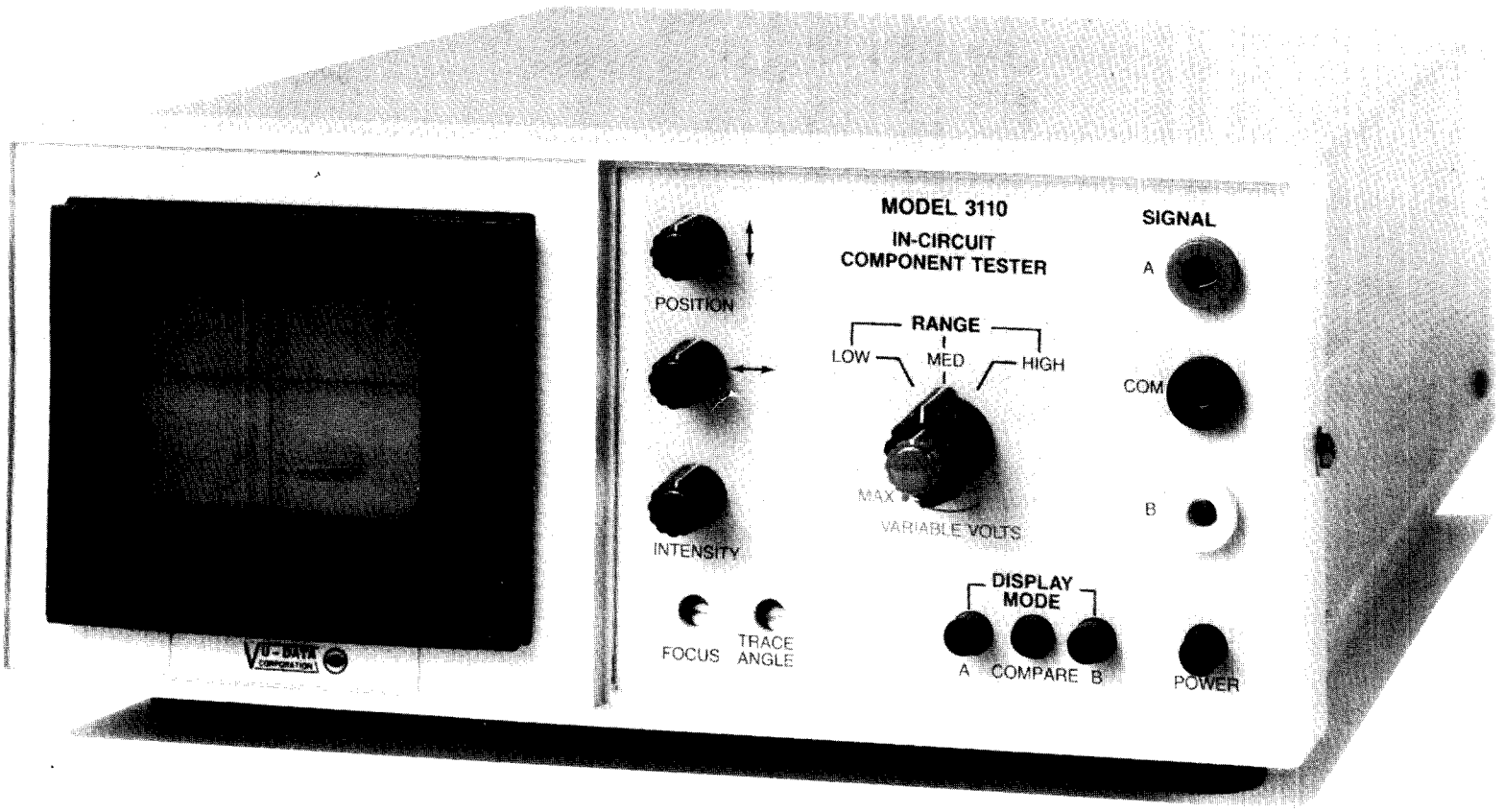
V U-DATA CORPORATION

TECHNICAL MANUAL

OPERATION
APPLICATION
MAINTENANCE



MODEL 3110 IN-CIRCUIT COMPONENT TESTER

INCLUDING MODEL 3210 IC TEST FIXTURE — PUB. No. 4-20405

PUBLICATION NO. 4-20404

WARRANTY AND ASSISTANCE

WARRANTY

VU-DATA warrants to the original Buyer of goods of VU-DATA design and manufacture for a period of one (1) year from the date of shipment from VU-DATA that the goods under the order will be of merchantable quality free from defects in material, workmanship and design each as determined at the date of shipment by VU-DATA. VU-DATA will not be liable for any design or design modification requested by or furnished by Buyer and incorporated into the goods.

Satisfaction of this warranty will be limited to replacement or repair or modification of, or issuance of credit for the goods involved at VU-DATA'S option. Repair or modification of the goods must be performed at VU-DATA or at any repair center authorized by VU-DATA to make such repairs or modifications as may be necessary. Buyer shall be responsible for transportation to the point of repair and for return shipment to Buyer. Such warranty satisfaction is available only if Buyer promptly notifies VU-DATA in writing upon discovery of the alleged defect and obtains from VU-DATA authorization for the return of the goods and VU-DATA'S examination of subject goods discloses that any defect is not the result of misuse; neglect; improper installation; improper operation; improper maintenance or repair; accident; or unusual deterioration or degradation due to electrical or electromagnetic environment. Should VU-DATA'S examination of subject goods determine that no defect exists, Buyer shall be assessed an inspection and calibration fee.

THE WARRANTY DESCRIBED HEREIN SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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ASSISTANCE

Certain limited procedures listed in the Maintenance Chapter of this manual, may be performed by competent, customer personnel with the expressed permission of VU-DATA Corporation. Beyond these limited procedures the opening, alteration or repair of this equipment except by VU-DATA personnel or VU-DATA authorized repair facilities will void the warranty. VU-DATA is not liable for incidental or consequential damage. See Warranty above. If any question or confusion arises concerning the warranty, check with VU-DATA before taking any action.

CALL (619) 452-7670

When information, assistance or authoriazation is required refer to the serial number on the back of the unit when contacting VU-DATA.

MODEL 3110

Serial Number _____

MODEL 3210

Serial Number _____

3110 MANUAL ADDENDUM

ADDENDUM OCT. 2, 1986

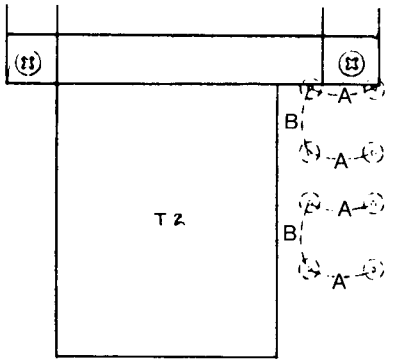
Starting at Serial Number 1681, availability problems caused the substitution of a different manufacturer for the cathode ray tube. The bill of material and schematic show the original values for the CRT manufactured by BRIMAR. If your 3110 has a CRT manufactured by TELEFUNKEN, the following changes should be made:

	BRIMAR		TELEFUNKEN	
PART	VALUE	PART NUMBER	VALUE	PART NUMBER
CRT	D-200	3-40002	D-232	3-40020
TRACE ANGLE COIL	—	5-90019	NONE	USED
R31, R29	47K	5-10473	22K	5-10223
R22	1 MEG	5-10105	750K	5-10754
R20, R21	10 OHM	5-10100	62 OHM	5-10620
R47	1K POT	5-73102	2K POT	5-73202

The following parts are added to the Masterboard Sub-Assembly 31105001:

C58, 5PF, #6-19050
C59, 7PF, #6-19070

The first model 3110's were produced with jumpers on the Masterboard Assembly to program the unit for 115V or 230V operation. The jumpers were set up as shown below:



"A" JUMPERS (4)
FOR 115V OPERATION

"B" JUMPERS (2)
FOR 230V OPERATION

Starting with Serial Number 1981, the jumpers have been replaced with a P.C.-mounted slide switch (S4), Part Number 2-10025. The voltage selected is automatically displayed on the switch body.

NOTES

TECHNICAL MANUAL

OPERATION
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PREFACE

This manual contains the information required by personnel at all levels of involvement to understand the functions, internal operation, application, and maintenance requirements of the Vu-Data Model 3110 In-Circuit Component Test and the Model 3210 IC Test Fixture.

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WARNING

Before removing the covers for troubleshooting, read and observe the following precautions. This instrument contains a CRT with an implosion hazard. High voltage circuits are exposed which could become hazardous if not handled properly.

CAUTION

Always remove the AC power cord from the connector on the rear panel before removing top and/or bottom covers. The interior of this instrument contains high voltage which could be hazardous to your health. AC power lines are exposed when covers are removed.

CAUTION

Avoid the use of chemical cleaning agents such as MEK, laquer thinner, or strong acids or alkali. These solvents will cause paint removal, deterioration of switches and melting of plastic parts.

CAUTION

Never connect the Model 3110 ICT in powered circuits. Damage to the unit will result.

CAUTION

Never apply power to device or PCB being tested while connected to the Model 3110 ICT. All ICT Testing of in-circuit components must be performed with NO CIRCUIT POWER applied.

CAUTION

All testing of in-circuit components must be performed with no circuit power applied. DO NOT attempt to use the ICT in a live circuit.

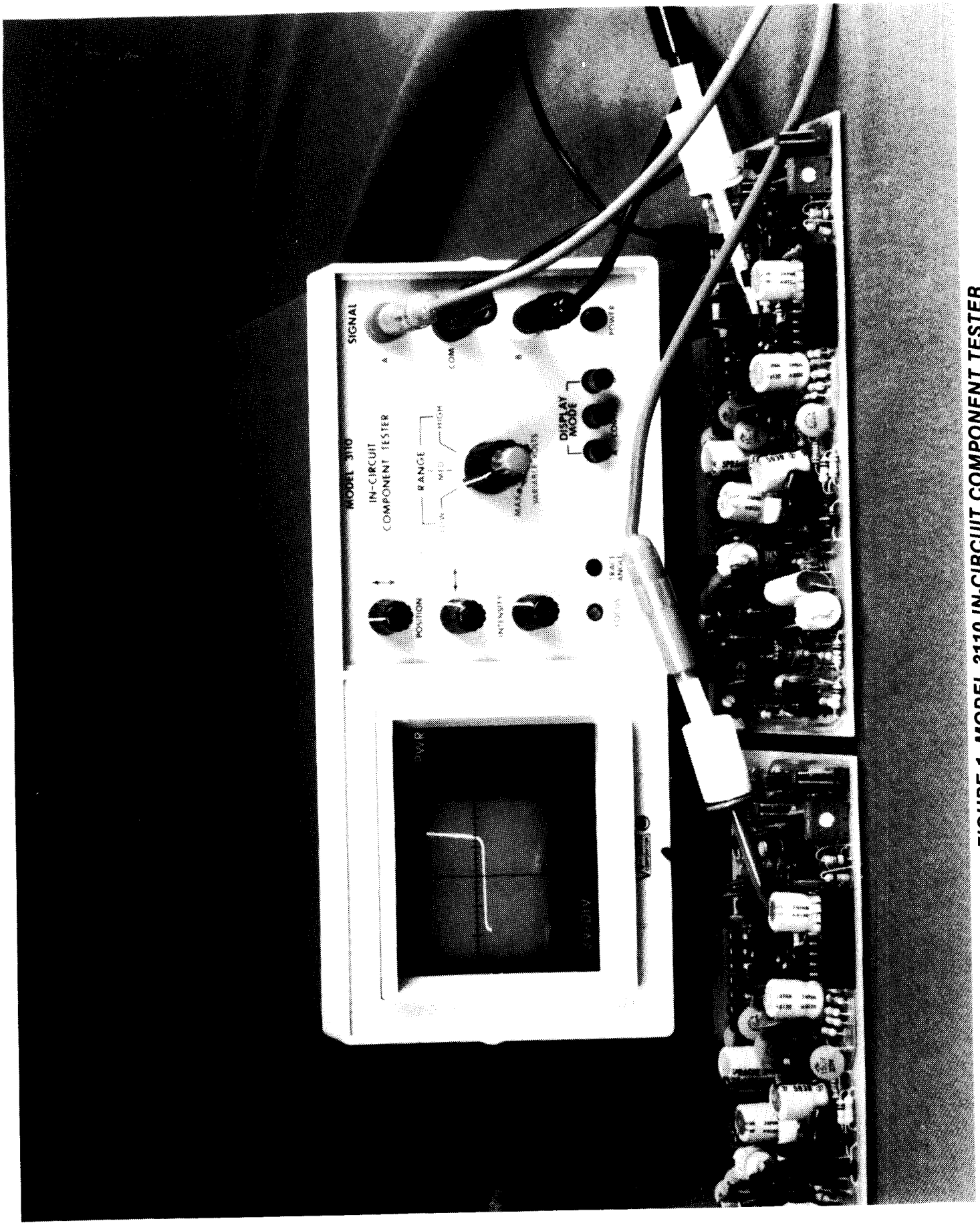


FIGURE 1. MODEL 3110 IN-CIRCUIT COMPONENT TESTER

This manual provides information relative to the use of the Model 3110 IN-CIRCUIT COMPONENT TESTER (ICT) manufactured by Vu-Data Corporation, 7122 Convoy Court, San Diego, California 92111. The Model 3110 is shown in Figure 1.

This manual contains complete operation, application, calibration, troubleshooting, and maintenance information required by the operator or service technicians and is presented as follows:

Introduction
Preparation For Use
Theory of Operation
Operating Instructions
Applications
Troubleshooting
Calibration
Maintenance and Service
Parts Listing
Drawings

General Description

The Model 3110 ICT is a portable "special purpose" type of oscilloscope and signal processing instrument that is used as an in-circuit component tester. The operator uses test probes to access the component and the results are displayed upon the CRT. The Model 3110 is a single unit suitable for bench-top use. Four plastic feet are provided on the bottom of the unit. A tilt stand is provided under the unit for better operator visibility.

The Model 3110, In-Circuit Component Tester, provides a simple, sure and inexpensive way to detect defective components in-circuit or out-of-circuit, without the need of circuit power. The ICT provides all the capability required for even the most inexperienced user to effectively determine "*Good*" or "*Bad*" components. The tester is used to test virtually all circuit elements, including diodes, transistors, capacitors, resistors, integrated circuits of all types and many special purpose type devices.

All controls for the ICT are front panel mounted for operator convenience. These controls include:

a) A three-position *Range Switch* (High - Med - -Low)

b) A *Variable Voltage* potentiometer

c) *Power* ON-OFF push-push pushbutton switch

d) Three *Display Mode* pushbutton switches (A - Compare - B)

e) *Horizontal* and *Vertical* adjustment potentiometers

f) *Intensity* adjustment potentiometer

g) *Focus* and *Trace Angle* trimpots

h) Three *Input Jacks* for test leads (A -Red; B -Yel; Com - Blk)

The Display is in two separate yet complementary groups. Of prime importance is the cathode-ray-tube (CRT) X-Y presentation of the E/I characteristic curve of device-under-test. A calibrated graticule allows the operator to easily read the voltage level of the test signal, in any of the three ranges, which can be adjusted to a particular value. (Valuable in breakdown testing.) Focus, Intensity and Trace Angle are easily accessible, and can be adjusted as required.

The second, and equally as important, display group is the annunciator which borders the CRT on the right and bottom. Light emitting diodes (LED)s and LED modules back light the nomenclature when applicable. On the right side, PWR serves as the power on light, while (A) and (B) provide indication as to which test signal is being applied. (Also which component or circuit element is on the display.) In the compare mode, A and B light alternately as the test signal is switched at a 1 Hz rate.

At the bottom of the annunciator panel, the low (3V/DIV), medium (10V/DIV) or high (20V/DIV) voltage range selected is presented to alert the operator of the test signal being applied.

As shown, all front panel controls are thus presented by the display groups.

Package Size

The Model 3110 is a compact 3.5 inch (8.89 cm) high by 8.5 inches (21.59 cm) wide, by 12.3 inches (31.24 cm) in depth. The chassis, front and back panel and case are of aluminum. A plastic bezel surrounds the display group. A power plug and fuse holder are located on the rear panel. A six foot 3-wire power cord is supplied with the unit.

Included as standard equipment with each unit is a set of special purpose test probes. The Test Probes are five feet in length with interchangable probes which allow a wide variety of testing from contact to very small component terminals, to P.C. board etchings without the danger of shorting adjacent terminals or leads. A four foot ground lead is also provided with an alligator clip on one end and a banana plug on the other.

Features

- Three full scale CALIBRATED voltage ranges.
- CALIBRATED GRATICULE
- Variable Output Voltage
- LED Display annoucator for Voltage Range (3V/DIV, 10V/DIV, 20V/DIV)
- LED Display Announcators for Display Mode (A - B)
- LED Display for Power
- A - B — COMPARE Display Modes
- 100 Hz Triangle-Wave-Test-Signal (eliminates display aberrations)
- Versatile Test Leads
- Rugged, all-metal Chassis eliminates interference from external noise environments.

Capabilities

The ICT provides all the capability required for even the most inexperienced user to effectively determine "*Good*" from "*Bad*" components.

Items Furnished

The ICT comes complete with the following items:

a) TEST LEAD SET containing:
Two 5-foot test leads with assorted probes
One 4-foot ground lead with alligator clip and plug Option 3001

b) One 6-foot 3-wire Power cord PN-2-70005

c) One Technical/Applications Manual PN-4-20404

Associated Equipment

To further enhance the capabilities of the ICT a Model 3210, IC Test Fixture, is available which provides two 20-pin and two 40-pin zero insertion force sockets to hold integrated circuits under test, or to connect DIP jumper cables to circuit boards under test. Two switches "1-20" and "21-40" are provided for pin test selection. The Model 3210 IC Test Fixture can also be used with a Dual Trace Oscilloscope (Vu-Data PS950 or equivalent) or a Digital Volt Meter (DVM), to compare waveforms or voltages on any pin of an IC or DIP cable in an operating circuit.

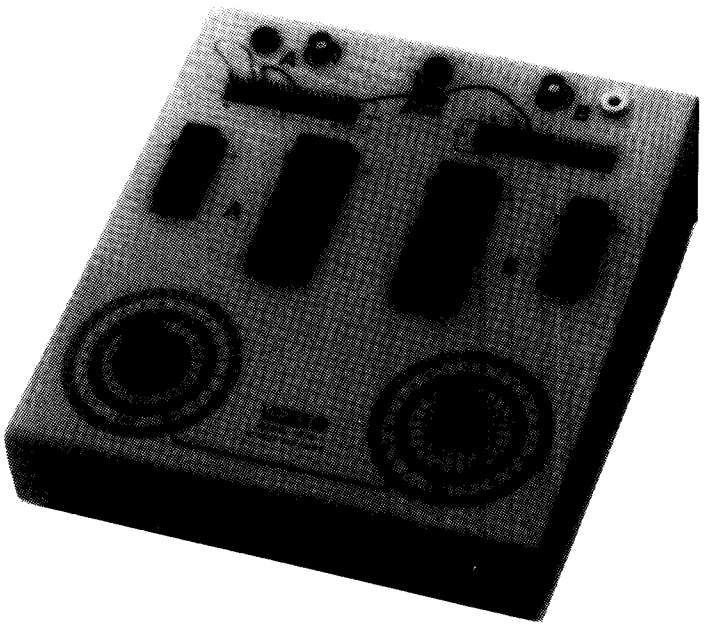


FIGURE 2. MODEL 3210 IC TEST FIXTURE

SPECIFICATIONS

TESTER RANGES:

LOW: 18 volts p-p open-circuit, 250 mA PK short-circuit

MEDIUM: 60 volts p-p open-circuit, 2.5 mA PK short-circuit

HIGH: 120 volts p-p open-circuit, 1 mA PK short-circuit

VARIABLE VOLTS:

All ranges continuously variable to half-amplitude

VOLTAGE SCALE:

X axis graticule divided into 6 major divisions, each subdivided into 5 minor divisions. Illuminated Range Indicator gives horizontal scale factor (V/DIV) depending on Range Selector.

Accuracy is ±5% on all ranges irrespective of Vernier position.

TEST SIGNAL:

Triangle, approximately 100 Hz, other frequencies available.

WAVEFORM COMPARISON:

COMPARE Mode switches display between two inputs at approximately 1 Hz, allowing good-bad comparisons without moving test probes. Illuminated Channel Indicators show selected input.

FRONT PANEL CONTROLS:

RANGE SELECTOR	LOW, MED, HIGH
VARIABLE VOLTS	Variable to half-amplitude
DISPLAY MODE	A, COMPARE, B
Vertical Position	
Horizontal Position	
INTENSITY	
INSTRUMENT POWER	
FOCUS	Screwdriver adjust
TRACE ANGLE	Screwdriver adjust

POWER:

115 VAC ±10%, 50-60 Hz, 230 VAC jumper selected.
20 Watts nominal, 25 Watts max.

SIZE:

Height 3.5″, Width 8.5″, Length 12.3″

WEIGHT:

5.5 lbs.

AMBIENT TEMPERATURE:

Operating: 0°C to +50°C
Non-operating: −55°C to +75°C

ALTITUDE:

Operating: 15,000 ft. max.
Non-operating: 50,000 ft. max.

SHOCK AND VIBRATION:

Will withstand the shock and vibration conditions encountered in normal commercial shipping and handling.

HUMIDITY:

Will operate in up to 95% relative humidity, non-condensing.

PREPARATION FOR USE

Acceptance of Delivery

Prior to accepting delivery, a careful inspection of the shipping container must be made. A severe gouge, abrasion or scratch; a badly battered corner or edge constitutes evidence of mishandling that may have damaged the unit. If there is any damage to the shipping container, a note of such must be signed by the carrier's representative acknowledging the damage before delivery can be accepted.

Unpacking

Each Vu-Data Model 3110 is shipped in a double container that is 14½ inches wide by 7 inches deep by 19½ inches high. The outer container is a fiber board container which provides a formfit to the inner container which is made of one-inch foam. After opening the outer carton, carefully slide the inner container out. Lift the lid, and remove the extra foam packing materials surrounding the unit.

NOTE

In preparing to unpack the unit, provisions should be made to retain the shipping container and packing material for use in the event that is should become necessary to repack the unit for shipment to another installation or to return it to the factory.

A visual inspection for damage should be accomplished upon removing the instrument from the shipping container. If damage is not apparent until the instrument is unpacked, a claim for concealed damage should be placed with the carrier within 15 days of receipt. All shipping containers and filler materials must be kept for inspection.

Receiving Inspection

Whether or not any damage to the shipping container was noted, a thorough inspection of the unit is essential prior to application of power. Visually examine the:

- Cover for dents or abrasions
- Control panel for broken knobs or damaged switches
- Rear panel for damage to fuse holder or connector

If any scratches, abrasions, dents, bulges, cracks or other evidence of damage is noted, notify Vu-Data Corporation, Customer Service Department immediately.

NOTE

To avoid cancellation of the warranty, do not apply power to a unit that has been dropped or damaged. Notify Vu-Data, requesting information as to disposition of damaged unit.

Reshipment

When reshipment of a Model 3110 becomes necessary, it should be packed in the original container in accordance with the following procedure:

1. Remove power cord and test leads.
2. Place unit in plastic bag.
3. Place unit in center of foam container. Pack accessories with it and fill space with foam pellets.
4. Place lid on container.
5. Place foam container in fiber-board container and seal. If the original shipping container is not available a replacement should be ordered from Vu-Data Corporation.

Power Requirements

The input power requirements are 115 Vac, ±10%, 50-60 Hz, 25 watts maximum (20 watts nominal). The unit is also capable of 230 Vac, ±10%, 50-60 Hz operation by internal jumper selection as shown in figure 3.

First Time Operation

The following procedure is provided to familiarize the operator with the Model 3110 controls and also serves as an operational test of the instrument.

Functional Checkout Procedures

The Model 3110 In-Circuit Component Tester was aligned, calibrated and tested prior to shipment. The instrument is therefore ready for immediate use upon receipt. If the unit has passed receiving inspection, then the following functional checkout tests may be performed.

NOTE

The Model 3110 is furnished with a detachable 3-prong power cord that grounds the chassis in accordance with NEMA recommendations to protect operating personnel from shock hazards. When plugged into an appropriate power source, the fused power input conforms to applicable safety standards. If it is necessary to operate the unit from a two-prong facility receptacle, the grounding feature should be retained by using a suitable 3-prong to 2-prong adapter and grounding the pigtail lead to the adapter.

TEST PROCEDURE

a) Connect the power cord to the connector on the rear panel.
Connect plug to AC outlet.
Depress power switch on front panel.
Observe "PWR" indicator is illuminated.

b) Allow two minutes for the instrument to warm up, then set the front panel controls as follows:

Display Mode Switch.....A
Range.....LOW
Variable Volts.....CW (MAX)
Trace Angle.....MIDRANGE
Focus.....MIDRANGE
Intensity.....CCW
Horizontal Position.....MIDRANGE
Vertical Position.....MIDRANGE
Obsere the A and 3V/DIV indicators are illuminated.

c) Rotate INTENSITY control clockwise until a full scale horizontal line appears.
Adjust the FOCUS and INTENSITY controls for a suitable display.

d) Adjust the VERTICAL POSITION and HORIZONTAL POSITION controls to center the trace on the graticule.

e) Adjust TRACE ANGLE control so that the trace is parallel to the horizontal line on the graticule.

f) Using a patch cord short the A SIGNAL CONNECTOR to COM and observe that a vertical trace is obtained. Note that the A CHANNEL indicator is illuminated.

g) Depress the COMPARE pushbutton of the DISPLAY MODE switch. Observe that the CRT display now alternates between a full-scale vertical line on Mode A and a full-scale horizontal line on Mode B at approximately a 1 Hz rate. Observe that the A channel indicator is illuminated when the trace is vertical and the B channel indicator is illuminated when the trace is horizontal.

h) Disconnect the patch cord from the A SIGNAL connector and connect it to the B SIGNAL connector.
OBSERVE that the display continues to alternate between horizontl and vertical lines, but with the A channel indicator illuminated when the trace is horizontal and the B channel indicator illuminated when the trace is vertical.

i) Rotate the VARIABLE VOLTS control counterclockwise.
Observe that horizontal and vertical lines reduce to approximately one-half full scale.
Return the VARIABLE VOLTS control to the fully CW position.
Observe the click of the detent and that the horizontal and vertical lines are now full scale.

