DANA

Instruction Manual

980440

MODELS 5330/5370 DIGITAL MULTIMETERS

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INSTRUCTION MANUAL

MODEL 5330/5370

DIGITAL MULTIMETER

This manual is to be used in conjunction with either the 600 or 700/703 Signal Conditioning Module manual.

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Warranty

Within one year of purchase, Dana Laboratories will repair or replace your instrument, at our option, if in any way it is defective in material or workmanship. All parts and labor charges will be paid by Dana Laboratories. Just call Dana Product Service at our toll free number (800)854-3288, or (714)833-1234 collect in California, for assistance. We will advise the proper shipping address for your prepaid shipment. Your instrument will be returned to you freight prepaid.

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INTRODUCTION

1.1 SCOPE.

1.2 This manual describes Models 5330 and 5370 Digital Multimeters. Descriptions are limited to the mainframe assembly which includes the Digital and Display Module, Power Supply, and BCD Output Module. The Signal Conditioning section of each instrument is covered in a separate manual: Model 600 or Model 700/703 Signal Conditioning Modules manuals.

1.3 MECHANICAL DESCRIPTION.

1.4 Models 5330 and 5370 differ only in their mechanical packaging. Model 5330 is a thin-line instrument (3-1/2 inches high) designed for standard rack mounting while Model 5370 is primarily a bench type instrument. Descriptions in this manual apply to both models unless otherwise indicated.

Figure 1.1 - Model 5370/600 Digital Multimeter

1.5 The Digital and Display Module, comprising the left-hand portion of Model 5330 and the upper half of Model 5370 contains the actual measurement circuits of the DMM.

1.6 The Power Supply Module, located at the rear of the instrument, provides all the DC voltages needed by the machine and serves as an interconnection board for all other modules. The BCD Output Module (optional) plugs into the rear of the instrument and provides 1-2-4-8 coded BCD for use in data systems.

1.7 The output is displayed on a five-digit visual display with a sixth overrange digit that extends full-scale of each range by 20% (99999 to 119999). Automatic ranging is performed by internal circuits which determine the optimum range and switch to that range automatically.

1.8 ELECTRICAL DESCRIPTION.

1.9 The Digital and Display Module (figure 1.2) measures the analog voltage from the Signal Conditioning Module by the high-accuracy dual-slope integration technique. The amplitude of the signal is measured by comparing it to a highly stable internal reference voltage. The DMM readout displays the contents of a counter which measures the time required for the integrator voltage to change from the level of the input signal to zero. The value displayed is equal to the voltage level of the input. A new reading is taken every 300 milliseconds with the OFF-ON-HOLD switch in the ON position. The HOLD position permits the instrument to remain at the last reading indefinitely. Reading accuracy of the DMM is maintained through the use of a highly stable, zener-regulated, internal reference voltage.

1.10 SPECIFICATIONS.

1.11 Specifications are listed in table 1.1.

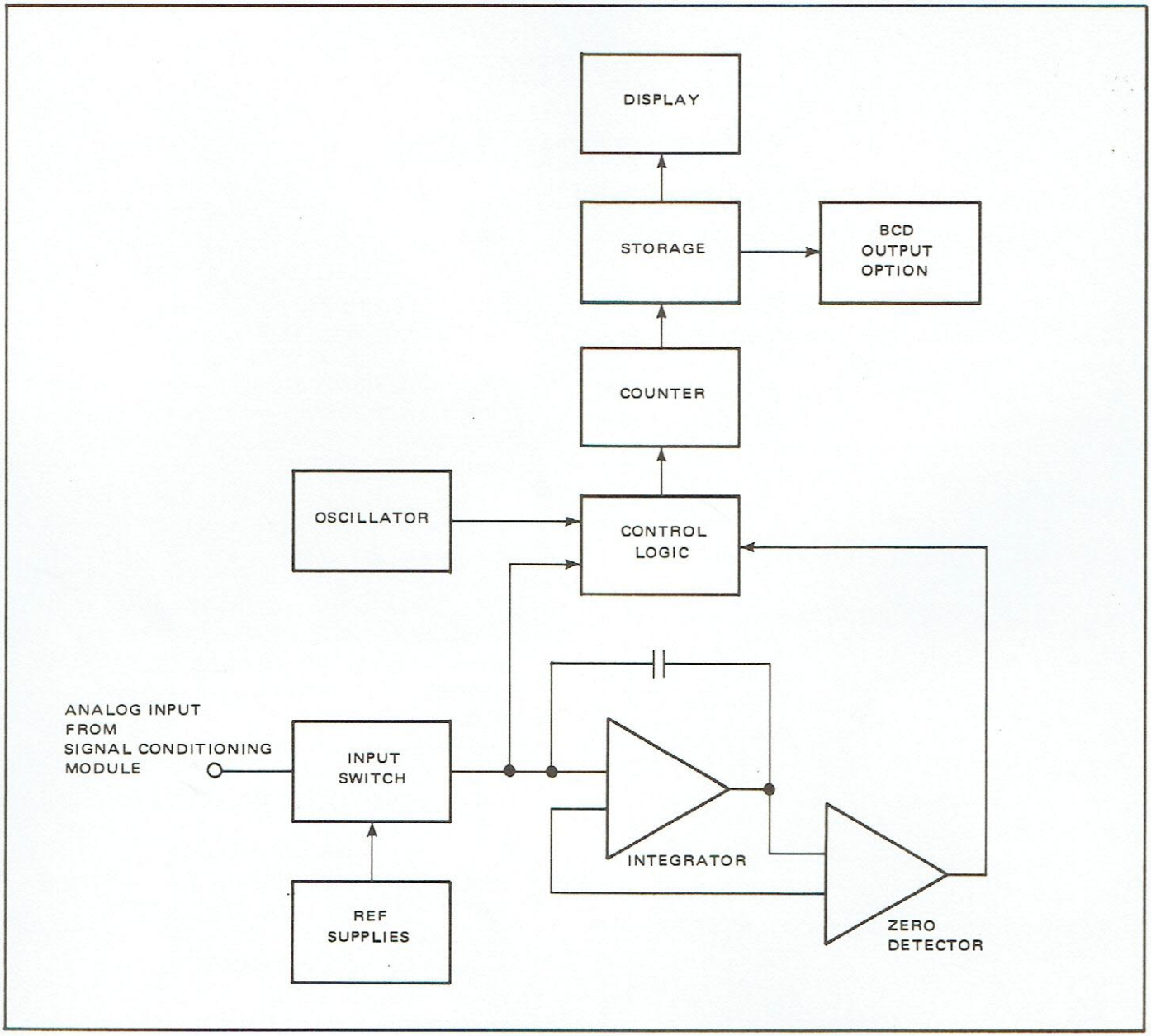


Figure 1.2 - Block Diagram

Table 1.1 - Specifications

(Specifications for individual functions vary with the Signal Conditioning module. See the appropriate Signal Conditioning manual for specifications.)

Ranging:	Automatic or manual
Digitizing Technique:	Dual Slope Integrator
Integration Time:	100 ms
Digitizing Time:	220 ms max.
Maximum Common Mode Voltage:	250 volts
Maximum Power Requirements:	25 watts, 105 to 125 volts, 50 to 400 Hz
Operating Temperature:	0 to 50°C
Warm Up:	1/2 hour
Dimensions:	
Model 5330	17 x 3-1/2 x 14 inches
Model 5370	8-1/2 x 7 x 14 inches
Weight: (Approx)	15 pounds net, 20 pounds shipping
Guarantee:	12 months, faulty workmanship or component failure

SECTION 2

INSTALLATION

2.1 UNPACKING AND INSPECTION.

2.2 The DMM is sandwiched between two forms of plastic foam and packed in a double-walled cardboard carton for shipment. The plastic forms hold the DMM securely in the carton and absorbs any reasonable external shock normally encountered in transit. Prior to unpacking, examine the exterior of the shipping carton for any signs of damage. Carefully remove the DMM from the carton and inspect the exterior of the instrument for any signs of damage. If damage is found, notify the carrier immediately.

2.3 The shipping carton and its internal support structure have been scientifically designed for maximum protection of the instrument. Dana recommends saving the carton and contents for use in future reshipping of the instrument. Alternate packing methods, such as plastic foam blocks and loose packing material, may prove to be insufficient for maximum protection and result in damage during shipment. If reshipping is required and the original carton is not available, special packing instructions can be obtained from Dana Labs' Product Service Department.

