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Data Precision Corporation, Electronics Ave., Danvers, MA. 01923

62-5016

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Instruction Manual

for

2590
2590R

Model 2590
(Average Sensing)
Model 2590R
(True RMS)

5½-Digit
DIGITAL MULTIMETER

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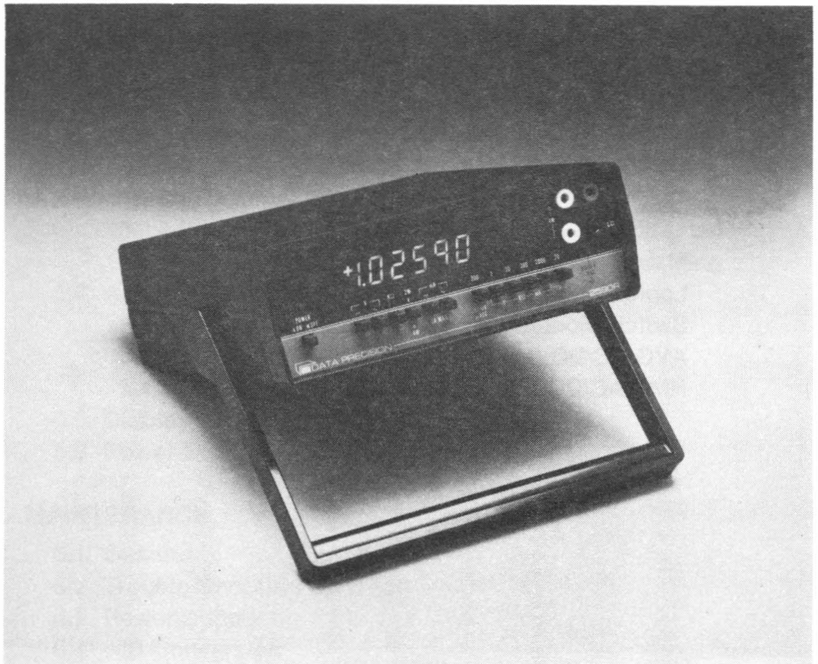
CONTENTS



Frontispiece. Model 2590/2590R DMM

Chapter 1
INTRODUCTION

1.1 GENERAL

Data Precision Model 2590/2590R Digital Multimeter (DMM) is a 5½ digit, general purpose, rugged and reliable bench-top performer. Its light weight assembly, mounted in a high impact-proof plastic case with integral carrying handle tilt stand makes it an ideal precision meter for laboratory and servicing applications.

The Model 2590/2590R provides 25 Measuring Function/Range Capabilities, including DCV, ACV, DCmA, ACmA, and 2- or 4-Wire KΩ measurements, with resolutions of 1 microvolt, 1 nanoampere, and 1 milliohm for voltage, current, and resistance measurements, respectively. In addition, the constant-current sourcing technique used for the resistance measurement function, in conjunction with the decade scaling introduced by the range switching, may be used for convenient measurement of diode characteristics.

Input circuitry is protected against application of peak voltages up to 1200 V on all voltage ranges, up to 500 Vdc or ac rms on all resistance measurement ranges, and currents up to 2 amperes. The DMM is protected against damage for currents over 2 amperes by a field-replaceable internal fuse rated for 2A @ 250 V. Open circuit voltages do not exceed 3.5 volts when measuring resistances.

High common mode rejection of 160 dB at dc and over 120 dB at 50 and 60Hz, and over 80 dB normal mode rejection ratio beginning at 50 Hz and at all 10-Hz increments thereafter, enhance the applications in harsh industrial environments.

The display of 0.56″ (14.22 mm) LED display digits provide excellent visibility even in high level ambient light. They are mounted immediately behind a front panel optical filter for wide-angle, parallax-free readings. Polarity is displayed automatically for dc measurements, and the decimal point is positioned automatically in all measurements so that readings are made directly in units indicated by the range scale selection. The display digits are blanked for out-of-range signals, leaving the decimal point and polarity sign (if dc measurement) lighted to indicate an operable multimeter and to avoid making invalid readings of out-of-range signals.

1.2 ORDERING CONFIGURATIONS

Model 2590 DMM and Model 2590R provide all of the features above. The Model 2590 senses the average value of the ac-coupled input and calibrates the display for an equivalent sinewave. The Model 2590R performs a true rms sensing of the ac-coupled input. In this instruction manual, unless stated otherwise, references to the Model 2590 are applicable to both instruments.

Both models of the multimeter are available for different powering mains installations. The standard model (no suffix) is intended for use with 105 to 125 V, 50 to 400 Hz sources; the "E" suffix denotes instruments intended for use with 210 to 250 V, 50 to 400 Hz sources; and the "J" suffix denotes instruments intended for use with 91 to 109 V, 50 to 400 Hz sources. Power consumption is less than 10 watts from all sources. A rear-panel-mounted fuse, in series with the sourcing power, provides overload protection.

A number of accessories are available for use with the multimeter. Refer to paragraph 2.7 for details.

Chapter 2
SPECIFICATIONS

2.1 DC VOLTS

Nominal Range	Max. Rdg.	Resolution	Input Impedance
± 200mV	± 199.999 mV	1 μV	>1000 MΩ
± 2V	± 1.99999 V	10 μV	>1000 MΩ
± 20V	± 19.9999 V	100 μV	>1000 MΩ
± 200V	± 199.999 V	1 mV	10 MΩ ± 1%
± 2000V*	± 1200.00 V	10 mV	10 MΩ ± 1%

*Maximum Input Voltage: ± 1200 Vdc or peak ac on all ranges.

Accuracy:

200mV Range:
24 Hours (@23°C ± 1°C): ± (0.007% inp. + 4 digits)
1 Year (@23°C ± 5°C): ± (0.01% inp. + 4 digits)

2V, 20V, and 200V Ranges:
24 Hours (@23°C ± 1°C): ± (0.004% inp. + 2 digits)
1 Year (@23°C ± 5°C): ± (0.007% inp. + 2 digits)

2000V Range:
24 Hours (@23°C ± 1°C): ± (0.007% inp. + 2 digits)
1 Year (@23°C ± 5°C): ± (0.01% inp. + 2 digits)

Temperature Coefficient (0°C to + 45°C):

200mV Range: ± (0.001% inp. + 0.5 digits)/°C

2V, 20V, and 200V Ranges: ± (0.001% inp. + 0.2 digits)/°C

2000V Range: ± (0.001% inp. + 0.2 digits)/°C

Common Mode Rejection Ratios (minimum):

At dc: 160 dB with 1000Ω source impedance unbalance
At 50/60 Hz: 120 dB with 1000Ω source impedance unbalance

Normal Mode Rejection Ratio:

50 Hz and at all 10Hz-increments above: >80 dB

2.2 AC VOLTS

Nominal Range	Max. Rdg.	Resolution
200mV	199.999 mV	1 μV
2mV	1.99999 V	10 μV
20V	19.9999 V	100 μV
200V	199.999 V	1 mV
2000V*	800.00 V	10 mV

***Maximum Input Voltage:**

At dc:	600 Vdc
20 Hz to 10 KHz:	800V to 10 KHz. Decrease linearly to 100V at 100 KHz
Peak Voltage:	1150V peak.

Input Impedance, all ranges:
1 MΩ ‖ <100 pF

Model 2590R (True RMS Sensing, AC Coupled)

Accuracy* (1 year @ 23°C ± 5°C) For Crest Factor ≤3[1]:

2V, 20V, 200V, and 2000V Ranges:

20 Hz:	±(1% inp. + 500 digits)
50 Hz to 1 KHz:	±(0.4% inp. + 300 digits)
5 KHz to 20 KHz:	±(1% inp. + 300 digits[2])

200mV Range:

20 Hz:	±(1% inp. + 5000 digits)
50 Hz to 1 KHz:	±(0.4% inp. + 3000 digits)
5 KHz to 20 KHz:	±(1% inp. + 3000 digits[3])

*Interpolate linearly between indicated frequencies.

Temperature Coefficient (0°C to + 45°C):

2V, 20V, 200V, and 2000V Ranges:

20 Hz to 1 KHz:	±(0.02% inp. + 20 digits)/°C
5 KHz to 20 kHz:	±(0.1% inp. + 30 digits)/°C

200mV Range:

20 Hz:	±(0.02% inp. + 200 digits)/°C
5 KHz to 20kHz:	±(0.05% inp. + 300 digits)/°C

Usable Crest Factor:

7 @ ½ Full Scale, decreasing to 5 @ Full Scale.

Note [1]: For Crest Factor = 4, add ±0.2% inp (50 Hz to 1 KHz)
For Crest Factor = 5, add ± 0.5% inp (50 Hz to 1 KHz)

Note [2]: Valid for Input Voltage ≥ 5000 digits.

Note [3]: Valid for Input Voltage ≥ 50 mV rms.

MODEL 2590 (Average Sensing, Calibrated in RMS of Sinewave)

Accuracy* (1 year @ 23°C ± 5°C)

2V, 20V, 200V, and 2000V Ranges:

20 Hz:	±(0.5% inp. + 30 digits)
50 Hz to 1 KHz:	±(0.05% inp. + 20 digits)
At 10 KHz:	±(0.4% inp. + 20 digits)
At 100 KHz:	±(1% inp. + 100 digits)

200mV Range:

20 Hz:	±(0.5% inp. + 300 digits)
50 Hz to 1 KHz:	±(0.05% inp. + 200 digits)
At 10 KHz:	±(0.4% inp. + 200 digits)
At 100 KHz:	±(1% inp. + 1000 digits)

*Interpolate linearly between frequencies.

Temperature Coefficient (0°C to + 45°C):

2V, 20V, 200V, and 2000V Ranges:

20 Hz to 1 KHz:	±(0.005% inp. + 20 digits)/°C
1 KHz to 10 KHz:	±[(0.005%inp. x freq. in KHz)%rdg. + 2 digits]/°C
10 KHz to 100 KHz:	±(0.05% inp. + 2 digits)°C

200mV Range:

20 Hz to 1 KHz:	±(0.005% inp. + 20 digits)/°C
1 KHz to 10 KHz:	±[(0.005%inp. x freq. in KHz)%rdg. + 20 digits]
10 KHz to 100 KHz:	±(0.05%inp. + 20 digits)/°C

Voltage Coefficient:

Add ± ½ ppm/volt.

2.3 DC CURRENT

Nominal Range	Max. Rdg.	Resolution
±200μA	±199.999 μA	1 nA
±2mA	±1.99999 mA	10 nA
±20 mA	±19.9999 mA	100 nA
±200 mA	±199.999 mA	1 μA
±2000 mA	±1999.99 mA	10 μA

Accuracy (1 year @ 23°C ± 5°C):

200μA, 2mA, and 20mA Ranges:
±(0.1% inp. + 10 digits)

200mA and 2000mA Ranges:
±(0.2% inp. + 10 digits)

Temperature Coefficient (0°C to + 45°C):

2mA, and 20mA Ranges:
±(0.01% inp. +1 digit)/°C

200uA +\-(0.1% inp.+20digits)

200mA and 2000mA Ranges:
±(0.02% inp. +1 digit)/°C

2.4 AC CURRENT

Nominal Range	Max. Rdg.	Resolution
2mA	1.99999 mA	10 nA
20mA	19.9999 mA	100 nA
200mA	199.999 mA	1 μA
2000mA	1999.99 mA	10 μA

MODEL 2590R (True RMS Sensing)

Accuracy*(1 year @ 23°C ±5°C)

At 20 Hz:	±(1.5% inp. + 500 digits)
50 Hz to 1 KHz:	±(0.75% inp. + 300 digits)
5 KHz to 20 KHz:	±(1.5% inp. + 300 digits)

Temperature Coefficient (0°C to + 45°C):

20 Hz to 1 KHz:	±(0.03% inp. + 20 digits).°C
5 KHz to 20 KHz:	±(0.1% inp. + 30 digits)/°C

*Linearly interpolate between stated points.
Valid for readings ≥ 10% of full scale.

MODEL 2590 (Average Sensing, Calibrated in RMS of Sinewave)

Accuracy* (1 year @ 23°C ±5°C)

At 20 Hz:	±(1% inp. + 40 digits)
50 Hz to 1 KHz:	±(0.3% inp. + 40 digits)
5 KHz to 20 KHz:	±(1% inp. + 60 digits)

Temperature Coefficient* (0°C to + 45°C):

20 Hz to 1 KHz:	±(0.02% inp. + 4 digits)/°C
5 KHz to 20 KHz:	±(0.05% inp. + 4 digits)/°C

*Linearly interpolate between stated points.

2.5 RESISTANCE

Nominal Range	Max. Rdg.	Resolution	Test Current**
200Ω	199.999 Ω	1 mΩ	1 mA
2KΩ	1.99999 kΩ	10 mΩ	1 mA
20KΩ	19.9999 kΩ	100 mΩ	100 μA
200KΩ	199.999 kΩ	1 Ω	10 μA
2000KΩ	1999.99 kΩ	10 Ω	1 μ A
20MΩ	19.9999 MΩ	100 Ω	0.10 μ A

****Absolute Accuracy:** ±10%;
Ratio Accuracy: Same as kΩ Accuracy.
For example: (1mA/100μA) ± 0.007%.
(1mA/1μA) ± 0.03%.

Configuration:
True 4-wire, or 2-wire, switch selected

Maximum Open Circuit Voltage:
<3.5 volts

Accuracy (1Year, 23°C ± 5°C)

Range	Accuracy
200Ω	±(0.01% inp. + 4 digits)
2kΩ/20kΩ/200kΩ	±(0.007% inp. + 2 digits)
2000kΩ	±(0.03% inp. + 3 digits)
20MΩ	±(0.25% inp. + 11 digits)

Temperature Coefficient (0°C to + 45°C):

Range(s)	Coefficient
200Ω	±(0.001% inp. + 0.5 digits)/°C
2kΩ/20kΩ/200kΩ	±(0.001% + 0.2 digit)/°C
2000kΩ	±(0.005% inp. + 1 digit)/°C
20MΩ	±(0.02% inp. + 5 digits)/°C

Settling Time (seconds) to Final Value ±0.01%:
0.1 + (0.3 x resistance in megohms)

Overvoltage Protection
±500 Vdc or rms ac.

2.6 GENERAL PERFORMANCE

Common Mode Voltage:
500 Vdc or peak ac, input LO to earth.

Display:
LED display, 0.56″ high, 7-segment, full + (plus) and – (minus).

Conversion Rate:
2.5 Conversions per second

Weight:
3.0lb (1.4Kg) net

Stand:
Adjustable, removable tilt-stand, for optimum viewing while on bench.

Case:
Polystyrene (bench/portable)
Dimensions (overall, including tilt stand):
8½″W (21.6cm) x 2⅞″H (7.3cm) x 8⅞″D (22.5cm)

Environmental:
Operating Temperature: 0° to 45°C
Storage Temperature: – 25°C to 60°C
Relative Humidity: 95% max, except 80% max above 40°

Power:
10W, max.
50 to 400 Hz

Model 2590/2590R: 105 to 125 V
Model 2590E/2590RE: 210 to 250 V
Model 2590J/2590RJ: 91 to 109 V

2.7 ACCESSORIES

The following accessories are available to extend the Model 2590/2590R DMM performance. They may be obtained from the Data Precision Distributors.

Description	DP No.
*Test Leads	T5
Rack Mount (L, R, or Dual)	RMD1
High Voltage Probe (to 40KV)	V41A
AC Current Probe	IP151
Deluxe Test Leads Kit	T7
AC Current Probe Clamp-On, 10 to 1000 Amp	IP1001
RF Probe	RF471
Temperature Probe	TP151
Carrying Case	CC50

*Included as standard item at no additional charge.

NOTES:

Chapter 3
OPERATION

NOTE: Read this chapter carefully before using your Model 2590/2590R DMM. Observe all WARNINGS and CAUTIONS.

3.1 GENERAL

Chapter 3 contains detailed instructions for connecting and operating the Model 2590, including safety precautions to prevent harm to personnel or damage to equipment. Refer to the specifications in Chapter 2 to obtain the tolerance with which displayed measurements may be interpreted. Instructions for recalibrating the instrument are contained in Chapter 4.

3.2 UNPACKING & REPACKING

Figure 3-1 identifies the components of the packaging configuration for Model 2590/2590R DMM. As shown in that illustration, the multimeter and an activated dessicant are placed in a waterproof plastic wrapper and securely fitted between molded-foam shock isolators. The probe is placed inside its own waterproof plastic bag, while spare fuses and alligator clip are placed in a separate waterproof bag. The two smaller bags and the documentation are placed in the space formed between the foam isolators, and all fitted within the sturdy shipping carton. When unpacked, you should find:

(1) Model 259/2590R DMM
(2) Test Probe Assembly & Alligator Clips
(3) Certificate of Conformance
(4) Warranty Card
(5) Factory Test Data Sheet
(6) Spare 2A, 250V, 3AG Fuse, FastBlo (for current input)
(7) Spare ¼ A (2590) / 1/8A (2590R), 250V, 3AG Fuse SloBlo (for power line input)
(8) Instruction Manual, P/N 62-5016

Carefully examine these articles, noting especially the matching serial numbers of the instrument and the test data. Inspect the packing case and the instrument for any signs of damage during shipment and report immediately to the carrier. Fill out and return the warranty card to register your instrument and to establish your warranty service interval.

Accessories, such as spare leads or high voltage probes, may have been ordered. These will be shipped in their own containers.

Retain the packing material for reshipment. When shipping Model 2590 DMM, place the instrument in a waterproof protective bag; use molded-foam isolators; include the probe set; and pack in original shipping carton, if available. If the foam shock isolators are not available, use a suitable shock isolating material, such as bubble plastic, to obtain a firm package.

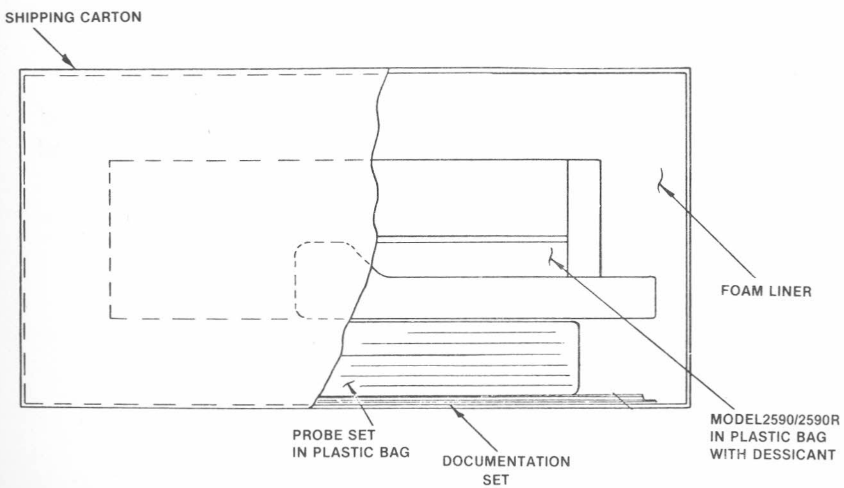


Fig. 3-1. Model 2590/2590R, Shipping Configuration

3.3 SAFETY MARKINGS

The front panel incorporates several standard operator warnings (See, also, Figure 3-2 and Figure 3-3.):

Located in the center of the four input terminals. This cautions the operator about limitations to the signals that may be connected to the terminals and advises him to refer to the instruction manual before connecting to them.

Located above and to the right of the terminals. This warns the operator that there may be dangerously high voltage at this location, or that there is a voltage limitation to be considered when using these terminals.

1200 V 800 VAC Located between the **HI** and **LO** panel markings to the right of the input terminals. These specify the limiting voltages (1200 Vdc or 800 Vac) that may be applied between these terminals.

± 500 V MAX Located beneath the input terminal group and above the symbol for earth (or case) ground, with a leader line to the **LO** terminal pair. This specifies the maximum common mode voltage (± 500 Vdc or peak ac) that may be tolerated between input **LO** and earth ground.

2A MAX Located beneath the **mA** selector switches. This specifies the maximum current (2A) that may be connected to the input terminals when making current measurements.

The rear panel mounts a standard grounding lug, electrically connected to the "ground" terminal of the 3-wire line cord receptacle in the rear panel. It is identified with an adjacent panel marking of the standard earth ground reference symbol.

3.4 POWER CONNECTION

A different configuration of the Model 2590 series DMM is available for powering from any of the nominal power sources universally available: Model 2590 or 2590R for 105 to 125 Vac, Model 2590E or 2590RE for 210 to 250 Vac, and Model 2590J or 2590RJ for 91 to 109 Vac; with line frequencies from 50 to 400 Hz. Before plugging the attached 3-wire power cord into the power source, check the model designation and power source specification on the label located on the rear panel. See Figure 3-3.

If correct power is available, plug in the power cord.

Turn on power at front panel and allow at least ½ hour warm-up in order to achieve in-spec performance.

3.5 OPERATING CONTROLS & INDICATORS

Figure 3-2 identifies the front-panel performance features and Table 3-1 includes a description of the function of each,

Figure 3-3 identifies the rear panel features, while Table 3-2 includes a description of these items.

