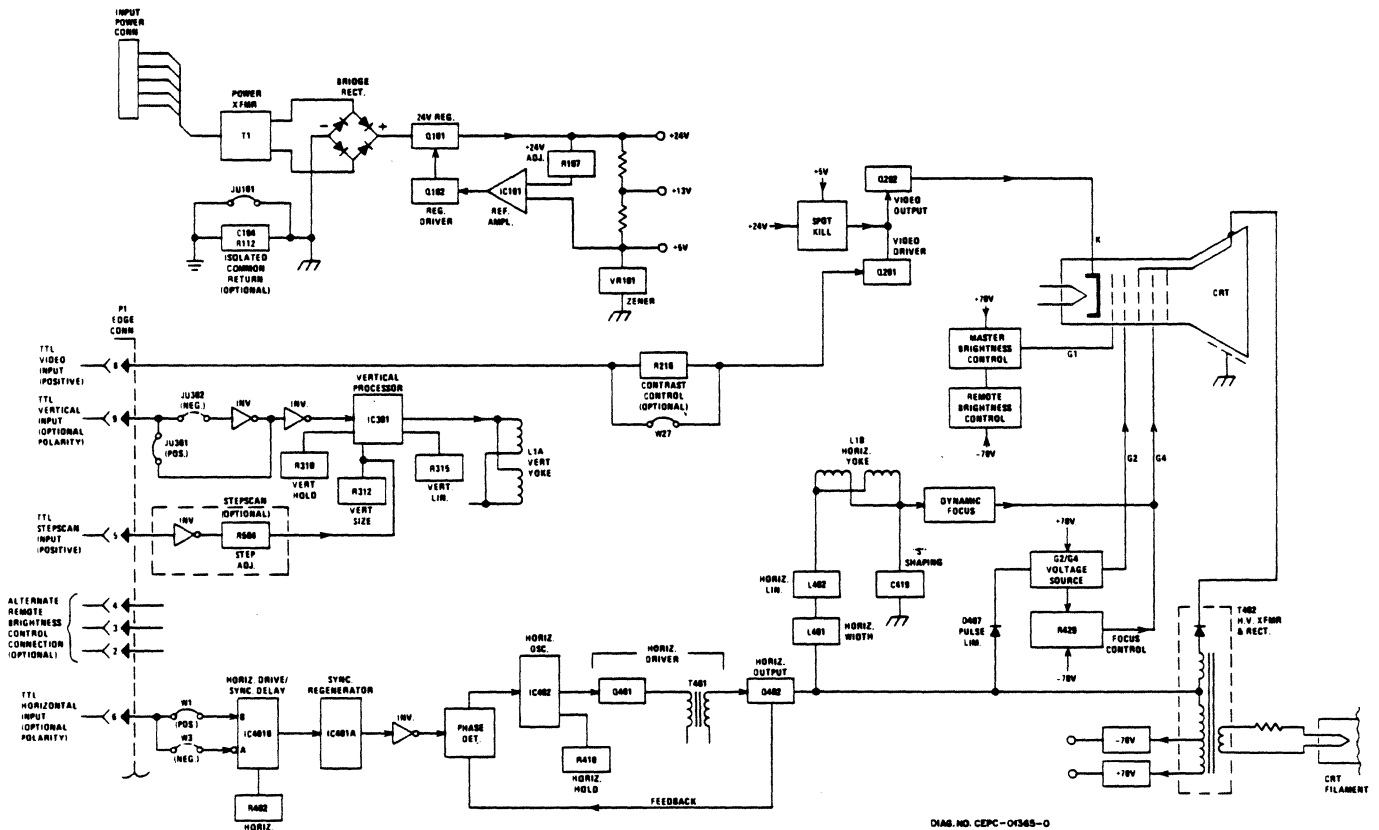


Figure 1. MDS-Series Display Monitor – Functional Block Diagram

- The transistor mounting nuts must be tight before applying power to the monitor. This insures proper cooling and electrical connections. **NON-COMPLIANCE WITH THESE INSTRUCTIONS CAN RESULT IN FAILURE OF THE TRANSISTOR AND/OR ITS RELATED COMPONENTS.**

- NOTE -

Use caution when tightening transistor mounting nuts. If the screw or nut threads are stripped by excessive pressure, a poor electrical and mechanical connection will result.

### INSTALLATION—MOUNTING SLOT HOLE DIMENSIONS

Figure 2 is a bottom view drawing that clearly illustrates mounting slot hole dimensions. Use it to identify mounting clearances in the final installation.

### CRT REPLACEMENT

#### General

Use extreme care in handling the CRT as rough handling may cause it to implode due to high vacuum pressure.

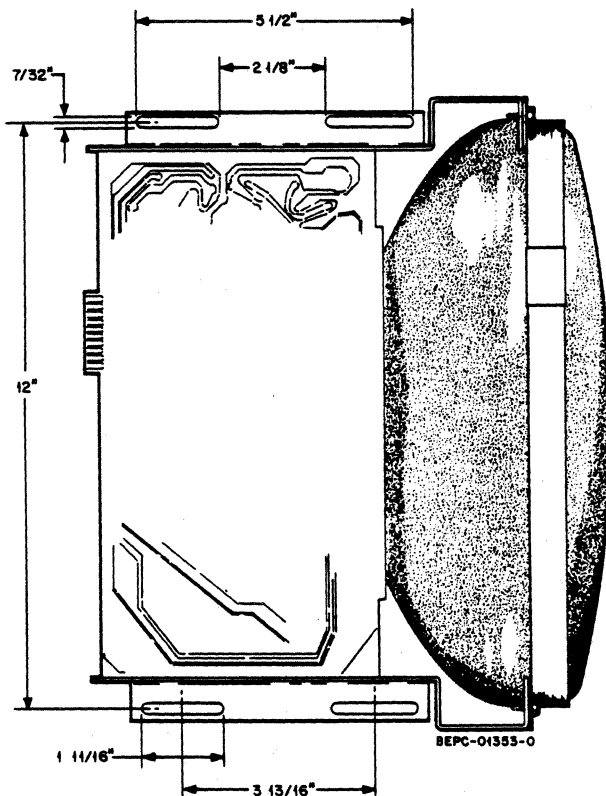


Figure 2. Mounting Slot Hole Dimensions

Do not nick or scratch glass or subject it to any undue pressure in removal or installation. Use goggles and heavy gloves for protection. Also, be sure to disconnect the monitor from all external voltage sources. Refer to Figure 5 for location of the CRT identification label. Information on the label is essential for ordering the correct replacement CRT!

#### Procedure

- Step 1. Connect a grounding strap (first) to the metal chassis for a good earth ground; then discharge CRT by shorting the H.V. 2nd anode to ground.
- Step 2. Remove the CRT socket, deflection yoke (loosen clamp screw) and 2nd anode lead.
- Step 3. Remove CRT from the front of the chassis by loosening and removing four screws, one at each corner of CRT.
- Step 4. Reverse the above steps to re-install the new CRT.
- Step 5. After installation perform operational check/adjustment procedures.

### SERVICE PHOTOGRAPHS

#### Figure 3:

Figure 3 shows the rear view of a typical MDS-Series display monitor. Callouts identify the circuit card edge connector (P1) for signal inputs, a six (6) pin power input connector, and a remote brightness control (R213) soldered to the circuit card. Variations to the aforementioned will include a different type of power connector, and the remote brightness control can be interconnected via the circuit card edge connector.

#### Figure 4:

For convenient access to the component (top) side of the circuit card, reference Figure 4. Callouts accompanying the illustration are self-explanatory.

#### Figure 5:

For convenient unobstructed troubleshooting of the circuit card, stand the monitor on its side as shown in Figure 5. Notice also in this illustration the location of the CRT identification label. The information on this label is essential for ordering the correct replacement CRT.

#### Figure 6:

Reference Figure 6 for quick identification and location of adjustable controls, transistors, integrated circuits, etc.

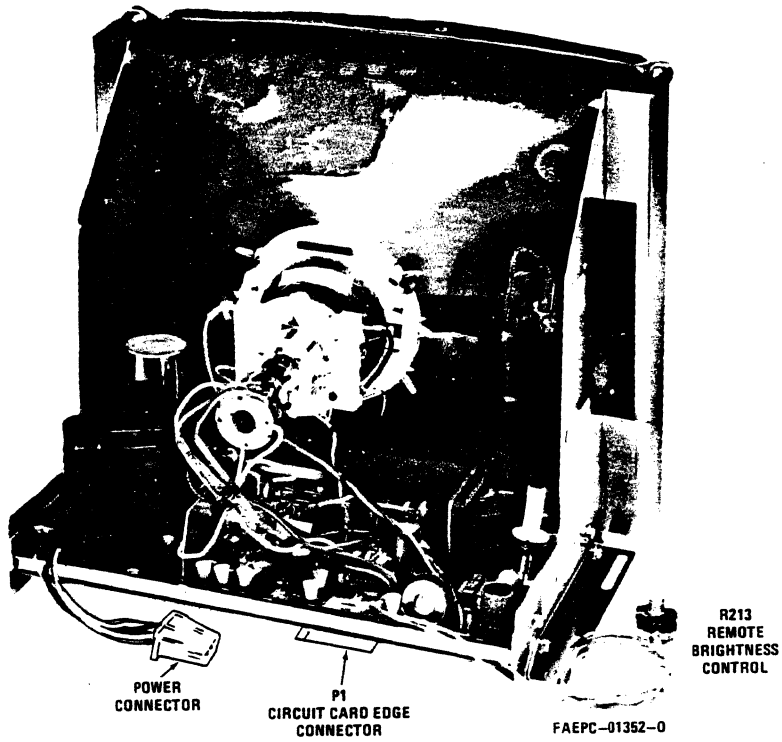


Figure 3. Typical MDS-Series Display Monitor - Rear View

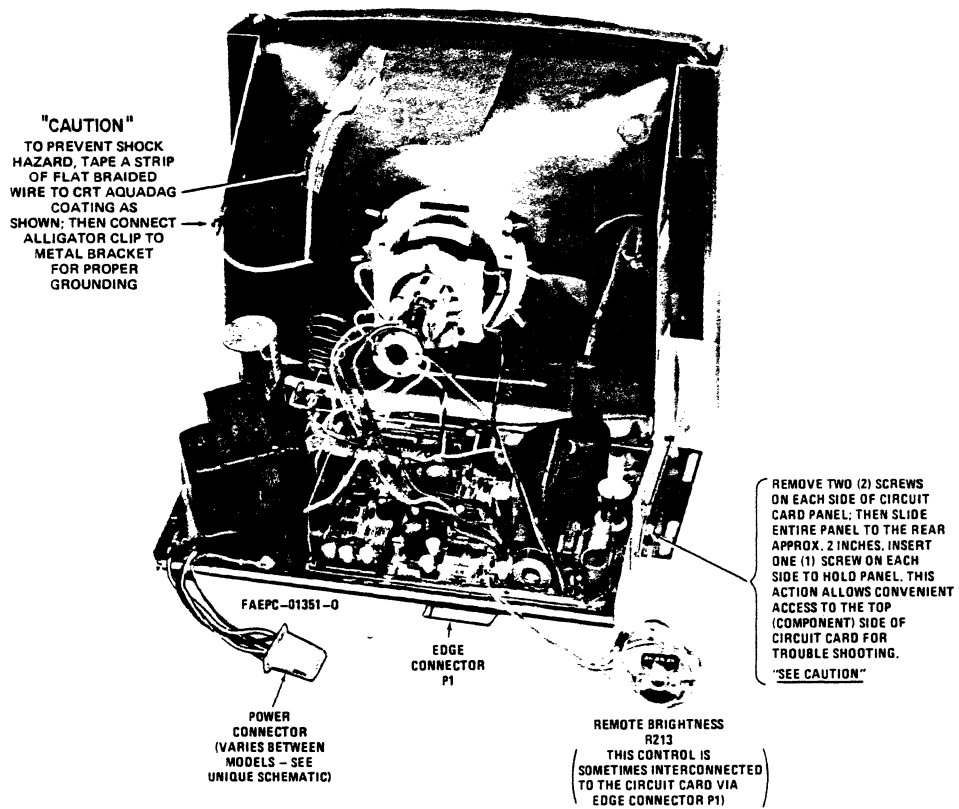


Figure 4. Circuit Card Troubleshooting from Component Side

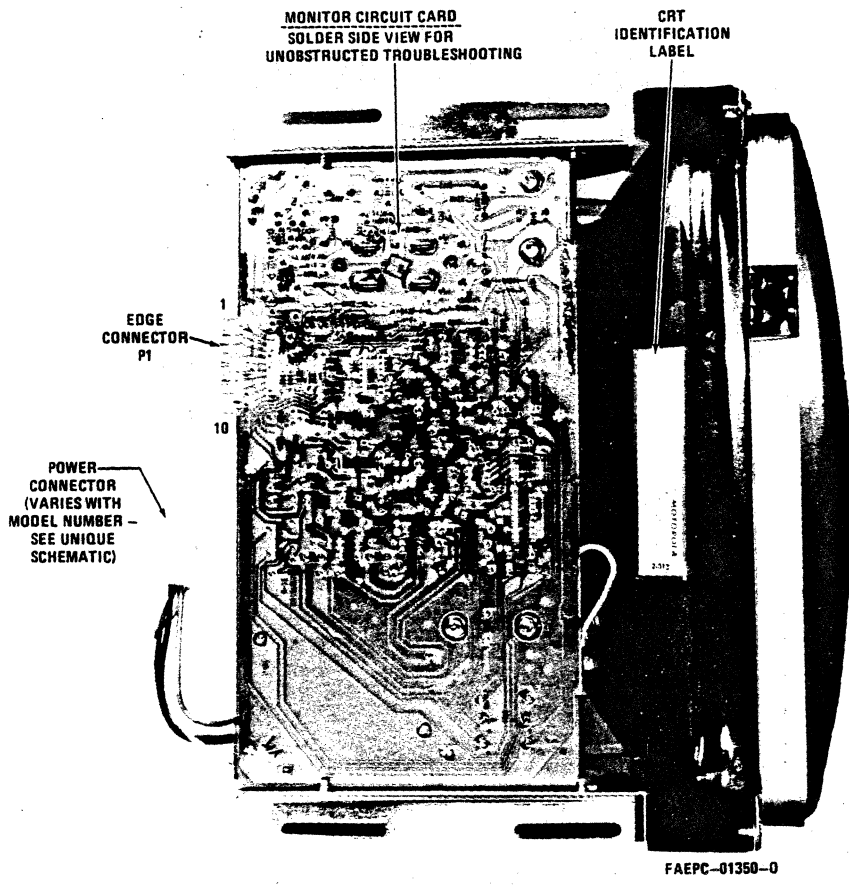


Figure 5. Circuit Card Troubleshooting from Component Side

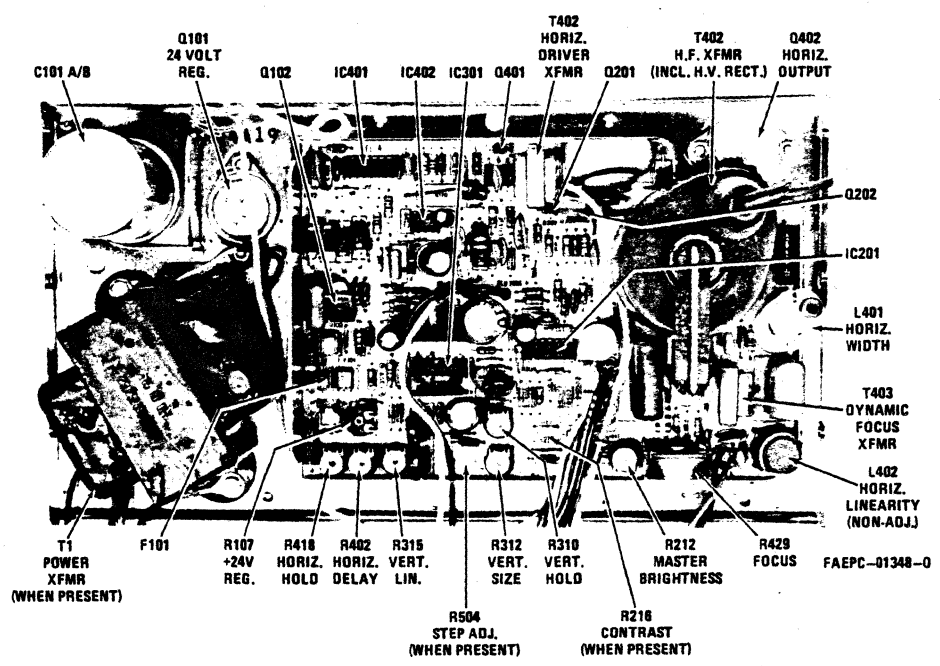


Figure 6. Identification and Location of Circuit Card Components - Adjustable Controls, Transistors, Integrated Circuits, Etc.



## OPERATIONAL CHECK/ADJUSTMENT PROCEDURES

### GENERAL

The following procedures are provided to check the operation of the monitor and perform simple preinstallation adjustments (if required), or readjust after servicing and component replacement.

When reference is made to adjust to a specific size display (vertically and horizontally), refer to original model specifications for correct dimensions by the monitor model number. This also applies to minimum and maximum tolerances when adjusting for correct CRT geometry, linearity, focus, etc.

#### – NOTE –

To assist in understanding more of the preceding terminology, refer to a separate Motorola Manual, "Incoming Inspection Guide" (Motorola part number 68P25253A71).

Perform the procedures in the sequence presented, and allow at least five (5) minutes warm-up before adjusting the monitor. In addition, when instructed to disconnect an input signal, do not ground the signal at the circuit card edge connector (P1). This action could damage the signal source generator. Instead, disconnect the signal at its source.

CCW = Counter Clockwise Rotation, CW = Clockwise Rotation. (As viewed from rear of circuit card.)