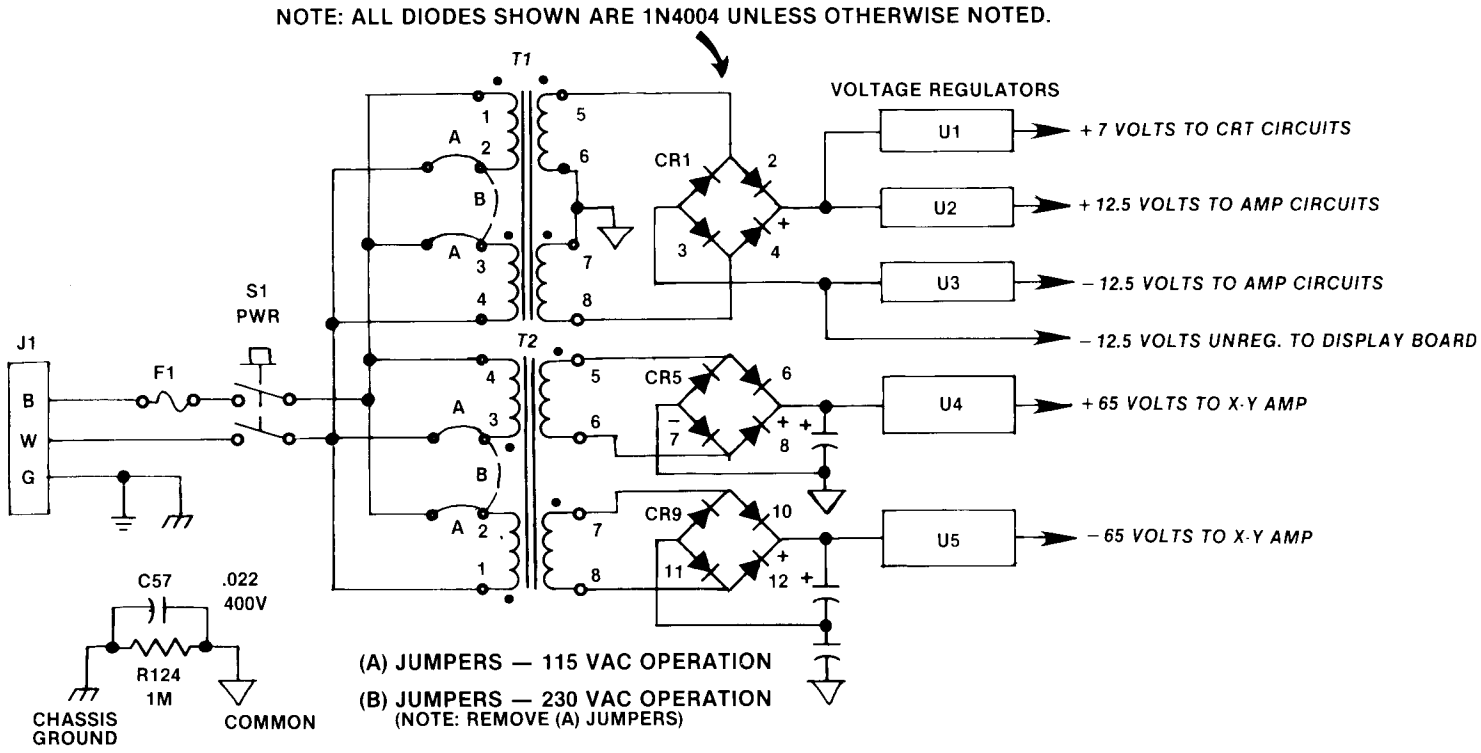


FIGURE 3. SYSTEM POWER DIAGRAM

j) Depress the B SIGNAL display mode switch and remove the patch cord. Observe B SIGNAL indicator is illuminated and the trace is horizontal.

k) Obtain a capacitor with a value between 0.5 μf and 2 μf.
Using the test leads, connect the capacitor between the B SIGNAL connector and the COMM connector.
Observe that the horizontal single line has opened to a very narrow ellipse with its major axis oriented horizontally.

NOTE

It may be necessary to readjust the FOCUS and INTENSITY controls for a well-defined trace.

Observe that the 3V/DIV Range Indicator is illuminated.

l) Select the MED position of the RANGE switch.
Observe that the 10V/DIV Range Indicator is illuminated.
Observe that the ellipse is oriented almost vertically and is wider than in Step (k).

m) Select the HIGH position of the RANGE switch.
Observe that the 20V/DIV Range Indicator is illuminated.
Observe that the ellipse is narrower than in Step (l).

n) Return RANGE switch to LOW position.
Remove all test leads.
Return DISPLAY MODE to A signal.
Depress power switch. Observe PWR indicator extinguishes.

o) TEST COMPLETED.

Introduction

The Model 3110 In-Circuit Component Tester (ICT) is a self-contained special purpose CRT instrument designed expressly to test a wide variety of components (e.g. semiconductors, diodes, transistors, capacitors, resistors, integrated circuits of all types, chokes, and transformers). As the name implies, the In-Circuit Component Tester has the capability to test most components without removal from the circuit board.

A system block diagram is shown in Figure 4.

The ICT applies a 100 Hz Triangle Wave Test Signal across the device under test (DUT), resulting in current flowing through the DUT and a voltage drop across its terminals. The current flow is processed within the ICT providing a VERTICAL deflection of the scope trace. The voltage drop across the DUT when processed within the ICT, provides A HORIZONTAL deflection of the scope trace.

An "*Open Circuit*" condition would have a zero current flowing through the test leads and therefore would show a maximum voltage across the test leads. On all range settings (HIGH - MED- LOW) an "*Open Circuit*" is represented by a straight HORIZONTAL trace on the scope.

A "*SHORTED*" condition would cause maximum current flow in the test leads and zero voltage drop across the test leads. A "*SHORTED*" condition is indicated by a VERTICAL trace from top to bottom of the scope. This applies to all ranges of the ICT (HIGH - MED - LOW). When the ICT is used to test individual components (not-in-circuit), it provides a CRT display of the component's "*characteristic curve*" (a current vs. voltage plot). Faulty parts are found by comparing each part's characteristics (E/I) to a known "*GOOD*" characteristic. The ICT also allows direct comparision between two parts. Using both the A and B inputs and their common ground, it is possible to compare the two parts on the CRT, (when in the compare mode), at a 1 Hz rate. This is accomplished by use of a relay/timer circuit to switch between the two separate input signals. As the relay circuit switches, the characteristics of the two separate devices-under-test are alternately displayed on the scope for comparision at the 1 Hz rate. The block diagram, Figure 4 , shows this relationship.

This simple comparsion technique is what makes the ICT a very powerful, result-oriented tool for production, test, field service or QC. If this technique is expanded to in-circuit situations, each pair of nodes within a circuit has a "*characteristic*". As in the individual component case, comparisions are made to find the "*BAD*" characteristics.

Ranges

The Model 3110 has three different "*ranges*" of open circuit voltage for the triangle wave generator; 120 Vp-p, 60 Vp-p, and 18 Vp-p. Additionally, there is a 2:1 vernier control that allows the open circuit voltage to be decreased to 60 Vp-p, 30 Vp-p, and 9 Vp-p, respectively. Similarly, the short circuit peak current values for the three ranges are 1 mA, 2.5 mA, and 250 mA, respectively. The current values are also reduced by half with the veriner control.

The two higher ranges (MED, HIGH) tend to lend themselves (by virtue of their impedance level) to voltage breakdown applications. Any open circuit voltage from 15V to 60V can be achieved by using the range switch and vernier control. The open circuit voltage can be set with 5% using the CRT graticule, allowing devices to be conveniently screened in a GO/NO-GO fashion.

The LOW range is intended for low impedance applications. Situations of this type are usually encountered when testing components in circuit. It frequently is the case, that the points of interest within a circuit exhibit rather low impedance. Thus, the Model 3110 is capable of supplying 250 mA peak current so as to fully exercise the circuitry-under-test.

The triangle wave generator runs at a frequency of 100 Hz as stated earlier. However, the frequency can easily be changed internally to accomodate a wider scope of applications. For

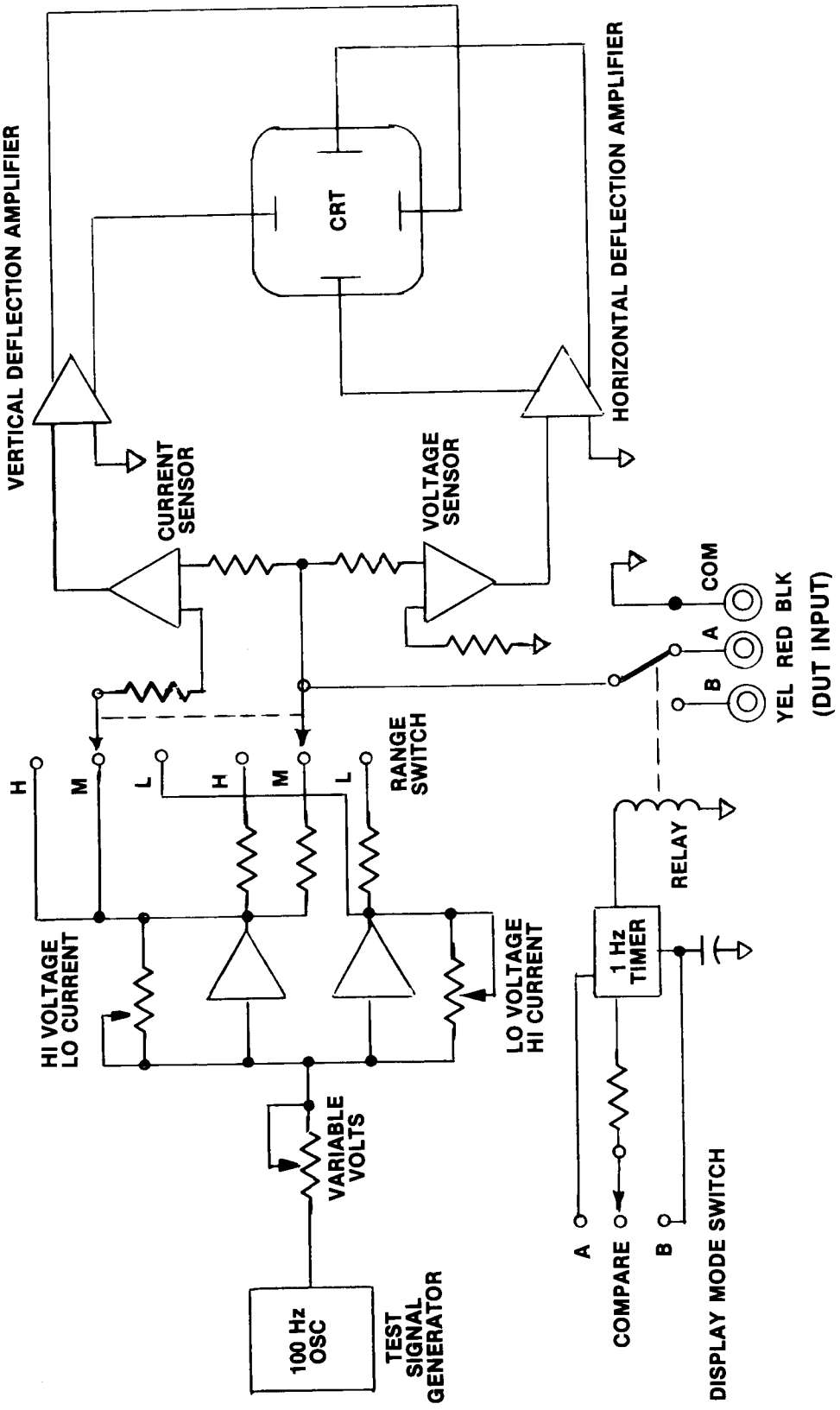


FIGURE 4. SYSTEM BLOCK DIAGRAM

example, a higher frequency might be more useful in testing for shorted turns in a transformer, or for testing low value capacitors, whereas a lower frequency would be handier for testing large value capacitors.

Test Signal

The ICT uses a 100 Hz Triangle Waveform Test Signal rather than a clipped sine wave or similar device. The reason for the triangle wave over the clipped wave is that the clipped sine wave has been shown to introduce abberations in the display not attributable to the device-under-test. The Triangle Wave Test Signal does not have this problem. Also, the Triangle Wave signal provides a display with uniform brightness.

A simplified block diagram of the ICT is shown below in Figure 5. The Triangle-Wave Generator (E), applies a 100 Hz test signal to the device-under-test (DUT) (component or circuit) through the current limiting resistors R1 and R2. Differential Amplifier (AR1), senses the voltage across R2 and applies the voltage, which is proportional to the current through R2, to the VERTICAL deflection plates of the CRT. The input impedance of AR1 is high enough so that there is negligible loading of R2 by AR1. This insures that the current through R2 is the same as the current through the DUT.

The voltage across the DUT is sensed by Differential Amplifier (AR2), and the proportional voltage is applied to the HORIZONTAL deflection plates of the CRT. An E/I signature, or characteristic curve, of the component or circuit-under-test is thus presented on the CRT for analysis and comparision.

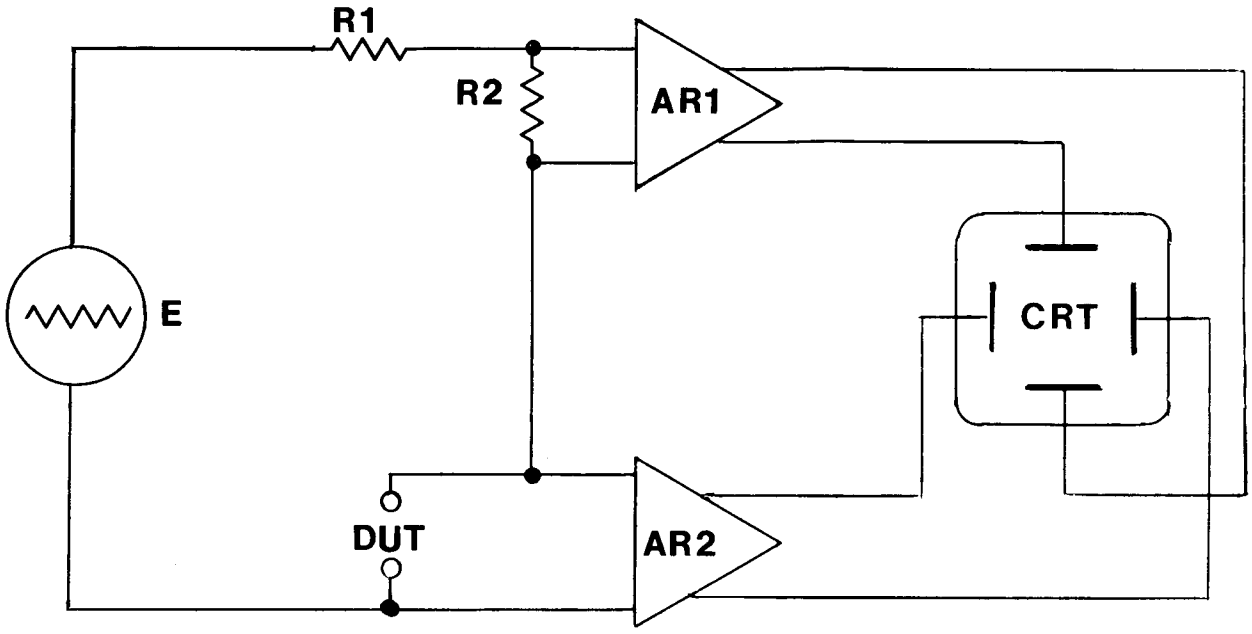


FIGURE 5. SIMPLIFIED BLOCK DIAGRAM

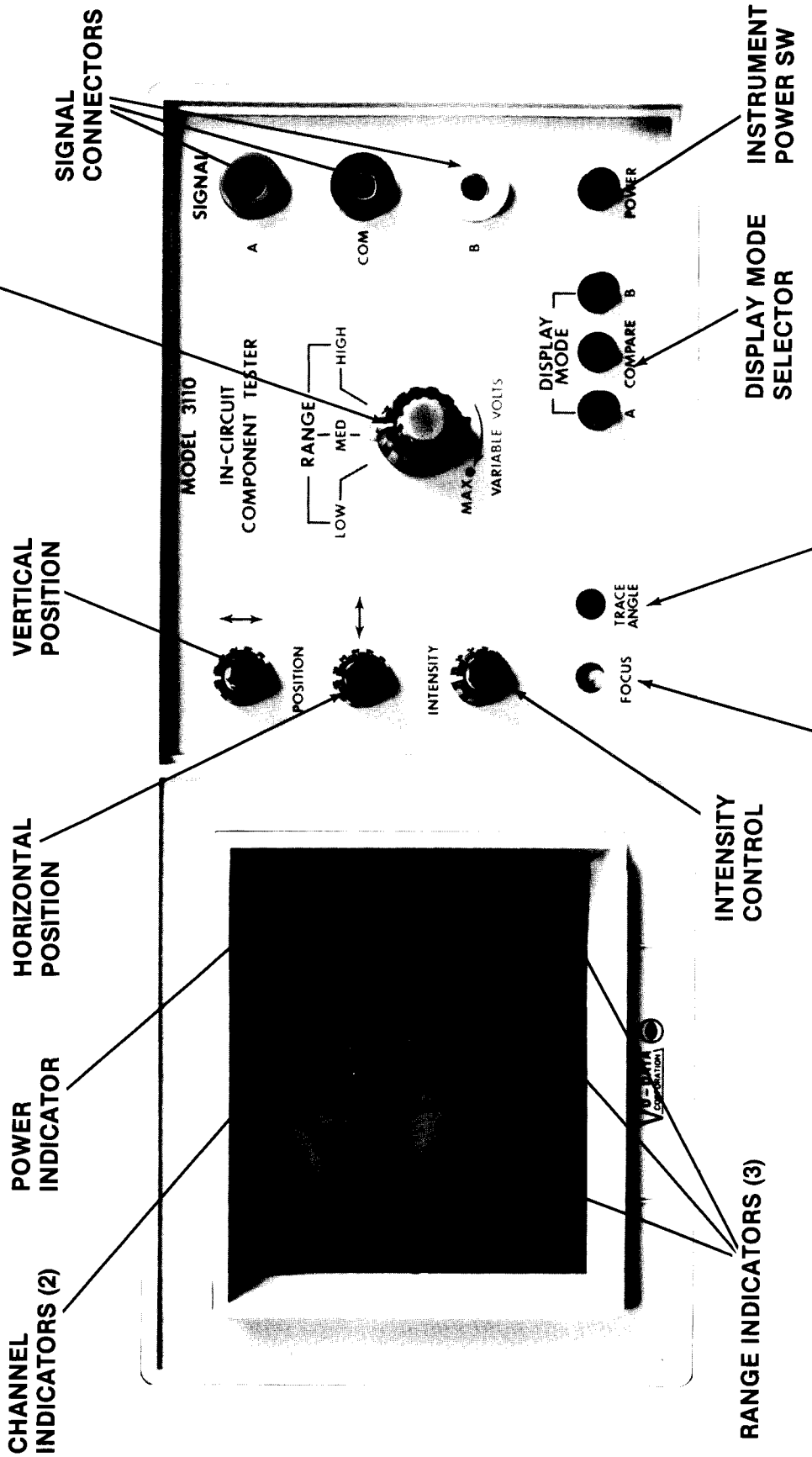


FIGURE 6. MODEL 3110 CONTROLS AND DISPLAY

FIGURE 6. MODEL 3110 CONTROLS AND DISPLAY

General

The Model 3110 In-Circuit Component Tester front panel is divided into two sections. These sections are as follows; Control section and Display section.

Control Section

The following controls and connectors are located on the front panel, refer to Figure 6 for location of individual controls or connectors.

a) **SIGNAL CONNECTORS**

A	Red "*banana jack*" — I/O terminal by which test signals are applied and sensed in Channel A.
COM	Black "*banana jack*" — I/O terminal for instrument signal common.
B	Yellow "*banana jack*" — I/O terminal by which test signals are applied and sensed in Channel B.

b) **POWER** — A two-position black push-push switch — depressed — "*ON*" extended "*OFF*" —applies AC power to unit.

c) **DISPLAY** — A three-station interlocking push button switch used to select mode.

A	Selects "*A*" and "*COM*" terminals for display on the CRT.
B	Selects "*B*" and "*COM*" terminals for display on CRT.
COMPARE	Alternately switches between "*A*" and "*B*" modes at approximately 1 Hz.

d) **RANGE** — A three-position switch — used to select one of three ranges as described below. Black Knob.

LOW	Selects 18 Vp-p open-circuit, triangle wave test signal applied to terminals as determined by Display Mode selector. Short circuit current 250 mA PK. Also known as 3V/DIV range.
MED	Selects 60 Vp-p open-circuit, triangle wave test signal applied to terminals as determined by Display Mode selector. Short circuit current 2.5 mA PK. Also known as 10V/DIV range.
HIGH	Selects 120 Vp-p open-circuit, triangle wave test signal applied to terminals as determined by Display Mode selector. Short circuit current 1 mA PK. Also known as 20V/DIV range.

e) **VARIABLE VOLTS** — Red Knob — concentric with RANGE knob. Provides variable control of open-circuit voltage and short-circuit current. When rotated fully counter-clockwise — the three ranges above are reduced to approximately half their respective maximum values.

f) **TRACE ANGLE** — A screwdriver adjustable potentiometer — controls angle of trace on CRT relative to graticule.

g) **FOCUS** — A screwdriver adjustable potentiometer — controls focus of CRT Display.

h) **INTENSITY** — Black Knob — potentiometer — rotates to control intensity of CRT display.

i) **HORIZONTAL POSITION** — Black Knob — potentiometer — rotates to control horizontal positon of trace on CRT.

j) **VERTICAL POSITION** — Black Knob — potentiometer — rotates to control vertical position of trace on CRT.

Display Section

The following Indicators and display are located on the front panel, refer to Figure 6, for location of an individual indicator or display.

a) **PWR** — A green LED "Power On" indicator.

b) **A** — A red LED indicator — illuminated when Channel A is displayed.

c) **B** — A yellow LED indicator — illuminated when Channel B is displayed.

d) **RANGE INDICATORS** — Green LED indicators — one of three illuminated showing horizontal scale factor for selected range.

3V/DIV

10V/DIV

20V/DIV

e) **CRT DISPLAY** — A rectangular CRT with blue filter. E/I axes; voltage scale (horizontal) divided into 6 major divisions, with 5 minor divisions per major division.

General

The Model 3110 In-Circuit Component Tester (ICT) applies an AC signal source (100 Hz Test Signal) to the device-under-test. Using this method the ICT scans and displays junction reactions of discrete components and IC packages. The CRT X-Y display presents the "*E/I*" characteristic curve of the particular component or circuit under test, while the COMPARE Mode allows the operator to easily detect the difference between a known GOOD and a bad circuit element by switching the CRT display at a 1 Hz rate, from the known good component to the suspected device.

At last there is a simple, sure and inexpensive way to detect defective components in-circuit or out-of-circuit, without the need of circut power.

Troubleshooting with the ICT

When using the ICT for troubleshooting a circuit board, plan ahead. If the area of trouble is known, then the search for the bad component(s) begins there, but, if the area is not known then an organized method of search should be followed to insure complete testing.

Selecting the Range

The ICT provides three ranges of operation to facilitate a greater range of testing. The three different "*ranges*" of open circuit voltages from the triangle wave form generator are: 18 Vp-p, 60 Vp-p, and 120 Vp-p. The short circuit peak current values for the three ranges are 250 mA, 2.5 mA and 1 mA respectively.

a) LOW RANGE — The low range is intended for low impedance applications. The low range is at a voltage level of 18 Vp-p, but has the highest peak current so as to exercise the circuit under test.

b) MEDIUM RANGE — The medium range is intended for voltage breakdown applications. The open circuit voltage can be set to within 5% using the CRT graticule and vernier control, allowing devices to be screened in a GO/NO-GO fashion.

c) HIGH RANGE — The high range extends the voltage breakdown application. Useful in detecting bad capacitors and high impedance circuitry.

Fault Isolation

The ICT will allow fault isolation to a single component in almost all cases when used properly. Most examination will start in the LOW range as it is quite useful in verifying low impedance shorts. Testing in the LOW range may result in no waveform or one that provides incomplete results due to insufficient voltage present to exercise the device-under-test. When this is suspected switch to a higher range.

NOTE

An "OPEN CIRCUIT" will alway be displayed as a HORIZONTAL line, in all three ranges. A "SHORT-CIRCUIT" will always be displayed as a VERTICAL line, in all three ranges.

The ICT can be used to test virtually any discrete component out of circuit, but where its real value shows is its ability to test devices in-circuit. Discrete components, IC's and other devices can be evaluated while installed on the printed circuit board, reducing the time required to locate defective parts while eliminating circuit board damage caused by removal and replacement of devices.

CAUTION

ALL TESTING OF IN-CIRCUIT COMPONENTS MUST BE PERFORMED WITH NO CIRCUIT POWER APPLIED. DO NOT ATTEMPT TO USE THE ICT IN A LIVE CIRCUIT.

The ICT may be used in any of the three ranges for in-circuit testing. Selection of range is dependent on the effective impedance of the circuit.

Basic Rules

- GOOD devices respond with straight trace lines and crisp angles where the lines meet.
- BAD devices will respond with curved traces, rounded angle junctions, combinations of the above and broken traces.
- RESISTANCE, or its influence, will result in a diagonal line, but will vary in degrees according to resistance.
- CAPACITANCE, or its influence, will result in some form of a loop, circle, elipse appearing on the CRT.
- OPEN-CIRCUITs will always be displayed as a horizontal line.
- SHORT-CIRCUITS will always be displayed as a vertical line.

Compare Mode Testing

When comparing a known "*GOOD*" device to a suspected device, use the "*COMPARE*" Mode of the ICT.

Connect the known GOOD device to the "*A*" channel (red jack) and common (black jack). Connect the second device to the "*B*" channel (yellow jack) and to the same common. With the ICT in the compare mode the test signal will switch the two at a 1 Hz rate. If both devices are good there will be little or no difference in the traces. If the suspected device is BAD the resulting trace variations will expose it. This highly simplified form of comparison testing is reliable and quick, and can be performed both in-circuit and out-of-circuit. It is especially useful in the testing of IC's.

Testing of IC Devices

IC's are tested pin by pin, using Vc for one test point and probing the other pins with the other probe. The waveforms will be varied by the different devices within the IC's and the combinations of these. It isn't possible to show all the combinations and waveforms that are possible with the amount of different IC packages available today. The Basic Rules still apply — Straight Lines and sharp angles GOOD. Curved lines, rounded angles BAD. Other forms of IC's will take on various shapes to the waveforms. The best way to check IC's is to comparison check using both Channel A and B on the ICT check the GOOD IC against the one to be tested on a pin to pin approach.

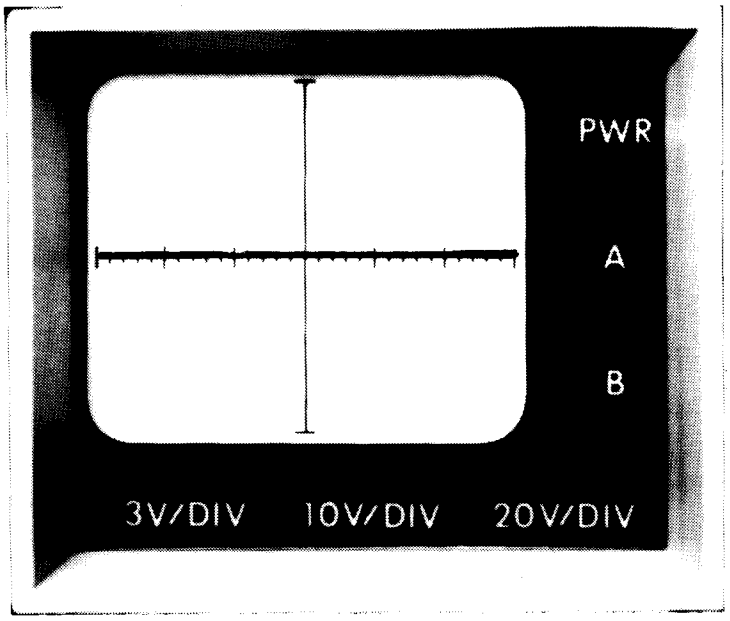
Application Notes

The following pages of application note provide general information on waveforms for various devices. These are provided for your help in determining what the traces should look like. REMEMBER, the traces you get on your ICT from your components may differ, but should follow the same pattern.