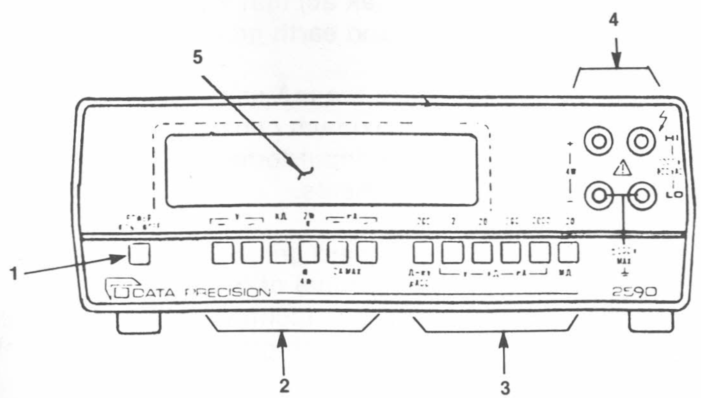


Fig. 3-2. Model 2590/2590R, Front Panel Features

Table 3-1
Model 2590 DMM Front-Panel Controls & Indicators

FIG REF	NAME*	DESCRIPTION/FUNCTION
1	POWER ON OFF (S1)	Push-push switch. Turns power to instrument ON and OFF with alternate actions. When power is turned ON, some components within the display will be turned on, indicating proper response to the switch action.
2	Mode Switches VDC (S2) VAC (S3) KΩ (S4) 2W/4W (S5) DCmA (S6) ACmA (S7)	6 Measurement Mode select pushbutton switches. S2, S3, S4, S6, and S7 are interlocked so that only one at a time may remain in the depressed position. 2W/4W switch is operated in conjunction with the resistance measurement switch. Pressing any one of the interlocked switches will release a previous selection.
3	Range Switches 200 (S8) 2 (S9) 20 (S10) 200 (S11) 2000 (S12) 20 (S13)	6 interlocked pushbutton switches for full-scale range selection: 5 active switches for voltage measurements; 4 active switches for current measurements; and 6 active switches for resistance measurements or for current sourcing operations. Operation of one switch releases any other previously selected. Nominal full scale range is identified by label above the switch; engineering units (Millivolts, Volts, Milliamperes, Milliohms, Ohms, Kilohms, Megohms, and Microamperes dc sourcing in ohms) are indicated by appropriate abbreviations. Selection of an improper range (20M for a voltage measurement) results in an automatic internal selection of the nearest valid range (2000).
4	Input Connectors HI (J1, J2) LO (J3, J4)	Recessed banana-type input jacks; for 2 or 4-wire resistance measurements. No external jumper straps are used.
5	Display	5 full decade LED digits, 1 MSD, polarity sign, and 6 possible decimal point locations.

* Reference Symbol Designations as used in the schematic for the controls are shown in parentheses.

Table 3-2
MODEL 2590/2590R REAR PANEL FEATURES

FIG REF	NAME*	DESCRIPTION/FUNCTION
1	Fastening Screws (2)	2 Screws, fastening top cover to rear panel assembly.
2	Line Cord	Attached main power cord. Refer to label designation for specified power source.
3	Label	Meter identification label, providing serial number, power source, patents, etc.
4	J5	Chassis ground terminal and label.
5	F2	Slo-Blo Fuse, main power protection.
6	F1	Fast-Blo Fuse, series protection for current measurements.
7	Fastening Screws(2)	2 Fastening screws, fastening bottom cover to rear panel assembly.
8	Rubber Feet (4)	Nonskid rubber feet for table-top use.

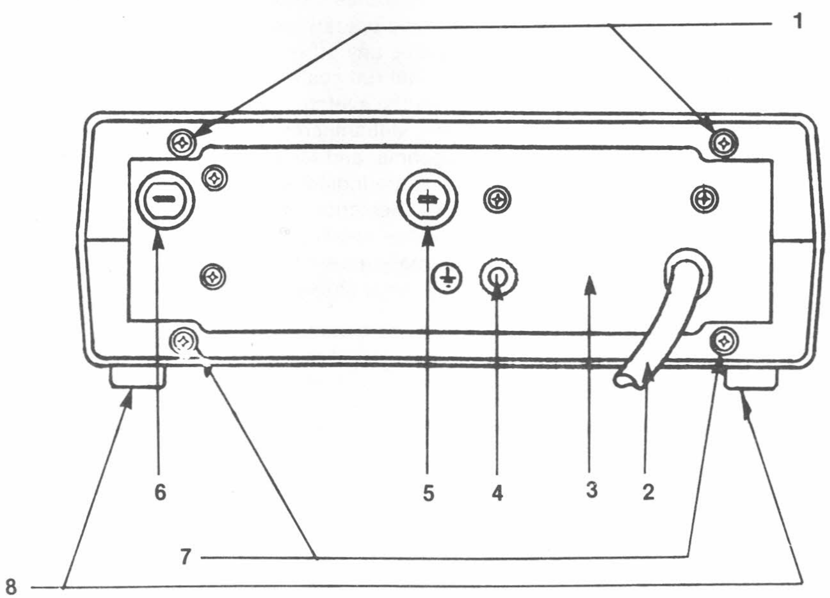


Fig. 3-3. Model 2590/2590R, Rear Panel Features

3.5 SIGNAL CONNECTIONS

CAUTION

Observe applicable maximum voltage ratings for all connections. (Refer to Chapter 2, Specifications.) Failure to comply with voltage ratings may result in equipment damage or hazardous operating conditions.

3.5.1 Voltage Measurement Connections

a. Connect unknown voltage high and low to the Model 2590 terminals as shown in Figure 3-4.

b. Operate **DCV** or **ACV** front-panel Mode switch.

c. Operate an appropriate range switch for the anticipated unknown voltage value to provide the maximum resolution in the display (or consistent with the accuracy of the required information).

d. Read the display. The dc voltage values will be displayed with the polarity sign. The ac voltage values will be displayed without sign, and the value will be displayed in volts rms. The calculation is determined according to the particular model and corresponding ac-to-dc converter that is installed. That is, average-sensed, true rms including the dc component, or rms excluding the dc component. The decimal point will be positioned automatically so that the value will be direct reading in volts. If the input exceeds the maximum reading of the selected range (refer to the Specifications), the message **OL** will appear.

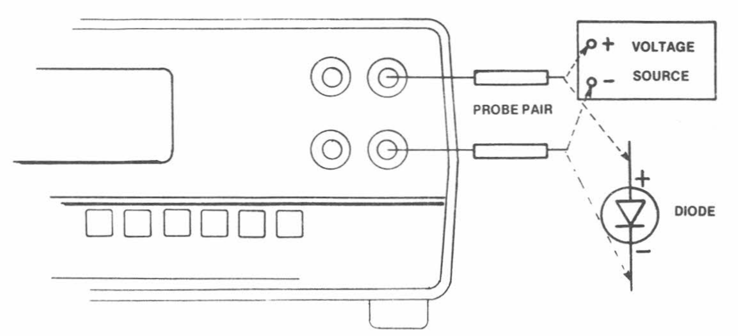


Fig. 3-4. Connecting Model 2590/2590R for Voltage or Diode Measurements

3.6.2 Resistance Measurements

When making resistance measurements of very high impedance sources, as when required to measure resistance on the 20MΩ-range, the input circuit may be susceptible to noise. The effect of voltage-producing noise fields on the probe leads may be sufficient to introduce significant changes in the least significant digits of the 5½-digit display.

Measurement errors may be kept to a minimum under these circumstances by using the 4-wire measurement configuration, and by keeping the leads as short as possible. Do not use any extensions on the probes. In addition, twist the probe leads so as to equalize any field effects on the signal input leads.

3.6.3 Measuring Diode Characteristics

The Model 2590 provides a convenient instrument for the measurement of diode characteristics as a subset of the resistance-measuring operations.

(1) Connect the diode to the input terminals, as shown.
(2) Select the Resistance Measurement mode.
(3) Select the 20MΩ resistance range scale. The current applied at this range is 100nA (approx).
(4) Record the display value. It represents the resistance of the diode in megohms, and is converted to the voltage across the diode by multiplying by the current value of 100nA. The mathematics is simplified by requiring only a decimal point move.
(5) Repeat steps (3) and (4) for the other current excitations. The applied current is increased in decade steps as the range selection is changed to the lower ranges, while the resistance is indicated in kilohms.
(6) Plot the Voltage-Current characteristic curve for the recorded and calculated values.

Note: By keeping the excitation to less than 0.25V, the Model 2590 makes it possible to perform in-circuit measurements safely.

Chapter 4
RECALIBRATION

4.1 GENERAL

CAUTION

Recalibration requires access to the interior of the instrument, allowing exposure to high voltages. Only qualified personnel should perform the operations described in this chapter.

Model 2590/2590R digital multimeters have been manufactured with precision, stable parts, and have been thoroughly tested, calibrated, and burned in prior to shipment. They are ready for use immediately upon receipt and are designed for extensive operating cycles with specified performance. The results of the comprehensive testing and factory calibration are recorded on the test data sheets shipped with every instrument, and these should be retained for reference when recalibration may be required.

Specified performance should be checked regularly at 3-month intervals, if possible, to determine the need for recalibration. Follow the procedures in the sequence described in this chapter when such recalibration may be required.

WARNING

Removal of the 2590 top cover for recalibration adjustments will expose high voltages (power line potentials). Use caution when making adjustments.

4.2 TEST STANDARDS & MEASURING INSTRUMENTS

DC Voltage Source:
Adjustable output to 1000 volts; ±0.002% accuracy. Data Precision Model 8200, or equivalent

AC Voltage Source:
Adjustable output to 150 Vac, with ±0.02% accuracy at 100 Hz, and ±0.1% accuracy from 10 KHz to 50 KHz.

AC Current Source:
Adjustable output to 2 mA, with ±0.06% accuracy at 1 KHz.

Standard Resistance Elements:
Values known to within 20 ppm.

4.3 Access to Calibrating Adjustments

Before attempting to recalibrate the Model 2590, the instrument should be allowed to warm up for at least ½ hour with the top cover in place so that all components come up to operating temperature. In addition, after the adjustments are completed, the cover should be replaced, the instrument allowed to warm up again, and the recalibration performance rechecked.

The calibrating adjustments for the Model 2590 are available when the top cover is removed. Observe the warning concerning high voltages. As shown in Figure 4-1. some of the adjustable components are located beneath the shield cover, and some are directly accessible on their assembly boards.

Do not remove the shield.

Follow the step-by-step procedures described in tabular form in the order of each of the succeeding subparagraphs.

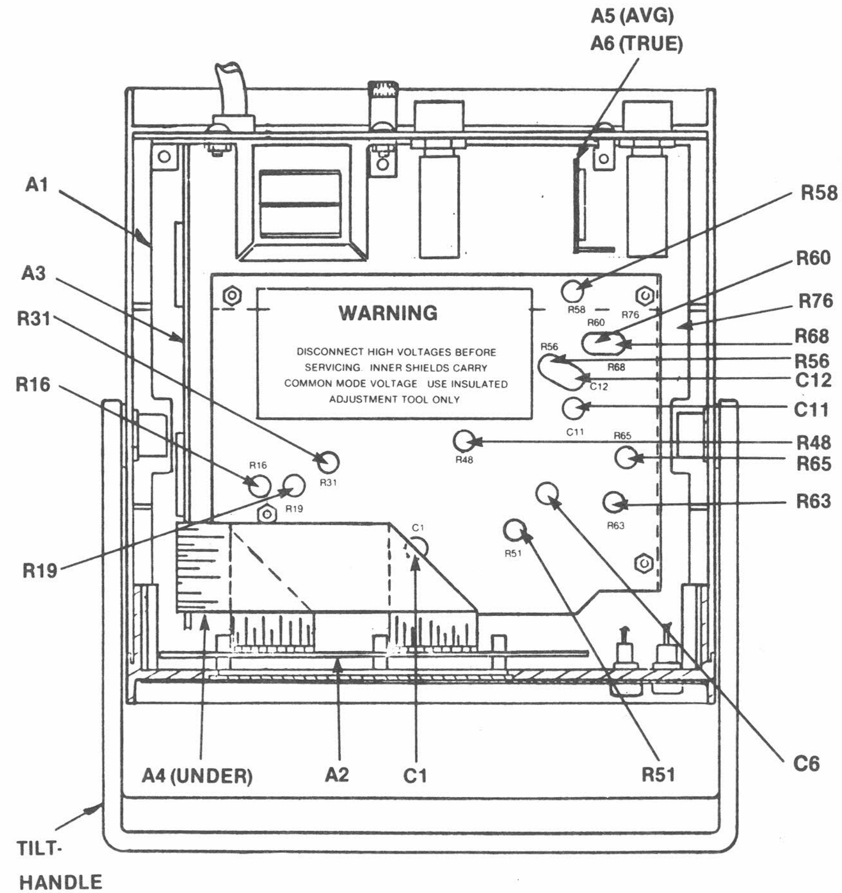


Fig. 4-1. Access to Calibrating Adjustments

4.4 PROCEDURES

DCV Adjustments:

Connect the adjustable DC Voltage Standard to the input terminals.
Select DCV Measuring Mode.
Select the Full Scale Range shown in the table.
Set the input to the value shown in the table.
Adjust the specified calibration control until the displayed value equals the input setting.

RANGE	INPUT	ADJUST
200mV	0.00000	A1R19
2V	+ 1.50000V	A1R3
2V	– 1.50000V	A1R16
200mV	+ 150.000mV	A1R31
200V	+ 150V	A1R65
2000V	+ 1000.00V	A1R63
20V	+ 15.0000V*	A1R68

*Any value between + 10V to + 17V may be used.

Resistance Measurement Calibration:

Select KΩ Measurement Mode, 4W setup.
Connect standard resistance values as shown in the INPUT column to the Model 2590, using the 4-wire connection mode. Other resistance values near full scale may be used instead of the values shown in the table.
Adjust the specified calibration control until the displayed value is exactly equal to the known input.

RANGE	INPUT	ADJUST
2KΩ	1.5KΩ	A1R48
20KΩ	15KΩ	A1R51
200KΩ	150KΩ	A1R56
2000KΩ	1MΩ	A1R58
20MΩ	10MΩ	A1R60

ACV Calibration:

Connect the output of the AC Voltage Standard to the Model 2590 input terminals.
Select the ACV Measuring Mode.
Select the range scale value shown in the table.
Set the AC Voltage Standard output to the rms value shown in the INPUT column of the table.
Adjust the specified calibrating control until the displayed value exactly equals the set input value.

For Model 2590 (Average Sensing)

RANGE	INPUT	ADJUST
20V	15.0000V, 100Hz	A5R1
2000V	500.00V, 20KHz	A1C1
200V	150.000V, 50KHz	A1C12
20V	15.0000V, 50KHz	A1C11
2V	1.50000V, 50KHz	A1C6

For Model 2590R (True RMS Sensing)

RANGE	INPUT	ADJUST
2V	0.01000V, 100Hz	A6R3
20V	15.0000V, 100Hz	A6R1
2000V	800V, 10KHz	A1C1
200V	150.000V, 10KHz	A1C12
20V	15.0000V, 10KHz	A1C11
2V	1.50000V, 10KHz	A1C6

AC Current Calibration:

Connect the AC Current Standard output to the Model 2590 input terminals.
Select the ACmA Measuring Mode.
Select the 2mA full scale range.
Set the current standard output to 1.50000mA at 1KHz.
Adjust A1R76 until the displayed value exactly equals the set input value.

NOTES:

Chapter 5
PRINCIPLES OF OPERATION

5.1 INSTRUMENT BLOCK DIAGRAM

5.1.1 General

As shown in Figure 5-1, the 2590 DMM consists of the following major functional blocks:

a. Front Panel Input switching functions to configure the circuitry for the selected measurement mode;

b. Input signal scaling and signal conditioning to develop a dc signal of 2-volts full scale for the selected full-scale range;

c. Analog-to-digital conversion of the scaled and conditioned input, including the necessary timing logic for the conversion;

d. Display of the digitized signal, including polarity sign (for dc measurements) and decimal point for the selected full scale range;

e. Power supply to develop the appropriate analog and digital supply voltages.

This chapter describes the principles of operation of the circuitry incorporated in these blocks and this paragraph provides an overview of system operation. The remaining subparagraphs of this introduction briefly review the operation of the major blocks. Subsequent paragraphs describe the component operation, and are supported by simplified circuit schematics derived from complete schematics that are bound into the rear of this manual.

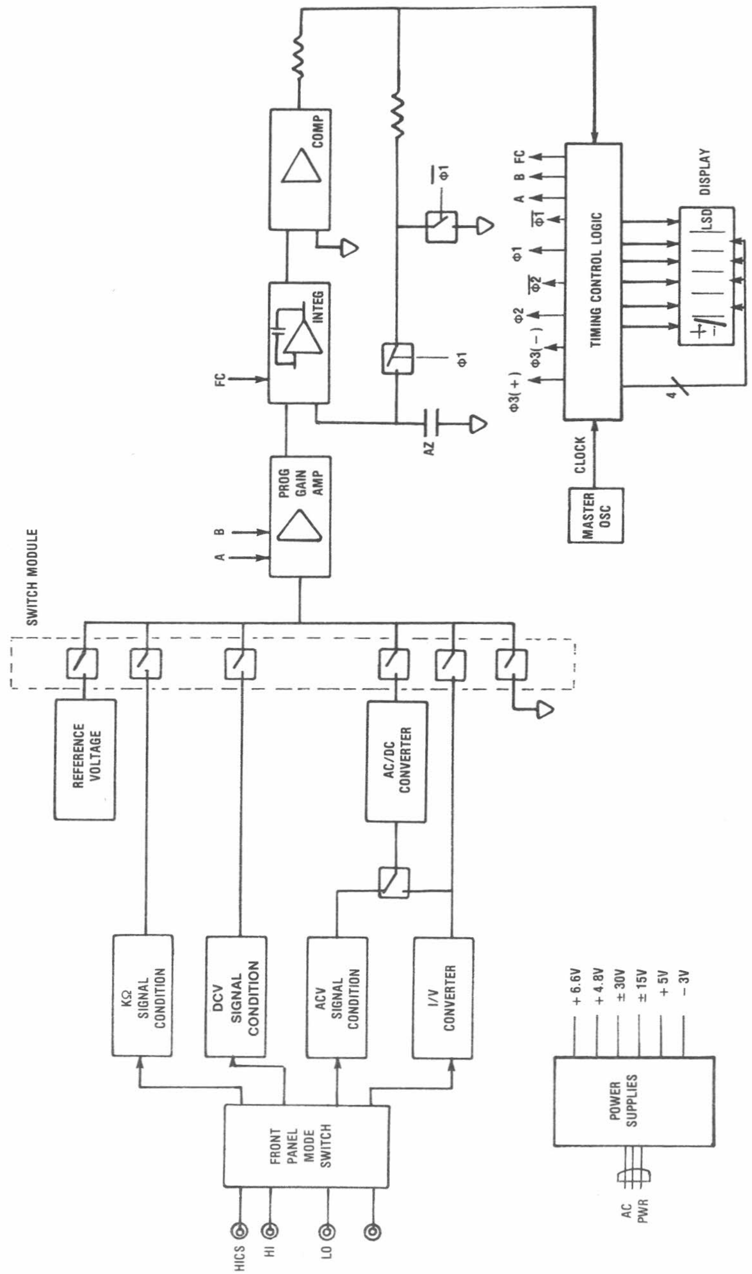


Fig. 5-1. Model 2590/2590R Functional Block Diagram

5.1.2 Measurement Modes and Input Signal Conditioning

Front-panel selection of a measurement mode connects the input signal to the appropriate signal scaling block. As indicated in the diagram: a separate scaling is performed for ac and dc voltages; a current shunt is used to convert both ac and dc current inputs to proportional voltages; ac voltages from the scaled input or from the shunt are then converted to dc voltages; and a separate current sourcing ciruit is used for resistance measurements.

The mode switching configures the input for 2-wire or 4-wire configurations for resistance measurement; current measuring circuits are fused for 2A limits. The AC/DC conversion may be accomplished by average-sensing and rms scaling (Model 2590), or may be performed for true rms conversions (Model 2590R).

5.1.3 Analog-to-Digital Conversion

The analog-to-digital conversion is accomplished by an integrating technique in three time segments, or phases:

a. Phase 1: a fixed time during which the analog input is disconnected from the converter, and the conversion circuit is automatically zeroed, while the standard 1-volt reference is "refreshed";

b. Phase 2: a fixed time during which the conditioned input is connected to the converter to cause the charge on the integrating capacitor to "ramp up" to a voltage proportional to the input magnitude and with a polarity depending upon the input polarity (for dc measurements);

c. Phase 3: a variable time during which the signal is disconnected from the input and a fixed reference voltage of opposite polarity to the signal during phase 2 is connected to the converter to cause the charge on the integrating capacitor to "ramp down" to its starting zero level. The time of phase 3 is read out as the digitized measurement.

A timing control logic circuitry block (within the analog-to-digital block) is driven from a crystal-controlled master oscillator and develops the phase control timing signals from timing counters within the block and from sensed output of the Comparator. The Comparator senses the voltage at the output of the dual-ramp integrator.

At the end of phase 2, the comparator output is an indicator of the polarity of the integrator output, and hence, of the polarity of the input signal. This results in a setting of the polarity of the display and of the selection of positive or negative reference voltage for the phase 3 operation.