### EQUIPMENT REQUIRED

Variac (0-150 Volts AC)

Precision Digital Voltmeter

Non-Metallic Alignment Tool

Test Signals (Bench test signals must be same amplitude, polarity, and frequency as final installed operating signal source. Refer to original specifications for values by monitor model number.)

The following Motorola gauges are required for performing complete and accurate CRT geometry and linearity alignment. Refer to original model specifications for correct gauges to use.

Linearity Gauge

Slot Gauge

Parallelogram Gauge

### ISOLATED GROUND/COMMON RETURN CHECK

#### – CAUTION –

Do not connect power or signals to monitor.

**Procedure No. 1.** For monitors with circuit card common return foil isolated from metallic chassis/earth ground. Isolating components are R112 (22K resistor) and C104 (0.1  $\mu$ F capacitor); jumper JU101 is out.

Step 1. Connect ohmmeter leads between edge connector P1, pin 1, and chassis (earth) ground. Resistance reading should be 22K ohms,  $\pm$  5%.

Step 2. Connect ohmmeter leads between edge connector P1, pin 10, and chassis (earth) ground. Resistance reading should be 22k ohms,  $\pm$  5%.

#### – NOTE –

Step 3 is only for monitors that have their Remote Brightness control (R213) interconnected to the circuit card via edge connector P1, pins 2, 3 and 4.

Step 3. Connect ohmmeter leads between edge connector P1, pin 2, and chassis (earth) ground. Resistance reading should be 22K ohms,  $\pm$  5%.

**Procedure No. 2.** For monitors with non-isolated circuit card common return foil; whereby, the foil is connected direct to the metallic chassis/earth ground via a (white) wire. (Jumper JU101 is in, while components R112 and C104 are out.)

Step 1. Measure between edge connector pins and chassis (earth) ground as described in Procedure No. 1. Resistance readings should be 0.2 ohms or less.

### +24V VOLTAGE REGULATOR CONTROL ADJUSTMENT

#### Procedure

Step 1. Connect monitor to AC line supply. Adjust supply to 120 volts.

Step 2. Apply signal connector to circuit card edge connector, P1.

Step 3. Adjust Vertical (R310) and Horizontal (R418) Hold controls until display is synced.

Step 4. Connect a DC digital voltmeter or other precision accuracy voltmeter to the collector (case) of the regulator output transistor, Q101.

Step 5. Adjust the +24V Voltage Regulator control, R107, for output of +24 volts  $\pm$  0.5 volts.

Step 6. When adjustment is complete, vary the AC line supply voltage between 105 and 135 volts to check for proper regulator operation. If regulator is operating properly there should be no change in display size.

## BRIGHTNESS/CONTRAST ADJUSTMENT

### Procedure

Step 1A. Disconnect video signal input (only) at pin 8 of edge connector P1 . . .

or

Step 1B. If monitor is equipped with a Contrast control (R216 on monitor circuit card or customer supplied off-circuit card), rotate to the position that cuts off the video input signal.

Step 2. Rotate Master Brightness control (R212) fully CCW (raster off).

Step 3. Rotate Remote Brightness control (R213) fully CCW (raster off).

Step 4. Rotate Master Brightness control (R212) until the raster just begins to appear on the CRT; then back off slightly to the threshold of raster cutoff.

Step 5A. Reconnect video signal . . .

or

Step 5B. Adjust Contrast control (if present) for desired video display level on CRT.

Step 6. Adjust Remote Brightness control (R213) for desired (overall) brightness level.

## HORIZONTAL OSCILLATOR ADJUSTMENT

### Procedure

Step 1. Disconnect horizontal sync input (only) at pin 6 of edge connector P1.

Step 2. Adjust Horizontal Hold control (R418) until video display approaches best horizontal sync condition. (Without the horizontal sync input connected, however, the display will never quite lock in.)

– NOTE –

It may be necessary to temporarily increase the raster brightness with the Remote Brightness control (R213) to view the raster edges.

Step 3. Reconnect the horizontal sync signal. (At this point the video display should be in sync.)

Step 4. Adjust the Horizontal Delay control (R402) until the video display is centered horizontally within the raster (as viewed from the left side to the right side of the raster).

## HORIZONTAL SIZE ADJUSTMENT

### Procedure

Adjust Horizontal Width coil (L401) for specified video width (horizontally).

– NOTE –

To increase width, rotate coil slug CCW (away from circuit card); to decrease width, rotate coil slug CW (toward circuit card).

## VERTICAL HOLD ADJUSTMENT

### Procedure

If video display is rolling, adjust the Vertical Hold control (R310) until the video display remains locked in.

## VERTICAL SIZE/LINEARITY ADJUSTMENT

### Procedure No. 1 (Monitors without StepScan)

Step 1. Adjust the Vertical Size control (R312) until the specified size display (vertically) is obtained.

Step 2. (Refer to Figure 7.) Adjust the Vertical Linearity control (R315) until the extreme top and bottom characters (designated "A" and "B") are equal in height to the center characters (designated "C").

Step 3. Readjust the Vertical Size control (R312), if necessary, for specified size display (vertically).

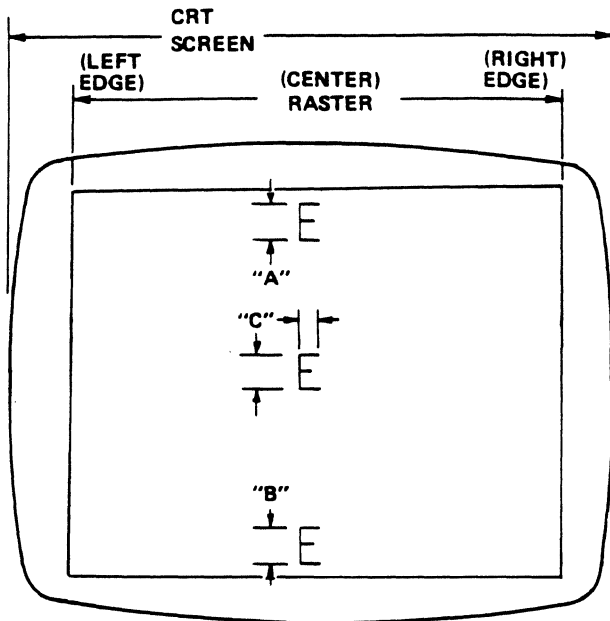
### Procedure No. 2 (Monitors with StepScan)

Step 1. With specified StepScan input connected to pin 5 of edge connector P1, rotate the Step Adjust control (R504) for minimum vertical size. (This control will be final adjusted later.)

Step 2. Adjust Vertical Size control (R312) for specified vertical size display – before StepScan is actively applied with Step Adjust control, R504.

Step 3. (Refer to Figure 7.) Adjust the Vertical Linearity control (R315) until the extreme top and bottom characters (designated "A" and "B") are equal in height to the center characters (designated "C").

Step 4. Readjust the Vertical Size control (R312), if necessary, for specified size display (vertically) as described in Step 2.



AEPC-01050-0

Figure 7. Partial CRT Display of Characters for Vertical Linearity Adjustment

**STEPSCAN ADJUSTMENT (Applicable to monitors with StepScan only)**

**General**

StepScan is a unique input signal that is accounted for, and incorporated, when the original video signal format is being developed. As a result, it cannot be connected to just any monitor, even if the monitor has the necessary StepScan circuitry. Check original video signal format specification.

**Procedure:**

- Step 1. Be sure specified positive-going TTL Level Step-Scan signal is connected to pin 5 of edge connector P1.
- Step 2. Rotate the Step Adjust control (R504) through its entire range slowly, and observe that the display size increases vertically.
- Step 3A. Adjust the Step Adjust control (R504) for correct vertical size per original model specifications  
...
- or
- Step 3B. If the StepScan is not required in the final installed application, rotate the Step Adjust control (R504) for minimum vertical size. (See following NOTE.)

**- NOTE -**

In Step 3B this is applicable only if the StepScan input remains connected to the edge connector from its source. However, if the StepScan source is physically disconnected from pin 5 of the edge connector, pin 5 must be grounded to pin 1 or 10. In either of these conditions, proceed to Step 4.

- Step 4. Readjust Vertical Size control (R312) to desired height vertically.

**RASTER CENTERING ADJUSTMENT (Applicable only if the CRT and/or deflection yoke have been changed.)**

**- NOTE -**

Depending on the input signal format, the video display on some monitors will be down-centered more than normal within the raster. As a result, an up-centering resistor (R325) is added, which shifts the entire raster (and video display) up. (The shift will vary between 0.1 – 0.4 inches.) This action is necessary to minimize over-adjusting the Centering Magnets to recenter the video display. (Excessive adjustment of the Centering Magnets could cause geometric distortion.)

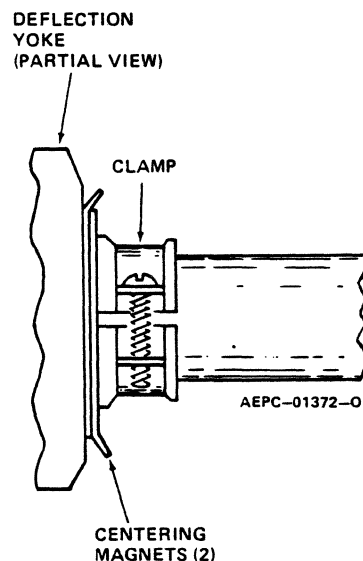


Figure 8. Partial View of CRT Neck/Deflection Yoke - Centering Magnets

## General

This procedure should be performed while the monitor is free-standing on a bench, and in the correct sequence (preceding the Raster Geometry Adjustment procedure). Do not readjust after the monitor has been installed in a cabinet or terminal.

### Procedure No. 1 (For monitors without up-centering resistor R325.)

- Step 1. Turn up the Remote Brightness control (R213) until the four (4) edges of the raster are visible.
- Step 2. (Reference Figure 8.) Rotate the two (2) centering magnets (simultaneously) until the raster is centered (horizontally and vertically) within the active phosphor area of the CRT. (Reference Figure 9.)
- Step 3. Readjust the Remote Brightness control (R213) for desired (overall) brightness level.

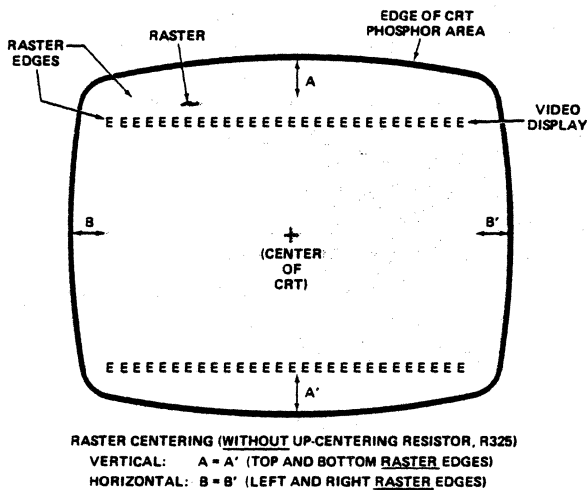


Figure 9. Raster Centering Without Up-Centering Resistor, R325

### Procedure No.2 (For monitors with up-centering resistor R325.)

- Step 1. Turn up the Remote Brightness control (R213) until the four (4) edges of the raster are visible.
- Step 2. (Reference Figure 8.) Rotate the two (2) centering magnets (simultaneously) until the left and right edges of the raster are centered horizontally, and the top and bottom edges of the video display are centered vertically within the active phosphor area of the CRT. (Reference Figure 10.)

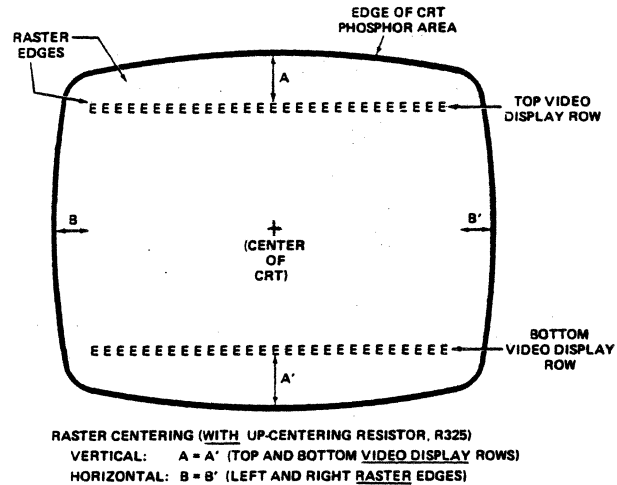


Figure 10. Raster Centering With Up-Centering Resistor, R325

- Step 3. Readjust the Remote Brightness control (R213) for desired (overall) brightness level.

### — CAUTION —

Remember, do not readjust the centering magnets after performing the CRT Raster Geometry Adjustment procedure that follows, or after final installation. CRT raster geometry will be affected.

## RASTER GEOMETRY ADJUSTMENTS

### General

This adjustment is normally required only if the yoke and/or CRT have been replaced. Upon completion of the geometry adjustments, there may not be a yoke magnet installed on every yoke mounting pin. Normal installation ranges from one to four yoke magnets per deflection yoke. In addition, keep in mind that there will be some interaction between yoke magnets on the deflection yoke mounting pins. Whereby, as the geometry adjustment proceeds, it may be necessary to remove an earlier positioned magnet from one pin when a new magnet is positioned (or added) on a different pin.

There are two (2) different strength yoke magnets available for correcting CRT geometry. The soft core (or flexible) magnet is the stronger of the two magnets. (Reference Figure 11 to identify their north poles.) Pincushion and trapezoidal correction generally require high strength magnets, and barrel correction requires a lower strength magnet for correction.

**— WARNING —**

High voltages are present at the deflection yoke and are a potential shock hazard. Exercise caution when performing the following adjustment procedures.

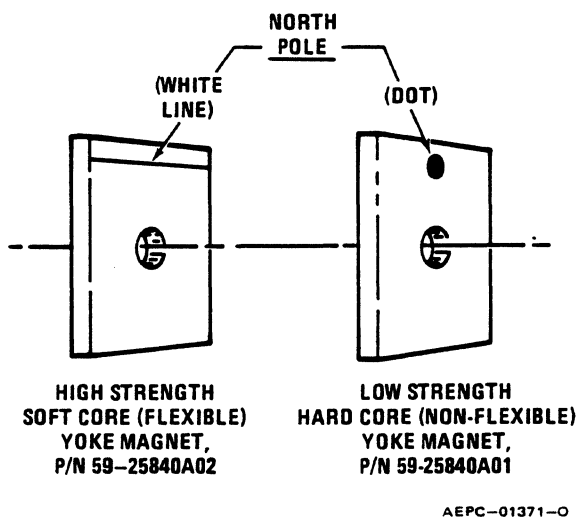


Figure 11. Yoke Magnet North Pole Identification

**Pincushion/Barrel Correction (top, bottom and sides) Procedure**

Perform this adjustment if the raster exhibits the abnormal effects shown in Figure 13.

- Step 1. Push a magnet on the yoke mounting pin as shown in Figure 13. A magnet should be placed only on the pin that corresponds to the affected area.
- Step 2. Rotate the magnet to obtain the desired raster, labeled "NORMAL" on Figure 13.
- Step 3. If the desired raster cannot be obtained, add a second magnet to the yoke mounting pin. Both magnets must be aligned as shown in Figure 12; then rotated simultaneously.

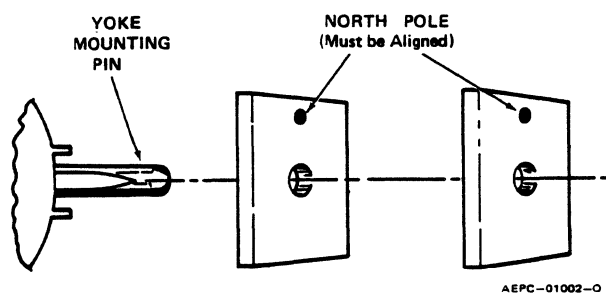


Figure 12. Installing a Second Yoke Magnet

**Trapezoidal Correction (corners) Procedure**

Perform this adjustment if the raster exhibits the abnormal effects shown in Figure 14.

- Step 1. Push a magnet onto the yoke mounting pin as shown in Figure 14. Magnet should be placed only on the pin that corresponds to the affected area.
- Step 2. Rotate the magnet to obtain the desired raster, labeled "NORMAL" in Figure 14.
- Step 3. If the desired raster cannot be obtained, add a second magnet to the yoke mounting pin. Both magnets must be aligned as shown in Figure 12; then rotated simultaneously.

**FOCUS ADJUSTMENT**

**Procedure**

The optimum focus of the display is obtained by adjusting the focus control, R429, for best focus at a point which is near the center and approximately one-third (1/3) down from the top of the display.