— CAUTION —

NEVER APPLY POWER TO DEVICE OR P.C. BOARD BEING TESTED WHILE CONNECTED TO THE MODEL 3110 ICT

ALL ICT TESTING OF IN-CIRCUIT COMPONENTS MUST BE PERFORMED WITH NO CIRCUIT POWER APPLIED



OPEN - CIRCUIT

OPEN - CIRCUITS will ALWAYS be displayed as a straight HORIZONTAL trace on the CRT.

Channel: A or B

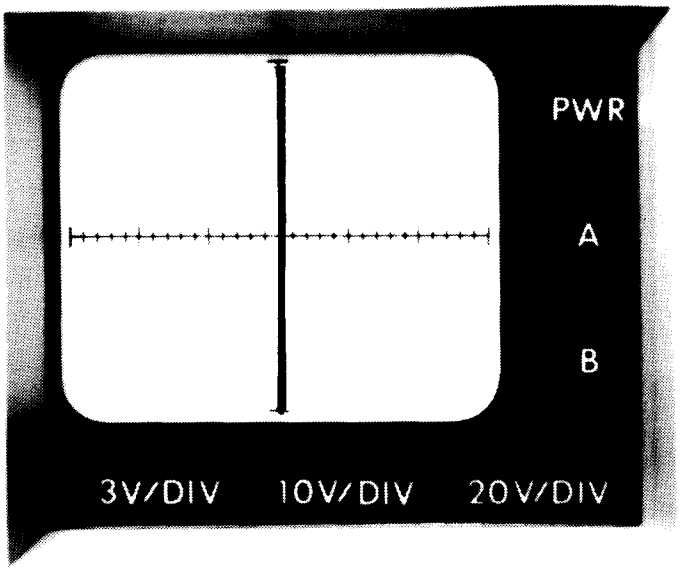
Range: Low - Med - High

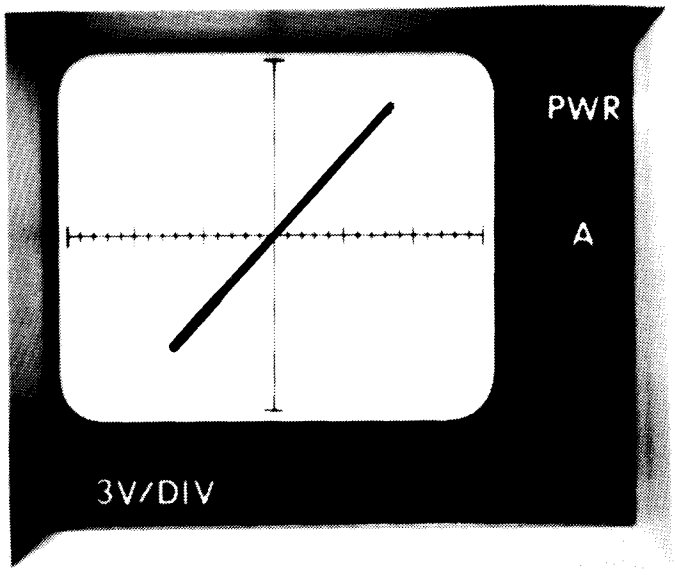
SHORT - CIRCUIT

SHORT - CIRCUITS will ALWAYS be displayed as a VERTICAL trace on the CRT.

Channel: A or B

Range: Low - Med - High





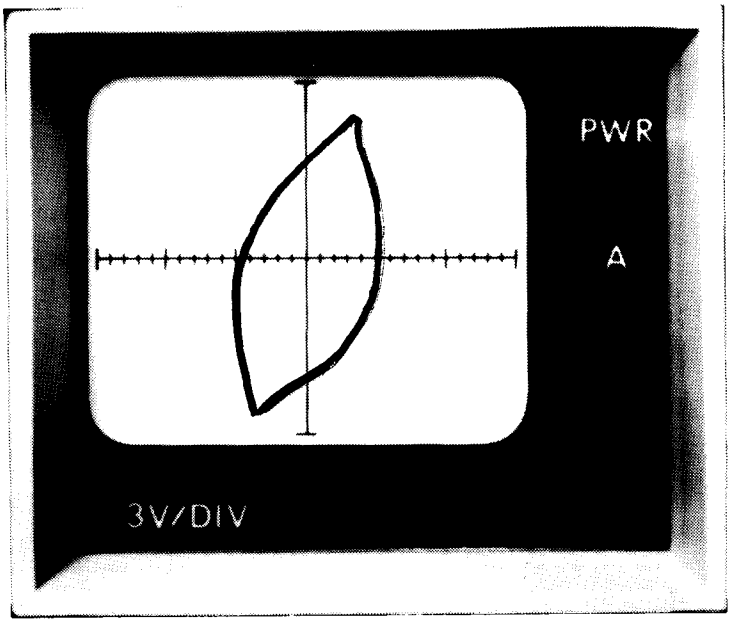
RESISTANCE

Resistance will always be displayed as a diagonal line, but will vary in degrees according to resistance and the range setting of the display

Displayed: 10 Ohm Resistor

Channel: A

Range: LOW



GOOD ELECTROLYTIC CAPACITOR

Displayed: Electrolytic Capacitor
10 μf, 16V

Channel: A

Range: LOW

Note the linear, eliptical response. The stable pattern of the trace indicates a GOOD capacitor.

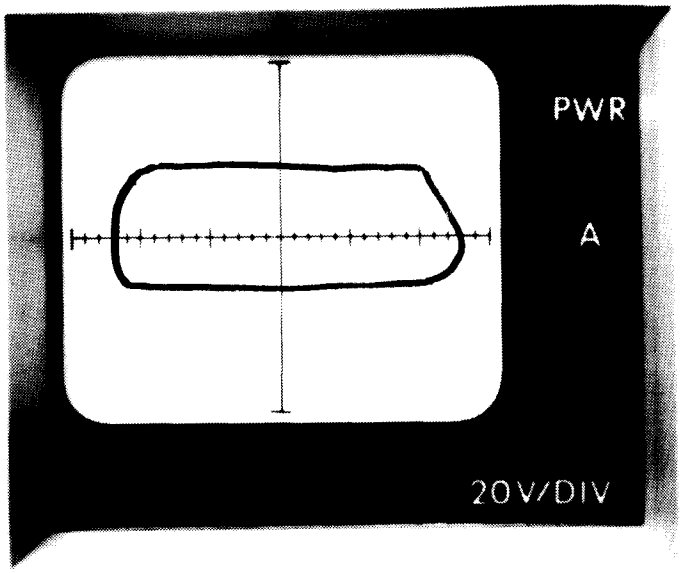
GOOD CERAMIC DISC CAPACITOR

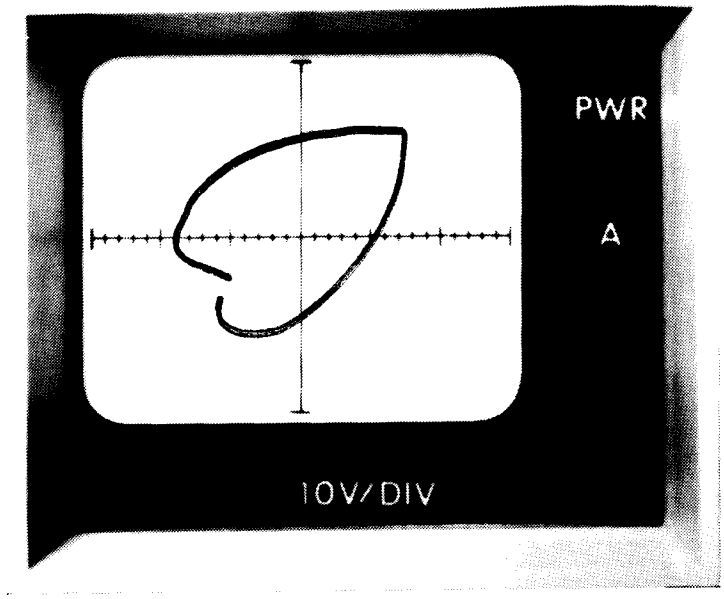
Displayed: Ceramic Disc Capacitor
0.01 μf, 150 V

Channel: A

Range: HIGH

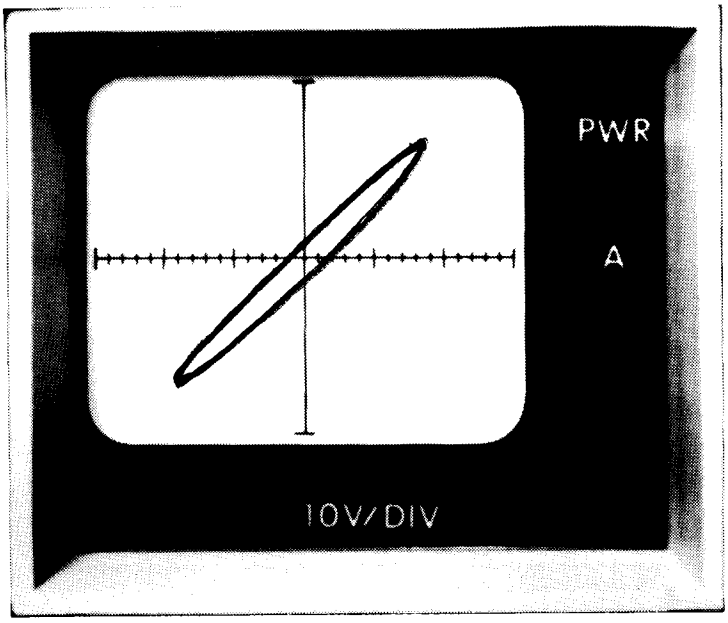
Again the linear, eliptical response with it's stable pattern represents a GOOD capacitor.





BAD CAPACITOR

The broken, non-linear, non-eliptical pattern at left is unstabale and random indicating a defective capacitor with deteriorated dielectric.



R-C NETWORK

Displayed: R-C Network in-parrallel.
Resistor: 10 K Ohm
Capacitor: Cer. Disc. .01 μf

Range: MED

Channel: A

A GOOD network will be indicated by a diagonal eliptical trace that will vary according to the network.

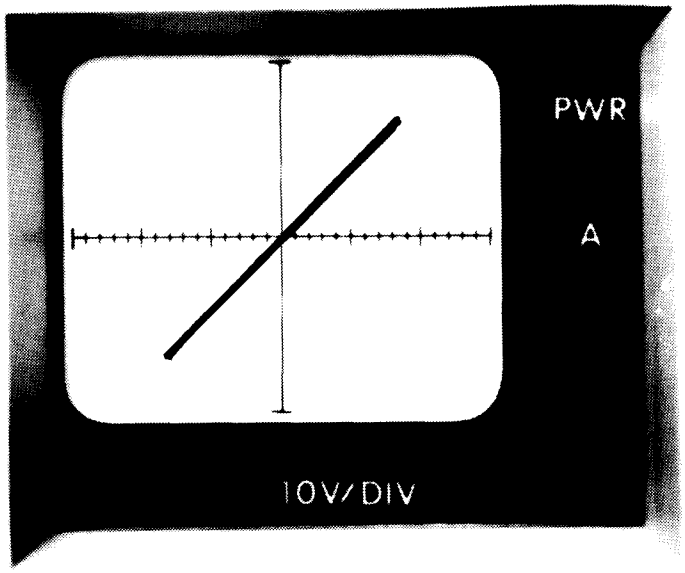
GOOD 10 K OHM RESISTOR

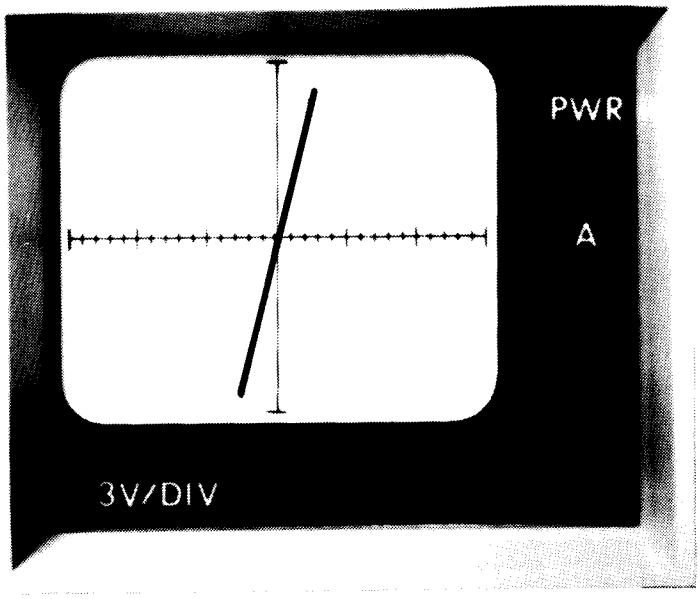
Displayed: Resistor, 10 K Ohm

Channel: A

Range: MED

A straight diagonal line indicates a GOOD resistor. The degree of the trace will vary with resistance and the range setting.





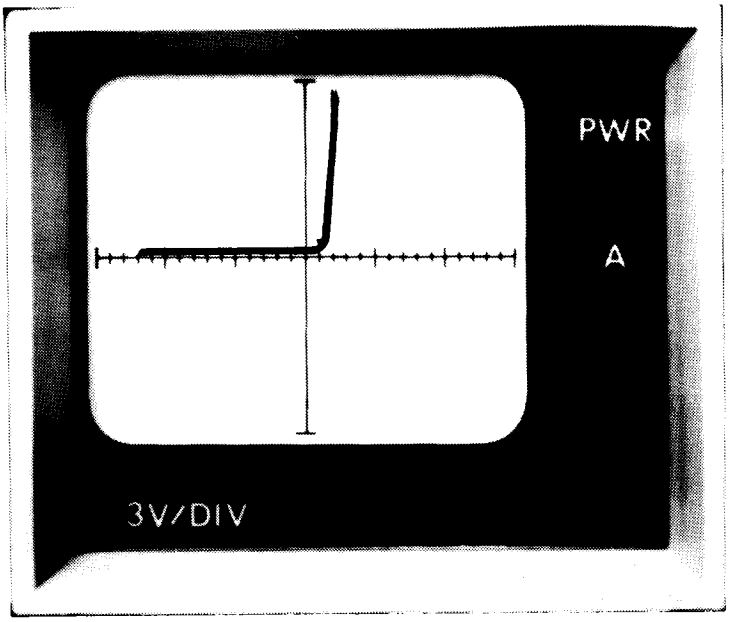
GOOD 10 OHM RESISTOR

Displayed: Resistor, 10 Ohms

Channel: A

Range: LOW

Again a straight diagonal line indicates a GOOD resistor. As before the degree of the diagonal will vary with resistance.



GOOD DIODE

Displayed DIODE SIGNAL

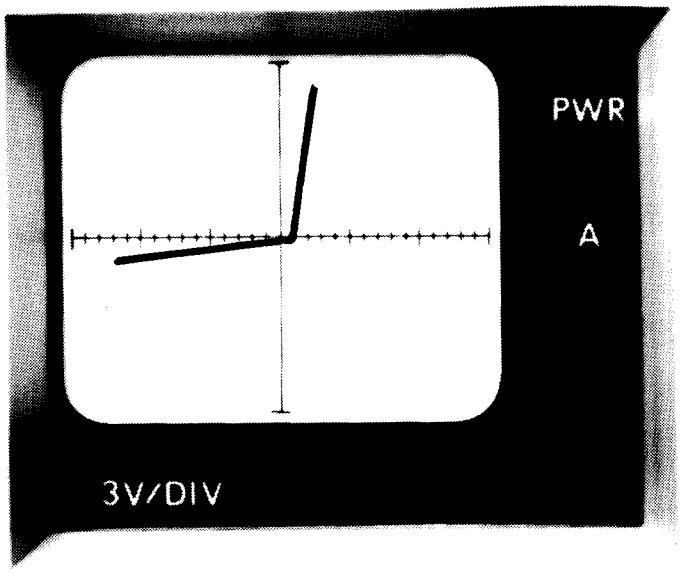
Channel: A

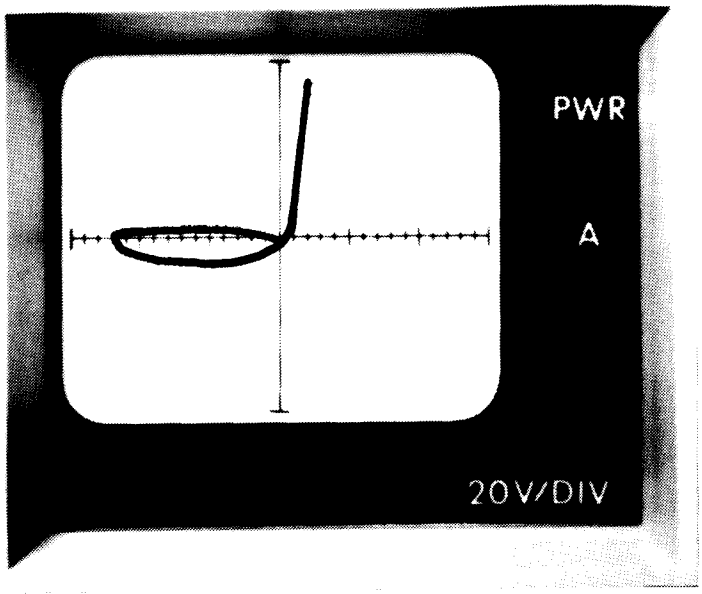
Range: LOW

A GOOD diode has a CRT trace at approximate right angle with a sharp angle and straight lines.

LEAKY DIODE

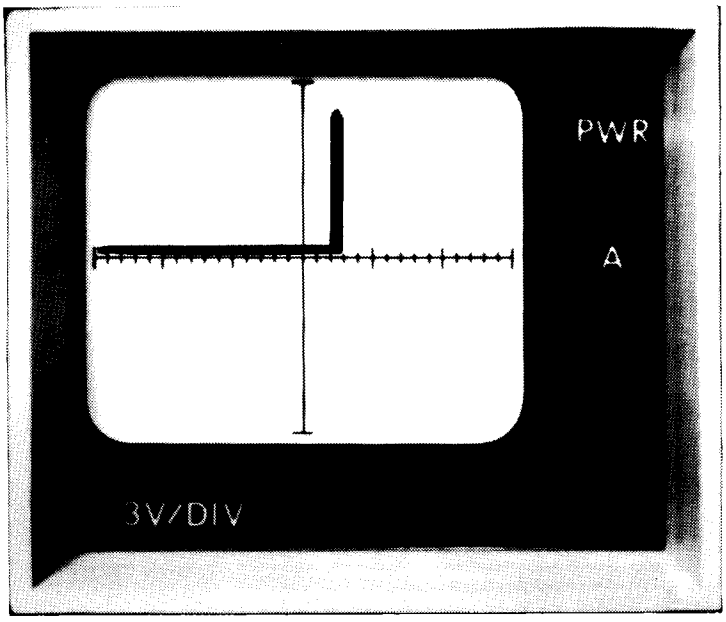
When a diode is leaking or in parallel with a resistance the base leg of the trace will drop. The higher the voltage (range) the greater the drop will appear.





LEAKY DIODE - CAPACITANCE

A leaky diode with capacitance present is shown to the left. The presence of capacitance in a device or circuit will always be represented by some form of a closed loop.



ZENER DIODE

Displayed: Zener Diode (1N965 15V)

Channel: A

Range: LOW

Note the voltage is too low to trigger the zener. Trace is similar to a signal diode.

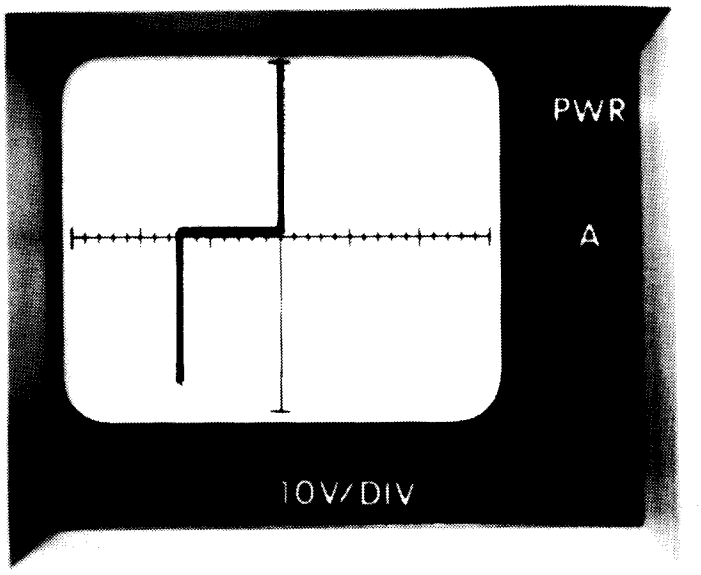
ZENER DIODE

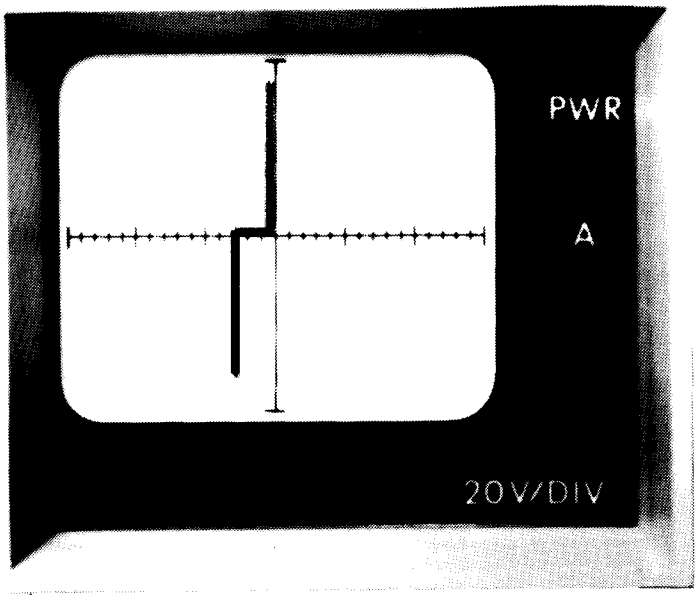
Displayed: Zener Diode (15V)

Channel: A

Range: MED

On the MEDIUM range the zener has now triggered.





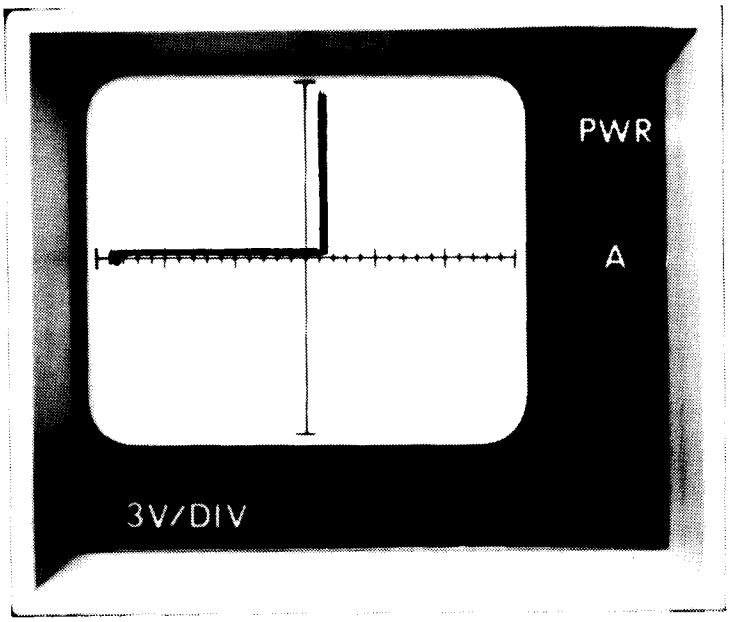
ZENER DIODE

Displayed: Zener Diode (15V)

Channel: A

Range: HIGH

In the high range the trace is the same as in the medium range, but notice the difference in the length of the base line. This is because the graticule is calibrated to the range.



GOOD TRANSISTOR/LOW RANGE/B-E

Displayed: Signal Transistor

Type: 2N3904

Channel: A

Range: LOW

GOOD Signal Transistors are evident by straight lines, sharp angles.

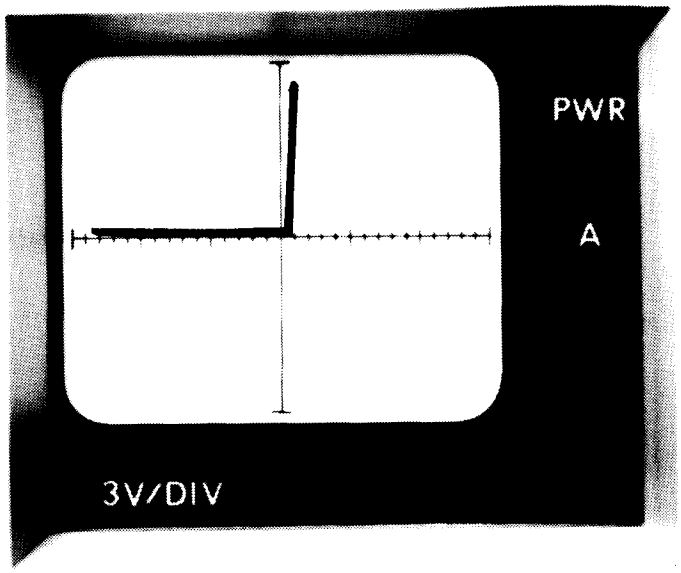
BASE — EMITTER

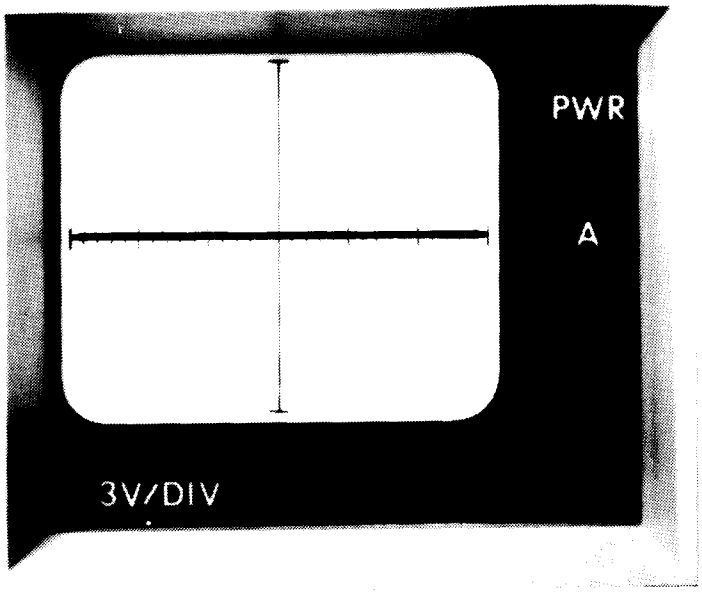
GOOD TRANSISTOR B-C

GOOD Signal Transistor

LOW Range

BASE-COLLECTOR





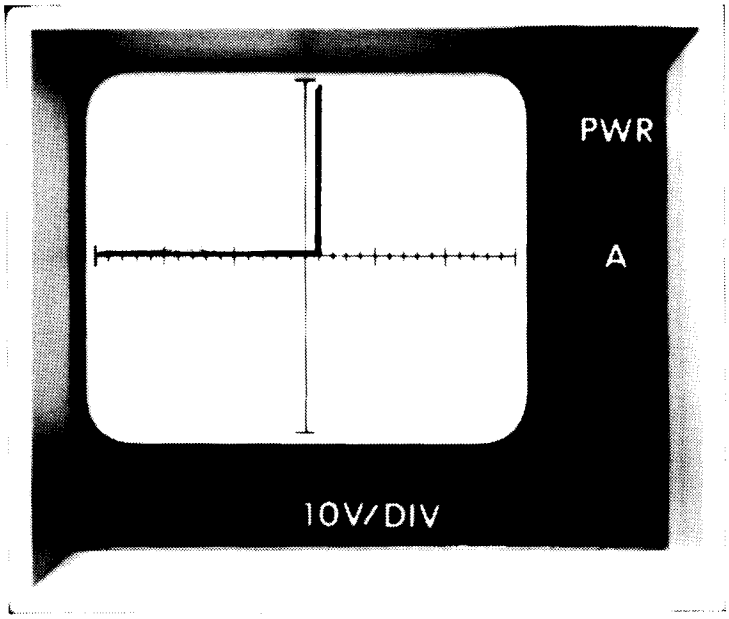
GOOD TRANSISTOR E-C

Normally a LOW range emiter-collector test will yield only a Horizontal trace.