The timing control counts the duration of phase 3, and when the output of the comparator crosses zero, this signals the end of that phase (end of conversion). The logic circuitry also places a limit on the duration of phase 3 at 199,999 counts. If the end of conversion signal is not sensed from the comparator by that time, the input is out-of-range, and the timing control causes two operations:

a. Sets up the out-of-range display signals;

b. Changes the time constant of the ramp-down circuit in the integrator to speed up the discharge of the capacitor, and introduces an additional drive signal to speed up the discharge still more. This is done to assure that the capacitor will be completely discharged during the auto zeroing action of phase 1.

The timing logic block also controls the gain of the amplifier ahead of the integrator. The block receives an indication of the full-scale range selection, and, for the lowest range (200mV), causes the amplifier to be configured with a gain 10 times greater than used for other ranges. This replaces the scaling function at the front end.

5.1.4 System Timing

Figure 5-2 summarizes the timing relationships described above. The system timing is illustrated with respect to the signal at the output of the integrating capacitor of the dual-ramp analog-to-digital conversion. A number of different input signals are illustrated:

a. An in-range positive input signal;
b. An in-range negative input signal;
c. An out-of-range positive input signal.

Note the change in slope of the ramp-down segment when the capacitor does not return to zero within the time limits of phase 3. Note, also, a 1-count delay between the end of phase 2 and the start of phase 3. This is introduced to assure that all switching conditions will be completed before the ramp-down process is begun.

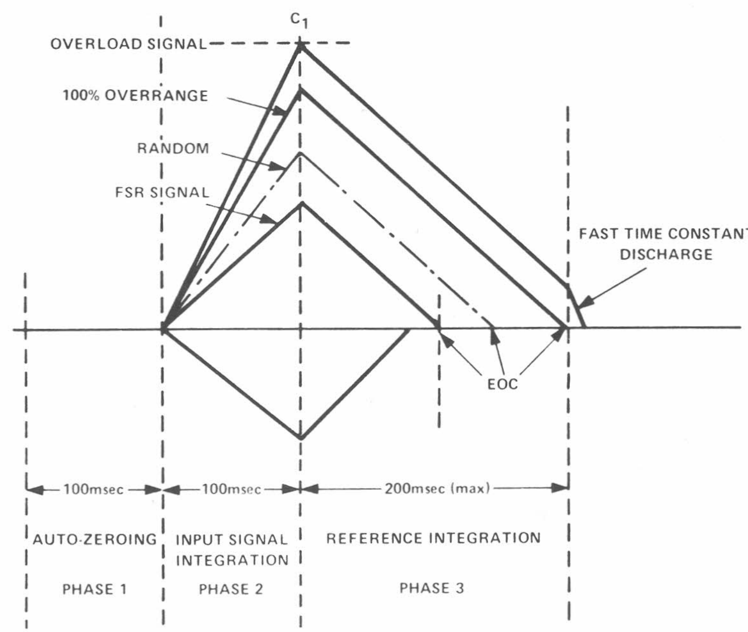


Fig. 5-2. Model 2590/2590R, System Timing Diagram

5.2 INPUT TERMINALS/MODE SWITCHING

Mode switches S2 through S6 are used to select the measurement mode at the front panel. They are interlocked so that selecting one of them releases a previous selection (except for S5 which controls the selection of 2-wire or 4-wire resistance measurement). Figure 5-3 is a simplified schematic of the switching controls and illustrates their actions on the signals connected to the banana jacks at the front-panel.

The **HI** input is connected to separate signal scaling circuits for dc volts, ac volts, or for current measurements. Until a resistance measurement is selected by S4, the **LO** input is conected to analog ground, and the resistance sensing from the **HI** input is disconnected, and the lead connected to analog ground.

When S4 is operated for a resistance mesurement, then the status of S5 (2W/4W) is significant. When a 2-wire measurement is to be made, the current sourcing is applied through the **HI** (J2) terminal, and the **LO** (J3) terminal is connected to analog ground. When a 4-wire measurement is to be made, the current sourcing is applied through **HICS** (J1), while **LOCS** (J4) is connected to analog ground.

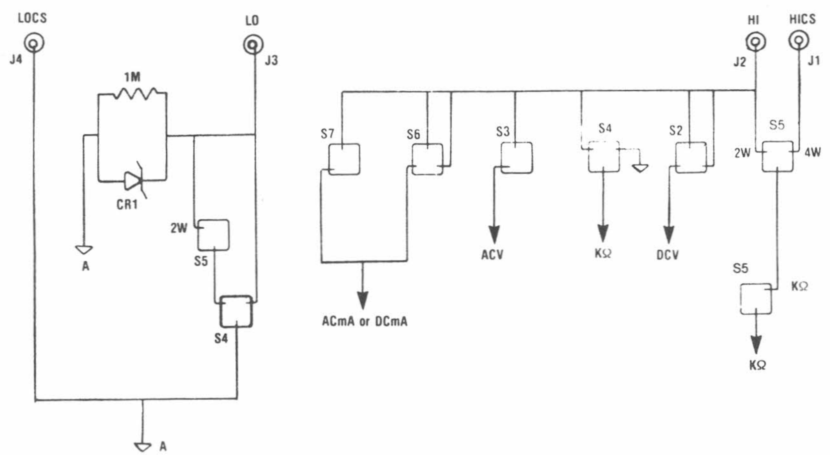


Fig. 5-3. Input Switching Controls, Schematic

The operation of either S6 or S7 will connect the input to the current shunt. However, a distinction is required for later circuit application, to determine the introduction of the ac/dc converter assembly for ac currents.

5.3 SIGNAL CONDITIONING

5.3.1 General

The function of the signal conditioning circuits is to develop a dc voltage proportional to a full scale of 2 volts for subsequent digitizing. As noted previously, the signal conditioning is performed in separate circuitry for each of the measuring modes. Details for each are contained in the subparagraphs that follow.

5.3.2 DCV Signal Conditioning

Figure 5-4 is a simplified schematic of the signal conditioning circuitry that is configured when the front-panel switch DCV (S2) is pressed for this measurement mode. Switch positions for the 2V-range selection are indicated in their connected position (one, and only one range switch , may be be actuated at a time). The actuated contact resulting from the front-panel range selection is identified in the illustration by the front-panel nomenclature. The output to the A/D converter circuitry is the voltage with respect to analog ground at the arm of S2 at the right end of the illustration.

As shown in Figure 5-4, the signal conditioning is essentially a resistance divider network to scale the input signal. However, unlike the standard form of divider in which the divider remains fixed while taps provide different ratios, the divider is reconfigured for different ranges, and the same tap may be used for different ranges. Notice that there are only 2 taps at R65 and R63 across the main resistance string, and these 2 plus the connection at the top serve all 5 voltage ranges. The reconfiguration is accomplished by the action of the circuit containing active element Z10.

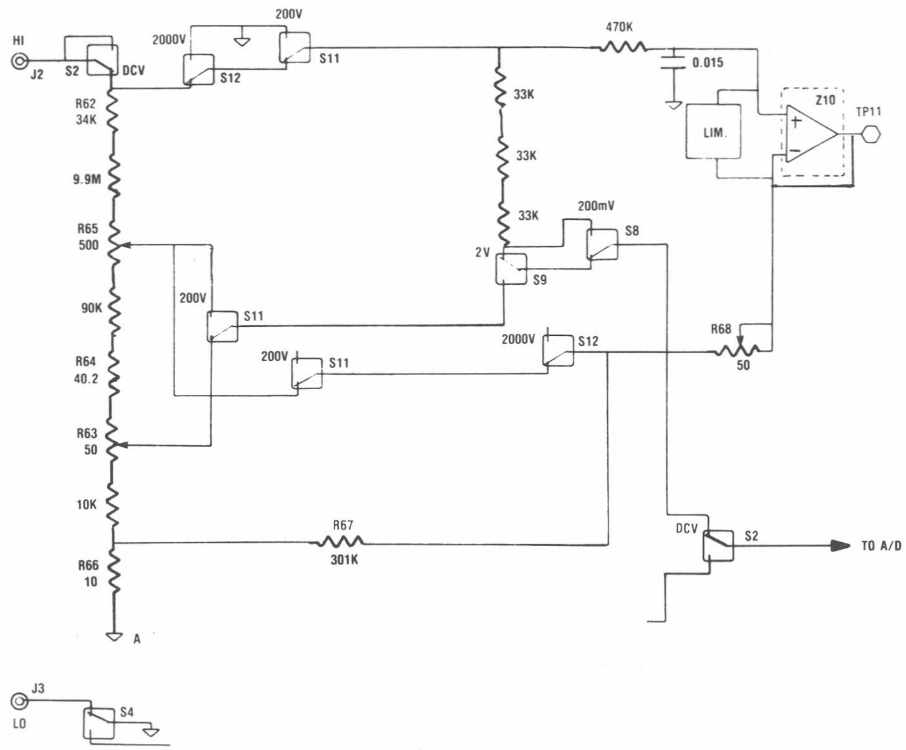


Fig. 5-4. DCV Signal Conditioning

For the 200V and 2000V ranges, for example, non-inverting input to Z10 is connected to analog ground, while the inverting input is connected to the bottom tap. The scaled output is taken from R63 for 2000V and from R65 for 200V. For 200mV, 2V, and 20V ranges, amplifier Z10 effectively shorts out the 9.9MΩ resistor group (including R62 and the tapped R65). For the 200mV and 2V ranges, the output is connected directly (through three 33K resistors) to the input without further scaling. No switching is required for the 20V range (connections are as shown). A change in the amplifier gain at the input to the A/D accomplishes the appropriate scaling for the 200mV.

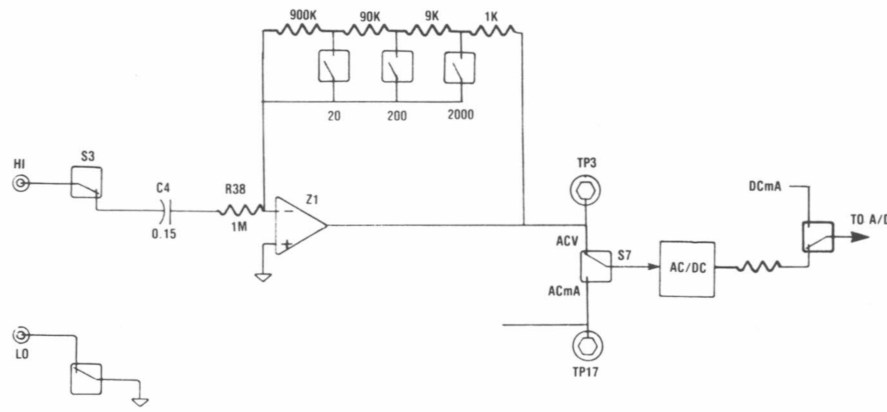


Fig. 5-5. ACV Signal Conditioning

5.3.3 ACV Signal Conditioning

The signal conditioning for ac voltage measurements is accomplished in two parts: scaling and ac/dc conversion. Figure 5-5 is a simplified schematic of the scaling operation, and Figures 5-6 and 5-7 are schematics of the ac/dc conversion for average sensing in Model 2590 (Figure 5-6), and true rms conversion in Model 2590R (Figure 5-7).

As shown in Figure 5-5, the scaling is accomplished by setting up the gain around amplifier Z1-7 by operating the appropriate front-panel range switch. Gain ratios from unity to 1/1000 are obtained.

For Model 2590, the average sensing and scaling to rms of an equivalent sinusoid is accomplished as shown in Figure 5-6. The scaled input from the previous circuit is ac-coupled to the ac/dc assembly and connected to the input of Z1 of that assembly through a precision 2.23K resistance and a series trimpot. The precision feedback resistance of 4.99K around the amplifier provides a gain factor of 2.2 in order to accomplish the scaling to the rms value of a sinusoid that has the equivalent average value being sensed. The dc output is connected via the mode switch to the A/D circuitry.

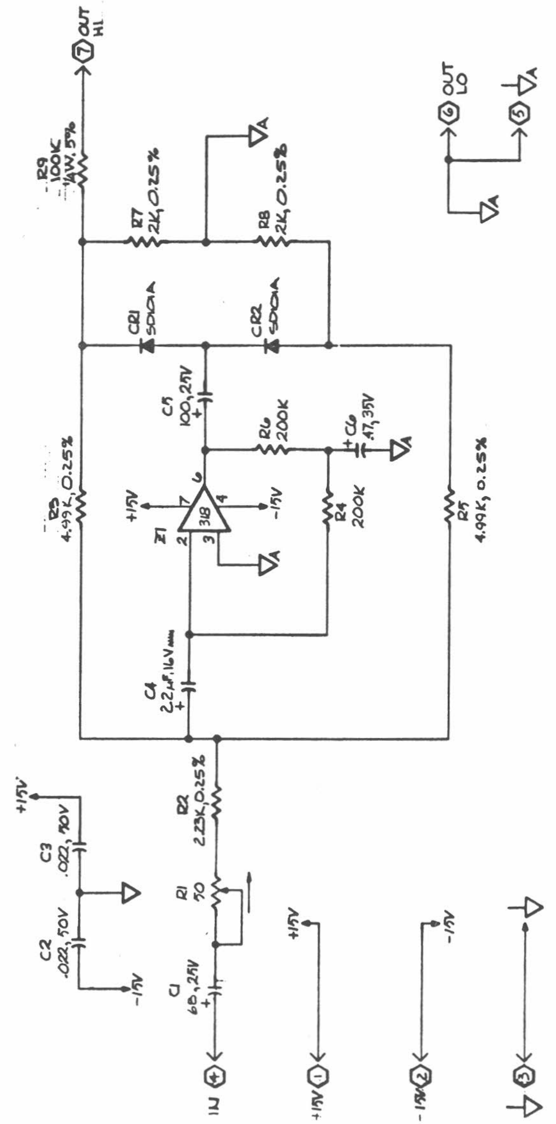


Fig. 5-6. Average-Sensing RMS (Model 2590)

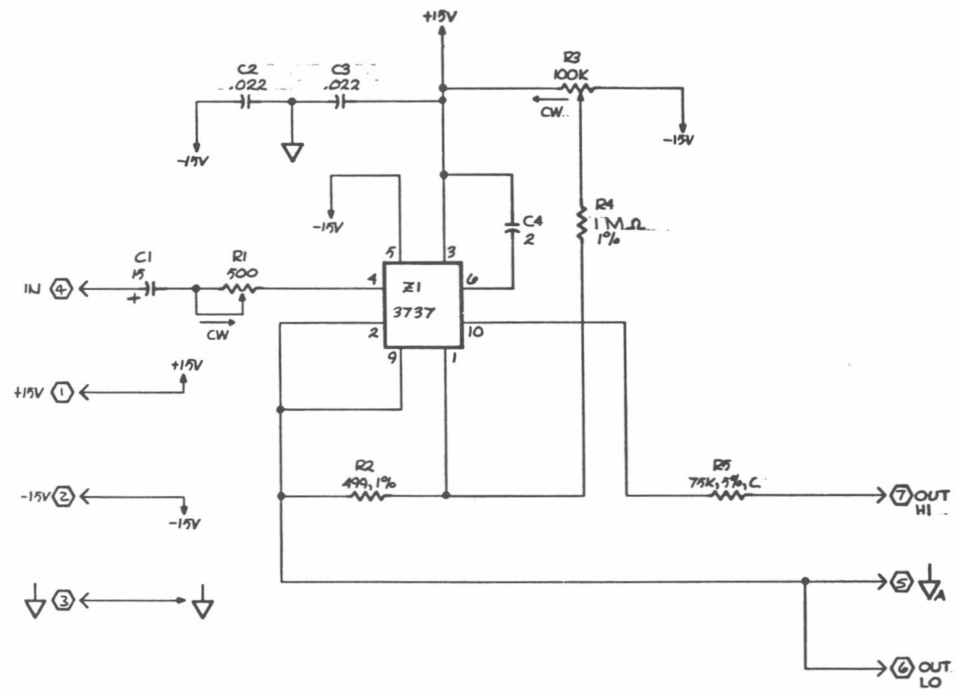


Fig. 5-7. True RMS (Model 2590R)

For the Model 2590R, the sensing and scaling to a true rms dc value is accomplished in a single integrated circuit, Z1 in that asembly, as shown in Figure 5-7. The signal is ac-coupled to the converter and connected to the input through a series trimpot.

5.3.4 Current Measurements Signal Conditioning

Figure 5-8 is a simplified schematic of the signal conditioning for ac and dc current measurements. Both measurement modes use the tapped current shunt consisting of resistors R69 through R73 for the scaling; the divider action is obtained by operating the appropriate range selector switch. For the DCmA measurement mode, the shunt output is a dc voltage that may be connected directly as the A/D circuit input.

For the ACmA measurement mode, the scaled ac output of the shunt is connected to the installed ac/dc converter circuit, as described above, for the Model 2590 (average sensing) or Model 2590R (true rms sensing) instruments.

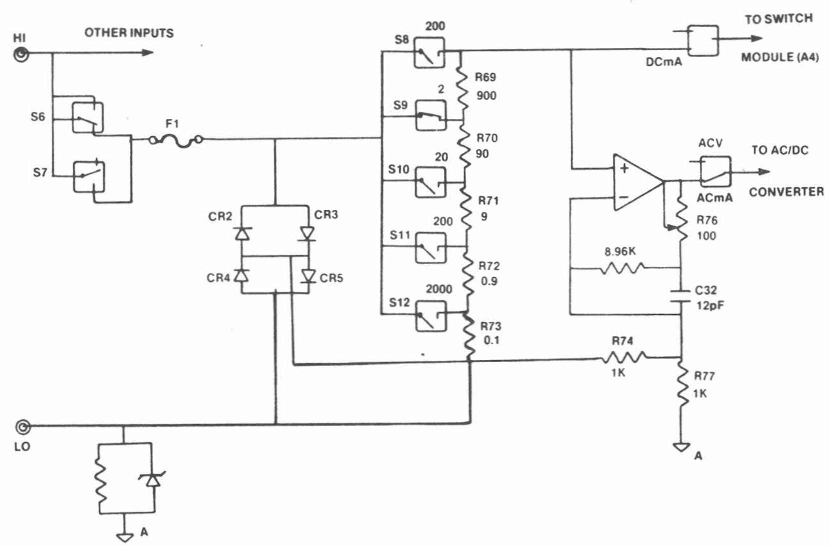


Fig. 5-8. Current Measuring Signal Conditioning

5.3.5 Resistance Measurement Signal Conditioning

As noted in the earlier paragraphs of this chapter, the resistance measurement employs the technique of driving a constant current of known magnitude through the resistance to be measured and through a known resistance standard. Then, the DMM measures the ratio of the voltages across these resistances. The current source and sink and the voltage high and low sense may be connected in a 2- or 4-wire configuration. (Refer to the oprating instructions in Chapter 3.) Figure 5-9 is a simplified schematic of the signal conditioning circuit employed in the Model 2590. The illustration also includes some of the switching whereby the sensed voltage across the unknown resistance and the reference voltage applied to the A/D converter circuits during appropriate phases of the conversion cycle. These latter actions will be described in later paragraphs.

The constant drive current is developed in the amplifier Z6 circuit. The inverting input terminal of Z6 is connected to a value of 3.8 volts obtained from the divided down supply of 4.8 volts. The standard resistance, R_S, in series with the 4.8V supply, Q5, 1K, and the unknown resistance, is selected by operating the appropriate front-panel range switch. The current through this resistance is forced to drop the voltage to the non-inverting terminal of Z6 to 3.8V, or to produce a 1V drop across the range-selected precision resistance.

The same current that flows through the standard resistance also flows through the resistance to be measured, R_X. The drop across the unknown resistance is the input to the A/D converter during phase 2.

During phase 3, the 1-volt drop across the standard resistance is connected through C2 to become the negative 1-volt reference for the A/D input. Thus, the A/D, in effect, is measuring the ratio of the voltages across the unknown and standard resistances. Because these voltages have been produced by a common current, their values are proportional to the resistances, and the resistance measurement is valid.