2.4 The instrument, as shipped, is designed for bench-top operation. A standup bracket is provided under the case to aid in reading the visual display. The Model 5330 instrument can be adapted for rack installation with two flange mounting holes located in each of the two side panels. The rack-mounting kit (Dana 402588) is attached to the instrument by removing and discarding the four set screws occupying the mounting screw holes and securing the two rack-mounting flanges to the side panels of the instrument with the four screws contained in the rack-mounting kit.

2.5 The Model 5370 can be ordered from the factory as a half-rack instrument or the standard instrument can be returned to the factory for modification to accommodate the half-rack mounting hardware.

2.6 POWER CONNECTIONS.

2.7 A standard eight-foot, three-wire, power cable is supplied with the instrument. This cord connects to a three-pin power connector at the rear of the unit.

NOTES

1. If the DMM has been stored for a prolonged period (5 or 6 months), without use, it is recommended that it be operated with a variable transformer, such as a Variac, at one-half line voltage for about two hours before gradually applying full power. This is done to "reform" the electrolytic capacitors in the amplifier and reduce the chance of capacitor failure.

2. To clean the glass on the readout panel, use a commercial glass cleaner such as Windex. Do not use alcohol or other cleaners containing ketones.

2.8 OPERATION.

2.9 For proper measurement connections and procedures, refer to the appropriate Signal Conditioning manual (600 or 700/703).

SECTION 3

BCD OUTPUT MODULE

3.1 MODEL 74 (Non-Isolated).

3.2 The BCD Output Module is an optional feature which plugs into the rear of the instrument. It allows the instrument to be used as part of a larger digital system. The module provides BCD outputs of function, range, and the state of the readout. In addition, a print command output is provided for use with digital printers and the module accepts a "read" command to begin a new reading. All outputs appear at the BCD Output connector J20 on the rear of the DMM. Outputs are referenced to common, pin 24. Pin assignments of J20 are listed in table 3.1.

3.3 LOGIC LEVEL OF BCD OUTPUT.

3.4 The voltage level of the positive true output is +3.6 volts delivered through a 640Ω resistor. The false level is near zero volts (figure 3.1).

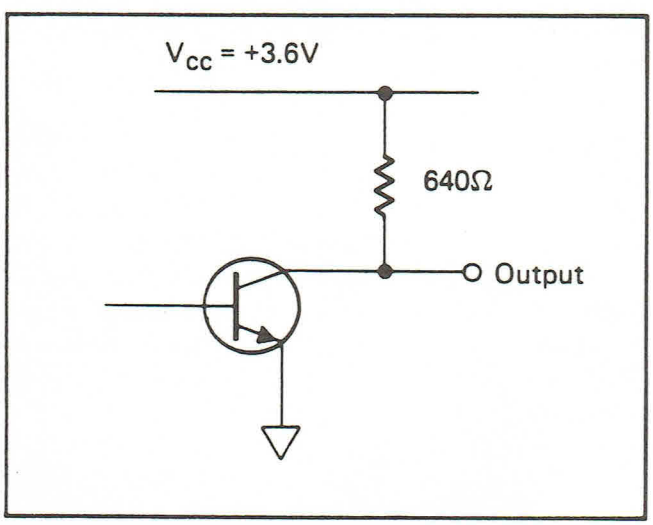


Figure 3.1 - Typical Output Circuit

Table 3.1 - J20 Pin Assignments

IDENTIFICATION		PINS J20		IDENTIFICATION	
RANGE	R1	1	26	R4	RANGE
RANGE	R2	2	27	R3	RANGE
FUNCTION	F2	3	28	F4	FUNCTION
FUNCTION	F1	4	29	F3	FUNCTION
UNITS	1	5	30	4	UNITS
UNITS	2	6	31	8	UNITS
10's	1	7	32	4	10's
10's	2	8	33	8	10's
100's	1	9	34	4	100's
100's	2	10	35	8	100's
1000's	1	11	36	4	1000's
1000's	2	12	37	8	1000's
10,000's	1	13	38	4	10,000's
10,000's	2	14	39	8	10,000's
100,000's	1	15	40		
		16	41		
		17	42		
		18	43		
		19	44		
		20	45		
		21	46	$\overline{\text{READ}}$ $\overline{\text{COMMAND}}$ $\overline{\text{INPUT}}$	
		22	47		
		23	48	$\overline{\text{PRINT}}$ $\overline{\text{COMMAND}}$	
LOGIC COMMON		24	49		
+ LOGIC REFERENCE		25	50	LOGIC COMMON	

3.5 DATA OUTPUT.

3.6 Data output lines are on pins 5 through 14 and pins 30 through 39. They are identified in table 3.1 by decade and binary weight. Table 3.2 lists sample data values and their BCD coding.

Table 3.2 - Sample Data Values

	100K	10,000				1000				100				10				UNITS			
J20 Pin → No's	15	13	14	38	39	11	12	36	37	9	10	34	35	7	8	32	33	5	6	30	31
000001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
000007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
000014	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
000101	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
001246	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0
120000	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Code	1	1	2	4	8	1	2	4	8	1	2	4	8	1	2	4	8	1	2	4	8

0 = FALSE
1 = TRUE

3.7 RANGE AND FUNCTION.

3.8 Range and function codes are identified in table 3.3. The instrument is equipped with six operating ranges: .1 through 10,000 (although not all ranges are used with all functions).

3.9 EXTERNAL READ COMMAND.

3.10 When the instrument is operated in the External Read Command mode, the OFF-ON-HOLD switch on the front of the instrument must be in the "HOLD" position. If this is not done, the instrument will continue taking readings automatically every 300 milliseconds.

3.11 On the BCD Module schematic, figure 3.2, resistors R3 and R4 bias the read command line at 2 volts. Thus the line is normally always in a "true" state. A one-millisecond delay is caused by the charging time required for capacitor C3. A one-millisecond one-shot is comprised of resistor R1, capacitor C1, diode CR1, and 1/2 of M4. The command flip-flop is comprised of one-half of M2 (A and B). Resistor R3 and zener diode CR3 protect the input of inverter M4-C from overload damage if an excessive voltage is applied to the Read Command input.

3.12 To externally command a reading, the Read Command Input is grounded, setting the Read Command line false. This causes the output of M4-C to go true which appears as a true input to OR M4-B after a one millisecond delay (to prevent false triggering due to noise or "bouncing" switch contacts). A one millisecond pulse is generated. This pulse sets the command line true, causing the instrument to take a reading.

3.13 If, during the process of taking a reading, a range change is involved, the timeout line will be set true, the command flip-flop is not reset, and the instrument continues taking readings until the correct range is found.

Table 3.3 - Range and Function Codes

J20 Pin No's.	1 R1	2 R2	26 R4	27* R3	4 F1	3 F2	29 F3	28* F4
RANGE 0.1	1	1	1	0				
RANGE 1	1	0	1	0				
RANGE 10	0	0	1	0				
RANGE 100	1	1	0	0				
RANGE 1000	0	1	0	0				
RANGE 10,000	1	0	0	0				
FUNCTION OHMS					0	0	0	0
FUNCTION AC					1	0	0	0
FUNCTION - DC					1	1	1	0
FUNCTION + DC					1	0	1	0
CODE	1	2	4	8	1	2	4	8

