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WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER TO THE SERVICE SAFETY SUMMARY PRIOR TO PERFORMING ANY SERVICE.

PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL

DM 5110 Programmable Digital Multimeter

DM 511 Digital Multimeter

Service

Tektronix, Inc.
P. O. Box 500
Beaverton, Oregon 97077
U.S.A.

Serial Number _____

Product Group 76

Tektronix Part No. 070-7479-00

First Printing AUG 1989

INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument.Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B000000	Tektronix, Inc. Beaverton Oregon, U.S.A.
G100000	Tektronix Guernsey Ltd., Channel Islands
E200000	Tektronix United Kingdom Ltd., London
J300000	Sony / Tektronix, Japan
H700000	Tektronix Holland N.V., Heerenveen, The Netherlands

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NOTE

The following tables are located in the diagrams foldout section at the rear of this manual

Operators Safety Summary

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply and do not appear in this summary.

TERMS

In this Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of live.

As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property including the instrument itself.

DANGER indicates a personal injury hazard immediately as one reads the markings.

SYMBOLS

In This Manual

This symbol indicates where applicable cautionary or other information is to be found.

This symbol indicates static sensitive devices, that are subject to be damaged by static electricity.

As Marked on Equipment

DANGER - High voltage

Protective ground (earth) terminal.

ATTENTION - Refer to manual.

Safety Summary (cont.)

POWER CONDITIONS

Use the Proper Power Cord

Use only the power cord and connector as specified for the instrument.

Power Source

Use the proper power source. Before switching on, make sure the instrument is set to the voltage of the power source. This product is intended to operate from a power source that will not apply more than 250 Volts RMS between the supply connectors or between either supply connector and ground. A protective ground connection by way of the grounding connector in the power cord is essential for safe operation.

Grounding the Product

This product is grounded through the grounding connector of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before making any connections to the product input or output terminals. A protective ground connection by way of the ground connection is essential for safe operation.

Danger Arising from Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulated) can render an electrical shock.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified for the instrument in the instrument part list. A replacement fuse must meet the type, voltage rating, and current rating specifications for the fuse that it replaces.

GENERAL

Do Not Operate In Explosive Atmospheres

To avoid explosions, do not operate this instrument in an atmosphere of explosive gasses.

Do Not Remove Covers or Panels

To avoid personal injury, the instrument covers or panels should only be removed by qualified service personnel. Do not operate the instrument without covers and panels properly installed.

Service Safety Summary

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the Operators Safety Summary in the DM 5110 / 511 Operators Manual

DO NOT SERVICE ALONE

Do not perform internal service or adjustment of this product unless another person, capable of rendering first aid and resuscitation is present.

USE CARE WHEN SERVICING WITH POWER ON

Dangerous voltages exist at several points in this instrument. To avoid personal injury , do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

POWER SOURCE

This product is intended to operate from a power source that will not apply more than 250 Volts rms between the supply connectors or between either supply connector and ground. A protective ground connection by way of the grounding connector in the power cord is essential for safe operation.

WARNING

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THEORY OF OPERATION

Introduction

This section contains an overall functional description of the DM 5110/ DM511.
Detailed schematics and component location drawings are located at the end of this instruction manual.

A simplified block diagram of the DM 5110/ DM511 is shown in Fig. 1-1.

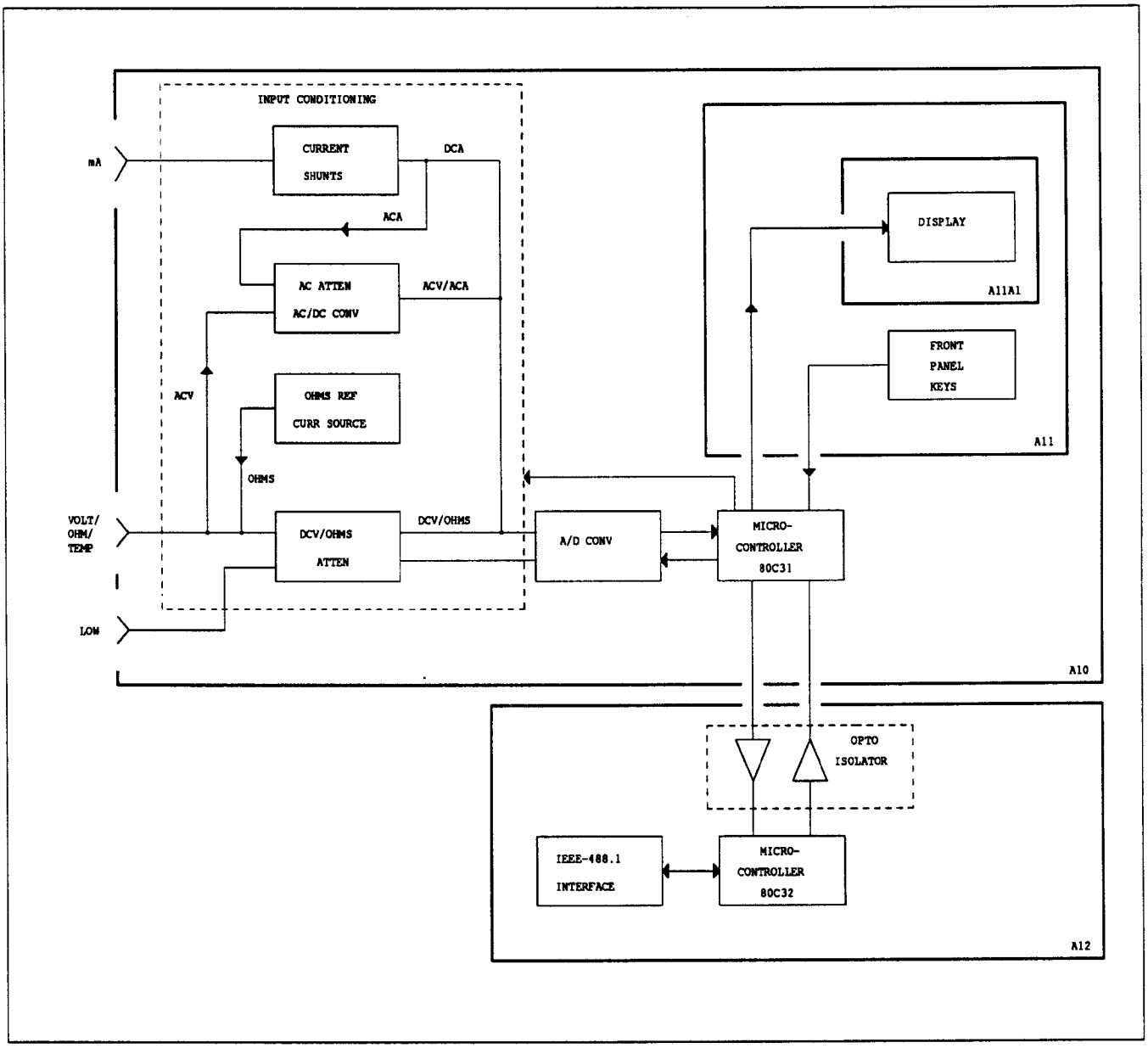


Fig. 1-1 Simplified Block Diagram

Overall Functional Description

The DM5110 may be divided into two sections: the main board and the GPIB board.
The non-programmable DM511 version does not have a GPIB board.
Both boards have their own microcontroller. Communication is done through an opto-isolated serial link.
The function of the GPIB board is protocol conversion from GPIB to the serial link with the main board.
All other functions are performed by the main board, including driving the display and scanning the keyboard.
This implies that all circuitry except for the major part of the GPIB board, is connected to the LOW input jack!!
Isolation of the floating circuitry from GND level is done at the transformer T300 on the main board and the opto-isolators U506 and U507 on the GPIB board.

WARNING

The major part of main board circuitry is connected to the floating input circuitry. When a measurement is taken, dangerous voltages can be present.

The main board can be divided in two sections: analog and digital circuitry.
The analog section consists of the signal conditioning circuits, input amplifier, A/D converter and control circuitry. The heart of the digital section is a 80C31 microcontroller.
Selecting input signal conditioning, taking measurements and control of the display board assembly, is all done by the main board microcontroller.
The number of adjustable components is reduced to a minimum; most calibration is done by software in the microcontroller.
Calibration constants are stored in EEPROM.

The GPIB board (DM5110 only) is controlled by a 80C32 microcontroller, connected to a 9914A GPIB control chip and to a receiving and a transmitting opto-isolator for communication with the main board.

Analog Circuitry

A simplified diagram of the analog circuitry is drawn in Fig. 1-2.
The detailed circuitry of the DM 5110/ DM511 analog section is located on diagram ◇1.

Input Signal Conditioning

Signal conditioning circuitry modifies the input to a signal that is usable to the A/D converter (200 mVolt or 2 Volt DC full scale).
A simplified schematic of the input circuitry, used in the DM 5110 /511 is shown in Fig.1-2.
The functions of the relays and MOS-switches are listed in Table1-1.
The relays except K104 are bi-stable, with a set and a reset coil and two contacts (A & B).
The setting in the different functions and ranges is shown in Table1-2.
The hardware functionality of dBm and dBV measurement is exactly the same as the five equivalent AC Voltage ranges.
Temperature measurement is a software converted version of the 200 Ω range, but does require separate calibration (to match the temperature probe).

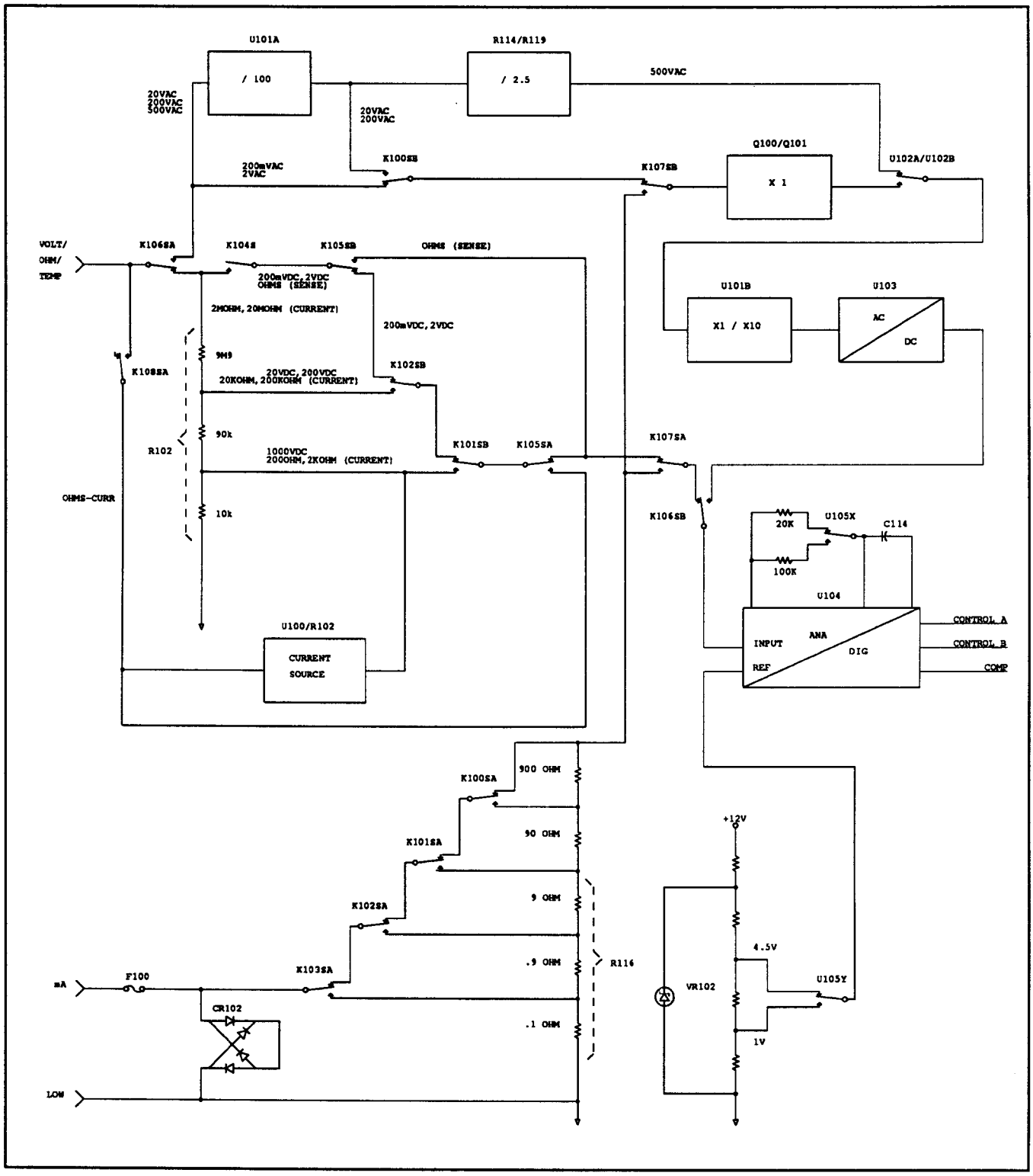


Fig. 1-2 Simplified Analog Circuitry

Table 1-1.
General Functionality of the Input Circuitry Relays and Switches:

	Set	Reset
K100SA: K100SB:	2 mA Range 20V, 200V and 500V AC ranges	Other current ranges 200 mV and 2 V AC ranges.
K101SA: K101SB:	20 mA Range 1/1000 Divider R102 @ 1000 VDC and 1µA current source in Ohms	Other current ranges Other DCV ranges and 10µA and 0.1µA current source in Ohms.
K102SA: K102SB:	200 mA current Range 1/100 Divider R102 @ 20 & 200VDC and 10 mA current source in Ohm	Other current ranges Other DCV ranges and 1 mA and 0.1 µA current source in Ohms.
K103:	2000 mA AC and DC ranges.	All other ranges.
K104:	200mV & 2 V DCV input sensit.	All other ranges.
K105:	Ohms measurement	All other functions
K106:	AC measurement	DC measurement
K107:	AC and DC Current measurement	All other functions
K108:	Ohms Current source ON	Ohms Current source OFF
IN1: IN2: IN3: N4:	ACV 1/250 divider (500 VAC) 200 mV, 2V, 20V and 200VAC U101B set to 10x amplifier U101B set to 1x amplifier	All other ACV ranges. In 500 VAC When IN4 is closed When IN3 is closed

DC Voltage (Diagram ①)

Signal conditioning in DC Voltage measurement is performed by resistor network R102. The Ohms current source and AC input circuitry are disconnected as K108 and K106 are in the reset position.
Selection of the DCV input sensitivity is done by selecting a connection directly from the input (K104S) or by tapping the divider at 1/100 (K102SB) or 1/1000 (K101SB).
The 200 mV or 2V full scale result is fed to the A/D converter from K101SB pt 13 through K105SA pt's 4-6, K107SA pt's 6-4 and K106SB pt's 11-13.
Circuitry protection is provided at CR100 and CR101, clamping at +/- 10V.

OHMS (Diagram ①)

In Ohms measurement a current source (U100) is connected to the V/Ω/TEMP input by setting relay K108. K104S in combination with K105 connects the input directly to the A/D converter from K105SB pt 9 through K107SA pt's 6-4 and K106SB pt's 11-13.
Circuitry protection is again provided by CR100 and CR101, connected to the input through K108SA pt's 8-4, R100 and R101 and K105SA pt's 8-4.
The source current that is applied to the resistor that needs to be measured, can be selected by switching relays K101 and K102.
With K101SB set, approximately 1 Volt (VR100 voltage

divided by 1.2 by R103 and R109) across R105 will result in a 1.0 mA ohms-converter current.
When K102SB is set, and K101SB reset, the same voltage across R104 in series with 90 kΩ of R102 will result in a 10 µA ohms-converter current.
With both K101SB and K102SB reset, the 9.9 MΩ in series with 90 kΩ of R102 and R140, will generate the 0.1 µA current that is required in the 2 MΩ and 20 MΩ ranges.

AC Voltage (Diagram ◇1)

The circuitry for measuring AC Voltage consists of an active divider U101A, a source-follower at FET's Q100 and Q101, an amplifier with selectable 1x and 10x gain U101B, and a true RMS converter U103.
As the sensitivity of the true RMS converter is 2 Volts, all conditioning of the AC input ranges should result in a 2 Volt full scale signal.
To measure AC, K106 is set.
In the 200 mV and 2 V range, the input signal is AC coupled from K106SA pt 8, fed through K100SB pt's 11-13 and K107SB pt's 11-13, to the source follower Q100 and Q101.
Circuitry protection is provided here at CR103 and CR104, clamping at +/- 10V.
The variable resistor R121 enables offset adjustment of the follower circuitry. A minimal offset voltage prevents auto-ranging to be disturbed by momentary DC voltages immediately after switching ranges. Especially when switching between 2 V and 20 V AC ranges, this adjustment has significant influence.
The output of the source follower is fed through MOS switch U102B to amplifier U101B. The 200 mV range will be amplified to 2 Volt full scale by U102C closed and U102D open. In the 2 V range, U101B functions as unity gain amplifier, by opening U102C and closing U102D.
True RMS converter U103 is followed by a two-pole filter C115, C116, R133 and R134 to achieve a high-pass filter. Especially in the range from 20 to 50 Hz this network is of great value.
The resulting positive DC voltage is fed to the A/D converter by K106SB pt's 9-13.

In the 20 V and 200 V AC ranges, the input signal is AC coupled from K106SA pt 8, and fed to the active 1/100 divider U101A.
AC compensation of this circuit can be done by trimming resistor R113.
Through K100SB pt's 9-13 and K107SB pt's 11-13, the resulting signal is routed to the source follower Q100 and Q101.
The following circuitry is the same as with the previously mentioned 200 mV and 2 V AC ranges.

In the 500 V AC range, an additional 1 / 2.5 divider R114 and R119 is switched in and the source follower is bypassed, by closing MOS switch U102A instead of U102B.
Unity gain amplification by U101B will feed the resulting 2 Volt full scale signal to the true RMS converter.

DC Current (Diagram ◇1)

The mA input is clamped by CR102, and protected for overcurrent by fuse F100.
Selection of the current range can be done by selecting 0.1 Ω, 1.0 Ω,10 Ω, 100 Ω or 1 kΩ shunt resistance.
This is done by switching relay contacts K103SA & SB,K102SA, K101SA and K100SA.
The resulting voltage (200 mVolt full scale) is fed through K107SA pt's 8-4 and K106SB pt's 11-13 to the A/D converter.

AC Current (Diagram ◇1)

Selection of current range shunt resistance is similar to the DC Current ranges.
The resulting 200 mVolt full scale voltage is routed from K100SA pt 6 through K107SB pt's 9-13 to the source follower Q100 and Q101 in the AC circuitry.
The output of the source follower is amplified 10x by U101B to achieve the required 2 Volt full scale signal for the true RMS converter.

A/D Converter (Diagram ◇1)

The DM 5110/ DM511 uses a TL500C analog processor (U104), performing dual- and multislope analog-to-digital conversion.
A simplified schematic of the A/D converter used in the DM 5110/ DM511 is shown in Fig. 1-2.

Table 1-2 Input Circuitry Settings

DC Voltage	K100	K101	K102	K103	K104	K105	K106	K107	K108	IN1	IN2	IN3	IN4	A/D SENS.
200 mV	Reset	Reset	Reset	Reset	Set	Reset	Reset	Reset	Reset	ON	OFF	OFF	ON	200 mV
2 V	Reset	Reset	Reset	Reset	Set	Reset	Reset	Reset	Reset	ON	OFF	OFF	ON	2 V
20 V	Reset	Reset	Set	Reset	Reset	Reset	Reset	Reset	Reset	ON	OFF	OFF	ON	200 mV
200 V	Reset	Reset	Set	Reset	Reset	Reset	Reset	Reset	Reset	ON	OFF	OFF	ON	2 V
1000 V	Reset	Set	Reset	Reset	Reset	Reset	Reset	Reset	Reset	ON	OFF	OFF	ON	2 V
Ohms	**K100**	**K101**	**K102**	**K103**	**K104**	**K105**	**K106**	**K107**	**K108**	**IN1**	**IN2**	**IN3**	**IN4**	**A/D SENS.**
200 Ω	Reset	Set	Reset	Reset	Set	Set	Reset	Reset	Set	ON	OFF	OFF	ON	200 mV
2 kΩ	Reset	Set	Reset	Reset	Set	Set	Reset	Reset	Set	ON	OFF	OFF	ON	2 V
20 kΩ	Reset	Reset	Set	Reset	Set	Set	Reset	Reset	Set	ON	OFF	OFF	ON	200 mV
200 kΩ	Reset	Reset	Set	Reset	Set	Set	Reset	Reset	Set	ON	OFF	OFF	ON	2 V
2 MΩ	Reset	Reset	Reset	Reset	Set	Set	Reset	Reset	Set	ON	OFF	OFF	ON	200 mV
20 MΩ	Reset	Reset	Reset	Reset	Set	Set	Reset	Reset	Set	ON	OFF	OFF	ON	2 V
DC Current	**K100**	**K101**	**K102**	**K103**	**K104**	**K105**	**K106**	**K107**	**K108**	**IN1**	**IN2**	**IN3**	**IN4**	**A/D SENS.**
200 mA	Reset	Reset	Reset	Reset	Reset	Reset	Reset	Set	Reset	ON	OFF	OFF	ON	200 mV
2 mA	Set	Reset	Reset	Reset	Reset	Reset	Reset	Set	Reset	ON	OFF	OFF	ON	200 mV
20 mA	Reset	Set	Reset	Reset	Reset	Reset	Reset	Set	Reset	ON	OFF	OFF	ON	200 mV
200 mA	Reset	Reset	Set	Reset	Reset	Reset	Reset	Set	Reset	ON	OFF	OFF	ON	200 mV
2 A	Reset	Reset	Reset	Set	Reset	Reset	Reset	Set	Reset	ON	OFF	OFF	ON	200 mV
AC Voltage	**K100**	**K101**	**K102**	**K103**	**K104**	**K105**	**K106**	**K107**	**K108**	**IN1**	**IN2**	**IN3**	**IN4**	**A/D SENS.**
200 mV	Reset	Reset	Reset	Reset	Reset	Reset	Set	Reset	Reset	OFF	ON	ON	OFF	200 mV
2 V	Reset	Reset	Reset	Reset	Reset	Reset	Set	Reset	Reset	OFF	ON	OFF	ON	200 mV
20 V	Set	Reset	Reset	Reset	Reset	Reset	Set	Reset	Reset	OFF	ON	ON	OFF	200 mV
200 V	Set	Reset	Reset	Reset	Reset	Reset	Set	Reset	Reset	OFF	ON	OFF	ON	200 mV
500 V	Set	Reset	Reset	Reset	Reset	Reset	Set	Reset	Reset	ON	OFF	OFF	ON	200 mV
AC Current	**K100**	**K101**	**K102**	**K103**	**K104**	**K105**	**K106**	**K107**	**K108**	**IN1**	**IN2**	**IN3**	**IN4**	**A/D SENS.**
200 mA	Reset	Reset	Reset	Reset	Reset	Reset	Set	Set	Reset	OFF	ON	ON	OFF	2 V
2 mA	Set	Reset	Reset	Reset	Reset	Reset	Set	Set	Reset	OFF	ON	ON	OFF	2 V
20 mA	Reset	Set	Reset	Reset	Reset	Reset	Set	Set	Reset	OFF	ON	ON	OFF	2 V
200 mA	Reset	Reset	Set	Reset	Reset	Reset	Set	Set	Reset	OFF	ON	ON	OFF	2 V
2 A	Reset	Reset	Reset	Set	Reset	Reset	Set	Set	Reset	OFF	ON	ON	OFF	2 V

NOTE
Settings in dBV and dBm are equal to the equivalent ACV ranges.
Settings in Temperature measurement are the same as in 200 Ω.

The TL500C is used in two sensitivity modes (200 mV and 2 V), two line-frequency settings (50 and 60 Hz) and two resolution settings (3.5 and 4.5 digit). The sensitivity is selected by switching between two different reference voltages and two integration resistors (analog multiplexer U105).
Also, there is a difference in timing (controlled by the microcontroller).
The 50/60 Hz setting is implemented by measuring the input signal in multiples of 20 or 16.66 msec.
In the 3.5 digit mode the microcontroller controls the TL500C to measure the input in a reasonably fast dual slope conversion cycle.
In 4.5 digit a more complicated multi-slope is performed, which, in a way, is a sequence of 5 or 6 (50 or 60 Hz setting) 3.5 digit measurements.

A special method of measurement is performed in the 20 MΩ range.
Then, in both 3.5 and 4.5 digit mode, a dual slope with special settings is performed.
Table 1-3 shows the combination of the three different parameters and their relation with the measurement slope.

Timing of the measurement process is completely done in the software of the 80C31 microcontroller driving the CONTRA and CONTRB lines of the TL500C analog processor (Table 1-4).

Table 1-3
A / D Converter Settings

Resolution	A/D conv. Sensitivity	Line-frequency setting	Number of input-integration periods per measurement	Duration of one input integration period.	Reference Voltage	Integration Resistance	Duration Autozero periods.
3.5	200 mV	50 Hz	1	20.000 msec.	1 Volt	20 kΩ	10 msec.
3.5	200 mV	60 Hz	1	16.667 msec.	1 Volt	20 kΩ	10 msec.
3.5	2 V	50 Hz	1	20.000 msec.	4.5 Volt	100 kΩ	10 msec.
3.5	2 V	60 Hz	1	16.667 msec.	4.5 Volt	100 kΩ	10 msec.
4.5	200 mV	50 Hz	5	40.000 msec.	1 Volt	20 kΩ	70 msec.
4.5	200 mV	60 Hz	6	33.333 msec.	1 Volt	20 kΩ	70 msec.
4.5	2 V	50 Hz	5	20.000 msec.	4.5 Volt	100 kΩ	70 msec.
4.5	2 V	60 Hz	6	16.667 msec.	4.5 Volt	100 kΩ	70 msec.
Special settings in 20 MΩ range:							
3.5	2 V	50 Hz	1	20.000 msec.	1 Volt	100 kΩ	30 msec.
3.5	2 V	60 Hz	1	16.667 msec.	1 Volt	100 kΩ	30 msec.
4.5	2 V	50 Hz	1	20.000 msec.	1 Volt	100 kΩ	70 msec.
4.5	2 V	60 Hz	1	16.667 msec.	1 Volt	100 kΩ	70 msec.

Table 1-4.
TL500C Conversion Control

CONTRA	CONTRB	Function of the TL500C
0	0	Auto-zero state
0	1	Negative de-integration of reference Voltage
1	0	Positive de-integration of reference Voltage
1	1	Integration of input signal

The microcontroller can also select the four combinations of the two reference voltages and two integration resistors by controlling the analog multiplexer U105 at the "200MV" and "FAST" lines (Table 1-5).

Table 1-5.
TL500C Sensitivity Control

200 MV	FAST	Reference Voltage	Integration Resistance
0	0	4.5 Volt	100 kΩ
0	1	1 Volt	100 kΩ
1	0	1 Volt	20 kΩ
1	1	4.5 Volt	20 kΩ

The output of the TL500C analog processor is the "COMP" output, indicating positive or negative charge in the integrator circuit.
Basically, a measurement is taken by charging the integrator capacitor C114 through a 20 or 100 kΩ resistor by the input voltage for a period of time that is related to the line frequency. Then, the time it takes to discharge with the same resistor and the reference voltage, is measured. This is done by pulse width measurement on the "COMP" line.
All the timing required is done internally in the 80C31 microcontroller.
At 2 V sensitivity, integration is usually done with a reference of 4.5 Volt and 100 kΩ resistance.
At 200 mV, a times 5 increase of sensitivity is achieved by lowering the resistance to 20 kΩ. Subsequently, to keep the discharge current at a value close to the setting in 2 V sensitivity, the reference voltage is decreased to about 1 V.