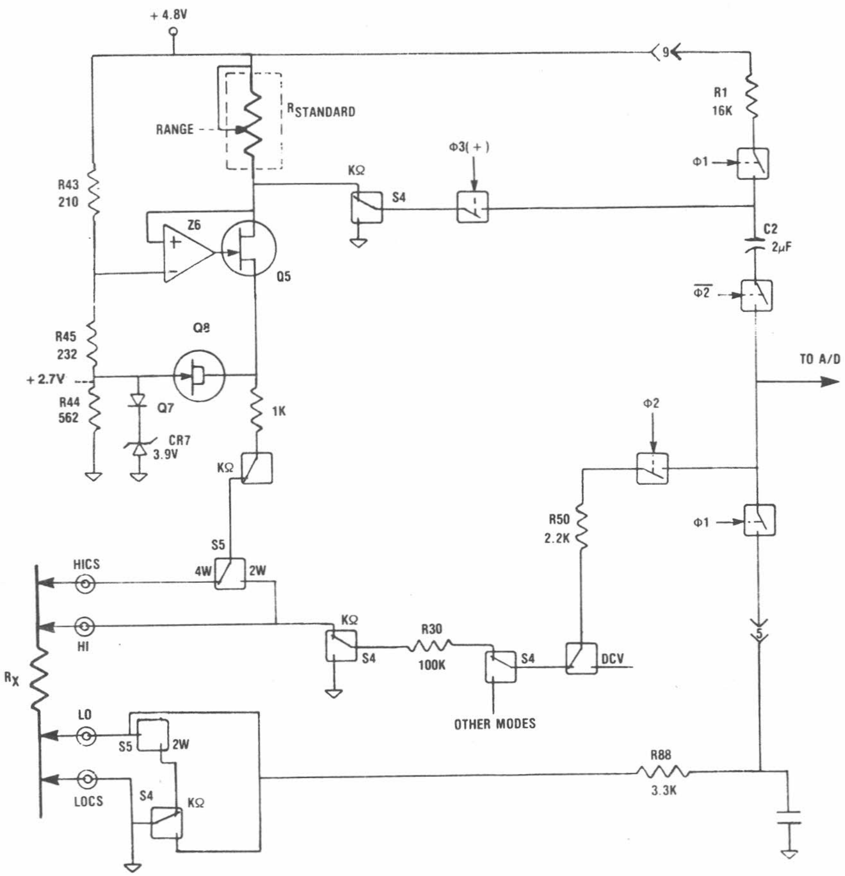


Fig. 5-9. Resistance Measuring Signal Conditioning

A number of protection circuits are incorporated in the resistance measurement instrumentation:

The 1K in series with the load resistance is inserted as a current limiter.

Q8provides a current path during an open-circuit condition.

The Q6, Q7, CR7, and R55 combination establishes a bypass for currents when the input voltage exceeds approximately 3 volts.

5.4 A/D CONVERSION

5.4.1 Analog Section

As indicated in the general description at the start of this chapter, the conditioned input is connected during phase 2 to charge an integrating capacitor for a fixed time interval of 100 milliseconds; the reference is connected during phase 3 to reduce the charge on the capacitor. The operation, in effect, "ratios" the conditioned signal to the reference voltage.

Control signals from the digital section reconfigure the analog section for its performance during the separate phases of the conversion cycle. The time intervals of phases 1 and 2 are developed from the timing counter and logic gates, while the output of the analog comaparator circuit is sensed to determine the phase 3 time interval.

As shown in the complete schematic at the rear of the manual, the analog section consists of a dual FET pre-amplifier input stage Q1, a programmable amplifier stage Z5, an integrator and amplifier stage Z3/Z2, and a comparator stage Z7. Figure 5-10 is a simplified schematic of the portion of the circuit beginning with the input to Z3.

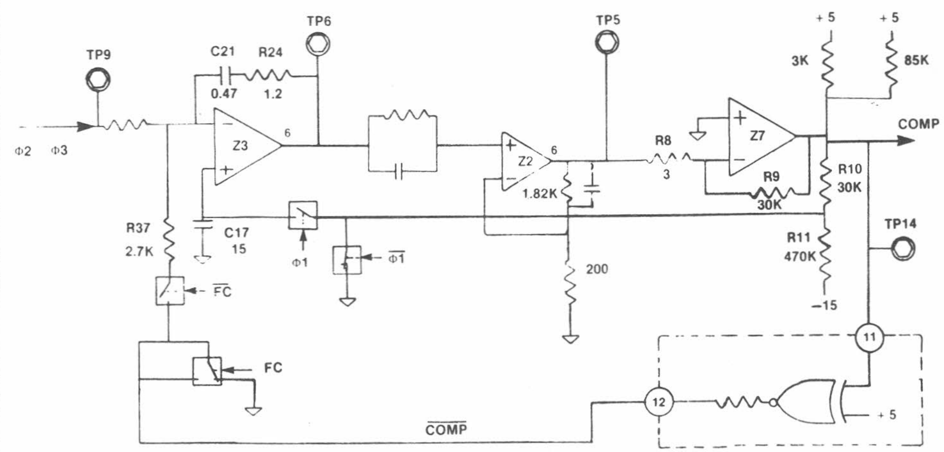


Fig. 5-10. A/D Conversion Simplified Schematic

During phase 1, the analog circuit is autozeroed. The input to the analog circuitry is grounded, and the output of the comparator is connected to the input of the integrator stage and to offset capacitor C17 by the switch control of Φ1 (in the Switch Module). Then, for the 100ms duration of phase 1, a charge will accumulate across C17 so as to compensate for all the non-zero offsets and drifts in the circuitry and to drive the comparator output to zero. The charge stored on C17 remains in the circuit for both the remaining phases. Note that its value is updated once each conversion cycle.

During phase 2, the conditioned signal input is connected to one side of the Q1 dual FET through a switch closed by the Φ2 signal. The other side of the dual FET receives the feedback signal from the programmable gain amplifier output through either switch A or switch B. These latter switches are selected to introduce a gain factor of 10 for the 200mV range scale. The output of the programmable gain amplifier is integrated in the Z3 stage for a fixed time interval of 100ms, and the output voltage at that time is proportional to the conditioned input signal.

Compound amplifier Z2/Z7 form a high-gain comparator that is driven into saturation with the opposite polarity of the integrator output. This polarity is sensed in the logic circuitry where its sense determines the selection of the proper polarity of reference signal to be connected to the input during phase 3.

5.4.2 A/D Reference Generation (Isopolar)

Generation of the reference voltage for voltage and current measurement modes is illustrated in the simplified schematic of Figure 5-11. The precision reference of 6.6 volts is divided down in the resistance network so that a 1-volt magnitude is connected to one arm of switch S4. (The switch is positioned for the non-resistance measurement modes.) During phase 1, the 1-volt level charges capacitor C2 through R1 and R88. The charge across the capacitor remains when the phase 1 switches are open, and is disconnected from the input to the A/D by the action of the $\overline{\Phi 2}$ control signal.

If the input had been a positive signal, then Φ3(+) control signal is received from the timing control logic and connects the top of C2 to analog ground (through terminal E3 and the S4 switch contact). This action shifts the level of the lower side of C2 to 1 volt below ground level, and connects it to the A/D input. If the input signal had been a negative signal, then Φ3(−) control signal causes the positive 1-volt reference to be connected to the A/D circuit.

For resistance measurement modes, refer to Figure 5-8, in which the signal conditioning had been described. During phase 1, the 4.8V reference supply is connected through the closed phase 1 switches to charge C2 through R1 and R88. During phase 3, the voltage level at the non-inverting input to Z6 (which is less than 4.8V by the drop across the standard resistance) is connected to the top of C2. The lower side of C2 is then driven below ground by the value of the voltage drop across the standard range resistance, and that negative reference is used during phase 3 to drive the A/D converter circuitry, as required.

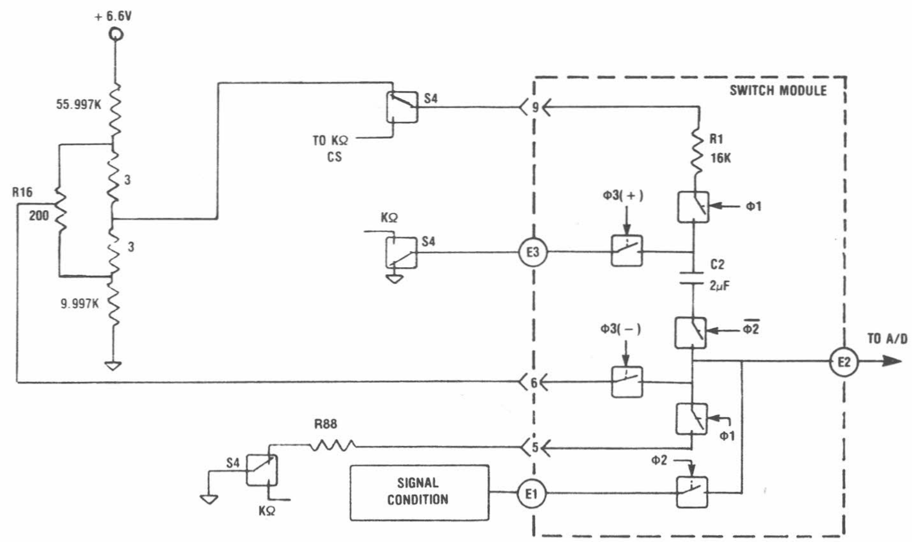


Fig. 5-11. A/D Isopolar Reference Generation (Non-Resistance)

5.4.3 Timing Control Logic

The timing control logic circuitry is illustrated in the simplified block schematic of Figure 5-11. The function of these blocks is to generate the control signals for all the switches identified in the previous circuits, and to generate the control signals for the 5½-digit display.

As shown in the illustration, the circuit incorporates a 4-MHz crystal controlled oscillator, from which the basic timing clock pulses of 1 MHz are derived. The 1MHZ clock drives a counter chain consisting of an initial decade counter, IC Z14, followed by four stages of divide-by-10 in another IC, Z10, followed by a 4-decade counter IC Z11; or a total of 9 decades. The output of Z10 is a pulse train of 100-millisecond period, and is the basic count for the three phases. The first carry output from Z10 causes a switch from the phase 1 to phase 2; the second carry is sensed as the first count from Z11 and causes a switch from phase 2 to phase 3, but only after a "pulse hog" circuit removes one pulse from the clock train. This delay provides time for all the switched circuitry to stabilize before starting phase 3. The COMP signal at the

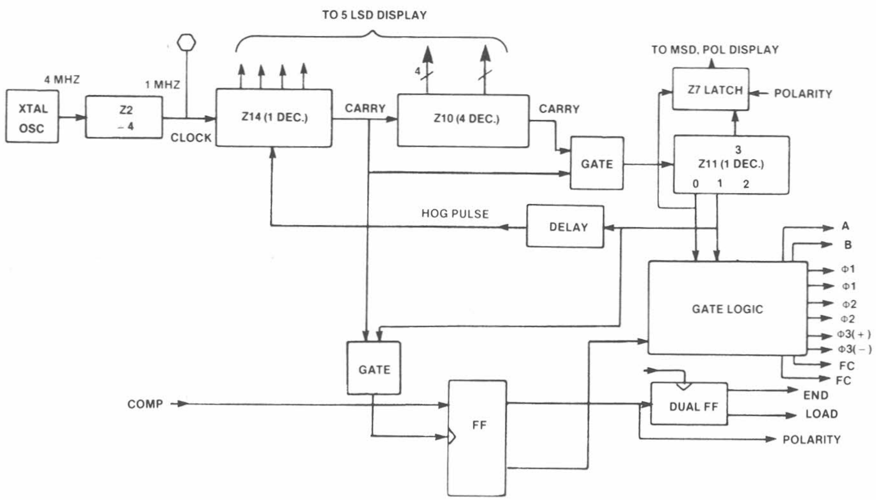


Fig. 5-12. Timing Counter Chain

end of Phase 1 sets a flip flop to gate the appropriate reference polarity control from the circuit when the phase 3 portion of the cycle is to start.

When the COMP signal changes at the end of conversion of an in-range signal, it is clocked by the next clock pulse to latch the values in Z14, Z10, and Z7. Z14 transmits the parallel BCD value of the LSD; Z10 cutputs a series of parallel addressed 4-bit BCD codes for the next four digits; Z7 outputs the controls for the MSD. The counters are reset for the start of the next conversion cycle.

When an out-of-range signal permits the third decade carry before the COMP signal indicates end of conversion, Z11 is configured to produce a carry pulse from the 0 digit which sets the FC control signal circuitry and blanks the MSD.

NOTES:

Chapter 6

MAINTENANCE

CAUTION

Your Multimeter is covered by a 12-month warranty and should be referred to the factory or Authorized Service Centers for maintenance within the warranty period. Attempts to make any extensive repairs within the warranty period may invalidate this warranty. If repairs are needed after the warranty period, only qualified technicians should attempt to effect such repairs and should use test instruments and standards calibrated with the accuracies and tolerances of the performance specifications of the instrument.

WARNING

High voltages are accessible within the instrument when the cover is removed. Proceed with caution when making any measurements within the instrument. Disconnect power and discharge power-supply filter capacitors before making repairs.

6.1 TROUBLE-SHOOTING STRATEGY

The Model 2590 DMM is particularly responsive to a well-defined strategy of trouble-shooting analysis because of its modular funtion architecture. That is, the DMM performance in a particular measurement mode utilizes a unique portion of the instrument circuitry, and proper performance in that mode demonstrates the proper operation of all the circuit groups involved. Where some modular circuit function blocks are operative in several measurement modes, it may be possible to isolate the trouble to a particular block (or even to a circuit component) by thoughtful analysis of the results in several measurement modes.

The flow chart of Figure 6-1 defines a trouble-shooting strategy based on the "positive" approach of defining properly operating circuit blocks, and thereby isolating the cause of trouble to a block or circuit component.

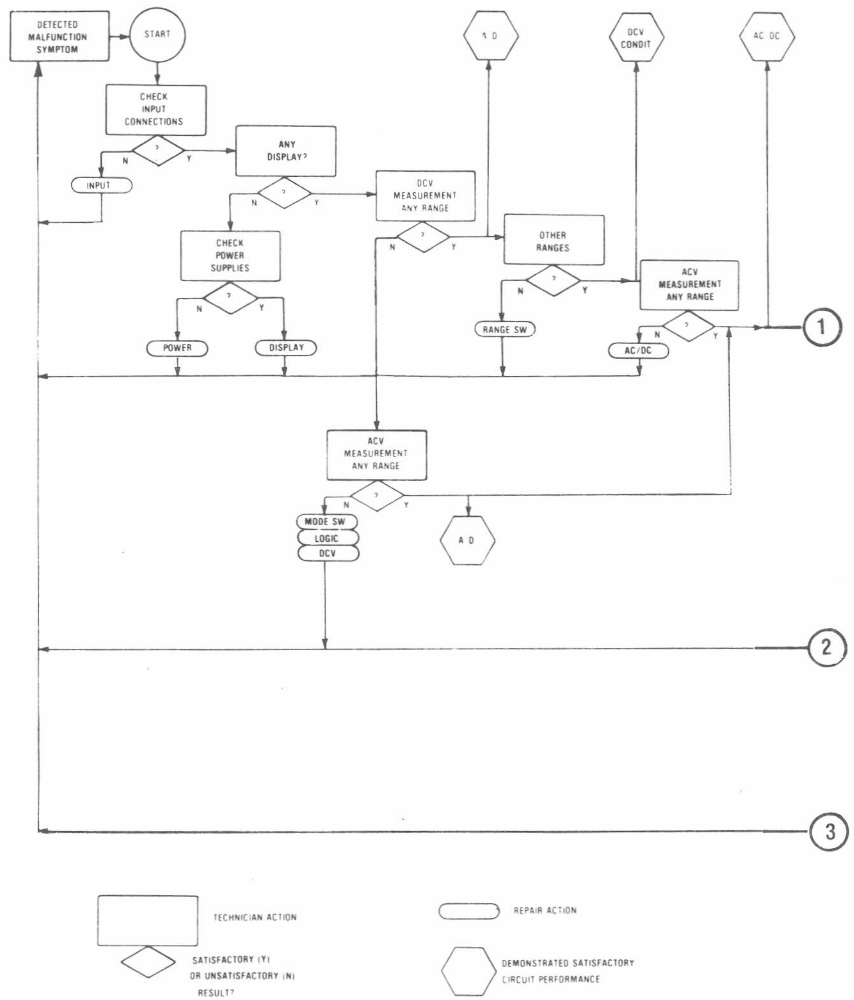


Fig. 6-1. Trouble-Shooting Flow Diagram Part 1

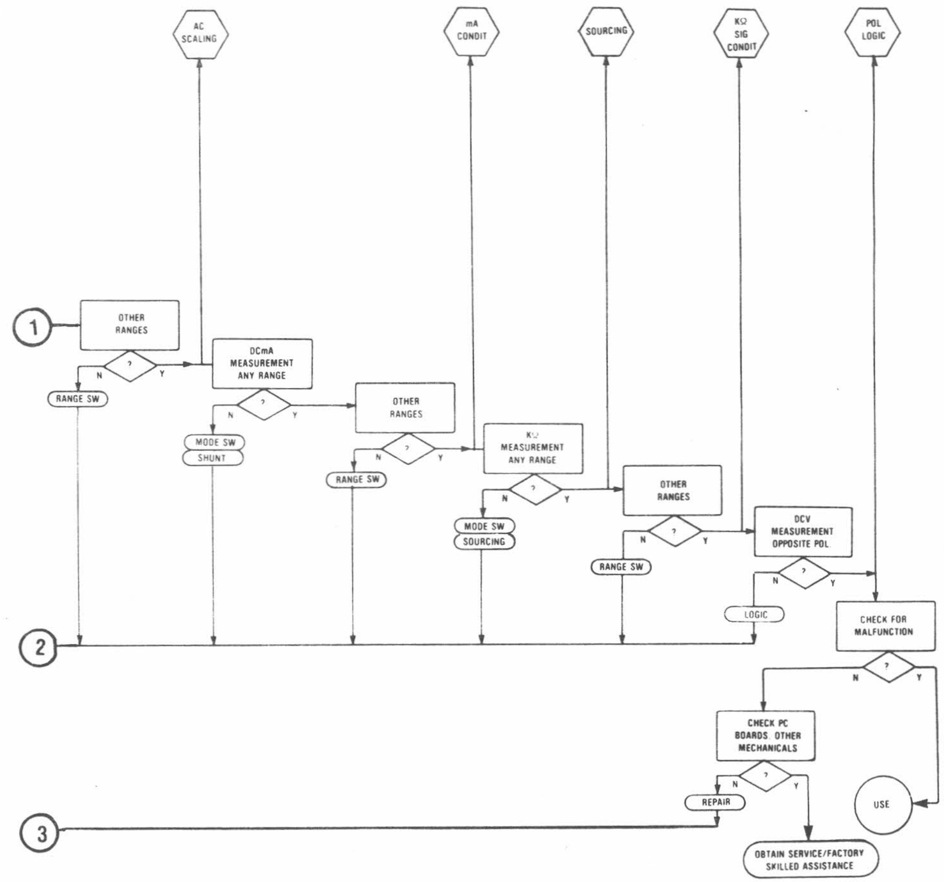


Fig. 6-1. Trouble-Shooting Flow Diagram Part 2

In many instances, a logical analysis of the instrument response to varying setups will isolate the probable source of trouble without opening the case.

You will note, in Figure 6-1, that the initial reaction to a detected malfunction is to verify the input connections. In other words, start with an assumption of "cockpit error" rather than instrument error. An apparent malfunction is often the result of disturbed input connections or a failure in the source of the signal to be measured.

When the analysis leads to an indicated repair/replacement action, as shown in the illustration, a functional block is identified within a coded graphic symbol. That function has been described in some detail in Chapter 5, and the complete schematic is included at the back of the book.

6.3 POWER SUPPLY

When no display is observed, and the DMM appears to be completely non-functioning, the fault may be in the power or in the display assembly (see Fig. 6-1.). The power supply circuit is instrumented with convenient test points, at which the various supply levels used in the instrument may be measured. Refer to Table 6-1 and to Figure 6-2 for further details.

6.4 A/D CONVERTER

As described in Chapter 5, the A/D conversion is performed in a circuit comprising separate components (as distinct from an integrated circuit assembly). When the analysis suggests a malfunction in that functional circuit, the further troubleshooting is aided by test points located along the conversion flow path. These were identified on the simplified schematic in Chapter 5; they are also shown on the complete schematic in the rear of the book; and further defined in Table 6-1. Their locations are shown in Figure 6-2. Refer to Figure 6-3 for a description of the typical waveforms to be measured at these points.