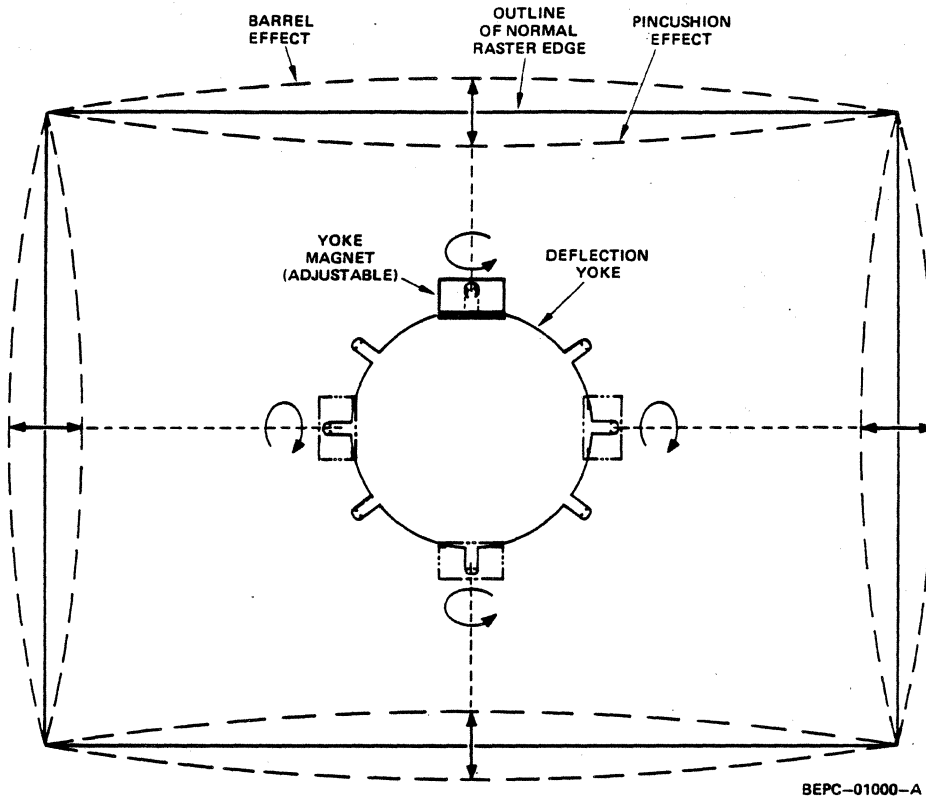


Figure 13. Pincushion/Barrel Effects and Adjustment

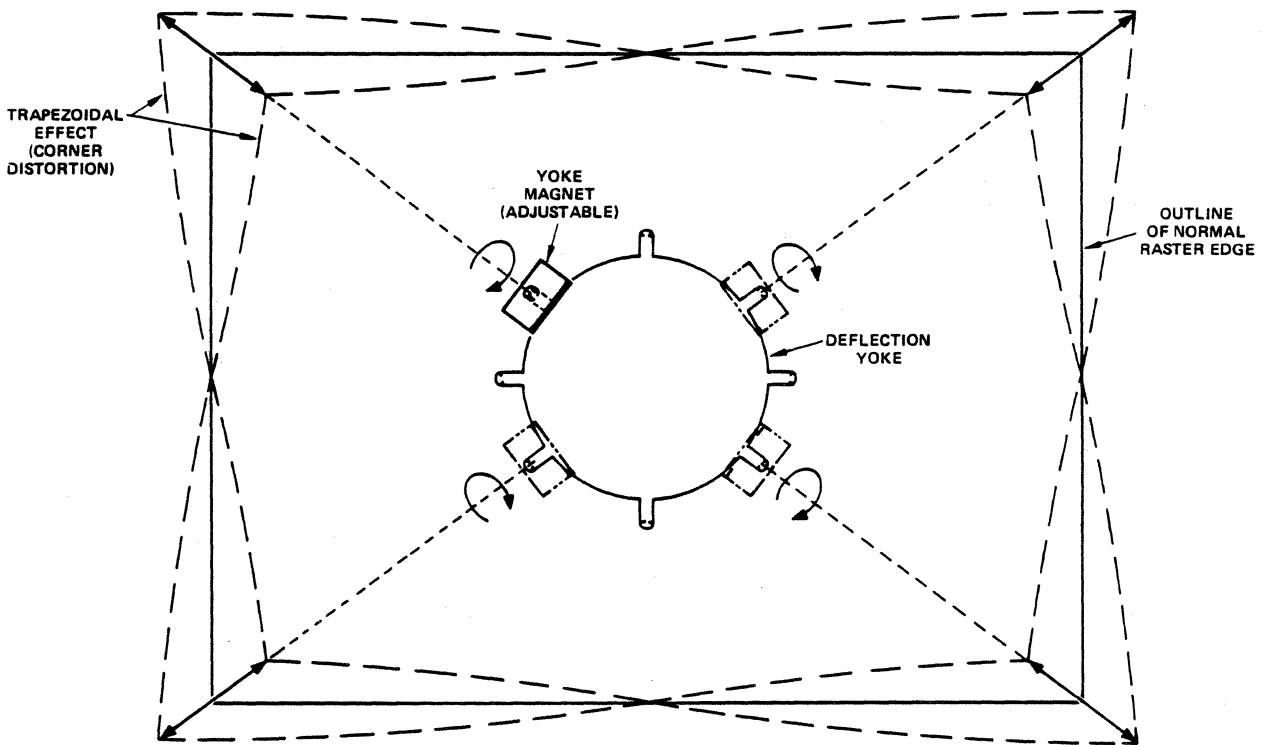


Figure 14. Trapezoidal Effect and Adjustment

# THEORY OF OPERATION

## POWER SUPPLY (Refer to Figure 15)

The power supply is a transformer operated, full wave, regulated series pass circuit that maintains a constant output voltage with line input variations of  $\pm 12.5\%$ . Depending on how connector S1 is wired, operation from 120, 220 or 240 volts, 50/60 Hz is possible. Integrated circuit IC101 is the reference amplifier, transistor Q102 is the regulated output driver, and Q101 is the series pass transistor.

The output voltage, +24V, appears at the collector of Q101. This voltage is divided between R106, R107 and R109. Resistor R108 limits the range of R107. The voltage appearing on the arm of potentiometer R107 (24V ADJ. control) is the reference input to the inverting input (-) of reference amplifier IC101.

A temperature compensated zener diode, VR101, establishes a fixed reference voltage at the non-inverting input (+) to IC101. Resistors R110 and R111 and diode D105 provide bias current for VR101. The junction of R110 and R111 is the +13V source for the horizontal oscillator, IC402. Regulator VR101 is also the 5 volt source for the monitor circuitry. Operating voltage for IC101 is derived from resistor network R101 and R105.

An increase in output current will cause a decrease in output voltage due to internal supply impedance. This will cause the voltage at the base of Q102 to become more positive via the inverting amplifier IC101. With the base more positive, Q102 will conduct more, increasing its collector current. This increases the base current in Q101. The result is increased output current from Q101, raising the output voltage and maintaining the proper output voltage level.

Electrolytic capacitor C101, section "A", filters the bridge rectifier (D101-D104) output, while section "B" provides additional filtering of the +24V regulator output. Capacitor C103 filters the +5 volt source. R102 is the load resistor for Q102. Resistors R103, R104 bias Q102. Capacitor C102 increases regulation at high frequencies for improved transient response.

## VIDEO AMPLIFIER (Refer to Figure 16)

The linear video amplifier consists of two stages, Q201 and Q202, which are connected in a cascode configuration. This common emitter-common base arrangement greatly reduces the effect of Miller capacity (when compared to a conventional single transistor video amplifier/output stage).

A TTL compatible non-composite video signal, approximately 4.0 volts P-P, is DC coupled to the base of Q201 via R202. Resistor R201 provides proper termination for the high frequency input video signal. R203 and C201 provide high frequency compensation to maintain a flat response when Q201 and Q202 conduct. Contrast control R216 (when present) is used to limit the input video signal, which indirectly varies the amplitude of the video drive to the CRT cathode. This action is necessary to provide a contrast function when more than one level of video is applied to the input. Capacitor C208 (when present) provides high frequency compensation for the input video signal.

During a no-signal condition, video driver transistor Q201 is off. At the same time, video output transistor Q202 is base

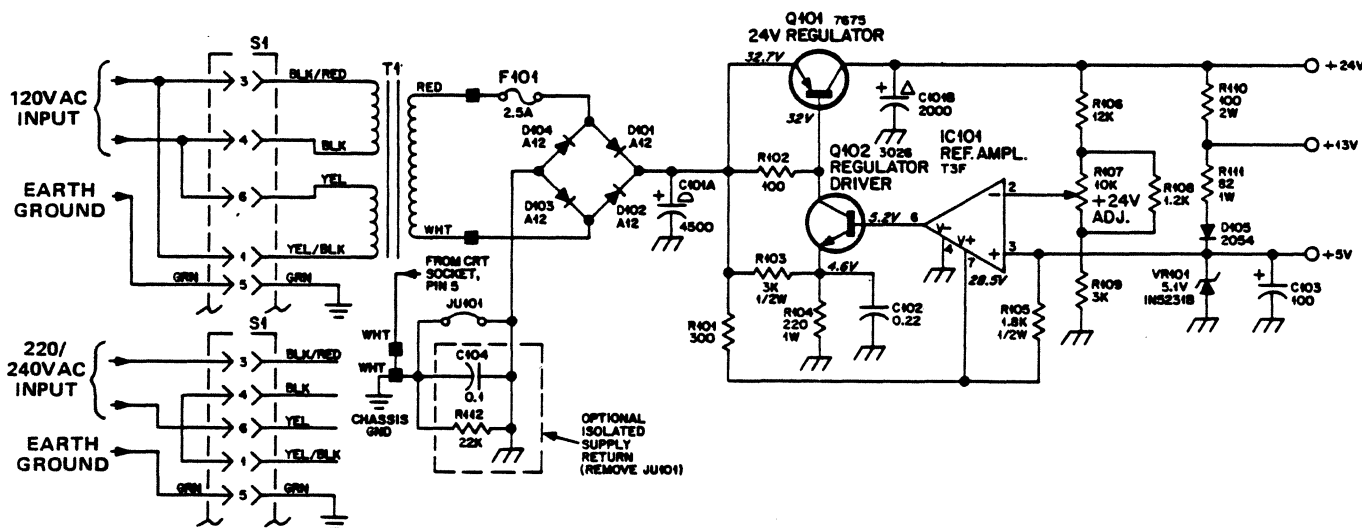


Figure 15. AC Power Input/Regulated Power Supply Output

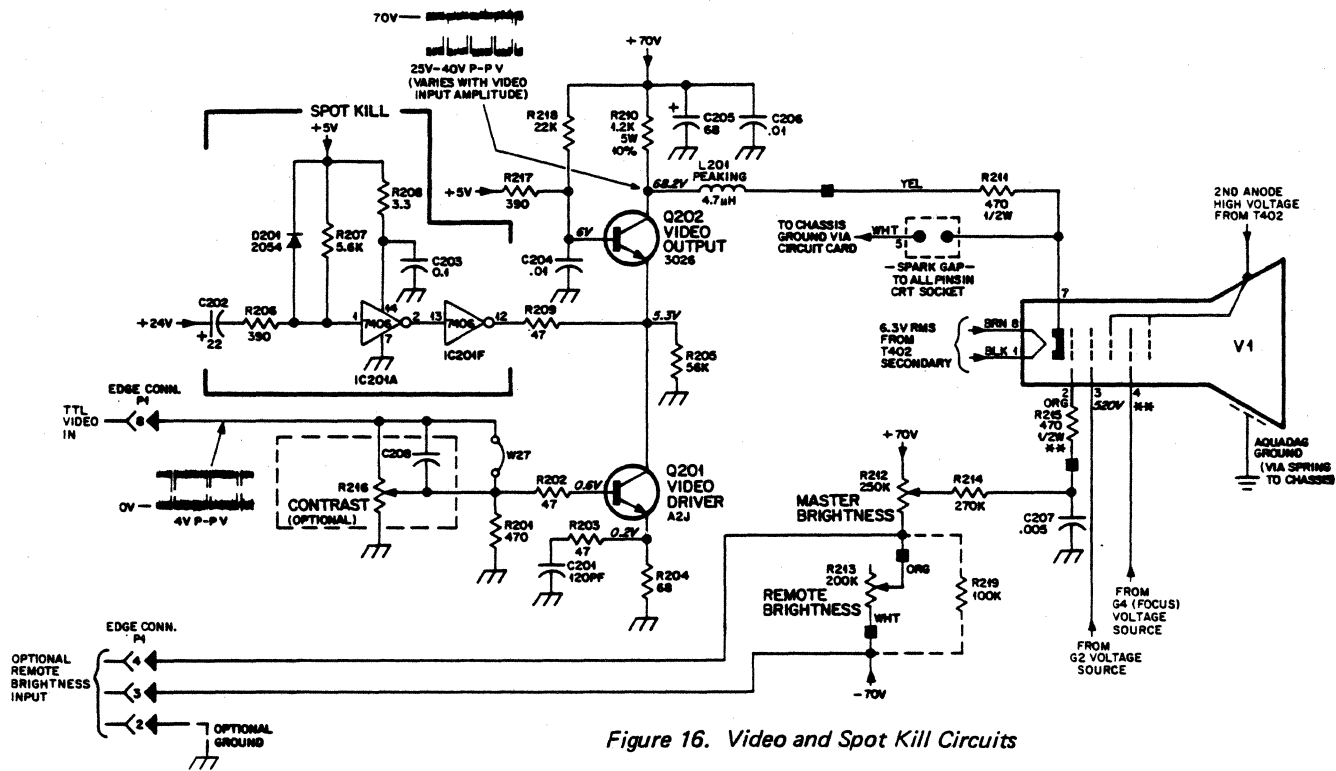


Figure 16. Video and Spot Kill Circuits

biased at 6.0V by R217 and R218. When a video signal is applied to the base of Q201, it turns on, allowing Q202 to conduct. The resultant output is developed across collector load resistor R210 and DC coupled to the CRT cathode via peaking coil L201 and resistor R211. Q202 is protected from CRT arcing by a spark gap built into the CRT socket, and R211 further isolates Q202 from transients. Capacitor C204 shorts video frequency signals from the base of Q202 to ground. Peaking coil L201 increases the high frequency response of the video amplifier. Capacitor C205 provides filtering of the +70V supply, while C206 is a high frequency AC bypass capacitor to ground.

#### SPOT KILL (Refer to Figure 16)

When power is removed from the monitor, the horizontal and vertical scans collapse and a bright spot is left that will burn a spot in the phosphor screen unless prevented from doing so.

When the monitor is turned off, the decrease in the 24V supply voltage is coupled through capacitor C202 and resistor R206 to pin 1 of IC201A. This TTL input is normally held in the high state by resistor R207. The falling 24V supply switches IC201A to the low state at pin 1, which is inverted to a high at pin 2 of IC201A; then inverted to a low again by IC201F at pin 12. The open collector output of IC201F, now in the low state (conducting), pulls R209 to ground to become the emitter resistor of Q202. With 6.0 volts on its base, Q202 saturates. The resulting low collector voltage on Q202 is coupled to the CRT cathode causing it to conduct heavily. The large cathode current in the CRT discharges the second anode during scan collapse. The second anode is completely discharged before the scan currents collapse completely so that a spot can not form.

#### STEPSCAN FUNCTION (Reference Figure 17)

StepScan is useful when it is desired to display more rows of data characters than the existing "alphanumeric video" signal format will permit. A typical display consists of 240 horizontal scan lines which form character rows of data. Between each character row is a desired amount of blank spacing which is made up of horizontal scan lines without video information. By accelerating the vertical deflection between character rows, one (1) horizontal scan line could provide the spacing between rows that would normally be occupied by three (3) horizontal scan lines (see Figure 17). This would reduce the number of blank horizontal scan lines between character rows from three (3) down to one (1). However, the physical spacing between the character rows would not change. Since two (2) horizontal lines are saved between each row, a 24 row format will accumulate 48 unused scan lines. These 48 extra scan lines will reside at the bottom of the display since the CRT still scans a total of 240 horizontal lines. Therefore, the 48 additional lines at the bottom can also be used to display data. This means an additional six (6) rows of characters can be displayed. (For example, 7 lines for char. height plus 1 line for spacing = 8 lines per char. block. 48 unused lines divided by 8 char. block lines = 6 additional rows.)

#### - NOTE -

StepScan does not actually produce the six (6) additional rows; instead, it simply provides space (and horizontal lines) for them. The six (6) additional rows of video must be designed into the original video signal format during its development.



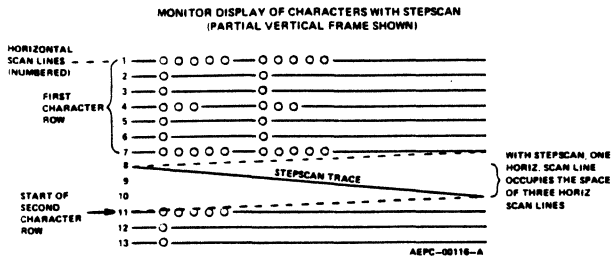


Figure 17. Displaying Characters on a Monitor with StepScan

### STEPSCAN CIRCUIT (Refer to Figure 18)

The StepScan circuit requires an external TTL positive-going pulse of approximately 4.0 volts P-P. These pulses are applied to pin 5 of IC201C through the protective network R501, D501 and D502. These pulses switch the TTL input of IC201C from the low state, normally maintained by resistor R502, to the high state. The open collector output of IC201C, pin 6, conducts during these pulses. These current pulses, regulated by control R504, are applied to the height control pin of the vertical processor, IC301. The slope of the output sawtooth current is increased during these pulses to "step" the vertical position to the next character.

The rate at which the vertical processor steps is determined by the repetition rate of the incoming StepScan pulses. The slope (charge rate) of the stepped portion of the sawtooth is adjustable with the STEP ADJ. control, R504, which varies the spacing between the character rows. With the vertical sawtooth thus modified, the yoke vertical deflection current will be "stepped" during the line between character rows chosen. One additional component associated

with StepScan operation is capacitor C307. It increases the response of IC301 internal amplifier output (pin 4) by coupling the leading edge of the StepScan pulses into the amplifier input of IC301 (pin 10).

### VERTICAL SCAN (Refer to Figure 18)

Input TTL level pulses pass through resistor R301 and protective diodes D301 and D302 to IC201B or IC201E inputs. The input to IC201B accepts, through jumper JU302, negative vertical sync and the input to IC201E accepts, through jumper JU301, positive vertical sync. R303 holds the input of IC201B low to prevent its output, an open collector, from shorting the input to IC201E when negative sync is not selected.