GOOD Signal Transistor

LOW Range

EMITTER-COLLECTOR



GOOD BASE-COLLECTOR JUNCTION

Displayed: Signal Transistor

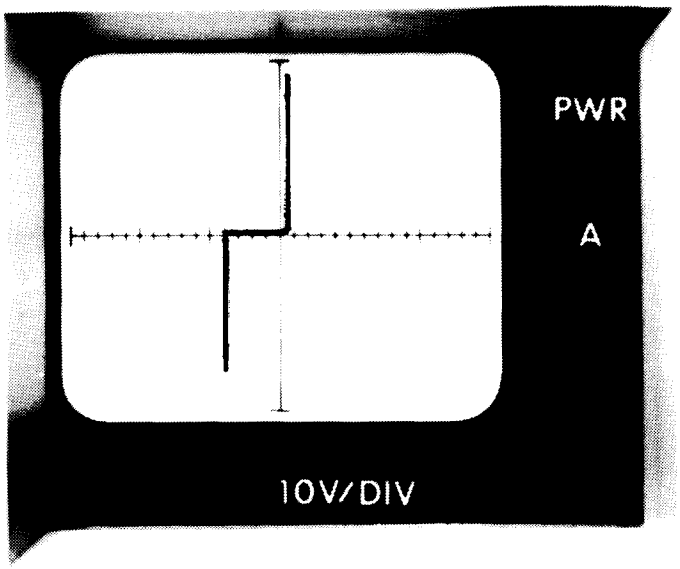
Type: 2N3904

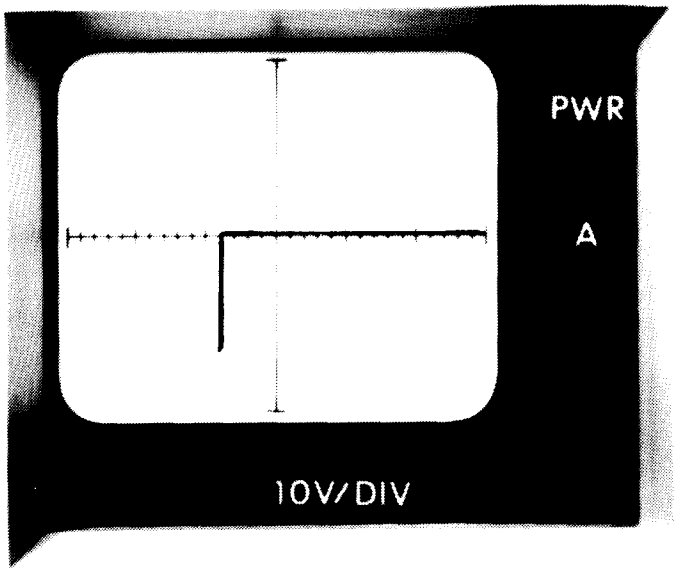
Range: MEDIUM

Channel: A

The three traces shown are normal for this transistor in the MEDIUM range.

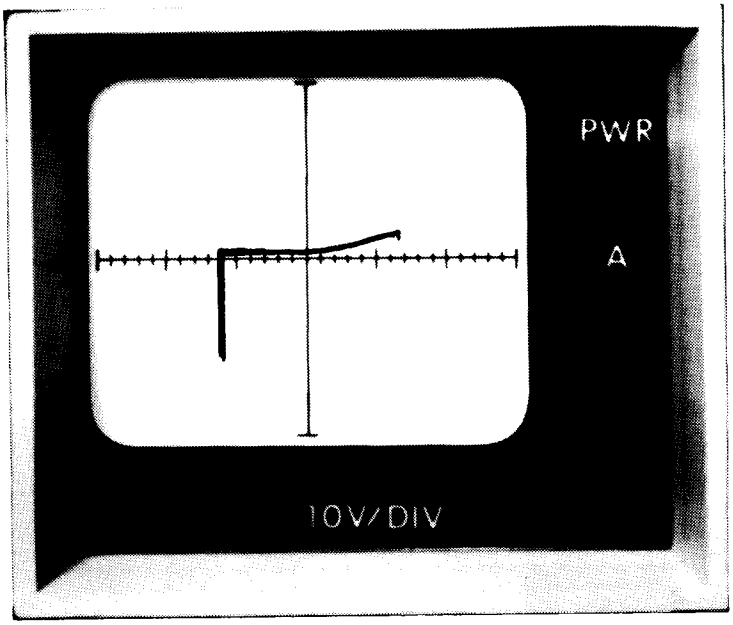
GOOD BASE-EMITTER JUNCTION





GOOD EMITTER-COLLECTOR JUNCTION

The MEDIUM range MUST be used to exercise the higher impedance of the Emitter-Collector junction.



BAD TRANSISTOR

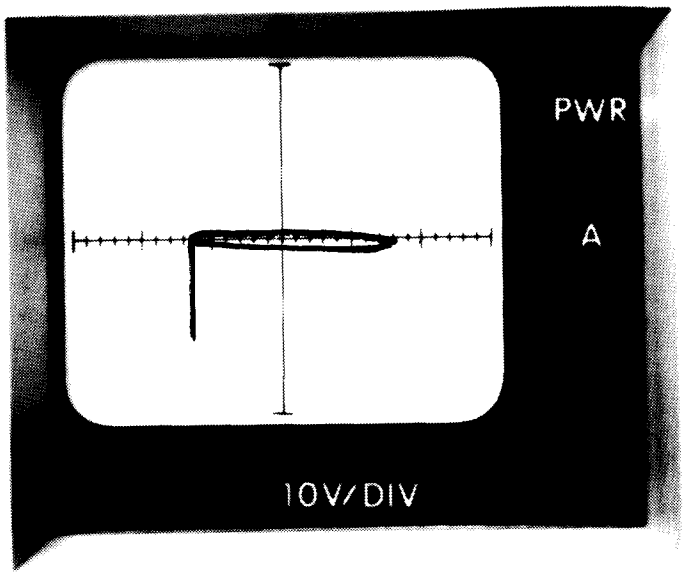
Displayed: Signal Transistor

Channel: A

Range: MEDIUM

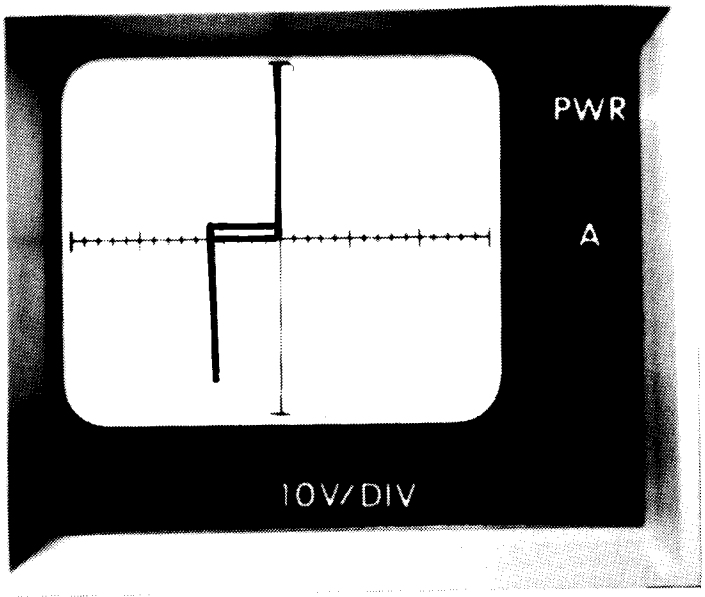
Emitter-Collector Junction

Displayed is a BAD signal transistor notice the curving trace.



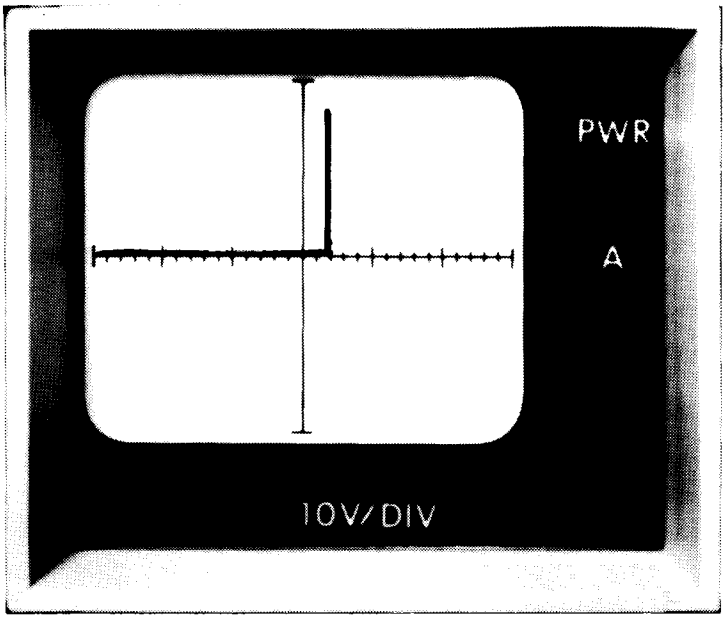
BAD TRANSISTOR

The presence of capacitance indicates a BAD transistor. Capacitance usually prevents proper operation of the transistor.



BAD TRANSISTOR

The view at left shows a leaky emitter-collector junction.



GOOD IC — TYPICAL RESPONSE

Displayed: Integrated Circuits

Range: MEDIUM

Channel: A

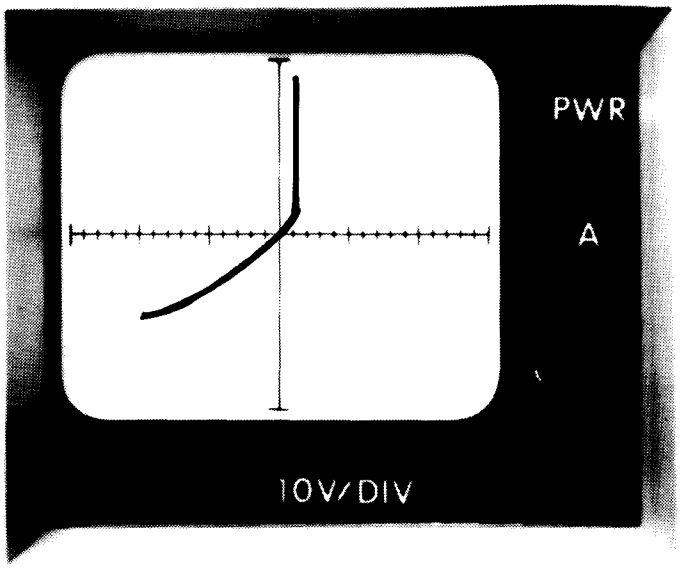
When testing IC's it is recommended the MEDIUM range be used as a starting point. This is to allow sufficient voltage to create a good junction response.

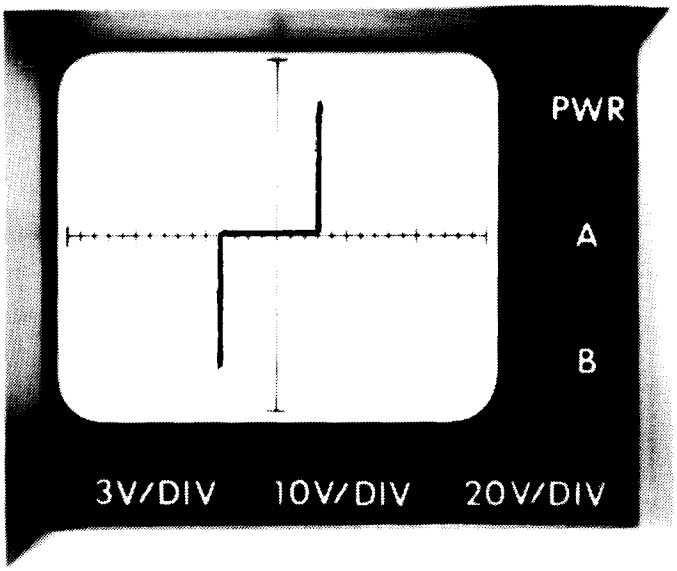
BAD IC — NOTICE CURVE IN TRACE

Since Vcc has the most internal connections to elements within the IC, place one test probe on Vcc and probe the pins with the other probe.

NOTE

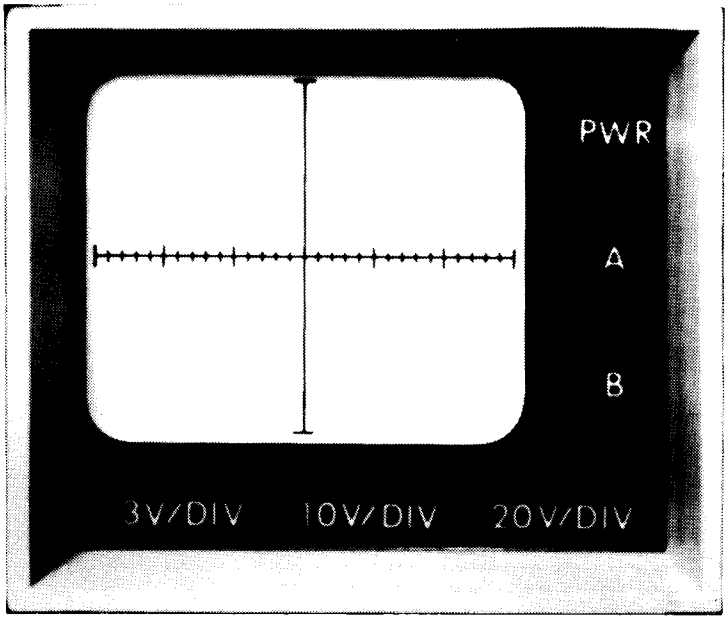
Many variations of displays are possible with IC's. Basic rules do apply: Straight lines, sharp angles — GOOD; Curved lines, rounded junctions — BAD.





GOOD IC — TYPICAL RESPONSE

The best method of testing IC's is to compare a known GOOD IC to the IC under test. Place the GOOD IC on Channel A and the other one on Channel B. Press compare button and observe the traces from pin to pin. If the same it is GOOD. If not, it may be BAD.



DISPLAYED: _____

CHANNEL: _____

RANGE: _____

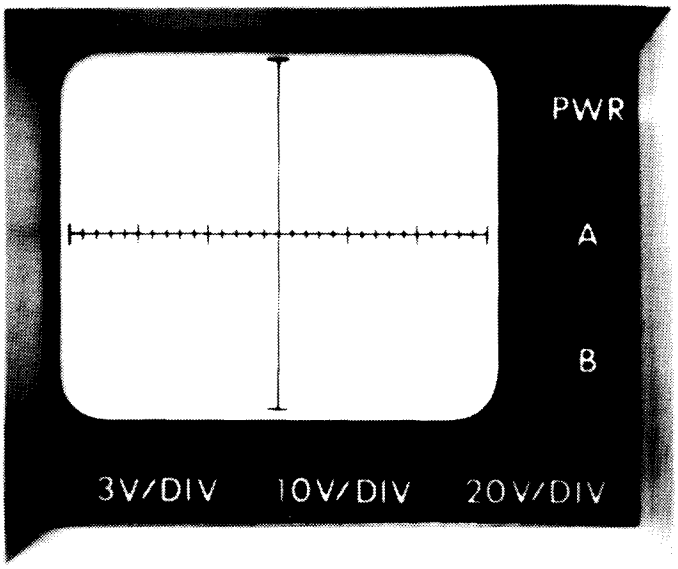
COMMENTS: _____

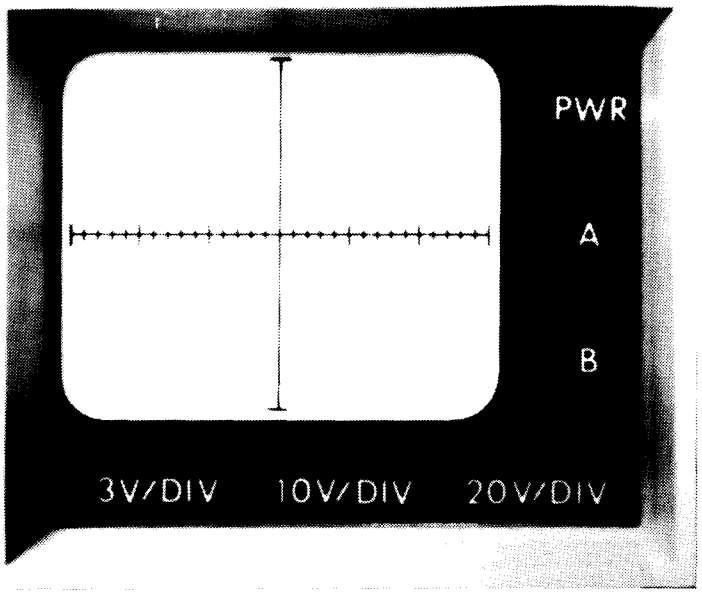
DISPLAYED: _____

CHANNEL: _____

RANGE: _____

COMMENTS: _____





DISPLAYED: _____

CHANNEL: _____

RANGE: _____

COMMENTS: _____

General

This chapter of the manual contains the information necessary for preventive maintenance, troubleshooting, corrective maintenance and calibration.

Preventive Maintenance

Preventive maintenance shall consist of periodic cleaning, inspecting, tightening, and recalibrating the instrument at a regular interval. This will keep the instrument at its operational and appearance peak.

CAUTION

Avoid the use of chemical cleaning agents such as MEK, laquer thinner, or strong acids or alkali. These solvents will cause paint removal, deterioration of switches and melting of plastic parts.

The accumlation of dirt or dust should be removed as noticed. The frequency of cleaning will depend on the environment in which the instrument is used. Loose dirt on the outside may be removed with a soft cloth or a dry brush. A diluted household cleaner (non-abrasive) may be used. Lens cleaning tissue should be used to clean the CRT. Cleaning of the inside of the unit should be accomplished with LOW pressure air or a soft brush. Cleaning of the unit should precede the calibration, since the cleaning procedure could alter the settings.

CAUTION

***ALWAYS** remove the AC Power Cord from the connector on the rear panel before removing top and bottom covers. The interior of this instrument contains high voltage which could be hazardous to your health. AC power lines are exposed when the covers are removed.*

Inspection

After cleaning the instrument, a thorough inspection of the components on the circuit boards can reveal areas where troubles could occur. Look for the obvious, like components with discolored markings from overheating. Check wiring for chafing. Removal of circuit boards is not recommended unless part replacement is required. Check that all screws are tight and all plugs and jacks are fully engaged.

Troubleshooting

Most of the problems resulting from a malfunction will be caused by the failure of an electronic component or a defective mechanical problem. Verify the obvious first. Check power, switch settings, etc., to verify proper inputs. The CRT display can be a valuable aid in isolating a malfunction.

Standard test equipment can be used to isolate down to the component level. The use of the Functional Checkout Procedure on page 9 , will verify the operation of the various controls.

Before starting troubleshooting a thorough knowledge of the operating procedure and the schematics will be of value.

Troubleshooting Precautions

WARNING

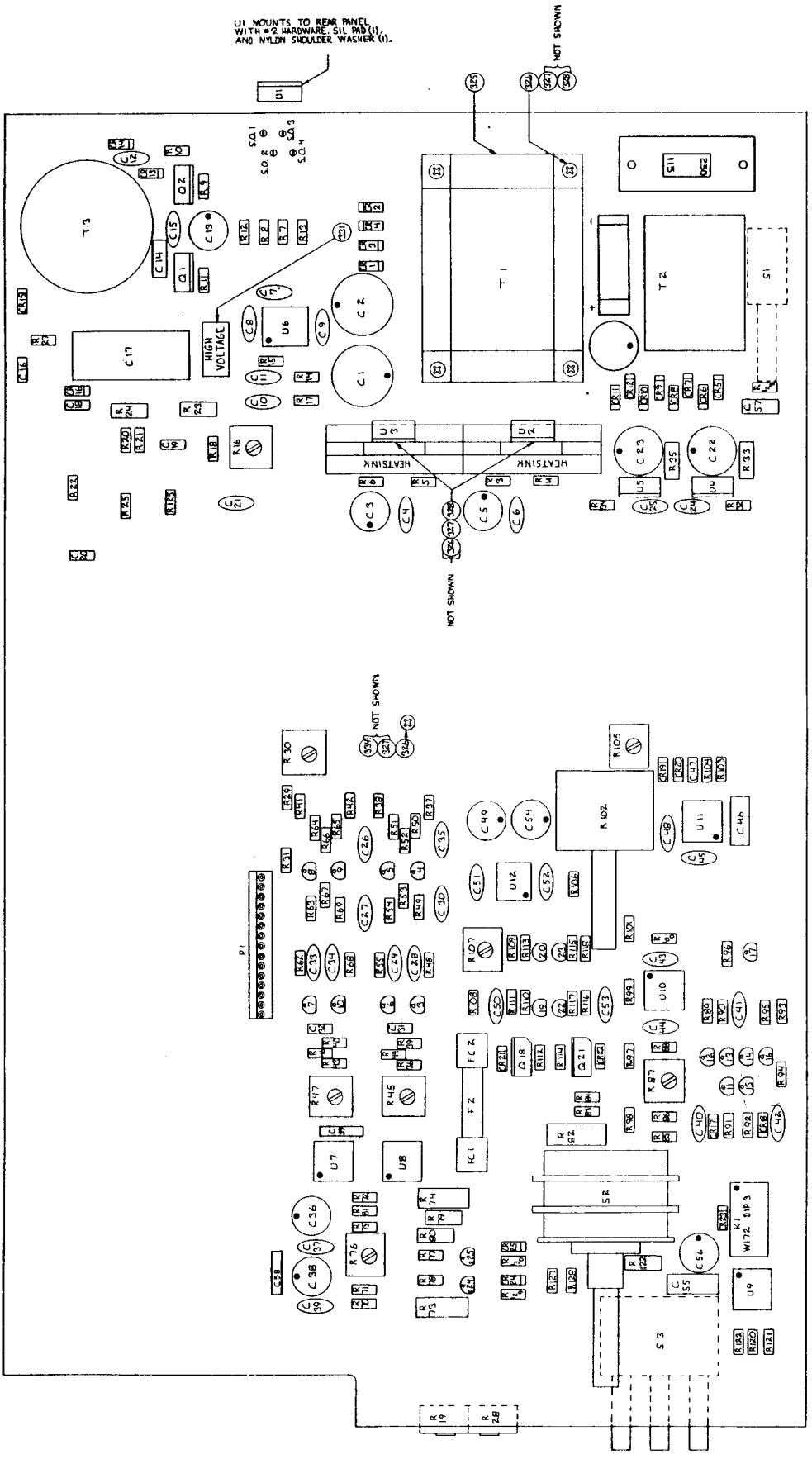
Before removing the covers for trouble shooting, read and observe the following precautions. This instrument contains a CRT with an implosion hazard. High voltage circuits are exposed which could become hazardous if not handled properly.

a) Always remove the power cord from the instrument BEFORE removing or replacing top and bottom covers.

b) When working on the instrument with the covers removed and the power cord connected, AC power is present at some points on the printed circuit board even with power "*OFF*".

c) This instrument contains a cathode ray tube with an implosion hazard. Wear safety goggles with side shields when handling the CRT.

d) Do not unplug any circuit boards or DIP connectors with power applied to the instrument.