Table 6-1
TEST POINTS on MAIN PCB (Assembly A1)

TP#	LOCATION	SIGNAL/FUNCTION
1	Q13 Emitter	
2	Z1	+6.6V Ref
3	Z1-7	AC/DC Buffered Input
4	Z11-7	+5V
5	Z2-6	Integrator Output
6	Z3-6	Buffer Output
7		+15V
8	Z12-3	−15V
9	Z5-6	Prog Gain Amp Out
10	Z11-1	+4.8V
11	Z10-6	Input Scaling Return
12	R29	−30V
13		+30V
14	Logic-11	COMP/Comparator Out
15	Z8-1	Temp Corrected Z8 Out (3.9V
16	DCR	−3V ref
17	Z15A-1	ACmA/conditioned signal

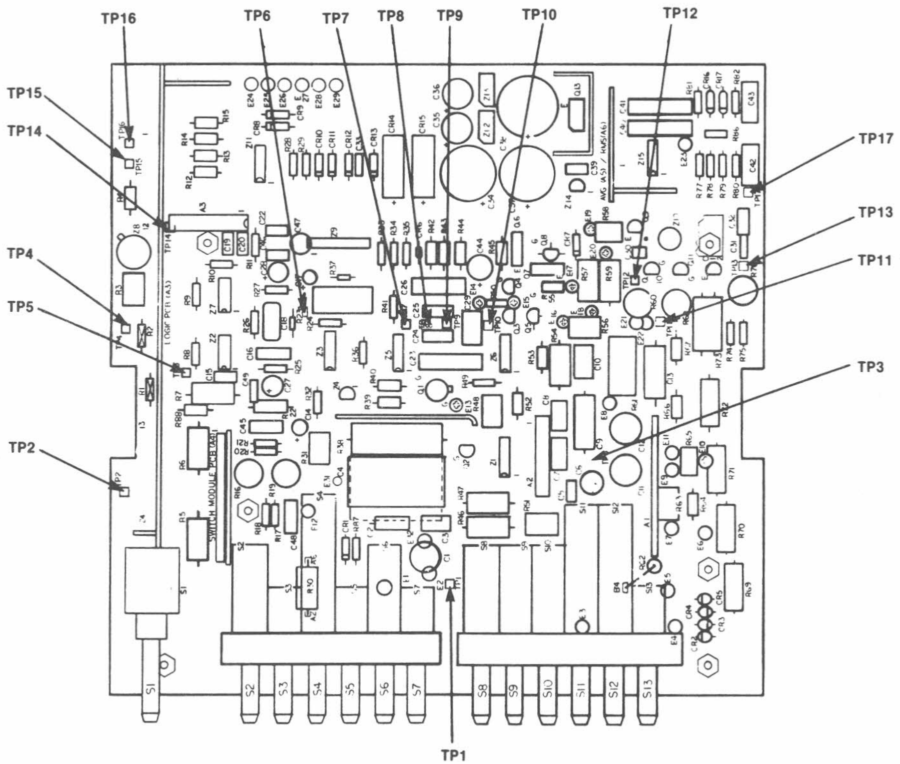


Fig. 6-2. Main PCB Test Point Locations

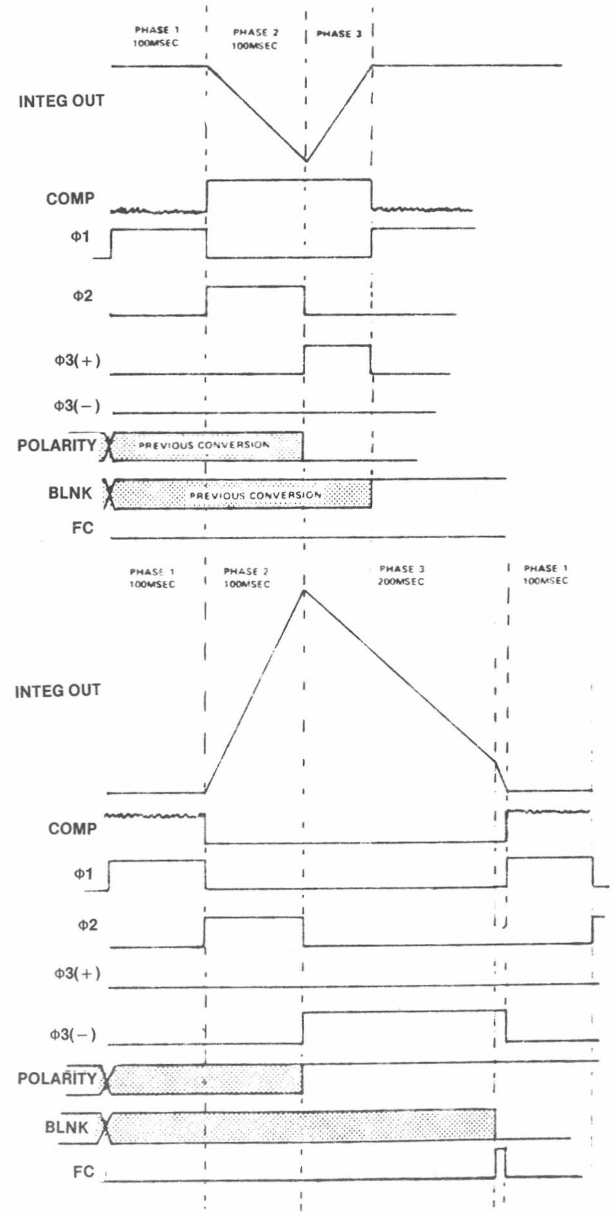


Fig. 6-3. A/D Conversion Waveforms

Chapter 7
PARTS LISTS

7.1 MODEL 2590 DMM ASSEMBLIES

Figure 7-1 illustrates the breakdown of the Multimeter into its major assemblies within the case. Four major assemblies (A1, A2, A3, and A4) are common to the two configurations, 2590 and 2590R. The fifth board assembly determines the performance and designation of the instrument as a 2590 (Schematic 65-1038) for Average Sensing, and as a 2590R (Schematic 65-1037) for True RMS Sensing. Transformer and wiring modifications in the case rear panel assembly determine the power sourcing configuration for the instrument.

7.2 PARTS LISTS

7.2.1 General

The parts lists that follow cover the replaceable electronic components for the separate assemblies. The lists are presented in the grouping according to the assemblies to which they refer. Parts locations are shown on the corresponding assembly drawings that are included with this manual.

7.2.2 Ordering Requirements

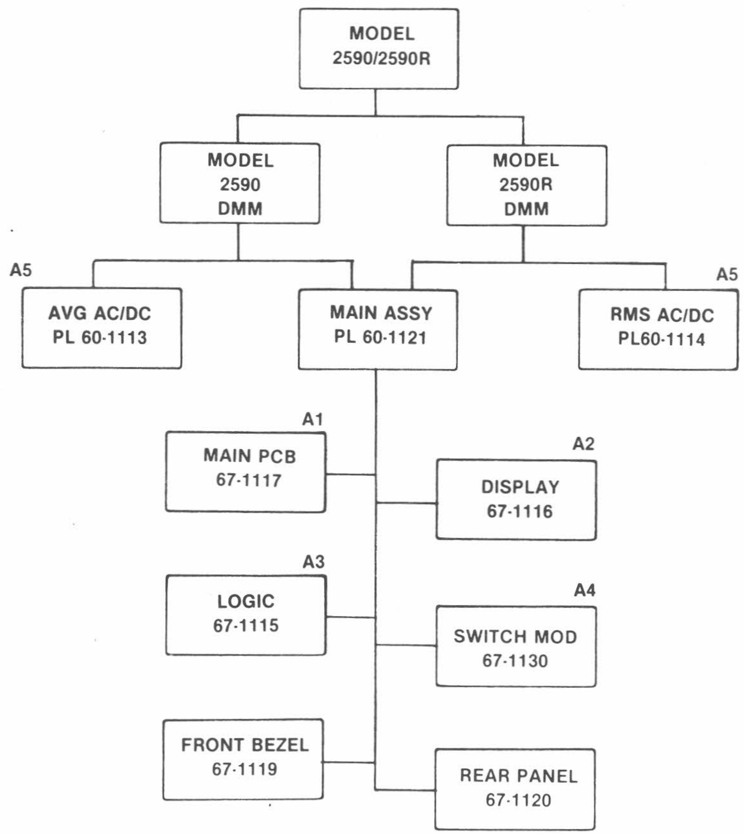
When replacement parts are required, the order should specify:

The part **Reference Designation** (for example: R1, C200, etc) as shown on the schematic or assembly board;

The complete **Part Description** as in the tabular listing;

The **Data Precision Part Number** (for example: DP Part No. 22-021029, etc.) as shown in the listings that follow.; and

The **Part Number and Revision Letter** of the pc-board on which the part is located.



Model 2590/2590R Assembly Breakdown

7.3 MAIN PCB ASSEMBLY (PL60-1117)

Ref. Des.	Description	DP Part No.
A1	Resistor Network, SIP, Voltage Divider	22-8000000
A2	Resistor Network, Input Attenuator	22-48-1085-03
A3	Resistor Network, SIP, 6 Resistors,	38-1074
AR1	Switch Module	67-1130
C1	Capacitor, Trim, 3 to 22 pF	23-810021
C2	Capacitor, Glass, 22pF, 5%	23-712001
C3	Capacitor, Mica, 68pF, DM10	23-310019
C4	Capacitor, PC, 0.15μF, 630V, 5%	23-530002
C5,32	Capacitor, Hi-Q, Cerm, 100V	23-143014
C6	Capacitor, Trim, 1.4 to 5.5 Top Adj	23-810027
C7	Capacitor, Mica, 130pF, DM10	23-310039
C8	Capacitor, Mica, 1500pF, 5%, 100V, DM7	23-301001
C9,13,26	Capacitor, Psty, 0.015μF, 2%, 50V, AX	23-550101
C10	Capacitor, Mica, FSV	T23-310xxx
C11,12	Capacitor, Trim, 5.5pF to 65pF	23-810020
C14,17	Capacitor, AlEl, 15uF, 20%, 16V	23-620020
C15	Capacitor, Mica, 5pF, DM10	23-310004
C16	Capacitor, Mica, 1000pF, 5%, DM10	23-311002
C18	Capacitor, Mica, 270pF, 5%, DM15	23-311022
C19,20,33,46	Capacitor, Cerm, 0.1μF,5%, 50V	23-140062
C21	Capacitor, Met.Polypropylene, 0.47μF	23-570000
C22,49	Capacitor, Cerm.,3300pF,50V	23-140045
C23,40,41	Capacitor, Met.Poly.,0.47μF, 100¼V, 10%	23-210323
C24,25,45	Capacitor, Mica, 15pF, 5%, DM10	23-310017
C27,28	Capacitor, Tant.m 6.8μF,20%, 20V, min	23-441005
C29	Capacitor, Mica, 4pF, DM10	23-310038
C30,31	Capacitor, Mica, 47pF, 20%, 50V, Rad	23-140021
C34,37	Capacitor, AlEl, 470μF, 25V, Rad	23-620011
C35,36	Capacitor, AlEl, 100μF, 35V, Rad	23-620002
C38	Capacitor, AlEl, 2500μF, 16¼v	23-620005
C39	Capacitor, Cerm., 68pF, 10%, 1KV	23-110019
C42,43	Capacitor, Mylar, 0.1μF, 20%, 100V	23-210302
C44	Capacitor, AlEl, 100μF,10V	23-620008
C48	Capacitor, Mylar, 0.01μF	23-210314

MAIN PCB ASSEMBLY (PL60-1117) (continued)

Ref. Des.	Description	DP Part No.
CR1,7	Diode, Zener. 1N4730A, 3.9V	24-121002
CR2,3	Diode, Selected, A 14U	24-48-1154
CR4,5	Diode, Rectifier, 2.5A, A14U	24-102001
CR6	Diode, Sil, 1N4148	24-110001
CR8,9,11,12	Diode,Rect. 1N4004	24-104004
CR10,13	Diode, Zener, 1N4744A, 15.0V	24-121103
CR14,15	Diode, Bridge, 200V	24-100020
CR16,17	Diode, Zener, 1N5234, 6.2V	24-121101
Q1	Transistor, Low Noise, Dual FET, U405	24-210405
Q2,10,11	Transistor, FET, N-Channel, Yel Dot	24-48-1014-05
Q3,4,8	Transistor, FET, N-Channel, Orn Dot	24-48-1014-10
Q5	Transistor, FET, N-Channel, Grn Dot	24-48-1014-03
Q6,7	Transistor, Low Leakage, Selected	24-68-1070
Q9	Transistor, PNP, MPS8599	24-248599
Q12	Transistor, NPN, MPS8099	24-238099
Q13	Transistor, Power NPN, D40D2	24-2240D2
R1	Resistor, FSV, 1%, RN55E	T22-35xxxx
R2	Resistor, FSV, 0.25%, 5pm/°C	T22-434xxx
R3,56	Resistor, 200, Trim, Multi-turn	22-680005
R4	Resistor, 7.15, 1%,RN55C	22-347151
R5	Resistor, Matched to R6, 55.997K	22-38-1072-01
R6	Resistor, Matched to R5,9.997K	22-38-1072-01
R7	Resistor, Matched to R22, 100.2	22-38-1072-03
R8,17,18	Resistor, 3, ¼W, 5%, Carbon	22-023R09
R9,10,79,82	Resistor, 30K, ¼W, 5%, Carbon	22-023039
R11	Resistor, 470K, ¼W, 5%, Carbon	22-024749
R12	Resistor, ,100K, 1%, RN55C	22-341003
R13	Resistor, 10.2K, 1%, RN55C	22-341022
R14	Resistor, 196K, 1%,RN55C	22-331963
R15	Resistor, 52.3K, 1%,RN55C	22-345232
R16	Resistor, 200, Trim, Single Turn	22-673201
R19,60	Resistor, 100K, Trim, Single Turn	22-673104
R20,88	Resistor, 3.3K, ¼W, 5%, Carbon	22-023329
R21	Resistor, 24.9K, RN55C	22-342492
R22	Resistor, Matched to R7, 900	22-38-1072-03

MAIN PCB ASSEMBLY (PL60-1117) (Continued)

Ref. Des.	Description	DP Part No.
R23	Resistor, 10K, 1/8W, 5%, Carbon	22-011039
R24	Resistor, 1.2, ¼W, 5%, Carbon	22-021R29
R25	Resistor, 200, 1%, RN55D	22-232000
R26	Resistor, 1.82K, 1%, RN55D	22-331821
R27	Resistor, 200, ¼W, 5%, Carbon	22-022019
R28,29	Resistor, 1.5K, ¼W, 5%, Carbon	22-021529
R30	Resistor, 100K, 2W, 5%, Carbon	22-051049
R31	Resistor, 100K, Trim, Multiturn	22-680013
R32	Resistor, 4.02K, 1%, RN55C	22-344021
R33	Resistor, 33K, ¼W, 5%, Carbon	22-023339
R34	Resistor, 1M, ¼W, 5%, Carbon	22-021059
R35	Resistor, 430K, ¼W, 5%, Carbon	22-024349
R36	Resistor, 237K, 1%, RN55C	22-342373
R37	Resistor, 2.7K, 1/8W, 5%, Carbon	22-012729
R38	Resistor, 1M, 0.25%, RN75E	22-401001
R39	Resistor, 75K, 1%, RN 55C	22-347502
R40,41	Resistor, 40.2K, 1%, RN55C	22-344022
R42,49,74	Resistor, 1K, ¼W, 5%, Carbon	22-021029
R43	Resistor, 210, 1%, RN 55C	22-342100
R44	Resistor, 562, 1%, RN55C	22-345620
R45	Resistor, 232, 1%, RN55C	22-342320
R46	Resistor, 8.99K, 0.1%	22-38-1071-06
R47	Resistor, 1.02K, 0.05%	22-38-1071-02
R48,58	Resistor, 5K, Trim, Multiturn	22-680009
R50	Resistor, 2.2K, ¼W, 5%, Carbon	22-022229-C
R51	Resistor, 20, Trim Multiturn	22-680002
R52	Resistor, 48.7K, 1%, RN55C	22-344872
R54	Resistor, 89.9K, 1%	22-38-1071-07
R55	Thermistor, 500V, Red Dot, Sel.	22-991001-A
R57	Resistor, 898K, 0.29%	22-38-1071-08
R59	9.86M, 0.25%	22-416002
R61	Resistor, 470K, 2W, 10%, CC only	22-054748-C
R62	Resistor, 34K, 1%, RN55C	22-343402
R63	Resistor, 50, Trim, Multiturn	22-680003
R64	Resistor, 40.2, 1%, RN55D	22-3340R2

MAIN PCB ASSEMBLY (PL60-1117) (Continued)

Ref. Des.	Description	DP Part No.
R65	Resistor, 500, Trim, Multiturn	22-680006
R66	Resistor, 10, 1%, RN55D	22-3310R0
R67	Resistor, 301K, 1%, RN55D	22-333013
R68	Resistor, 50, Trim, Single Turn	22-673500
R69	Resistor, 900, 0.07%	22-68-1015-01
R70	Resistor, 90. 0.07%	22-68-1015-02
R71	Resistor, 9, Precision, 0.07%	22-68-1015-03
R72	Resistor, 0.9, Precision, 0.15%	22-68-1015-07
R73	Resistor, 0.1, Precision, 0.15%	22-68-1015-06
R75	Resistor. 8.96K, 0.1%, 5 ppm/°C	22-413005
R76	Resistor, 100, Trim, Single Turn	22-673101
R77	Resistor, 1K, 0.1%, 5ppm/°C	22-413006
R78,80	Resistor, 120K, ¼W, 5%, Carbon	22-021249
R81	Resistor, 200K, ¼W, 5%, Carbon	22-022049
R83,84,85	Resistor, 33K, 4W, 10%, CC only	22-063338-C
R86	Resistor, 2.7K, ¼W, 5%, Carbon	22-022729
R87	Resistor, 1M, ¼W, 5%, Carbon	22-021059
S1	Switch, Line	25-431011
S2 -7	Switch, Function	68-1073
S8 - 13	Switch, Range	68-1074
Z1,11,15	IC, Dual Op Amp, LF353	24-400353
Z2	IC, OP AMP, NE5534	24-405534
Z3	IC, OP AMP, LF356	24-400356
Z4	IC, Current Mirror, 1:2, TL02	24-36L012
Z5	IC, OP AMP, LM318, DIL	24-400318
Z6	IC, OP AMP, TL061, Sel	24-24p48-1174
Z7	IC, Comparator, LM311	24-400311
Z8	IC, Precision Reference	24-38-1077
Z9	IC, Quad Bilateral Switch, Sel.	24-38-1062-02
Z10	IC, ICL 7650, Chopper Op Amp	24-427650
Z12	IC, Voltage Reg., – 15V, 250mA	24-370320
Z13	IC, Voltage Reg., + 15V, 250mA	24-370342
Z14	IC, Voltage Reg., 8V. 78L08A	24-378L08

7.4 LOGIC PCB ASSEMBLY (67-115)

Ref. Des.	Description	DP Part No.
C1	Capacitor, 39pF, Cerm, 20%	23-110014
C2	Capacitor, 150pF, Cerm, 20%	23-111011
C3	Capacitor, 6.8 μF, Tant, 25V	23-441005
C4,5	Capacitor, 100pF, 1KV, 10%	23-111072
C6	Capacitor, 680pF, 1KV, 10%	23-110048
C7	Capacitor, 0.01μF, 10%, 200V, Cerm	23-142001
C8,9,10	Capacitor, AIEI, 15μF, 20%, 16V	23-620020
C11	Capacitor, AIEI, 1000μF, 10V	23-610004
CR1 - 6	Diode, Sil, 1N4148	24-110001
R1	Resistor, 2.2M, ¼W, 5%, Carbon	22-022259
R2	Resistor, 2.2K, ¼W, 5%, Carbon	22-022229
R3,5,7,8, 10,11,12	Resistor, 47K, ¼W, 5%, Carbon	22-024739
R4,8	Resistor, 4.7K, ¼W, 5%, Carbon	22-024729
R6	Resistor, 15K, ¼W, 5%, Carbon	22-021539
R9	Resistor, 22, ¼W, 5%, Carbon	22-022209
Y1	Crystal, 4.0MHz, HC-18	25-144001
Z1,2,8	IC, CMOSm Dual D F/F, 74C74	24-G74C74
Z3	IC, CMOS, Dual D F/F, 4013B	24-L04013B
Z4	IC, CMOS, 3-Input NAND, 74C10	24-G74C10
Z5	IC, CMOS, Hex Inverter, 74C04	24-G74C04
Z6	IC, CMOS, Exclusive OR, 4070B	24-L04070
Z7	IC, CMOS, Quad Latch, 4042B	24-L04042
Z9	IC, CMOS, 2-Input NOR, 74C02	24-G74C02
Z10	IC, CMOS, 4-Decade Up Ctr, w/latch	24-L00003
Z11	IC, CMOS, Decade Ctr, 4017B	24-L04017
Z12	IC, CMOS, D F/F, 40175B	24-L40175
Z13	IC, Darlington Driver, ULN2004	24-330002
Z14	IC, CMOS, Decade Ctr, 40162B	24-L40162

*All resistance values in ohms, except where otherwise specified.

7.5 DISPLAY PCB ASSEMBLY (67-1116)

Ref. Des.	Description	DP Part No.
A1	Resistor, Net, 820Ω, 4 Res. Floating	22-751002
A2	Resistor, Net, 150Ω, 7 Res, Floating	22-701008
A3	Resistor, Net, 750Ω, 7 Res, Floating	22-701009
	Display Set	68-1075
DS1-6	MSD (overflow)	25-225307
DS2-6	7-segment Digits	25-225303
Q1	Transistor, NPN GP, MPS6515	24-236515
R1	Resistor, 1K, ¼W, 5%, Carbon	22-021029
R2	Resistor, 4.7K, ¼W, 5%, Carbon	22-024729
R3	Resistor, 27K, ¼W, 5%, Carbon	22-022739
R4	Resistor, 910, ¼W, 5%, Carbon	22-029119
R5,7	Resistor, 200, ¼W, 5%, Carbon	22-022019
R6	Resistor, 180, ¼W, 5%, Carbon	22-021819
Z1	IC, CMOS, BCD-7 Seg Decoder	24-L14547
Z2	IC, CMOS, BCD-7 Seg Decoder	24-L14511

7.6 FRONT BEZEL ASSEMBLY (67-1119)

Ref. Des.	Description	DP Part No.
J1,4	Banana Jack, White	25-700024
J2	Banana Jack, Red	25-700025
J3	Banana Jack, Black	25-700022

7.7 REAR PANEL ASSEMBLY (67-1120)

Ref. Des.	Description	DP Part No.
F1	Fuse, 2A, Fast-Blo	25-500002
F2	Fuse, 1/8 A, Slo-Blo	25-500016
T1	Transformer	
	115V/230V	68-1076
	100V	68-1077

Resistor values in ohms, unless otherwise defined.