To get the 10 times ratio, required in the 4.5 digit mode, all input integration periods are doubled in the 200 mV ranges.
In the 3.5 digit mode, the resolution is sufficient and speed of operation is of great importance.
In 3.5 digit mode the input integration timing in 200 mV and 2V sensitivity is the same.
A special setting is the 20 MΩ measurement, where a dual slope conversion with 4.5 digit resolution is required at 2 V sensitivity. Here the 1 V reference is used in combination with the 100 kΩ resistor.
Another special setting is the 4.5 V reference with 20 kΩ resistor. This is used occasionally for fast discharge of the integrator capacitor, when overrange has been detected.

Digital Circuitry

The DM 5110/ DM511 main board is controlled by a 80C31 microcontroller.
This section briefly describes the operation of the microcontroller and associated digital circuitry. Refer to diagram ◇2◇ for circuit details.

Microcontroller (Diagram ◇2◇)

The 80C31 microcontroller (U210) has direct control over the display, the front panel switches, the A/D converter and the serial link with the GPIB board.
Power up control is handled by the supply-voltage supervisor circuit U203.
Also the circuitry connected to U208A, U208B and U208F makes sure that at power up the outputs of the relays and display drivers are disabled.
Continued activity of the microcontroller driven clock line (U210 pt.7), will enable these functions.

Timing for the microcontroller is accomplished by the use of X200, an 9.830400 MHz crystal. Internally, this frequency is divided down by twelve to obtain an instruction cycletime of 1.224 microseconds.
Instrument operation software is stored in EPROM U212. The revision level of this software can be displayed by pushing the INST ID key during power up.

From the multiplexed address/data bus, the lower address byte is latched in the 8 bits latch U211, timed by the ALE/P output of the 80C31.
Calibration constants, are stored in the serially coupled EEPROM U209.

The crystal frequency is also used for clocking the ripple counter U206.
A 600 Hz signal from U206 is connected to the INT1 interrupt input of the microcontroller. This interrupt period of 1.66667 msec. is the "heartbeat" of the measurement process. It is used to create accurate timing to control the A/D converter. Also refresh of the display and reading switches is done at 600 Hz.

Because it is not possible to achieve an absolutely exact timing for the control of the A/D converter, the output of P1.0 and P1.1 is synchronized by a set of flip-flop's (U204), clocked by a 153600 Hz output of U206 pt.4. The synchronized lines are connected to CONTRA and CONTRB of the TL500C analog processor.
The output "COMP" of the TL500C, in combination with CONTRA and CONTRB, is connected to the multiplexer U207.
A logic function is performed to generate a signal at the INT0 input of the microcontroller that is "1" during de-integration, and goes low as soon as the integrator crosses zero. The pulse width of this signal is used by a 16 bits internal counter of the 80C31 for making measurements.

A 1200 Hz connection from U206 pt.2 is used as beeper frequency.

The control of the display, and scanning the switches, is done serially through direct connections from the microcontroller to connector J200.
To read the only switch on the main board (FRONT/ REAR) transistor Q200 is connected to the "SWITCH" line. When the switch is in the "REAR" position, the emitter of Q200 will be pulled low by the current shunt resistances enabling Q200 to pull the "SWITCH"line "LOW".. In the firmware, current measurement is set to 0000, when switch S100 is in the "REAR" position. In this way, measurement of the sense current is disabled.
To drive relays, MOS switch control lines of the A/D converter and the beeper, a 24 output shift register is configured from U202, U201 and U200. These three IC's with latched open collector outputs are driven serially by the 80C31.
For communication with the GPIB board (DM5110), the TXD and RXD lines of the microcontroller are indirectly connected to J201.

Display Circuitry (Diagram ◈4)

Display information is serially clocked in shift registers U401 and U404.
The separate LED's are connected in a matrix together with the 7-segment displays (9x6). Data is first clocked in U401 and U404 and afterwards latched to the output. The cathodes are driven by the open collector transistor network U407.
Every 1.666 msec. interrupt, the microcontroller will drive the next common cathode. The common cathode D6 is turned "on" during 2 interrupt periods .
Therefore, a full display scan takes 7 interrupt periods (11.66 msec).
Before driving D6 for the second time, a "1" is shifted through the outputs of U401 and U404, to read all the switches and the CAL jumper setting one by one at the "switch" -line.
The FRONT/REAR switch setting is read by pulsing T0 of the microcontroller.
When reading switches is finished, the display data of D6 is refreshed.

Main board Power Supply (Diagram ◈3)

For the main board circuitry, a 26 VAC primary power is supplied by the power module to the power transformer T300 .
T300 has three secondary windings; one for the +5 V analog supply and two for the +/- 12 V analog supply.
CR300 and CR301 provide full wave rectification, while U300, U301, and U302 provide the regulation.
The analog and digital grounds of the main board circuitry are connected to the LOW input jack.

GPIB Board (Diagram ⑤)

The DM 5110 GPIB board is controlled by a 80C32 microcontroller (U500).
Power up control is handled by the supply-voltage supervisor circuit U510.
Timing for the microcontroller is accomplished by the use of Y500, a 9.830400 MHz crystal. Internally, this frequency is divided down by twelve to obtain a instruction cycle time of 1.224 microseconds.
Instrument operation software is stored in EPROM U504.
The revision level of this software can be checked by the GPIB "ID" query.
From the multiplexed address/data bus, the address byte is latched in the 8 bits latch U502, timed by the ALE/P output of the 80C32.
The GPIB address and terminator settings are stored in the EEPROM of the main board.
Before being able to react to the GPIB bus, the boards exchange data through the serial link. When this is successfully done, the diagnostic LED DS500 on the GPIB board will blink at a one second repetition rate.
When this procedure fails, the diagnostic LED will be "off" constantly, and the GPIB board will not react to GPIB bus commands.

For the communication with the main board, the TXD and RXD lines of the microcontroller are connected with opto-isolators U506 and U507.
Up to these opto-isolators, the circuitry is at chassis ground level.
The parts R507, R508, R509, Q501, C508 and the connector P501 are all at the same voltage level as the LOW input jack of the DMM.

WARNING

Part of the GPIB board is connected to the floating input circuitry. When a measurement is taken, dangerous voltages can be present.

To perform the GPIB interface, the GPIB board is equipped with a TI 9914A GPIB chip (U505). The 9914A is capable of performing all IEEE talker-listener protocols. The bidirectional data lines AD0 through AD7 permit the transfer of data between the microcontroller and U505. The 9914A is mapped in the "data memory" field of the 80C32 microcontroller. Data is buffered by U508 and U509 and connected to the IEEE 488.1 bus via connector P502.

The +5 V digital supply for the GPIB board is derived from +8 VDC supplied by the power module via P301 and J303 on the main board to P500 on the GPIB board. Regulation is provided by U503.

PERFORMANCE CHECK PROCEDURE

Introduction

This procedure verifies that the DM 5110 or DM 511 is operating within the limits of the performance requirements as listed in the Specification section of the DM 5110/511 Instruction manual.

To ensure instrument accuracy, check the performance every 1000 hours of operation or at a minimum of every six months if used infrequently.

This procedure may also be used to determine acceptability of performance in an incoming inspection facility; it may also be used whenever there is a question of instrument accuracy, following repair or internal adjustment.

If the instrument fails to meet these performance checks, or adjustment is considered to be needed, a qualified service person should perform the adjustment procedure in Section 3 and repeat the Performance Check Procedure.

If readjustment does not correct discrepancy, circuit troubleshooting is needed.

NOTE

If the instrument performance falls outside the specified range and it is still under warranty, contact Tektronix, Inc.

Services Available

Tektronix, Inc. provides complete instrument repair and adjustment at local field service centers and at the factory service center.

Contact your local Tektronix field office or representative for further information.

Environmental Conditions

All performance checks should be made at 18 - 28 °C (65 - 82 °F) and at less than 75% relative humidity.

The DM 5110/511 must be turned on and allowed to warm up for at least 30 minutes before beginning the performance checks.

After exposure to or storage in high humidity (condensing) environment one hour warm-up time is required.

Recommended Test Equipment

The test equipment listed in Table 2-1, or equivalent is suggested to make the performance checks.

NOTE

For optimal conditions during performance checks, it is required to use a DM5110 in a TM5000 series mainframe, and a DM511 in a TM500 version.

NOTE

The performance limits in this procedure do not include test equipment tolerance.

Table 2-1
Test Equipment Required

Description	Performance Specifications	Required for these Checks	Recommended
DC Voltage Calibrator	Range, 0 to 1000V; accuracy, +/- 0.01 %	DC Volts, DC Current	Fluke Model 343A or 341A
AC Voltage Calibrator + AC Power Amplifier	Range, 0 to 1000V; accuracy +/- 0.05 %, 20Hz to 20kHz Adjustable +/- 0.2 Hz at 50 Hz and 60 Hz.	TRMS AC Volts, TRMS AC Current	Fluke 5200A Fluke 5215A
Resistance Calibrator	Range, 0 - 20 MΩ; accuracy +/- 0.05 %	Ohms	Electro Scientific Industries, Inc. Model DB62 Dekabox
Current Calibrator	0 to 2 A AC, sine wave from 20 Hz to 10 kHz; accuracy, +/- 0.06 %. Range 0 to 2 Amps DC, accuracy +/- 0.01 %.	AC Current, DC Current	Valhalla 2500E AC-DC Current Calibrator
Shorting plug	Tektronix		PN 134-0012-00
Temperature	Temp. bath: 0 °C +/- 0.1 °C Temp. bath:100 °C +/- 0.1 °C	Temperature probe check and adjustment	RTE 4 Neslab ZX3 Tamson

Preparation

1. Insert instrument into the power module.
2. Check that the line selector (on the power module/ cabinet) is set to the correct voltage.
3. Turn on the power.
4. Allow the instrument to warm up for at least 30 minutes before continuing with the performance checks. (See Environmental Conditions above.)
5. Check to see that the DMM is set at the proper line-frequency.

Check Procedures

NOTE
In the following procedure, the DM 5110 and DM 511 instruments are referred to as DMM.

The following steps are for verifying the accuracy specifications of the DM5110 or DM 511 at 4 1/2d resolution, for each of the six measuring functions: DC voltage, TRMS AC voltage, resistance, TRMS AC current, DC current and Temperature. These procedures are intended for use by qualified personnel using accurate and reliable test equipment.

WARNING

To prevent a shock hazard, do not exceed 1000 V peak between input low and chassis ground. Some of the procedures in this section may expose the user to dangerous voltages. Use standard safety precautions when such dangerous voltages are encountered.

All following measurement procedures need to be performed with the following settings:

Resolution	4.5 digit (right hand digit ON)
NULL-mode OFF	NULL-led OFF)
Autoranging	(AUTO-led ON)
In RUN mode	HOLD-led OFF)

NOTE

The dBm and dBV functions are recalculated AC Voltage ranges.
Checking AC Voltage will suffice.

1. Check DC Volts

Test Equipment Required:

DC Voltage Calibrator
Standard Test Leads
Shorting plug

CAUTION

Do not exceed 1000 V peak between the input V/Ω/TEMP and LOW terminals or instrument damage may occur.

a. Set the DMM to DCV measurement function by pressing the DCV key.
b. Short the LOW and V/Ω/TEMP jacks together with a shorting plug.
c. Select the 200 mVolt range.
d. CHECK-DMM display reads .000 mV +/- 3 counts.
e. Select the 2 Volt range.
f. CHECK-DMM display reads 0.00 mV +/- 2 counts.
g. Repeat steps e and f in 20, 200 and 1000 Volt ranges.
h. Remove the shorting plug and connect the DMM to the DC voltage calibrator.
i. Select autoranging.
j. Check the 200mV, 2 V, 20 V, 200 V and 1000 V ranges by applying the respective DC voltage levels listed in Table 2-2.
k. Repeat step j while applying negative voltages.

Table 2-2
Limits for DC Volts check

DMM DCV Range	Applied DC Voltage	Reading Limits (18 to 28°C)
200 mV	190.000 mV	189.87 to 190.13 mV
2 V	1.90000 V	1.8988 to 1.9012 V
20 V	19.0000 V	18.987 t0 19.013 V
200 V	190.000 V	189.88 to 190.12 V
1000 V	1000.00 V	999.3 to 1000.7 V

2. Check TRMS AC Volts

Test Equipment Required:

AC Voltage Calibrator
AC Power Amplifier
Standard Test Leads

CAUTION

Do not exceed 1000 V peak or RMS 500 V between the input VΩ/TEMP and LOW terminals or instrument damage may occur.

a. Set the DMM to ACV measurement function by pressing the ACV key.
b. Connect the DMM to the AC voltage calibrator and the power amplifier .
c. Select autoranging.
d. Set the calibrator to output 190 mV at a frequency of 20 Hz.
e. CHECK-the reading is within the limits listed in Table 2-3.
f. Repeat the 190 mV measurement at the other frequencies specified in Table 2-3.
g. Repeat the procedure for the 2 V, 20 V, 200 V and 500 V ranges by applying the respective AC voltages and frequencies listed in Table 2-3.
h. CHECK-the reading for each range should be within the limits listed in Table 2-3.

Table 2-3
Limits for TRMS AC VOLTS Check

DMM ACV Range	Applied AC Voltage	Reading Limits (18°C to 28°C)				
		20 Hz	100 Hz	1 kHz	20 kHz	50 kHz
200 mV	190.000 mV	188.38 to 191.62	189.33 to 190.67	189.33 to 190.67	188.76 to 191.24	188.00 to 192.00
2 V	1.90000 V	1.8838 to 1.9162	1.8933 to 1.9067	1.8933 to 1.9067	1.8876 to 1.9124	1.8800 to 1.9200
20 V	19.0000 V	18.838 to 19.162	18.933 to 19.067	18.933 to 19.067	18.876 to 19.124	18.800 to 19.200
200 V	190.000 V	188.38 to 191.62	189.33 to 190.67	189.33 to 190.67	188.76 to 191.24	188.00 to 192.00
500 V	500.000 V	495.7 to 504.3	498.2 to 501.8	498.2 to 501.8	496.7 to 503.3	494.7 to 505.3

3. Check Ohms

Test Equipment Required:

Resistance Calibrator
Standard Test Leads
Shorting plug

CAUTION

Do not exceed 300 V peak between the input V/Ω/TEMP and LOW terminals during Ohms measurement, or instrument damage may occur.

a. Set the DMM to Ohms measurement function by pressing the Ω key.
b. Short the LOW and V/Ω/Temp Jacks together with a shorting plug.
c. Select the 200 Ω range.
d. CHECK-DMM display reads between 0.00 Ω and 0.04 Ω (Table 2-4).
e. Select the 2 kΩ range.
f. CHECK-DMM display reads between 0.000 kΩ and 0.002 kΩ (Table 2-4).
g. Repeat steps e and f in 20 kΩ, 200 kΩ, 2 MΩ and 20 MΩ ranges.
h. Remove the shorting plug and connect the DMM to the Resistance Calibrator.
i. Select autoranging.
j. Check the 200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ and 20 MΩ ranges by applying the respective resistance listed in Table 2-4.

Table 2-4
Limits for Ohms Check

DMM Ohms Range	Applied Resistance	Reading Limits (18 to 28°C)
200 Ω	Short	00.00 to 00.04
2 kΩ	Short	00.00 to 00.02
20 kΩ	Short	00.00 to 00.04
200 kΩ	Short	00.00 to 00.02
2 MΩ	Short	00.00 to 00.04
20 MΩ	Short	00.00 to 00.02
200 Ω	100.000 Ω	99.91 to 100.09 Ω
2 kΩ	1.00000 kΩ	.9993 to 1.0007 kΩ
20 kΩ	10.0000 kΩ	9.991 to 10.009 kΩ
200 kΩ	100.000 kΩ	99.93 to 100.07 kΩ
2 MΩ	1.00000 MΩ	.9986 to 1.0014 MΩ
20 MΩ	10.0000 MΩ	9.988 to 10.012 MΩ

4. Check DC Current

Test Equipment Required:

Current Calibrator
DC Voltage Calibrator
Standard Test Leads

CAUTION

Do not exceed 2 A to the mA and LOW input terminals or the internal current fuse will blow.

a. Set the DMM to DC Current measurement function by pressing the DCA key.
b. Use the DMM with open jacks.
c. Select the 200 µAmps range.
d. CHECK-DMM display reads 0.00 µA +/- 2 counts.
e. Repeat steps c and d in 2, 20, 200 and 2000 mA ranges.
f. Connect the DMM to the DC current calibrator.
g. Select autoranging.
h. Check the 200 µA, 2 mA, 20 mA, 200 mA and 2000 mA ranges by applying the respective DC currents listed in Table 2-5.
i. Repeat step h while applying negative currents.

Table 2-5
Limits DC current Check

DMM DCA Range	Applied DC Current	Reading Limits (18 to 28°C)
200 µA	190.000 µA	189.79 to 190.21 µA
2 mA	1.90000 mA	1.8979 to 1.9021 mA
20 mA	19.0000 mA	18.979 to 19.021 mA
200 mA	190.000 mA	189.79 to 190.21 mA
2000 mA	1900.00 mA	1897.9 to 1902.1 mA

5. Check TRMS AC Current

Test Equipment Required:

Current Calibrator
AC Voltage Calibrator
Standard Test Leads

CAUTION

Do not exceed 2 A to the mA and LOW input terminals or the internal current fuse will blow.

a. Set the DMM to AC Current measurement function by pressing the ACA key.
b. Connect the DMM to the AC current calibrator .
c. Select autoranging.
d. Set the calibrator to output 190 µA at a frequency of 20 Hz.
e. CHECK-the reading is within the limits listed in Table 2-6.
f. Repeat the 190 µA measurement at the other frequencies specified in Table 2-6.
g. Repeat the procedure for the 2, 20, 200, and 2000 mA ranges by applying the respective AC currents and frequencies listed in Table 2-6.
h. CHECK-the reading for each range should be within the limits listed in Table 2-6.

Table 2-6
Limits for TRMS AC Current check

DMM ACA Range	Applied AC Current	Reading Limits (18 C to 28 C)			
		20 Hz	100 Hz	1 kHz	10 kHz
200 µA	190.000 µA	188.38 to 191.62	189.33 to 190.67	189.33 to 190.67	189.33 to 190.67
2 mA	1.90000 mA	1.8838 to 1.9162	1.8933 to 1.9067	1.8933 to 1.9067	1.8933 to 1.9067
20 mA	19.0000 mA	18.838 to 19.162	18.933 to 19.067	18.933 to 19.067	18.933 to 19.067
200 mA	190.000 mA	188.38 to 191.62	189.33 to 190.67	189.33 to 190.67	189.33 to 190.67
2000 mA	1900.00 mA	1883.8 to 1916.2	1893.3 to 1906.7	1893.3 to 1906.7	1893.3 to 1906.7

6. Check Temperature

Test Equipment Required:

Temp. bath: 0 °C +/- 0.1 °C
Temp. bath:100 °C +/- 0.1 °C

a. Set the DMM to Temperature measurement function by pressing the HOLD and TEMP key.
b. Connect the P6602 Probe to which the DMM is calibrated to the LOW and V/Ω/TEMP jacks.
c. Put the tip of the temperature probe about 1 inch into the temperature bath of 0 °C (+/- 0.1 °C).
d. Wait for the measurement to stabilize.
e. CHECK-DMM display reads between - 0.6 °C and + 0.6 °C.
f. Put the tip of the temperature probe about 1 inch into the temperature bath of 100 °C (+/- 0.1 °C).
g. Wait for the measurement to stabilize.
h. CHECK-DMM display reads between +99.4 °C and + 100.6 °C.

CALIBRATION PROCEDURE

Introduction

Use this calibration procedure to restore the DM 5110 or DM 511 to the original performance requirements. This procedure needs not to be performed unless the Performance Check Procedure in Section 2 cannot be completed satisfactorily or the instrument fails to meet the Performance Requirements of the electrical characteristics listed in the Specification section in the DM 5110/ 511 Instruction manual.

Calibration Interval

Calibration should be performed if the performance check procedures in Section 2 show that the DM 5110/511 is out of specification.
Calibration is also recommended following instrument repair or modification. If any of the calibration procedures in this section cannot be performed properly, refer to the troubleshooting information in Section 4, Maintenance.

Environmental Conditions

Calibration should be performed under laboratory conditions having an ambient temperature of 22 - 24 °C and a relative humidity of less than 70%.

The DM 5110/511 must be turned on and allowed to warm up for at least 30 minutes before beginning the performance checks. After exposure to or storage in high humidity (condensing) environment one hour warm-up time is required.

Recommended Test Equipment

The test equipment listed in Table 3-1, or equivalent is suggested to perform the DM 5110/511 calibration. Alternate equipment may be used as long as the accuracy is at least as good as the specifications listed in the table.

NOTE

For optimal conditions during performance checks, it is required to use a DM5110 in a TM5000 series mainframe, and a DM511 in a TM500 version.

Table 3-1
TEST EQUIPMENT REQUIRED

Description	Performance Specifications	Required for These Adjustments	Recommended
DC Voltage Calibrator	Range, 0 to 1000V; accuracy, +/- 0.01 %	DC Volts, DC Current	Fluke Model 343A or 341A
AC Voltage Calibrator + AC Power Amplifier	Range, 0 to 1000V; accuracy +/- 0.05 %, 20Hz to 20kHz Adjustable +/- 0.2 Hz at 50 Hz and 60 Hz.	TRMS AC Volts, TRMS AC Current	Fluke 5200A Fluke 5215A
Resistance Calibrator	Range, 0 - 20 MΩ; accuracy +/- 0.05 %	Ohms	Electro Scientific Industries, Inc. Model DB62 Dekabox
Current Calibrator	0 to 2 A AC, sine wave from 20 Hz to 10 kHz; accuracy, +/- 0.06 %. Range 0 to 2 A DC, accuracy +/- 0.01 %.	AC Current, DC Current	Valhalla 2500E AC-DC Current Calibrator
Shorting plug			Tektronix PN 134-0012-00
Temperature	Temp. bath: 0 °C +/- 0.1 C Temp. bath:100 °C +/- 0.1 C	Temperature probe check and adjustment	RTE 4 Neslab ZX3 Tamson
Extender Cable	TM500 and TM5000 mainframes	AC trimmer adjustment	Tektronix 067-0645-02
GPIB Extender Cable	TM5000 mainframes	AC trimmer adjustment, GPIB controlled	Tektronix 067-0996-00

Internal Adjustments

The entire calibration procedure may be performed without having to make any internal adjustments if AC compensation has been verified, as explained in step 3. Calibration can be performed by either of two methods:
(1) from the front panel or (2) over the IEEE-488 bus (GPIB).

To make internal adjustments, you must operate the DM 5110/511 outside the power module using the extender cables listed in Table 3-1.
All other calibrations need to be performed with the DMM inside the mainframe.

Preparation for Calibration

1. Remove the left-hand side panel (as you face the instrument).
A calibration enable jumper is positioned behind the front panel on the display board assembly.
Place the jumper in the lower position (marked "CAL") and replace the cover.

2. Check that the line selector (on the power module/ cabinet) is set to the correct voltage.

3. Insert instrument into an appropriate power module.

4. Turn on the power.

5. Check to see if the calibration jumper is in the "CAL" position by noticing that the "AUTO" led is constantly blinking.

6. Check to see if the DMM is set at the proper line-frequency.

7. Allow the instrument to warm up for at least 30 minutes before continuing with the performance checks. (See Environmental Conditions above.)

Calibration Procedures

NOTE

In the following procedure, the DM 5110 and DM 511 instruments are referred to as DMM.

The following steps are for calibrating the DM5110 or DM 511, for each of the six measuring functions: DC voltage, TRMS AC voltage, resistance, TRMS AC current, DC current and temperature. These procedures are intended for use by qualified personnel using accurate and reliable test equipment.
The dBm and dBV functions are recalculated AC Voltage ranges.
Calibrating AC Voltage will suffice.
All following measurement procedures need to be performed with the following settings:

4.5 digit resolution	(Right hand digit ON)
NULL-mode OFF	(NULL-led OFF)
In RUN mode	(HOLD-led OFF)

WARNING

To prevent a shock hazard, do not exceed 1000 V peak between input low and chassis ground. Some of the procedures in this section may expose the user to dangerous voltages. Use standard safety precautions when such dangerous voltages are encountered.

Introduction

The DM5110 and DM511 are software calibrated by constants that are stored in EEPROM. Every range has its own calibration values: an offset and a gain.
In this way there is no interference between ranges; re-calibrating one range, will not change other ranges.
All DC voltage and DC current ranges, have a positive and a negative offset value, and a positive and a negative gain.
When taking a measurement, the offset value is first subtracted from the measurement counts that are measured by the microcontroller. The result is multiplied by the gain to get the display value.
There is a GPIB query "CALFACTOR" that will output the calibration settings per range. (see page 3-11)
In AC ranges, calibration is done at 5% and 95 % of full scale, because of reduced accuracy of true RMS converter at small signals. For the microcontroller to be able to convert these two calibration measurements to the standard offset and gain, both measurements need to be known. For that reason, calibration of AC ranges needs to be done in a specific order.
The 5% of full scale calibration needs to be done first, immediately followed by the 95% calibration of that same range. Only after that, the new offset and gain values will be checked, and written to EEPROM.
Obviously, for proper calibration of both gain and offset, it is needed to do the offset calibration of a range before the gain calibration.

In normal measurement, before the settings read from EEPROM are used, the firmware compares the offset and the gain with values in a table.
When one of the EEPROM settings of a range is not within these boundaries, the DMM will consider that range to be uncalibrated.

In DC ranges this check is done on the calibration settings of the polarity that is used at that moment. In that way, the positive measurements of a range can be calibrated, while the negative measurements are uncalibrated.
The two least significant digits of the display will constantly blink, when a range is not fully calibrated.
To be able to make measurements, the DMM microcontroller decides to use default offset and gain values from fixed firmware tables. Accuracy of the instrument is then reduced to about +/- 2 % !!!
Uncalibrated ranges will only occur when the EEPROM is defective, or when the EEPROM (U209) has been replaced and re-calibration has not been done completely.

Calibration is done only in 4.5 digit mode. The 3.5 digit measurements are directly derived from the 4.5 digit calibration values.
Calibration can be done in either 50 Hz or 60Hz.
Changing the setting after calibration will not degrade performance. Obviously, setting the line frequency to the proper setting during calibration improves stability and accuracy.

Front Panel Calibration

Command Sequence

When the DM5110 is in the calibration mode, autoranging is no longer functioning. Simultaneously pressing of the UP and the DOWN key, is now the command for the DMM to calibrate!!!!
The operator is warned for the DMM being in the CAL enabled mode, by the constantly blinking "AUTO"-led.
When a calibration command is given to the DMM, the micro-controller will automatically determine if an offset or gain calibration is required.
This is done, depending upon the input signal level.
During calibration the operator is kept informed about the status, by messages on the display (Table 3-2).
The calibration command can also be given over the GPIB bus (DM5110 only).
GPIB error messages will then also indicate the status, enabling full automatic verification and calibration over the bus.For this subject, see at the end of this section.

Table 3-2
Displayed Calibration Messages

Message	Problem and/or Suggested Action
doNE	The DM5110/DM511 has successfully executed a calibration step.
+oooo	Positive offset calibration is busy; wait. (DC Voltage and DC Current only)
-oooo	Negative offset calibration is busy; wait. (DC Voltage and DC Current only)
190.?	5% of full scale AC calibration command accepted, continue with 95% of full scale value.
500.?	100 VAC calibration command accepted, continue with 500 VAC value.
4.5 d	Select 4.5 digit; calibration command not accepted.
ACV	Select AC Voltage function; calibration cannot be done in dBm or dBV function.
????	Input reference is outside firmware boundary settings; calibration command is not accepted.
UnSt	Unstable input during calibration, calibration command is not accepted.
StoP	Calibration stopped, command not accepted: range or function setting changed during calibration.
1FrSt	Calibration command is not accepted, the lower calibration value should be applied first. (AC only)
EErr	EEPROM error; attempt to write new settings has failed. Hardware error??