Output pulses from IC201E (pin 10) are differentiated by capacitor C301 and resistor R306. Diode D303 couples only the negative-going spikes from the differentiator circuit to the sync input of IC301 (pin 8). R307 and R308 provide input current limiting. The sync input (pin 8) performs several functions. It strips away any random noise that may be present on the input line and conditions the vertical pulses for processing. It also converts the input voltage pulses to current to control the internal oscillator. The oscillator generates a non-symmetrical square wave with a short duty cycle at the vertical scan frequency (50 to 60 Hz). Components R310, R311 and C304 determine the frequency. This square wave signal is applied to a ramp generator whose slope and amplitude is determined by R312, R313, C305 and C306. The ramp voltage signal is applied to a buffer stage which isolates the ramp generator from the output stages and reduces any loading effect on the previous stages. Components R314, R316 and R315 reshape the ramp voltage to make it extremely linear.

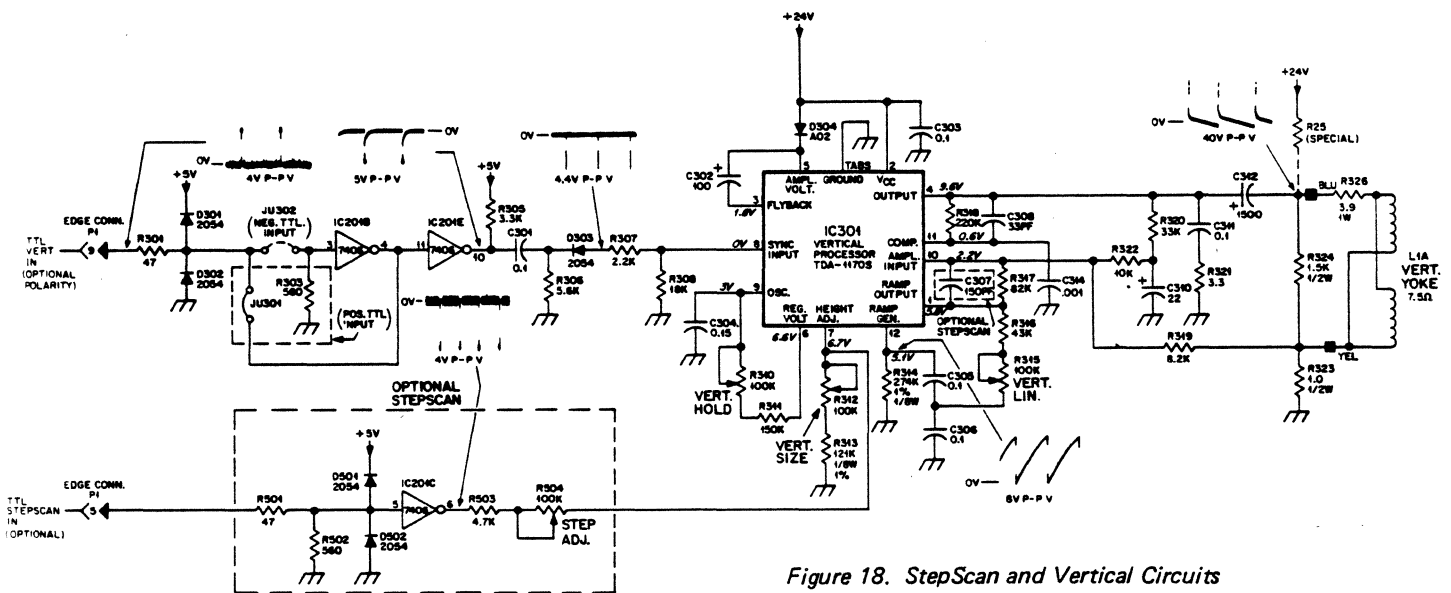


Figure 18. StepScan and Vertical Circuits

The output signal from pin 4 (IC301) drives the vertical deflection coils directly via coupling capacitor C312. Components R321 and C311 provide damping to prevent any oscillations in the output circuit. R320, R322, R319, R318, R323, C310 and C308 provide AC and DC feedback for the output stage to maintain proper gain and linearity. When the scan reaches the bottom of the screen a sync pulse initiates retrace. To insure a quick return to the top of the screen the voltage across the yoke is doubled during retrace to quickly discharge the yoke inductance. This voltage doubling circuit consists of diode D304, capacitor C302 and a transistor network in IC301. Capacitor C314 provides additional (external) compensation for IC301, pin 11. Resistor R325 (when present) is used to up-center the raster and video display.

### HORIZONTAL DRIVE/SYNC DELAY AND REGENERATOR (Refer to Figure 19)

TTL horizontal rate sync is coupled to the input of IC401B through the protective network consisting of resistor R401 and diodes D401 and D402. Jumpers W1 or W2 and W3 select positive or negative sync respectively. IC401B is a monostable multivibrator with its time constant being established by resistor R403, HORIZ. DELAY control R402, and capacitor C401. A positive pulse appears at pin 13 of IC401B, the leading edge coincident with the selected leading edge of horizontal sync and the trailing edge determined by the HORIZ. DELAY control, R402.

The falling edge of this pulse triggers IC401A, another monostable multivibrator, whose time constant (established by R406 and C403) regenerate a positive pulse at pin 5 of IC401A. Pulse width at this point is approximately equal to the input sync pulse. This pulse is inverted and increased in amplitude to 24V P-P by IC201D.

### PHASE DETECTOR (Refer to Figure 19)

The phase detector consists of two diodes D403 and

D404 in a keyed clamp circuit. Its function is to develop a control voltage for synchronizing the horizontal oscillator with the incoming sync pulses. Two inputs are required to generate the required output; one from the horizontal sync regenerator IC401A, and one from the horizontal output circuit, Q402. The required output must be of the proper polarity and amplitude to correct phase differences between the input horizontal sync pulses and the horizontal time base. Each pulse from the collector of the horizontal output, Q402, is integrated into a sawtooth by R411 and C405. Capacitor C406 blocks DC from the collector of Q402. The output transistor of IC201D is normally at cut-off and its collector voltage rests at approximately 24 volts. Since C404 is connected to the output of IC201D, it will charge up to the collector voltage. When a pulse turns on and saturates the output of IC201D, its collector voltage drops to near ground potential. C404 will now discharge, coupling a negative-going sync pulse to the cathodes of D403 and D404. This negative potential is sufficient to forward bias both diodes to conduct and discharge any positive or negative charge on C405 to ground. In other words, it clamps the voltage on capacitor C405 during sync pulse time to approximately zero volts.

Without considering the sync pulses, the sawtooth wave would cause current flow into capacitor C405 when it is negative, and out of C405 when it is positive. Since the sawtooth is symmetrical about its AC axis, the charge and discharge currents of C405 are equal. C405 would therefore average a zero voltage level. A sync pulse (waveform A, Figure 20) clamping the sawtooth as it passes through its AC axis (waveform B, Figure 20), will not affect its positive and negative symmetry. Therefore, the average voltage on C405 would remain zero. However, if the horizontal time base begins to lag, the sync pulse will clamp the sawtooth to ground at a point below its AC axis, resulting in a non-symmetrical charge on C405. This clamping action will cause the sawtooth's AC axis to shift to a point above the

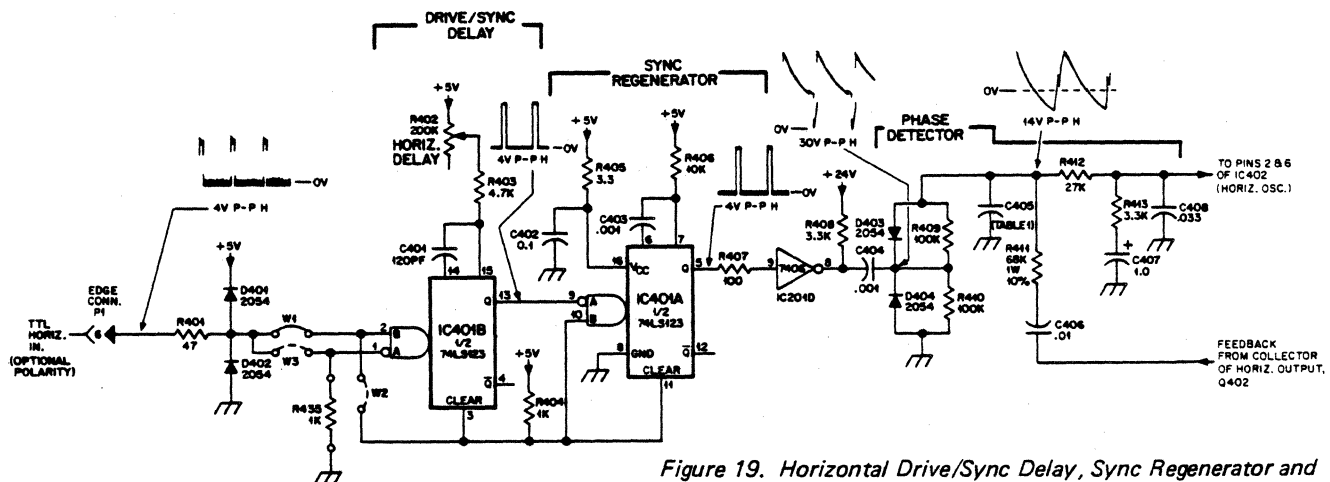


Figure 19. Horizontal Drive/Sync Delay, Sync Regenerator and Phase Detector Circuits

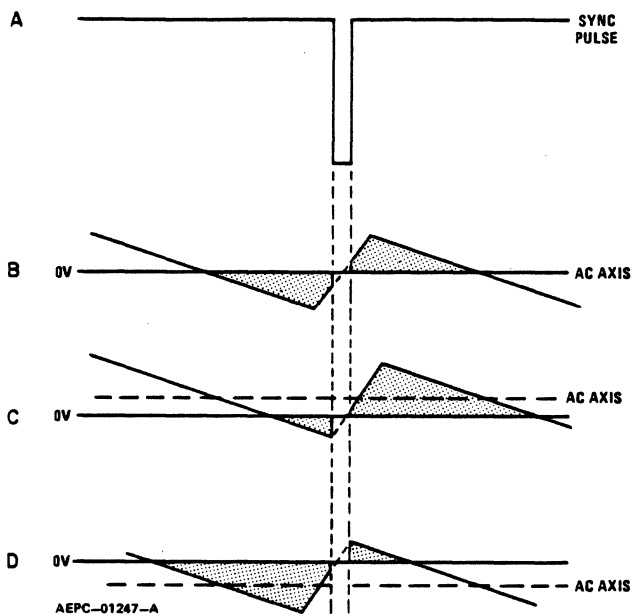


Figure 20. Phase Synchronization Waveforms

ground reference (waveform C, Figure 20). Therefore, most of the sawtooth's waveform is now above ground which will produce a positive voltage on C405. This is the correct polarity to cause the horizontal oscillator to speed up to correct the phase lag. Likewise, if the horizontal time base is leading the sync pulse, the sawtooth will be clamped to ground at a point above its AC axis. This clamping action will cause the sawtooth's AC axis to shift to a point below the ground reference (waveform D, Figure 20). Now most of the sawtooth's waveform is below ground, which will produce a negative voltage on C405. This is the correct polarity to cause the horizontal oscillator to slow down. The voltage level on C405 is dependent upon which point of the sawtooth is clamped. This also determines how far its AC axis will shift above or below ground.

R412, C407, R413 and C408 comprise the phase detector filter. The bandpass of this filter is designed to provide correction of horizontal oscillator phase without ringing or hunting.

#### HORIZONTAL OSCILLATOR/DRIVER (Refer to Figure 21)

Integrated circuit timer IC402 operates as an astable square wave oscillator. Its free running frequency is determined by resistors R415, R416, and capacitor C409. The phase detector correction voltage is coupled through resistor R414 to pins 2 and 6 of IC402 to vary the frequency of the oscillator. A second input to IC402, pin 5, allows control of the oscillator free-run frequency by means of R418, HORIZ. HOLD control.

The non-symmetrical output of IC402 (pin 3) is coupled to the horizontal driver transistor, Q401, through C411 and current limiting resistor R419. D405 protects Q401 from

reverse base-emitter voltage. Q401 operates as a switch to drive the horizontal output transformer T401. T401 is a voltage stepdown transformer to provide a low impedance drive to Q402. R421 is a current limiting resistor for Q401 and C414 is an AC bypass capacitor. R420 and C413 damp the transformer to prevent ringing when Q401 goes into cutoff.

#### HORIZONTAL OUTPUT (Refer to Figure 21)

The secondary of T401 provides the required low drive impedance for Q402. Components R422 and C415 form a time constant for fast turn-off of Q402. The horizontal output transistor, Q402, is simply a switch that is turned on and off at the horizontal scan rate by the drive signal applied to its base. A sawtooth current through the deflection coils is required to sweep the beam linearly across the CRT screen. The sweep begins at the center of the CRT and sweeps to the right. This happens when Q402 is turned on and its collector voltage drops to near zero. C419 begins discharging through the deflection coils to deflect the beam to the right edge of the CRT. At this time, Q402 cuts off and C419 ceases to supply current to the deflection coils. However, an induced voltage appears across the deflection coil as the magnetic field collapses, and an oscillation occurs between the deflection coils and C416.

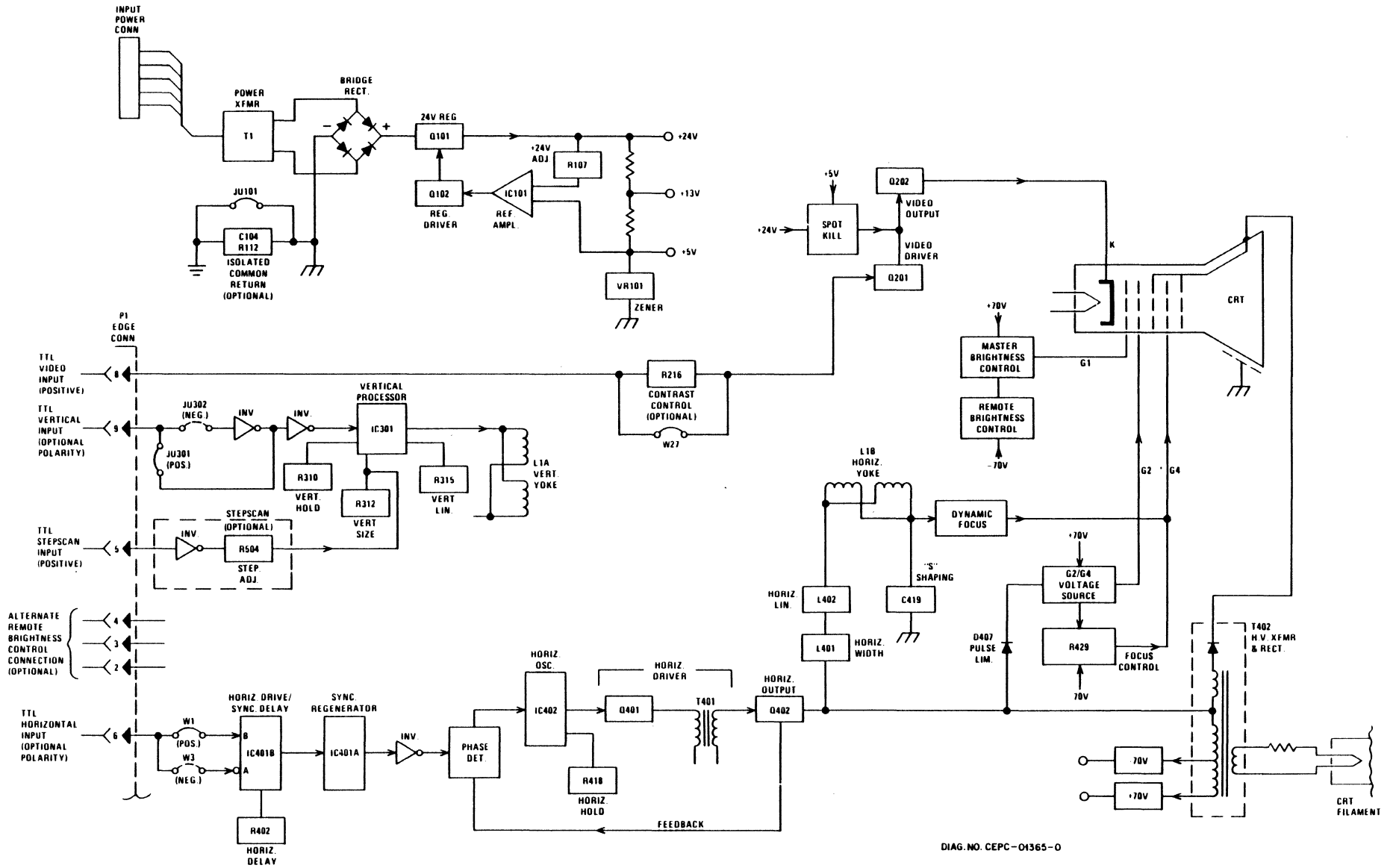
During the first half cycle of this oscillation, the induced voltage is felt across the collector of now cut off Q402, C416, and the primary of T402, the flyback transformer. This voltage is stepped up by T402 and rectified to produce the required high voltage that is applied to the 2nd anode of the CRT. The electron beam is also deflected to the left edge of the CRT at this time because the collapsing magnetic field of the deflection coils reverses polarity.

During the second half cycle of the deflection coils/C416 oscillation, the voltage on the collector of still cut off Q402 becomes negative. At this time, camper diode D406 becomes forward biased and begins conduction. The deflection coil current gradually decreases to zero during damper conduction allowing the beam to sweep linearly to the center of the screen.

The horizontal retrace pulse charges C422 through D407 to provide operating voltage for G2 of the CRT. Momentary transients at the collector of Q402, should they occur, are limited to the voltage on C422 since D407 will conduct if the collector voltage exceeds this value. Coil L402 is a magnetically biased Horiz. Linearity coil that shapes the deflection current for optimum trace linearity. Coil L401 is a series Horiz. Width control. Components R425 and C418, R424 and C417 are damping network components for the Horizontal Linearity (L402) and Width (L401) controls.