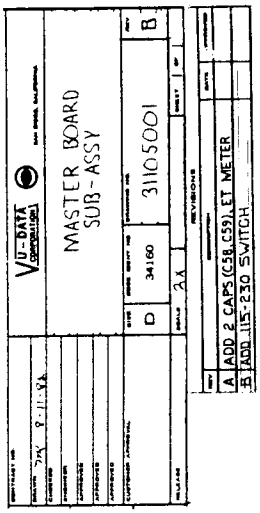
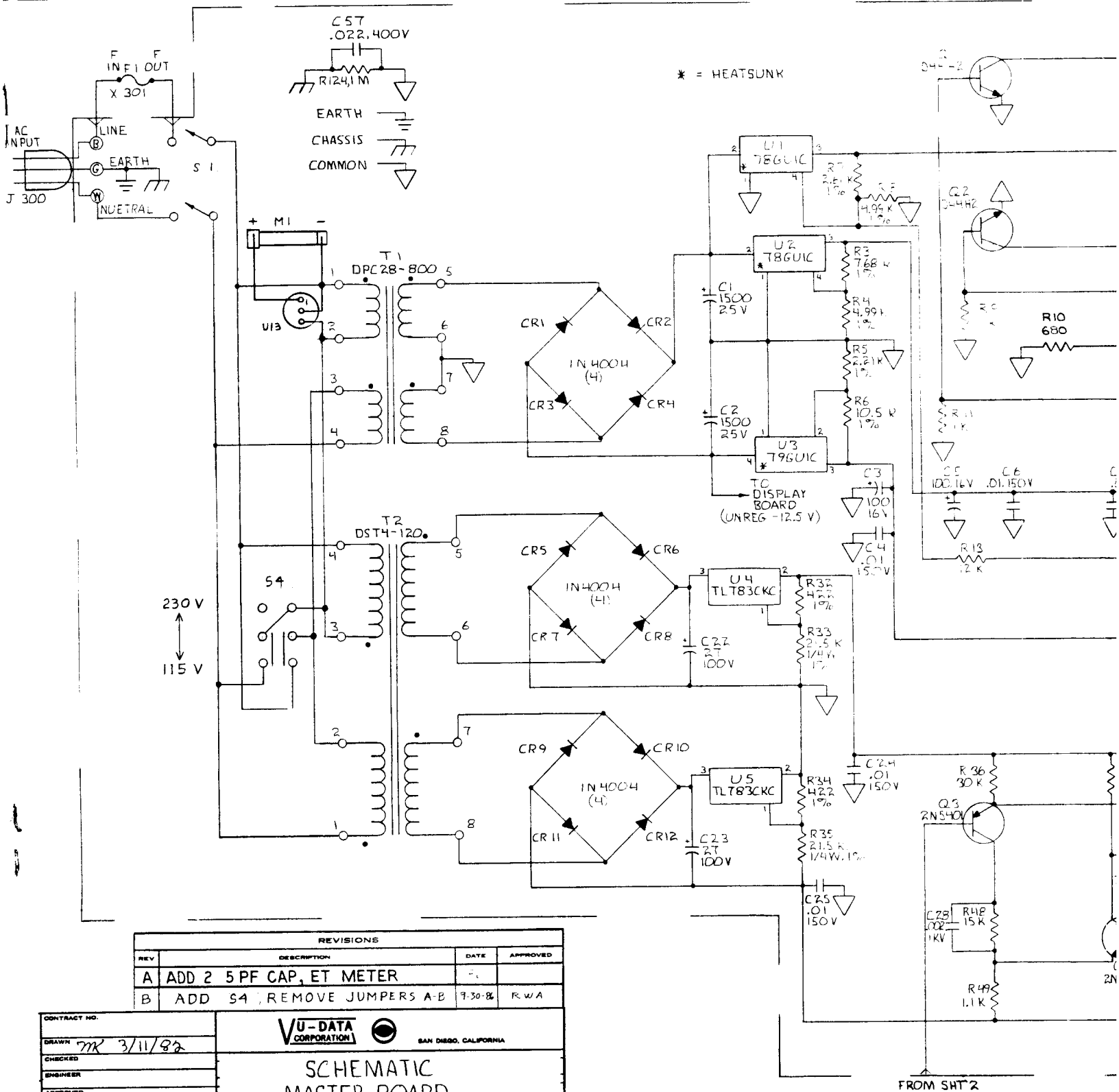


FIGURE 7. MASTER BOARD SUB-ASSEMBLY



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADD 2 5PF CAP, ET METER		
B	ADD S4, REMOVE JUMPERS A-B	9-30-82	R.W.A

CONTRACT NO.	VU-DATA CORPORATION SAN DIEGO, CALIFORNIA		
DRAWN MR 3/11/82	SCHEMATIC MASTER BOARD POWER SUPPLIES & DEFLECTION AMPS		
CHECKED			
ENGINEER			
APPROVED			
APPROVED			
APPROVED			
CUSTOMER APPROVAL	SIZE: D	CODE IDENT NO.: 34160	DRAWING NO.: 31101001 REV: B
RELEASE	SCALE		SHEET 1 OF 2

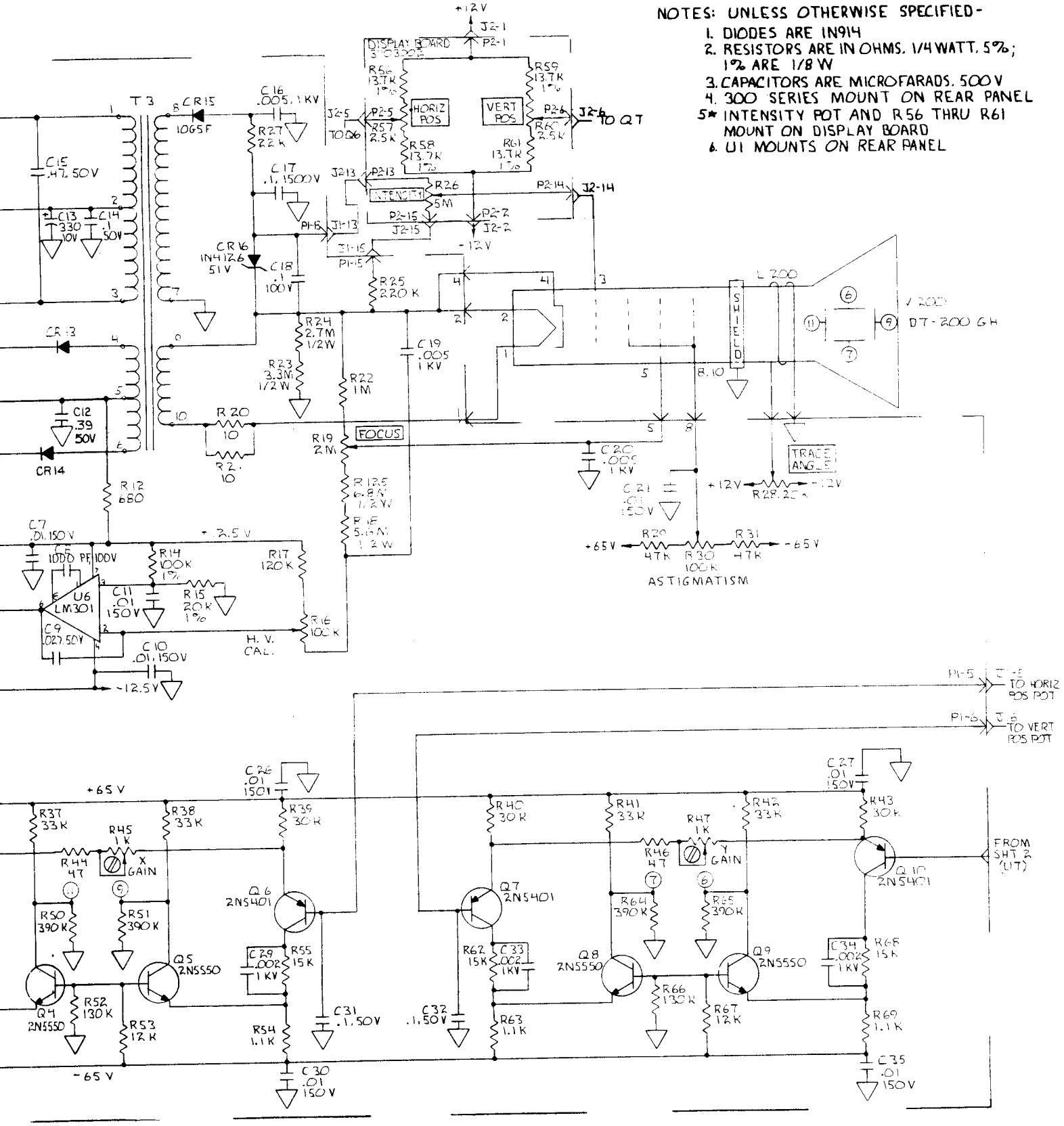


FIGURE 8. SYSTEM SCHEMATIC (SHEET 1 OF 2)

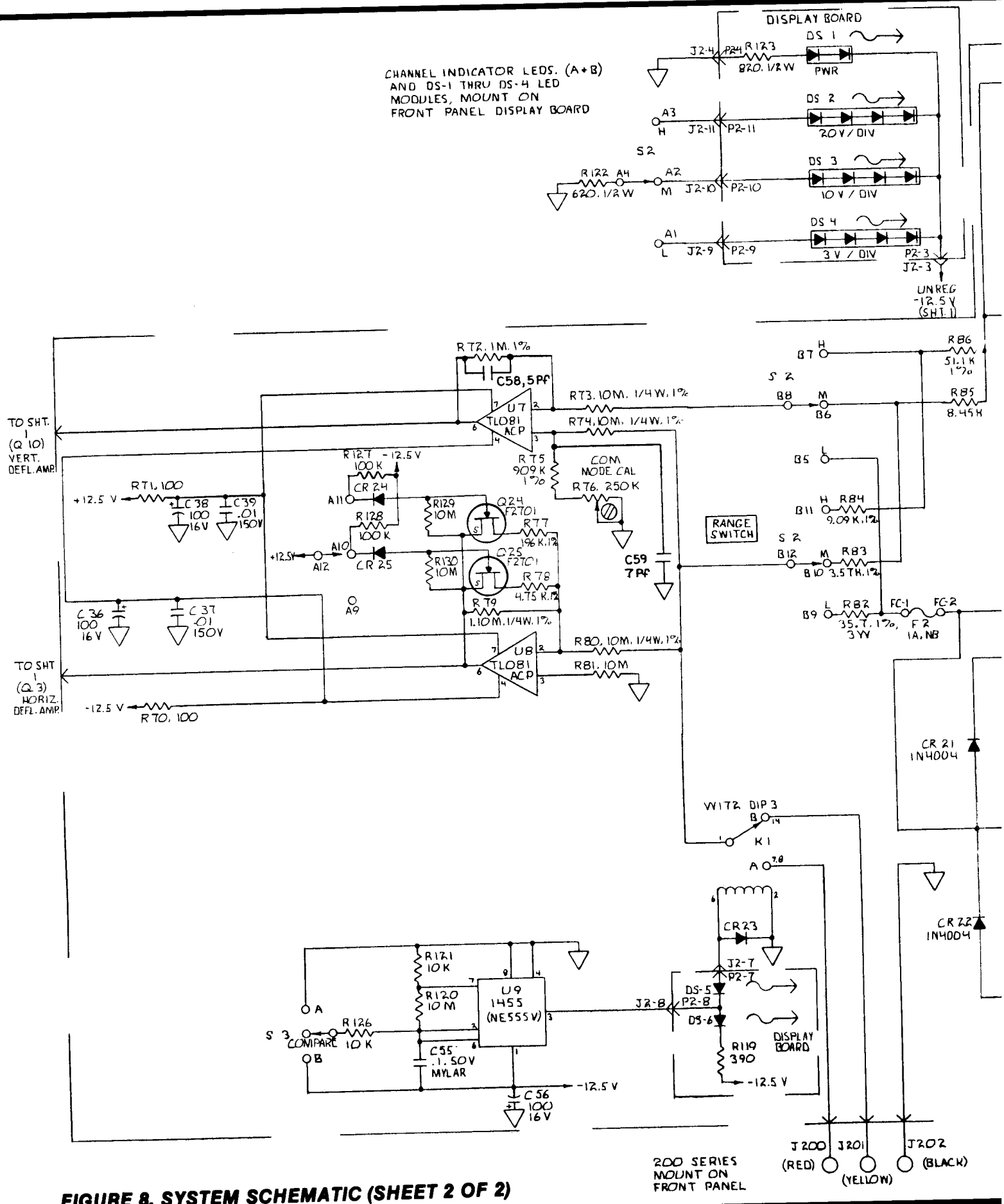
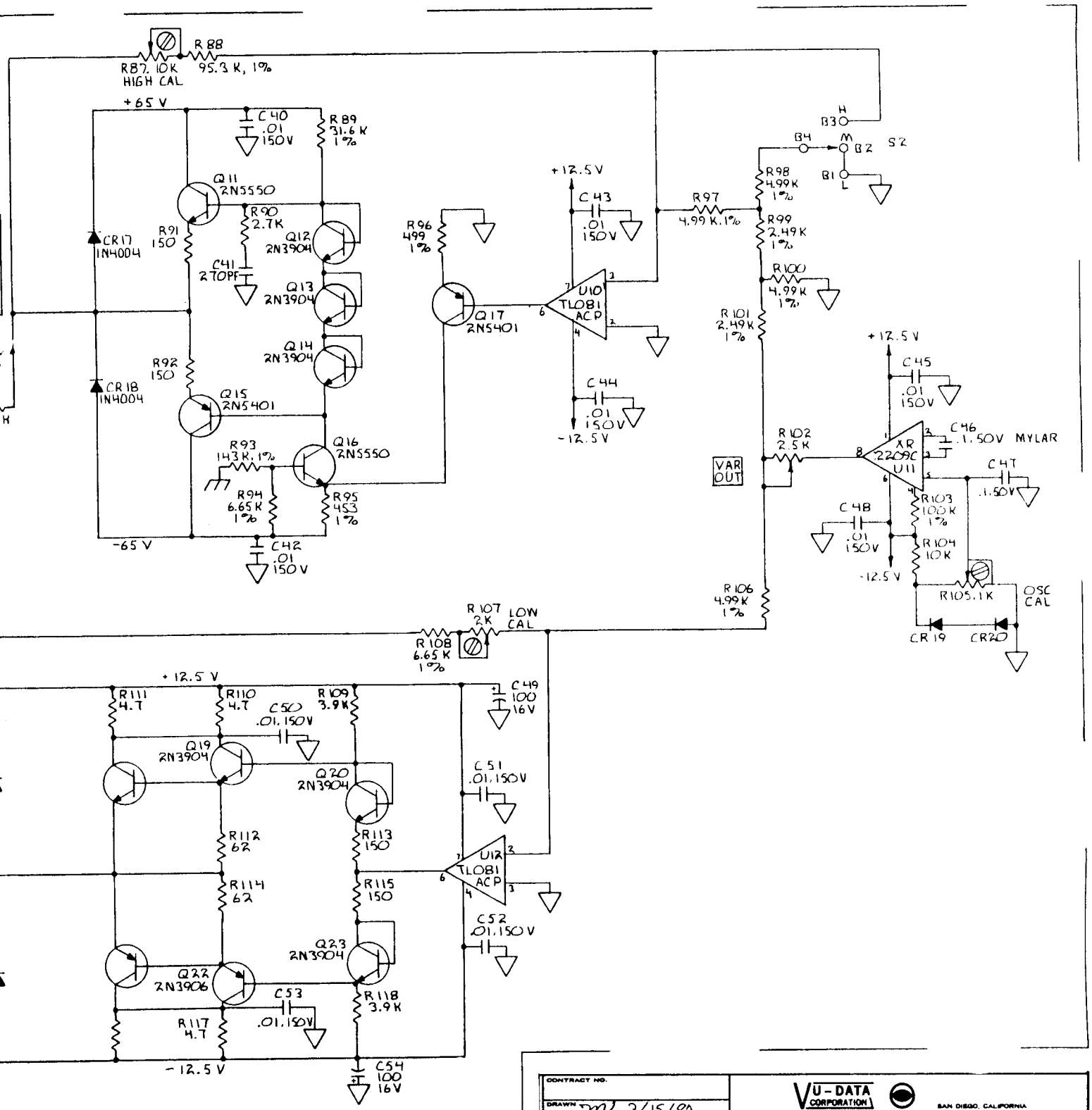


FIGURE 8. SYSTEM SCHEMATIC (SHEET 2 OF 2)

ND CALIBRATION



CONTRACT NO.	VU-DATA CORPORATION, SAN DIEGO, CALIFORNIA		
DRAWN MR 3/15/82	SCHEMATIC MASTER BOARD SIGNAL CIRCUITRY		
CHECKED			
ENGINEER			
APPROVED			
APPROVED			
APPROVED			
CUSTOMER APPROVAL	SIZE D	CODE IDENT NO. 34160	DRAWING NO. 31101001 REV B
RELEASE	SCALE —		SHEET 2 OF 2

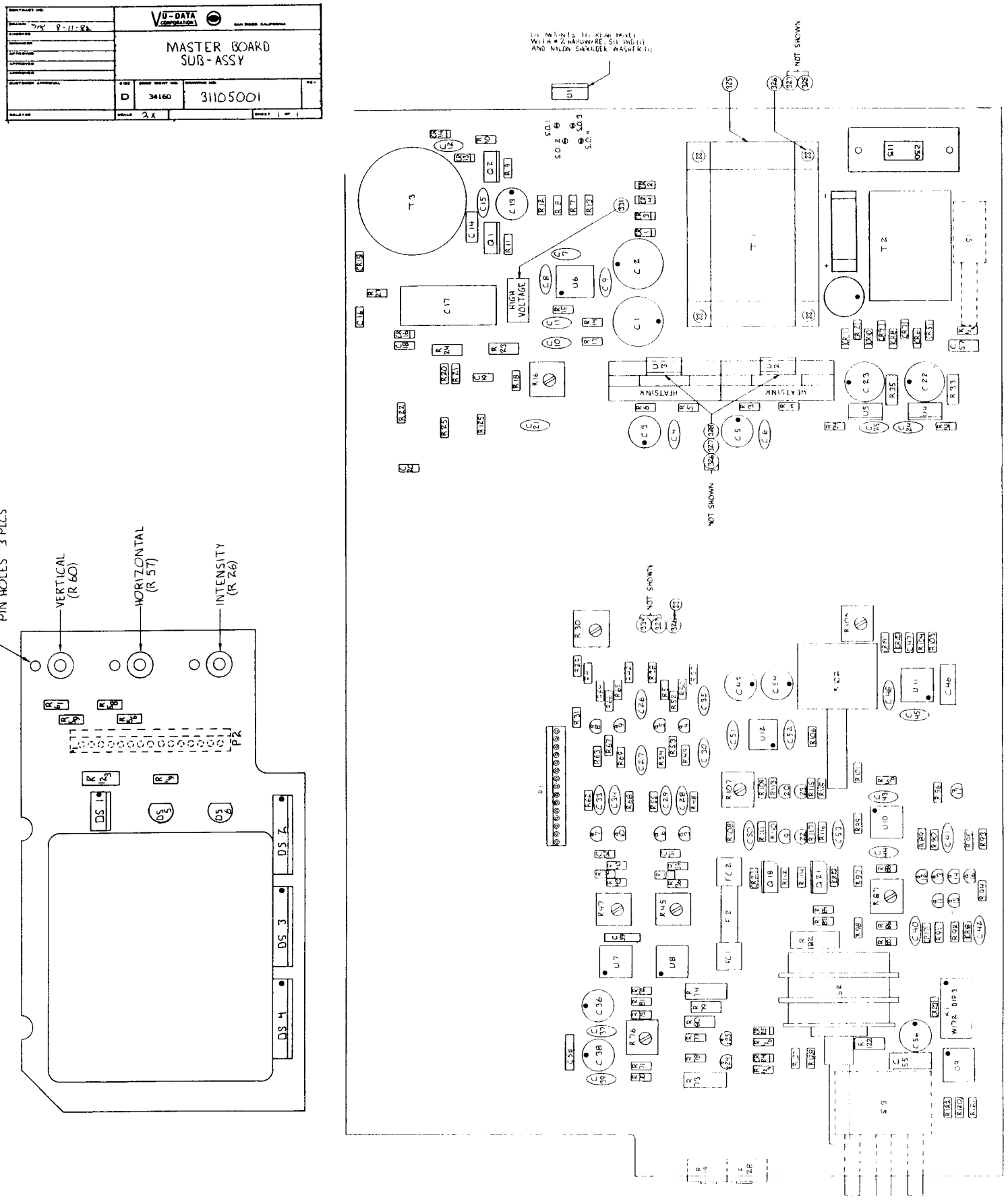


FIGURE 9. MASTER BOARD & DISPLAY BOARD S/A

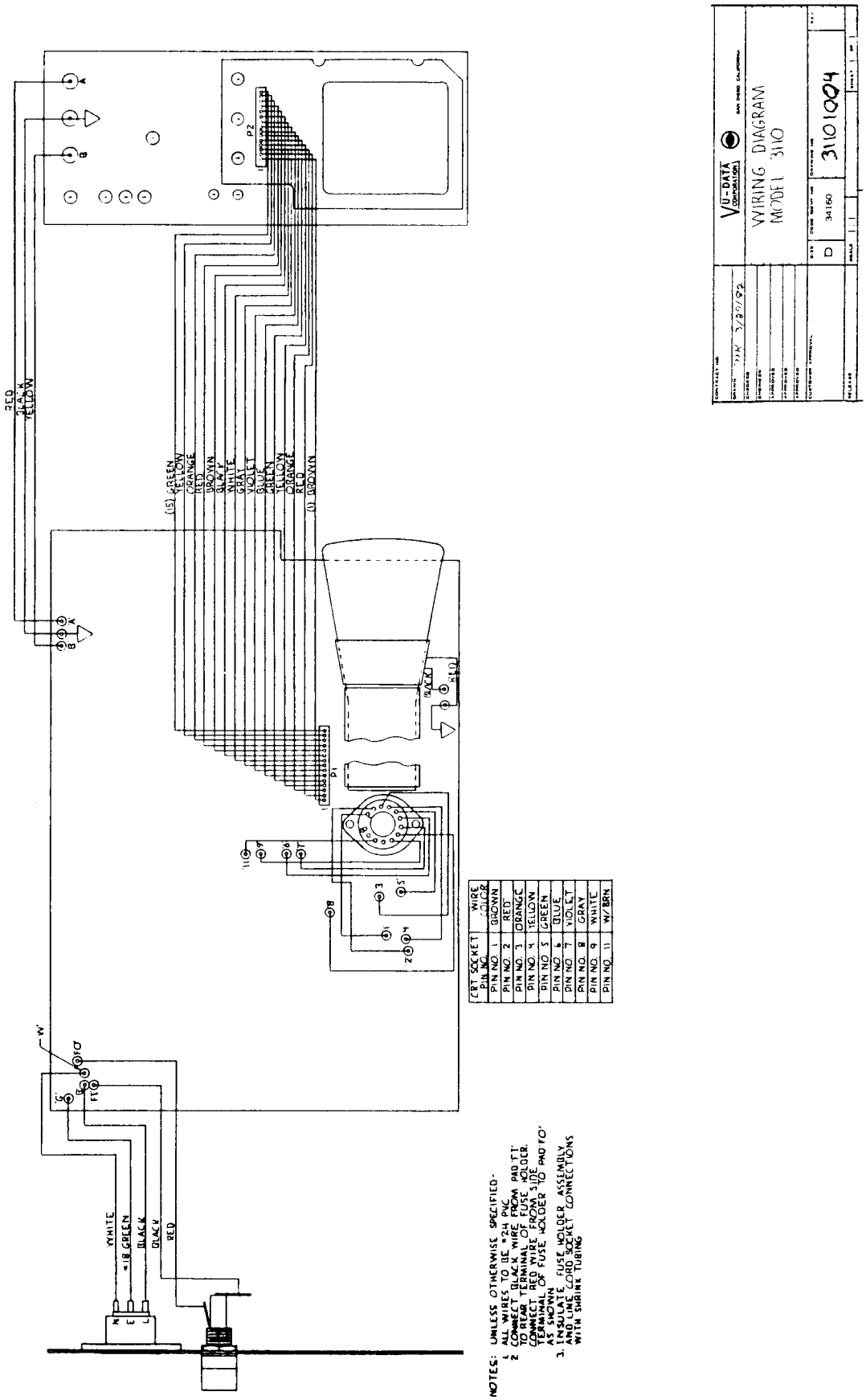


FIGURE 10. WIRING DIAGRAM

TROUBLESHOOTING ANALYSIS

The following troubleshooting analysis will help isolate defective circuitry and locate specific defective components:

POWER SUPPLY

Symptom: UNIT DEAD — front panel PWR indicator extinguished. Power switch engaged (pushed in), AC power applied to unit.

Conditons: Open or shorted test leads — all 3 ranges

Probable cause:
a) Check fuse on rear panel (F1)
b) Check connector on rear panel (AC input)
c) Check POWER switch S1.
d) Check power transformers T1 and T2 and associated diodes.

Symptom: No ±12 volt power

Probable cause:
a) Shorted Filter Cap
b) U2 and U3 Voltage Regulators

Symptom: No ±65 volt power

Probable cause:
a) Shorted Filter Cap
b) U4 and U5 Voltage Regulators

Symptom: Loss of +7 volt inverter power

Probable cause:
a) Shorted Filter Cap
b) U1 Voltage Regulator

Symptom: Loss of −1000 volt power

Probable cause:
a) Short on high voltage lines
b) Q1 or Q2 defective
c) T3 defective

Symptom: No control of −1000 calibration

Probable cause:
a) Open resistor in **Focus** string
b) Defective U6 or U1

SIGNAL SECTION

Symptom: Dot in center of screen — no deflection.

Conditions: Open or shorted test points

Probable cause:
a) 100 Hz oscillator defective
b) Fuse F2 open (LOW range only)
c) Loss of ±65 volt power
d) Loss of ±12 V to oscillator

Symptom: No vertical deflection.

Condition: Shorted test points

Probable cause:
a) Defective deflection amp Q7-10
b) Defective current sense U7

Symptom: No horizontal deflection

Condition: Open test points

Probable cause:
a) Defective deflection amp Q3-6
b) Defective voltage sense U8

Symptom: Display is erratic or shows one channel regardless of position of **Display Mode Selector** switch.

Condition: Open or shorted test points

Probable cause: Welded contacts on reed relay K1

Parts Identification

The Model 3110 is divided into three sub-assemblies as follows:

1. Master Board Sub-Assembly (31105001)
2. Display Board Sub-Assembly (31105002)
3. Chassis Sub-Assembly (31105004)

These modules comprise the sub-assemblies that assemble into:

a) Final Assembly (31105005)

These assemblies and sub-assemblies are tabulated in Table 1.

Table 1. Model 3110 Assemblies

Table	Assembly Number	Assembly
2	31105001	Master Board Sub-Assy
3	31105002	Display Board Sub-Assy
4	31105004	Chassis Sub-Assy
5	31105005	Final Assembly

In addition there are four tables which contain parts lists of the varous sub-assemblies and assembly. Table 1 identifies the additional tables according to assembly.

Each part is identified by drawing reference designator, manufacturer's part number, description of part, manufacturer and Vu-Data part number.

Replacement Parts

Individual components are generally "*off-the-shelf*" and are available at local suppliers or may be ordered from Vu-Data Corporation. If other parts are substituted, verify that the part is a direct replacement, or performance and/or calibration difficulties may arise.

Calibration Procedure

CAUTION

This mother board and display board have ± 65 volts DC, – 1050 volts DC, and AC line voltages exposed at various points on the boards.

The following procedure provides the information necessary for technical personnel to calibrate the Model 3110. This calibration should be performed at periodic intervals to certify proper operation. The calibration procedure is divided into six sections.

Test Equipment Required

a) Oscilloscope — Vu-Data PS935 or equivalent.

b) Digital Volt Meter (DVM) — Vu-Data DM975 or equivalent.

NOTE

COMMON: *Instrument common (black banana jack) is one (1) Megohm away from chassis ground. The easiest way to connect test equipment grounds to the common etch is to clip onto the black banana jack solder lug or the CRT shield mounting stud.*

Refer to Figure 12 for location of alignment adjustments.

Preliminary Control Settings

Remove the AC power cord. Remove the top and bottom covers. Plug in the AC line cord on the rear of the instrument and turn the instrument "*ON*", allow ten (10) minutes warm-up before starting calibration procedure.

Set the front panel controls as follows (Refer to Figure 11.)

1. POWER.....PUSHED IN "ON"
2. POSITION-VERTICAL.....MID-POINT
3. POSITION-HORIZONTAL ..... MID-POINT
4. INTENSITY ..... MID-POINT
5. RANGE.....MEDIUM
6. VARIABLE VOLTS.....MAX (FULL CLOCKWISE)
7. DISPLAY.....A ONLY

Verify that the following indicators are illuminated:

1. PWR (GREEN)
2. 10V/DIV (GREEN)
3. A (RED)

You may now proceed with calibraton.