1. Adjustment DC Voltage Accuracy

a. Set the DMM in the DCV, 200 mV range.

b. Short circuit the LOW and V/Ω/TEMP jacks with a shorting plug.

c. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the positive and negative offset.

d. After writing the new settings in EEPROM the readout will show: "doNE"

e. A few seconds later, the readout returns to 0.00 mV. The offset calibration of the 200 mV range is now completed (see table 3.3).

f. Repeat the steps a through e for the remaining DCV ranges.

g. Remove the shorting plug and connect the DC Voltage calibrator to the LOW and V/Ω/TEMP jacks.

h. Set the DMM in the DCV, 200 mV range.

i. Set the calibrator to +190.000 mV.

j. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the positive gain.

k. After completion of the calibration the readout will show: "doNE", and the positive gain is now successfully written in EEPROM.

l. As a result, the DMM display should now read +190.00 mV +/- 1 count.

m. Apply –190.000 mV to the DMM.

n. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the negative gain.

o. After completion of the calibration the readout will show: "doNE", meaning that also the negative gain is now successfully stored.

p. As a result, the DMM display should now read -190.00 mV +/- 1 count.

q. Repeat steps h through p for the 2, 20, 200 and 1000 Volt DC ranges according to the settings in Table 3-3.

Table 3-3.
DC Voltage Calibration Settings

DM5110/ DM511 range	Input VΩ/TEMP to LOW	Display reading after Calibration (+/- 1 LS digit)
200 mV DC	Shorted	0.00 mV
2 V DC	Shorted	0.0000 V
20 V DC	Shorted	0.000 V
200 V DC	Shorted	0.00 V
1000 V DC	Shorted	0.0 V
200 mV DC	+190.000 mV	+190.00 mV
2 V DC	+1.90000 V	+1.9000 V
20 V DC	+19.0000 V	+19.000 V
200 V DC	+190.000 V	+190.00 V
1000 V DC	+1000.00 V	+1000.0 V
200 mV DC	–190.000 mV	–190.00 mV
2 V DC	–1.90000 V	–1.9000 V
20 V DC	–19.0000 V	–19.000 V
200 V DC	–190.000 V	–190.00 V
1000 V DC	–1000.00 V	–1000.0 V

2. Adjustment Resistance Accuracy

a. Set the DMM in the Ohms, 200 Ω range.

b. Short circuit the LOW and V/Ω/TEMP jacks with a shorting plug.

c. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the offset of the 200 Ω range.

d. After writing the new settings in EEPROM the readout will show: "doNE"

e. A few seconds later, the readout returns to 0.00 Ω. The offset calibration of the 200 Ω range is now completed (see table 3.4).

f. Repeat the steps a through e for the remaining Ohms ranges.

g. Remove the shorting plug, and connect the Resistance Calibrator to the LOW and V/Ω/TEMP jacks.

h. Set the DMM in the Ohms, 200 Ω range.

i. Set the calibrator to +100.000 Ω.

j. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the gain.

k. After completion of the calibration the readout will show: "doNE", and the gain of this range is now successfully written in EEPROM.

l. As a result, the DMM display should now read 100.00 Ω +/- 1 count.

m. Repeat steps h through l for the 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ and 20 MΩ ranges according to the settings in Table 3-4.

Table 3-4.
Resistance Calibration Settings

DM5110/ DM511 range	Input LOW to VΩ/TEMP	Display reading after Calibration (+/- 1 LS digit)
200 Ω	Shorted	0.00 Ω
2 kΩ	Shorted	.0000 kΩ
20 kΩ	Shorted	0.000 kΩ
200 kΩ	Shorted	0.00 kΩ
2 MΩ	Shorted	.0000 MΩ
20 MΩ	Shorted	0.000 MΩ
200 Ω	100.000 Ω	100.00 Ω
2 kΩ	1.00000 kΩ	1.0000 kΩ
20 kΩ	10.0000 kΩ	10.000 kΩ
200 kΩ	100.000 kΩ	100.00 kΩ
2 MΩ	1.00000 MΩ	1.0000 MΩ
20 MΩ	10.0000 MΩ	10.000 MΩ

3. Adjustment AC Voltage Accuracy

Before the calibration of the AC Voltage ranges can be done, the two resistance trimmers R113 and R121 need to be properly adjusted.

Adjustment of R113 (Frequency Compensation)

a. Turn off the Mainframe power.
Connect the DMM to an extender cable (table 3-1) outside the mainframe and remove the left-hand side panel (as you face the instrument).

WARNING

To avoid electric shock hazard, do not touch exposed circuitry. The shields on the analog board are at input LOW potential and can have up to 1000 V on it. Use an insulated alignment tool to make the following adjustments.

b. Turn on the power.

c. Select the 200 V AC range and connect the AC Voltage calibrator to the LOW and VΩ/TEMP jacks.

d. Set the calibrator to 180.000 V AC.

e. Switch the frequency of the calibrator signal between 300 Hz and 10 kHz, and adjust R113 (figure 3-1), until the reading is the same for both frequencies (within a tolerance of +/- 3 counts).

Adjustment of R121 (AC stage DC offset voltage)

R121 gives the ability to reduce the DC offset voltage produced by the source follower circuitry of Q100 and Q101. When there is to much offset, switching between especially the 2 V and the 20 V ranges, will create temporary charge in the True RMS circuitry, that will disturb proper autoranging. Re-adjustment is needed when the readings 'jumps' more than 200 counts when switching beyween the 2 VAC and the 20 VAC range. If necessary, perform the following procedure:

f. Disconnect the DC Voltage calibrator and connect the shorting plug to the LOW and VΩ/TEMP jacks.

g. Select the 20 Volt AC range.

h. Measure the voltage at U101 pt 7 (the AC amplifier output) with a DMM.

i. Adjust R121 to reduce the DC voltage at that point to less then 20 mVolt.

j. Turn the power off, replace the side cover, insert the instrument into the power module, turn on the power and allow the instrument time to warm up.

Calibration of AC Voltage ranges.

k. Set the DMM in the AC, 200 mV range.

l. Connect the AC Voltage calibrator to the LOW and V/Ω/TEMP jacks.

m. Set the calibrator to 10.000 mV AC @ 300 Hz.

n. Press the DOWN and UP keys simultaneously. The DMM will then store this measurement in RAM memory and show "190.?' on the display.

o. Set the calibrator to 190.000 mV AC @ 300 Hz.

p. Press the DOWN and UP keys simultaneously. The DMM will then calculate the offset and gain of the range.

q. After completion of the calibration the readout will show: "doNE", and the offset and gain are now successfully written in EEPROM.

r. As a result, the DMM display should now read +190.00 mV AC +/- 1 count.

s. Repeat steps k through r for the 2, 20, 200 and 500 VAC ranges according to the settings in Table 3-5

Table 3-5.
AC Voltage Calibration Settings

DM5110/ DM511 range	Input LOW to V/Ω/TEMP	Display reading after Calibration (+/- 1 LS digit)
200 mV AC	10.000 mV, 300 Hz	
200 mV AC	190.000 mV,300 Hz	190.00mV AC
2 V AC	0.10000 V, 300 Hz	
2 V AC	1.90000 V, 300 Hz	1.9000 V AC
20 V AC	1.0000 V, 300 Hz	
20 V AC	19.0000 V, 300 Hz	19.000 V AC
200 V AC	10.000 V, 300 Hz	
200 V AC	190.000 V, 300 Hz	190.00 V AC
500 V AC	100.00 V, 300 Hz	
500 V AC	500.00 V, 300 Hz	500.0 V AC

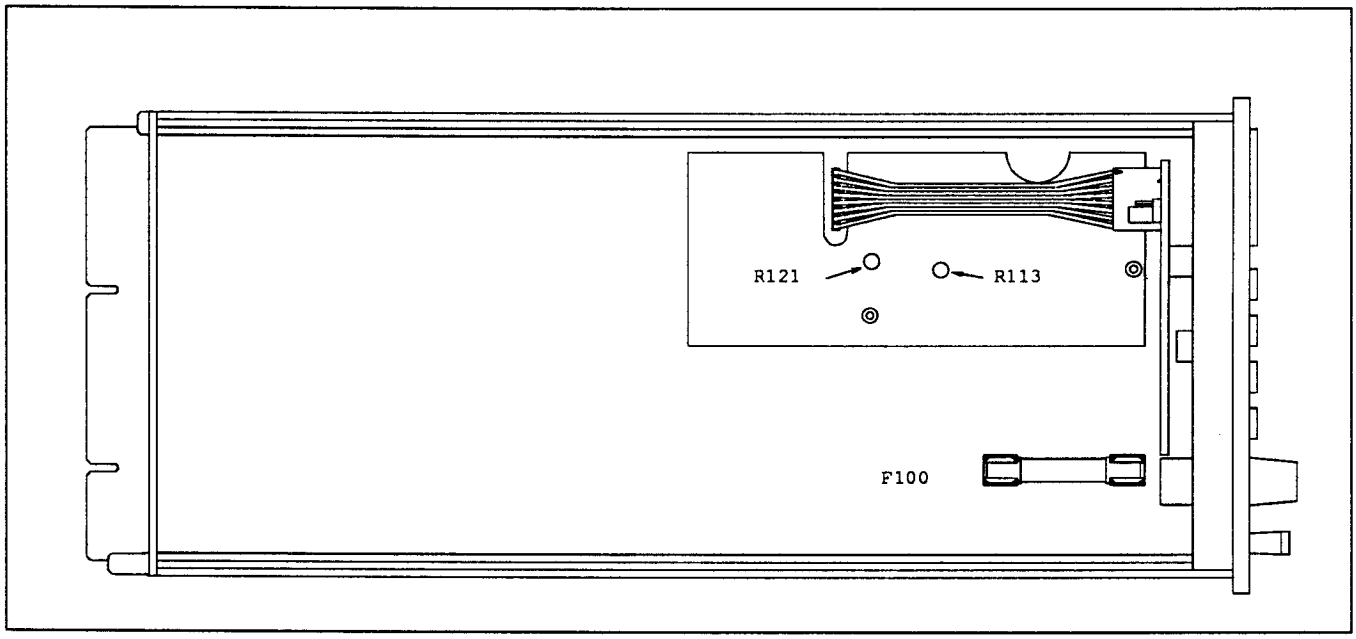


Fig. 3-1. Sideview DM 5110 / DM 511

4. Adjustment DC Current Accuracy

a. Set the DMM in the DCA, 200 µA range.

b. Use the DMM with open jacks.

c. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the positive and negative offset.

d. After writing the new settings in EEPROM the readout will show: "doNE"

e. A few seconds later, the readout returns to 0.00 µA. The offset calibration of the 200 µA range is now completed (see table 3.6).

f. Repeat the steps a through e for the remaining DCA ranges.

g. Connect the DC Current calibrator to the LOW and mA jacks.

h. Set the DMM in the DCA, 200 µA range.

i. Set the calibrator to +190.000 µA.

j. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the positive gain.

k. After completion of the calibration the readout will show: "doNE", and the positive gain is now successfully written in EEPROM.

l. As a result, the DMM display should now read +190.00 µA +/- 1 count.

m. Apply -190.000 µA to the DMM.

n. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the negative gain.

o. After completion of the calibration the readout will show: "doNE", meaning that also the negative gain is now successfully stored.

p. As a result, the DMM display should now read −190.00 µA +/- 1 count.

q. Repeat steps h through p for the 2, 20, 200 and 2000 mA DC ranges according to the settings in Table 3-6.

Table 3-6.
DC Current Calibration Settings

DM5110/ DM511 range	Input LOW to mA	Display reading after Calibration (+/- 1 LS digit)
200 µA DC	Open	0.00 µA
2 mA DC	Open	.0000 mA
20 mA DC	Open	0.000 mA
200 mA DC	Open	0.00 mA
1000 mA DC	Open	0.0 mA
200 µA DC	+190.000 µA	+190.00 µA
2 mA DC	+1.90000 mA	+1.9000 mA
20 mA DC	+19.0000 mA	+19.000 mA
200 mA DC	+190.000 mA	+190.00 mA
2000 mA DC	+1900.00 mA	+1900.0 mA
200 µA DC	-190.000 µA	-190.00 µA
2 mA DC	-1.90000 mA	-1.9000 mA
20 mA DC	-19.0000 mA	-19.000 mA
200 mA DC	-190.000 mA	-190.00 mA
2000 mA DC	-1900.00 mA	-1900.0 mA

5. Adjustment AC Current Accuracy

Before calibrating AC current, R121 adjustment needs to be correct (see AC voltage calibration).

a. Connect the AC Current calibrator to the LOW and mA jacks.

b. Set the DMM in the AC, 200 µA range.

c. Set the calibrator to 10.000 µA AC @ 300 Hz.

d. Press the DOWN and UP keys simultaneously. The DMM will then store this measurement in RAM memory and show "190.?' on the display.

e. Set the calibrator to 190.000 µA AC @ 300 Hz.

f. Press the DOWN and UP keys simultaneously. The DMM will then calculate the offset and gain of the range.

g. After completion of the calibration the readout will show: "doNE", and the offset and gain are now successfully written in EEPROM.

h. As a result, the DMM display should now read 190.00 µA AC +/- 1 count.

i. Repeat steps b through h for the 2, 20, 200 and 2000 mAmp AC ranges according to the settings in Table 3-7.

Table 3-7.
AC Current Calibration Settings

DM5110/ DM511 range	Input LOW to mA	Display reading after Calibration (+/- 1 LS digit)
200 µA AC	10.000 µA, 300 Hz	
200 µA AC	190.000 µA, 300 Hz	190.00 µA AC
2 mA AC	0.10000 mA, 300 Hz	
2 mA AC	1.90000 mA, 300 Hz	1.9000 mA AC
20 mA AC	1.0000 mA, 300 Hz	
20 mA AC	19.0000 mA, 300 Hz	19.000 mA AC
200 mA AC	10.000 mA, 300 Hz	
200 mA AC	190.000 mA, 300 Hz	190.00 mA AC
2000 mA AC	100.00 mA, 300 Hz	
2000 mA AC	1900.00 mA, 300 Hz	1900.0 mA AC

6. Adjustment Temperature Accuracy

As an option a P6602 PT100 temperature probe can be delivered with the DM5110/DM511. Then the instrument is calibrated to the probe at shipment. When re-calibration is needed, or when a different P6602 probe needs to be used, follow the next procedure:

a. Set the DMM to Temperature measurement function by pressing the HOLD and TEMP key.

b. Connect the P6602 Probe to which the DMM is calibrated to the LOW and V/Ω/TEMP jacks.

c. Put the tip of the temperature probe about 1 inch into the temperature bath of 0 °C (+/- 0.1 °C).

d. Wait for the measurement to stabilize.

e. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the offset.

f. After writing the new settings in EEPROM the readout will show: "doNE"

g. A few seconds later, the readout returns to 0.0 °C. The offset calibration of the temperature function is now completed.

h. Put the tip of the temperature probe about 1 inch into the temperature bath of 100 °C (+/- 0.1 °C).

i. Wait for the measurement to stabilize.

j. Press the DOWN and UP keys simultaneously. The DMM will then calibrate the gain.

k. After completion of the calibration the readout will show: "doNE", and the positive gain is now successfully written in EEPROM.

l. As a result, the DMM display should now read +100.0 °C+/- 1 count.

When all previously mentioned calibration steps are successfully performed, re-calibration of the DM5110/DM511 is completed .

GPIB Controlled Calibration (DM5110 only)

The calibration procedure that is described in the previous section, can also be performed, controlled by GPIB commands.

The procedure is very similar. The same function as pressing the UP and DOWN key simultaneously to give a calibration command can be done by sending the "CAL" command over the GPIB bus.

Besides the display messages during calibration (Table 3-2), then also a reduced list of GPIB error messages will be generated.
(See GPIB CALIBRATION COMMANDS LIST).

Table 3-8.

GPIB CALIBRATION COMMANDS LIST

CAL
(Calibration Command Function)

Type : Operational

Syntax : CAL

Response : CAL <error number>

Discussion :

This command will start the calibration of the instrument and the DM5110 will report the result.

NOTE:
If the CAL command is used when the voltage reference is not set up the calibration of the instrument can be affected.

If the cal jumper is set for calibration disable, and the CAL command is sent, error 260 is returned.
If the deviation between the reference voltage and the predicted calibration reading is to great then error 655 is returned. Other errors that can occur are numbers 651 - 654.
The cal response is as listed below:

Calibration step done	: 455
Calibration stopped	: 651
Calibrate LOVAC first	: 652
Unstable measurement error	: 653
Eeprom error	: 654
Calibration beyond bounderies	: 655

CALEN?
(Return to Normal Operation Function)

Type : Query

Query Syntax : CALEN?

Query Response : CALEN ON | OFF

Discussion :

This query will return the state of the calibration jumper.

If CALEN ON; is returned then the jumper is set to enable the calibration of the instrument.

If CALEN OFF; is returned then the jumper is set to disable the calibration of the instrument.

If CALEN OFF; is returned, then the CAL command will cause an error if it is sent (error 260).

CALFACTOR? <function>,<range>
(Returns Calibration Factors of a Range)

Type : Query

Query Syntax : CALFACTOR? <function>,<range>

Query Response :CALFAC
{<pos.offset>,<pos.gain>[,<neg.offset>,<neg.gain>]};

Discussion :

This query will return the calibration factors for the selected function and range.
Only in DCV and DCA a negative offset and gain value is given.
The values of offset and gain will consist of a four ascii digit hexadecimal number, immediately followed by a "c" for calibrated, or an "u" for uncalibrated, meaning that the value in EEPROM is, or is not within a tolerance range that is pre-programmed in software.

MAINTENANCE

General Information

Introduction

This section of the manual provides maintenance instructions and serving information for the DM 5110 and the DM 511 (and power module).

WARNING

Dangerous potentials exist at several points throughout the instrument and power module. When the power module must be operated with the cabinet removed, do not touch exposed connections or components.. Disconnect power before cabinet removal, cleaning, or replacing parts.

Static-Sensitive Components

CAUTION

Static discharge may damage semiconductor components in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. See Table 4-1 for relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.
3. Discharge the static voltage from your body by wearing a grounded wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.
4. Allow nothing capable of generating or holding a static charge on the work station surface.
5. Keep the component leads shorted together whenever possible.
6. Pick up components by the body, never by the leads.
7. Do not slide the components over any surface.
8. Avoid handling components in areas that have a floor or work surface covering capable of generating a static charge.
9. Use a soldering iron that is connected to earth ground.
10. Use only special antistatic suction type or wick type desoldering tools.

Table 4-1
RELATIVE SUSCEPTIBILITY TO STATIC DISCHARGE DAMAGE

Semiconductor Classes	Relative Susceptibility Levels[a]
MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs. (Most Sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFETs	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (Least Sensitive)	9

[a] **Voltage equivalent for levels:**
1 = 100 to 500 V 4 = 500 V 7 = 400 to 1000 V(est.)
2 = 200 to 500 V 5 = 400 to 600 V 8 = 900 V
3 = 250 V 6 = 600 to 800 V 9 = 1200 V
(Voltage discharged from a 100 pF capacitor through a resistance of 100 ohms.)

Test Equipment

Before using any test equipment to make measurements on static-sensitive components or assemblies, be certain that any voltage or current supplied by the test equipment does not exceed the limits of the component to be tested.

Cleaning Instructions

This instrument should be cleaned as often as operating conditions require. Loose dust accumulated on the outside of the instrument can be removed with a soft cloth or small brush. Remove dirt that remains with a soft cloth dampened in a mild detergent an water solution.
Do not use abrasive cleaners.

CAUTION

To clean the front panel use freon, isopropyl alcohol, or denatured ethyl alcohol. Do not use petroleum based cleansing agents. Do not use air or any solvent to clean the Display (front panel) board. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (approximately 5 lb./in^2) or use a soft brush or cloth dampened with a mild detergent and water solution.

Hold the board such that the residue runs away from the connectors. Do not scrape or use an eraser to clean the edge connector contacts. Abrasive cleaning can remove the gold plating.

CAUTION

Circuit boards and components must be dry before applying power.

Obtaining Replacement Parts

Electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained from a local commercial source.

Before purchasing or ordering parts from a source other than Tektronix, Inc., check the Replaceable Electrical Parts list for the proper value, rating, tolerance, and description.

Ordering Parts

When ordering replacement parts from Tektronix, Inc., it is important to include all of the following information.

1. Instrument type (include modification or option numbers).
2. Instrument serial number.
3. A description of the part (if electrical, include the component number).
4. Tektronix part number.

Soldering Techniques

WARNING

To avoid electric shock hazard, disconnect the instrument from the power source before soldering.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques which apply to maintenance of any precision electronic equipment should be used when working on this instrument. Use only 60/40 rosin-core, electronic-grade solder. The choice of soldering iron is determined by the repair to be made.

When soldering on circuit boards or small wiring, use only a 15 watt pencil type iron. A higher wattage soldering iron can cause the etched circuit wiring to separate from the board base material and melt the insulation from small wiring. Always keep the soldering iron tip properly tinned to ensure the best heat transfer to the solder joint. Apply only enough heat to remove the component or to make a good solder joint. To protect heat sensitive components, hold the component lead with a pair of long-nose pliers between the component body and the solder joint. Use a solder removing wick to remove excess solder from connections or to clean circuit board pads.

Semiconductors

To remove the in-line integrated circuits installed in sockets, use an extracting tool. This tool is available from Tektronix, inc.; order Tektronix Part Number 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the integrated circuit. Try to avoid disengaging one end before the other. IC's that are soldered in should be carefully unsoldered, using commercially available de-soldering tools. If these tools are not available, the pins in the IC may be clipped with diagonal cutters, and the pins then individually removed from the board.

Disassembly Instructions

WARNING

To avoid electric-shock hazard, disconnect the power source and other instrumentation connected to the instrument before disassembly.

NOTE

To disassemble the DM 5110/511, refer to the following removal procedures and exploded views in the Replaceable Mechanical Parts section at the back of this manual.

Side Cover Removal

To remove the side panels, turn the plastic screw at the back, a quarter of a turn counterclockwise and carefully pull the cover away from the rail.

To replace covers, insert the front edge of the cover along the inside edge of the front frame assembly. Then close the cover and turn the plastic screw at the back, a quarter of a turn clockwise for fastening.

Internal Fuse Replacement

Remove the DM 5110 or DM 511 from its power module. The fuse is located under the cover on the right side of the DMM (as you face the front of the unit),close to the input jacks.

Replacement fuse:

2 A, 250 V, 3 AG, fast blow,
Tektronix Part No. 159-0021-00

After fuse replacement, reinstall the side cover.

Release Latch Handle and Slider Removal

All plastic parts of the latch assembly and the return springs are individually replaceable. However, if a latch tension spring becomes damaged, the bottom frame rail assembly that it is attached to must be replaced.

1. Remove the side panel from the DM 5110/511.
2. Pull the release latch handle out about 1/8" and hold.
3. Using a small screwdriver, move the release latch slider forward slightly while pushing down on the release latch handle to free the handle shaft from the slider. Pull out on handle to remove.
4. To repair the release latch assembly, remove the bottom rail that it is fastened to. The rails are held with screws into the front and rear panel assemblies and the Digital board.
5. To replace the release latch handle, push the handle shaft through slot in the front panel as far as it will go and hold it. Using a small screwdriver, move the release latch slider forward and the handle upward until the T-shaped end of handle engages the end of the slider.

Front Panel Assembly Removal

1. Remove side panels.
2. Remove the release latch handles. See removal procedure described above.
3. Unplug the flat cable from the Main board and disconnect the three wires connected to the input jacks.
4. Remove 4 screws (2 on top and 2 on bottom) holding the front panel assembly to the top and bottom frame assemblies.Remove the ground post from the lower right corner of the front panel.
5. Remove the front panel assembly.
6. Reassemble in reverse order.

Display Board Assembly (A11) Removal

1. Remove Front Panel Assembly.
2. Remove four screws holding the Display board to the front panel assembly.
3. Carefully move the Display board away from the front panel to clear the push buttons and remove the Display board from the instrument. A mask with transparent texture is held in place by the led's of the display board. Take care that this part does not get lost.
4. Reassemble in reverse order.

GPIB Board Assembly (A12) Removal (DM5110 only).

1. Remove side panels.
2. Lay the instrument on its right side with the bottom facing you.
3. Remove the four screws holding the GPIB board and the it's shield to posts on the main board assembly.
4. Carefully lift the GPIB board and it's shield straight up and out of the instrument.
5. Reassemble in reverse order.

Main Board Assembly (A10) Removal

1. Remove GPIB Board Assembly (DM5110 only).
2. Remove Display Board Assembly.
3. Remove the four screws holding the Main board to the top and bottom frame assemblies.
4. Carefully slide the Main board out of the instrument.
5. The Main board can be exposed completely by removing the two shields (three screws on the solder side shield).
6. Reassemble in reverse order.

Troubleshooting

The troubleshooting information contained in this section is intended to aid qualified service personnel to isolate a defective circuit or circuit section.

To aid in troubleshooting, schematic diagrams and component location drawings are located in subsequent sections of this manual.

Disassembly for Troubleshooting

To gain access to the circuitry on boards you may have to remove the boards and reconnect the cables outside of the instrument frame. For digital problems on the Main board the removal of the GPIB board will give better access. Removal of the two shields on opposite sides of the main board can be very helpfull with troubleshooting in the input circuitry.
Refer to the disassembly instructions in this section to remove a board, then appropriately support the board and reconnect the cables.

Recommended Test Equipment

Table 4-2 lists the test equipment recommended for troubleshooting the DM 5110/511. Other equipment such as logic analyzers and capacitance meters could also be helpful, especially in difficult situations.
In addition you will need extender cables (see Table 3-1 for part numbers) for operating the instrument outside of the power module.

Table 4-2
RECOMMENDED TROUBLESHOOTING EQUIPMENT

Equipment	Use
Five function DMM with 0.1% DCV accuracy, 10 MΩ input impedance.	Power supply and DC voltage checks; analog signal tracing continuity, logic levels.
Dual-trace, triggered sweep oscilloscope, dc to 50 MHz	Digital and analog wave form checks.
Digital frequency counter	Checking clock frequencies.
TM 5003 or TM 5006 Power Module	Power for DM 5110
TM 501A, TM 502A, TM 503A , TM 504 or TM506 Power Module	Power for DM 511

Power Up Self Test

Upon power up, the instrument will test the EEPROM circuitry where the calibration constants, GPIB settings and selected line frequency are stored. This check is done on the EEPROM string where the GPIB address, terminator setting and 50/60 Hz setting are memorized. If this test fails, for a few seconds the following message is displayed:

EE r r

The settings will then be set to 60 Hz and GPIB address 15. If this test still fails after attempting to set 50/60 Hz and the GPIB settings, try replacing U209 and re-calibrate the instrument completely. When doubting the EEPROM functionality, always check calibration of all ranges.

After the EEPROM check, the main board firmware checks the communication with the GPIB board after power up (DM5110 only). There is no difference in firmware between the DM5110 and the DM511. If the communication test after power up fails, the main board of the instrument will consider it to be a DM511. This can easily be checked by pushing the INST ID button after power-up. A DM511 will not show a GPIB address setting.

The GPIB board has a red diagnostics led indicating the status of the board. When operating properly, the led will start blinking slowly in a one second repetition rate, as soon as the communication with the main board is established. If no blinking occurs, there is a possibility that the 80C32 microcontroller of the GPIB board is not functioning, or that the communication with the main board has failed. If blinking at double speed occurs, the communication with the GPIB bus is malfunctioning. This will only occur if there is activity on the GPIB bus. The first items to check, are the socket-mounted GPIB driver IC's U508 and U509.