*Strapped to Common

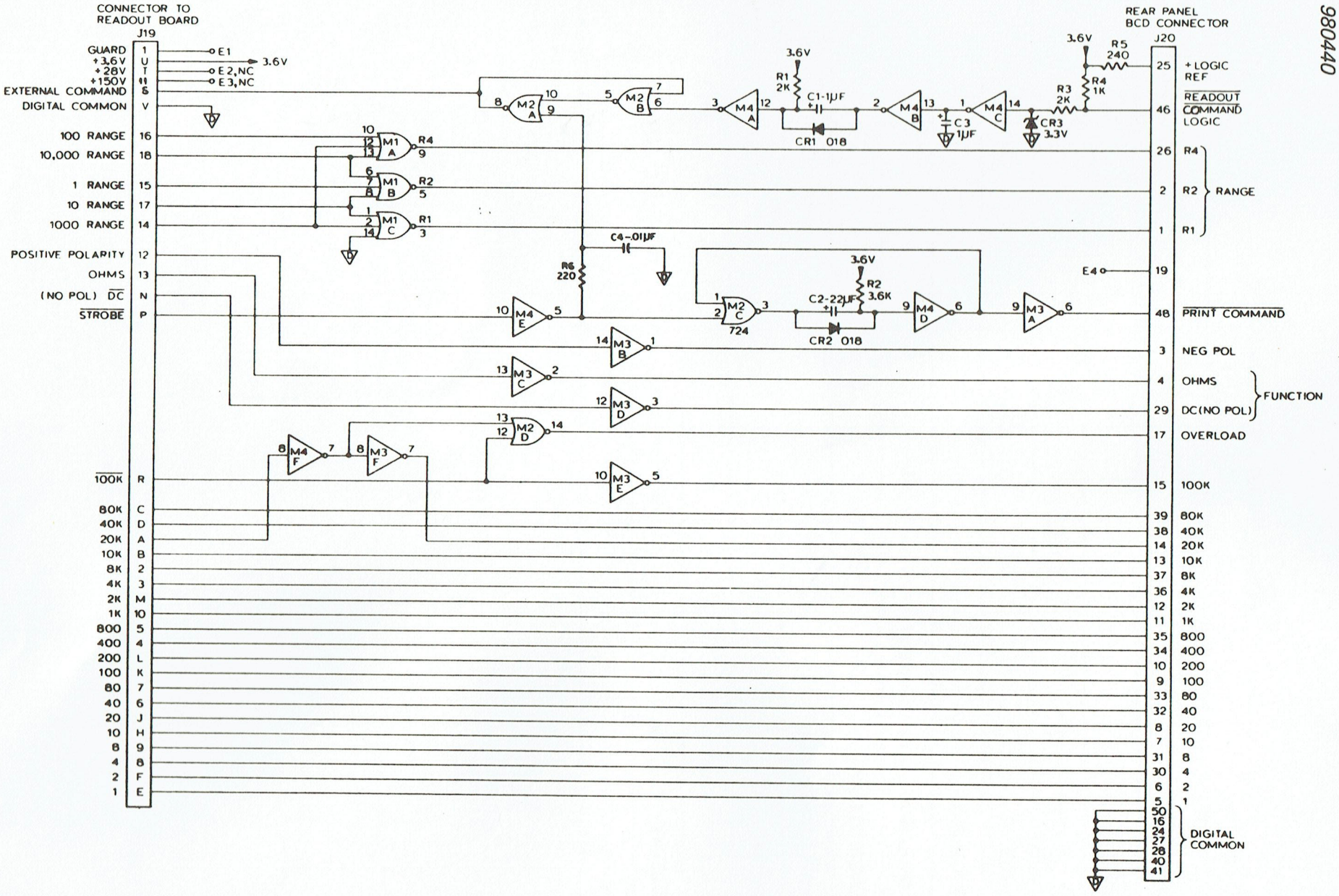


Figure 3.2 - BCD Output Module

SECTION 4

THEORY OF OPERATION

4.1 INTRODUCTION.

4.2 The Digital and Display Module is a complete DC digital voltmeter. The module displays the voltage and polarity of any DC input signal between zero and 12V full-scale (including overrange). A 10V input signal gives a displayed reading of 100,000. The Digital and Display Module includes some analog circuitry and the digital circuitry. In addition, solid state switches at the input to the Integrator are switched by the digital circuitry but perform an analog function.

4.3 Decimal points are placed by the ranging logic which is located on the Signal Conditioning Module. The driver transistors that actually switch the decimal points are located on the Digitizing and Display Module. Their driving signal, however, comes from the ranging logic on the Signal Conditioning Module.

4.4 The analog circuitry is entirely constructed around monolithic, linear, differential amplifier, integrated-circuits, which are connected either as inverting operational, or non-inverting potentiometric amplifiers. The solid-state switching circuitry, at the input to the integrator, consists of four N-channel field effect junction transistors. They and their associated driving circuitry comprise the only other section of the Digitizing and Display Module constructed from discrete components. The Digitizing and Display Module may be broken up into the following sub-sections:

a. Analog

Reference supplies
Integrator
Null Detector

b. Digital

Clock oscillator
Counter-readout
Ranging logic
Polarity sensing logic

c. Switching Circuitry

> **NOTE**
>
> Individual circuits are described followed by an over-all description of operation.

4.5 REFERENCE SUPPLIES.

4.6 The reference supplies, shown in figure 4.1, are built around two types of 301A differential amplifier IC's. The primary reference supply is the +10 volt supply. The negative supply inverts the +10V supply to −10V using an operational amplifier.

4.7 The stability of the +10V reference supply is dependent upon the inherent stability of the reference zener. These zeners are individually graded by Dana to obtain maximum long term stability and minimum temperature coefficient (TC). The zener and the series resistor through which it is biased are connected across a precision 10V source. The series resistor is then factory selected (FSV) to obtain the biasing current which will provide optimum temperature stability. The selected resistor and zener are then installed in each DMM as a matched pair.

4.8 The +10V reference supply is designed around a differential amplifier connected as a non-inverting, potentiometric feedback amplifier. The feedback network sets the forward closed-loop gain of the amplifier at approximately 1.6. A potentio-

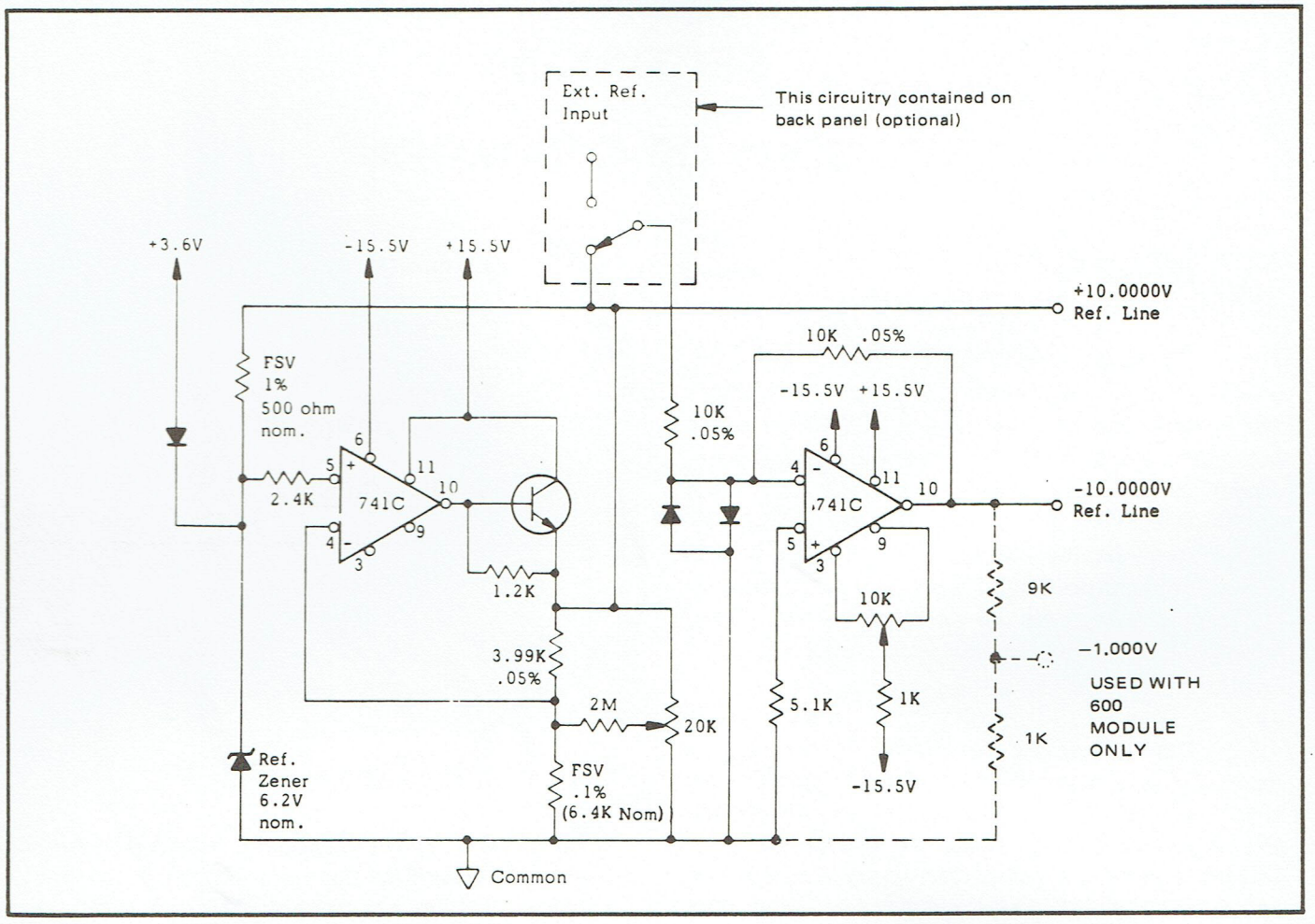


Figure 4.1 - Reference Supplies

meter in the feedback circuit provides a "fine" adjustment of the gain for calibration purposes. The reference zener and its biasing resistor are connected between the output of the +10V reference supply and circuit common. The cathode voltage of the reference zener provides the input signal to the amplifier in the +10V reference supply.