7.8 AVERAGE AC/DC ASSEMBLY (67-1113)

Ref. Des.	Description	DP Part No.
C1	Capacitor, 68μF, 25V	23-620024
C2,3	Capacitor, 0.022μF, 10%, 50V	23-140100
C4	Capacitor, 2.2μF, 16V min	23-441010
C5	Capacitor, 100μF, 25V	23-620018
C6	Capacitor, 0.47μF, 35V	23-441051
CR1,2	Diode, Schottky, SD101A	24-110006
R1	Resistor, Trim, MultiTurn, 50Ω	22-681001
R2	Resistor, 2.23K, 0.25%	22-417001
R3,5	Resistor, 4.99K, 0.25%	22-417002
R4,6	Resistor, 200K, ¼W, 5%, Carbon	22-022019
R7,8	Resistor, 2K, 0.25%	22-417000
R9	Resistor, 100K, ¼W, 5%, Carbon	22-021049
Z1	IC, OPAMP, LM318	24-400318

7.9 RMS AC/DC ASSEMBLY (67-1114)

Ref. Des.	Description	DP Part No.
C1	Capacitor, 15μF, 10V, 20%, Tant	23-441003
C2,3	Capacitor, 0.022μF, 10%, 50V	23-140100
C4	Capacitor, Polyc, 2μF, 10%, 50V	23-510002
R1	Resistor, 100K, Side Adj	22-681016
R2	Resistor, 499, RN55C, 1%	22-344990
R3	Resistor, Trimpot, 500, Side Adj	22-681003
R4	Resistor, 1M, RN55D, 1%	22-331004
R5	Resistor, 75K, ¼W, 5%, Carbon	22-027539
Z1	IC, 3737, RMS to DC Converter	24-423737

Resistance in ohms, unless otherwise defined.

NOTES:

Chapter 8

REFERENCE DRAWINGS

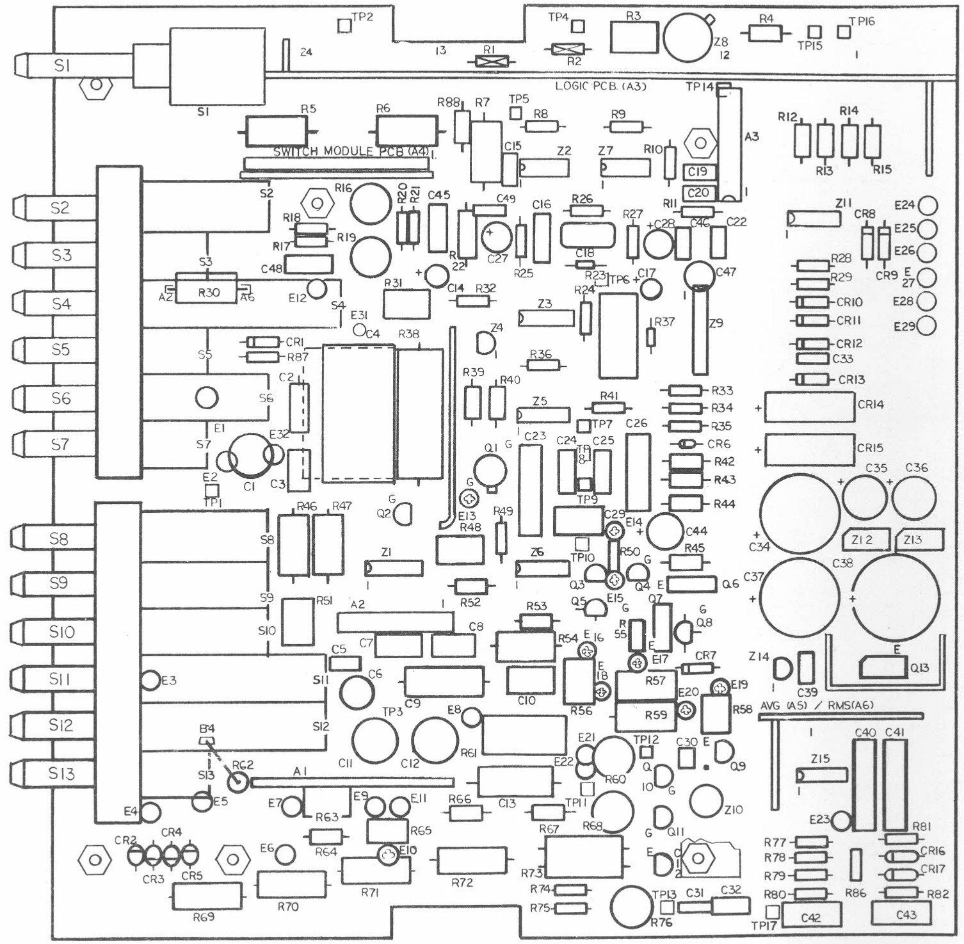
Assembly Drawings:

- Main PCB (A1): 67-1117
- Display PCB (A2): 67-1116
- Logic PCB (A3): 67-1115
- Switch Module (A4): 67-1130
- Front Bezel: 67-1119
- Rear Panel: 67-1120
- ACG AC/DC PCB (A5): 67-1113
- RMS AC/DC PCB (A5): 67-1114

Schematics:

- Main PCB (A1): 65-1040 Sheet 1)
- Logic (A3) and Display (A2): 65-1040 (Sheet 2)
- Switch Module (A4): 65-1039
- AVG AC/DC (A5): 65-1038
- RMS AC/DC (A5): 65-1037

REVISIONS					
REV	ECO	DESCRIPTION	DWN	APPLS	DATE



NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
± ± ±

MATERIAL

FINISH

APPLICABLE SPECIFICATIONS

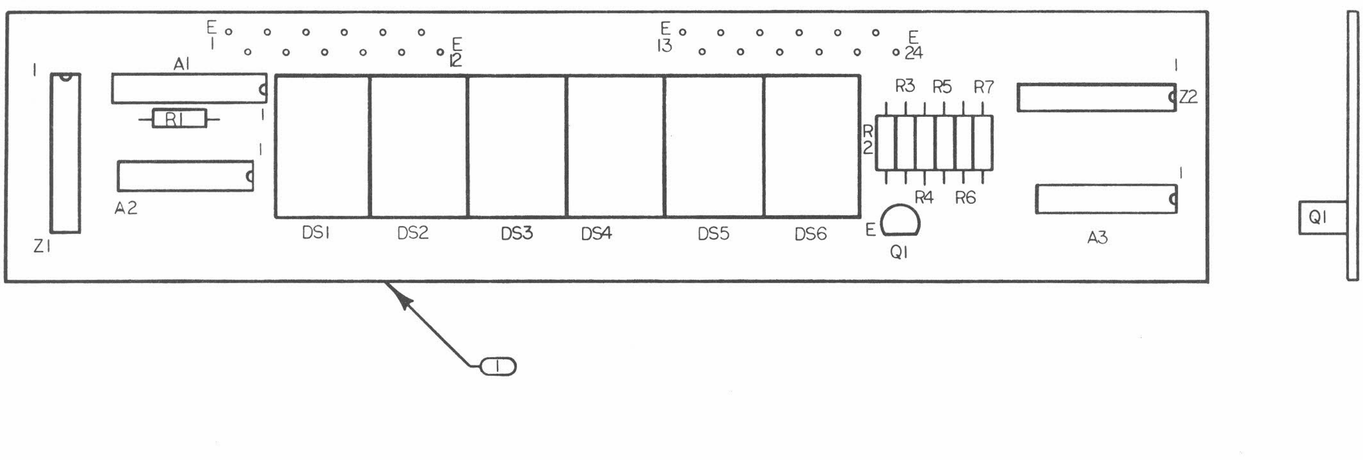
DRAWN KN | DATE
CHECKED
DESIGNER
ENGINEER
APPROVED
RELEASED
WEIGHT

ANALOGIC
DATA PRECISION DANVERS, MASS. 01923

(MANUAL MASTER)

MAIN PCB ASSY
MODEL 2590 (A1)

CODE IDENT NO.	SIZE		REV
51692	D	67-1117-M.M.	
SCALE	ACCOUNT NO.	SHEET	OF



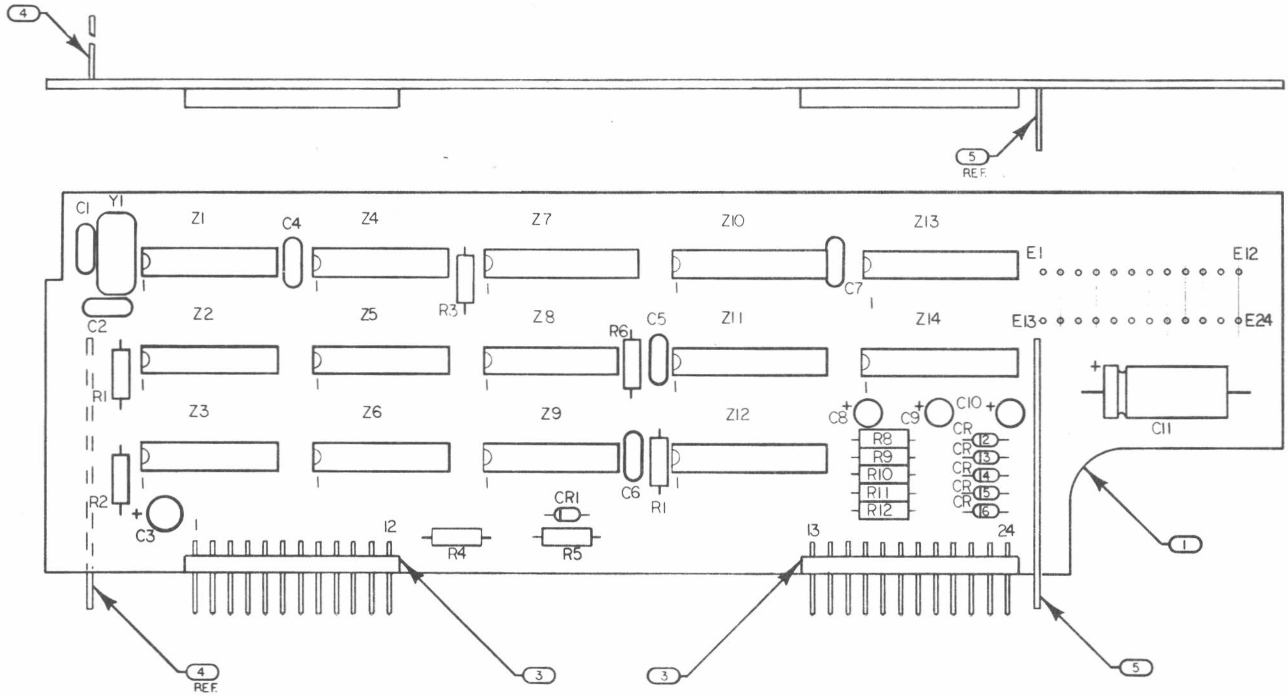
DATA PRECISION

DISPLAY
PCB ASSY
(A2)

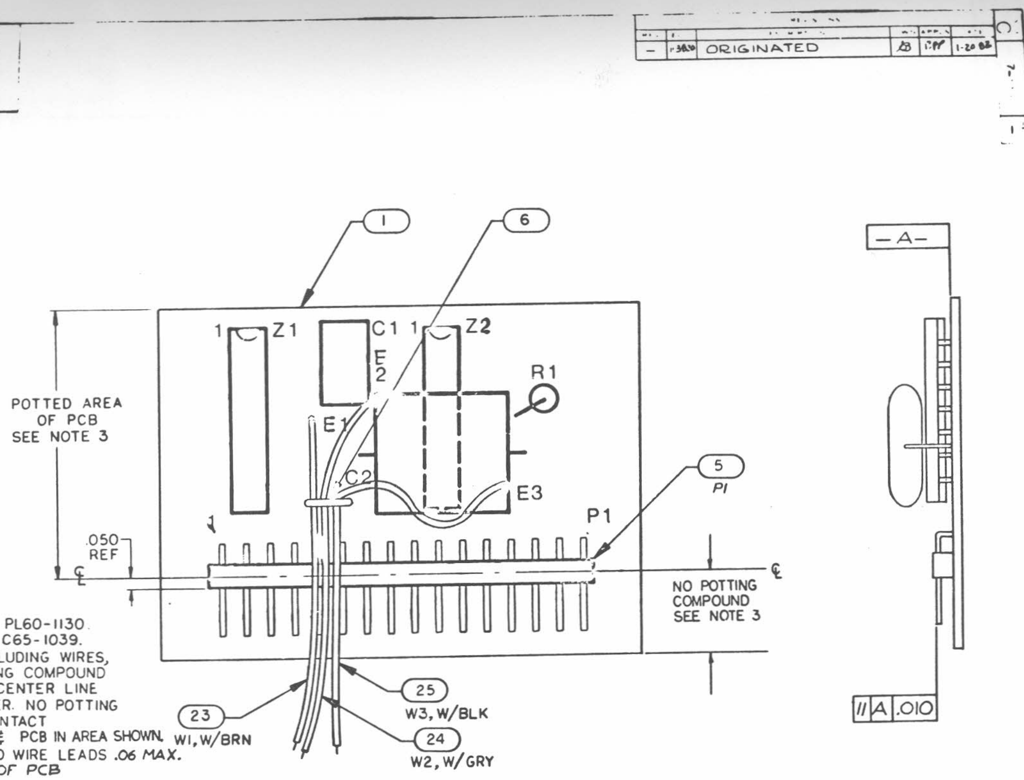
PL60-1121 2590/2590R

D 67-1116

4/1



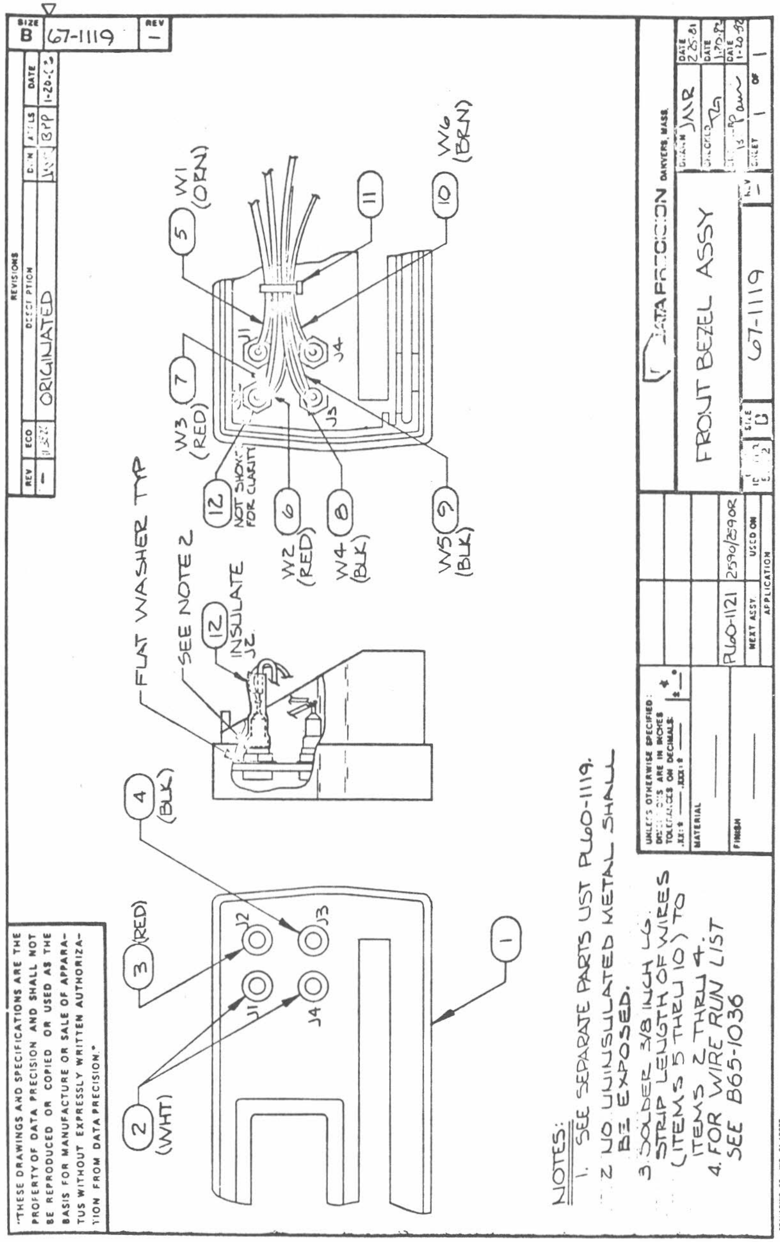
					DATA PRECISION
					LOGIC PCB ASSY (A3)
PL60-1121	2590/2590R				D 67-1115
					4/1



NOTES:

1. FOR PARTS LIST SEE PL60-1130.
2. FOR SCHEMATIC SEE C65-1039.
3. POT ENTIRE PCB INCLUDING WIRES, USING ITEM 7. POTTING COMPOUND SHALL END AT THE CENTER LINE OF THE BLACK HEADER. NO POTTING COMPOUND SHALL CONTACT CONNECTOR(PI)PINS & PCB IN AREA SHOWN.
4. TRIM COMPONENT AND WIRE LEADS .06 MAX. FROM WIRING SIDE OF PCB