The 24 volt supply to the horizontal output is coupled through diode D409 to pin 3 of the transformer, T402. Autoformer action of the transformer boosts the effec-



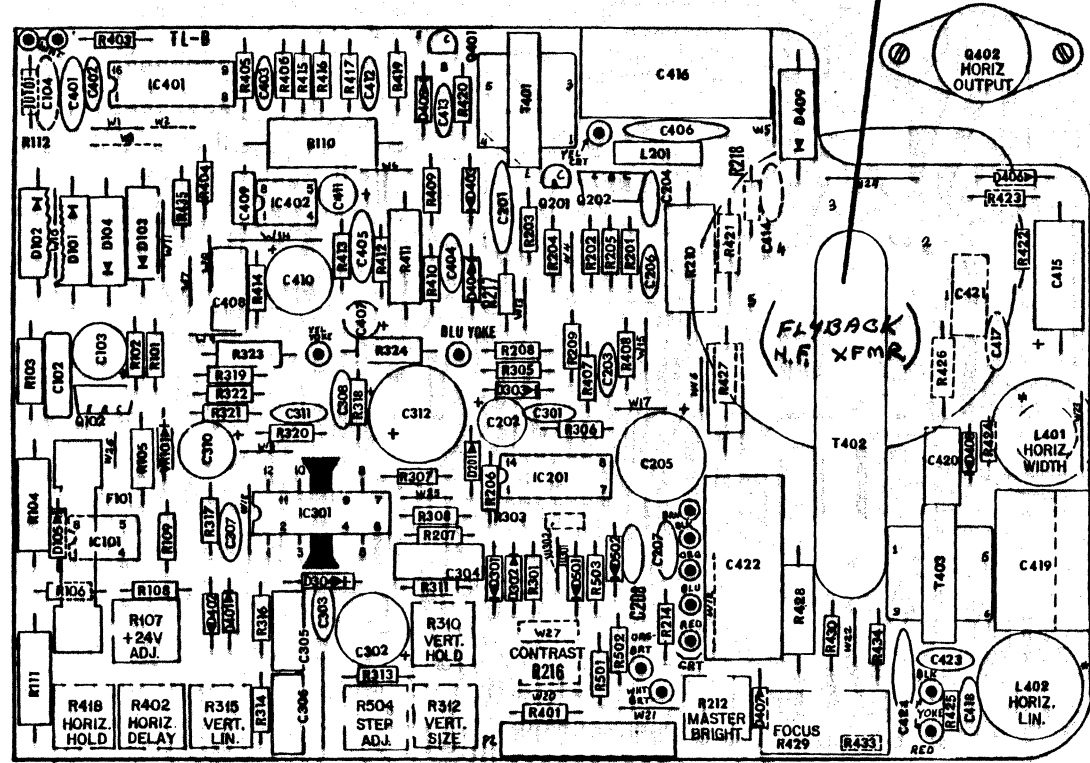
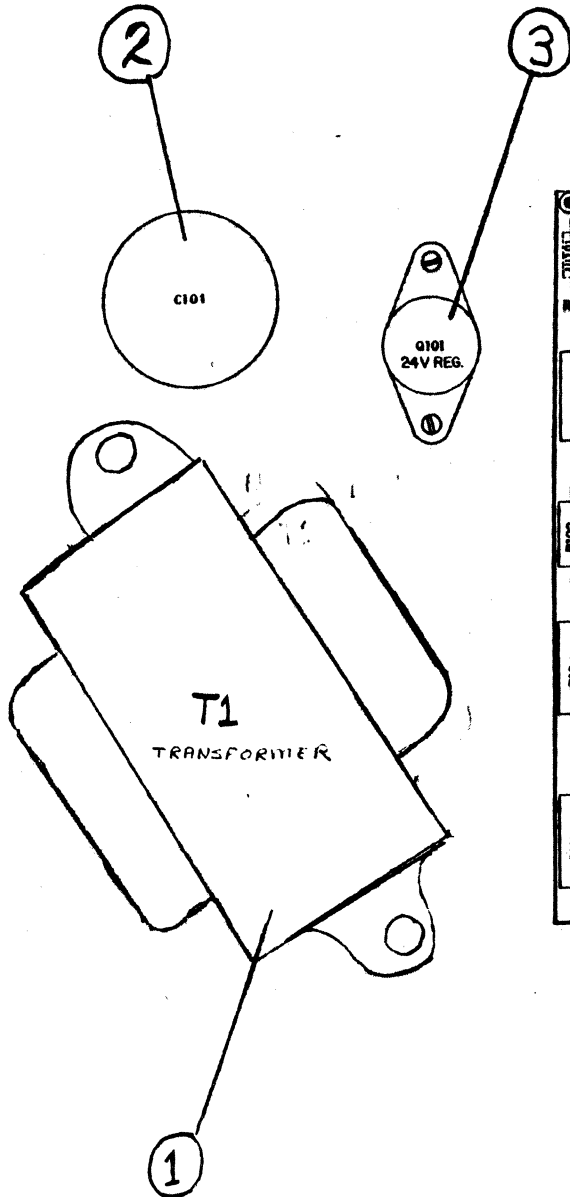


DIAG. NO. CEPC-04365-0

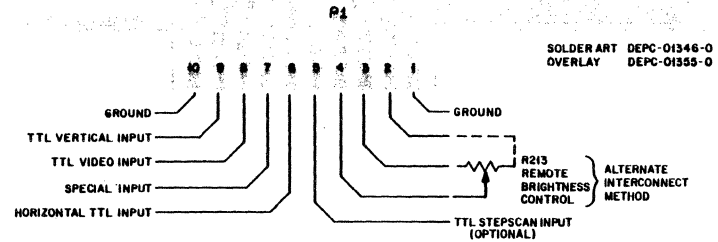
Block Diagram

BASE PLATE ASSY, COMPLETE PN- 916025  
 MOTOROLA ADM-42 MONITOR ASSY

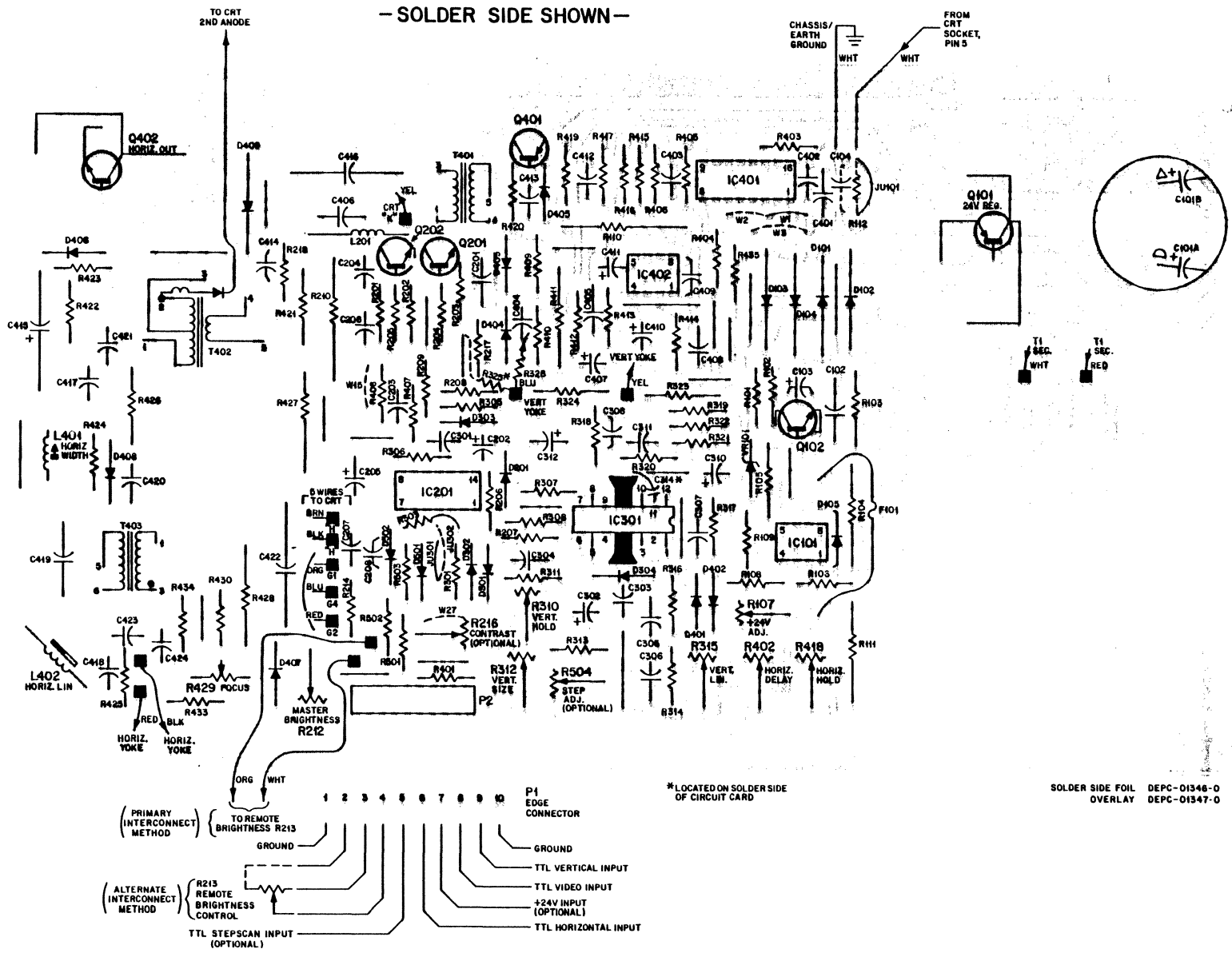
- COMPONENT SIDE SHOWN -



28



ASSY 916025 Circuit Card Layout - Component Side



MANUAL: 68P25253A82 FILE: VP38

MDS-SERIES CRT DISPLAY MONITORS




REVISIONS

LTR	SHEET	DESCRIPTION	DATE	APPROVED
A		RELEASE PER DCN # 998 S. FIGUEROA	6-5-80 6/10/80	R. J. J. [Signature]
B		INCORP DCN # 1471 DWA 11-17-80	11-21-80 11/21/80	[Signature]
C		INCORP DCN # 1902 EnB 3-20-81	3-27-81 3/31/81	[Signature]
D		INCORP DCN # 2785 ESC 10-5-81	10/5/81	[Signature]
E		INC DCN 3130 D.T.B 3-2-83	3-10-83	[Signature]
F		INC DCN 3279 D.T.B 3-2-83	3-10-83	[Signature]
G		INC DCN 3708 D.T.B. 3-2-83	3-10-83	[Signature]
-		DEVIATION D 3763 D.T.B 3-2-83	3-10-83	[Signature]
H		INC DCN 4281 D.T.B 3-2-83	3-10-83	[Signature]
J		INC DCN 4506 D.T.B. 3-2-83	3-10-83	[Signature]

- 4. 128348-5027 MAY BE SUBSTITUTED FOR -5037.
- 3. -1 SAME AS -002 EXCEPT WITHOUT PROGRAM ROMS AND CHARACTER GENERATOR.
- 2. 128348-5016 MAY BE USED IN PLACE OF -8116.
- 1. VENDOR ITEM - SEE DWG BEFORE ORDERING.

NOTES:

-002	131390	DL129810
-1	131390	DL129810
DASH NO.	NEXT ASSY	USED ON
APPLICATION		

UNLESS OTHERWISE SPECIFIED DIM. IN INCHES TOLERANCES XX ± .1 XXX ± .03 ANGLES ± 0.5° MACH. FIN.	DR. S. FIGUEROA	 LEAR SIEGLER, INC. ELECTRONIC INSTRUMENTATION DIV. ANAHEIM, CALIF.	PC BOARD ASSY MPU, ADM 42			
	CHK. W. Kelly 6-4-80					
	DSGN		SIZE	CODE IDENT	REV	
	ENGR R. O. [Signature] 6-6-80		A	98438	PL 131394	J
	PROJ		SCALE		SHEET 1 OF 6	
	REL [Signature] 6/1/80					
CUSTOMER APPD						

1,3,4,5,6,8

FIND NO.	QTY REQD		STOCK NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	REMARKS
	-002	-1				
1		✓		-1	P.C. BOARD ASSY	
2		✓		-002	P.C. BOARD ASSY	
3						
4						
5		1 1		131395-3	PRINTED WIRING BOARD	
6						
7		REF REF		131396	SCHEMATIC	
8						
9						
10		1 1		129762-3	OSC	1A
11		1 1		811016	CRYSTAL, 5.0688MHZ	Y1
12		3 3		809300	CONN, 25P RCPT DSUB PCBM	J4,5,7
13		1 1		131365-1	CONN ASSY, 9 PIN	J6
14		1 1		809106	CONN, 9 PIN (09-75-1091)	J1
15		2 2		809096	CONN, 50 PIN	J2,3
16		2 2		804021	SWITCH, DIP, 8 POS	S5,6
17		1 1		804006		6 POS S2
18		1 1		804028		3 POS S7
19		1 1		804048		MOM, SPST (8125AV2) S1
20		1 1		804047		ROT, BCD (1A210031GFY) S3
21		3 3		819046	RES MODULE, SIP, 4.7K	RM8-10
22		1 1		129476-102		1K RM5
23		1 1		-202		2K RM6
24		4 4		-332		3.3K RM1-4
25		1 1		-472		4.7K RM11

SIZE  
A

FSCM NO.  
98438

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PL 131394  
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REV  
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FIND NO.	QTY RECD		STOCK NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	REMARKS
		-1				
26	1	1		129476-103	RES MODULE, SIP, 10K	RM7
27						
28	5	5		129467-00	IC, TYPE 74LS00	6C, 6F, 7D, 9C, 16E
29	5	5		-02	74LS02	3C, 5C, 6D, 4F, 13H
30	6	6		-04	74LS04	1C, 2A, 3A, 7F, 12B, 15D
31	6	6		-08	74LS08	2C, 5F, 6E, 5D, 8E, 11B
32	1	1		-09	74LS09	16B
33	1	1		-11	74LS11	7C
34	2	2		-20	74LS20	8F, 15E
35	1	1		-28	74LS28	14E
36	2	2		-32	74LS32	12J, 13B
37	1	1		-74	74LS74	11D
38	1	1		-138	74LS138	12H
39	4	4		-139	74LS139	11J, 12F, 13F, 14F
40	6	6		-157	74LS157	3E, 3F, 8H, 9H, 10H, 11H
41	4	4		-175	74LS175	4E, 5E, 7E, 16C
42	5	5		-244	74LS244	6H, 7H, 11L, 12L, 13L
43	1	1		-260	74LS260	2F-B
44	2	2		-283	74LS283	9F, 10F
45	2	2		-374	74LS374	4H, 5H
46	1	1		-161	74LS161	9D-A
47	2	2		129466-21143	RAM, TYPE 1Kx4	9K, 10K
48	16	16		129466-4027	RAM, TYPE 4027, 4Kx1	1J-8J, 1L-8L
49						
50						

SIZE

FSCM NO. 98438

SH

DL 13/394

REV J

FIND NO.	QTY REQD		STOCK NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	REMARKS
51		1 1		129753-005	PROM, TYPE 82S123, 32x8 (TRANSLATION)	11F
52						
53		1 0		129867-1	ROM 2KX8 (CHAR GEN)	1H
54		1 0		-30	(PROG E000)	13K
55		1 0		-31	(PROG E800)	14K
56		1 0		-32	(PROG F000)	15K
57		1 0		129867-33	ROM 2KX8 (PROG F800)	16K
58						
59		1 1		129826-00	IC, TYPE 74500	13D
60		1 1		-02	74502	15F
61		1 1		-05	74505	9B
62		1 1		-08	74508	1E
63		2 2		-32	74532	4D, 10B
64		3 3		-74	74574	1D, 2D, 14D
65		2 2		-86	74586	2E, 12D
66		2 2		-174	745174	3D, 13E
67		1 1		-175	745175	12E
68		2 2		-195	745195	1F, 2F-A
69						
70		1 1		129824-6800	IC, TYPE 6800	14H
71		2 2		-6821	6821	4A, 6A
72		1 1		-6850	6850	8A
73						
74						
75						

SIZE  
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FSCM NO.  
98438

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PL 13/394  
4

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1

FIND NO	QTY RECD		STOCK NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	REMARKS
76	2	2		128348-06	I.C., TYPE 7406	3B, 8C <span style="float:right">▲</span>
77	2	2		-8T97	8T97	1B, 15C <span style="float:right">▲</span>
78	3	3		-1488	1488	11A, 12A, 13A <span style="float:right">▲</span>
79	3	3		-1489	1489	10A, 4A, 14B <span style="float:right">▲</span>
80	2	2		-3648	3648	9J, 10J <span style="float:right">▲</span>
81	3	3		-4040	4040B	2B, 4C, 8D <span style="float:right">▲</span>
82	1	1		-8304	8304	16J <span style="float:right">▲</span>
83	1	1		-5037	5037	9D-B <span style="float:right">▲</span>
84	1	1		-8116	8116	9L <span style="float:right">▲</span> <span style="float:right">▲</span>
85	1	1		-79M05	VOLT REG, TYPE 79M05 (-5V)	VR1 <span style="float:right">▲</span>
86						
87						
88	1	1		808004	DIODE, SIL, TYPE 1N4001	CR1 <span style="float:right">▲</span>
89	2	2		808078	DIODE, SIL, TYPE 1N4148	CR8,9 <span style="float:right">▲</span>
90	1	1		810001	TRANS, NPN, TYPE 2N3904	Q1 <span style="float:right">▲</span>
91						
92						
93	1	1		128518-1011	CAP, 100 PF 10%, 1KV, CER	C5 <span style="float:right">▲</span>
94	67	67		129876-103	.01 UF, 10%, 50V, MONO	C1, 4, 6, 7, 13, 59-126 <span style="float:right">▲</span>
95	49	49		129876-104	.1 UF, 10%, 50V, MONO	C3, 10, 11, 12, 14, 15-5B <span style="float:right">▲</span>
96	18	18		129469-106	10 UF, +100-10%, 25V AL ELEC	C121-13B <span style="float:right">▲</span>
97	10	10		128518-106	10 UF, 10%, 25V, TANT	C139-14B <span style="float:right">▲</span>
98	1	1		128518-226	22 UF, 10%, 15V, TANT	C2 <span style="float:right">▲</span>
99						
100						