If malfunctioning of one of the microcontrollers is suspected, a logical trouble shooting sequence could be:

1. Check oscillation of the crystal oscillator at the microcontroller pins 18 and 19.
2. Check a "0" level on the reset input of the 80C31/ 80C32. If a "1" level is measured after power up, check the TL7705A supply voltage supervisor.
3. Check for the presence of the ALE/P (Address Latch Enable/Program) clocking signal at pin 11 of the bus de-multiplexer 74LS373 (1.6 MHz), and the lower address byte activity at the outputs of the 74LS373.
4. Check for the presence of the PSEN (Program Store Enable) clocking signal at pin 22 of the PROM 27C256 (1.6 MHz).
5. Check the 600 Hz interrupt frequency at the microcontroller INT1 (pin 13). (main board only)

For further debugging in the circuitry refer to chapter 1 : "THEORY OF OPERATION".

Firmware versions

If the INST ID key is pushed during power up, the display will show the firmware version of the Main board software. (F 1.0 etc.)

The firmware version of the GPIB board software can be obtained by using the GPIB "ID" query over the bus.

OPTIONS

Option 2 adds a P6602 temperature probe to the DM5110 / DM511 and the DMM is factory calibrated to that specific probe.

There is no hardware or software change to the instrument.

Information concerning the TEKTRONIX P6602 Temperature Probe can be found in the instruction manual for that accessory.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representitive.

Changes to Tektronix instruments are sometimes made to accomodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordereing parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representitive will contact you concerning any change in part number .

Change information, if any, is located at the rear of this manual.

LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

The Manufacturer Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

ABBREVIATIONS

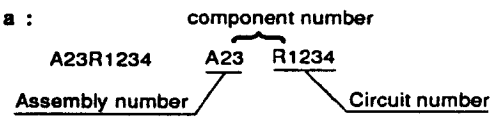
Abbreviations conform to American National Standard Y1.1

COMPONENT NUMBER

(Column one of the Electrical Part List)

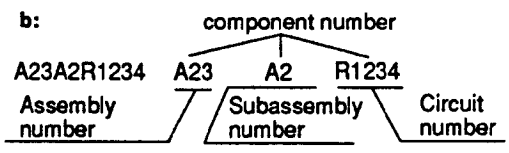
A numbering system has been used to identify assemblies, subassemblies and parts. Examples of this numbering system and typical expansions are illustrated by the following:

Example a :



Read : Resistor 1234 of Assembly 23

Example b:



Read : Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO.

(column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

SERIAL/MODEL NO.

(column three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the part number at which the part was removed. No serial number entered indicates the part is good for all serial numbers.

NAME & DESCRIPTION

(column five of the Electrical Parts List)

In the Parts List, an Item Name is seperated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

MFR. CODE

(column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER

(column seven of the Electrical Parts List)

Indicates actual manufacturers part number

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03888	PYROFILM DIV DIV OF KDI ELECTRONICS INC	60 S JEFFERSON RD	WHIPPANY NJ 07981-1001
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
07263	FAIRCHILD SEMICONDUCTOR CORP NORTH AMERICAN SALES SUB OF SCHLUMBERGER LTD MS 118	10400 RIDGEVIEW CT	CUPERTINO CA 95014
11502	INTERNATIONAL RESISTIVE CO INC	GREENWAY RD PO BOX 1860	BOONE NC 28607-1860
12954	MICROSEMI CORP - SCOTTSDALE	8700 E THOMAS RD P O BOX 1390	SCOTTSDALE AZ 85252
14936	GENERAL INSTRUMENT CORP DISCRETE SEMI CONDUCTOR DIV	600 W JOHN ST	HICKSVILLE NY 11802
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054-1516
18324	SIGNETICS CORP MILITARY PRODUCTS DIV	4130 S MARKET COURT	SACRAMENTO CA 95834-1222
19701	MEPCO A NORTH AMERICAN PHILIPS CO	MINERAL WELLS AIRPORT PO BOX 760	MINERAL WELLS TX 76067-0760
24355	ANALOG DEVICES INC	RT 1 INDUSTRIAL PK PO BOX 9106	NORWOOD MA 02062
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
34649	INTEL CORP	SALES OFFICE 3065 BOWERS AVE	SANTA CLARA CA 95051
50157	MIDWEST COMPONENTS INC	1981 PORT CITY BLVD P O BOX 787	MUSKEGON MI 49443
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY PO BOX 1501	SECAUCUS NJ 07094-2917
55680	NICHICON	927 E STATE PKY	SCHAUMBURG IL 60195-4526
56289	SPRAGUE ELECTRIC CO WORLD HEADQUARTERS	92 HAYDEN AVE	LEXINGTON MA 02173-7929
57027	INTERNATIONAL RESISTIVE PRODUCTS INC	4222 S STAPLES	CORPUS CHRISTI TX 78411-2702
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
59821	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	7158 MERCHANT AVE	EL PASO TX 79915-1207
75498	MULTICOMP INC	3005 SW 154TH TERRACE	BEAVERTON OR 97006
75915	LITTELFUSE INC SUB TRACOR INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
80031	MEPCO	22 COLUMBIA RD	MORRISTOWN NJ 07960
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
TK0900	UNITED CHEMI-CON INC	9801 W HIGGINS SUITE 430	ROSEMONT IL 60018-4704
TK0GR	CADDOCK	HOLLAND	
TK0GT	INTERSIL	HOLLAND	
TK0GV	MURATA	HOLLAND	57115004
TK1483	TEKA PRODUCTS INC	45 SALEM ST	PROVIDENCE RI 02907
TK1727	PHILIPS NEDERLAND BV AFD ELONCO	POSTBUS 90050	5600 PB EINDHOVEN THE NETHERLANDS
TK2205	OR-X LTD	PO BOX 2116	REEHOVOT ISRAEL 76121

Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A10	671-1255-00		CIRCUIT BD ASSY:MAIN	80009	671-1255-00
A10BZ200	119-3196-00		BEEPER:PIEZO	TK0GV	PKM22EPP4001
A10C100	281-0773-00		CAP,FXD,CER DI:0.01UF,10%,100V	04222	SA201C103KAA
A10C101	285-1451-00		CAP,FXD,CER DI:0.1UF	80009	285-1451-00
A10C102	283-0342-00		CAP,FXD,CER DI:6.5PF,0.5PF,2KV,DISK	59660	838-564-COHO-659D
A10C103	283-0631-00		CAP,FXD,MICA DI:95PF,1%,500V	09023	CD15FD950F03
A10C104	283-0789-00		CAP,FXD,MICA DI:600PF,1%,500V	09023	CD15FD950F03
A10C106	281-0810-00		CAP,FXD,CER DI:5.6PF,+-0.5PF,100V	04222	SA101A5R6DAA
A10C107	290-0523-00		CAP,FXD,ELCTLT:2.2UF,20%,20V TANT	56289	196D225X0020HA1
A10C108	290-0848-00		CAP,FXD,ELCTLT:47UF,+100-20%,16V ALU	TK0900	16VB47(BP)LL
A10C109	285-1431-00		CAP,FXD,PLASTIC:1UF,10%,160V	80009	285-1431-00
A10C110	285-1431-00		CAP,FXD,PLASTIC:1UF,10%,160V	80009	285-1431-00
A10C111	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C112	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C113	285-1452-00		CAP,FXD,PLASTIC:0.01UF,20%,630VDC	80009	285-1452-00
A10C114	285-1453-00		CAP,FXD,CER DI:0.068UF	80009	285-1453-00
A10C115	290-0183-00		CAP,FXD,ELCTLT:1UF,10%,35V TANT	12954	AT513A105K035N
A10C116	290-0183-00		CAP,FXD,ELCTLT:1UF,10%,35V TANT	12954	AT513A105K035N
A10C117	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C140	283-0199-00		CAP,FXD,CER DI:25PF,10%,4KV	59660	0818-617-COGO-250K
A10C200	290-0771-00		CAP,FXD,ELCTLT:220UF,+50-10%,10VDC ALF	55680	UVX1V221MPA
A10C202	281-0956-00		CAP,FXD,CER DI:33PF,2%,100V	TK1727	CAP. 2222-683-10339
A10C203	281-0956-00		CAP,FXD,CER DI:33PF,2%,100V	TK1727	CAP. 2222-683-10339
A10C204	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C205	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C206	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C207	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C208	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C209	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A10C210	281-0826-00		CAP,FXD,CER DI:2200PF,10%,100V	04222	SA101C222KAA
A10C300	281-0826-00		CAP,FXD,CER DI:2200PF,10%,100V	04222	SA101C222KAA
A10C301	281-0826-00		CAP,FXD,CER DI:2200PF,10%,100V	04222	SA101C222KAA
A10C302	281-0826-00		CAP,FXD,CER DI:2200PF,10%,100V	04222	SA101C222KAA
A10C303	281-0826-00		CAP,FXD,CER DI:2200PF,10%,100V	04222	SA101C222KAA
A10C304	290-0845-00		CAP,FXD,ELCTLT:330UF,+50-20%,25V ALU	54473	ECE-A25V330L
A10C305	290-0845-00		CAP,FXD,ELCTLT:330UF,+50-20%,25V ALU	54473	ECE-A25V330L
A10C306	290-1204-00		CAP,FXD,ELCTLT:4700uF,16V	80009	290-1204-00
A10C307	290-0804-00		CAP,FXD,ELCTLT:10UF,+50-20%,25V ALU	55680	UVX2A100MPA
A10C308	290-0804-00		CAP,FXD,ELCTLT:10UF,+50-20%,25V ALU	55680	UVX2A100MPA
A10C309	290-0804-00		CAP,FXD,ELCTLT:10UF,+50-20%,25V ALU	55680	UVX2A100MPA
A10CR100	152-0323-00		SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	12954	MT5282
A10CR101	152-0323-00		SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	12954	MT5282
A10CR102	152-0488-00		SEMICOND DVC,DI:BRIDGE,SI,200V,1.5A	14936	2KBP02M-8
A10CR103	152-0323-00		SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	12954	MT5282
A10CR104	152-0323-00		SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	12954	MT5282
A10CR200	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A10CR300	152-0585-00		SEMICOND DVC,DI:RECT,SI,200V,1A WO2M	14936	W02M-30
A10CR301	152-0585-00		SEMICOND DVC,DI:RECT,SI,200V,1A WO2M	14936	W02M-30
A10F100	159-0021-00		FUSE,CARTRIDGE:3AG,2A,250V,FAST BLOW	75915	312002
A10J200	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A10J201	131-2132-01		CONN,RCPT,ELEC:1 X 36,0.1 CTR	TK1483	082-3640-SS05
A10J303	131-2132-01		CONN,RCPT,ELEC:1 X 36,0.1 CTR	TK1483	082-3640-SS05
A10K100	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00
A10K101	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00
A10K102	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00
A10K103	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00
A10K104	148-0214-00		RELAY,ARMATURE:FORM A,5V,140 OHMS	80009	148-0214-00
A10K105	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A10K106	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00
A10K107	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00
A10K108	148-0238-00		RELAY,ARMATURE:LM32B01	80009	148-0238-00
A10Q100	151-1006-00		TRANSISTOR:FET,N-CHAN,SI,TO-106	17856	FN686
A10Q101	151-1006-00		TRANSISTOR:FET,N-CHAN,SI,TO-106	17856	FN686
A10Q200	151-0190-00		TRANSISTOR:NPN,SI,TO-92	04713	2N3904
A10R100	307-0662-00		RES,THERMAL:1K OHM,40%	50157	180Q10216
A10R101	301-0182-00		RES,FXD,FILM:1.8K OHM,5%,0.5W	19701	5053CX1K800J
A10R102	307-1483-00		RES NTWK,FXD,FI:9.9M OHM,0.1%,0.2W	TK0GR	1776-8
A10R103	321-0289-07		RES,FXD,FILM:10K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C10001B
A10R104	321-0289-07		RES,FXD,FILM:10K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C10001B
A10R105	321-0193-07		RES,FXD,FILM:1K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C10000B
A10R106	315-0222-00		RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A10R107	315-0222-00		RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A10R108	307-0643-00		RES,FXD,FILM:200K OHM,1%,3W	11502	GS3 200KOHM +/-1%
A10R109	321-0222-07		RES,FXD,FILM:2K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C20000B
A10R110	325-0385-00		RES,FXD,FILM:2M OHM,0.1%,0.5W,TC=T9	03888	PME70 2 M OHM .1 % T9 A
A10R111	315-0123-00		RES,FXD,FILM:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A10R112	321-0318-07		RES,FXD,FILM:20K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C20001B
A10R113	311-1896-00		RES,VAR,NONWW:TRMR,5K,10%,0.5W	32997	3299W-R27-502
A10R114	321-0243-00		RES,FXD,FILM:3.32K OHM,1%,0.125W,TC=T0	91637	CMF55116G33200F
A10R115	321-0895-07		RES,FXD,FILM:90 OHM,0.1%,0.125W,TC=T9	91637	CMF55116C90R00B
A10R116	307-0400-00		RES,NTWK,FXD:10 OHM,0.1%	75498	-
A10R117	315-0104-00		RES,FXD,FILM:100K OHM,5%,0.25W	80031	5043CX100K0J
A10R118	321-0754-07		RES,FXD,FILM:900 OHM,0.1%,0.125W,TC=T9	91637	CMF55116C900R0B
A10R119	321-0222-07		RES,FXD,FILM:2K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C20000B
A10R120	307-0645-00		RES,THERMAL:5K OHM,40%	50157	180Q50201
A10R121	311-1307-00		RES,VAR,NONWW:500 OHM,0.5W	32997	3299W-R27-501
A10R122	315-0101-00		RES,FXD,FILM:100 OHM,5%,0.25W	80031	5043CX100ROJ
A10R123	321-1718-07		RES,FXD,FILM:1.111K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C11110B
A10R124	321-0289-07		RES,FXD,FILM:10K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C10001B
A10R125	315-0103-00		RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A10R126	321-0385-07		RES,FXD,FILM:100K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C10002B
A10R127	321-0318-07		RES,FXD,FILM:20K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C20001B
A10R128	321-1724-07		RES,FXD,FILM:7.04K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C70400B
A10R129	321-0222-07		RES,FXD,FILM:2K OHM,0.1%,0.125W,TC=T9	91637	CMF55116C20000B
A10R130	321-0247-07		RES,FXD,FILM:3.65K OHM,0.1%,0.125W,TC=T9	57027	3.65K CM55 T9.1%
A10R131	321-0179-00		RES,FXD,FILM:715 OHM,1%,0.125W,TC=T0	91637	CMF55116G715R0F
A10R132	315-0104-00		RES,FXD,FILM:100K OHM,5%,0.25W	80031	5043CX100K0J
A10R133	315-0243-00		RES,FXD,FILM:24K OHM,5%,0.25W	80031	5043CX24K00J
A10R134	315-0243-00		RES,FXD,FILM:24K OHM,5%,0.25W	80031	5043CX24K00J
A10R140	315-0331-00		RES,FXD,FILM:330 OHM,5%,0.25W	80031	5043CX330R0J
A10R200	315-0620-00		RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
A10R201	307-0445-00		RES,NTWK,FXD,FI:4.7K OHM,20%,(9)RES	91637	MSP10A-01-472G,J,K OR M
A10R202	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A10R203	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A10R204	315-0103-00		RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A10R205	315-0105-00		RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A10R206	307-0445-00		RES,NTWK,FXD,FI:4.7K OHM,20%,(9)RES	91637	MSP10A-01-472G,J,K OR M
A10R207	315-0102-00		RES,FXD,FILM:1K OHM,5%,0.25W	80031	5043CX1K000J
A10R208	315-0221-00		RES,FXD,FILM:220 OHM,5%,0.25W	80031	5043CX220R0J
A10R209	315-0473-00		RES,FXD,FILM:47K OHM,5%,0.25W	80031	5043CX47K00J
A10R300	315-0152-00		RES,FXD,FILM:1.5K OHM,5%,0.25W	80031	5043CX1K500J
A10R301	315-0152-00		RES,FXD,FILM:1.5K OHM,5%,0.25W	80031	5043CX1K500J
A10S100	260-2523-00		SWITCH,PUSH:1 BUTTON,8 POLE,INPUT	59821	K10481GC3
A10T300	120-1797-00		XFMR,PWR,STU:	80009	120-1797-00
A10TP300	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A10U100	156-1134-00		MICROCKT,LINEAR:OPAMP,MOS/FET INPUT	02735	CA3140EX-98

Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A10U101	156-1272-00		MICROCKT,LINEAR:DUAL OPNL AMPL	18324	NE5532N
A10U102	156-1850-00		IC,MISC:CMOS,ANALOG SWITCH;QUAD	17856	SDG21107
A10U103	156-3098-00		MICROCKT,LINEAR:RMS-2-DC CONVERTER WIDTH BW	24355	AD637JQ
A10U104	156-3507-00		MICROCKT,DGTL:ANALOG PROCESSOR	01295	TL500CJ
A10U105	156-0514-02		MICROCKT,DGTL:DIFF 4 CHANNEL MUX,SEL	04713	MC14052BCP
A10U200	156-2670-00		MICROCKT,INTFC:REL DRVR,8 OUTP,SIN W/LATCHES	56289	UCN-5841 A
A10U201	156-2670-00		MICROCKT,INTFC:REL DRVR,8 OUTP,SIN W/LATCHES	56289	UCN-5841 A
A10U202	156-2670-00		MICROCKT,INTFC:REL DRVR,8 OUTP,SIN W/LATCHES	56289	UCN-5841 A
A10U203	156-2396-00		MICROCKT,LINEAR:BIPOLAR,MPU RES GEN	01295	TL7705 ACP
A10U204	156-0388-00		MICROCKT,DGTL:DUAL D FLIP-FLOP	01295	SN74LS74AN
A10U206	156-2355-00		MICROCKT,DGTL:CMOS,14 STAGE BIN RIPPLE CNTR	02735	CD74HCT4020EX
A10U207	156-0513-00		IC,MISC:CMOS,ANALOG MUX;8 CHANNEL	04713	MC14051B CP
A10U208	156-2392-00		MICROCKT,DGTL:CMOS,HEX SCHMITT TRIG INV	04713	MC74HC14N
A10U209	156-3447-00		MICROCKT,DGTL:NMOS,64 X 16 SERIAL EEROM	27014	NMC9346N
A10U210	156-3269-00		MICROCKT,DGTL:CMOS,MICROCOMPUTER,8 BIT	18324	SC80C31BCCN40
A10U211	156-1065-00		MICROCKT,DGTL:OCTAL D TYPE TRANS LATCHES	04713	SN74LS373N
A10U212	160-6237-00		MICROCKT,DGTL:CMOS,32768 X 8 EPROM W/3 ST OUTP	80009	160-6237-00
A10U300	156-0285-00		MICROCKT,LINEAR:VOLTAGE REGULATOR	04713	M7812CT
A10U301	156-0872-00		MICROCKT,LINEAR:VOLTAGE REGULATOR	04713	M7912CT
A10U302	156-0277-00		MICROCKT,LINEAR:VOLTAGE REGULATOR	04713	M7805CT
A10VR100	152-1054-00		SEMICOND DVC,DI:BANDGAP REF,50PPM	TK0GT	ICL8069 CCZR
A10VR101	152-0149-00		SEMICOND DVC,DI:ZEN,SI,10V,5%,0.4W,DO-7	04713	1N961B
A10VR102	152-0149-00		SEMICOND DVC,DI:ZEN,SI,10V,5%,0.4W,DO-7	04713	1N961B
A10VR103	152-0727-00		SEMICOND DVC,DI:ZEN,SI,6.3V,2%,0.4W,DO-7	04713	SZG20246
A10W200	131-0566-00		BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA 07
A10Y200	158-0343-00		XTAL UNIT,QTZ:9.8304MHZ	80009	158-0343-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective Decont	Name & Description	Mfr. Code	Mfr. Part No.
A11	671-1258-00		CIRCUIT BD ASSY:LOWER DISPLAY	80009	671-1258-00
A11C400	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A11C401	281-0865-00		CAP,FXD,CER DI:1000PF,5%,100V	04222	SA101A102JAA
A11CR400	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR401	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR402	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR403	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR404	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR405	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR406	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR407	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR408	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR409	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR410	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR411	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11CR412	152-0141-02		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	07263	FDH9427
A11J400	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A11J401	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A11J402	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A11R405	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A11R406	315-0472-00		RES,FXD,FILM:3.3K OHM,5%,0.25W	80031	5043CX4K700J
A11S400	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S401	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S402	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S403	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S404	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S405	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S406	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S407	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S408	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S409	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S410	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11S411	260-2453-00		SWITCH,PB:SINGLE POLE,MOMENTARY	TK2205	102-2007
A11U401	156-0796-00		MICROCKT,DGTL:CMOS,8 STG SHF & STORE BUS RGTR	04713	MC14094BCP
A11U404	156-0796-00		MICROCKT,DGTL:CMOS,8 STG SHF & STORE BUS RGTR	04713	MC14094BCP
A11U407	156-1245-00		MICROCKT,LINEAR:7 XSTR,NPN,SI,HV/HIGH CUR	04713	MC1413P
A11A1	671-1257-00		CIRCUIT BD ASSY:UPPER DISPLAY	80009	671-1257-00
A11A1DS400	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS401	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS402	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS403	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS404	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS405	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS406	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS407	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS408	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS409	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS410	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS411	150-1208-00		LT EMITTING DIO:ORANGE,SQ,5MM	80009	150-1208-00
A11A1DS412	150-1233-00		LT EMITTING DIO:RED 3223A LAMP	80009	150-1233-00
A11A1DS413	150-1233-00		LT EMITTING DIO:RED 3223A LAMP	80009	150-1233-00
A11A1DS414	150-1233-00		LT EMITTING DIO:RED 3223A LAMP	80009	150-1233-00
A11A1DS415	150-1233-00		LT EMITTING DIO:RED 3223A LAMP	80009	150-1233-00
A11A1DS416	150-1233-00		LT EMITTING DIO:RED 3223A LAMP	80009	150-1233-00
A11A1P401	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A11A1Q400	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1Q401	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1Q402	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3

Component No.	Tektronix Part No.	Serial/Assembly No. Effective Descnt	Name & Description	Mfr. Code	Mfr. Part No.
A11A1Q403	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1Q404	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1Q405	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1Q406	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1Q407	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1Q408	151-5021-00		TRANSISTOR:NPN,SI,SOT-23 2N2222A	04713	MMBT2222AT1,T3
A11A1R400	307-0525-00		RES NTWK,FXD,FI:56 OHM,2%,0.125W,(9)RES	91637	MSP10A01560G
A11A1R401	315-0270-00		RES,FXD,FILM:27 OHM,5%,0.25W	19701	5043CX27R00J
A11A1U402	150-1213-00		LT EMITTING DIO:RED,6 SEG,+/-1.	80009	150-1213-00
A11A1U403	150-1214-00		LT EMITTING DIO:RED,7 SEGMENTS	80009	150-1214-00
A11A1U408	150-1214-00		LT EMITTING DIO:RED,7 SEGMENTS	80009	150-1214-00
A11A1U409	150-1214-00		LT EMITTING DIO:RED,7 SEGMENTS	80009	150-1214-00
A11A1U410	150-1214-00		LT EMITTING DIO:RED,7 SEGMENTS	80009	150-1214-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A12	671-1256-00		CIRCUIT BD ASSY:IEEE	80009	671-1256-00
A12C500	281-0956-00		CAP,FXD,CER DI:33PF,2%,100V	TK1727	CAP. 2222-683-10339
A12C501	281-0956-00		CAP,FXD,CER DI:33PF,2%,100V	TK1727	CAP. 2222-683-10339
A12C502	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C503	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C504	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C505	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C506	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C507	290-0804-00		CAP,FXD,ELCTLT:10UF,+50-20%,25V ALU	55680	UVX2A100MPA
A12C508	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C509	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C510	281-0775-00		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A12C521	281-0826-00		CAP,FXD,CER DI:2200PF,10%,100V	04222	SA101C222KAA
A12DS500	150-1036-00		LT EMITTING DIO:RED,650NM,40MA MAX	14936	MV5074C
A12P500	136-0499-02		CONN,RCPT,ELEC:CIRCUIT BD,2 CONTACTS	00779	3-380949-2
A12P501	136-0499-04		CONN,RCPT,ELEC:CIRCUIT BD,4 CONTACTS	00779	3-380949-4
A12Q500	151-0190-00		TRANSISTOR:NPN,SI,TO-92	04713	2N3904
A12Q501	151-0190-00		TRANSISTOR:NPN,SI,TO-92	04713	2N3904
A12R500	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A12R501	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A12R502	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A12R503	315-0103-00		RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A12R504	315-0391-00		RES,FXD,FILM:390 OHM,5%,0.25W	80031	5043CX390R0J
A12R505	315-0153-00		RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A12R506	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A12R507	315-0153-00		RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A12R508	315-0391-00		RES,FXD,FILM:390 OHM,5%,0.25W	80031	5043CX390R0J
A12R509	315-0103-00		RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A12R519	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A12R521	315-0101-00		RES,FXD,FILM:100 OHM,5%,0.25W	80031	5043CX100ROJ
A12R522	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A12R523	315-0472-00		RES,FXD,FILM:4.7K OHM,5%,0.25W	80031	5043CX4K700J
A12R524	315-0102-00		RES,FXD,FILM:1K OHM,5%,0.25W	80031	5043CX1K000J
A12TP503	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A12U500	156-3268-00		MICROCKT,DGTL:CMOS,MICROCOMPUTER,8 BIT	80009	156-3268-00
A12U501	156-2392-00		MICROCKT,DGTL:CMOS,HEX SCHMITT TRIG INV	04713	MC74HC14N
A12U502	156-1065-00		MICROCKT,DGTL:OCTAL D TYPE TRANS LATCHES	04713	SN74LS373N
A12U503	156-0277-00		MICROCKT,LINEAR:VOLTAGE REGULATOR	04713	M7805CT
A12U504	160-6238-00		MICROCKT,DGTL:CMOS,32768 X 8 EPROM W/3 ST OUTP	80009	160-6238-00
A12U505	156-1444-01		MICROCKT,DGTL:NMOS,GPIB INTFC CONTROLLER	01295	TMS9914A NL
A12U506	156-1562-00		CPLR,OPTOEL:LED & PHOTO DARLINGTON,5KV ISLN	04713	4N29A
A12U507	156-1562-00		CPLR,OPTOEL:LED & PHOTO DARLINGTON,5KV ISLN	04713	4N29A
A12U508	156-3831-00		MICROCKT,DGTL:ALSTTL,OCTAL GPIB XCVR DATA BUS	01295	SN75ALS160S
A12U509	156-3832-00		MICROCKT,DGTL:ALSTTL,OCTAL GPIB XCVR MGT BUS	01295	SN75ALS161N
A12U510	156-2396-00		MICROCKT,LINEAR:BIPOLAR,MPU RES GEN	01295	TL7705 ACP
A12W500	131-0566-00		BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA 07
A12Y500	158-0343-00		XTAL UNIT,QTZ:9.8304MHZ	80009	158-0343-00
T100	120-1835-00		XFMR,FXD,ASSY:2 AMPS,250V	80009	120-1835-00

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2 -1975.

Logic symbology is based on ANSI Y32.14 -1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it is in the low state.

Abbreviations are based on ANSI Y1.1 -1972.

Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

Y14. 15, 1966	Drafting Practices.
Y 14. 2, 1973	Line Confentions and Lettering.
Y 10. 5, 1968	Letter Symbols for Quantities Used in Electrical Sience and Electrical Engineering.