					DATA PRECISION
					SWITCH MODULE PCB ASSY (A4)
PL60-1121	2590				
PL60-1121	2590R			51692	C 67-1130
APPLICATION					4/1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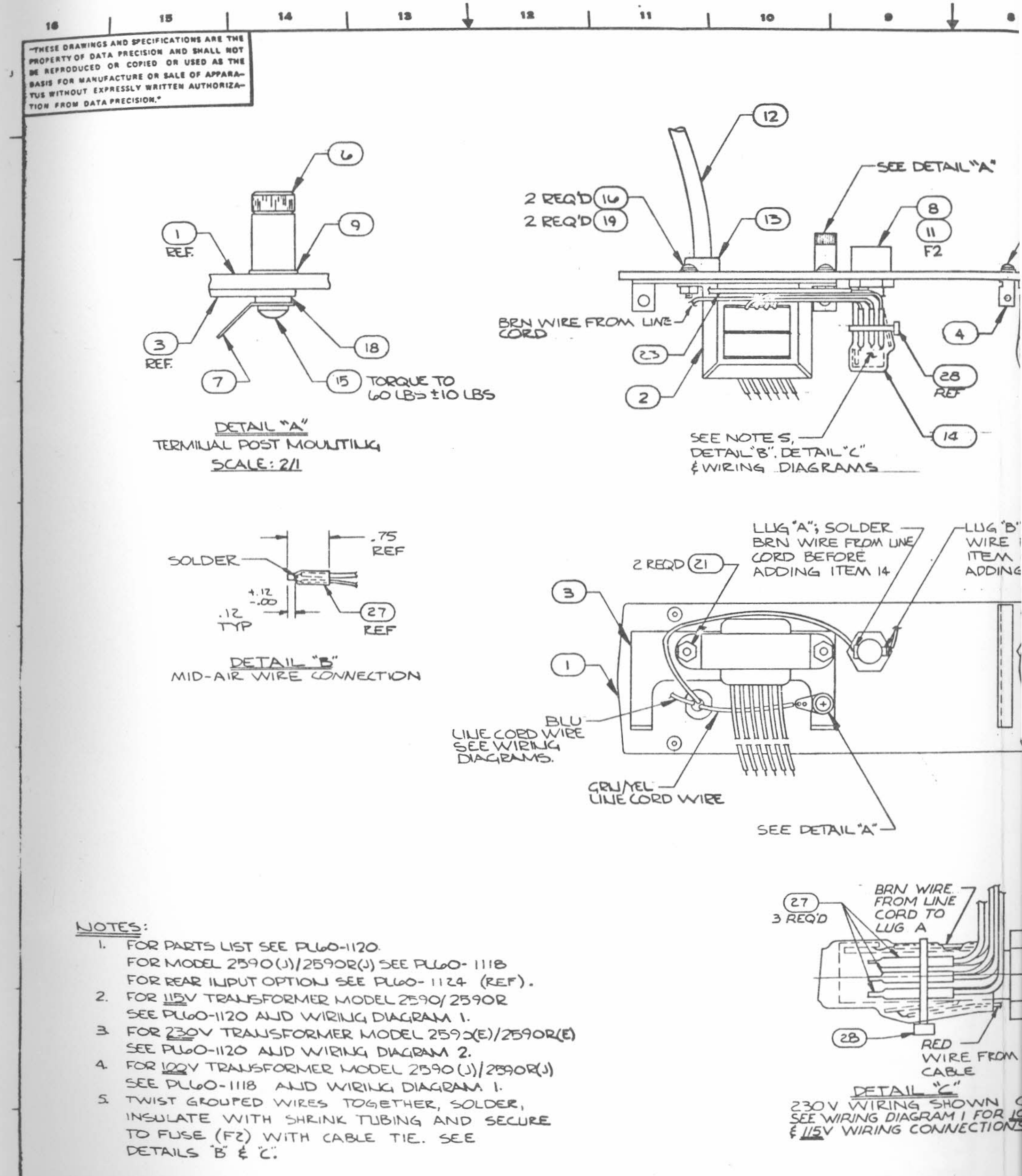
SIZE B 67-1119 REV 1
REVISIONS
REV ECO DESCRIPTION DATE
1 ORIGINATED 1-20-83
FLAT WASHER TYP
SEE NOTE 2
INSULATE J2
W1 (ORN)
W6 (BRN)
W3 (RED)
W2 (RED)
W4 (BLK)
W5 (BLK)
NOT SHOWN FOR CLARITY
(WHT)
(RED)
(BLK)
J1 J2 J3 J4
NOTES:
1. SEE SEPARATE PARTS LIST PL60-1119.
2. NO UNINSULATED METAL SHALL BE EXPOSED.
3. SOLDER 3/8 INCH LG. STRIP LENGTH OF WIRES (ITEMS 5 THRU 10) TO ITEMS 2 THRU 4.
4. FOR WIRE RUN LIST SEE B65-1036
DATA PRECISION DANVERS, MASS.
FRONT BEZEL ASSY
67-1119
PL60-1121 2590/2590R
NEXT ASSY USED ON
APPLICATION
MATERIAL
FINISH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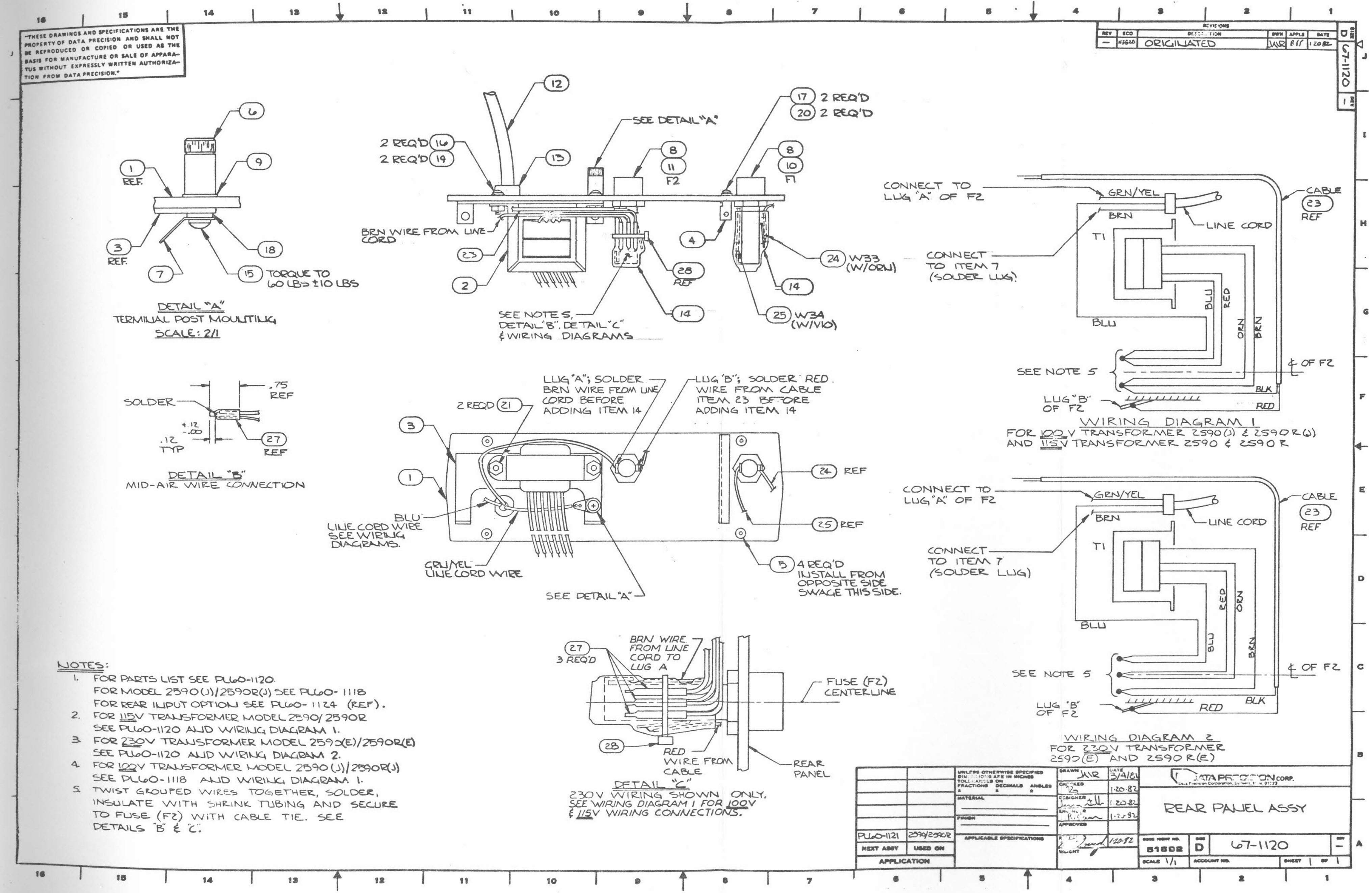
16 15 14 13 12 11 10 9 8
REF.
TORQUE TO 60 LBS ±10 LBS
DETAIL "A"
TERMINAL POST MOUNTING
SCALE: 2/1
2 REQ'D 16
2 REQ'D 19
SEE DETAIL "A"
F2
BRN WIRE FROM LINE CORD
SEE NOTE 5, DETAIL "B", DETAIL "C" & WIRING DIAGRAMS
SOLDER
.75 REF
+.12 -.00
.12 TYP
DETAIL "B"
MID-AIR WIRE CONNECTION
2 REQD 21
LUG "A"; SOLDER BRN WIRE FROM LINE CORD BEFORE ADDING ITEM 14
LUG "B" WIRE ITEM ADDING
BLU LINE CORD WIRE SEE WIRING DIAGRAMS.
GRN/YEL LINE CORD WIRE
SEE DETAIL "A"
3 REQ'D
BRN WIRE FROM LINE CORD TO LUG A
RED WIRE FROM CABLE
DETAIL "C"
230V WIRING SHOWN
SEE WIRING DIAGRAM I FOR
& 115V WIRING CONNECTIONS
NOTES:
1. FOR PARTS LIST SEE PL60-1120.
FOR MODEL 2590(J)/2590R(J) SEE PL60-1118
FOR REAR INPUT OPTION SEE PL60-1124 (REF).
2. FOR 115V TRANSFORMER MODEL 2590/2590R
SEE PL60-1120 AND WIRING DIAGRAM 1.
3. FOR 230V TRANSFORMER MODEL 2590(E)/2590R(E)
SEE PL60-1120 AND WIRING DIAGRAM 2.
4. FOR 100V TRANSFORMER MODEL 2590(J)/2590R(J)
SEE PL60-1118 AND WIRING DIAGRAM 1.
5. TWIST GROUPED WIRES TOGETHER, SOLDER, INSULATE WITH SHRINK TUBING AND SECURE TO FUSE (F2) WITH CABLE TIE. SEE DETAILS "B" & "C".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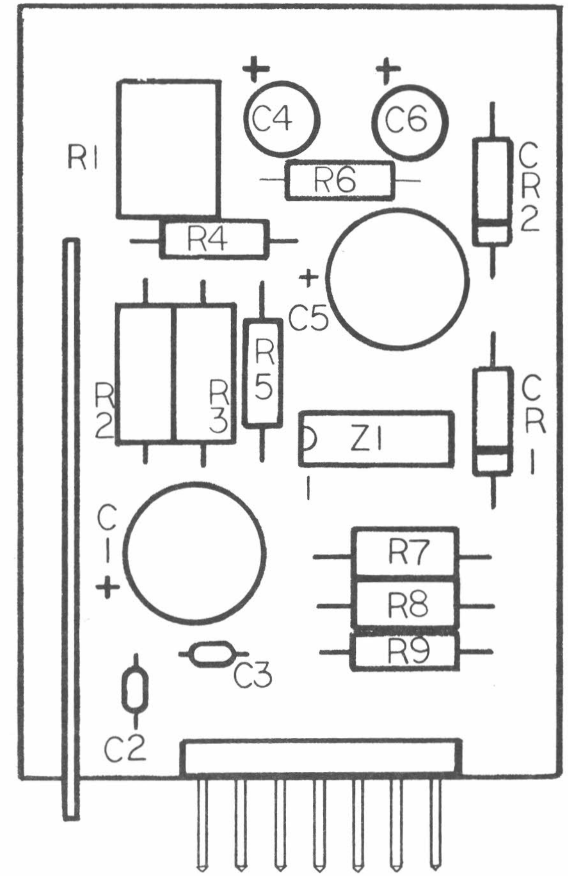
REVISIONS
REV | ECO | DESCRIPTION | DWN | APPLS | DATE
— | 113620 | ORIGINATED | JWR | BH | 1-20-82
67-1120
DETAIL "A"
TERMINAL POST MOUNTING
SCALE: 2/1
REF.
TORQUE TO 60 LBS ±10 LBS
2 REQ'D 16
2 REQ'D 19
SEE DETAIL "A"
17 2 REQ'D
20 2 REQ'D
F2
F1
BRN WIRE FROM LINE CORD
W33 (W/ORN)
W34 (W/VIO)
SEE NOTE 5, DETAIL "B", DETAIL "C" & WIRING DIAGRAMS
SOLDER
.75 REF
+.12 -.00
.12 TYP
REF
DETAIL "B"
MID-AIR WIRE CONNECTION
2 REQ'D 21
LUG "A"; SOLDER BRN WIRE FROM LINE CORD BEFORE ADDING ITEM 14
LUG "B"; SOLDER RED WIRE FROM CABLE ITEM 23 BEFORE ADDING ITEM 14
BLU LINE CORD WIRE SEE WIRING DIAGRAMS.
GRN/YEL LINE CORD WIRE
SEE DETAIL "A"
24 REF
25 REF
5 4 REQ'D INSTALL FROM OPPOSITE SIDE SWAGE THIS SIDE.
CONNECT TO LUG "A" OF F2
GRN/YEL
BRN
LINE CORD
CABLE 23 REF
T1
CONNECT TO ITEM 7 (SOLDER LUG)
BLU
RED
ORN
BRN
SEE NOTE 5
℄ OF F2
BLK
LUG "B" OF F2
RED
WIRING DIAGRAM 1
FOR 100V TRANSFORMER 2590(J) & 2590R(J) AND 115V TRANSFORMER 2590 & 2590R
WIRING DIAGRAM 2
FOR 230V TRANSFORMER 2590(E) AND 2590R(E)
27 3 REQ'D
BRN WIRE FROM LINE CORD TO LUG A
FUSE (F2) CENTERLINE
28
RED WIRE FROM CABLE
REAR PANEL
DETAIL "C"
230V WIRING SHOWN ONLY. SEE WIRING DIAGRAM 1 FOR 100V & 115V WIRING CONNECTIONS.
NOTES:
1. FOR PARTS LIST SEE PL60-1120. FOR MODEL 2590(J)/2590R(J) SEE PL60-1118 FOR REAR INPUT OPTION SEE PL60-1124 (REF).
2. FOR 115V TRANSFORMER MODEL 2590/2590R SEE PL60-1120 AND WIRING DIAGRAM 1.
3. FOR 230V TRANSFORMER MODEL 2590(E)/2590R(E) SEE PL60-1120 AND WIRING DIAGRAM 2.
4. FOR 100V TRANSFORMER MODEL 2590(J)/2590R(J) SEE PL60-1118 AND WIRING DIAGRAM 1.
5. TWIST GROUPED WIRES TOGETHER, SOLDER, INSULATE WITH SHRINK TUBING AND SECURE TO FUSE (F2) WITH CABLE TIE. SEE DETAILS "B" & "C".
PL60-1121 | 2590/2590R
NEXT ASSY | USED ON
APPLICATION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
MATERIAL
FINISH
APPLICABLE SPECIFICATIONS
DRAWN JWR 3/4/81
CHECKED 1-20-82
DESIGNER 1-20-82
ENGINEER 1-20-82
APPROVED 1-20-82
DATA PRECISION CORP.
REAR PANEL ASSY
CODE IDENT NO. 51602
SIZE D
67-1120
REV —
SCALE 1/1
ACCOUNT NO.
SHEET OF

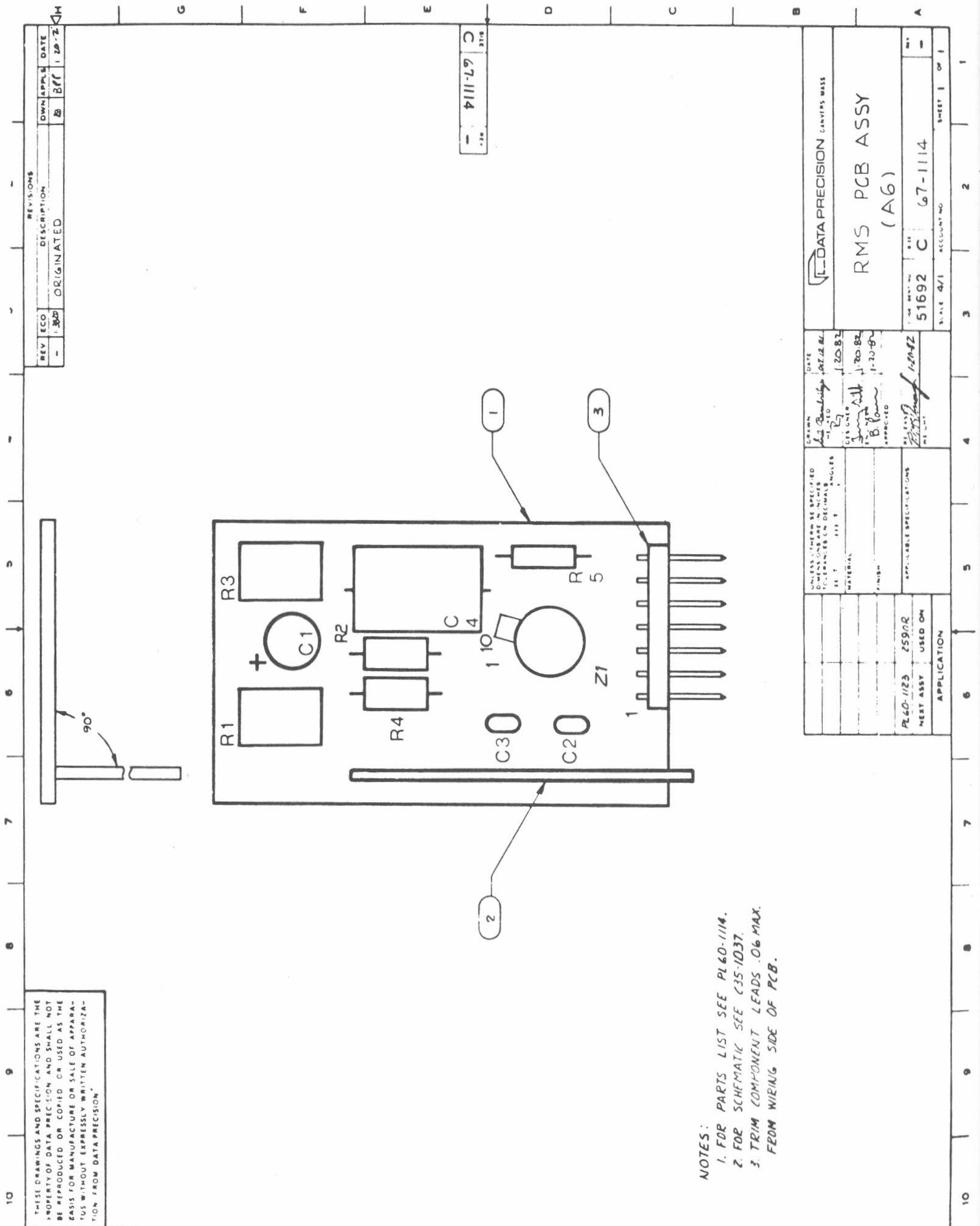


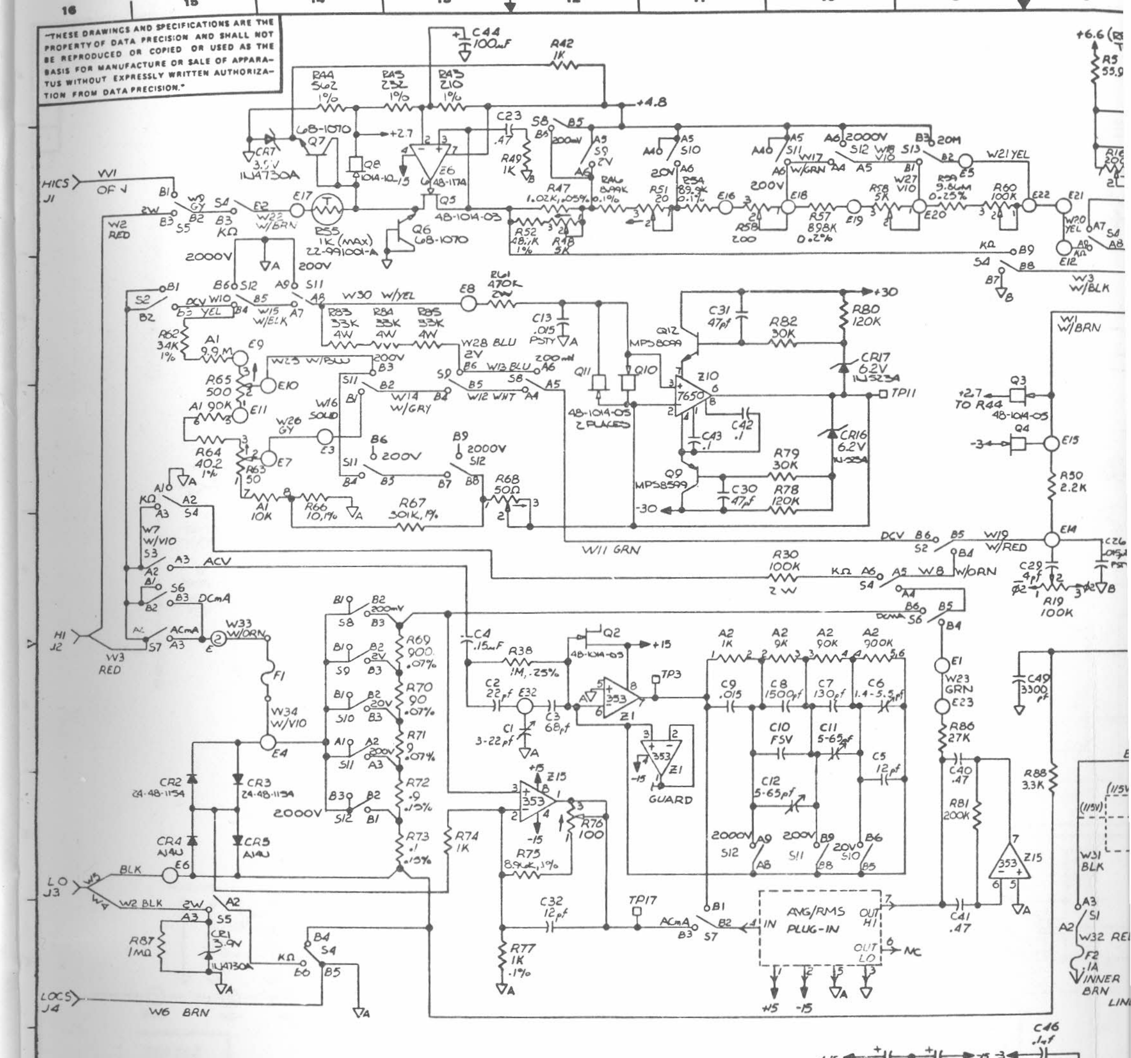
DATA PRECISION

AVG PCB ASSY

(A5)

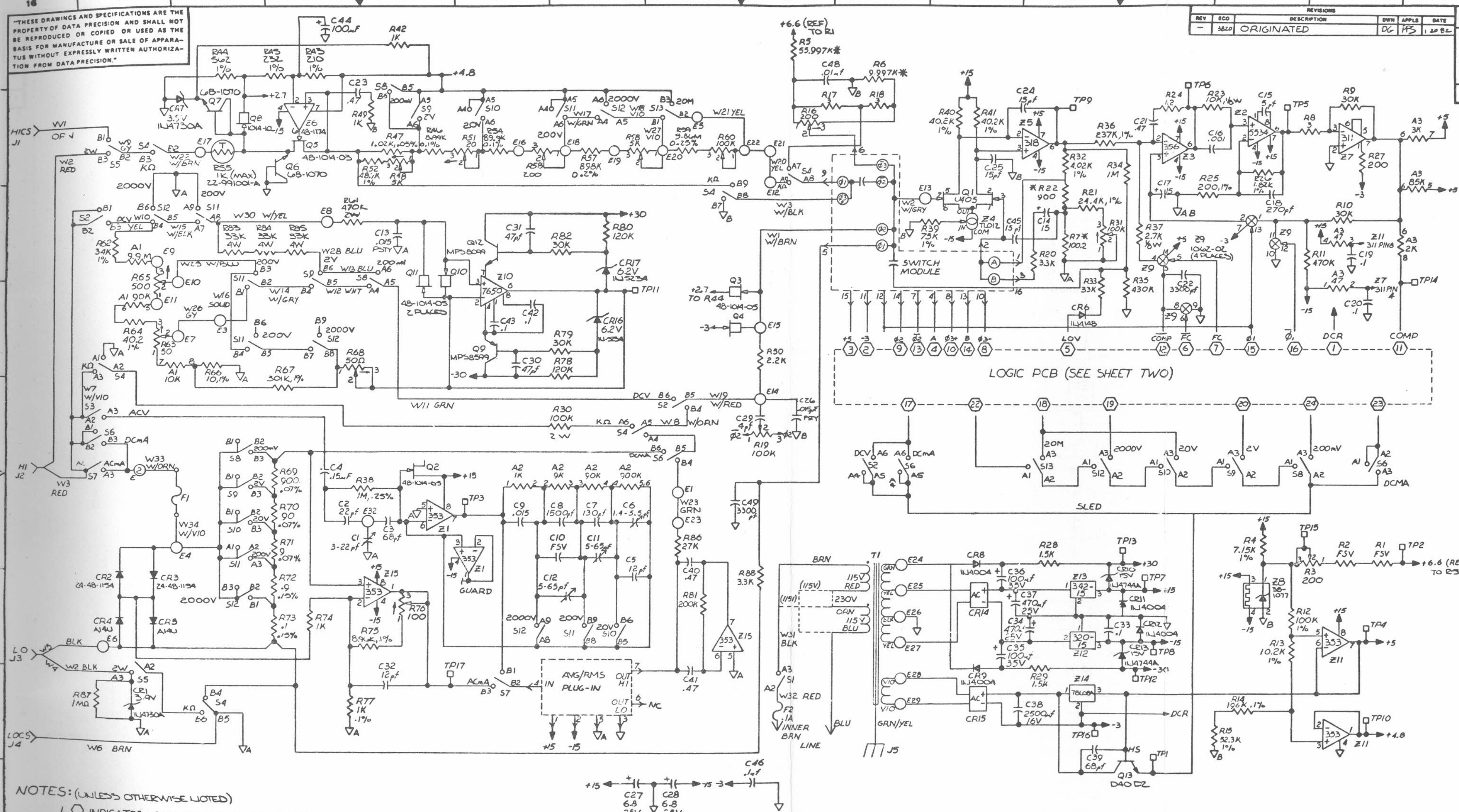
	D	67-1113
4/1		





NOTES: (UNLESS OTHERWISE NOTED)

1. ◯ INDICATES CONNECTION TO LOGIC BD.
2. SEE SHEET TWO FOR DISPLAY & LOGIC BD. SCHEMATIC.
3. ✱ INDICATES A MATCHED SET. (R5 & 6 , R7 & 22)
4. ALL RESISTORS ARE 1/4W, 5%, CARBON. VALUES IN OHMS.