4.9 The −10V reference supply consists of a differential amplifier operated as an operational amplifier with a closed loop gain of one. Since an operational amplifier is an inverting amplifier, it simply inverts the +10V reference to −10V. The input impedance of an operational amplifier is equal to the value of the input summing resistor, which in this case is 10K. Therefore, the −10V supply draws only one milliampere from the +10V supply.

4.10 INTEGRATOR.

4.11 The integrator, shown in figure 4.2, is the center of the analog-to-digital conversion circuitry. It is designed around a high-gain differential amplifier. The circuit is connected as an operational amplifier, having a summing resistor of 200K ohms, and in the feedback element is a 0.55 microfarad capacitor. In operation, the circuit functions as outlined below.

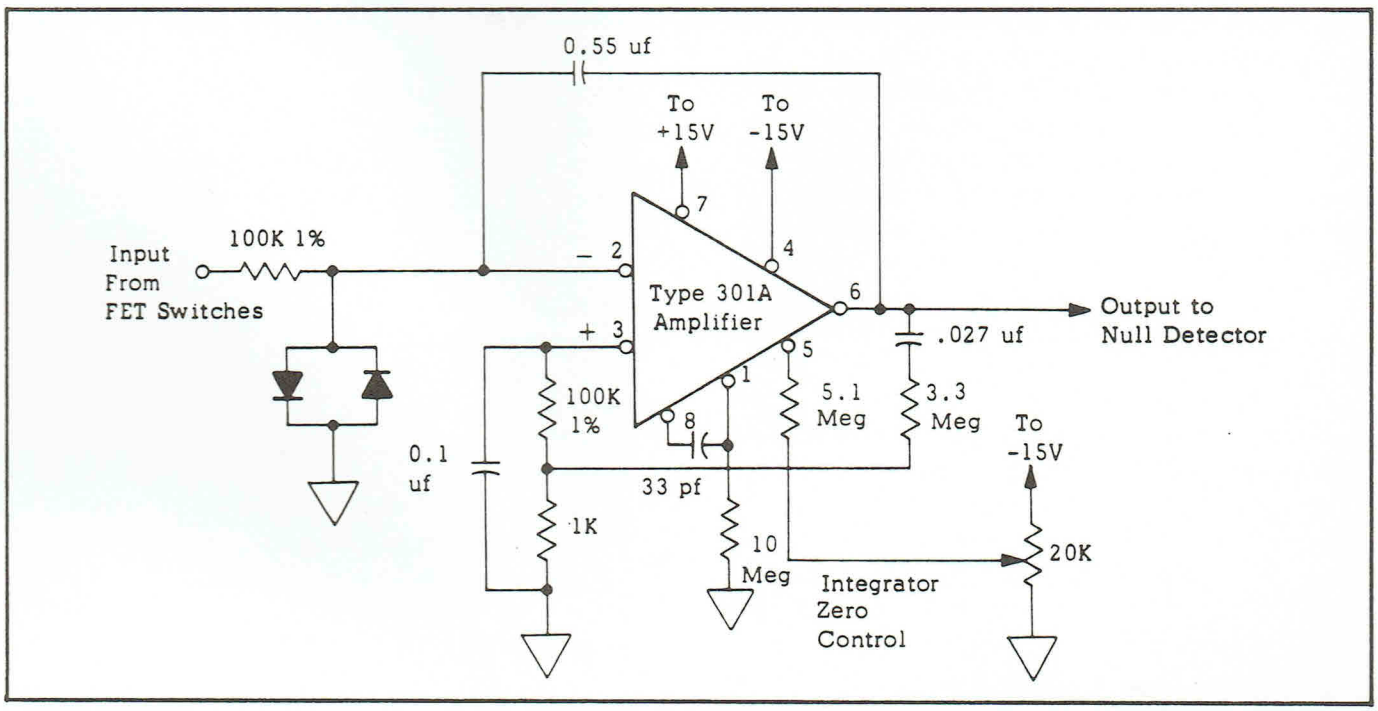


Figure 4.2 - Schematic, Integrator

4.12 Immediately prior to the beginning of a new reading the integrator is in a "reset" state. Its input and output are both at zero volts. When the instrument begins a new reading a solid-state switch Q21 closes, connecting the input of the Integrator to the output from the Signal Conditioning Module. At this point the output voltage from the Integrator begins to move in a polarity opposite to the polarity of the voltage at its input. The Integrator's output voltage moves at a rate which is equal to the charging rate of the 0.55 microfarad feedback capacitor charged at a constant current which is equal to the $\frac{E}{R}$ relationship of the input voltage to the 200K ohm summing resistor. The amplifier acts as a constant current source which charges the capacitor. This charging of the feedback capacitor by a constant current source produces a linear ramp at the output of the Integrator, the change in whose voltage is given by the formula:

$$\Delta V = \frac{Ein\ Ts}{RC}$$

Where: ΔV = The change in voltage from the integrator

Ein = The input signal voltage

Ts = The fixed time that the switch connecting the Integrator's input to the input signal remains closed

R = The Integrator's summing resistor

C = The value of the Integrator's feedback capacitor

4.13 The solid-state switch connecting the input of the Integrator to the signal voltage remains closed for a fixed period of time. This is referred to as the signal integration time (Ts). At the time that Ts begins, an oscillator of frequency f begins advancing the digital counter. The counter counts until a fixed number of counts (Cf) is reached.

4.14 When fixed count (Cf) is reached, the signal integration time (Ts) is terminated and the counter goes to zero. At this point the solid-state switch which connected the signal voltage to the Integrator's input opens and another switch closes connecting the Integrator's input to a precision 10V reference supply. This begins the reference integration period (Tr). The reference supply is opposite in polarity to the polarity of the input signal voltage. This causes the output voltage from the Integrator to ramp back toward zero until zero is reached, at which time the Null Detector senses the null state and causes the reference integrator time to be terminated. The counter accumulates oscillator counts from the beginning of Tr until Tr is terminated. At this time the counter contains a number of counts (Cx), which is the number displayed in the DVM readout. Since Tr ends with the output voltage from the Integrator at the same level as when Ts started, the changes in voltage at the output of the Integrator must be equal and opposite:

$$\Delta V = \frac{Eref\ Tr}{RC}$$

Where: ΔV = The change in output voltage from the Integrator

Eref = The voltage of the reference supply

Tr = The reference integration time

R = The value of the Integrator's summing resistor

C = The value of the Integrator's feedback capacitor

4.15 The measurement accuracy is entirely based upon the ratio of the signal integration time, a fixed number of counts (Cf), to the reference integration time, a variable number of counts (Cx). It is completely unaffected by oscillator frequency (f), or the RC components in the Integrator, provided only that these quantities remain stable during the time period required to take a measurement.

4.16 NULL DETECTOR.

4.17 The Null Detector, shown in figure 4.3, is a high gain non-inverting amplifier used to detect and signal the end of the reference integrate period. The Null Detector is designed around a high-gain differential amplifier. The circuit is of the potentiometric feedback type and has a closed-loop gain of 1100. The 20K resistor in series with the input and the two back-to-back diodes serve to limit the input voltage to the null detector to ± 0.6 volts. The Null Detector has two outputs. One output goes directly to the digital circuits. The second output, a diode drop away from the first output, is applied to the FET Reset switch. The Reset switch is one of four FET switches connected to the input of the Integrator.