American National Institute
1430 Broadway
New York 10018

Component Values

Electrical components shown on the diagrams are in the following units noted otherwise:

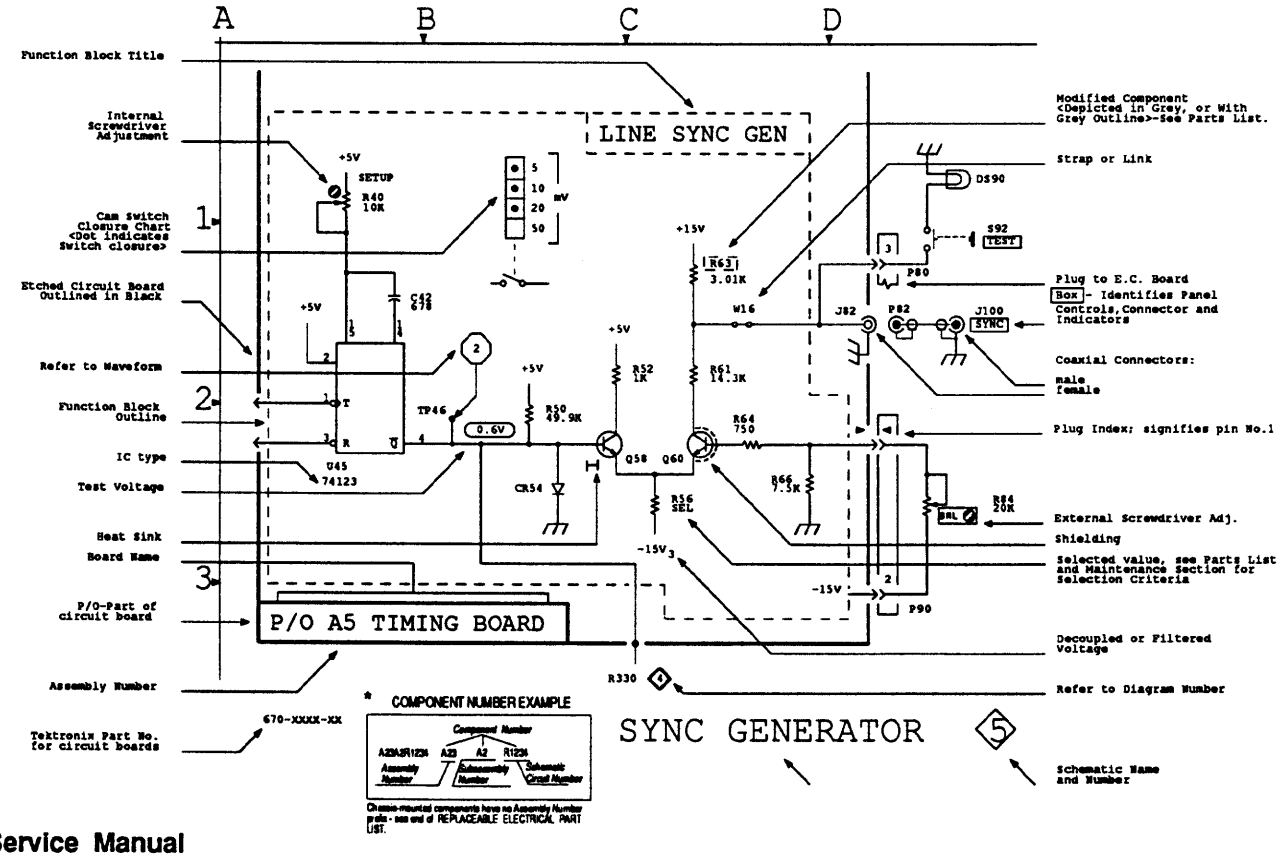
Capacitors =	Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF)
Resistors =	Ohms (Ω)

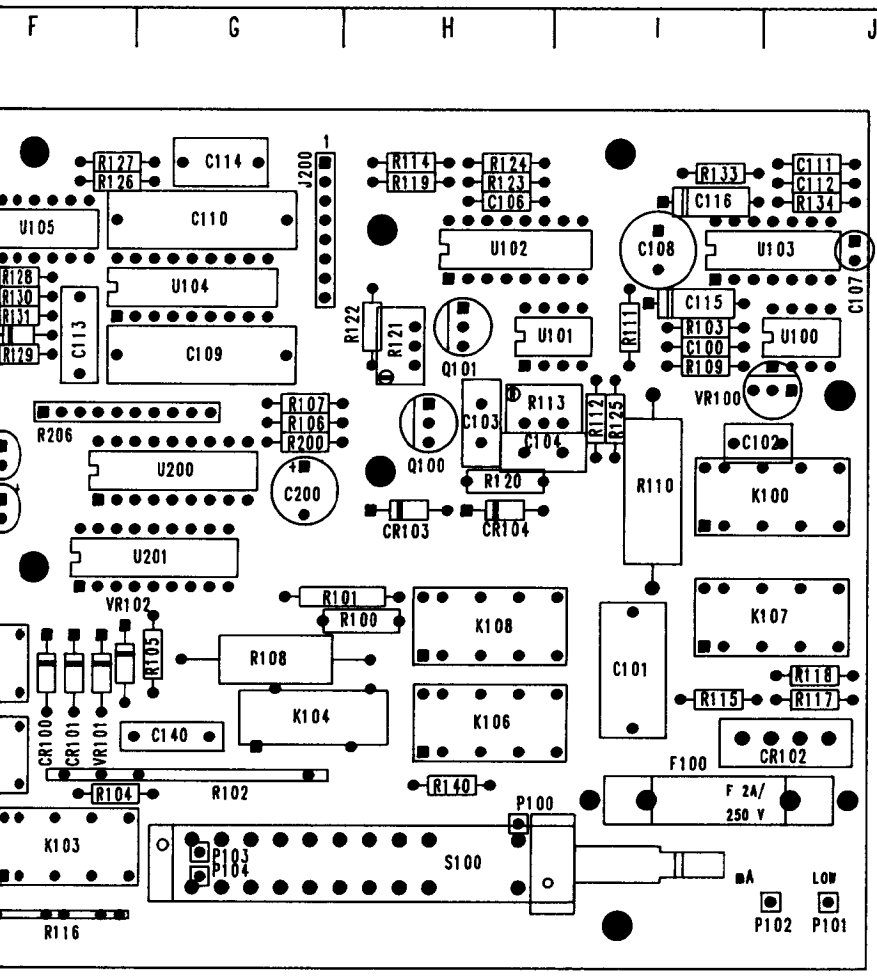
The information and special symbols below may appear in this manual.

Assembly numbers and Grid Coordinates

Each assembly in the instrument is assigned an assembly number (e.g. A10). The assembly number appears on the circuit boare outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in number sequence; the components are listed by component number *(see following illustration for constructing a component number).

The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is providedfor ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagramon which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the cicuit board appears on.



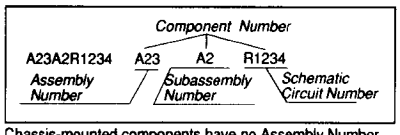


A10 ASSY

rd (A10)

STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix - see end of REPLACEABLE ELECTRICAL PART LIST.

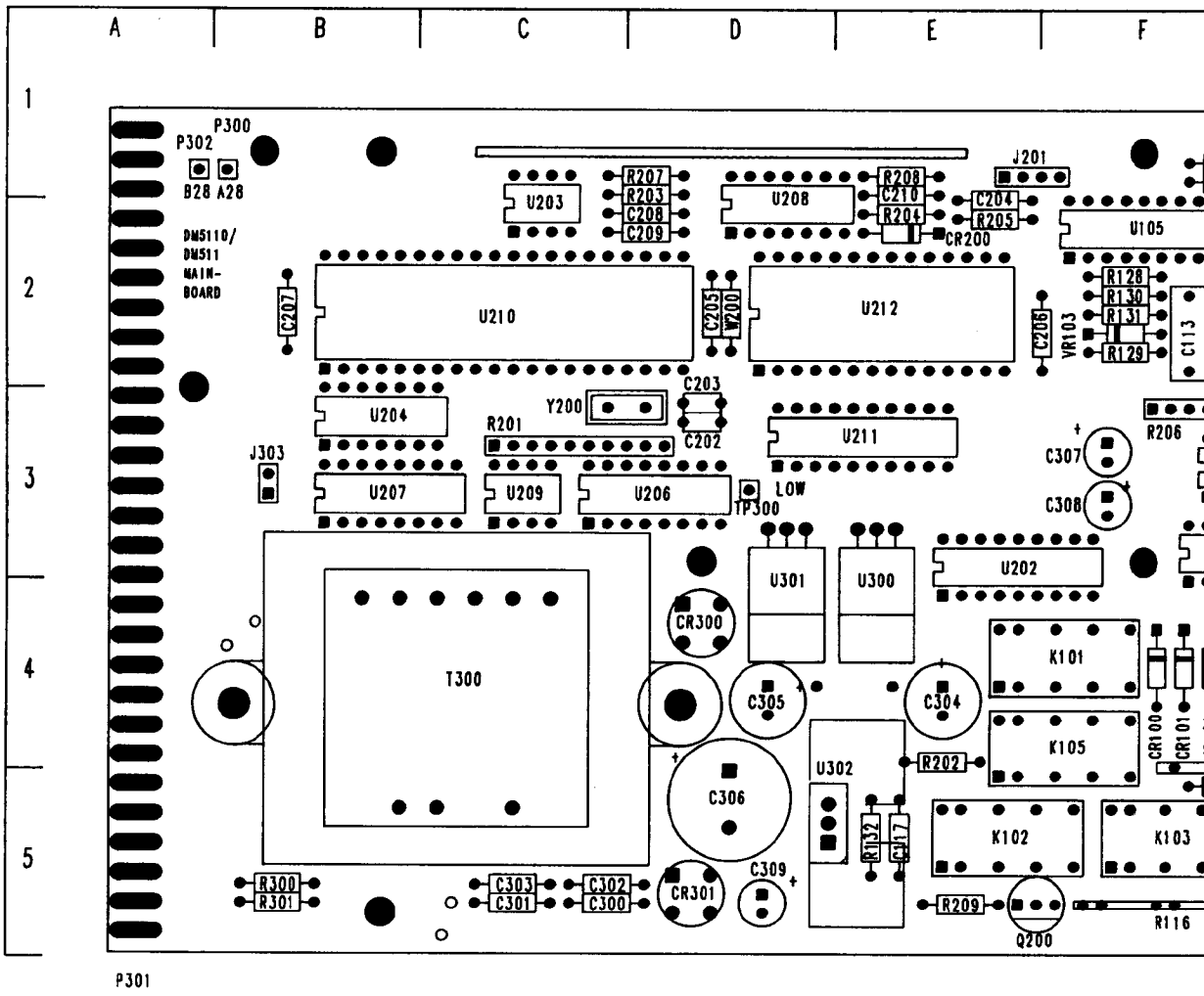


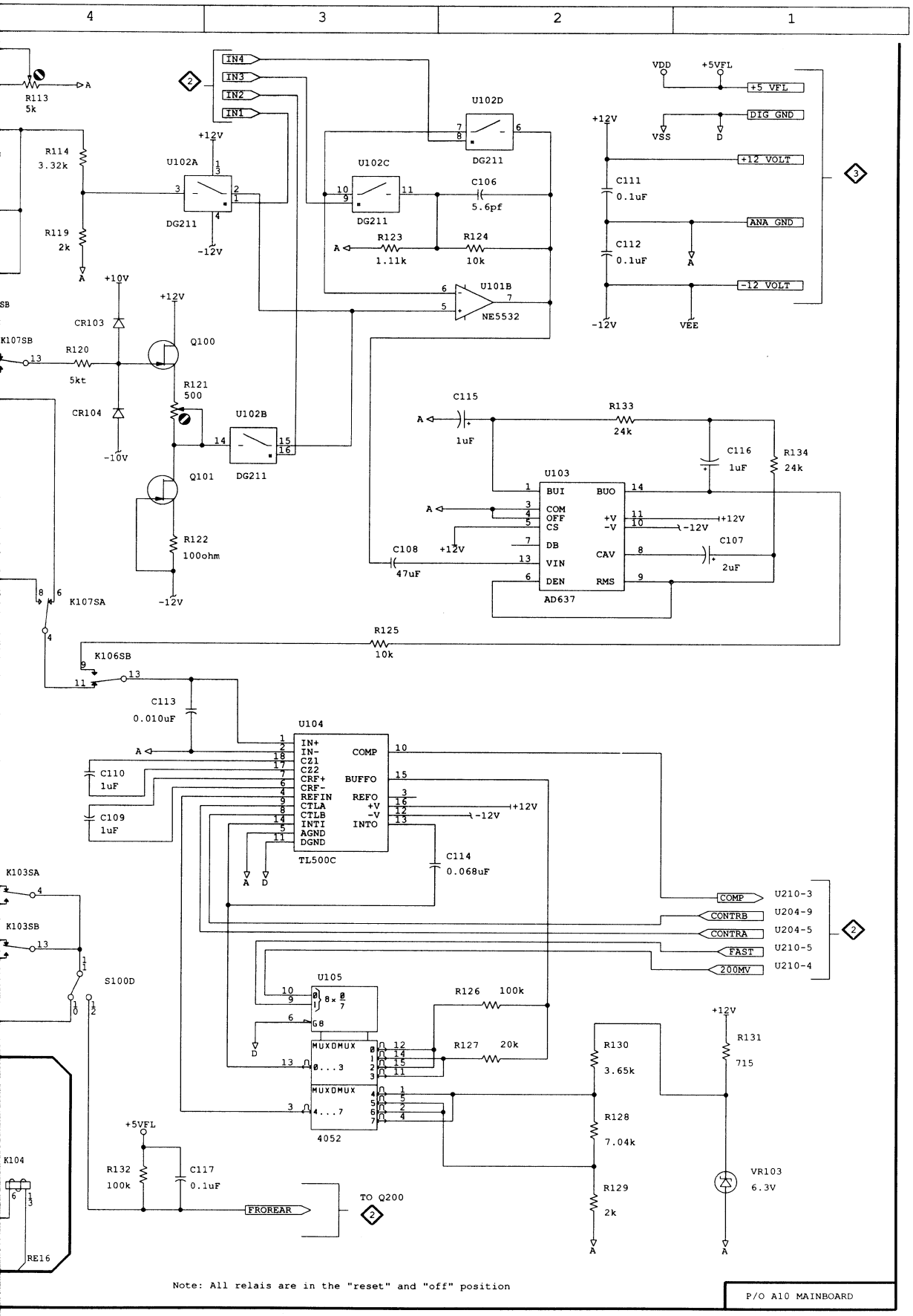
Fig 7-1. Main Board (A10)

Table 7-1
COMPONENT REFERENCE CHART

P/O A10 ASSY — ANALOG CIRCUIT ◇1

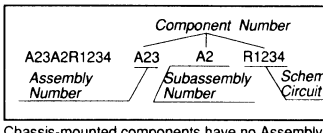
CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C100	B7	I2
C101	D6	I4
C102	D5	J3
C103	D5	H3
C104	D5	H3
C106	D2	H2
C107	C1	J2
C108	C3	I2
C109	B4	G2
C110	B4	G2
C111	D2	J1
C112	D2	J1
C113	B4	F2
C114	B2	G2
C115	C2	I2
C116	C1	I2
C117	A4	E5
C140	D6	G4
CR100	C6	F4
CR101	C5	F4
CR102	A7	J4
CR103	D4	H3
CR104	C4	H3
F100	A7	I4
K100	A6	J3
K101	A6	F4
K102	A6	E5
K103	A6	F5
K104	A5	G4
K105	A6	F4
K106	A5	H4
K107	A5	J4
K108	A5	H4
K100S-A	B5	J3
K100S-B	D5	J3
K101S-A	B5	F4
K101S-B	C6	F4
K102S-A	B5	E5
K102S-B	C6	E5
K103S-A	B4	F5
K103S-B	B4	F5
K104S-A	D6	G4
K105S-A	C5	F4
K105S-B	D6	F4
K106S-A	D7	H4
K106S-B	B4	H4
K107S-A	C4	J4
K107S-B	C4	J4
108S-A	D7	H4
K108S-B	C6	H4
P100	D8	H5
P101	B8	J5
P102	A8	J5
P103	C8	G5
P104	B8	G5
Q100	C4	H3
Q101	C4	H2
R100	C7	H4
R101	C7	H4
R102	C7	G4
R103	C7	I2
R104	C6	G4
R105	C6	G4
R106	C6	G3
R107	C5	G3
R108	D6	G4
R109	C7	I2
R110	D5	I3
R111	C7	I2
R112	D5	I3
R113	D4	H3
R114	D4	H1
R115	B6	I4
R116	B7	F5
R117	C4	J4
R118	B6	J4
R119	D4	H1
R120	C4	H3
R121	C4	H2
R122	C4	H2
R123	D3	H1
R124	D2	H1
R125	C3	I3
R126	B2	F1
R127	A2	F1
R128	A2	F2
R129	A2	F2
R130	A2	F2
R131	A1	F2
R132	A4	E5
R133	C2	I1
R134	C1	J1
R140	D7	H5
S100-A	D8	H5
S100-B	B7	H5
S100-C	A7	H5
S100-D	B4	H5
S100-E	D7	H5
S100-F	B7	H5
S100-G	C8	H5
S100-H	B7	H5
T100	A8	-
U100	C7	J2
U101-A	D5	H2
U101-B	D2	H2
U102-A	D3	H2
U102-B	C3	H2
U102-C	D3	H2
U102-D	D2	H2
U102-E	D2	H2
U103	C2	J2
U104	B3	G2
U105	A3	F2
VR100	B7	J2
VR101	C6	F4
VR102	C5	F4
VR103	B7	F2

P/O A 10 also shown on ◇2 ◇3



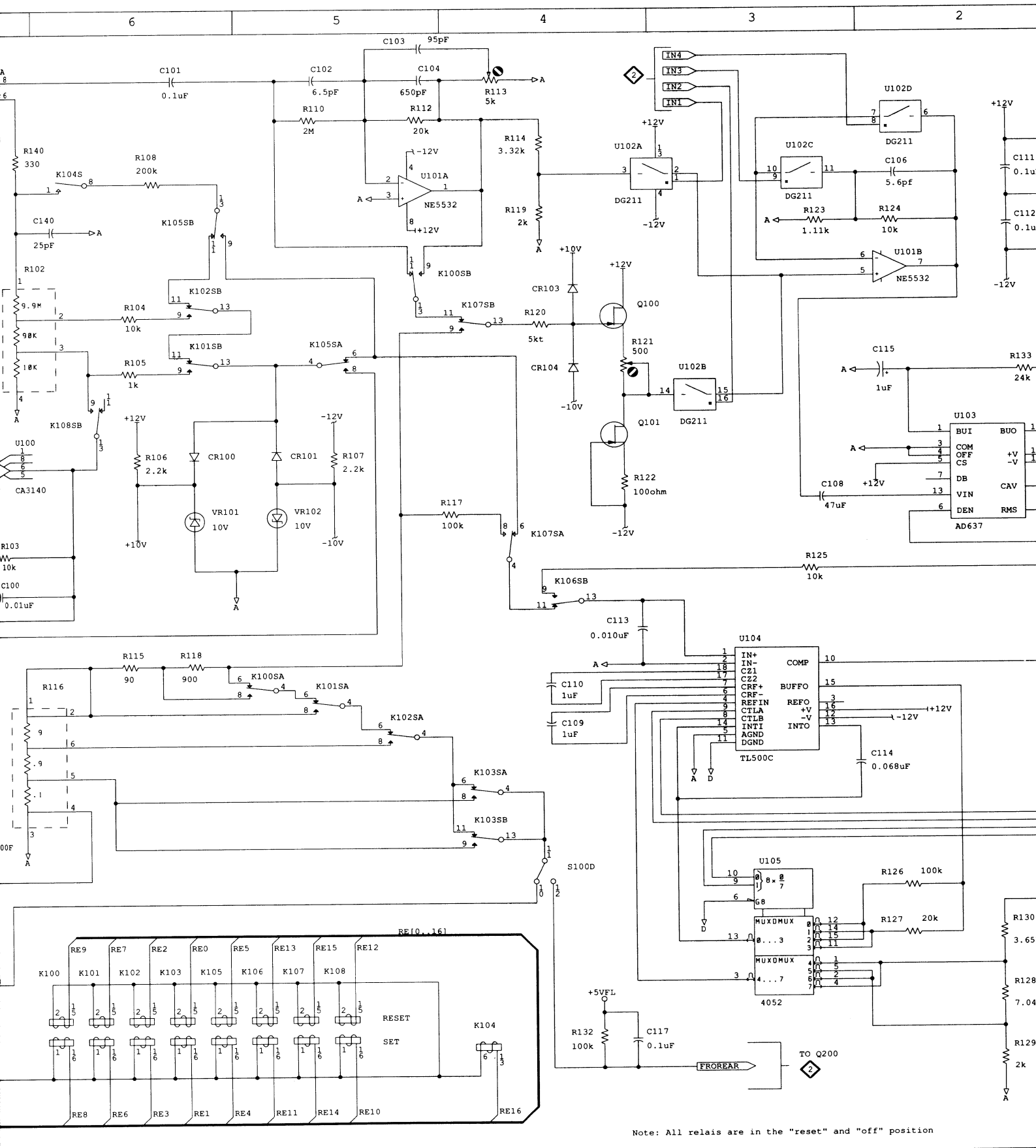
STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAM



Chassis-mounted components have no Assembly prefix - see end of REPLACEABLE ELECTRICA LIST.

ANALOG CIRCUIT ①


6
5
4
3
2
C103 95pF
C101 0.1uF
C102 6.5pF
C104 650pF
R113 5k
R110 2M
R112 20k
R114 3.32k
R119 2k
R140 330
R108 200k
K104S
C140 25pF
K105SB
K100SB
R102 9.9M
90K
10K
R104 10k
K102SB
K101SB
K105SA
R105 1k
K108SB
U100
CA3140
R103 10k
C100 0.01uF
U101A NE5532
-12V
+12V
A
IN4
IN3
IN2
IN1
U102A
U102C
U102D
DG211
C106 5.6pf
R123 1.11k
R124 10k
U101B NE5532
+10V
CR103
CR104
Q100
Q101
K107SB
R120 5kt
R121 500
U102B
R122 100ohm
C115 1uF
R133 24k
U103
BUI
BUO
COM
OFF
CS
+V
-V
DB
CAV
VIN
DEN
RMS
AD637
C108 47uF
R106 2.2k
R107 2.2k
CR100
CR101
VR101 10V
VR102 10V
R117 100k
K107SA
R125 10k
K106SB
C113 0.010uF
U104
IN+
IN-
CZ1
CZ2
CRF+
CRF-
REFIN
CTLA
CTLB
INTI
AGND
DGND
COMP
BUFFO
REFO
+V
-V
INTO
TL500C
C110 1uF
C109 1uF
C114 0.068uF
R115 90
R118 900
R116
K100SA
K101SA
K102SA
K103SA
K103SB
S100D
U105
8x 0
G8
MUXOMUX
0...3
4...7
4052
R126 100k
R127 20k
R130 3.65
R128 7.04
R129 2k
+5VFL
R132 100k
C117 0.1uF
FROREAR
TO Q200
RE[0..16]
RE9 RE7 RE2 RE0 RE5 RE13 RE15 RE12
K100 K101 K102 K103 K105 K106 K107 K108
RESET
SET
K104
RE8 RE6 RE3 RE1 RE4 RE11 RE14 RE10 RE16
Note: All relais are in the "reset" and "off" position

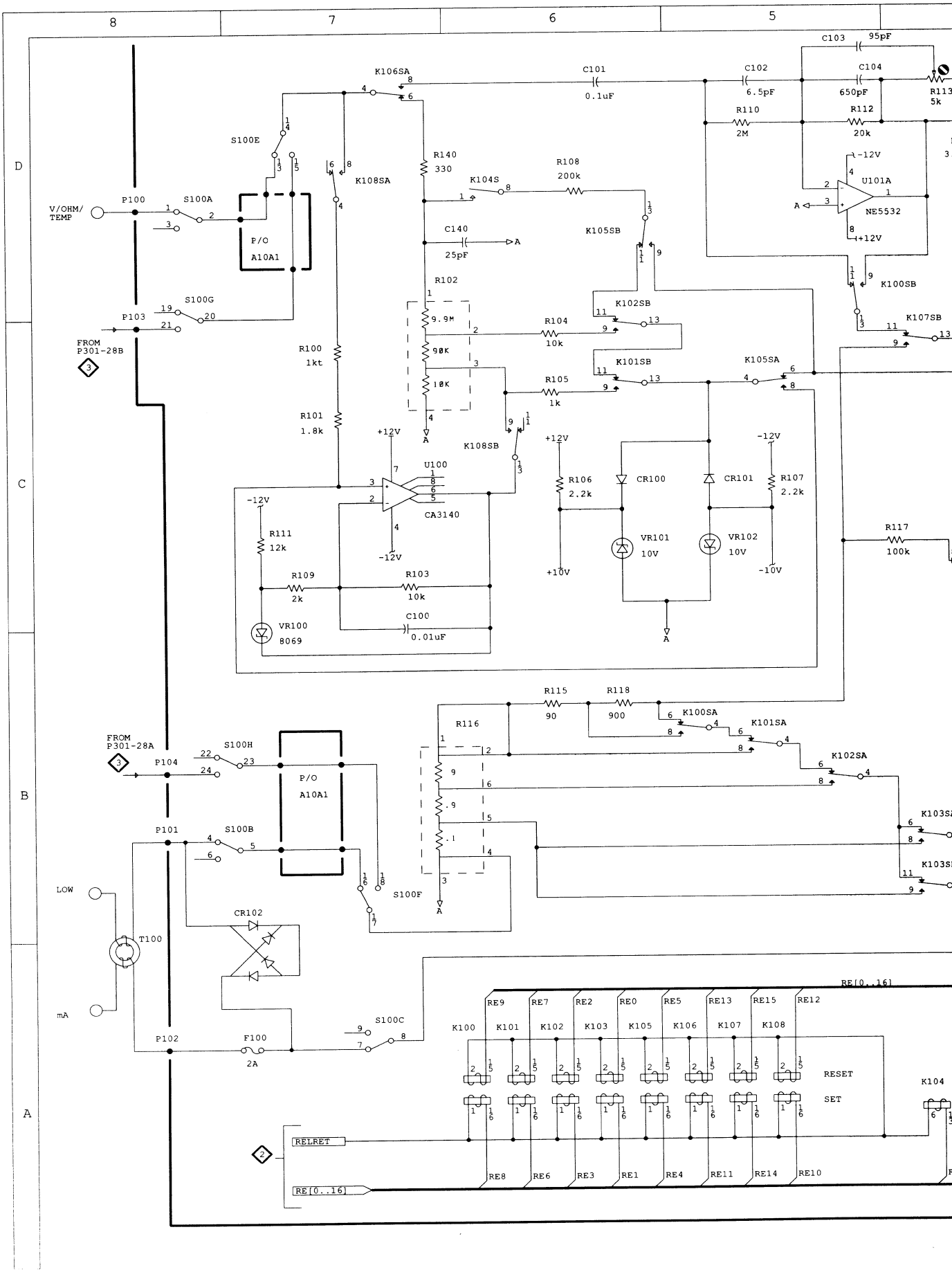
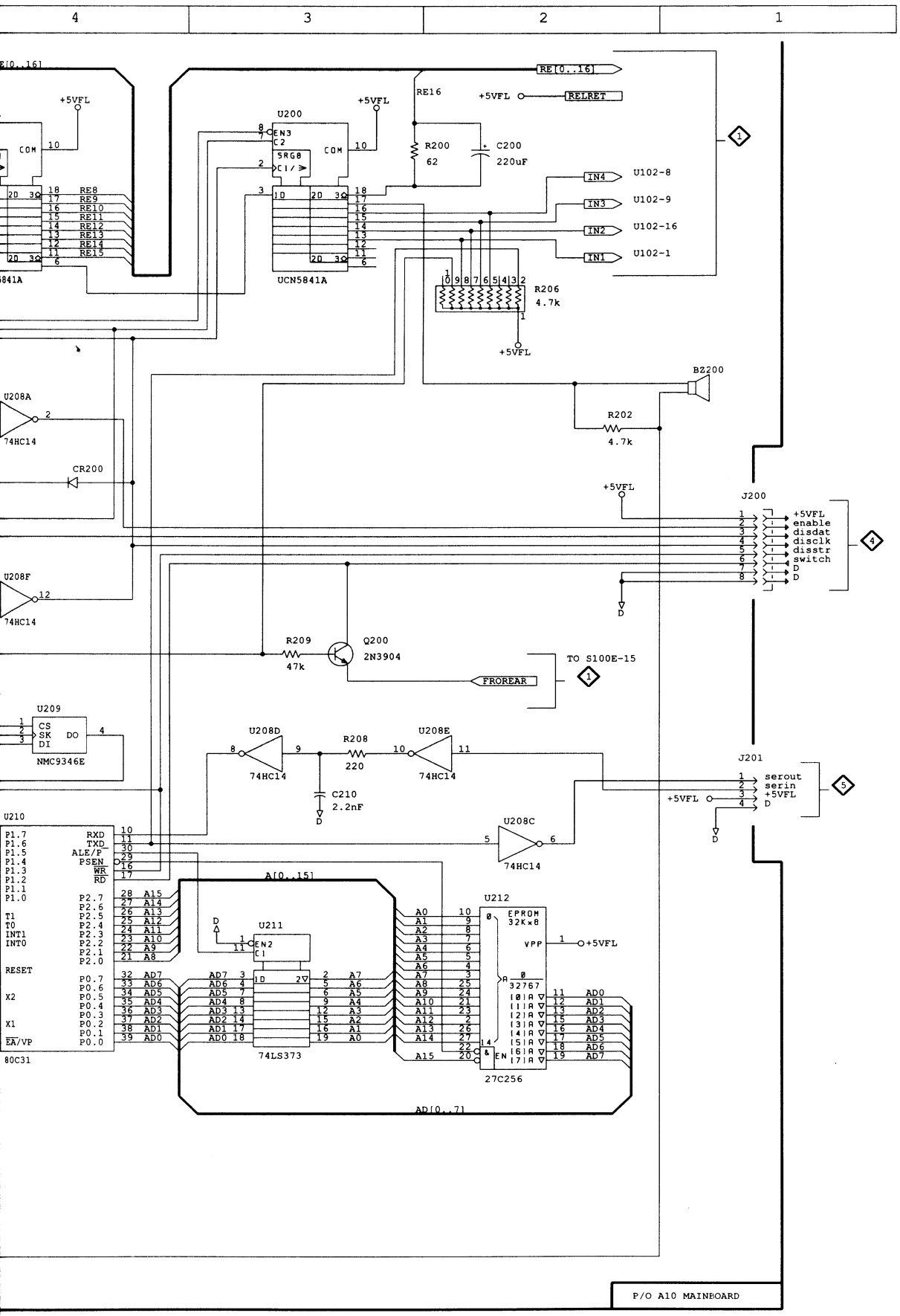