SIZE A  
 FSCM NO. 98438  
 SH PL 131394  
 REV J

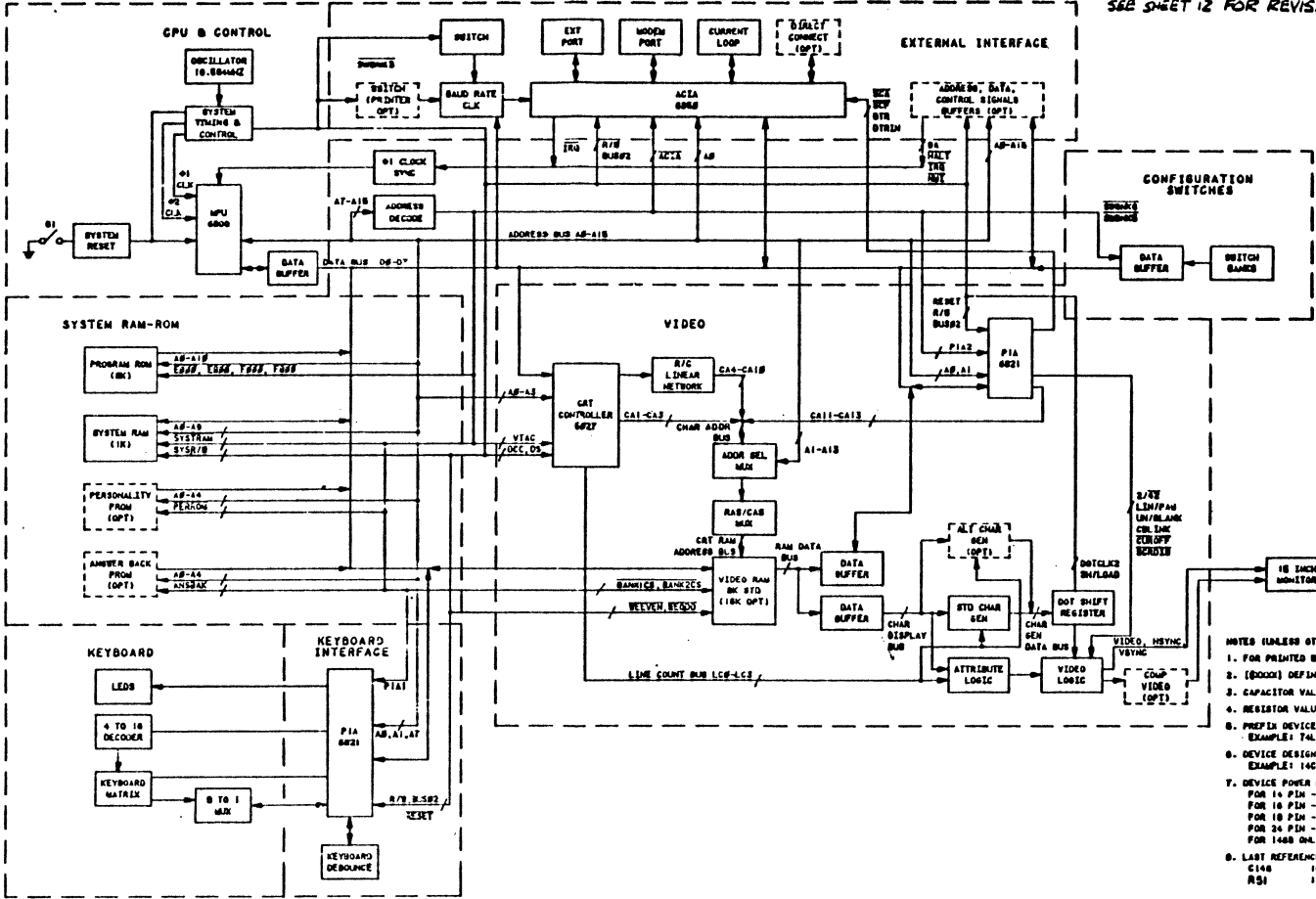
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101		1 1		128533-470	RES, 47, 5%, 1/4W	R40
102		1 1		-101	100	R5
103		1 1		-151	150	R8
104						
105		1 1		-271	270	R43
106		2 2		-391	390	R44,45
107		3 3		-471	470	R6,17,49
108						
109		10 10		-102	1K	R1,3,16,37,38,39,41,42,46,47
110		2 2		-302	3K	R2,48
111						
112		4 4		-512	5.1K	R10,12,13,20
113		1 1		-822	8.2K	R18
114		1 1		-223	22K	R11
115		1 1		-473	47K	R4
116						
117						
118		4 4		802034	SOCKET, 40 PIN	4A,6A,9D,14H
119		7 7		802033	24 PIN	8A,1H,2H,13K-16K
120		35 35		802031	16 PIN	16D,13J,15L,1U-8U,1K-8K,1L-8L,1M-8M
121		3 3		129877-20	20 PIN	16F,16H,16L
122		1/2 1/2			TAPE, DBL SIDED, 1/32	
123		1 1		839012	INSULATOR, T0-5 (7717-5)	FOR VRI
124		8 8		824002	RIVET (R3479 x 7/32)	
125		1 1		129747-3	SPACER, P.C. BOARD	

SIZE  
A  
FSCM NO.  
98438

SH  
PL 131394

REV  
J

SMT ZONE		LTR		REVISIONS		DESCRIPTION		DATE		APPROVED	
A				RELEASE PER DCN #		SEE SHEET 12 FOR REVISIONS					



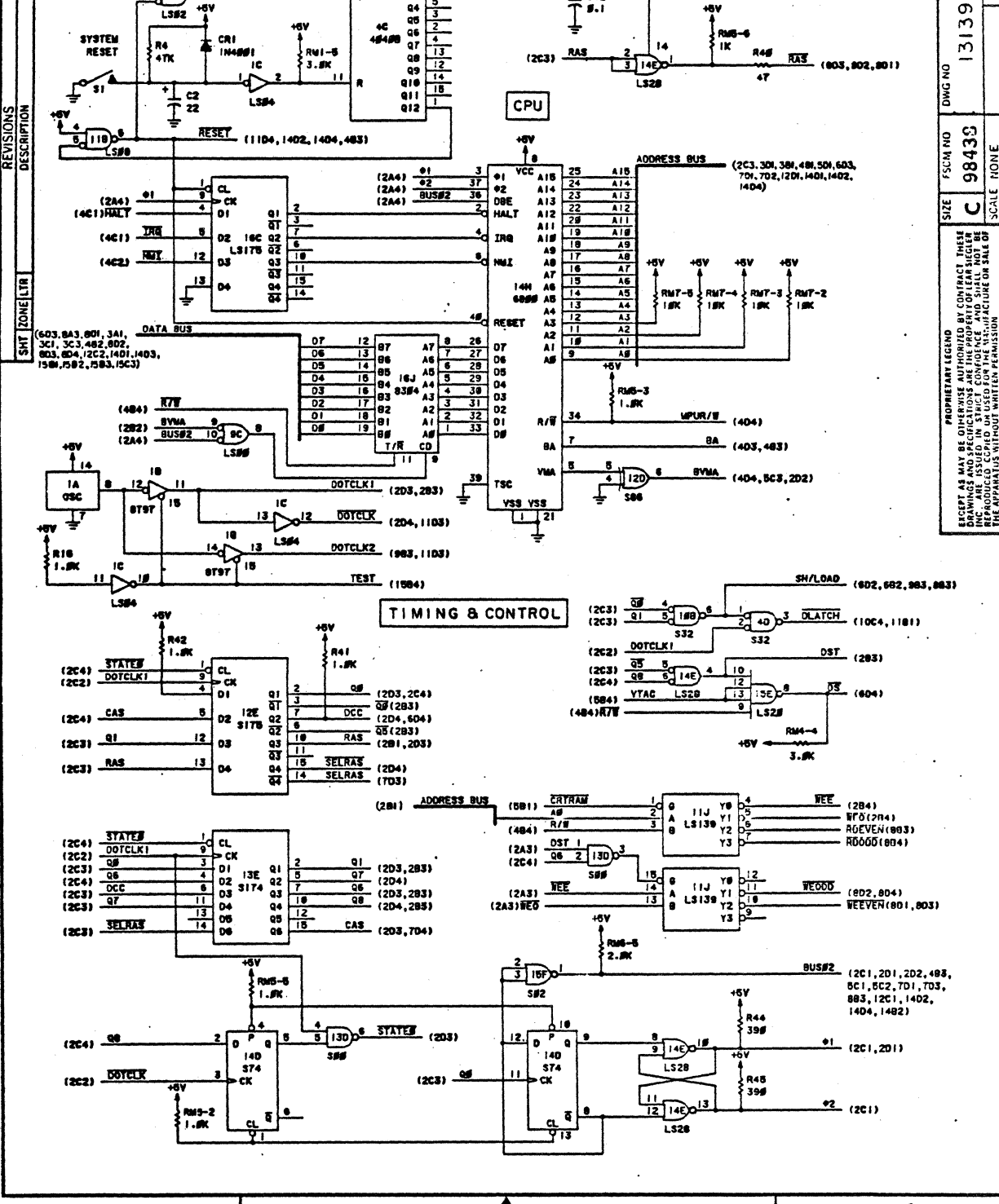
- NOTES (UNLESS OTHERWISE SPECIFIED):
- FOR PRINTED CIRCUIT BOARD (PCB) - 1, ARMY 131394.
  - [BOARDS] DEFINES HEXIDECIMAL ADDRESS.
  - CAPACITOR VALUES ARE IN MICROFARADS.
  - RESISTOR VALUES ARE IN OHMS, K $\Omega$ , 10 $\Omega$  W.
  - PREFER DEVICE TYPE WITH T $\Omega$ .  
EXAMPLE: 74LS161
  - DEVICE DESIGNATION INDICATES LOCATION.  
EXAMPLE: 14C
  - DEVICE POWER PINS ARE:  
FOR 16 PIN - 7(640), 14(+5)  
FOR 18 PIN - 8(640), 16(+5)  
FOR 18 PIN - 8(640), 16(+5)  
FOR 24 PIN - 12(640), 24(+5)  
FOR 1488 ONLY - 7(640), 11(-12), 14(+12).
  - LAST REFERENCE DESIGNATION USED!  
C148 16R0 1.0 1019  
R51 107 10R1 171

UNLESS OTHERWISE SPECIFIED:		CONTR NO.	
DIM IN INCHES		DR # F4VER04 6-8-80	
TOLERANCES:		CHK	
X ± .1		DSGN 11/11/80 660	
XX ± .03		ENGR	
XXX ± .010		PROJ 2000 240	
ANGLES ± 5°		REL	
DASH - 131394 DL 2310		APPD	
NEXT ASSY USED 04		APPD	
APPLICATION:			

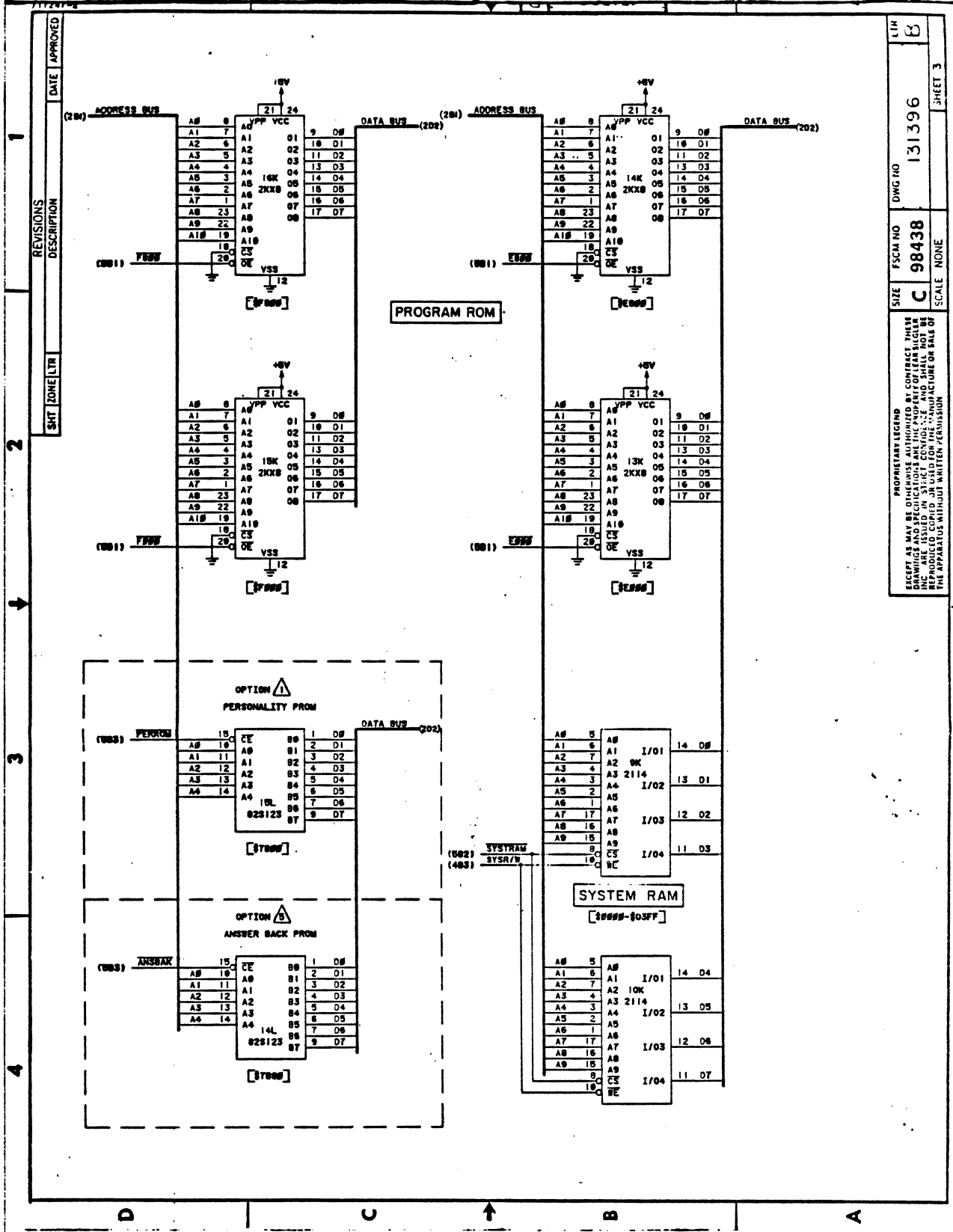
**LEAR SIEGLER, INC.**  
DATA PRODUCTS DIVISION  
ANAHEIM CALIFORNIA 92803

**SCHMATIC**  
LOGIC BOARD ADM-42

PROPRIETARY/LEND		APPD		SIZE		FSCM NO		DWG NO		LTR	
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				SCALE				SHEET 1		OF 16	







REVISIONS

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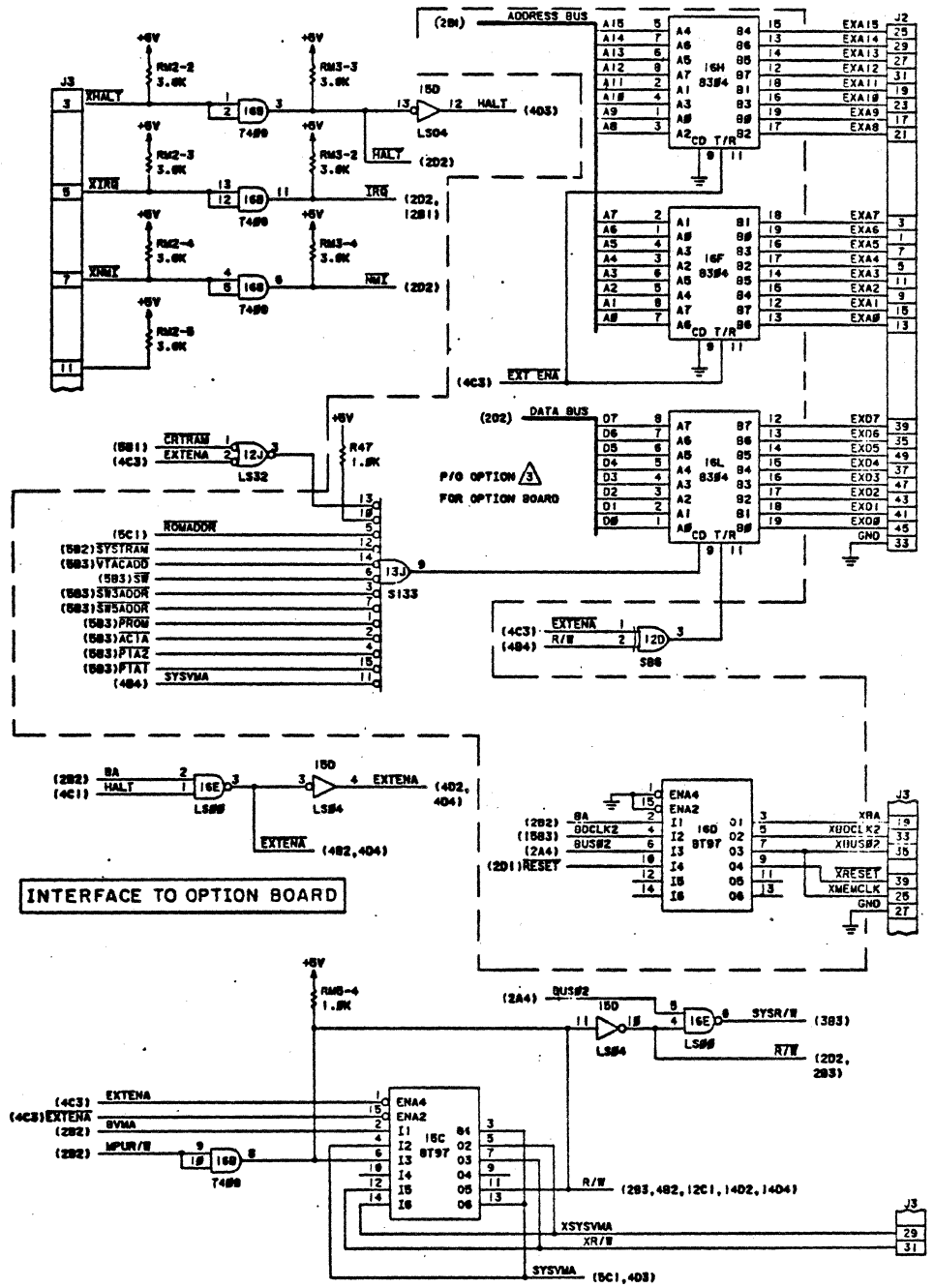
LTR	B
DWG NO	131396
ESCA NO	98438
SIZE	C
SCALE	NONE
SHEET	3