4.18 OPERATION OF THE DIGITAL AND DISPLAY MODULE.

4.19 Figure 4.4 is a simplified version of the actual schematic which appears in the "drawings" section of this manual. As shown, all lines and logic levels are as they actually appear in the instrument. "Nor" gates which are used as inverters are shown as inverters and "nor" gates which are interconnected to form RS flip-flops are shown as RS flip-flops.

4.20 The counter consists of five individual decades and is continuously running and is never reset. The clock is gated to stop the counter whenever the instrument is in "hold" or during "strobe" time. A five decade counter can count only to 99999 whereupon it resets itself to 00000. A new reading is initiated every third time the counter reaches 00000.

4.21 At the beginning of each new reading the Signal Integrate line goes true. This closes the FET signal switch at the input to the integrator. The integrator begins to ramp up or down, depending on the polarity of the input signal. The signal integration ramp continues until the counter reaches 99999 and resets to 00000. At the moment the

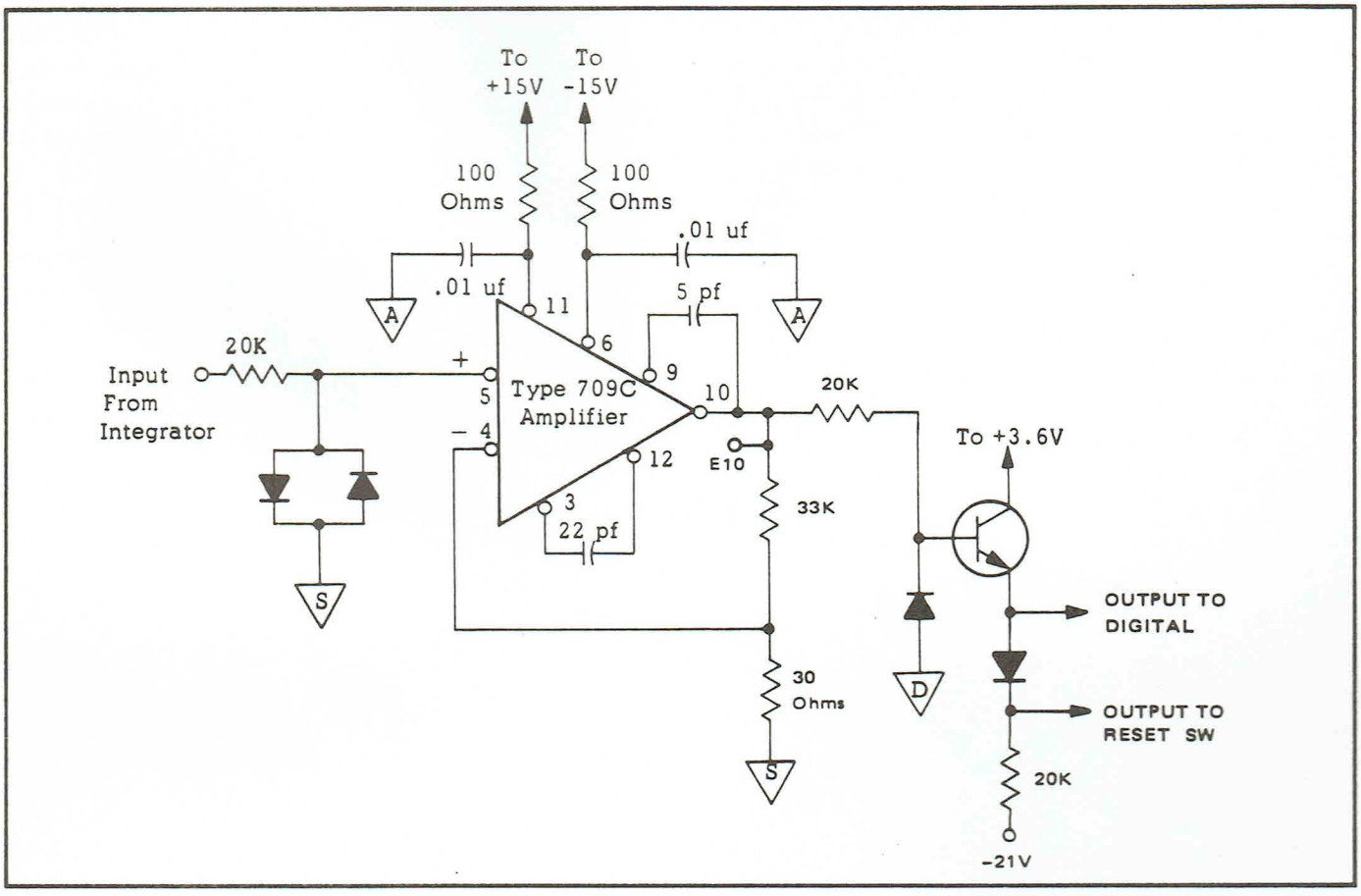


Figure 4.3 - Null Detector

counter resets to 00000, the 80,000 line (which went true when the counter reached 80,000) goes false. This toggles the control flip-flop and the Signal Integrate line goes false. The Signal Integrate line going false disables the signal switch driver and the FET signal switch opens.

4.22 The polarity decision is made at the moment the counter resets from 099999 to 000000. If the input signal to the integrator is positive, the output voltage from the Integrator at the end of the signal integration time is negative. This causes the output voltage from the Null Detector to also be negative. This level is inverted by inverter M1A, setting the positive polarity line true (positive). The true level of the positive polarity line is inverted by inverter M1B, setting the negative polarity line false. If the polarity of the input signal were negative, the converse would be true.

4.23 Therefore, if the polarity of the input signal is positive, the positive polarity line is true and the

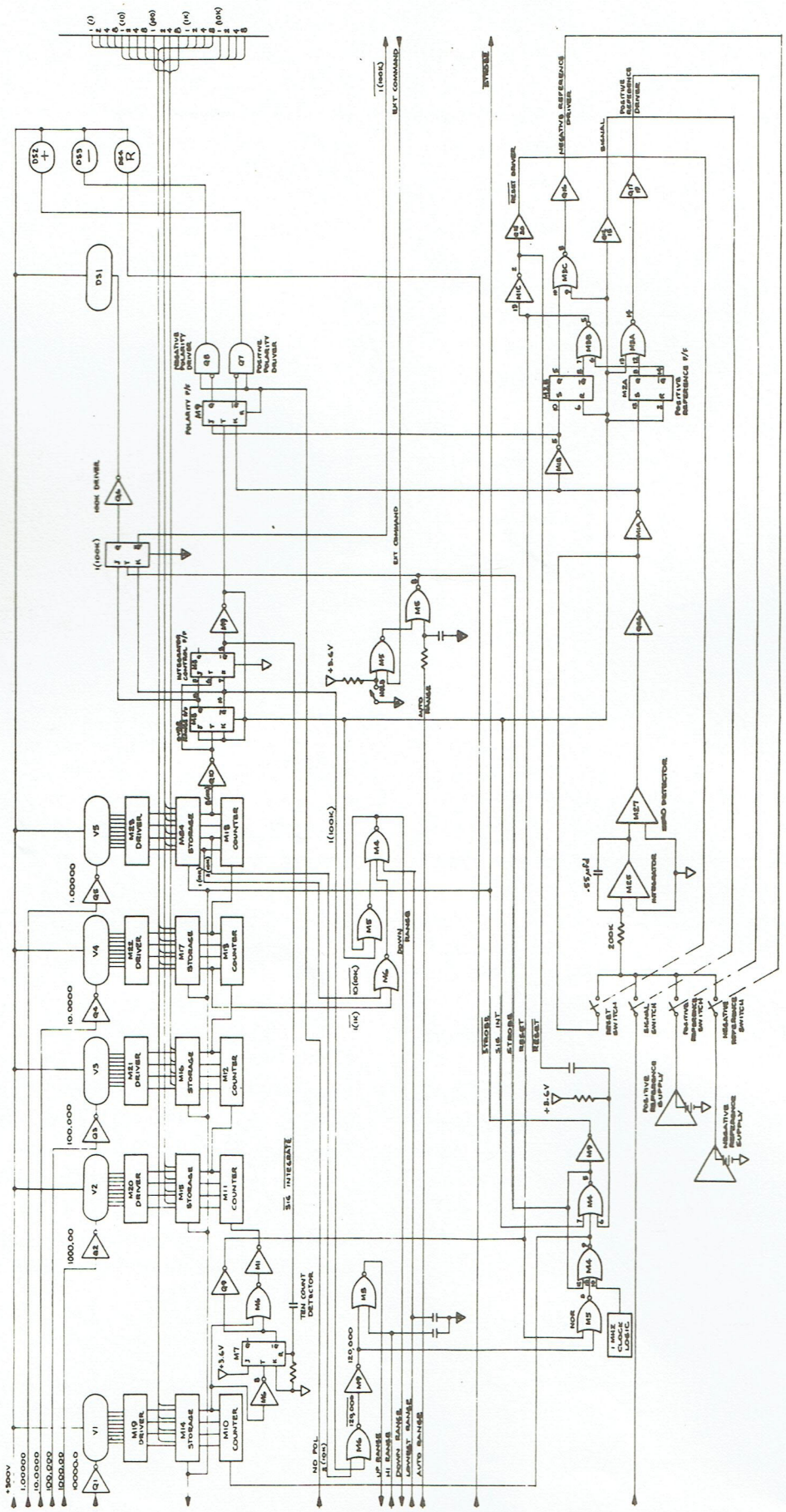


Figure 4.4 - Digitizing and Display Module - Simplified

negative polarity line false at the end of the signal integration period. If the polarity of the input signal is negative, the positive polarity line is false and the negative polarity line true at the end of the signal integration period.