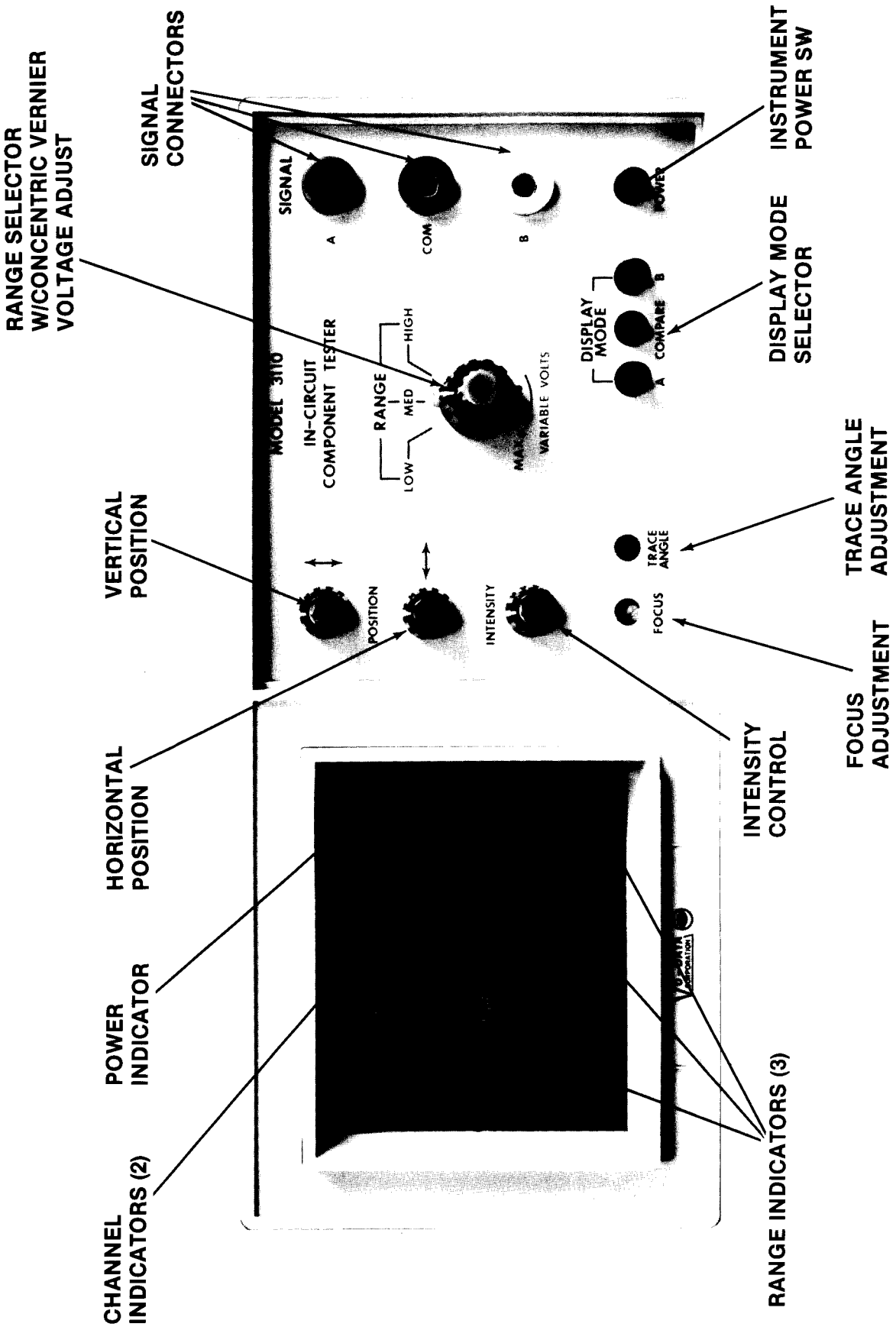


FIGURE 11. FRONT PANEL CONTROLS & INDICATORS

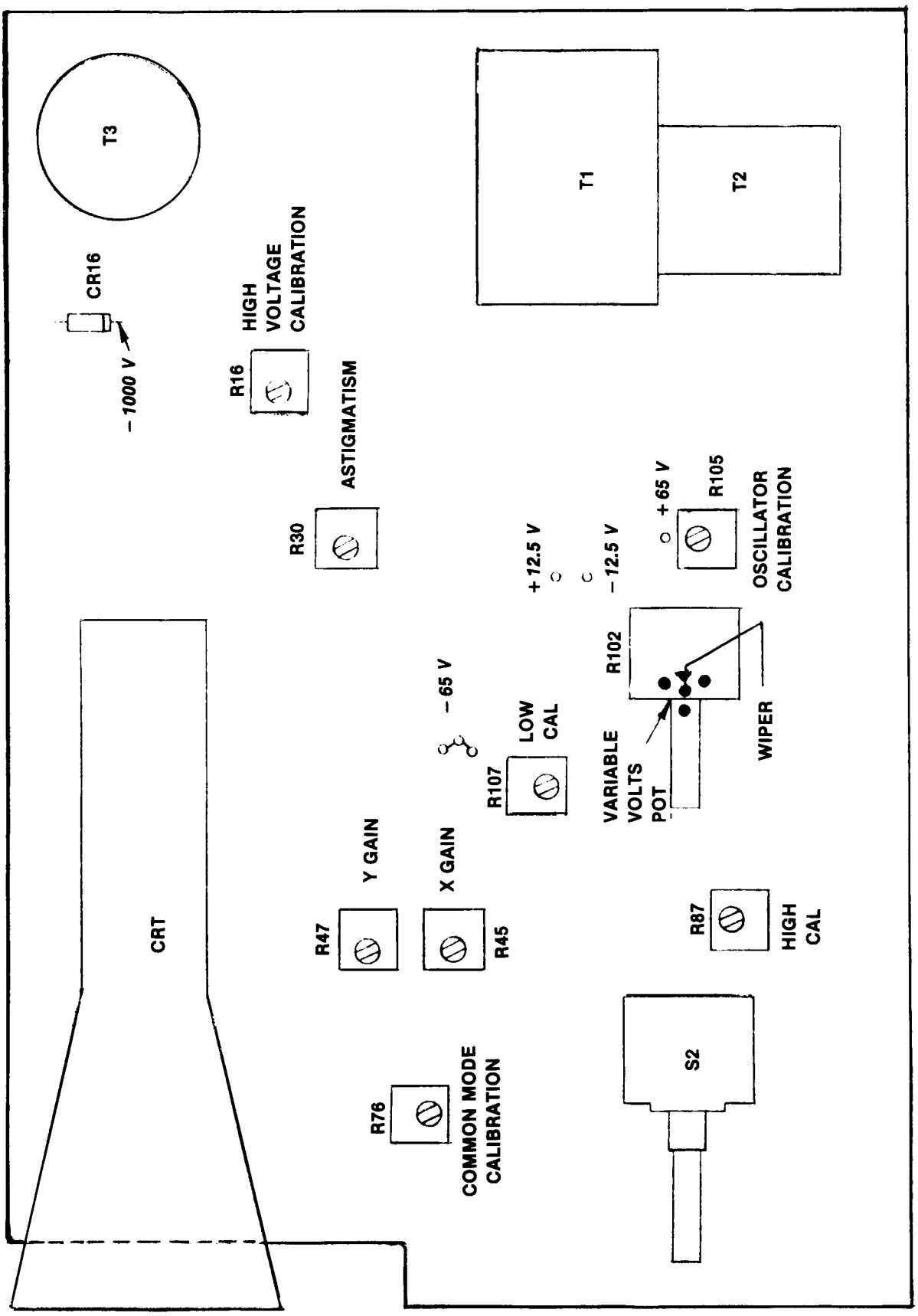


FIGURE 12. ALIGNMENT ADJUSTMENT LOCATIONS

CALIBRATION PROCEEDURE

Power Supply Calibration

a) Confirm operation of power supply regulators U1 through U7.

1. Using DVM connect the low lead to signal common. Probe the test points on the mother board (Refer to Figure 12.)
   +12.5 VDC and −12.5 VDC....12.45 to 13.00 VDC
   +65 VDC and −65 VDC.....64.8 to 68.2 VDC
2. Connect the DVM to the cathode of zener CR16 (−1000V) and adjust R16 (H.V. CAL) for −1000 VDC ±5 VDC.

Oscillator

Connect the oscilloscope to the wiper of R102 (VARIABLE VOLTS POT). Adjust the "*DC OFF-SET*" of the triangle waveform to (0) zero volts DC with R105 (OSCILLATOR CAL.).

Amplifier Calibration

a) On the front panel, select LOW RANGE. Connect the oscilloscope to output (A), (Red banana jack). A output open-circuit. Set the waveform for 18.0 Volts p-p using R107 (LOW CAL).

b) On front panel select MEDIUM RANGE. Set waveform for 60.0 Volts p-p using R87 (HIGH CAL).

c) On front panel, select HIGH RANGE. Confirm the waveform is 120 Volts p-p ±2 volts.

Common Mode

a) On front panel, select LOW RANGE. Output, open-circuit. Adjust TRACE ANGLE potentiometer to set the trace parallel to the horizontal graticule line on the CRT.

b) On the front panel, switch RANGE switch back and forth between LOW and HIGH ranges and adjust R76 (COMMON MODE CAL) to eliminate "*tilting*" of the trace between ranges.

Display

a) Adjust FOCUS, INTENSITY control on the front panel, and R30 (ASTIGMATISM) on the mother board, for a sharp trace.

b) With output A open-circuit, adjust R45 (X GAIN) for exactly six (6) major divisions of the horizotal trace.

c) Short output A to common and adjust R47 (Y GAIN) for full scale deflection.

Ranging

a) With output A first shorted to common, and then open-circuit switch the RANGE switch through LOW, MED and HIGH positions. Confirm — no change — in trace length between ranges and proper operation of the range indicator LED's.

b) Select the COMPARE MODE of the Display Mode Selector and confirm the output switches between jacks A (red) and B (yellow). Check that indicator LED's A and B are illuminated as the proper channel is activated.

c) The VARIABLE VOLTS control should "*click*" into a detent positon when at the fully clockwise position, (CW). Rotating fully counterclockwise (CCW) should decrease the output voltage approximately one-half (½) of full scale. After checking return control to the detent position, (fully CW).

This concludes the calibration procedure. Return all controls to normal. Turn power "*OFF*" by depressing POWER pushbutton. Remove power line cord. Replace the top and bottom covers. Connect power cord. Unit is now ready for use.

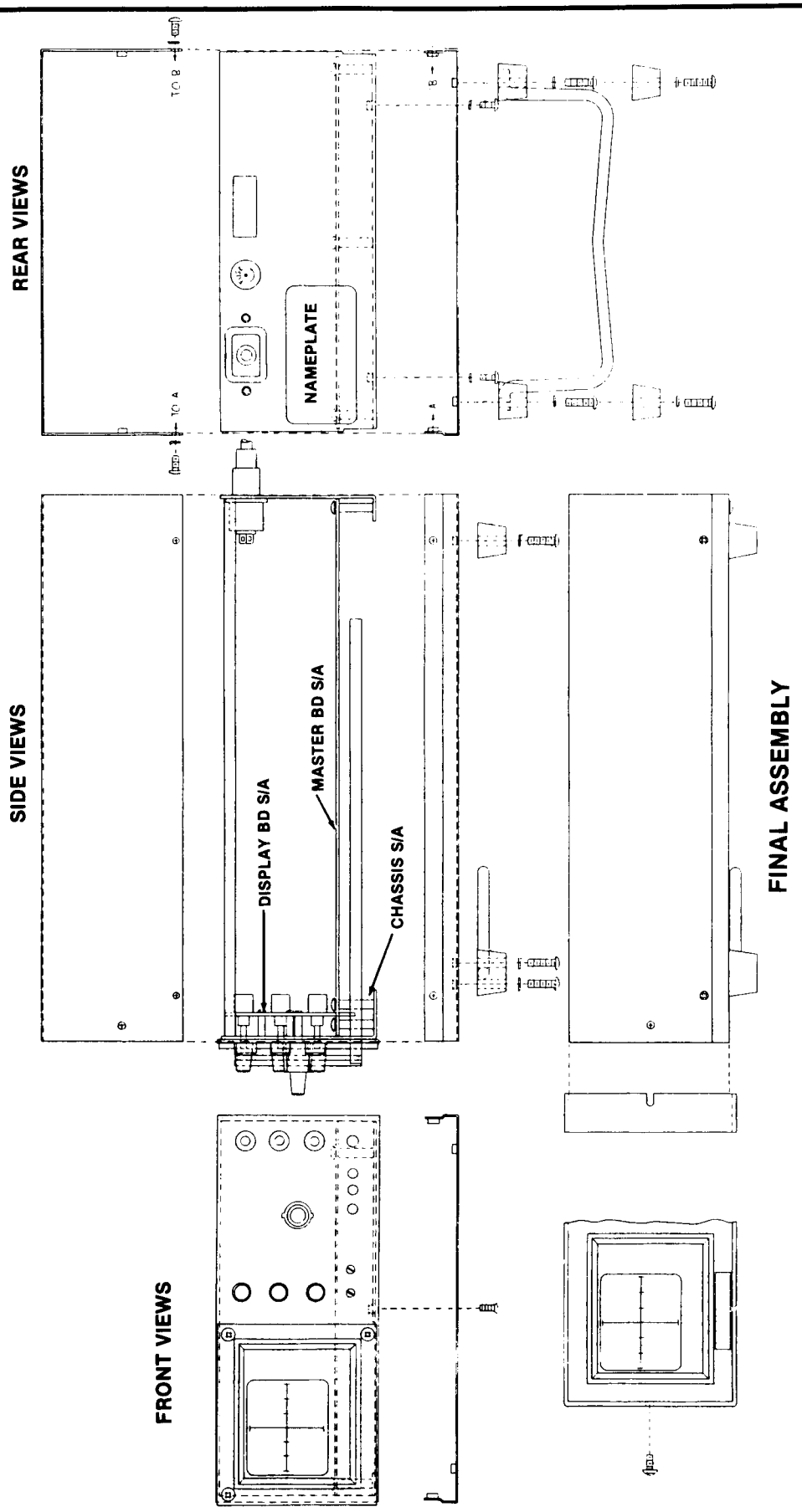


FIGURE 13. FINAL ASSEMBLY — MODEL 3110

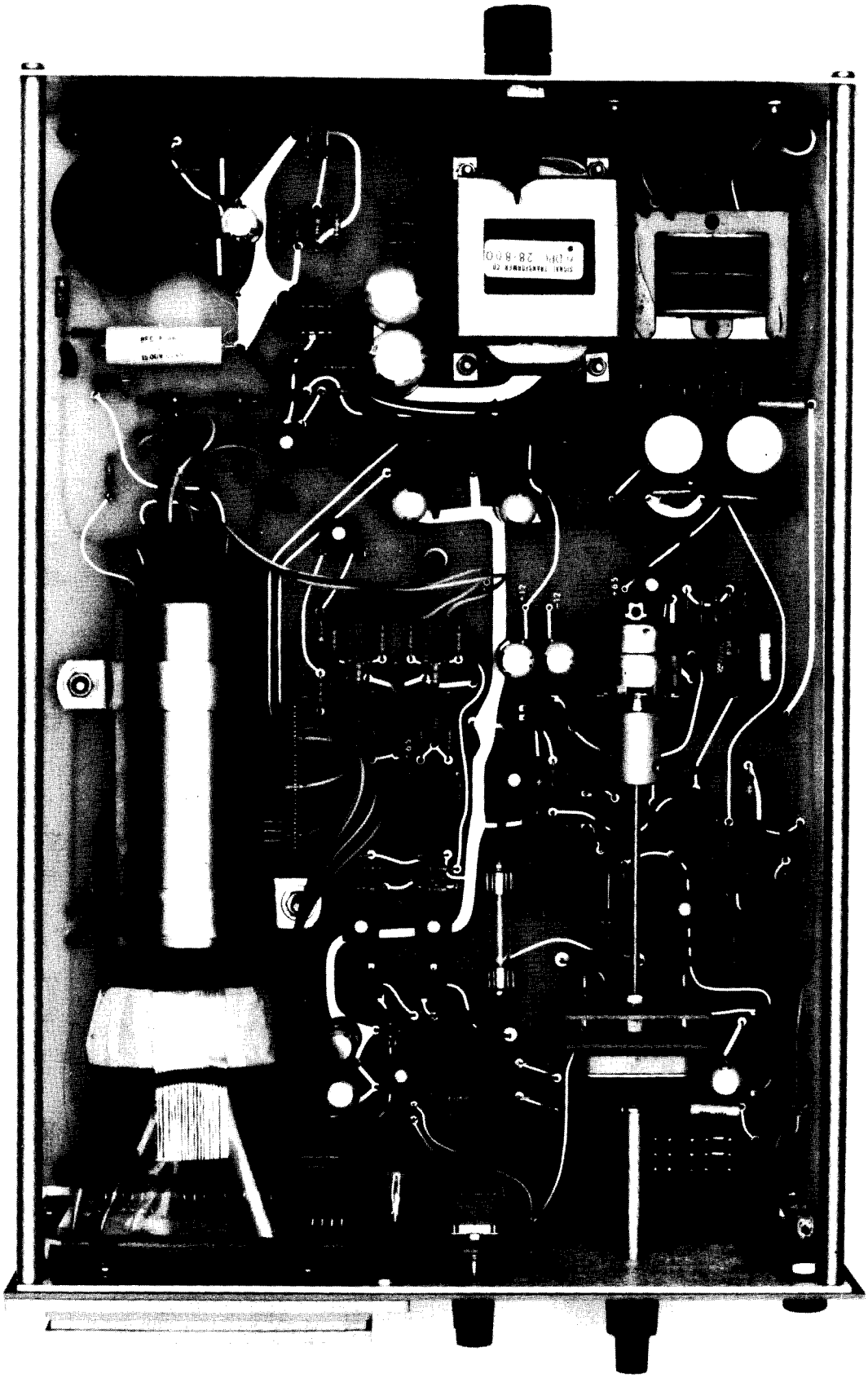


Figure 14. MASTER BOARD

PARTS LIST

Table 2. Parts List (Master Board Sub-Assy 31105001)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	31103001	Etched Circuit Board	Vu-Data	1-20137
		CAPACITORS		
C1	503D158F025QG	ELECT, 1500uf, 25V	Sprague	6-87158
C2	503D158F025QG	ELECT, 1500uf, 25V	Sprague	6-87158
C3	503D107F016NB	ELECT, 100uf, 16V	Sprague	6-87107
C4	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C5	504D107F016NB	ELECT, 100uf, 16V	Sprague	6-87107
C6	DM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C7	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C8	DM15-102J	DM, 1000Pf ± 5%, 100V	Elmenco	6-19102
C9	SR215C273KAA	DM, .02uf ± 10%, 50V	AVX	6-36273
C10	DDM-103	CD, .01uf ± 60 – 40%, 150V	Centralab	6-27103
C11	DDM-103	CD, .01uf ± 60 – 140%, 150V	Centralab	6-27103
C12	SR305C394KAA	MONO CER, .39uf ± 10%, 50V	AVX	6-36394
C13	503D337F010ND	ELECT, 330uf, 10V	Sprague	6-87337
C14	GE50-104ZBT	MONO CER, .1uf + 80 – 20%, 50V	Marata	6-36104
C15	SR305C474KAA	MONO CER, .47uf ± 10%, 50V	AVX	6-36464
C16	5GA-D50	CD, .005uf ± 20%, 1KV	Sprague	6-29502
C17	ZA4470	MYLAR, .1uf ± 20%, 1.5KV	IMB	6-40104
C18	SR271E104ZAT	DM, .1uf + 80 – 20%, 100V	AVX	6-37104
C19	5GA-D50	CD, .005uf ± 20%, 1KV	Sprague	6-29502
C20	5GA-D50	CD, .005uf ± 20%, 1KV	Sprague	6-29502
C21	DDM-103	CD, .01uf + 60140%, 150V	Centralab	6-27103
C22	672D276H100DM2C	ELECT, 27uf, 100V	Sprague	6-87276
C23	672D276H100DM2C	ELECT, 27uf 100V	Sprague	6-87276
C24	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C25	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C26	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C27	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C28	5GA-D20	CD,. 002uf ± 20%, 1KV	Sprague	6-20202
C29	5GA-D20	CD, .002uf ± 20%, 1KV	Sprague	6-20202
C30	DDM-103	CD, .01uf + 60 – 20%, 150V	Centralab	6-27103
C31	GE50-104ZBT	MONO CER, .1uf + 80 – 20%, 50V	Marata	6-36104
C32	GE50-104ZBT	MONO CER, .1uf + 80 – 20%, 50V	Marata	6-36104
C33	5GA-D20	CD, .002uf ± 20%, 1KV	Sprague	6-20202
C34	5GA-D20	CD, .002uf ± 20%, 1KV	Sprague	6-20202
C35	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C36	503D107F016NB	ELECT, 100uf, 16V	Sprague	6-87107
C37	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C38	503D107F016NB	ELECT, 100uf, 16V	Sprague	6-87107
C39	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C40	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C41	DM15-271J	DM, 270Pf ± 5%m 500V	Elmenco	6-19271
C42	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C43	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C44	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C45	DDM-103	CD,. 01uf + 60 – 40%, 150V	Centralab	6-27103
C46	XAZA-104J	MYLAR, .1uf ± 5%, 50V	IMB	6-46104
C47	GE50-104ZBT	MONO CER, .1uf + 80 – 20%, 50V	Marata	6-36104
C48	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C49	503D107F016NB	ELECT, 100uf, 16V	Sprague	6-87107
C50	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C51	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103

Table 2. Parts List (Master Board Sub-Assy 31105001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
C53	DDM-103	CD, .01uf + 60 – 40%, 150V	Centralab	6-27103
C54	503D107F016NB	ELECT, 100uf, 16V	Sprague	6-87107
C55	XAZA-104J	MYLAR, .1uf ± 5%, 50V	IMB	6-46104
C56	503D107F016NB	ELECT, 100uf, 16V	Sprague	6-87107
C57	ZA2E-223	MYLAR, .022uf ± 20%, 400V		6-49223
		DIODES		
CR1	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR2	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR3	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR4	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR5	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR6	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR7	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR8	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR9	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR10	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR11	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR12	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR13	1N914	GP, Signal	Fairchild	3-10914
CR14	1N914	GP, Signal	Fairchild	3-10914
CR15	10G5F	High Voltage	Semtech	3-10340
CR16	1N4126	Zener, 51V	Motorola	3-14126
CR17	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR18	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR19	1N914	GP, Signal	Fairchild	3-10914
CR20	1N914	GP, Signal	Fairchld	3-10914
CR21	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR22	1N4004	Power, 1 Amp, 400V	Fairchild	3-14004
CR23	1N914	GP, Signal	Fairchild	3-10914
CR24	1N914	GP, Signal	Fairchild	3-10914
CR25	1N914	GP, Signal	Fairchild	3-10914
		INTEGRATED CIRCUITS		
U1	78GUIC	Volt, Reg, uA78GC	Fairchild	3-30780
U2	78GUIC	Volt, Reg, uA78GC	Fairchild	3-30780
U3	79GUIC	Volt, Reg, uA79GC	Fairchild	3-30790
U4	TL783CKC	High Voltage Regulator	Texas Instr.	3-30783
U5	TL783CKC	High Voltage Regulator	Texas Instr.	3-30783
U6	LM301A	Amplifier	National	3-38005
U7	TL081ACP	OP Amp, Bi-FET	Texas Instr.	3-30081
U8	TL081ACP	OP Amp, Bi-FET	Texas Instr.	3-30081
U9	1455 (NE555)	Timer	Signetics	3-30555
U10	TL081ACP	OP Amp, Bi-FET	Texas Instr.	3-30081
U11	XR2209C	Oscillator	Exar	3-32209
U12	TL081ACP	OP Amp, Bi-FET	Texas Instr.	3-30081
		RESISTORS		
R1				
R2				
R3	RN55D7681F	MF, 7.68Kohm, 1/8W, 1%	Dale	5-51288
R4	RN55D4991F	MF, 4.99Kohm, 1/8W, 1%	Dale	5-51270
R5	RN55D2211F	MF, 2.21Kohm, 1/8W, 1%	Dale	5-51226
R6	RN55D1051F	MF, 10.5Kohm, 1/8W, 1%	Dale	5-51301

Table 2. Parts List (Master Board Sub-Assy 31105001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R7	RN55D2611F	MF, 2.61Kohm, 1/8W, 1%	Dale	5-51233
R8	RN55D4991F	MF, 4.99Kohm, 1/8W, 1%	Dale	5-51270
R9	RCR07G102JR	CC, 1Kohm, 1/4W, 5%	Allen Bradley	5-10102
R10	RCR07G681JR	CC, 680ohm, 1/4W, 5%	Allen Bradley	5-10681
R11	RCR07G102JR	CC, 1Kohm, 1/4W, 5%	Allen Bradley	5-10102
R12	RCR07G681JR	CC, 680ohm, 1/4W, 5%	Allen Bradley	5-10681
R13	RCR07G123JR	CC, 12Kohm, 1/4W, 5%	Allen Bradley	5-10123
R14	RN55D1003F	MF, 100Kohm, 1/8W, 1%	Dale	5-51394
R15	RN55D2002F	MF, 20Kohm, 1/8W, 1%	Dale	5-51328
R16	3386S-1-104	VAR, CER, 100Kohm	Bourns	5-73104
R17	RCR07G124JR	CC, 120Kohm, 1/4W, 5%	Allen Bradley	5-10124
R18	RCR20G565JR	CC, 5.6Mohm, 1/2W, 5%	Allen Bradley	5-20565
R19	3386S-1-205	VAR, CER, 2Mohm	Bourns	5-73205
R20	RCR07G010JR	CC, 10ohm, 1/4W, 5%	Allen Bradley	5-10010
R21	RCR07G010JR	CC, 10ohm, 1/4W, 5%	Allen Bradley	5-10010
R22	RCR07G105JR	CC, 1Mohm, 1/4W, 5%	Allen Bradley	5-10105
R23	RCR20G335JR	CC, 3.3Mohm, 1/2W, 5%	Allen Bradley	5-20335
R24	RCR20G275JR	CC, 2.7Mohm, 1/2W, 5%	Allen Bradley	5-20275
R25	RCR07G224JR	CC, 220Kohm, 1/4W, 5%	Allen Bradley	5-10224
R27	RCR07G223JR	CC, 22Kohm, 1/4W, 5%	Allen Bradley	5-10223
R28	3386S-1-203	VAR, CER, 20Kohm	Bourns	5-73203
R29	RCR07G473JR	CC, 47Kohm, 1/4W, 5%	Allen Bradley	5-10473
R30	3386S-1-104	VAR, CER, 100Kohm	Bourns	5-73104
R31	RCR07G473JR	CC, 47Kohm, 1/4W, 5%	Allen Bradley	5-10473
R32	RN55D4220F	MF, 422ohm, 1/8W, 1%	Dale	5-51156
R33	RN60D2152F	MF, 21.5Kohm, 1/4W, 1%	Dale	5-50331
R34	RN55D4220F	MF, 422ohm, 1/8W, 1%	Dale	5-51156
R35	RN60D2152F	NFM 21.5Kohm, 1/4W, 1%	Dale	5-5033
R36	RCR07G303JR	CC, 30Kohm, 1/4W, 5%	Allen Bradley	5-10303
R37	RCR07G333JR	CC, 33Kohm, 1/4W, 5%	Allen Bradley	5-10333
R38	RCR07G333JR	CC, 33Kohm, 1/4W, 5%	Allen Bradley	5-10333
R39	RCR07G303JR	CC, 30Kohm, 1/4W, 5%	Allen Bradley	5-10333
R40	RCR07G303JR	CC, 30Kohm, 1/4W, 5%	Allen Bradley	5-10303
R41	RCR07G333JR	CC, 33Kohm, 1/4W, 5%	Allen Bradley	5-10333
R42	RCR07G333JR	CC, 33Kohm, 1/4W, 5%	Allen Bradley	5-10333
R43	RCR07G303JR	CC, 30Kohm, 1/4W, 5%	Allen Bradley	5-10303
R44	RCR07G604JR	CC, 47ohm, 1/4W, 5%	Allen Bradley	5-10047
R45	3386S-1-102	VAR, CER, 1Kohm	Bourns	5-73102
R46	RCR07G047JR	CC, 47ohm, 1/4W, 5%	Allen Bradley	5-10047
R47	3386S-1102	VAR, CER, 1Kohm	Bourns	5-73102
R48	RCR07G153JR	CC, 15Kom, 1/4W, 5%	Allen Bradley	5-10153
R49	RCR07G112JR	CC, 1.1Kohm, 1/4W, 5%	Allen Bradley	5-10112
R50	RCR07G394JR	CC, 390Kohm, 1/4W, 5%	Allen Bradley	5-10394
R51	RCR07G394JR	CC, 390Kohm, 1/4W, 5%	Allen Bradley	5-10394
R52	RCR07G134JR	CC, 130Kohm, 1/4W, 5%	Allen Bradley	5-10134
R53	RCR07G123JR	CC, 12Kohm, 1/4W, 5%	Allen Bradley	5-10123
R54	RCR07G112JR	CC, 1.1Kohm, 1/4W, 5%	Allen Bradley	5-10112
R55	RCR07G153JR	CC, 15Kohm, 1/4W, 5%	Allen Bradley	5-10153
R62	RCR07G153JR	CC, 15Kohm, 1/4W, 5%	Allen Bradley	5-10153
R63	RCR07G112JR	CC, 1.1Kohm, 1/4W, 5%	Allen Bradley	5-10112
R64	RCR07G394JR	CC, 390Kohm, 1/4W, 5%	Allen Bradley	5-10394
R65	RCR07G394JR	CC, 390Kohm, 1/4W, 5%	Allen Bradley	5-10394
R66	RCR07G134JR	CC, 130Kohm, 1/4W, 5%	Allen Bradley	5-10134
R67	RCR07G123JR	CC, 12Kohm, 1/4W, 5%	Allen Bradley	5-10123