REV. NO.	DATE	APPROVED
1		
2		
3		
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REV. NO.	DESCRIPTION
1	
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REV. NO.	DATE	APPROVED
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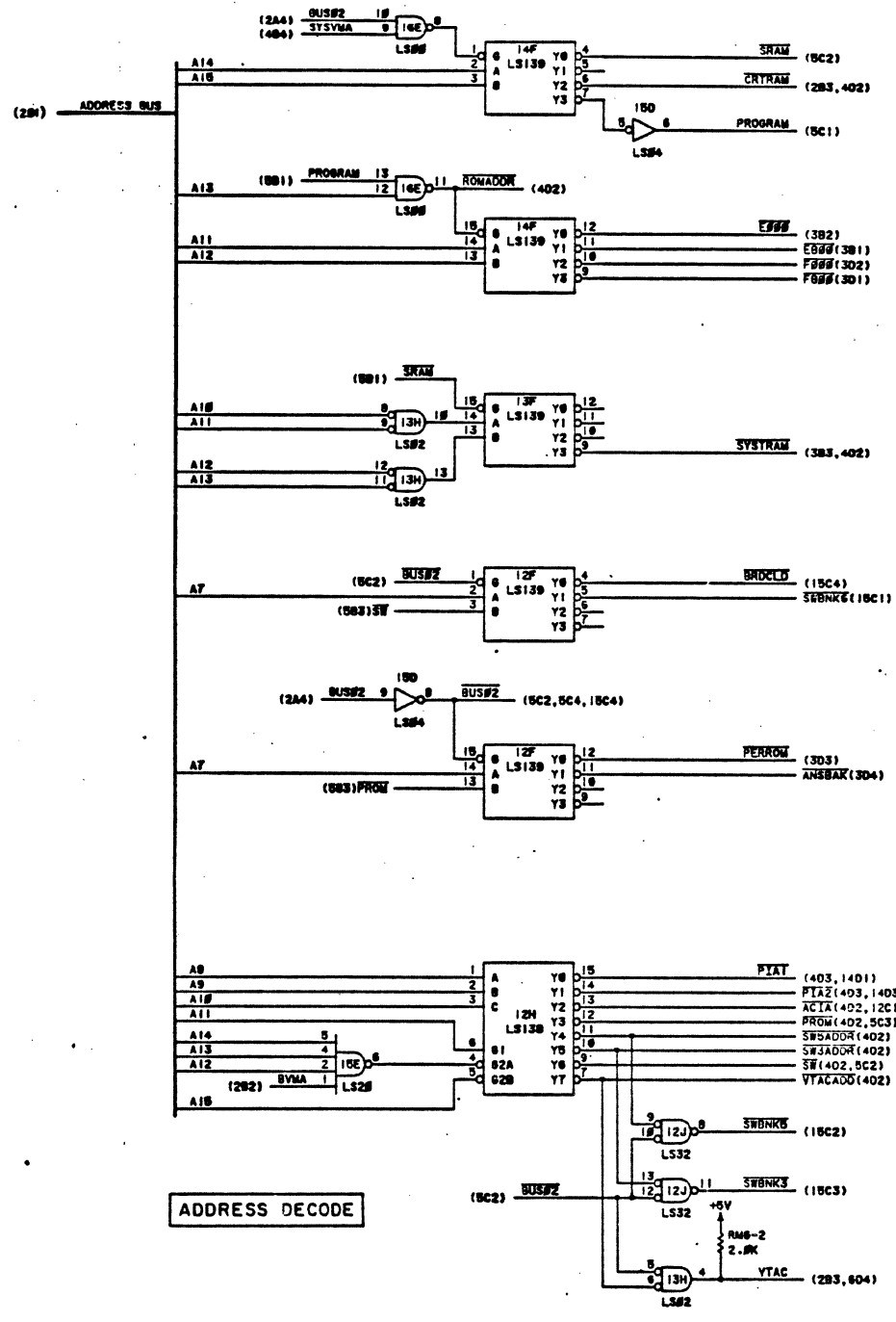


**INTERFACE TO OPTION BOARD**

LTR	DWG NO	131396	SHEET 4
FSCIA NO	98438	SCALE	NONE
SIZE	C	PROPRIETARY LEGEND RECEPT AS MAY BE OTHERWISE AUTHORIZED BY CONTRACT THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF LEAR SILEX INC. AND ARE TO BE USED ONLY IN CONNECTION WITH THE MANUFACTURE OF THE APPARATUS WITHOUT WRITTEN PERMISSION	

D C B A

1	REVISIONS	DATE	APPROVED
	DESCRIPTION		
2	SMT ZONE LTR		
3			
4			



ADDRESS DECODE

LTR	B
DWG NO	131396
SIZE	C
FSCM NO	98438
SCALE	NONE
SHEET	5

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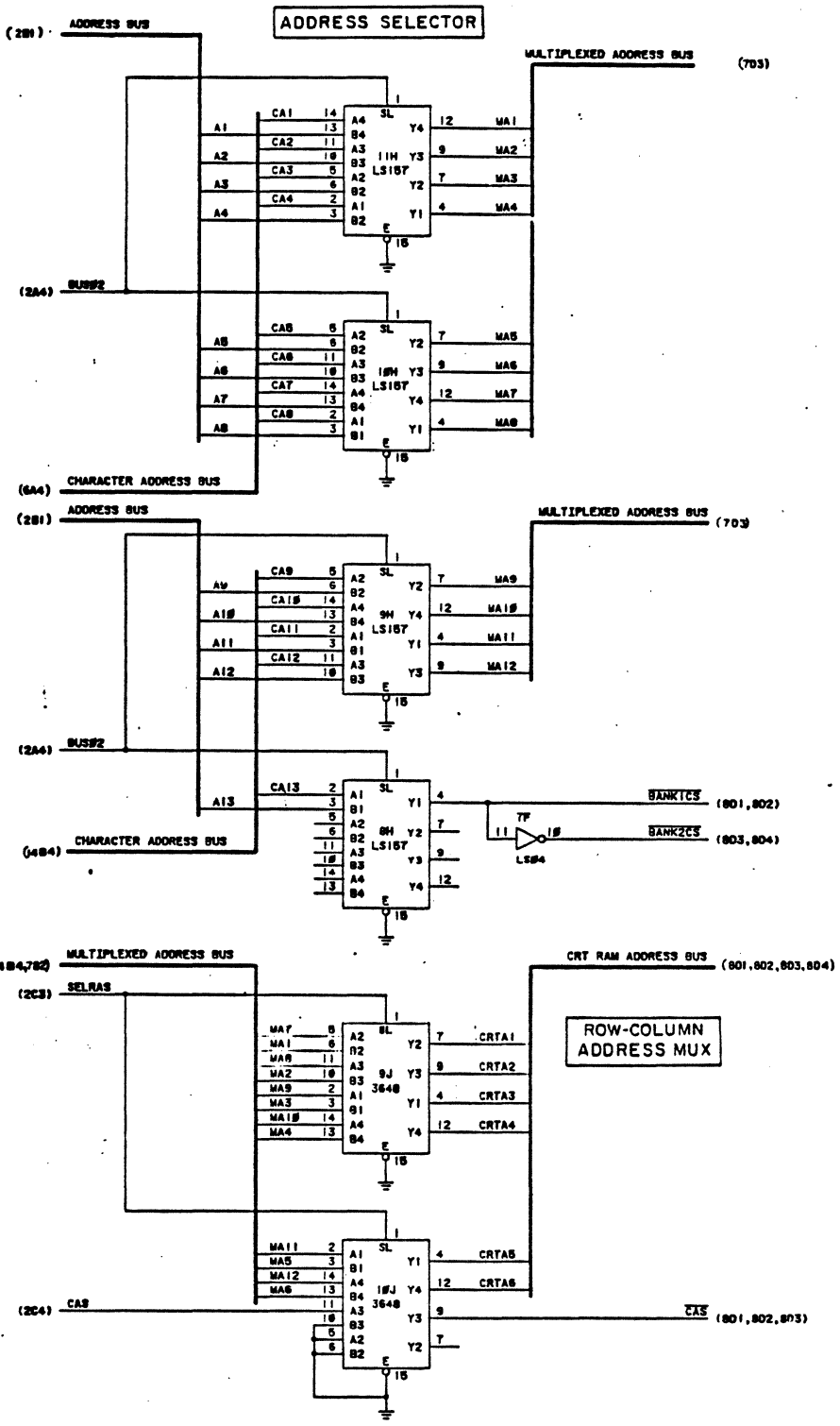
REV	DATE	APPROVED
1		

2

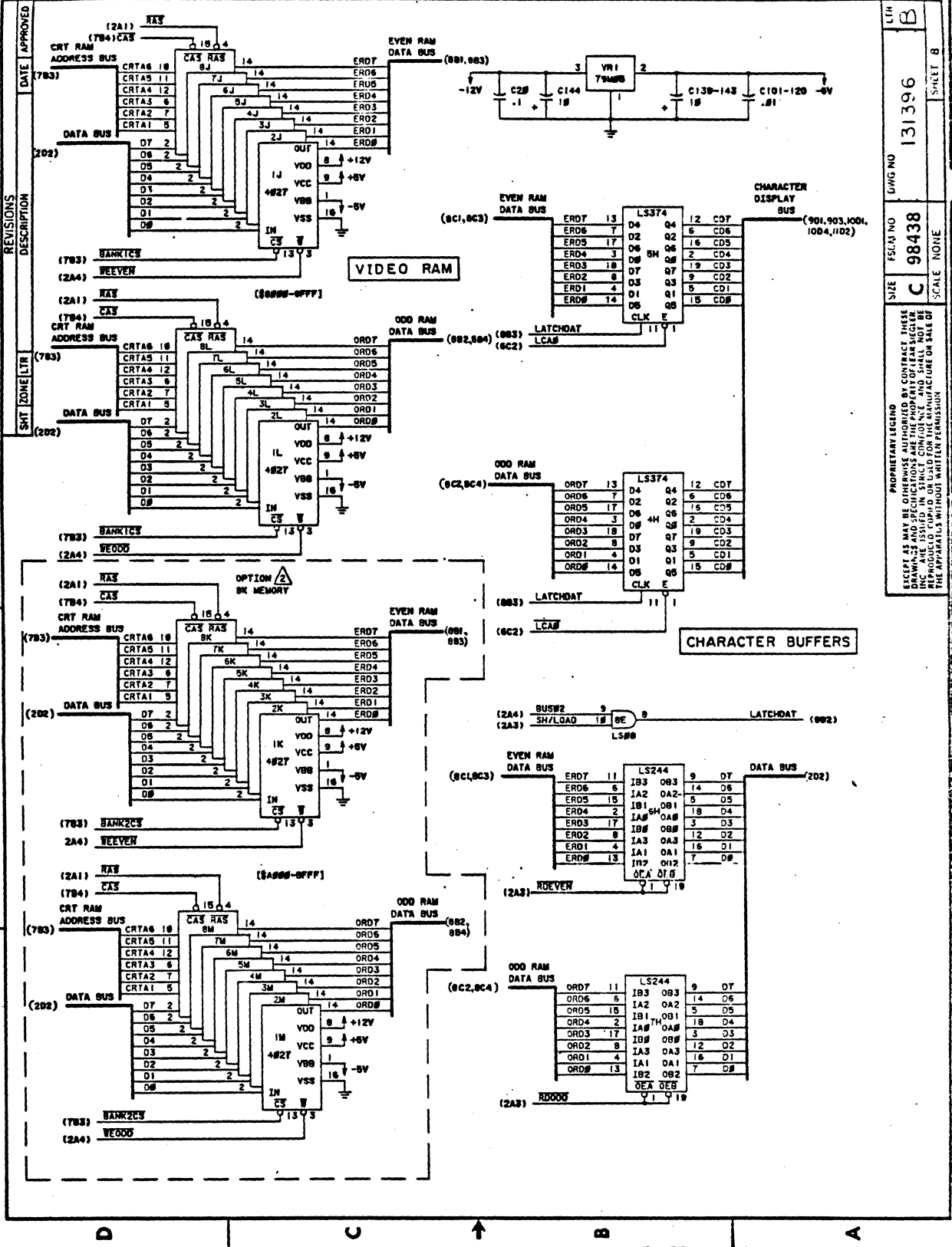
3

4

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LTW	DWG NO	131396	SHEET 7
SIZE	FSCW NO	98438	SCALE NONE
PROPRIETARY LEGEND EXCEPT AS MAY BE OTHERWISE AUTHORIZED BY CONTRACT THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF LEAR SIEGLER INC. AND ARE TO BE USED ONLY FOR THE MANUFACTURE OF THE APPARATUS WITHOUT WRITTEN PERMISSION			



DATE	APPROVED	REVISIONS	DESCRIPTION
1			
2			
3			
4			

LIT	B
DWG NO	131396
FSCA NO	98438
SIZE	C
SCALE	NONE
PROPRIETARY LEGEND EXCEPT AS MAY BE OTHERWISE AUTHORIZED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF THE MANUFACTURER AND SHALL NOT BE REPRODUCED, COPIED, OR USED FOR THE MANUFACTURE OR SALE OF THE APPARATUS WITHOUT WRITTEN PERMISSION.	

D C A



DATE APPROVED

SMT ZONE LTR

REVISIONS

DESCRIPTION

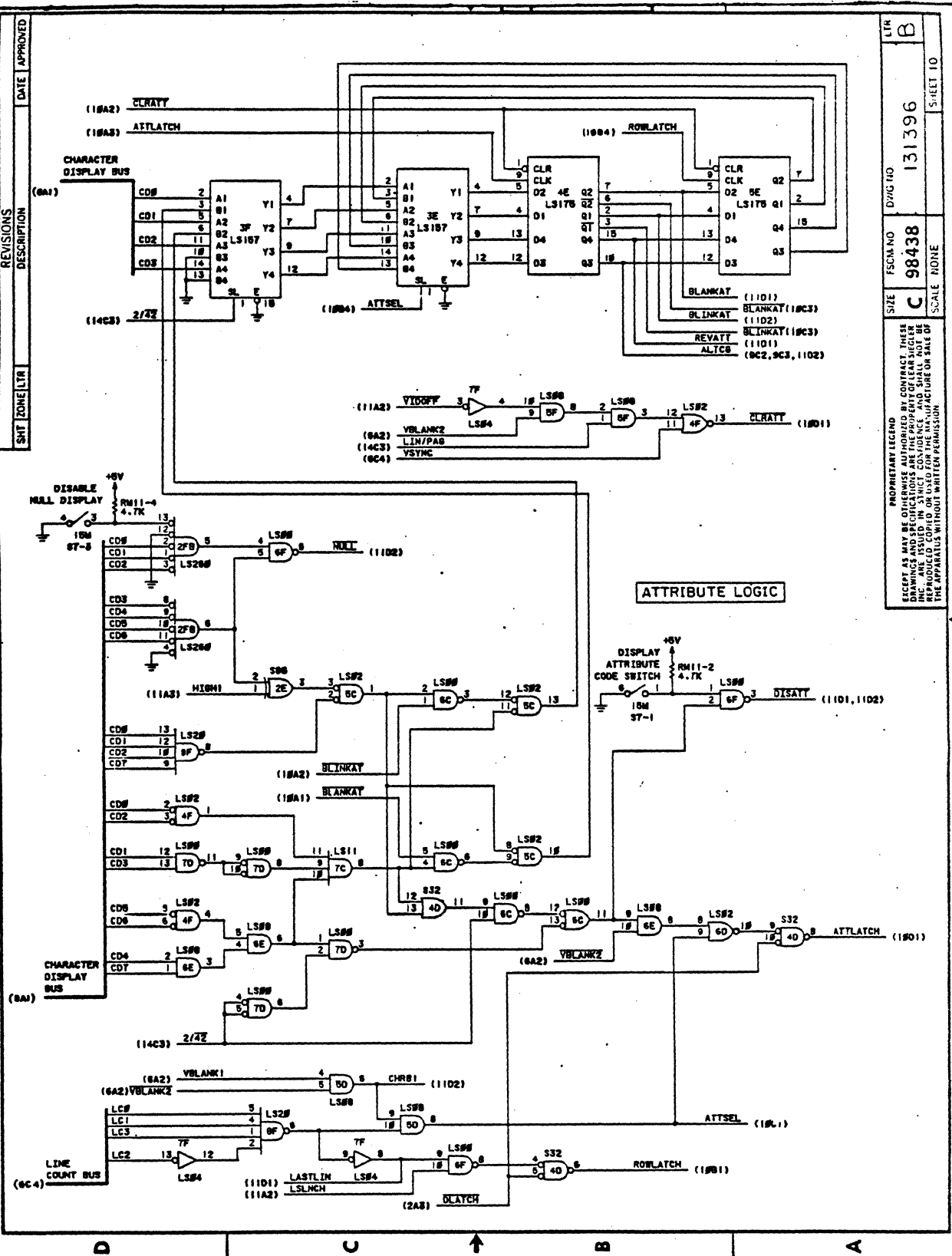
DATE APPROVED

1

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3

4



LTR	B
SIZE	C
FCGM NO	98438
DWG NO	131396
SCALE	NONE
SHEET NO	10

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 INC. ARE ISSUED IN STRICT CONFIDENCE AND SHALL NOT BE  
 REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY  
 MEANS WITHOUT WRITTEN PERMISSION.