4.24 When the signal integrate line goes false at the time the counter overflows to 000000, the polarity flip-flop toggles. The position taken by the polarity flip-flop is determined by the state of the positive polarity line and the negative polarity line at the end of the signal integration period. If the input signal is of positive polarity, the positive polarity line is true and the negative polarity line false. This causes the $\overline{Q}$ side of the polarity flip-flop to be set which enables driver Q7. Driver Q7 lights the + polarity light. If the input signal is of negative polarity the positive polarity line is false and the negative polarity line is true. This causes the Q side of the polarity flip-flop to be set which enables driver Q8. Driver Q8 lights the – polarity light.

4.25 During the signal integration period the signal integrate line is true. This holds the negative polarity flip-flop and the positive polarity flip-flop in a reset state. At the time the counter goes from 099999 to 000000 at the end of the signal integration period, one or the other of these flip-flops toggles, depending on whether the positive polarity line or the negative polarity line is true. If the positive polarity line is true, the positive polarity flip-flop toggles, its Q output going true. This disables nor gate M3A, keeping the positive reference integrate line from going true when the signal integrate line goes false. Since the negative polarity flip-flop did not toggle, its Q output is false. This enables nor gate M3C as soon as the signal integrate line goes false. When nor gate M3C is enabled, the negative reference integrate line goes true, enabling the negative reference switch driver. The negative reference switch driver closes the FET negative reference switch.

4.26 At this point, the reference integration period begins and the output voltage from the integrator begins to ramp back toward zero volts. Had the input signal being measured been of negative polarity, the positive polarity line would have been false and the negative polarity line true at the end of the signal integration period. This would have caused the negative polarity flip-flop to toggle when the signal integrate line went false, leaving the positive polarity flip-flop in a reset state. This would have enabled nor gate M3A, setting the positive reference integrate line true (rather than the negative reference integrate line) and closed the negative reference switch.

4.27 At the moment the output voltage from the Integrator crosses zero (on the reference integration slope) the positive polarity line and negative polarity line change state. That is, whichever one was true goes false and whichever one was false goes true. This causes the remaining polarity flip-flop to toggle. Whichever one did not toggle at the beginning of the reference integration period will do so at the end. This causes both nor gates M3C and M3A to be disabled so both the negative reference integrate line and the positive reference integrate line go (or remain) false. This opens both FET reference switches. When both the positive polarity flip-flop and the negative polarity flip-flop are in the set state, which occurs at the end of the reference integration period, nor gate M3B is enabled and the reset line goes true. This level is inverted by inverter M1C and the $\overline{\text{reset}}$ line goes false. This holds the output of the integrator at a level of zero volts.

4.28 When the reset line goes true at the end of the reference integration period, the strobe flip-flop is actuated through or gate M5. This causes the Q output of the strobe flip-flop to go true which actuates the strobe generator which is a 10 microsecond one-shot. The strobe generator causes the STROBE line to go true for a 10 microsecond period. This is inverted by inverter M9 and causes the $\overline{\text{STROBE}}$ line to go false for a 10 microsecond period. Then the STROBE line goes true, nor gate M4 is disabled, stopping the clock signals from reaching the counter for the duration of the strobe time. The negative level of the $\overline{\text{STROBE}}$ line gates the buffer storage units which translate whatever levels exist at their inputs at that moment to their outputs.

4.29 Information is stored at the outputs of the buffer storage units until the next negative transition of the $\overline{\text{STROBE}}$ line at the end of the next

reading. The levels at the inputs of the buffer storage units are the output of the counter. Since the transition of the $\overline{\text{STROBE}}$ line which actuates the buffer storage units comes exactly at the end of the signal integration period, and at that time the state of the counter represents the value of the voltage being measured, the reading displayed by the instrument equals the value of the signal voltage.

4.30 At the end of the 10 microsecond STROBE time, the strobe line again goes false and the $\overline{\text{STROBE}}$ line again goes true. When the strobe line goes false, nor gate M4 is again enabled and allows clock signals to reach the counter. The counter continues counting until it reaches 99999 whereupon it again resets itself to 00000. On this, the second transition of the counter from 99999 to 00000, the 80,000 line going false toggles the overrange flip-flop but does not again toggle the control flip-flop.

4.31 The overrange flip-flop did not toggle on the first transition of the 80,000 line, at the end of the signal integration period, because both its J and K inputs were held true by the signal integrate line which was true at that time. The control flip-flop does not re-toggle on the second transition of the 80,000 line because: a) the overrange flip-flop, at that time has not yet toggled at all so its Q output is still false and its $\overline{Q}$ output is still true; b) the J and K inputs of the control flip-flop are so connected that it cannot re-toggle until after the overrange flip-flop does.

4.32 The counter continues to count until it again reaches a count of 99999 and resets itself to 00000. At this point the 80,000 line again makes a transition from true to false. This time both the overrange flip-flop and the control flip-flop toggle. The overrange flip-flop is reset and the control flip-flop is set, causing the signal integrate line to go true, which initiates a new reading.

4.33 AUTO RANGE CIRCUITS.

4.34 In order to facilitate automatic ranging operation, uprange and downrange signals are generated by the Digitizing and Display Module. These signals command the range counter in the Signal Conditioning Module to count up or down. If the instrument is in too low a range for the signal voltage being measured the counter will reach a full-scale count of 120,000 prior to the zero-crossing of the output voltage of the integrator on the reference integration period. When this occurs, the 120,000 line goes true initiating strobe action. When this happens, the 120,000 line (which is normally always in a true state) goes false.

4.35 If the instrument is not already in the highest range, the highest range line into the Digitizing and Display Module will be false. This enables nor gate M3 setting the uprange line true. If the instrument is in too high a range for the signal being measured, null detection (and subsequently strobe) will occur before the counter reaches a count of 1000. This means that at the time strobe occurs the 1000 line is still false. If the instrument is not already in the lowest range the downrange flip-flop remains in a reset state. Its $\overline{Q}$ side is true setting the downrange line true. If the instrument is already in the lowest range the lowest range line is true. This causes the downrange flip-flop to be "set" as soon as the signal integrate line goes false at the end of the signal integrate period. When the downrange flip-flop is "set" its Q side is false causing the downrange line to be false. Whenever the count of the counter is between 1000 and 12,000 at the time the Integrator zero-crossing occurs the 1000 line is true so the downrange flip-flop is "set", resulting in no downrange signal and the 12,000 line is true, resulting in no uprange signal.

4.36 FET SWITCHING CIRCUITRY.

4.37 The four switches at the input to the Integrator are N-channel, field-effect, junction transistors. They are driven by circuitry composed of discrete components. The FET switches and their driving circuitry are shown in figure 4.5. The source and gate of each FET are connected to each other through fairly high value resistors (100K or 1 Meg). The gate of each FET connects to the driving circuitry through a series diode whose cathode connects to the collector of the driving transistor.