8
7
6
5
D
C
B
A
C103 95pF
C101 0.1uF
C102 6.5pF
C104 650pF
R113 5k
R110 2M
R112 20k
K106SA
S100E
K108SA
R140 330
K104S
R108 200k
C140 25pF
K105SB
R102
9.9M
90K
10K
R104 10k
R100 1kt
R101 1.8k
K102SB
K101SB
K105SA
R105 1k
K108SB
U100
CA3140
R111 12k
R109 2k
R103 10k
C100 0.01uF
VR100 8069
R106 2.2k
CR100
CR101
R107 2.2k
VR101 10V
VR102 10V
U101A
NE5532
-12V
+12V
+10V
-10V
K100SB
K107SB
R117 100k
V/OHM/ TEMP
P100
S100A
P/O A10A1
P103
S100G
FROM P301-28B
FROM P301-28A
P104
S100H
P101
S100B
R115 90
R118 900
R116
K100SA
K101SA
K102SA
K103SA
K103SB
S100F
LOW
mA
T100
CR102
P102
F100 2A
S100C
RE[0..16]
RE9
RE7
RE2
RE0
RE5
RE13
RE15
RE12
K100
K101
K102
K103
K105
K106
K107
K108
RESET
SET
K104
RELRET
RE8
RE6
RE3
RE1
RE4
RE11
RE14
RE10

Table 7-2
COMPONENT REFERENCE CHART

P/O A10 ASSY — DIGITAL CIRCUIT ◇2

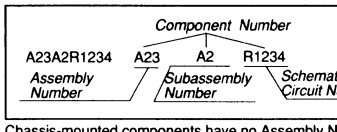
CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
BZ200	C1	_
C200	D2	G3
C202	A5	D3
C203	A4	D3
C204	C5	E2
C205	D8	D2
C206	D8	F2
C207	D7	B2
C208	C7	D2
C209	C8	D2
C210	B3	E1
CR200	C4	E2
J200	C1	G1
J201	B1	E1
Q200	C3	F5
R200	D3	G3
R201	B5	C3
R202	C2	E4
R203	B6	D1
R204	C4	E2
R205	C5	E2
R206	D2	F3
R207	C5	D1
R208	B3	E1
R209	C3	E5
U200	D3	G3
U201	D4	G3
U202	D5	E3
U203	C7	C2
U204-A	A7	B3
U204-B	B7	B3
U206	A6	D3
U207	C7	B3
U208-A	C4	D2
U208-B	C5	D2
U208-C	B2	D2
U208-D	B3	D2
U208-E	B2	D2
U208-F	C4	D2
U209	B4	C3
U210	B4	C2
U211	B3	E3
U212	B2	E2
W200	-	D2
Y200	A5	C3

P/O A10 also shown on ◇1 ◇3



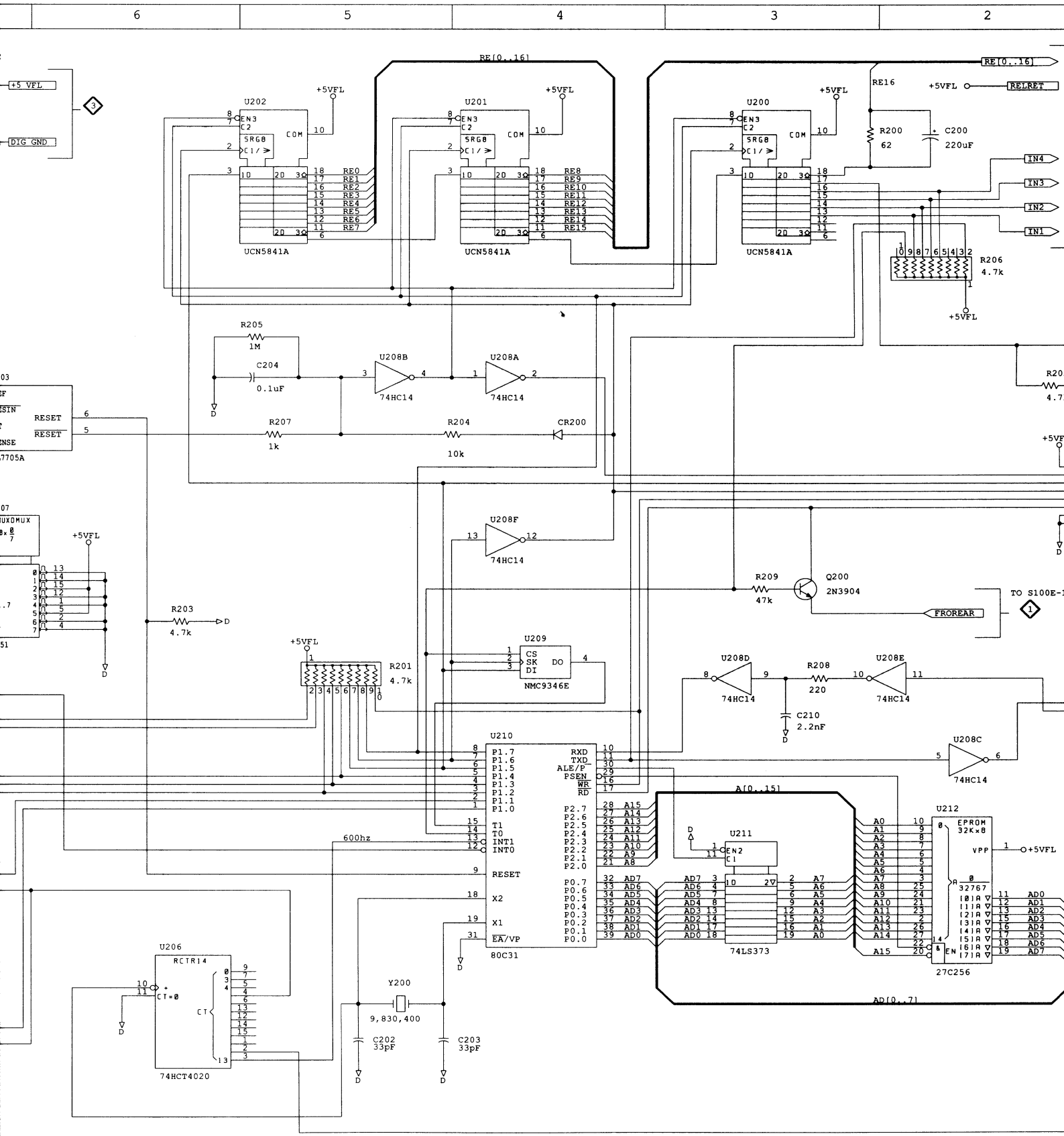
STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAMP



Chassis-mounted components have no Assembly N
prefix - see end of REPLACEABLE ELECTRICAL
LIST.

DIGITAL CIRCUIT 2


6
5
4
3
2
RE[0..16]
U202
U201
U200
UCN5841A
SRG8
COM
+5VFL
RE16
RELRET
R200
62
C200
220uF
IN4
IN3
IN2
IN1
R206
4.7k
R205
1M
C204
0.1uF
U208B
U208A
74HC14
R207
1k
R204
10k
CR200
RESET
U208F
R209
47k
Q200
2N3904
TO S100E-1
FROREAR
R203
4.7k
R201
4.7k
U209
NMC9346E
U208D
U208E
R208
220
C210
2.2nF
U208C
U210
80C31
600hz
A[0..15]
U211
74LS373
U212
EPROM
32Kx8
27C256
AD[0..7]
U206
RCTR14
74HCT4020
Y200
9,830,400
C202
33pF
C203
33pF

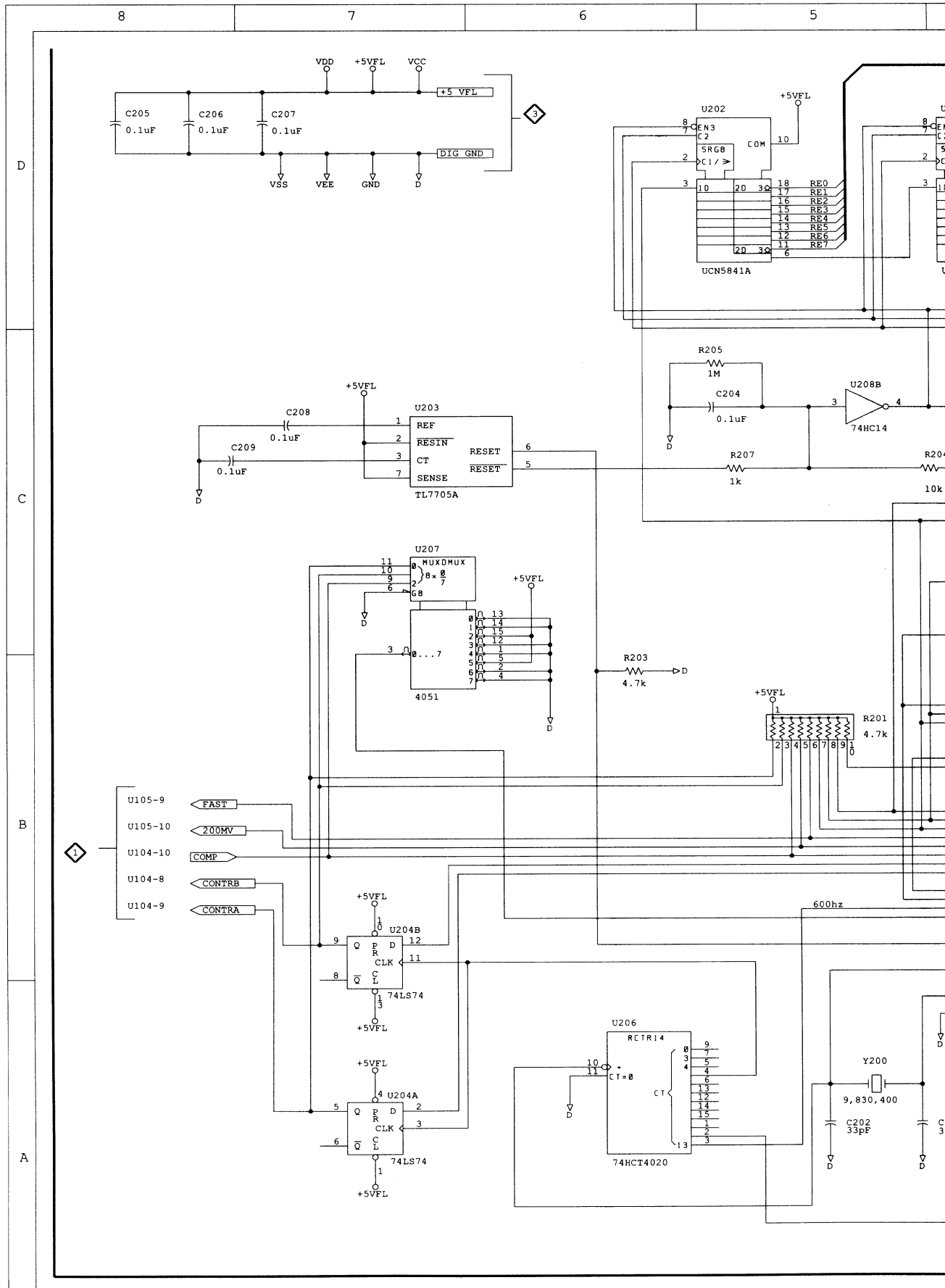

8
7
6
5
D
C
B
A
VDD
+5VFL
VCC
+5 VFL
C205
0.1uF
C206
0.1uF
C207
0.1uF
DIG GND
VSS
VEE
GND
D
U202
EN3
C2
SRGB
C1/>
COM
1D
2D
3D
RE0
RE1
RE2
RE3
RE4
RE5
RE6
RE7
UCN5841A
R205
1M
C204
0.1uF
U208B
74HC14
C208
0.1uF
C209
0.1uF
U203
REF
RESIN
CT
SENSE
RESET
RESET
TL7705A
R207
1k
R204
10k
U207
MUXDMUX
8x
G8
0...7
4051
R203
4.7k
R201
4.7k
U105-9
U105-10
U104-10
U104-8
U104-9
FAST
200MV
COMP
CONTRB
CONTRA
U204B
U204A
CLK
74LS74
600hz
U206
RCTR14
CT=0
CT
74HCT4020
Y200
9,830,400
C202
33pF

Table 7-3
COMPONENT REFERENCE CHART

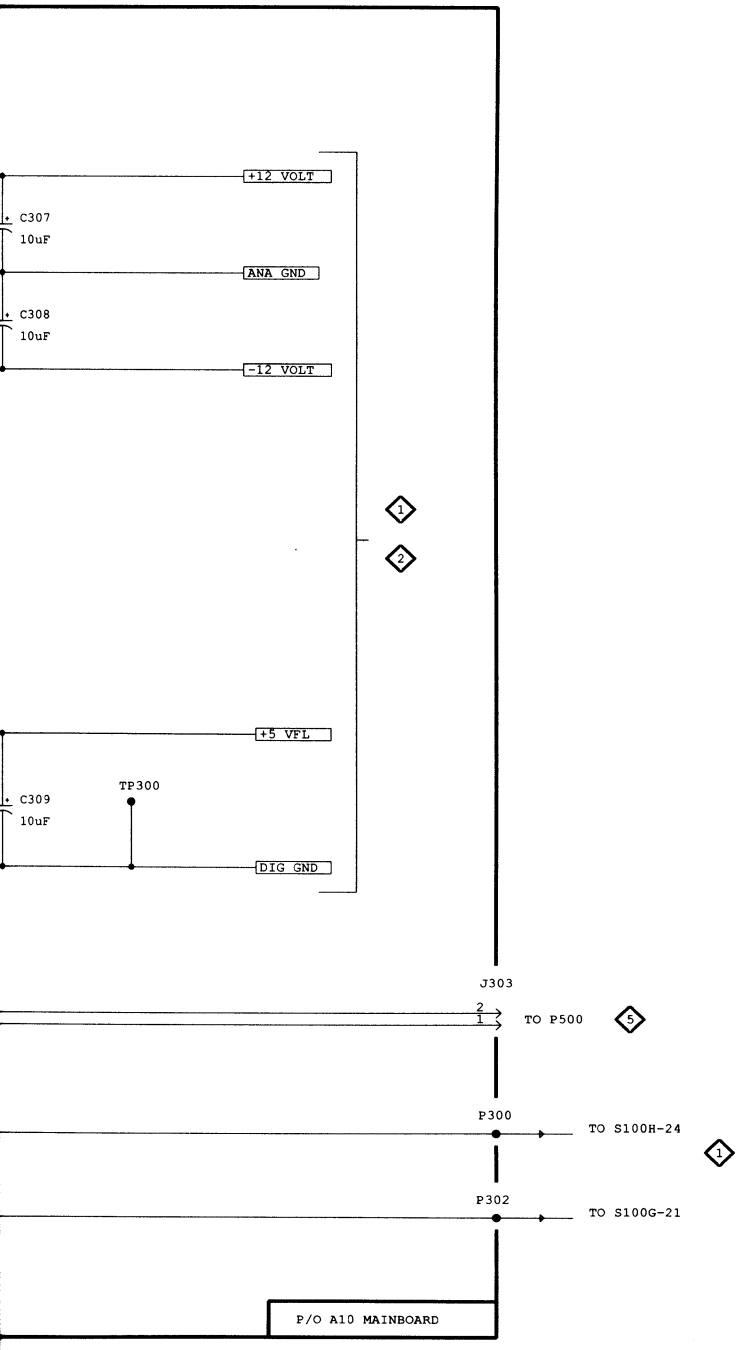
P/O A10 ASSY

POWER CIRCUIT ◇3

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C300	B6	C5	J303	A3	B3
C301	B6	C5	P300	A3	B1
C302	B6	C5	P301	C8	A1
C303	B6	C5	P302	A3	A1
C304	C5	E4	R300	C8	B5
C305	C5	D4	R301	C7	B5
C306	B5	D5	T300	C7	C4
C307	C4	F3	TP300	B4	D3
C308	C4	F3			
C309	B4	D5	U300	C5	E3
CR300	C6	D4	U301	C5	D3
CR301	B6	D5	U302	B5	E5

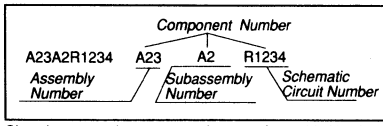
P/O A10 also shown on ◇1 ◇2

4	3	2	1



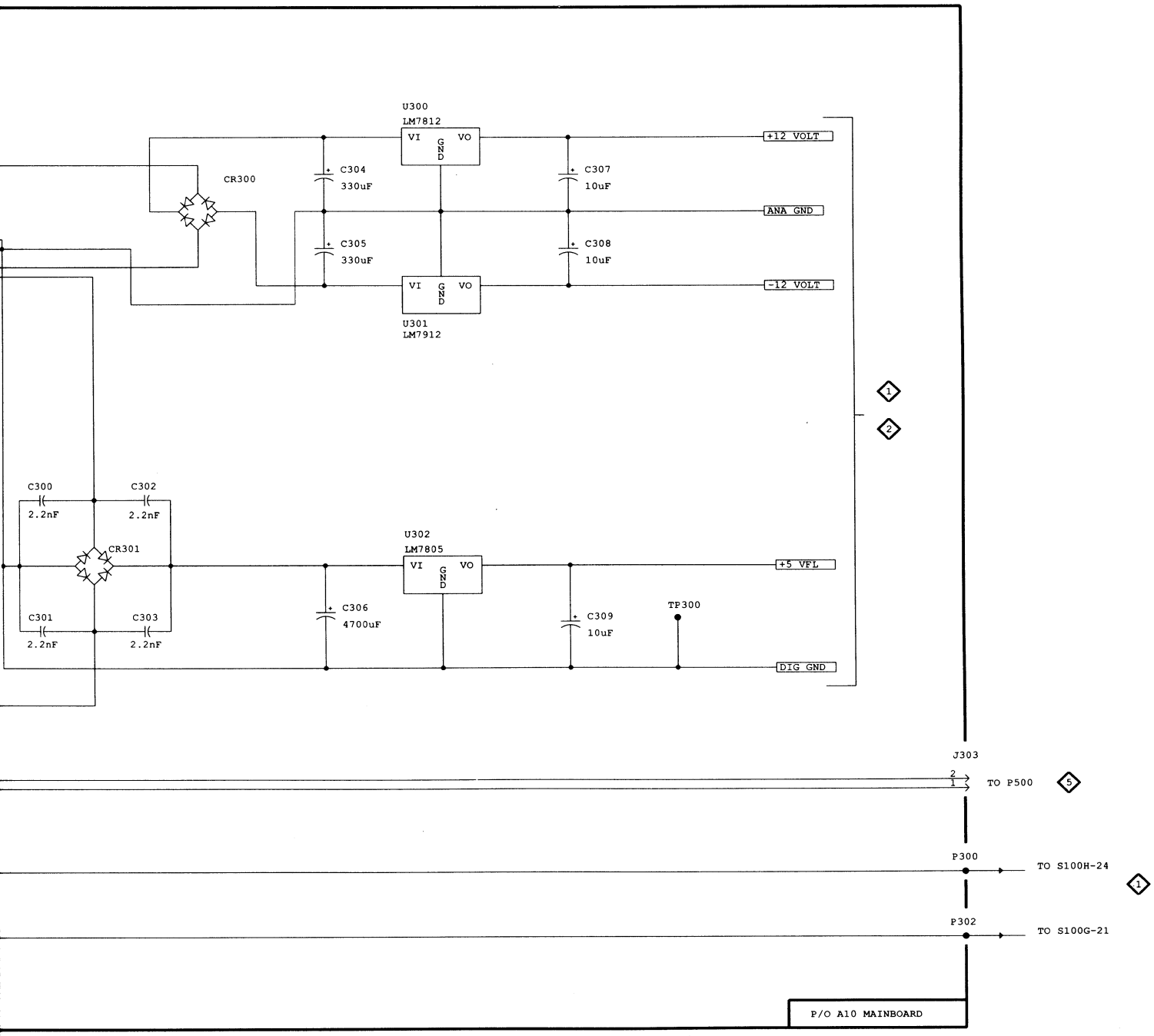
STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

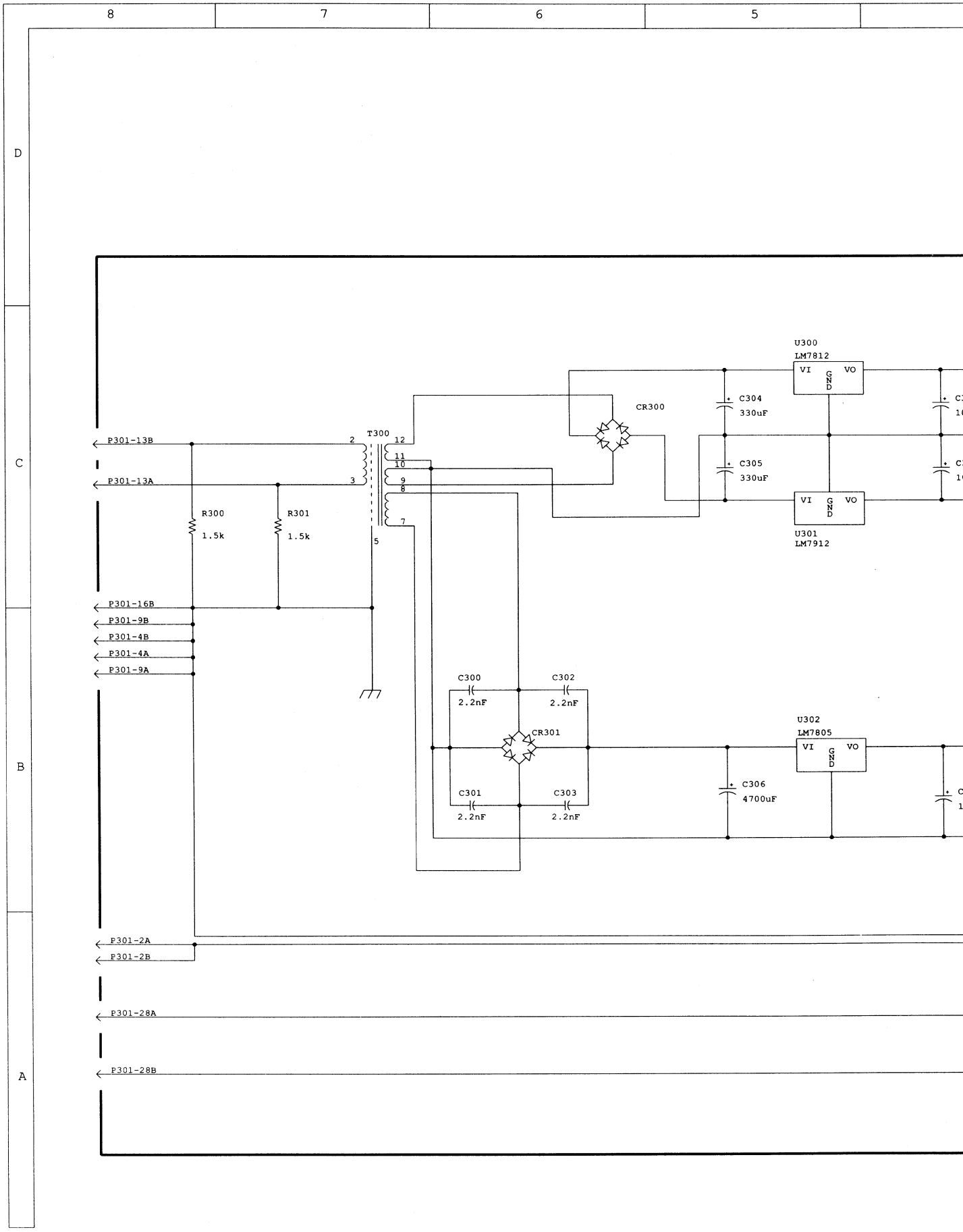
COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix - see end of REPLACEABLE ELECTRICAL PART LIST.