Table 2. Parts List (Master Board Sub-Assy 31105001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R68	RCR07G153JR	CC, 15Kohm, 1/4W, 5%	Allen Bradley	5-10153
R69	RCR07G112JR	CC, 1.1Kohm, 1/4W, 5%	Allen Bradley	5-10112
R70	RCR07G101JR	CC, 100ohm, 1/4W, 5%	Allen Bradley	5-10101
R71	RCR07G101JR	CC, 100ohm, 1/4W, 5%	Allen Bradley	5-10101
R72	RN55D1004F	MF, 1Mohm, 1/8W, 1%	Dale	5-51490
R73	CCA-TO-10M-1%	MF, 10Mohm, 1/4W, 1%	TRW	5-55106
R74	CCA-TO-10M-1%	MF, 10Mohm, 1/4W, 1%	TRW	5-55106
R75	RN55D9093F	MF, 909Kohm, 1/8W, 1%	Dale	5-51486
R76	3386S-1-254	VAR, CER, 250Kohm	Bourns	5-73254
R77	RN55D1963F	MF, 196Kohm, 1/8W, 1%	Dale	5-51422
R78	RN55D4753F	MF, 475Kohm, 1/8W, 1%	Dale	5-51459
R79	RN65D1104F	MF, 1.10Mohm, 1/4W, 1%	Dale	5-52494
R80	CCA-TO-10M-1%	MF, 10Mohm, 1/4W, 1%	TRW	5-55106
R81	RCR07G106JR	CC, 10Mohm, 1/4W, 5%	Allen Bradley	5-10106
R82	AS2-35.7-1%	WW, 35.7ohm, 3W, 1%	TRW	5-60357
R83	RN55D3571F	MF, 3.57Kohm, 1/8W, 1%	Dale	5-51246
R84	RN55D9091F	MF, 9.09Kohm, 1/8W, 1%	Dale	5-51295
R85	RN55D8451F	MF, 8.45Kohm, 1/8W, 1%	Dale	5-51292
R86	RN55D5112F	MF, 51.1Kohm, 1/8W, 1%	Dale	5-51367
R87	3386S-1-203	VAR, CER, 20Kohm	Bourn	5-73203
R88	RN55D8872F	MF, 88.7Kohm, 1/8W, 1%	Dale	5-51389
R89	RN55D3162F	MF, 31.6Kohm 1/8W, 1%	Dale	5-51347
R90	RCR07G272JR	CC, 2.7Kohm, 1/4W, 5%	Allen Bradley	5-10272
R91	RCR07G151JR	CC, 150ohm, 1/4W, 5%	Allen Bradley	5-10151
R92	RCE07G151JR	CC, 150ohm, 1/4W, 5%	Allen Bradley	5-10151
R93	RN55D1433F	MF, 143Kohm, 1/8W, 1%	Dale	5-51409
R94	RN55D6651F	MF, 6.65Kohm, 1/8W, 1%	Dale	5-51282
R95	RN55D4530F	MF, 453ohm, 1/8W, 1%	Dale	5-51159
R96	RN55D4990F	MF, 499ohm, 1/8W, 1%	Dale	5-51163
R97	RN55D4991F	MF, 4.99Kohm, 1/8W, 1%	Dale	5-51270
R98	RN55D4991F	MF, 4.99Kohm, 1/8W, 1%	Dale	5-51270
R99	RN55D2491F	MF, 2.49Kohm, 1/8W, 1%	Dale	5-51231
R100	RN55D4991F	MF, 4.99Kohm, 1/8W, 1%	Dale	5-51270
R101	RN55D2491F	MF, 2.49Kohm, 1/8W, 1%	Dale	5-51231
R102	31102012	Pot, W/rot. sw. 2.5Kohm	Clarostat	5-79527
R103	RN55D1003F	MF, 100Kohm, 1/8W, 1%	Dale	5-51394
R104	RCR07G103JR	CC, 10Kohm, 1/4W, 5%	Allen Bradley	5-10103
R105	3386S-1-102	VAR, CER, 1Kohm4	Bourns	5-73102
R106	RN55D4991F	MF, 4.99Kohm, 1/8W, 1%	Dale	5-51270
R107	3386S-1-202	VAR, CER, 2Kohm	Bourns	5-73202
R108	RN55D6651F	MF, 6.65Kohm, 1/8W, 1%	Dale	5-51282
R109	RCR07G392JR	CC, 3.9Kohm, 1/4W, 5%	Allen Bradley	5-10392
R110	RCR07G047JR	CC, 4.7ohm, 1/4W, 5%	Allen Bradley	5-10047
R111	RCR07G047JR	CC, 4.7ohm, 1/4W, 5%	Allen Bradley	5-10047
R112	RCR07G062JR	CC, 62ohm, 1/4W, 5%	Allen Bradley	5-10062
R113	RCR07G151JR	CC, 150ohm, 1/4W, 5%	Allen Bradley	5-10151
R114	RCR07G062JR	CC, 62ohm, 1/4W, 5%	Allen Bradley	5-10062
R115	RCR07G151JR	CC, 150ohm, 1/4W, 5%	Allen Bradley	5-10152
R116	RCR07G047JR	CC, 4.7ohm, 1/4W, 5%	Allen Bradley	5-10047
R117	RCR07G047JR	CC, 4.7ohm, 1/4W, 5%	Allen Bradley	5-10047
R118	RCR07G392JR	CC, 3.9Kohm, 1/4W, 5%	Allen Bradley	5-10392
R120	RCR07G106JR	CC, 10Mohm, 1/4W, 5%	Allen Bradley	5-1016
R121	RCR07G103JR	CC, 10Kohm, 1/4W, 5%	Allen Bradley	5-10103
R122	RCR20G621JR	CC, 620ohm, 1/2W, 5%	Allen Bradley	5-20621

Table 2. Parts List (Master Board Sub-Assy 31105001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R124	RCR07G105JR	CC, 1Mohm, 1/4W, 5%	Allen Bradley	5-10105
R125	RCR20G685JR	CC, 6.8Mohm, 1/2W, 5%	Allen Bradley	5-20685
R126	RCR07G103JR	CC, 10Kohm, 1/4W, 5%	Allen Bradley	5-10103
R127	RCR07G104JR	CC, 100Kohm, 1/4W, 5%	Allen Bradley	5-10104
R128	RCR07G104JR	CC, 100Kohm, 1/4W, 5%	Allen Bradley	5-10104
R129	RCR07G106JR	CC, 10Mohm, 1/4W, 5%	Allen Bradley	5-10106
R130	RCR07G106JR	CC, 10Mohm, 1/4W, 5%	Allen Bradley	5-10106
		SWITCHES		
S-1	F2UEE	Push-Push, DPDT	Shadow	2-10072
S-2	31102001	Rotary, 6 pole, 3 pos	Vu-Data	2-1073
S-3	9152003	3 St., Interlocking	Vu-Data	2-10047
K1	W172DIP-3	Relay, Reed, SPDT		4-20383
		TRANSISTORS		
Q1	D44H2	NPN, Signal	G.E.	3-24442
Q2	D44H2	NPN, Signal	G-R	3-24442
Q3	2N5401	PNP, Signal	Fairchild	3-25401
Q4	2N5550	NPN, Signal	Fairchild	3-25550
Q5	2N5550	NPN, Signal	Fairchild	3-25550
Q6	2N5401	PNP, Signal	Fairchild	3-25401
Q7	2N5401	PNP, Signal	Fairchild	3-25401
Q8	2N5550	NPN, Signal	Fairchild	3-25550
Q9	2N5550	NPN, Signal	Fairchild	3-25550
Q10	2N5401	PNP, Signal	Fairchild	3-25401
Q11	2N5550	NPN, Signal	Fairchild	3-25550
Q12	2N3904	NPN, Signal	Fairchild	3-23904
Q13	2N3904	NPN, Signal	Fairchild	3-23904
Q14	2N3904	NPN, Signal	Fairchild	3-23904
Q15	2N5401	PNP, Signal	Fairchild	3-25401
Q16	2N5550	NPN, Signal	Fairchild	3-25550
Q17	2N5401	PNP, Signal	Fairchild	3-25401
Q18	D40D2	NPN, Signal	Fairchild	3-24042
Q19	2N3904	NPN, Signal	Fairchild	3-23904
Q20	2N3904	NPN, Signal	Fairchild	3-23904
Q21	D41D2	PNP, Signal	G-R	3-24142
Q22	2N3906	PNP, Signal	Fairchild	3-23906
Q23	2N3904	NPN, Signal	Fairchild	3-23904
Q24	F2701	FET, NCH	Solitron	3-22701
Q25	F2701	FET, NCH	Solitron	3-22701
		MISCELLANEOUS		
F2	312001	Fuse, 1A, 3AG, NB	Littlefuse	2-40009
FC-1&FC-2	1020T1	Fuse clips	Litlefuse	2-40019
T1	DPC28-800	Transformer	Signal	7-61033
P1	1-640454-5	Header, 15 pin .1 ctr	AMP	2-24030
T2	DST-120	Transformer	Signal	7-61034
T3	9352017B	Hi Voltage Transformer	Vu-Data	7-61023
	24-BR	Transformer mtg. brkt.	Signal	4-20391
	MS51957-14	Screw, #4-40 × 5/16		8-10014
	MS35333-TO	Washer, Int. Locking		8-40002
	NAS671C4	Nut, #4-40		8-30005
	6034B	Heatsink	Thermalloy	3-90006

Table 2. Parts List (Master Board Sub-Assy 31105001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	2000C-7	Bifurcated Standoff	Useco	2-24010
	20102013	High Voltage Decal	Vu-Data	4-20375
	T403-09FR-51	Sil Pad	Berquist	4-20290
	2630-N-12425-093	Nylon Shoulder Washer		8-60001
	2373	Spacer, 1/4 o.d. × .750	H. H. Smith	4-20166
	NAS6T1C2	Nut, Hex #2-56		8-30003
	MS35333-69	Washer, Int. Lck #2		8-40001

Table 3. Parts List (Display Board Sub-Assy 31105002)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	31103002	Display Board	Vu-Data	1-20138
R57, R60	2432001-20	RES, Var, CP, 2.5Kohm ± 10%	Vu-Data	5-79528
R26	2432001-21	RES, Var, CP, 5Mohm ± 10%	Vu-Data	5-79529
DS2-4	HLMP-2550	LED Module, Grn	H-P	3-12550
DS1	HLMP-2500	LED Module, Grn	H-P	3-12500
DS5	5082-4791	LED, Red	H-P	3-14791
DS6	5082-4592	LED, Yellow	H-P	3-14592
R56, 58, 59, 61	RN55D1372F	RES, MF, 13.7Kohm, 1/8W, 1%	Dale	5-51312
R123	RCR20G821JR	RES, CC, 820ohm, 1/2W, 5%	Allen Bradley	5-20821
R119	RCR07G391JR	RES, CC, 390ohm, 1/4W, 5%	Allen Bradley	5-10391
P2	1-64045405	Header 15 pin .1 ctr	AMP	2-24030

Table 4. Parts List (Chassis Sub-Assy 31105004)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	31105001	Master Board Sub-Assy	Vu-Data	
	31105002	Display Board Sub-Assy	Vu-Data	
	31102002	Sub-Front Panel	Vu-Data	1-10888
	31102003	Front Panel	Vu-Data	1-10889
	31102004	Rear Panel	Vu-Data	1-10890
	31102007	Support Spacer	Vu-Data	1-10893
	12012026	CRT Shield	Vu-Data	1-10330
L200	12012073	Trace Angle Coil	Vu-Data	5-90019
	31102010	CRT Filter	Vu-Data	4-20386
	31103010	Graticule	Vu-Data	4-20389
	9402019-3	Bezel	Vu-Data	1-10910
	31102008	Shaft Coupler, 1/4″ to 3/32″	Vu-Data	1-10894
	31102011	Shaft — Pwr Switch	Vu-Data	4-20388
	31102013	Shaft Ext-Vernier	Vu-Data	1-10918
V200	D7-200Gh	Cathode Ray Tube	Brimar	3-40002
J300	EAC-301	AC Connector	Switchcraft	2-24000
X301	342-014L	Fuseholder	Littlefuse	2-40000
F	313.500	Fuse, SB, 3AG, 1/2 Amp	Littlefuse	2-40017
F1	313.250	Fuse, SB, 3AG, 1/4 Amp	Littlefuse	2-40004
J200	1509-102	Banana, Jack, Red	H. H. Smith	4-20393
J202	1509-103	Banana, Jack, Blk	H. H. Smith	4-20394
J201	1509-107	Banana, Jack, Yel	H. H. Smith	4-20395
J1, J2	1-640441-5	Connector, 15 pin	AMP	2-24034
	UF-1524-105B	Ribbon Cable, 15 Cond.	SpectraStrip	2-70021
	2432010	Button	Vu-Data	1-10716
	023-3520	Knob, Wing, 14.5mm, Blk	Interlock	4-10013
	021-1230	Knob, 9mm, Red	Interlock	4-10009
	021-2220	Knob, 10mm, Blk	Interlock	4-10011
	040-1020	Knob, Cap, Blk	Interlock	4-10012
	040-1030	Knob, Cap, Red	Interlock	4-10010
	B13B	CRT Socket	Brimar	2-50010
	AN742-24	Cable Clamp, 1.5″i.d.	Umpco	4-20384
	8828	Spacer, 8-32 × 5/16″ 1.	H. H. Smith	4-20385
	MS51957-47	Screw, PanHd #8-32 × 3/4		8-10047
	MS51957-26	Screw, PanHd #6-32 × 1/4		8-10026
	MS24693-C26	Screw, FlatHd #6-32 × 3/8		8-20028
	MS24693-C27	Screw, FlatHd #6-32 × 7/16		8-20029
	MS24693-C25	Screw, FlatHd #6-32 × 5/16		8-20027
	MS51957-12	Screw, PanHd #4-40 × 3/16		8-10012
	MS51957-13	Screw, PanHd #4-40 × 1/4		8-10013
	MS35333-T1	Washer, #6, Int Ick		8-40003
	MS35333-TO	Washer, #4, Int Ick		8-40002
	AD44ABS	Rivet	USM	4-20344
	NAS671C8	Nut, Hex #8-32		8-30007
	NAS671C4	Nut, Hec #4-40		8-30005
	MS15795-804	Washer, #4, Flat		8-50002
	MS35333-72	Washer, #8, Int Ick		8-40004
	MS15795-807	Washer, #8, Flat		8-50004
	5710-272-40	Washer, #5, Flat .375od	Seastrom	8-90031
	MS35333-75	Washer, 5/16, Int Ick		8-40007

Table 5. Parts List (Final Assembly 31105005)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	3115004	Chassis Sub-Assy	Vu-Data	
	31102005	Top Cover	Vu-Data	1-10891
	31102006	Bottom Cover	Vu-Data	1-10891
	9402061-3	Front Panel Trim	Vu-Data	1-10920
		Test Lead Set	TPI	See Supplement
	MP40008-2	Bail & Mtg. feet set, 7″ mtg.	Buckeye	4-20390
	31102006	Bezel Decal	Vu-Data	4-20396
	31102009	Serial Number Decal	Vu-Data	4-20387
	9352080	Calibrated Decal	Vu-Data	4-20312
	SPH-386	Line Cord	Belden	2-70005
	SFSW4C5DS30GY	Pan-IScrew, #4-40 × 5/16	Pan-I-Screw	8-90030
	MS51957-30	Screw, PanHd #6-32 × 1/2		8-10030
	MS51957-13	Screw, PanHd #4-40 × 1/4		8-10013
	MS24693-C2	Screw, 100° FlatHd #4-40 × 1/4		8-20013
	MS35333-71	Washer, Int. Ick. #6		8-40003
	MS35333-TO	Washer, Int. Ick. #5		8-40002
		SUPPLEMENT		
		3110 Test Lead Set	TPI	9-00027
	3220-48-0	Banana to Alligator-Black	Pomona	9-00028

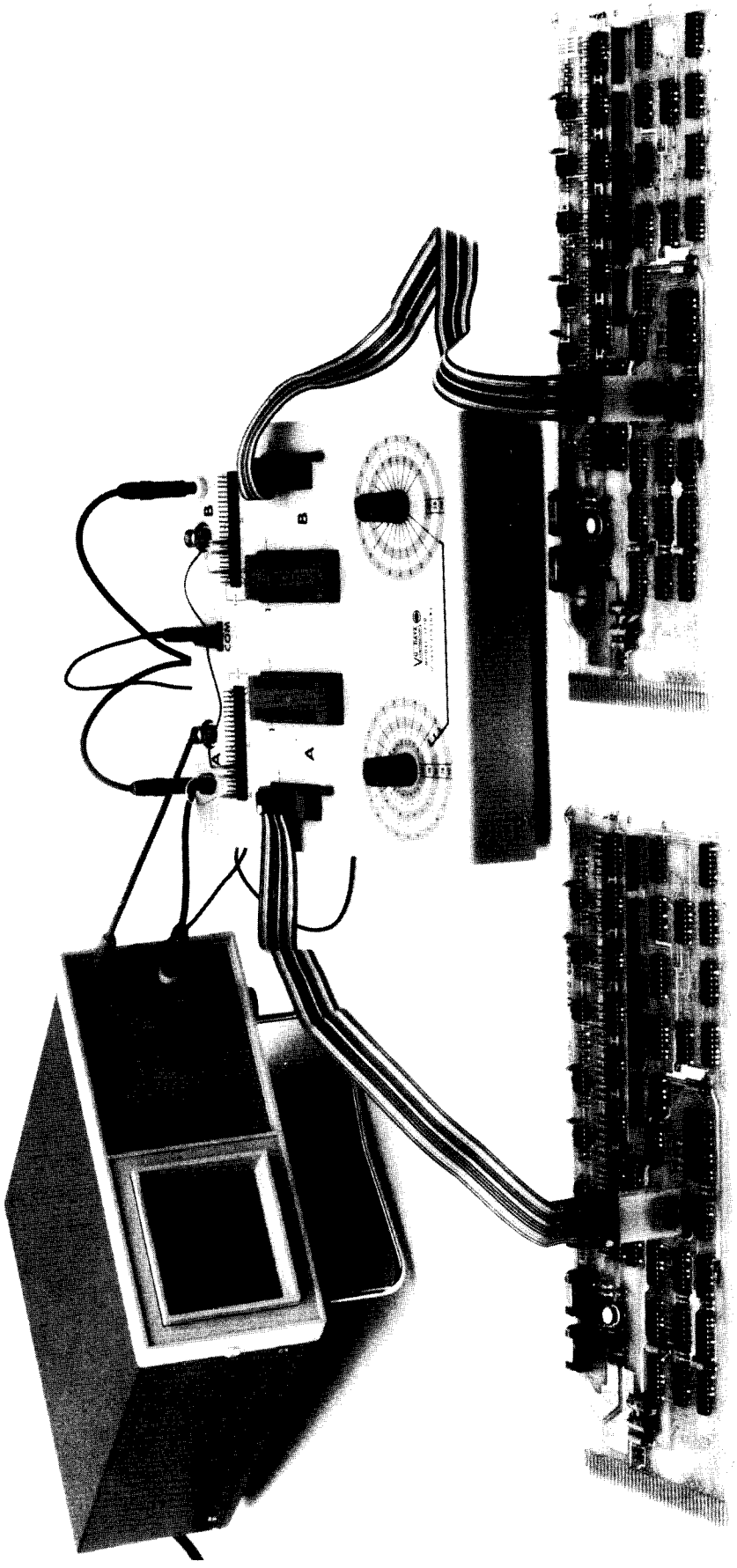
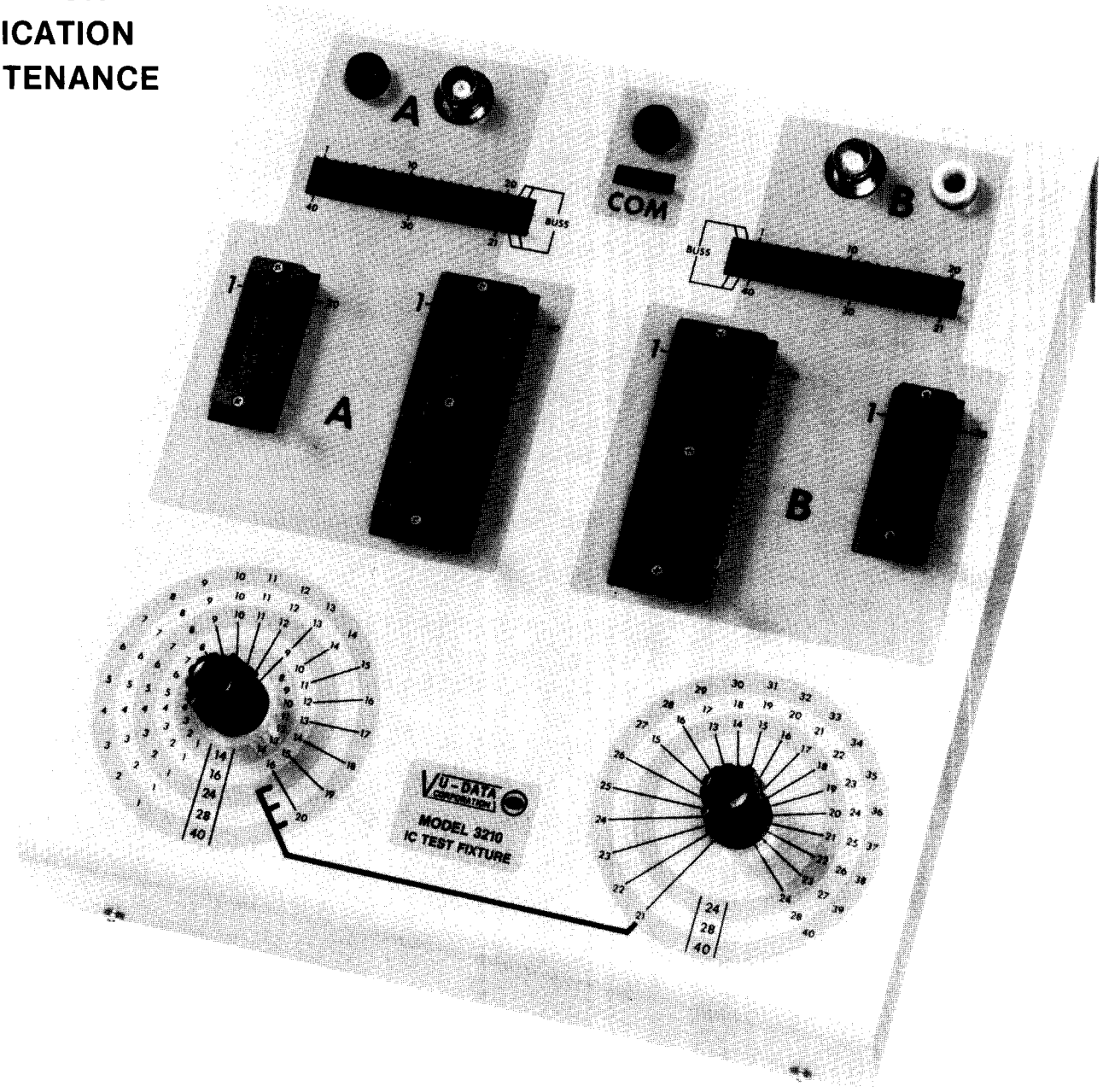


FIGURE 15. MODEL 3110 & MODEL 3210 IN-CIRCUIT COMPONENT TESTING

TECHNICAL MANUAL

OPERATION
APPLICATION
MAINTENANCE



MODEL 3210
IC TEST FIXTURE

PUBLICATION NO. 4-20405

INTRODUCTION

When users of the Model 3110 In-Circuit Component Tester (ICT), asked for an even easier way to test integrated circuits (IC's), the Model 3210 was designed to meet this need. Although the Model 3210 was designed to operate with the Model 3110 for good-bad no power comparison tests, its versatility also allows it to be used with a dual-trace oscilloscope like Vu-Data's Model 975 or a DVM to compare waveforms or voltages on any pin of an IC (from 1-40) in an operating circuit. Tests of IC's having 8 to 40 pins are accomplished WITHOUT having to reverse the IC.

Either way, the Model 3210 offers more versatility than similar products on the market today. Using the Model 3210, the user can rapidly and accurately test all sizes and many types of IC's in-circuit or out-of-circuit, operating or with power off. The two 20-pin and two 40-pin Zero Insertion Force Sockets are provided to hold IC's under test (out-of-circuit), or to connect DIP jumper cables (16-pin or 40-pin) to circuit boards and in-circuit IC's being tested.

The two rotary switches provide continuous selection of pins from 1 to 40. The switches are labeled for 14, 16, 24, 28 and 40 pin configurations, making pin selection a positive selection, no guessing or converting. The left hand switch (Switch 1-20) is used for pins 1 to 20. When Switch 1-20 is in the black bar position, Switch 21-40 is activated, which provides selection of pins 21 to 40. This arrangement provides positive switching at all times, removing the chance of conversion error. Switch 21-40 is ONLY active when Switch 1-20 is set to the black bar position.

Two 44-pin Test Point sockets are provided for jumpering of pins, with the four extra pins being used for bussing. The TP pins are also used to connect the "*COM*" Test Point Pins to ANY pins from 1 to 40. The 20-pin socket, 40-pin socket and Test Point Pins of each channel are connected in parallel. Therefore when Switch 1-20 is set to a given number, say 5, then socket "*A-20*" and "*A-40*" pin 5 and Test Point pin 5 are connected to Output "*A*". At the same time, socket "*B-20*" and "*B-40*" pin 5 and "*B*" Test Point 5 are connected to Output "*B*". Both outputs are available at ALL times, allowing such things as logic level checking by connecting a DVM between "*A*" and "*B*" or making real-time comparisons on a dual-trace oscilliscope.

Features

- Performs GOOD-BAD comparison tests on IC's and components in conjunction with the Model 3110 ICT.
- Tests IC's having 8 to 40 pins without reversal of IC's.
- Tests PCB mounted IC's and components in operating or non-operating circuits.
- Two 20-pin and two 40-pin sockets permit out-of-circuit test or connection of DIP cables.
- Dual output connectors (BNC and Banana Jack) for each channel.
- Rotating Selector Switches allow POSITIVE SELECTION of pins of IC's from 1 to 40.
- No AC power input required.
- Selection of ANY pin from 1 to 40 as a common.
- Test Points allow jumpering of pins and bussing of pins in any combination the user desires (pins 1 to 40).
- Continuous output on BOTH channels at ALL times, allowing logic level checking or real-time comparisons.