NOTES: (UNLESS OTHERWISE NOTED)

1. ⬡ INDICATES CONNECTION TO LOGIC BD.
2. SEE SHEET TWO FOR DISPLAY & LOGIC BD. SCHEMATIC.
3. * INDICATES A MATCHED SET. (R5 & 6, R7 & 22)
4. ALL RESISTORS ARE 1/4W, 5%, CARBON. VALUES IN OHMS.

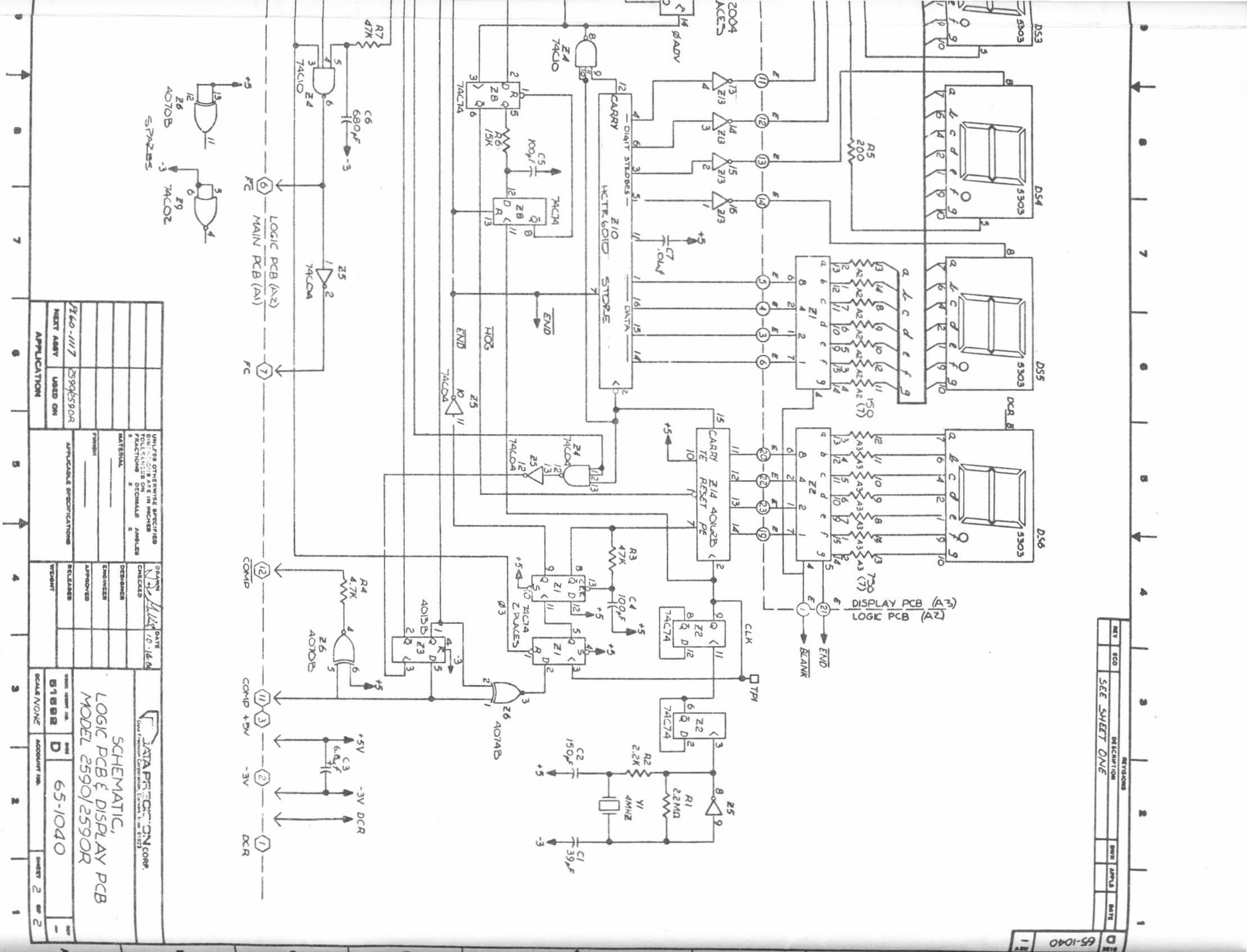
PL60-1117	2590/2590R
NEXT ASSY	USED ON
APPLICATION	

DATA PRECISION CORP.

SCHEMATIC
MAIN PCB (A1)
MODEL 2590/2590R

CODE IDENT NO.	SIZE	DWG NO.	REV
51692	D	65-1040	—

SCALE NONE — SHEET 1 OF 2



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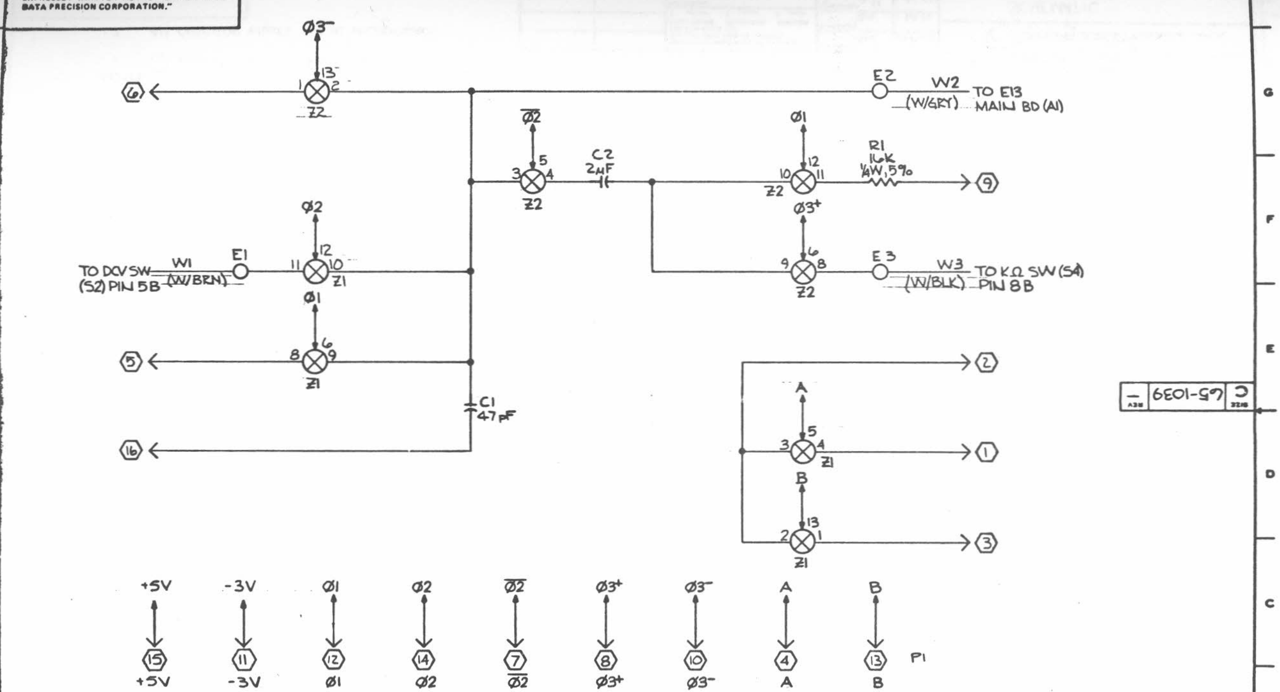
—	ORIGINATED	JMR



NOTES:

1. ⬡ INDICATES CONNECTION TO MAIN BD (A1).
2. ADDITIONAL CONNECTIONS:
   - -3: PIN 7 OF Z1 & Z2.
   - +5: PIN 14 OF Z1 & Z2.

REQD	ITEM	PART NO.	CIRCUIT SYM	DESCRIPTION	MATL SPEC

LIST OF MATERIAL

NEXT ASSY	USED ON
PL60-1130	2590/2590R

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS DECIMALS ANGLES

MATERIAL

FINISH

APPLICABLE SPECIFICATIONS

		DATE
DRAWN	JMR	1-23-81
CHECKED		1-20-82
DESIGNER		1-20-82
ENGINEER		1/20/82
APPROVED		
RELEASED		1-20-82
WEIGHT		

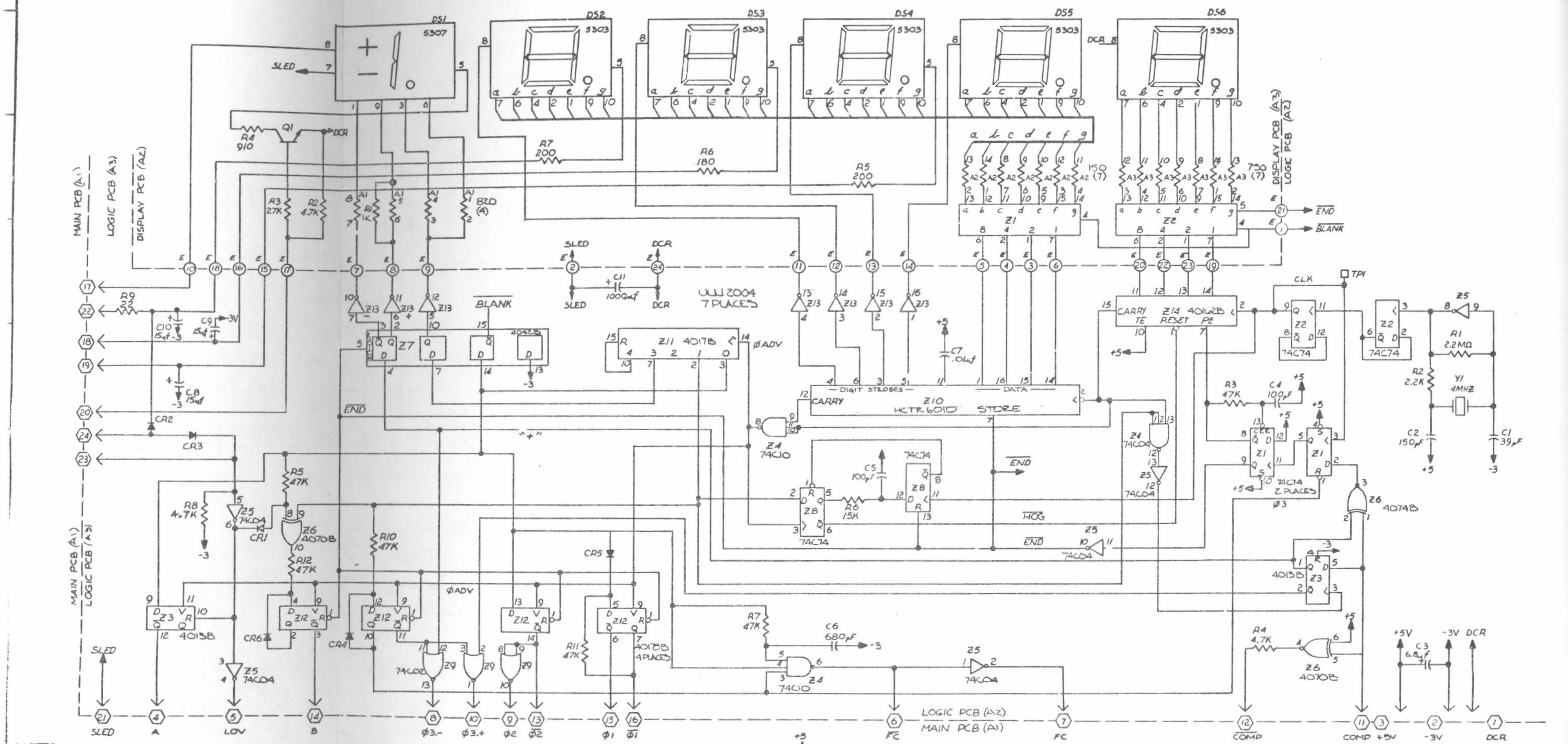
DATA PRECISION

SCHEMATIC SWITCH MODULE MODEL 2590

SIZE C 65-1039 REV —

SCALE NONE SHEET 1 OF 1

REVISIONS					
REV	ECO	DESCRIPTION	DWN	APPLS	DATE
		SEE SHEET ONE			



NOTES

1. ALL DIODES ARE 1N4148.
2. ALL RESISTORS ARE 1/4W, 5%, CARBON; VALUES IN OHMS.
3. ⬡ INDICATES CONNECTION TO MAIN PCB.
4. ◯ INDICATES CONNECTION TO DISPLAY PCB.
5. ADDITIONAL +5V CONNECTIONS:
   PIN 14 OF: Z1, Z2, Z3, Z4, Z5, Z6, Z8, Z9;
   PIN 16 OF: Z7, Z11, Z12, Z14;
   PINS 1, 4, 10 & 13 OF Z2;
   PINS 4 & 10 OF Z2.
6. ADDITIONAL -3V CONNECTIONS:
   PIN 7 OF: Z1, Z2, Z3, Z4, Z5, Z6, Z8, Z9;
   PIN 8 OF: Z3, Z7, Z11, Z12, Z14;
   PIN 6 OF Z3 & Z7;
   PINS 9 & 10 OF Z10;
   PIN 13 OF Z1;
   PINS 3, 4, 5 & 6 OF Z14.
7. ADDITIONAL DCR CONNECTION:
   PIN 8 OF Z13.

NEXT ASSY	USED ON
P260-1117	2590/2590R
APPLICATION	

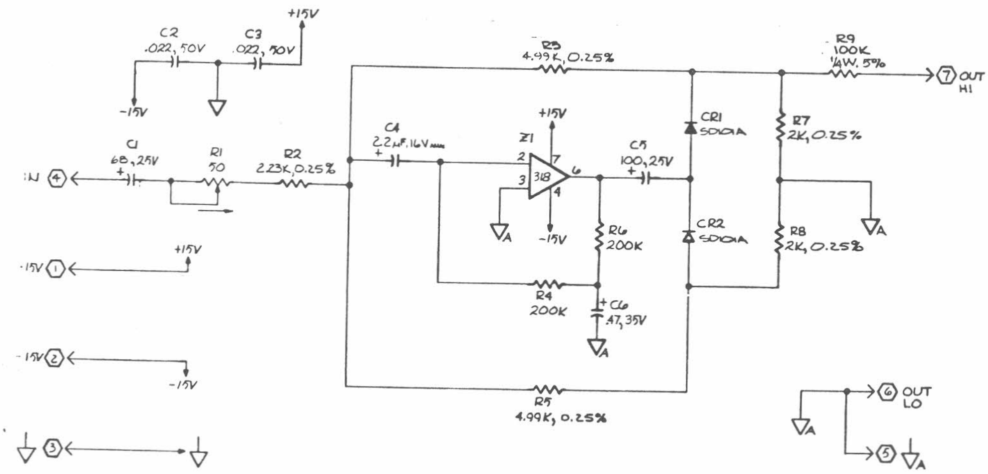
DATA PRECISION CORP.

SCHEMATIC, LOGIC PCB & DISPLAY PCB MODEL 2590/2590R

SIZE D 65-1040

SCALE NONE SHEET 2 OF 2

REV	ECO	DESCRIPTION	DWN	APPLS	DATE
—	3520	ORIGINATED	JMR	HS	1-20-82



NOTES:
1. ⬡ INDICATES CONNECTION TO MOTHER PCB
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

REQD	ITEM	PART NO	CIRCUIT SYM	DESCRIPTION	MATL SPEC

LIST OF MATERIAL

NEXT ASSY	USED ON
PL60-1113	2590

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS ~ DECIMALS ~ ANGLES ~
MATERIAL ~
FINISH ~
APPLICABLE SPECIFICATIONS

DRAWN JMR 10-15-80
CHECKED 1-20-82
DESIGNER 1-20-82
ENGR 1/20/82
APPROVED
RELEASED 1-20-82
WEIGHT

DATA PRECISION ELECTRONICS INC.

SCHEMATIC
AVERAGING PCB
MODEL 2590

CODE IDENT NO | SIZE C | 65-1038 | REV —
SCALE NONE | ACCOUNT NO | SHEET 1 OF 1

C | 65-1038 | —

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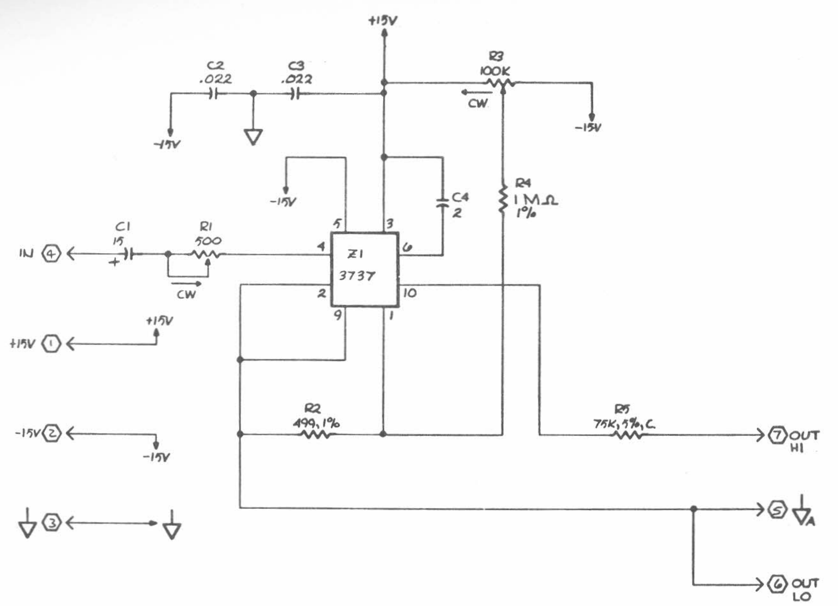
REVISIONS

REV	ECO	DESCRIPTION	DWN	APPLS	DATE
—	3520	ORIGINATED	JMR	HS	1-20-82



NOTES:
1. ⬡ INDICATES CONNECTION TO MOTHER PCB
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

REQD	ITEM	PART NO	CIRCUIT SYM	DESCRIPTION	MATL SPEC

LIST OF MATERIAL

NEXT ASSY	USED ON
PL60-1114	2590

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS ~ DECIMALS ~ ANGLES ~
MATERIAL ~
FINISH ~
APPLICABLE SPECIFICATIONS

DRAWN JMR 10-15-80
CHECKED 1-20-82
DESIGNER 1-20-82
ENGR 1/20/82
APPROVED
RELEASED 1-20-82
WEIGHT

DATA PRECISION ELECTRONICS INC.

SCHEMATIC
RMS PCB
MODEL 2590 (A6)

CODE IDENT NO | SIZE C | 65-1037 | REV —
SCALE NONE | ACCOUNT NO | SHEET 1 OF 1

C | 65-1037 | —