4.38 In operation, the field-effect transistors are fully cut off (switch open) when the voltage at the gate, with respect to the source, is approximately

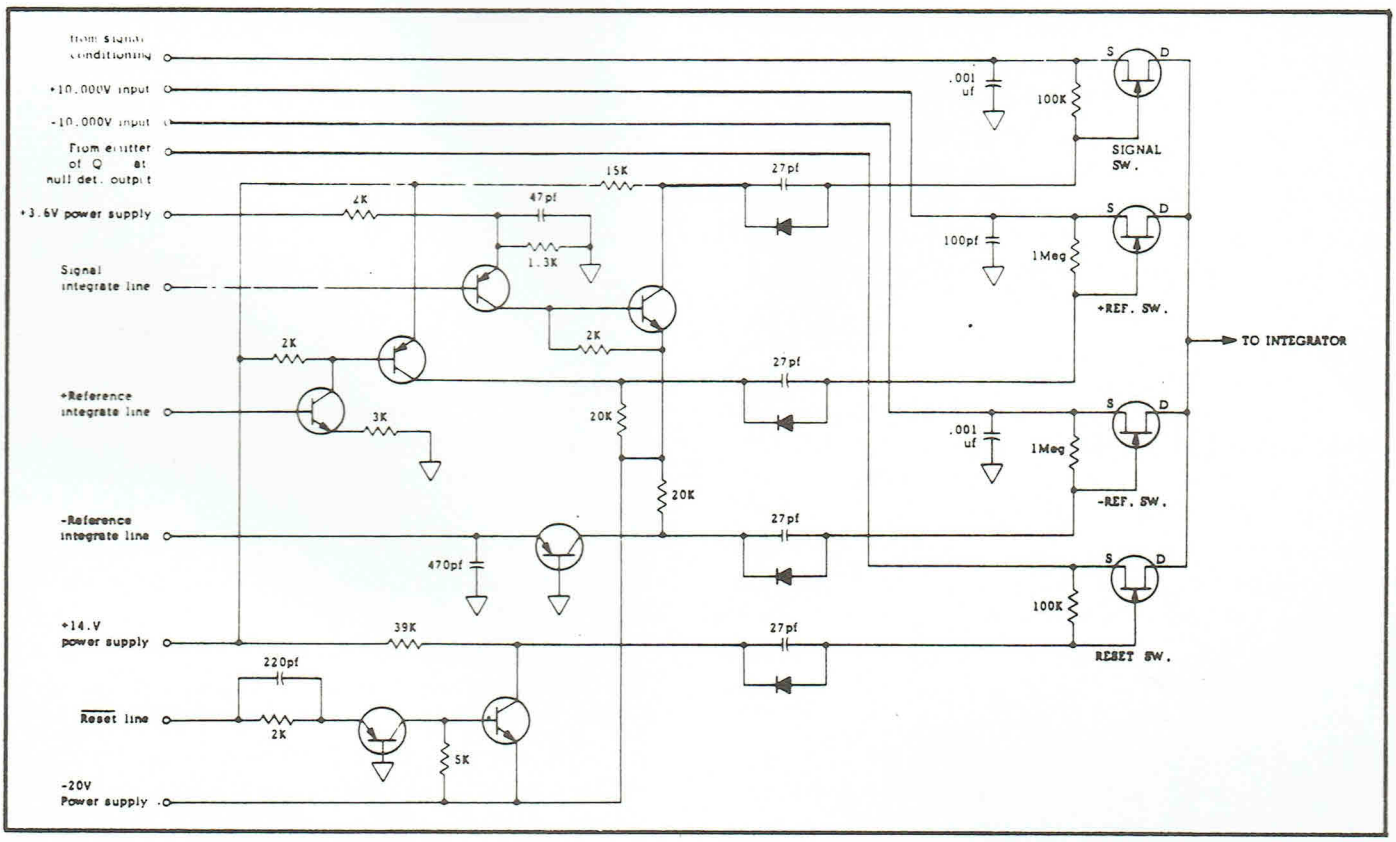


Figure 4.5 - Schematic, FET switches and switch drivers

–6V or more (–6V negative bias). When a FET is turned off, its driving transistor is either fully saturated (as is the case with the signal integrate switch and the reset switch) or fully turned off (as is the case with the + Ref Switch and the – Ref Switch). In either case the net effect places its collector voltage at –20V. Since the cathode of the diode which connects to the gate of the FET is connected to the driver transistor's collector it too is at a –20V potential. Under this condition, the diode is forward biased. Current flows through the resistor which is connected between the source and gate of the FET. This produces a voltage drop across the resistor which places the FET's gate voltage at nearly –20V. Since no input signal to any of the FET switches is more negative than about –14V (under overload conditions) this assures that the FET is completely cut off.

4.39 When a FET is turned on (switch closed) its driver transistor's collector goes positive (relative to the most positive voltage that appears at the source of that particular FET). This causes the diode to be back biased so no current flows through it. Under this condition no current flows through the resistor connected between the source and gate of the FET so the source and gate are at the same potential (zero volts bias).

4.40 POWER SUPPLY.

4.41 The Power Supply Module provides all DC operating power to the instrument and it serves to interconnect the Digital and Display Module and the Signal Conditioning Module. It is constructed on a single printed circuit board. Both the Digital and Display Module and Signal Conditioning Module plug into sockets on the Power Supply Module.

4.42 The Power Supply, shown in figure 4.6, provides DC power to both the analog and digital

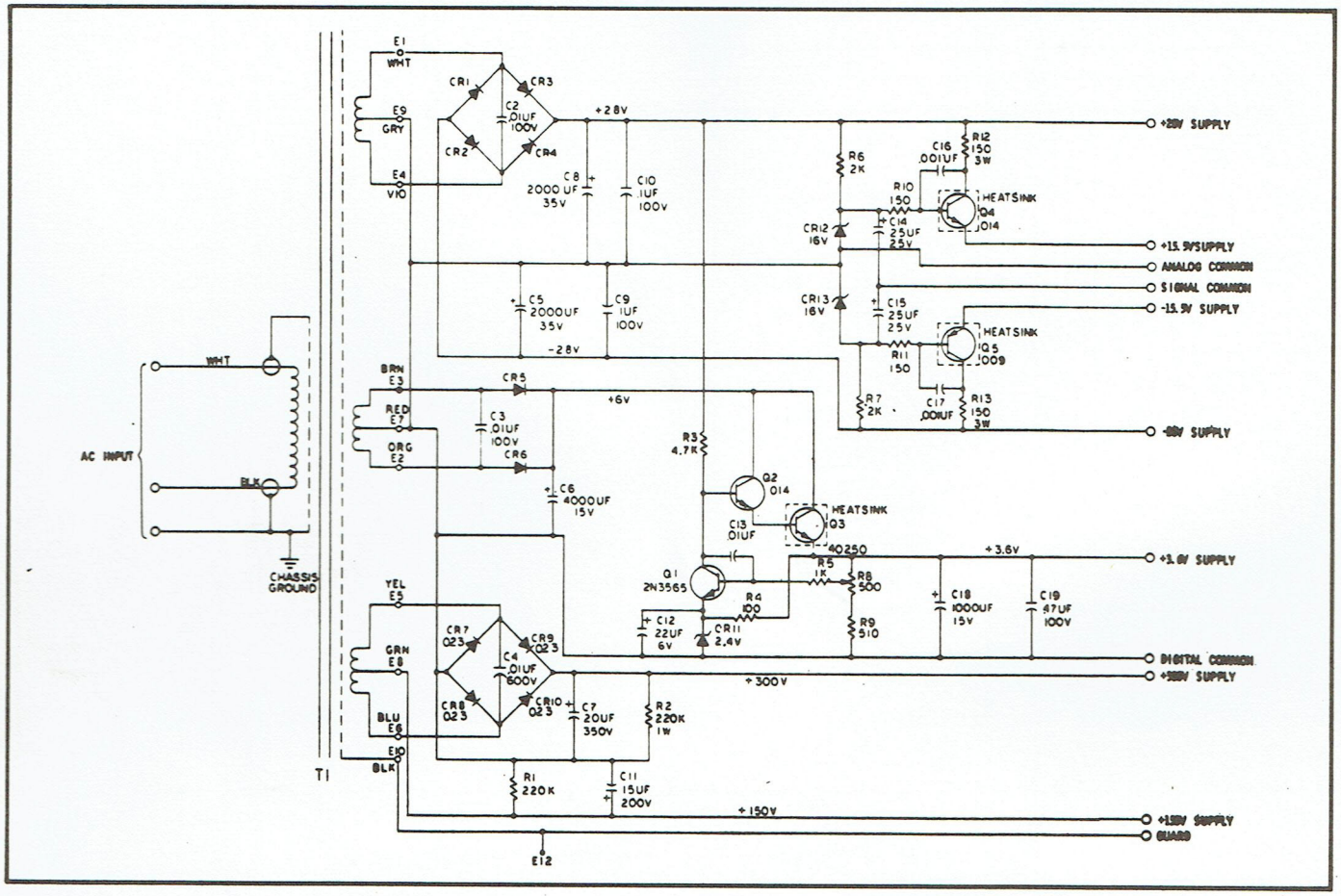


Figure 4.6 - Power Supply

portions of the instrument. Seven different voltage levels are provided. These are:

+28V	unregulated
−28V	unregulated
+15.5V	regulated
−15.5V	regulated
+3.6	regulated
+300V	unregulated
+150V	unregulated

4.43 The power transformer has three secondary windings which step the AC line voltage to three different levels. The 300V winding provides power for the +300V and +150V supplies. The 6V winding supplies power for the +3.6V supply and the 56V winding provides power for the positive and negative 28V and 15.5V supplies.