Power

The Model 3210 does not require input power as there is not an internal requirement for power. The box contains only a circuit card — no components except for the switches and connectors. The power that is required is supplied by either the Model 3110 test signal to the device-under-test via the circuitry of the Model 3210 or the device-under-test is powered-up as in the case of use with the dual trace scope or DVM.

Items Furnished

The Model 3210 comes complete with the following items:

16-Pin Cable Set (2 cable assemblies) PN-4-20411

Technical Manual (1) PN-4-20405

Optional Items

A 40-Pin Cable Set (2 cable assemblies) is available. PN-4-20410

A Test Lead Set with retractable probes is available. Option 3001

Inspection Upon Receipt

The Model 3210 is tested prior to shipment and is ready for operation upon receipt. The following checks should be made however, to assure that the instrument has suffered no damage in shipment.

a) A visual inspection of the shipping container should be accomplished prior to acceptance from the carrier. If extensive damage of the shipping container is evident, a description of the damage should be noted on the carrier's receipt and signed by the carrier's agent. If damage is not apparent until the instrument is unpacked, a claim for concealed damage should be placed with the carrier within 15 days of receipt. All shipping containers and filler material must be kept for inspection.

b) A visual inspection for damage should be accomplished upon removing the instrument from the shipping container. If there is any visual damage to the outside of the unit, return unit to Vu-Data. Do not open unit for inspection.

SPECIFICATIONS

EXTERNAL INPUT:

Bandwidth:	DC to greater than 100 KHz within 3 dB, useable to over 10 MHz
Maximum Input Voltage:	500V (DC + peak AC)
Maximum Switched Current:	.100 A at 115 VAC

ENVIRONMENTAL:

Ambient Temperature:	−55 °C to +75 °C
Altitude:	50,000 Feet
Shock and Vibration:	Will withstand the shock and vibration conditions encountered in normal commercial shipping and handling.
Humidity:	Will operate in up to 95% relative humidity non-condensing.

GENERAL:

Dimensions and Weights:

Height:	4.0″
Width:	8.5″
Depth:	9″
Weight:	2.25 lbs.

OPERATING INSTRUCTIONS

CONNECTIONS:

RED Banana Jack & BNC — CHANNEL "*A*" — Connects device in sockets "*A*" to input "*A*" of Model 3110 or Channel 1 of a dual-trace oscilloscope or DVM.

YELLOW Banana Jack & BNC — CHANNEL "*B*" — Connects device in sockets "*B*" to input "*B*" of Model 3110 or Channel 2 of a dual-trace oscilloscope or DVM.

BLACK Banana Jack & 5 TP's — COMMON — Connects common of test fixture to common of Model 3110 and connects common of test fixture to desired pins or sockets "*A*" and/or "*B*" via 4-inch jumpes and TP's "*A*" and/or "*B*" pins 1-40.

BUSS (4TP pins on TP "*A*" & "*B*" — Used to tie together any pins as required to form a buss, using 4-inch jumpers.

Sockets "*A*" & "*B*" — Two 20-pin and two 40-pin Zero Insertion Force Sockets used to hold IC's under test, or to connect DIP jumper cables to circuit boards or IC's on PCB's.

CONTROLS:

"Switch 1-20" — Connects the pin number selected to the "*A*" and "*B*" Banana Jack and BNC connectors.

"Switch 21-40" — Connects the pin number selected to the "*A*" and "*B*" Banana Jack and BNC connectors.

NOTE

Switch 21-40 is active ONLY when switch 1-20 is set to the black bar position.

OPERATING—NON-POWERED CKTS

OPERATION: NON-POWER CIRCUITS

a) Connect the three line "*A*", "*B*" and "*COM*" to the three jacks on the Model 3110 ICT and the Model 3210 IC Test Fixture, RED to RED, YELLOW to YELLOW, BLACK to BLACK.

b) If testing IC's, install the known GOOD device in socket "*A*" and the device-under-test in socket "*B*".

c) If testing circuit boards, connect the DIP cable to the ZIF sockets on the Test Fixture. Connect "*A*" cable to the known GOOD IC on the board and connect "*B*" cable to IC-under-test on the suspected board.

d) Use 4-inch jumpers to select the Test Point pin(s) to be connected to common. Use the same pin numbers on TP-"*A*" and TP-"*B*".

e) Select the pin number to be tested with switches 1-20 or 21-40 and observe the results on the Model 3110 ICT.

NOTE

All Integrated Circuits or DIP Jumper cables must be installed in the ZIF Sockets with Pin 1 in the location marked "1" on the Test Fixture front panel.

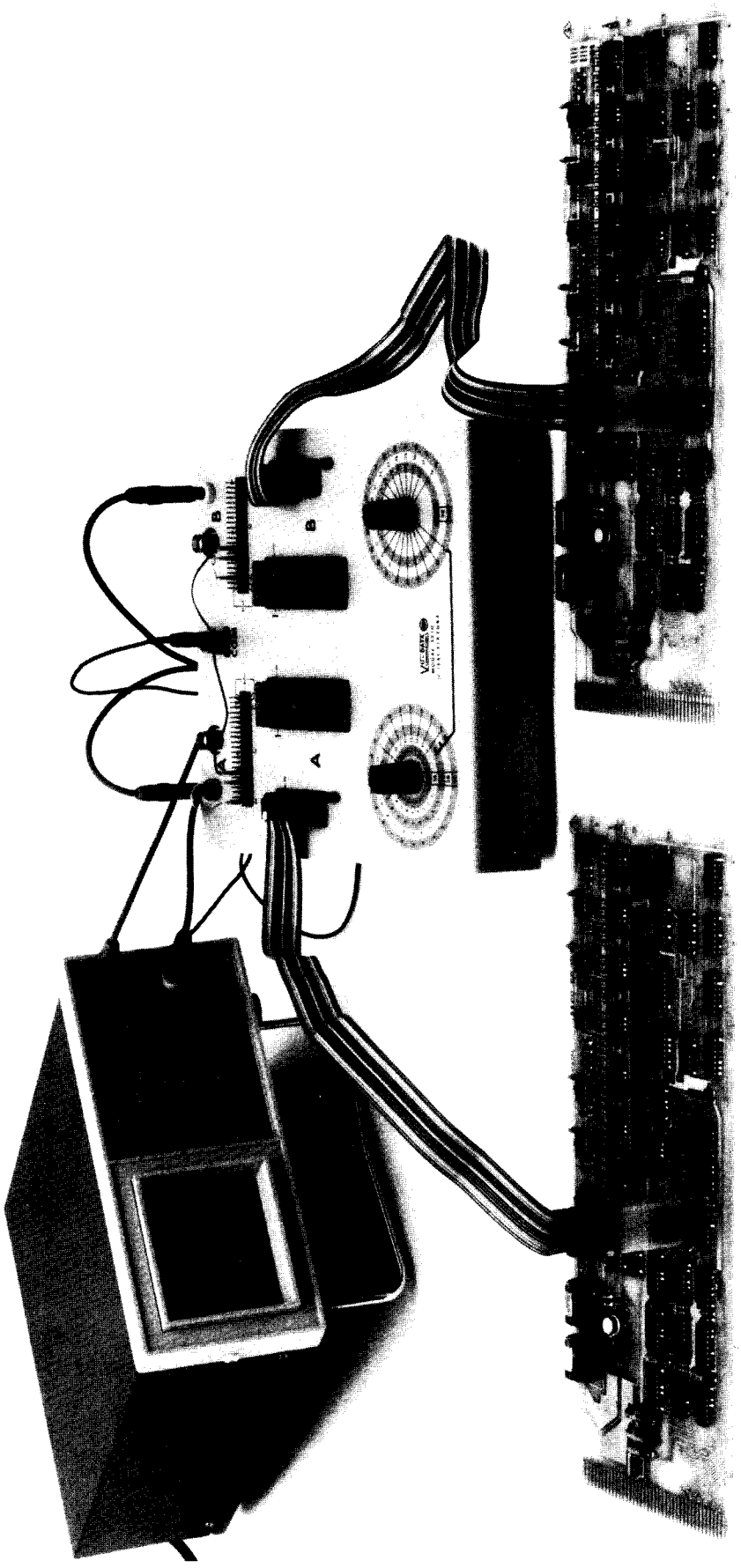


FIGURE 1. MODEL 3210 & MODEL 3110 — POWER OFF TESTING

OPERATION: POWERED CIRCUITS

CAUTION

Never connect the Model 3110 ICT in powered circuits. Damage to unit will result.

a) Disconnect the Model 3110 ICT before connecting circuit.

NOTE

The Model 3210 IC Test Fixture can be used with a dual trace oscilloscope or a DVM to compare wave forms or voltges on any pin of an IC in an operating circuit.

b) Connect DIP jumper cables to the two devices you wish to compare.

c) Use the Test Point pins to select common and/or to tie several pins on an IC together, or to ground a pin to initiate a "*test*" mode.

d) Compare the two waveforms or DC voltage levels on the oscilloscope display.

A quick comparison of HI-LO status can be made on many pins by connecting the HI and LO lines of a floating DVM to "*A*" and "*B*" and selecting the pin number(s) with Switches 1-20 and 21-40. If both devices are the same state, the DVM reads zero volts. If the device being tested is at the wrong state, the DVM will read 5V.

MODEL 3210 MAINTENANCE

Preventative Maintenance/Cleaning

CAUTION

Avoid the use of chemical cleaning agents such as MEK, laquer thinner, or strong acids or alkali. These solvents will cause paint removal, deterioration of switches and the melting of plastic parts.

Accumulation of dirt or dust should be removed when it becomes noticeable. The frequency of cleaning will depend on the environment in which it is used. Loose dust on the outside may be removed with a soft brush or cloth. A diluted household cleaner can be used but avoid abrasive cleaners. DO NOT attempt to clean the inside of the unit.

Inspection

After cleaning, a thorough inspection of the exterior unit can reveal any problem areas. Check that all screws are tight and all jacks and connectors are clean.

Replacement Parts

Individual components are generally "*off-the-shelf*" and are available at local suppliers or may be ordered from Vu-Data Corporation. If other parts are substituted, make sure that the part is a direct replacement or performance difficulties may arise.

Calibration

Calibration of this unit is not required. The instrument has no adjustments or parts requiring calibration.

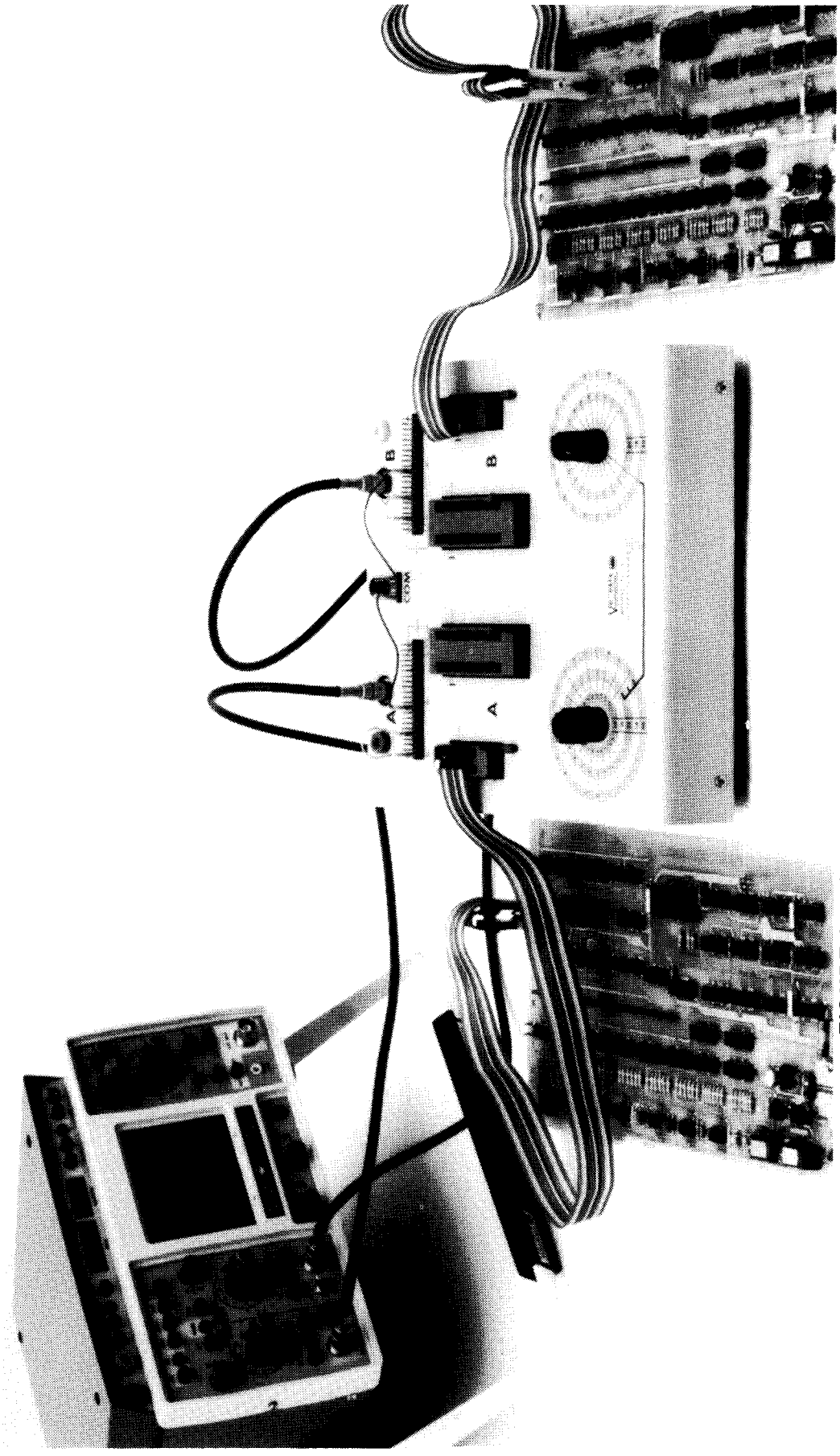


FIGURE 2. MODEL 3210 & MODEL PS975 — POWER ON TESTING

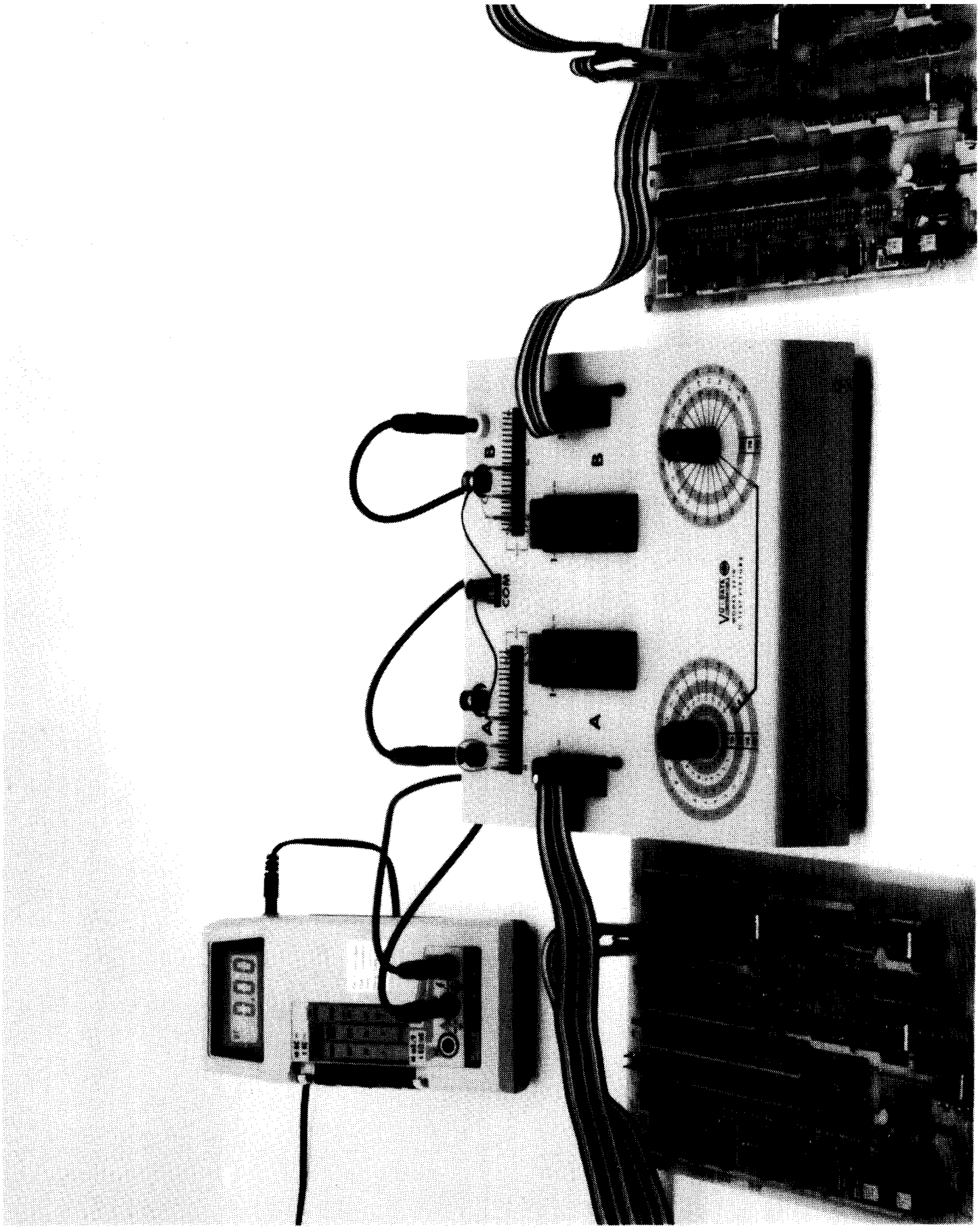


FIGURE 3. MODEL 3210 & DMM — POWER ON TESTING

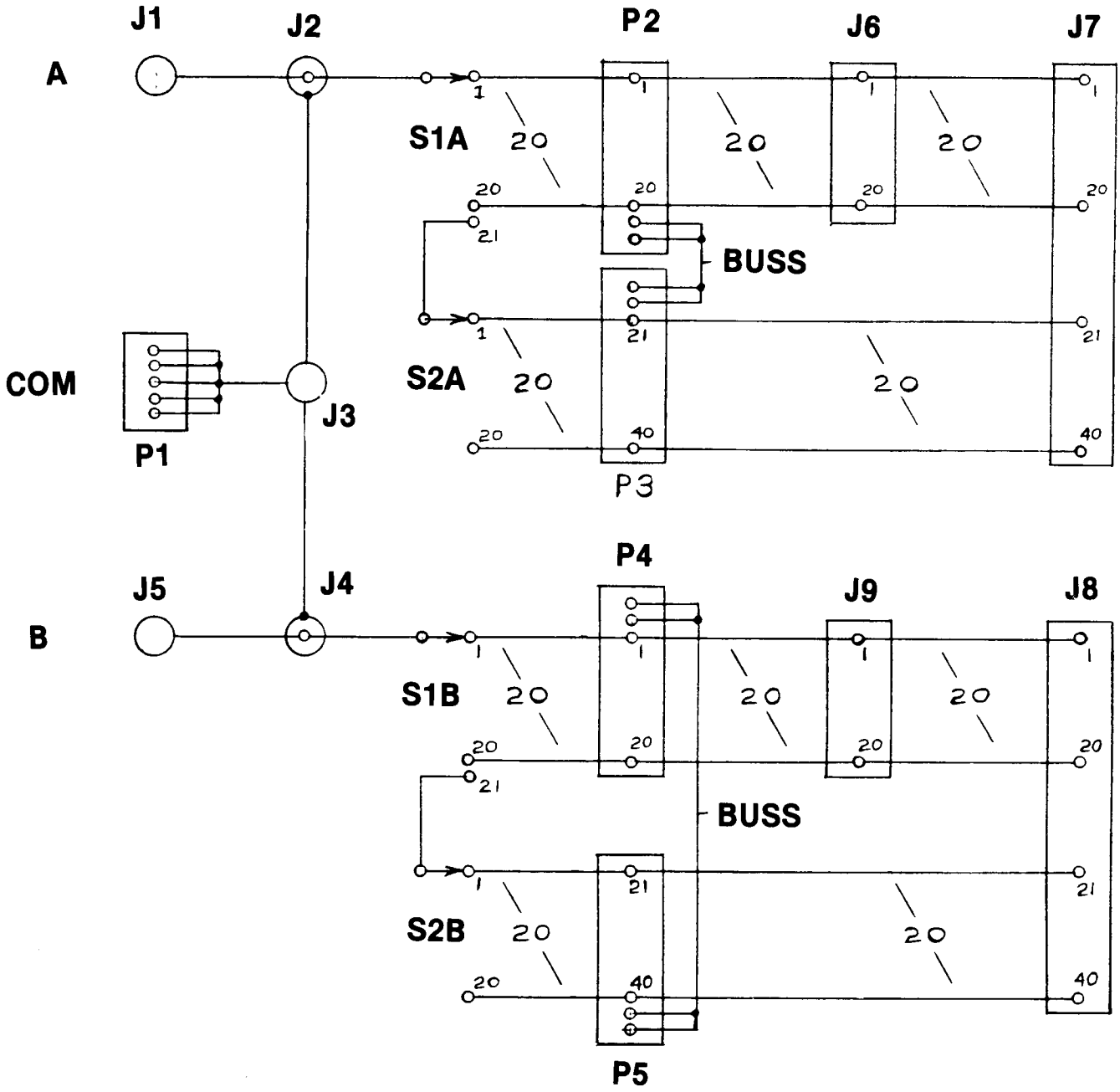


FIGURE 4. MODEL 3210 SCHEMATIC

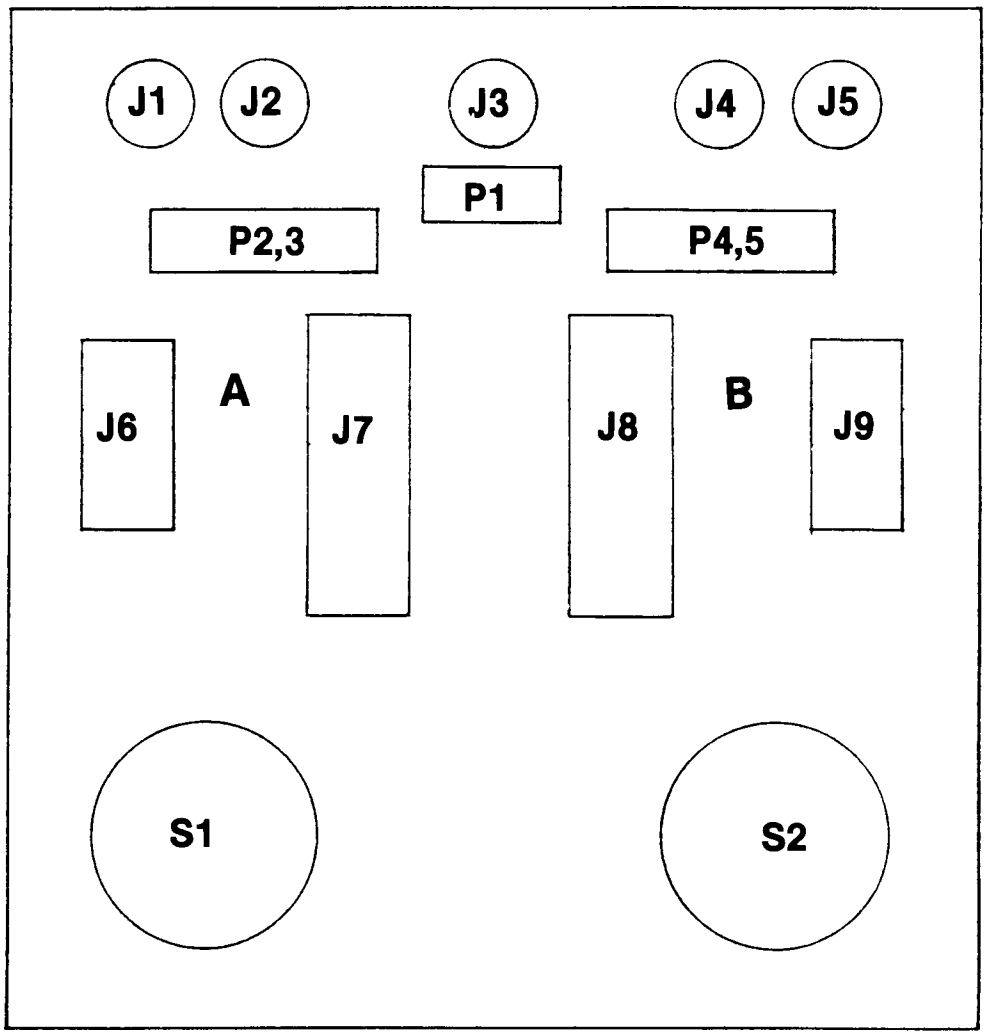


FIGURE 5. MODEL 3210 COMPONENT LOCATION

NOTES

NOTES

Table 1. Parts List Model 3210

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
		Printed Circuit Board		3210-3001-A
J2	UG1094/U	BNC-Connector		2-28998
J4	UG194/U	BNC-Connector		2-28998
S1		Pin Selector Switch		32102001
S2		Pin Selector Switch		32102001
P2	1101-1-122-02	22 Pin Header	Methode	2-24051
P3	1101-1-122-02	22 Pin Header	Methode	2-24051
P4	1101-1-122-02	22 Pin Header	Methode	2-24051
P5	1101-1-122-02	22 pin Header	Methode	2-24051
P1		5 Pin Header	(Make from	2-24049)
J5	220-3342-00-0605	20 Pin ZIF Socket	Textool	2-60019
J9	220-3342-00-0605	20 Pin ZIF Socket	Textool	2-60019
J7	240-3346-00-0605	40 Pin ZIF Socket	Textool	2-6020
J8	240-3346-00-0605	40 Pin ZIF Socket	Textool	2-6020
	32105001	Sub-Assy PCB		32105001
	32102002	Chassis		32102002
	32102003	Top Cover		32102003
	F6B	Feet	Budwig	4-20177
	023-3520	Knob; Blk Wing	Intlok	4-10013
	040-3020	Knob Cap, Large Blk	Intlok	4-10014
	243-2017	Nut Cover	Intlok	4-10032
J1	1509-102	Banana Jack - Red	H. H. Smith	4-20393
J3	1509-103	Banana Jack - Blk	H. H. Smith	4-20394
J5	1509-107	Banana Jack - Yel	H. H. Smith	4-20395
	2678	Spacer - Flat Nylon	H.H. Smith	8-60008
	1220-02	Lock Washer 3/8 int.	Hays-Blt	8-90033
		Nut 3/8		8-90009
	MS35333-75	Lock Washer 5/16 int.		8-40007
	MS51957-13	Screw - Phil Pan 4-40 1/4		8-10013
	MS52957-28	Screw - Phil Pan 6-32 3/8		8-10028
	2432009	Serial No. Decal		4-20260
		Manual, Technical		4-20405
	923884-16	16 Pin DIP Jumper Cable		4-20402
		4-inch Jumper Cable		4-20403

TECHNICAL MANUAL

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