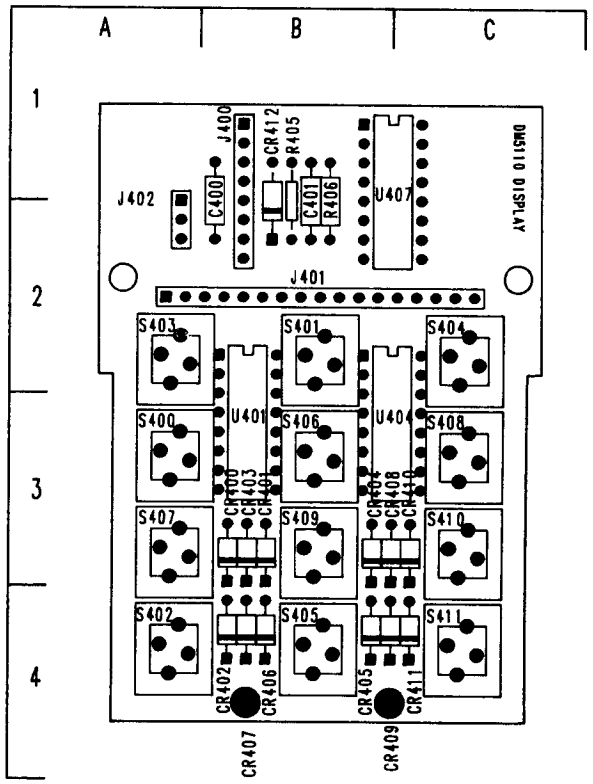
POWER CIRCUIT 3


U300
LM7812
VI
GND
VO
+12 VOLT
CR300
C304
330uF
C307
10uF
ANA GND
C305
330uF
C308
10uF
-12 VOLT
U301
LM7912
1
2
C300
2.2nF
C302
2.2nF
CR301
U302
LM7805
+5 VFL
C306
4700uF
C309
10uF
TP300
C301
2.2nF
C303
2.2nF
DIG GND
J303
2
1
TO P500
5
P300
TO S100H-24
1
P302
TO S100G-21
P/O A10 MAINBOARD


8
7
6
5
D
C
B
A
P301-13B
P301-13A
P301-16B
P301-9B
P301-4B
P301-4A
P301-9A
P301-2A
P301-2B
P301-28A
P301-28B
T300
2
3
12
11
10
9
8
7
5
R300
1.5k
R301
1.5k
CR300
CR301
C300
2.2nF
C301
2.2nF
C302
2.2nF
C303
2.2nF
C304
330uF
C305
330uF
C306
4700uF
U300
LM7812
U301
LM7912
U302
LM7805
VI
GND
VO

DM 5110 / 511

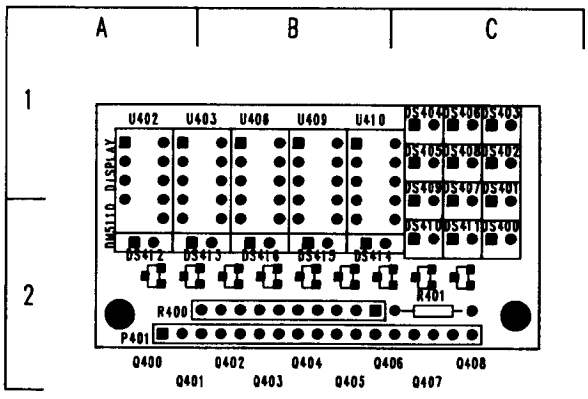
PARTS LOCATION GRID



A11 ASSY

Fig 7-2. Switch Board (A11)

PARTS LOCATION GRID

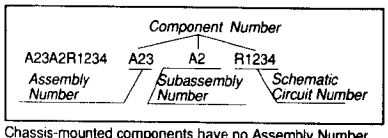


A11A1 ASSY

Fig 7-3 Display Board (A11A1)

STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix - see end of REPLACEABLE ELECTRICAL PART LIST.

Table 7-4
COMPONENT REFERENCE CHART

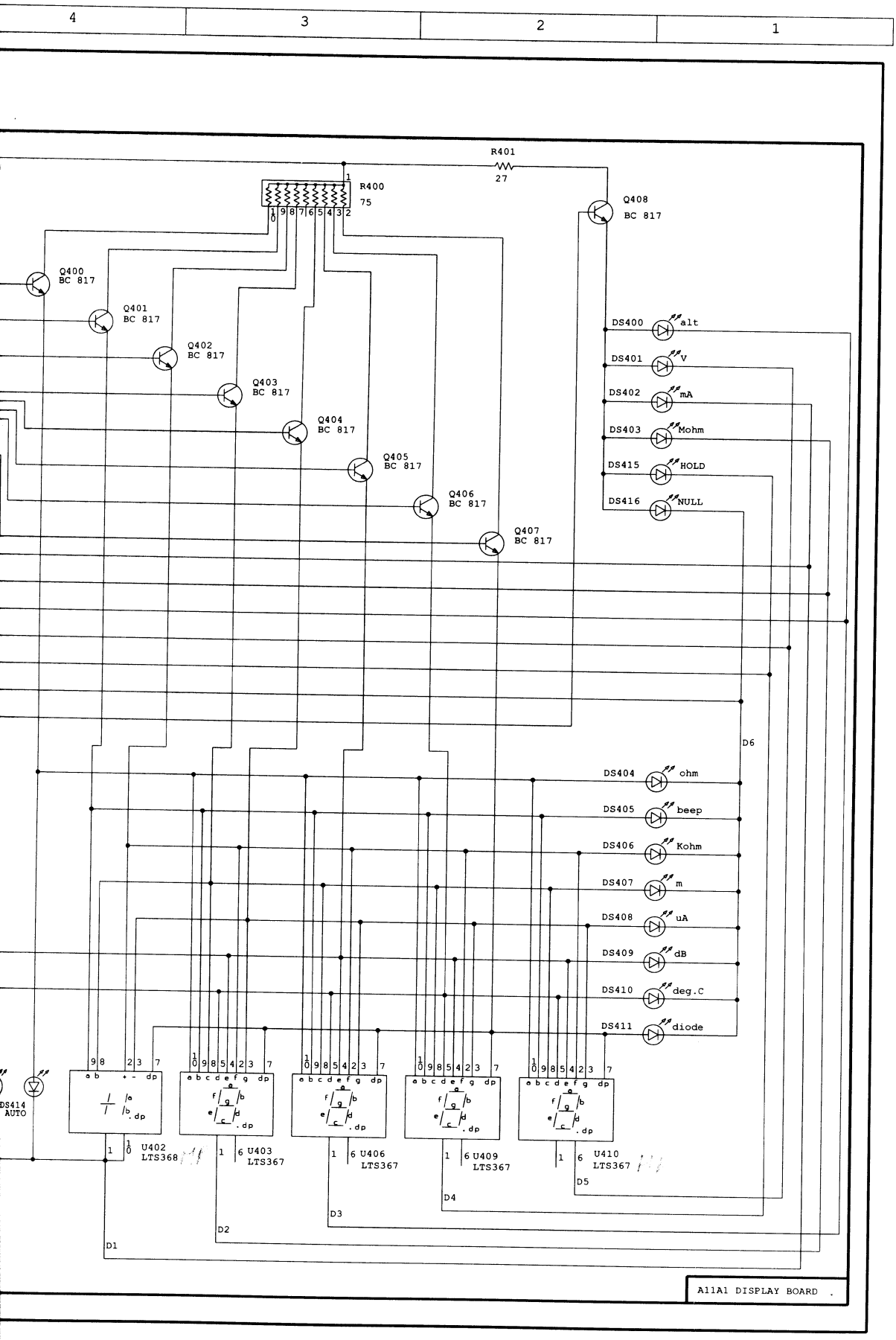
A11 ASSY — **SWITCH CIRCUIT** ④

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C400	A8	B1	R405	D7	B1
C401	D6	B1	R406	D6	B1
CR400	C7	B3	S400	C7	A3
CR401	B7	B3	S401	B7	B2
CR402	B7	B4	S402	B7	A4
CR403	B7	B3	S403	B7	A2
CR404	B7	B3	S404	B7	C2
CR405	B7	B4	S405	B7	B4
CR406	B7	B4	S406	B7	B3
CR407	B7	B4	S407	B7	A3
CR408	C7	B3	S408	C7	C3
CR409	C7	B4	S409	C7	B3
CR410	C7	C3	S410	C7	C3
CR411	C7	C4	S411	C7	C4
CR412	C7	B1			
J400	D8	B1	U401	A7	B3
J401	C5	B2	U404	D7	C3
J402	C7	A2	U407	D6	C1

Table 7-5
COMPONENT REFERENCE CHART

A11A1 ASSY — **DISPLAY CIRCUIT** ④

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
DS400	D1	C2	P401	C5	A2
DS401	C1	C2	Q400	D4	A2
DS402	C1	C1	Q401	D4	A2
DS403	C1	C1	Q402	C4	B2
DS404	B1	C1	Q403	C3	B2
DS405	B1	C1	Q404	C3	B2
DS406	B1	C1	Q405	C3	B2
DS407	B1	C2	Q406	C2	B2
DS408	B1	C1	Q407	C2	C2
DS409	B1	C2	Q408	D2	C2
DS410	B1	C2			
DS411	A1	C2	R400	D3	B2
DS412	A4	A2	R401	D2	C2
DS413	A4	A2	U402	A4	A1
DS414	A4	B2	U403	A3	B2
DS415	C1	B2	U406	A3	B2
DS416	C1	B2	U409	A2	B2
			U410	A2	B2



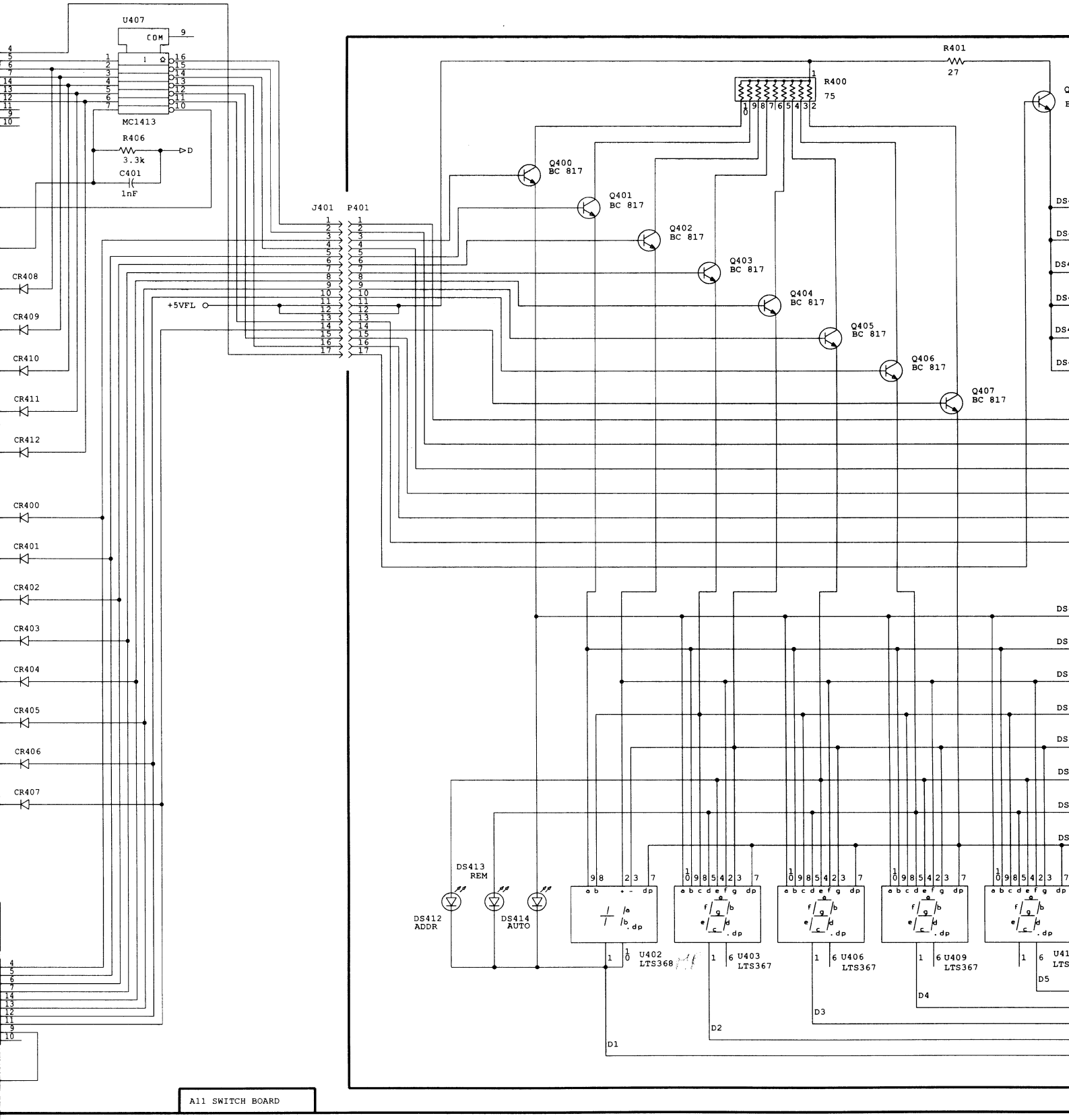
STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAMPLE

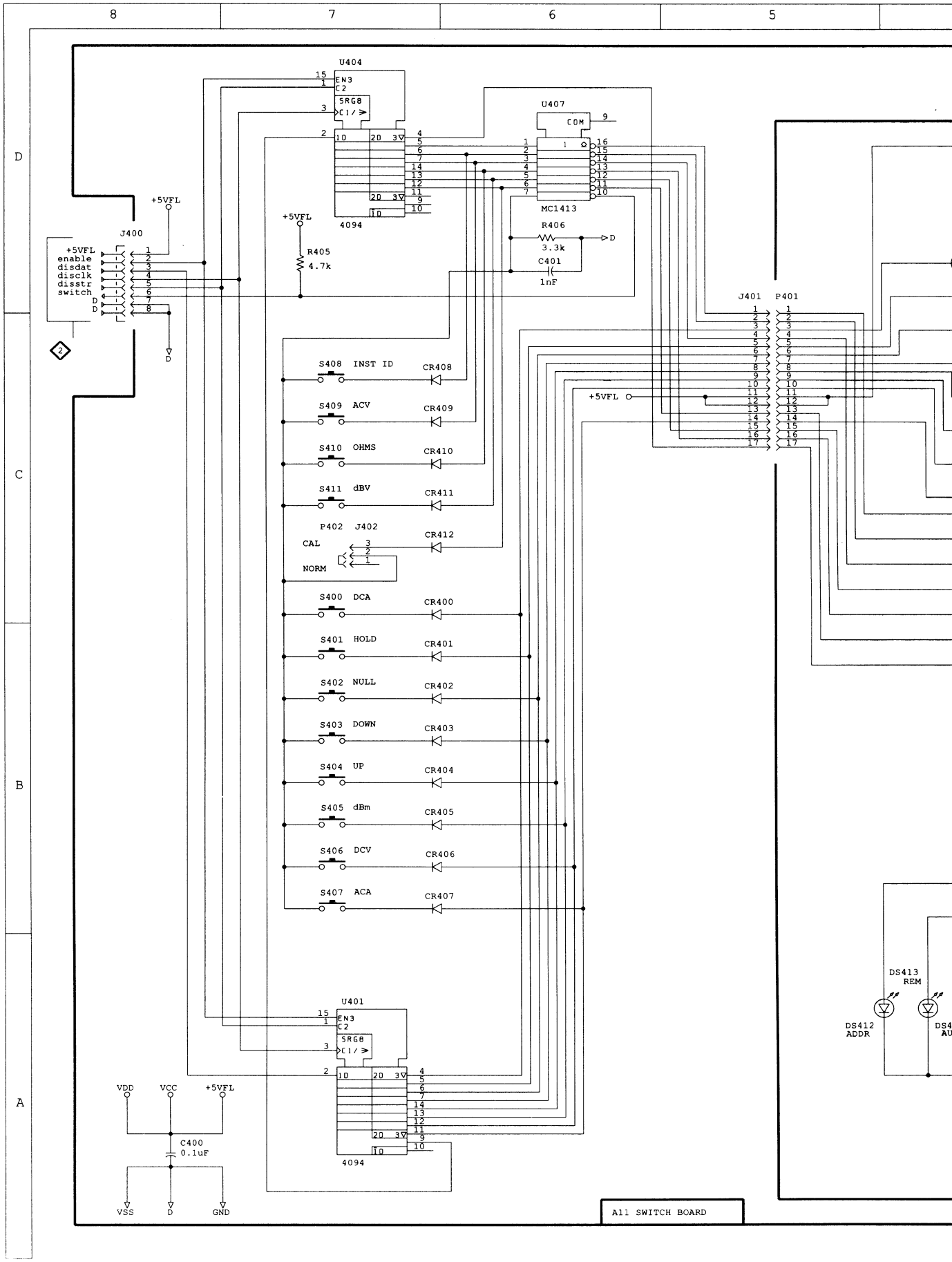
Component Number			
A23A2R1234	A23	A2	R1234
Assembly Number		Subassembly Number	Schematic Circuit Numb

Chassis-mounted components have no Assembly Numb prefix - see end of REPLACEABLE ELECTRICAL PAR LIST.

SWITCH/DISPLAY CIRCUIT 4



A11 SWITCH BOARD


8
7
6
5
D
C
B
A
U404
EN3
C2
SRG8
C1/
1D
2D
3D
4094
U407
COM
MC1413
R406
3.3k
C401
1nF
R405
4.7k
+5VFL
J400
+5VFL
enable
disdat
disclk
disstr
switch
D
J401
P401
S408 INST ID
CR408
S409 ACV
CR409
S410 OHMS
CR410
S411 dBV
CR411
P402 J402
CAL
NORM
CR412
S400 DCA
CR400
S401 HOLD
CR401
S402 NULL
CR402
S403 DOWN
CR403
S404 UP
CR404
S405 dBm
CR405
S406 DCV
CR406
S407 ACA
CR407
U401
VDD
VCC
C400
0.1uF
VSS
GND
DS413
REM
DS412
ADDR
A11 SWITCH BOARD

PARTS LOCATION GRID

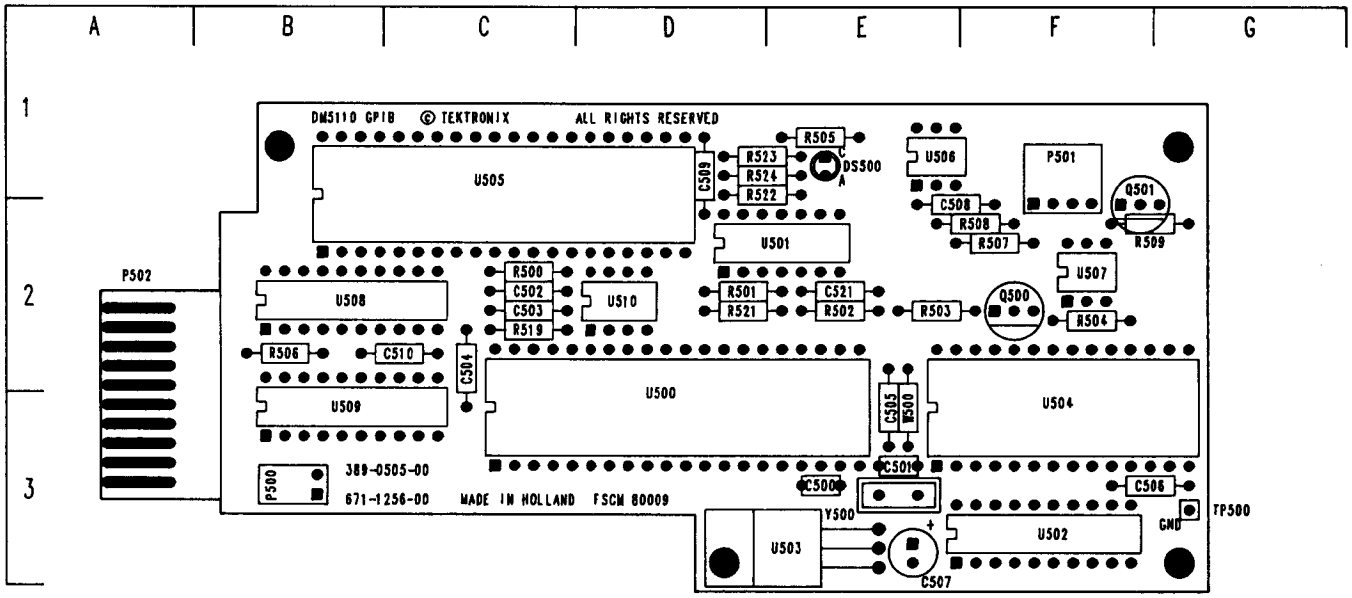
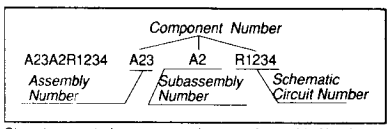


Fig 7-4. GPIB Board (A12)

STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAMPLE

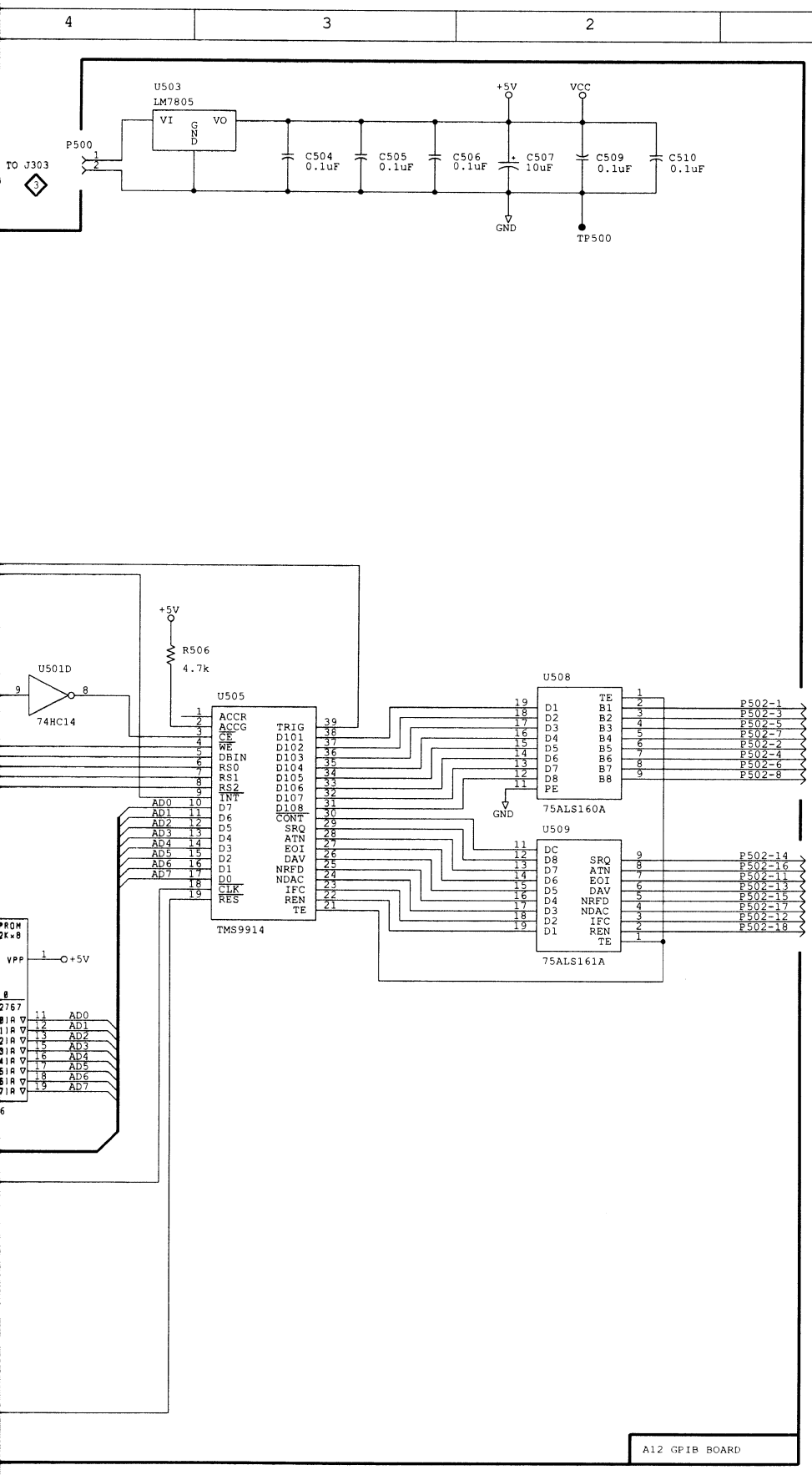


Chassis-mounted components have no Assembly Number prefix - see end of REPLACEABLE ELECTRICAL PART LIST

Table 7-6
COMPONENT REFERENCE CHART

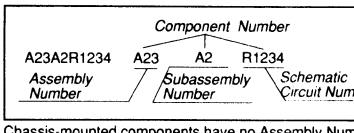
A12 ASSY — **GPIB CIRCUIT** ◇5

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C500	A7	E3
C501	A7	E3
C502	A7	C2
C503	A7	C2
C504	D3	C2
C505	D3	E3
C506	D3	F3
C507	D2	E3
C508	D7	E2
C509	D2	D1
C510	D2	C2
C521	D5	E2
DS500	C6	E1
P500	D4	B3
P501	D8	F1
P502	C1	A2
Q500	D6	F2
Q501	D7	F2
R500	A8	C2
R501	D5	D2
R502	C4	E2
R503	D5	E2
R504	D6	F2
R505	D6	E1
R506	C6	B2
R507	D7	F2
R508	D7	F2
R509	D7	F2
R519	A6	C2
R521	D5	D2
R522	C6	D1
R523	C7	D1
R524	C6	D1
TP500	D2	G3
U500	B7	C3
U501-A	D5	D2
U501-B	D6	D2
U501-C	D5	D2
U501-D	C4	D2
U501-E	B5	D2
U501-F	C6	D2
U502	B6	F3
U503	D4	E3
U504	B4	F3
U505	B3	B1
U506	D6	E1
U507	D6	F2
U508	C2	B2
U509	B2	B3
U510	A7	D2
W500	-	E3
Y500	A7	E3



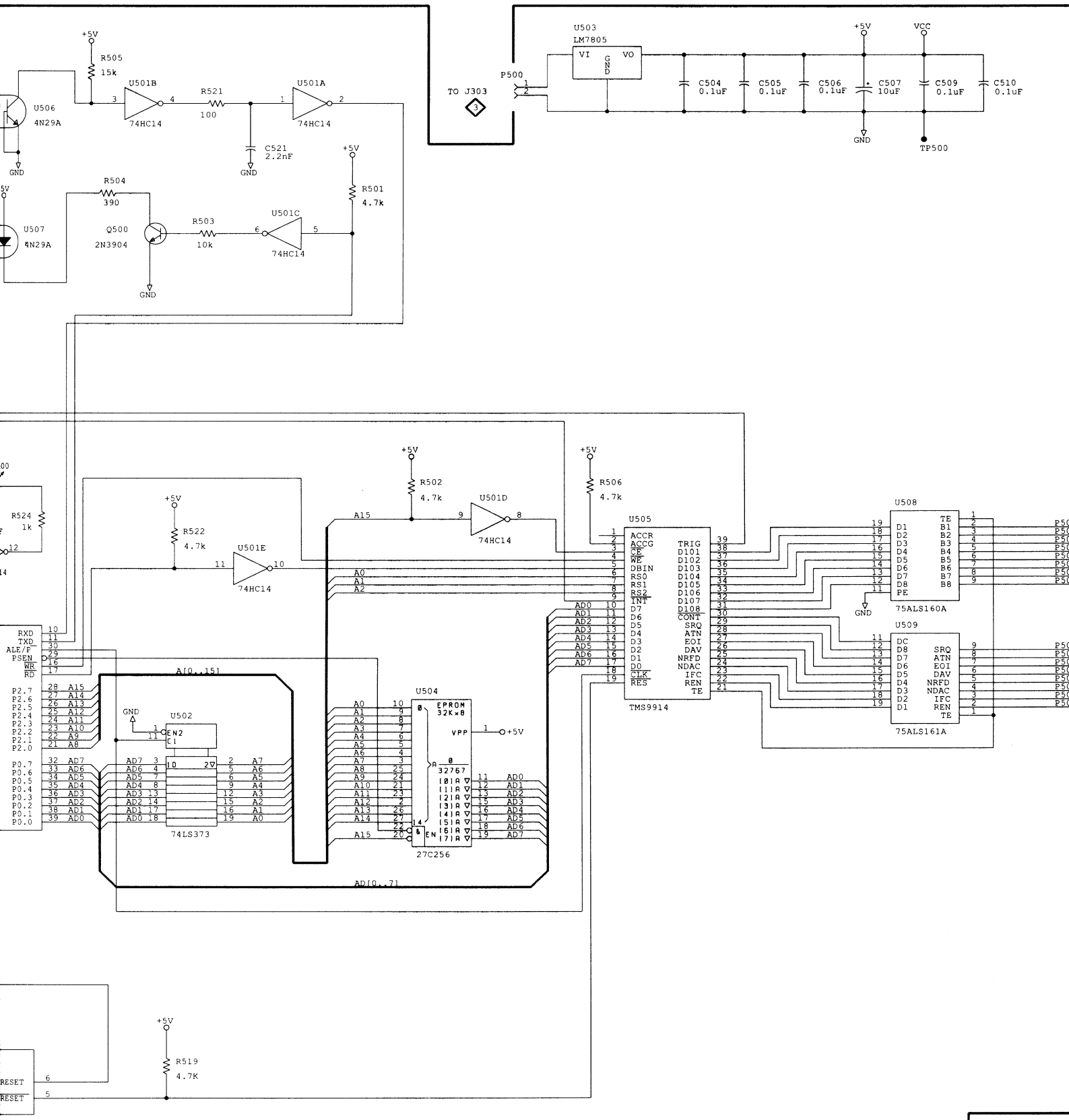
STATIC SENSITIVE DEVICES
SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAMPLE

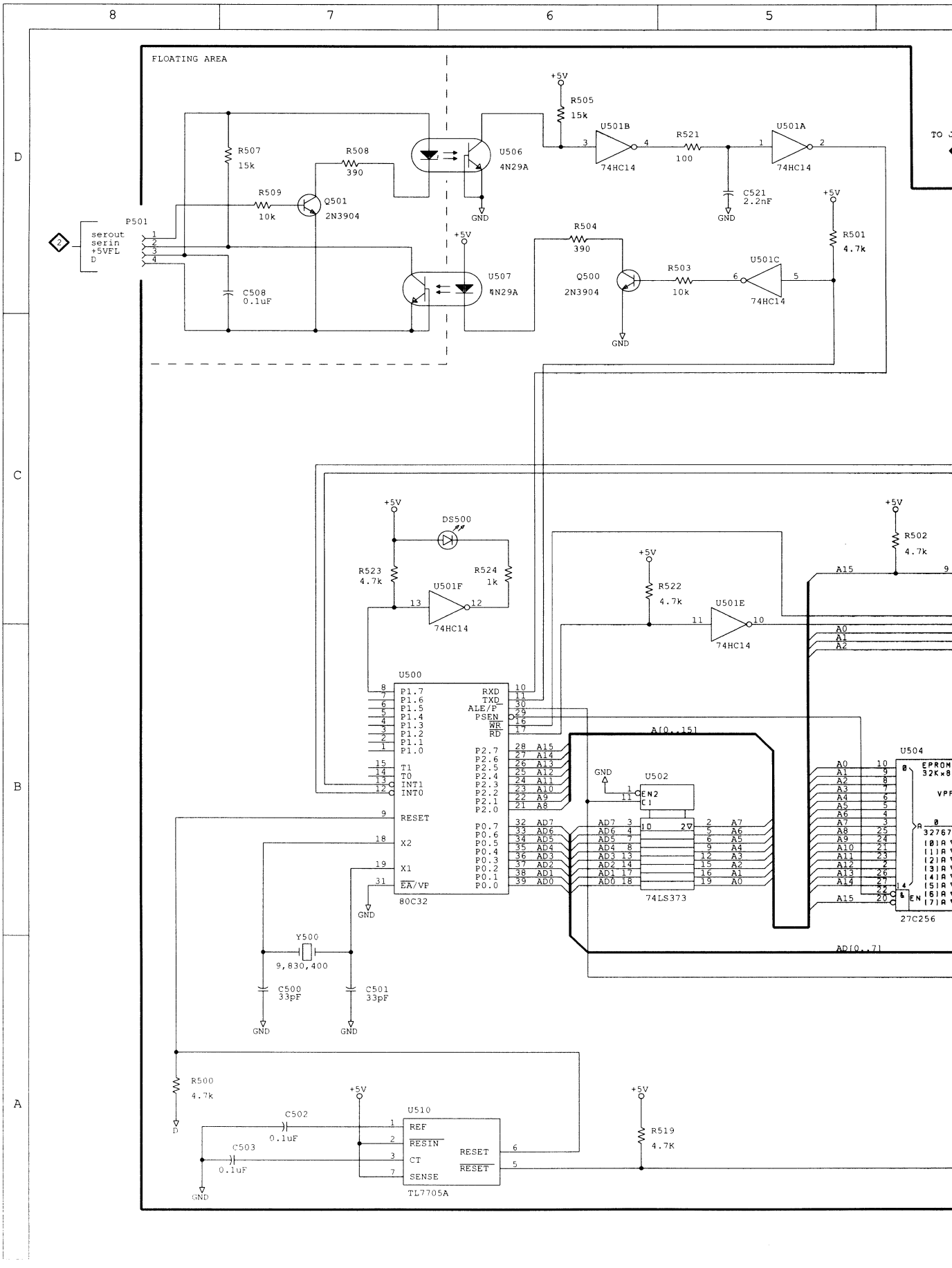


Chassis-mounted components have no Assembly Num
prefix - see end of REPLACEABLE ELECTRICAL PA
LIST.

GPIB CIRCUIT



A12 GPIB BOARD


8
7
6
5
D
C
B
A
FLOATING AREA
P501
serout
serin
+5VFL
D
R507
15k
R508
390
R509
10k
Q501
2N3904
U506
4N29A
C508
0.1uF
R505
15k
U501B
74HC14
R521
100
U501A
74HC14
C521
2.2nF
GND
+5V
R501
4.7k
R504
390
U507
4N29A
Q500
2N3904
R503
10k
U501C
74HC14
DS500
R523
4.7k
R524
1k
U501F
74HC14
R522
4.7k
U501E
74HC14
R502
4.7k
A15
A0
A1
A2
U500
80C32
RXD
TXD
ALE/P
PSEN
WR
RD
RESET
X2
X1
EA/VP
A[0..15]
U502
74LS373
AD[0..7]
U504
27C256
EPROM
32K x 8
VPP
Y500
9,830,400
C500
33pF
C501
33pF
R500
4.7k
C502
0.1uF
C503
0.1uF
U510
TL7705A
REF
RESIN
CT
SENSE
RESET
R519
4.7K

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representitive.

Changes to Tektronix instruments are sometimes made to accomodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representitive will contact you concerning any change in part number .

Change information, if any, is located at the rear of this manual.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon(:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical part list is intended to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component

END ATTACHING PARTS

Detail Part of Assembly and/or Component
Attaching parts for Detail Part

END ATTACHING PARTS

Parts or Detail Part
Attaching parts for Parts of Detail Part

END ATTACHING PARTS

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Attaching parts must be purchased seperately, unless otherwhise specified.

ABBREVIATIONS

Abbreviations conform to American National Standards Institute Y1.1

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	address	City, State, Zip Code
01536	TEXTRON INC	1818 CRISTINA ST	ROCKFORD IL 61108
	CAMCAR DIV		
	SEMS PRODUCTS UNIT		
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125-4632
12703	JUDD WIRE	250 TURNPIKE RD	TURNERS FALLS MA 01376
	DIV OF HIGH VOLTAGE ENGINEERING CORP	P O BOX 390	
22526	DU PONT E I DE NEWOURS AND CO INC	30 HUNTER LANE	CAMP HILL PA 17011
	DU PONT CONNECTOR SYSTEMS		
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
	SUB TRACOR INC		
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR	BEAVERTON OR 97077-0001
		PO BOX 500	
83385	MICRODOT MFG INC	3221 W BIG BEAVER RD	TROY MI 48098
	GREER-CENTRAL DIV		
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431
91260	CONNOR SPRING AND MFG CO	1729 JUNCTION AVE	SAN JOSE CA 95112
	A SLOSS AND BRITTAN INC CO		
93907	TEXTRON INC	600 18TH AVE	ROCKFORD IL 61108-5181
	CAMCAR DIV		
98159	RUBBER TECK INC	19115 HAMILTON AVE	GARDENA CA 90247
		PO BOX 389	
TK1176	KASO PLASTICS INC	11015 A NE 39TH	VANCOUVER WA 98662
TK1319	MORELLIS Q	1812 16-TH AVE	FOREST GROVE OR 97116
TK2165	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Qty	1 2 3 4 5 Name & Description	Mfr. Code	Mfr. Part No.
1-1	337-3039-00		2	SHIELD,ELEC:SIDE PLUG-IN	80009	337-3039-00
				(ATTACHING PARTS)		
-2	214-3364-00		2	FASTENER,LATCH:ACETAL,SIL GRAY	80009	214-3364-00
-3	105-0932-00		2	LATCH,PANEL:SIDE	80009	105-0932-00
				(END ATTACHING PARTS)		
-4	426-0725-24		1	FR SECT,PLUG-IN:TOP,ALUMINIUM	80009	426-0725-24
				(ATTACHING PARTS)		
-5	211-0101-00		2	SCREW,MACH:4-40 X0.25,FLH,100 DEG,STL CD PL,POZ	93907	ORDER BY DESCR
				(END ATTACHING PARTS)		
-6	214-1061-00		1	CONTACT,ELEC:GROUNDING,CU BE	80009	214-1061-00
-7	386-4866-00		1	SUPPORT,FRAME:REAR,AL	80009	386-3657-01
				(ATTACHING PARTS)		
-8	213-0793-00		2	SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH CD PL,POZ	93907	234-22661-024
-9	386-3657-01		2	SUPPORT,PLUG-IN:	93907	ORDER BY DESCR
				(END ATTACHING PARTS)		
-10	426-0724-25		1	FR SECT,PLUG-IN:BOTTEM	80009	426-0724-25
				(ATTACHING PARTS)		
-11	211-0101-00		2	SCREW,MACH:4-40 X0.25,FLH,100 DEG,STL CD PL,POZ	93907	ORDER BY DESCR
				(END ATTACHING PARTS)		
-12	105-0865-00		1	BAR,LATCH RLSE:	80009	105-0865-00
-13	105-0866-00		1	LATCH,RETAINING:SAFETY	80009	105-0866-00
-14	214-3143-00		1	SPRING,HLEXT:0.125 OD X 0.545 L,XLOOP	91260	ORDER BY DESCR
	333-3740-00		1	PANEL,FRONT ASSY:		
-15	333-3732-00		1	. PANEL,FRONT:DM5110/511 OVERLAY	80009	333-3732-00
-16	386-5936-00		1	. SUBPANEL,FRONT:DM5110/511	80009	386-5936-00
	378-2030-13		1	LENS ASSEMBLY:DM5110		
	378-2030-14		1	LENS ASSEMBLY:DM511		
-17	378-2030-00		1	. LENS,LED DSPL:RED	80009	378-2030-00
-18	331-0503-00		1	. MASK,OVERLAY:MASK/STICKER LENS	80009	331-0503-00
-19	334-7591-00		1	. MARKER,IDENT:MARKED DM5110	80009	334-7591-00
	334-7592-00		1	. MARKER,IDENT:MARKED DM511	80009	334-7592-00
-20	136-0765-00		3	JACK,TIP:BANANA	TK2278	ORDER BY DESCR
				(ATTACHING PARTS)		
-21	210-0202-00		3	TERMINAL,LUG:0.146 ID,LOCKING,BRZ TIN PL	86928	A-373-158-2
-22	211-0304-00		3	SCR,ASSEM WSHR:4-4- X 0.312,PNH,STL,T9 TORX	01536	ORDER BY DESCR
				(END ATTACHING PARTS)		
-23	366-1851-01		1	KNOB,LATCH:IVORY GY,0.625 X 0.25 X 1.09	80009	366-1851-01
-24	366-1559-09		1	PUSH BUTTON:IVORY GRAY,0.18 SQ X 0.43 H	80009	366-1559-09
-25	220-0633-00		1	NUT,PLAIN,KNURL:0.25-28 X 0.375 OD,BRS NP	80009	220-0663-00
-26	355-0239-00		1	STUD,SHOULDERED:BINDING POST,BRASS	80009	355-0239-00
	672-1249-00		1	CIRCUIT BD ASSY:KEYBD/DISPLAY		
-27	————		1	. CIRCUIT BD ASSY:(SEE A11 REPL)	80009	671-1258-00
-28	————		1	. . TERM SET,PIN:(SEE A11J401,J402,P400		
-29	131-0993-00		1	. . BUS,CONDUCTOR:SHUNT ASSEMBLY,BLACK	22526	64474-006
-30	671-1257-00		1	. CIRCUIT BD ASSY:(SEE A11A1 REPL)	80009	671-1257-00
-31	361-1540-00		2	. SPACER,DISPLAY:DM5110/511	80009	361-1540-00
				(ATTACHING PARTS)		
-32	211-0014-00		2	SCREW,MACH:4-40 X 0.5,PNH,STL CD PL,POZ	93907	ORDER BY DESCR
-33	211-0008-00		2	SCREW,MACHINE:4-40 X 0.25,PNH,STL CD PL,POZ	93907	ORDER BY DESCR
-34	210-0994-00		2	WASHER,FL:0.125 ID X 0.25 OD X 0.022,STL CD PL	12327	ORDER BY DESCR
				(END ATTACHING PARTS)		
-35	————		1	CIRCUIT BD ASSY:(SEE A10 REPL)		
				. (ATTACHING PARTS)		
-36	213-0146-00		4	. SCREW,TPG,TF:6-20 X 0.312,TYPE B,PNH,STL CD PL,POZ	83385	ORDER BY DESCR
				. (END ATTACHING PARTS)		
-37	————		1	. SHIELD,ELEC:A10A1		
-38	136-0757-00		1	. SKT,PL-IN ELEK:MICROCKT,40 DIP	09922	DILB40P-108
-39	136-0755-00		1	. SKT,PL-IN ELEK:MICROCKT,28 DIP	09922	DILB28P-108
-40	214-2518-01		1	. HEAT SINK,XSTR:TO-202/TO220,AL W/O TABS	TK0303	332-012
-41	————		1	. CON,RCPT,ELEC:(SEE A10J201,J303 REPL)		
-42	344-0326-00		2	. CLIP,ELECTRICAL:FUSE,BRASS	75915	102071
-43	————		1	. SWITCH,PUSH:(SEE A10S100 REPL)		
-44	————		1	. CIRCUIT BD ASSY:(SEE A10A1 REPL)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Qty	1 2 3 4 5 Name & Description	Mfr. Code	Mfr. Part No.
-45	————		1	. XFMR,FXD,ASSY:(SEE T100 REPL)		
-46	384-1354-00		1	EXTENSION SHAFT:1.585 L,OFFSET,NYLON	TK1319	NA
-47	384-1099-00		1	EXTENSION SHAFT:1.58 L X 0.187 SQ PLSTC	TK2165	384-1099-00
-48	337-3598-00		1	SHIELD,ELEC:SOLDER SIDE & DANGER LABEL	82535	337-3598-00
				(ATTACHING PARTS)		
-49	211-0012-00		3	SCREW,MACHINE:4-40 X 0.375,PNH,STL CD PL,POZ	93907	ORDER BY DESCR
				(END ATTACHING PARTS)		
-50	337-3597-00		1	SHIELD,ELEC:COMP SIDE & DANGER LABEL	82535	337-3597-00
-51	174-1735-00		1	CA ASSY,SP,ELEC:	80009	174-1735-00
-52	175-5021-00		1	WIRE,ELECTRICAL:STRD,24 AWG,5KVDC,CROSSLINKED	12703	V0510013
				WHITE POLYHALOCARBON UL3239		
-53	177-1232-00		1	WIRE,ELECTRICAL:STRD,24 AWG,9-2,5000V	12703	ORDER BY DESCR
-54	177-1236-00		1	WIRE,ELECTRICAL:STRD,24 AWG,9-6,5000V	12703	ORDER BY DESCR
-55	346-0032-00		2	STRAP,RETAINING:0.075 DIA X 4.0 L,MLD RBR	98159	2829-75-4
	(DM5110 ONLY)					
-56	214-3089-00		2	LOCKOUT,PLUG-IN:PLASTIC	80009	214-3089-00
-57	671-1256-00		1	CIRCUIT BD ASSY:IEEE(SEE A12 REPL)		
				(ATTACHING PARTS)		
-58	211-0014-00		4	SCREW,MACH:4-40 X 0.5,PNH,STL CD PL,POZ	93907	ORDER BY DESCR
				(END ATTACHING PARTS)		
-59	136-0752-00		2	. SKT,PL-IN ELEK:MICROCKT,20 DIP MI	09922	DILB20P-108
-60	136-0757-00		1	. SKT,PL-IN ELEK:MICROCKT,40 DIP	09922	DILB40P-108
-61	136-0755-00		1	. SKT,PL-IN ELEK:MICROCKT,28 DIP	09922	DILB28P-108
-62	337-3621-00		1	SHIELD,ELEC:GPIB,ALU DM5110	80009	337-3621-00
-63	129-1333-00		4	SPACER,POST:0.7 L,4-40 BOTH ENDS,NYLON ROUND	80009	129-1333-00
-64	211-0008-00		4	SCREW,MACHINE:4-40 X 0.25,PNH,STL CD PL,POZ	93907	ORDER BY DESCR

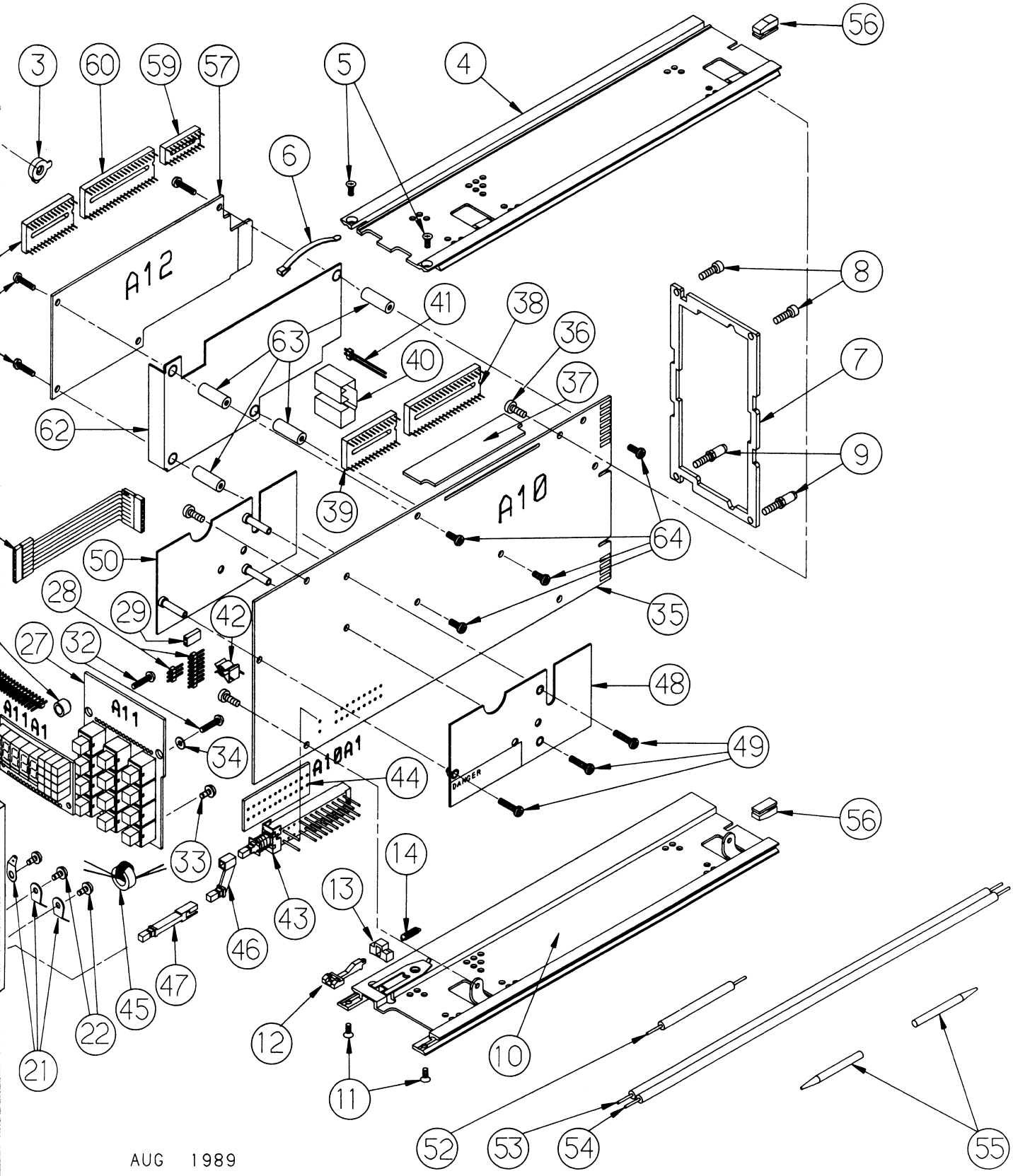


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FIG.1 EXPLODED VIEW

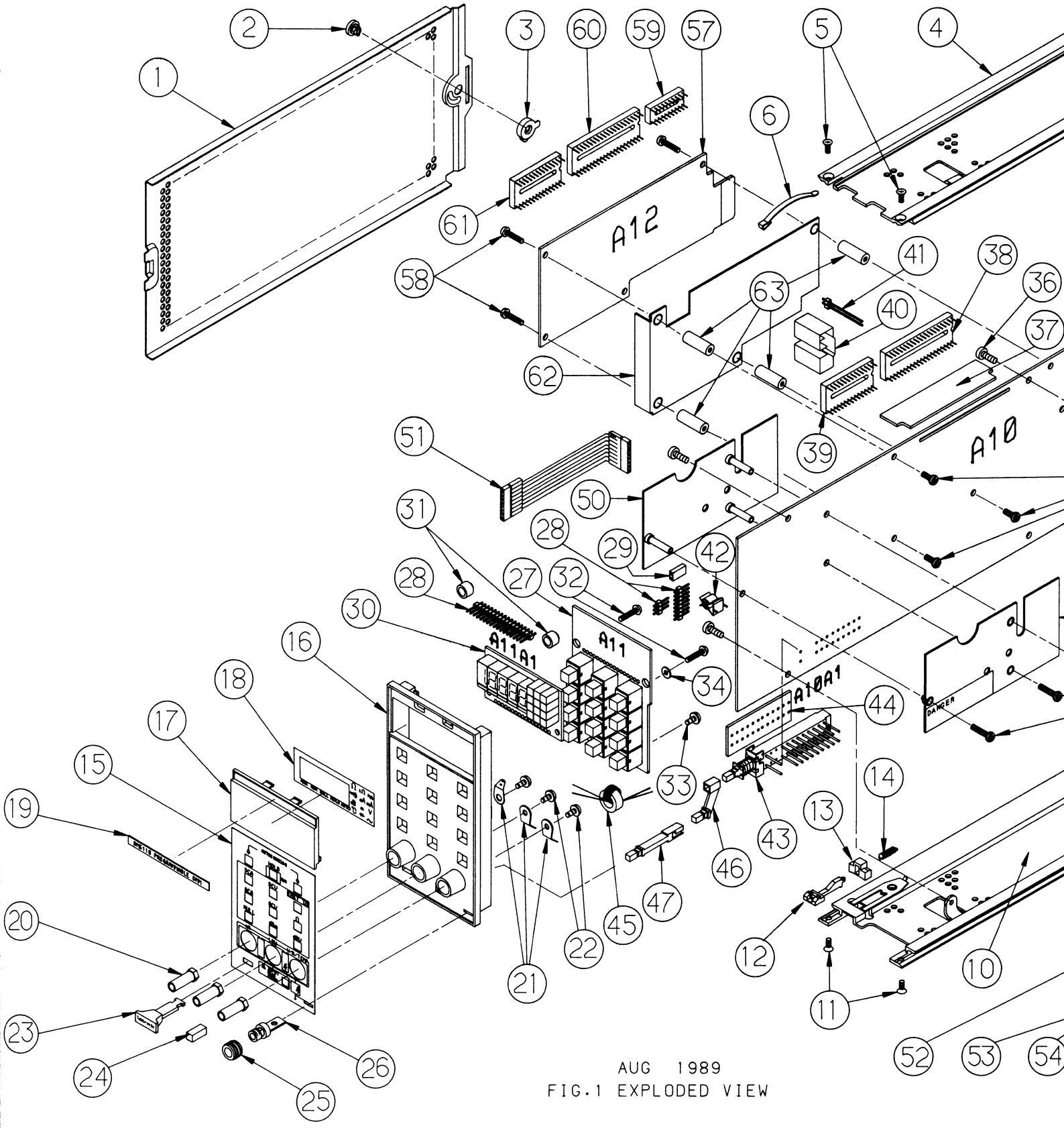

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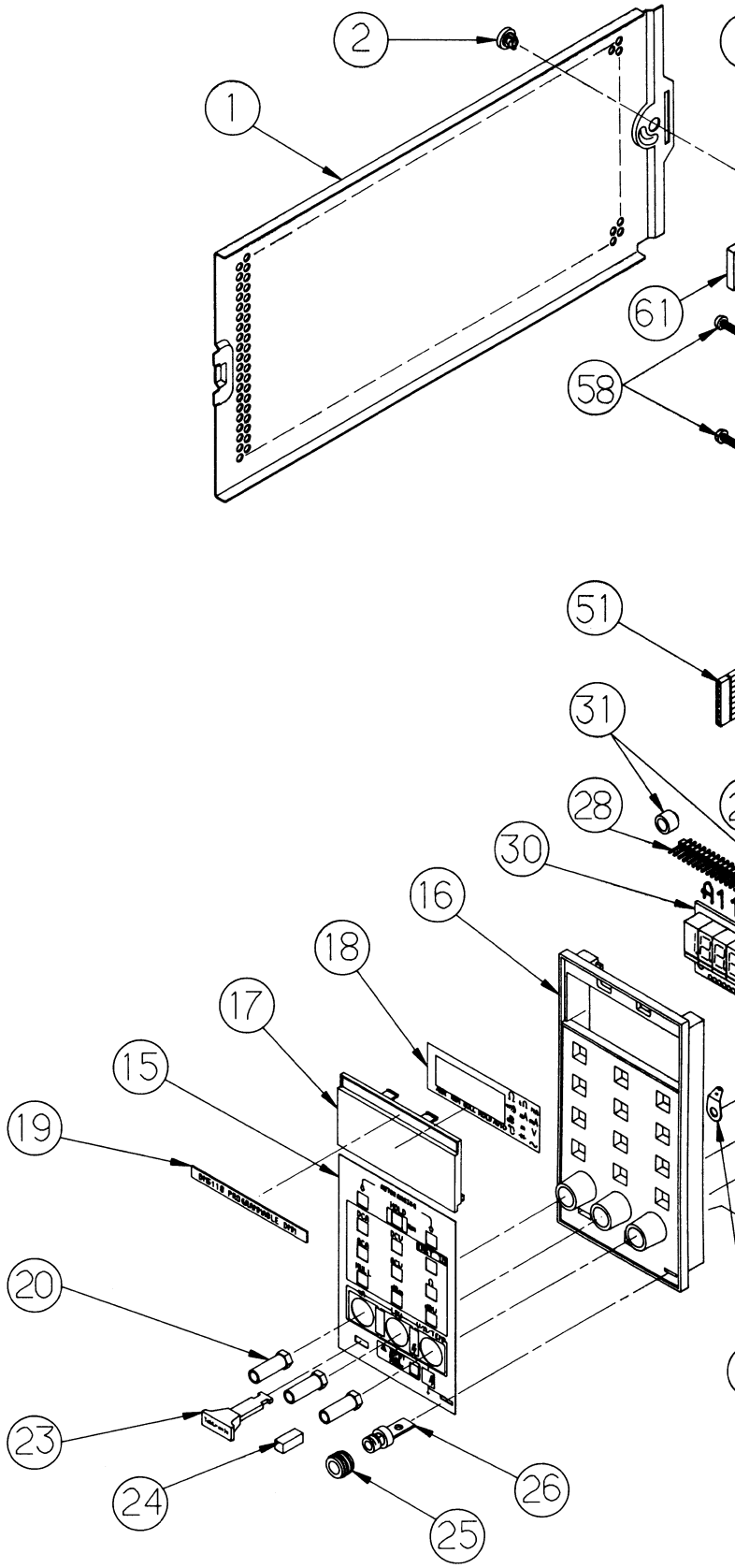
FIG.1 EXPLODED VIEW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MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.