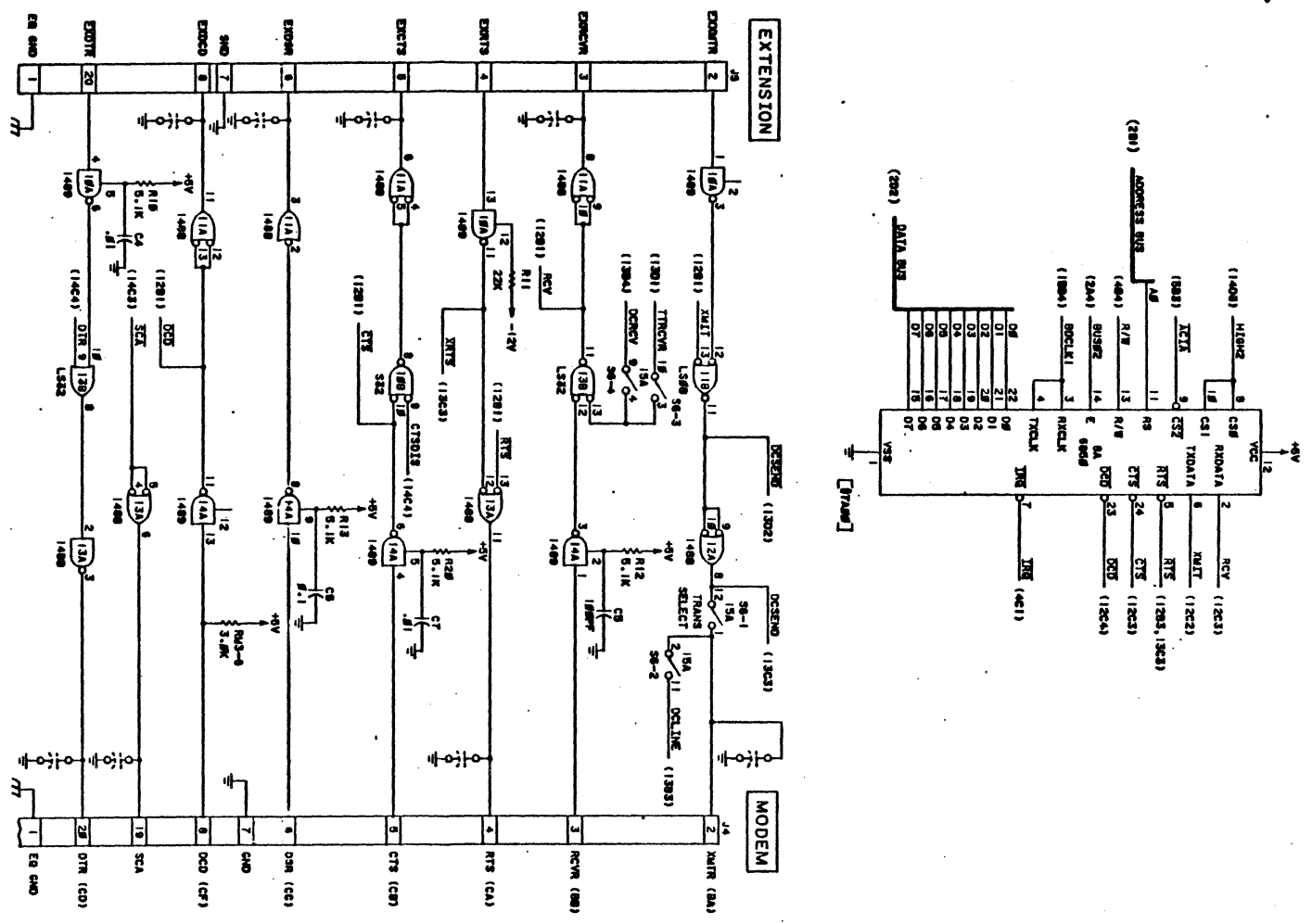
ATTRIBUTE LOGIC

D C B A





REVISIONS				DATE	APPROVED
SHT	ZONE	LTR	DESCRIPTION		
	B		INCORP DCN # 2413	7-28-61	<i>[Signature]</i>



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B  
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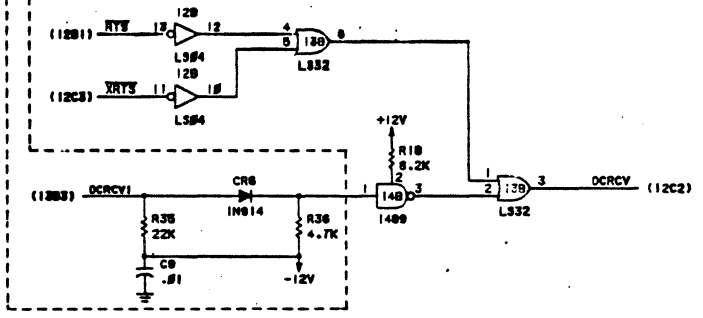
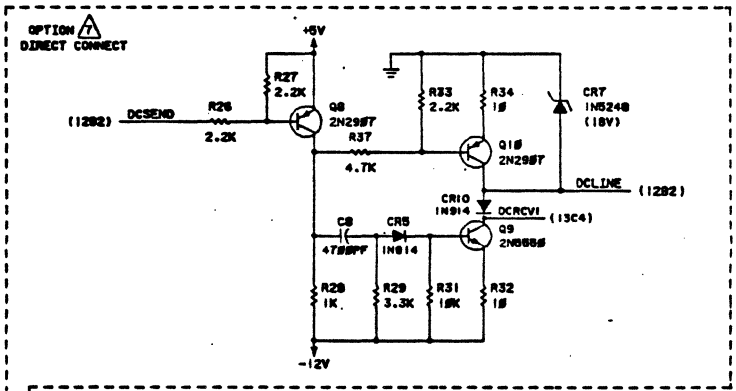
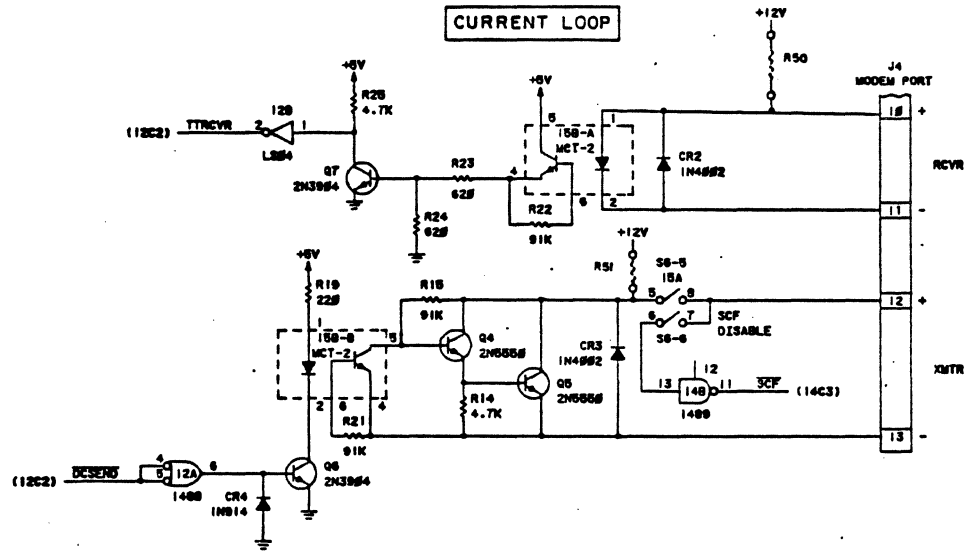
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SCALE NONE						SHEET 12	

REV	DATE	APPROVED

SHT ZONE LTR

REVISIONS DESCRIPTION

DATE APPROVED



LTR	DWG NO	FSCN NO	SIZE	SCALE
B	131396	98438	C	NONE

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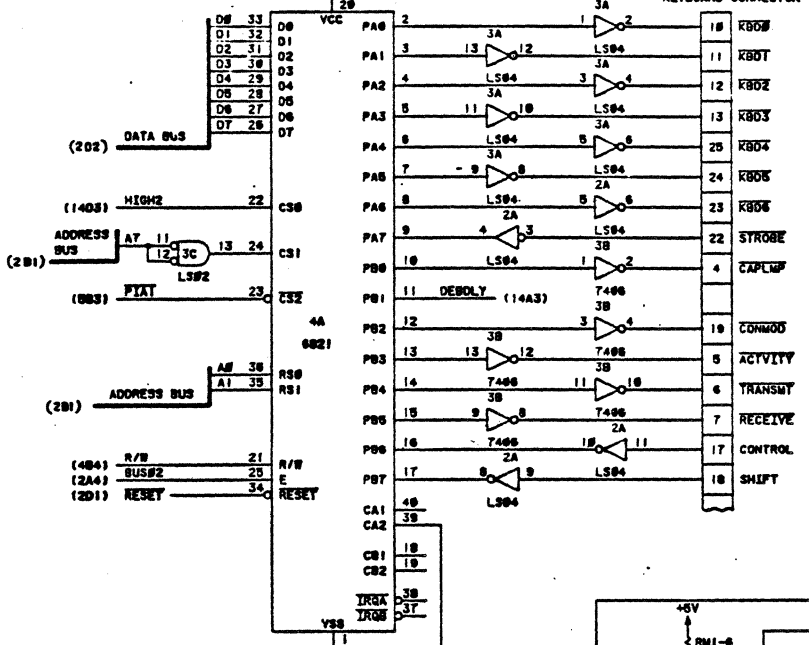
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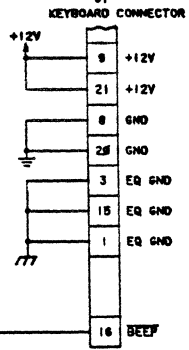
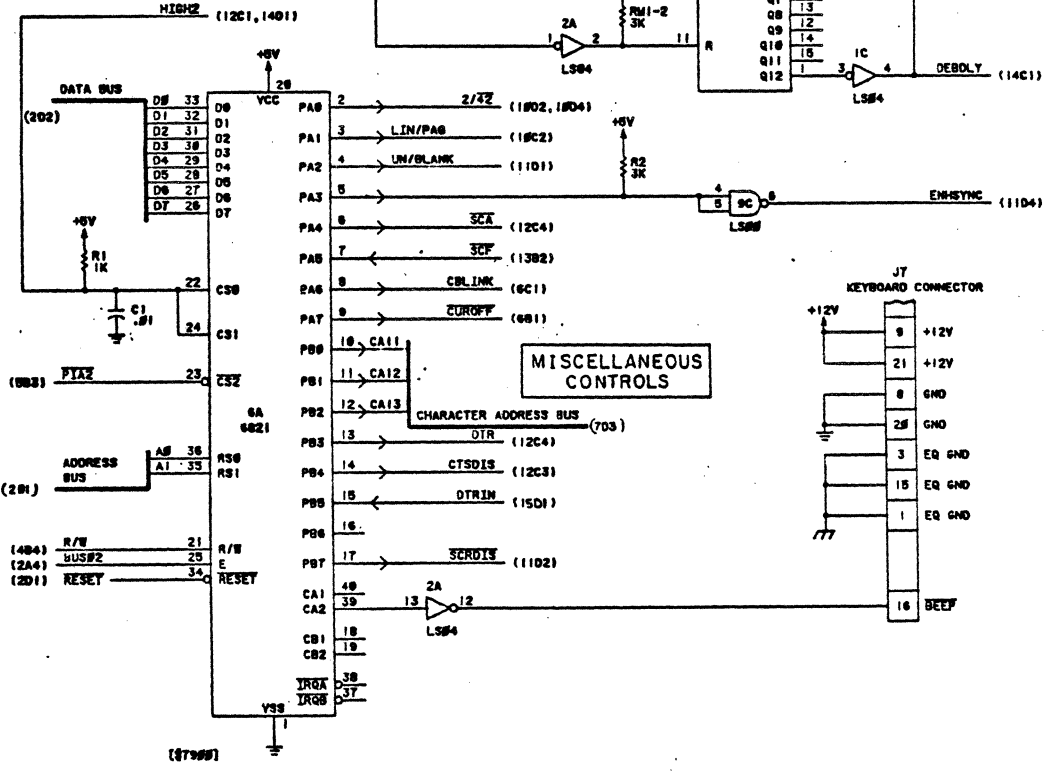
3

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KEYBOARD INTERFACE



MISCELLANEOUS CONTROLS



LTR B  
DWG NO 131396  
FSCM NO 98438  
SIZE C  
SCALE NONE  
SHEET 14

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DESCRIPTION  
DATE APPROVED

SMT ZONE LTR

**J1 POWER**

PIN NO.	FUNCTION	REF
1	GND	15D3
2	N/U	
3	+12V	15D4
4	-12V	15D4
5	GND	15D4
6	KEY	15D4
7	+5V	15D4
8	GND	15D4
9	EQ. GND	15D4

**J2 ADDRESS/DATA BUS**

PIN NO.	FUNCTION	REF
1	A6	4A1
3	A7	4A1
5	A4	4A2
7	A5	4A2
9	A2	4A2
11	A3	4A2
13	A8	4A2
15	A1	4A2
17	A9	4A1
19	A11	4A1
21	A8	4A1
23	A10	4A1
25	A15	4A1
27	A13	4A1
29	A14	4A1
31	A12	4A1
33	GND	4A2
35	D6	4A2
37	D4	4A2
39	D7	4A2
41	D1	4A2
43	D2	4A2
45	D8	4A2
47	D3	4A2
49	D5	4A2
EVEN	GND	

**J3 CONTROL SIGNALS**

PIN NO.	FUNCTION	REF
1	N/U	
3	HALT	4D1
5	IRQ	4D1
7	NMI	4D2
9	N/U	
11	↑	
13	↓	
15	N/U	
17	GND	
19	BA	4A3
21	N/U	
23	N/U	
25	MEMCLK	4A3
27	GND	4A3
29	SYSVMA	4A4
31	R/W	4A4
33	N/U	
35	BUS02	4A3
37	N/U	
39	RESET	4A3
41	N/U	
43	GND	
45	GND	
47	GND	
49	GND	
EVEN	GND	

**J4 MODEM**

PIN NO.	FUNCTION	REF
1	EQ GND	12A4
2	XMTR (BA)	12A2
3	RCVR (BB)	12A3
4	RTS (CA)	12A3
5	CTS (CB)	12A3
6	DSR (CC)	12A3
7	GND	12A3
8	DCD (CF)	12A4
9	N/U	
10	CL RCVR+	13A1
11	CL RCVR-	13A1
12	CL XMTR+	13A2
13	CL XMTR-	13A2
14	N/U	
15	↑	
16	↓	
17	N/U	
18	SCA	12A4
19	DTR (CD)	12A4
20	N/U	
21	↑	
22	↓	
23	N/U	
24	↑	
25	N/U	

**J5 EXTENSION**

PIN NO.	FUNCTION	REF
1	EQ. GND	12D4
2	XMTR (BA)	12D2
3	RCVR (BB)	12D3
4	RTS (CA)	12D3
5	CTS (CB)	12D3
6	DSR (CC)	12D3
7	GND	12D3
8	DCD (CF)	12D4
9	N/U	
10	↑	
11	↓	
12	N/U	
13	↑	
14	↓	
15	N/U	
16	↑	
17	↓	
18	N/U	
19	DTR (CD)	12D4
20	N/U	
21	↑	
22	↓	
23	N/U	
24	↑	
25	N/U	

**J6 MONITOR**

PIN NO.	FUNCTION	REF
1	EQ. GND	11C4
2	HSYNC	11C4
3	VSYNC	11C4
4	VIDEO	11C4
5	N/U	11C4
6	GND	11C4
7	GND	11C4
8	GND	11C4
9	N/U	11C4

**J7 KEYBOARD**

PIN NO.	FUNCTION	REF
1	EQ. GND	14A4
2	N/U	
3	EQ. GND	14A4
4	CAPLMP	14B1
5	ACTIVITY	14B2
6	TRANSMT	14B2
7	RECEIVE	14B2
8	GND	14A3
9	+12V	14A3
10	KBD0	14B1
11	KBD1	14B1
12	KBD2	14B1
13	KBD3	14B1
14	N/U	
15	EQ. GND	14A4
16	BEEP	14A4
17	CONTROL	14B2
18	SHIFT	14B2
19	CONMOD	14B2
20	GND	14A4
21	+12V	14A3
22	STROBE	14B1
23	KBD6	14B1
24	KBD5	14B1
25	KBD4	14B1

**J8 COMPOSITE VIDEO (OPT.)**

PIN NO.	FUNCTION	REF
1	VIDEO	11A4

131396  
98438  
C  
SCALE NONE  
SHEET 16  
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1  
2  
3  
4  
D  
C  
B  
A