4.44 Diodes CR-7 through 10 form a full wave bridge type rectifier whose input is connected across the 300V winding of the power transformer. The output of the bridge rectifier is connected across capacitor C7 which is the filter capacitor for the +300V line. Resistor R2 is connected across capacitor C7 as a bleeder resistor to eliminate shock hazard. The +150V DC output is taken from the center tap of the 300V transformer winding. Capacitor C11 is the filter capacitor for the +150V DC line. Resistor R1 is the bleeder resistor for capacitor C11.

4.45 Diodes CR-1 through 4 are shown on the schematic diagram connected across the 56V transformer winding as a bridge. In operation, however, they do not function in exactly the same manner as a conventional full wave bridge rectifier. The winding is center tapped and this point is connected to digital common (ground). Diodes CR-3 and CR-4 form a full wave rectifier which charge capacitor C8 to +28V DC. C8 is connected between the +28V line and digital common and is the +28V filter capacitor. Similarly, diodes CR-1 and CR-2 form a full wave rectifier which charges capacitor C5 to −28V DC. C8 is connected between the −28V line and digital common and is the filter capacitor.

4.46 Transistors Q4 and Q5 are series regulators which reduce the +28V to +15.5V and −28V to −15.5V respectively. Zener diodes CR-12 and CR-13 clamp the bases of these transistors at a 16V level. The voltages at the emitters of these transistors are always about 0.6V less than that at the bases and since the voltage at the bases is clamped by the zeners the 15.5V lines are regulated. Resistors R12 and R13, in series with the collectors of the regulator transistors, provide protection for the transistors in the event of an accidental short circuit between either 15.5V supply line and circuit common. The digital, analog, and signal commons all connect together in the Signal Conditioning Module. Capacitors C14 and C15 filter zener noise and keep it off the 15.5V lines.

4.47 The 6V winding of the power transformer is connected to circuit common. Diodes CR-5 and CR-6 and the center tap of the winding form a full wave rectifier which charges filter capacitor C6. In operation the voltage across capacitor C6 is approximately +6V DC with respect to circuit common. Transistor Q3 is a series regulator transistor which converts the +6V to +3.6V. Transistors Q2 and Q3 are connected in a Darlington configuration. The current gain of Q3 is thus multiplied by the current gain of Q2. Base drive for the Darlington connected regulator transistors is provided by resistor R3 which connects to the +28V line. It is controlled by the collector current through transistor Q1.

4.48 Base bias for transistor Q1 comes through resistor R5 which connects to the wiper of potentiometer R8. Zener diode CR-11 clamps the voltage at the emitter of transistor Q1 at +2.4V. This forces the voltage at Q1's base to always be approximately +3V. This causes any voltage change at the wiper of potentiometer R8 to result in a directly proportional change in the current through resistor R5. Since this is the current controlling transistor Q2, the zener acts as a reference element which stabilizes the output voltage of the supply.

4.49 Potentiometer R8 is adjusted to set the collector current through transistor Q1. The potentiometer is adjusted to a point to give enough base drive to the Darlington circuit to keep the emitter voltage of transistor Q3 at exactly +3.6V. If the voltage at the emitter of Q3 should drop (due to a change in either the line voltage or level current) the available base drive to transistor Q1 will also decrease. This will cause less collector current to flow through transistor Q1. More current is available as base drive for the regulator transistors. This current turns transistor Q3 on harder and raises the emitter voltage back to +3.6V.

SECTION 5

CALIBRATION

5.1 Since calibration procedures are dependent on the model of Signal Conditioning Module used, please refer to the appropriate Signal Conditioning manual, Section 5, for calibration procedures.

SECTION 6

DRAWINGS

6.1 DRAWINGS.

PCB Assembly, Readout	403446
Schematic, Readout	430960
Assembly, Power Supply, 5330	403543
Assembly, Power Supply, 5370	403542
PCB Assembly, Power Supply, 5330	403081
PCB Assembly, Power Supply, 5370	403225
Schematic, Power Supply	430842
Assembly, Rear Panel, 5330	403539
Assembly, Rear Panel, 5370	403540
Ratio Option, 5370	403533
Ratio Option, 5330	403536
Schematic, Ratio Option	430973
PCB Assembly, Model 74	403466
Schematic, Model 74	430967
Rear Input, 4-wire	403512

600297
FSV TERM.
2 REQ'D

920007 TRANS PADS
TO BE USED IF TRANSISTORS
Q21-Q24 ARE METAL CAN
TYPE

920460
I.C. SOCKET 14 PIN
15 REQ'D △5

920279
CRYSTAL PAD

600591
TEST PIN
3 REQ'D

920482
I.C. SOCKET
3 REQ'D

600245
JUMPER INSUL.
5 PLACES

920563
FERITE BEADS
2 REQ'D. ON LEADS
OF CR17

920006
TRANS PAD
3 REQ'D

453552
BRACKET READOUT
610042
SCR. PPH 4-40 X 1/4 LG
2 REQ'D
617077 #4 LK WASH
2 REQ'D

610283
SCREW PPH-4-40X1/4LG. BLK.
2 REQ'D
617077
WASHER #4 INT. LK.
2 REQ'D

453553
BRACKET
READOUT TUBES

920468
NIXIE SOCKETS
6 REQ'D

920506
NIXIE TUBES
6 REQ'D

610027
GROMMET
6 REQ'D

453364
HOUSING FUNC.
BOUD HOUSINGS
TO BRACKET
W/ EASTMAN 910
920008

453339
SCREEN,
DISPLAY

SEE DETAIL 'C'

600590
REF.

DETAIL 'B'

FOR ASSY DETAIL 'B'
FOR WIRING DETAIL 'A'

501376
SLEEVING
A/R

920116
LAMP NE2H
3 REQ'D

453464
INSERT REFLECT
3 REQ'D

DETAIL 'C'
SCALE 1:1

VIEW A-A
2 PLACES
1/16

500043
TEFLON WIRE A/R

500009
SHRINK TUBING
A/R

WAFER
INDEX

524000
WIRE 24GA. A/R
500002
SHRINK TUB. A/R
500006
CABLE, STORM
21" LONG

453552
BRKT. REF.

600596
SWITCH

MECHANICAL
KEYWAY

DETAIL "A"
SCALE: NONE

501376
TEFLON TUB.
A/R

610487
MOUSETAIL

600243
TERM. TEP.
2 REQ'D

410591
P.C. BOARD

920419
I.C. SOCKET 16 PIN
10 REQ'D △4

600370
PLUG
600380
PIN
3 REQ'D

△3 PIN 1 OF IC & PIN 1 OF SOCKET TO HAVE SAME ORIENTATION.

△2 PART OF ZENER KIT 403294.

△1 REMOVE W5 & INSTALL R86 & R87 WHEN READOUT IS MATED WITH 600 MODULE, (SEE MODIFICATION KIT 403538.)
INSTALL W5 JUMPER WHEN READOUT IS MATED WITH 700 MODULE.

6. SCHEMATIC REF. 430960
5. FOR RATIO OPTION INFORMATION SEE
4. ALL DIODES 018.
3. ALL RESISTORS ARE IN OHMS ±5%, 1/4 W. CARBON.
2. SCHEMATIC REF.
1. ASSY PROCEDURES & PROCESSES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

NOTES: UNLESS OTHERWISE SPECIFIED

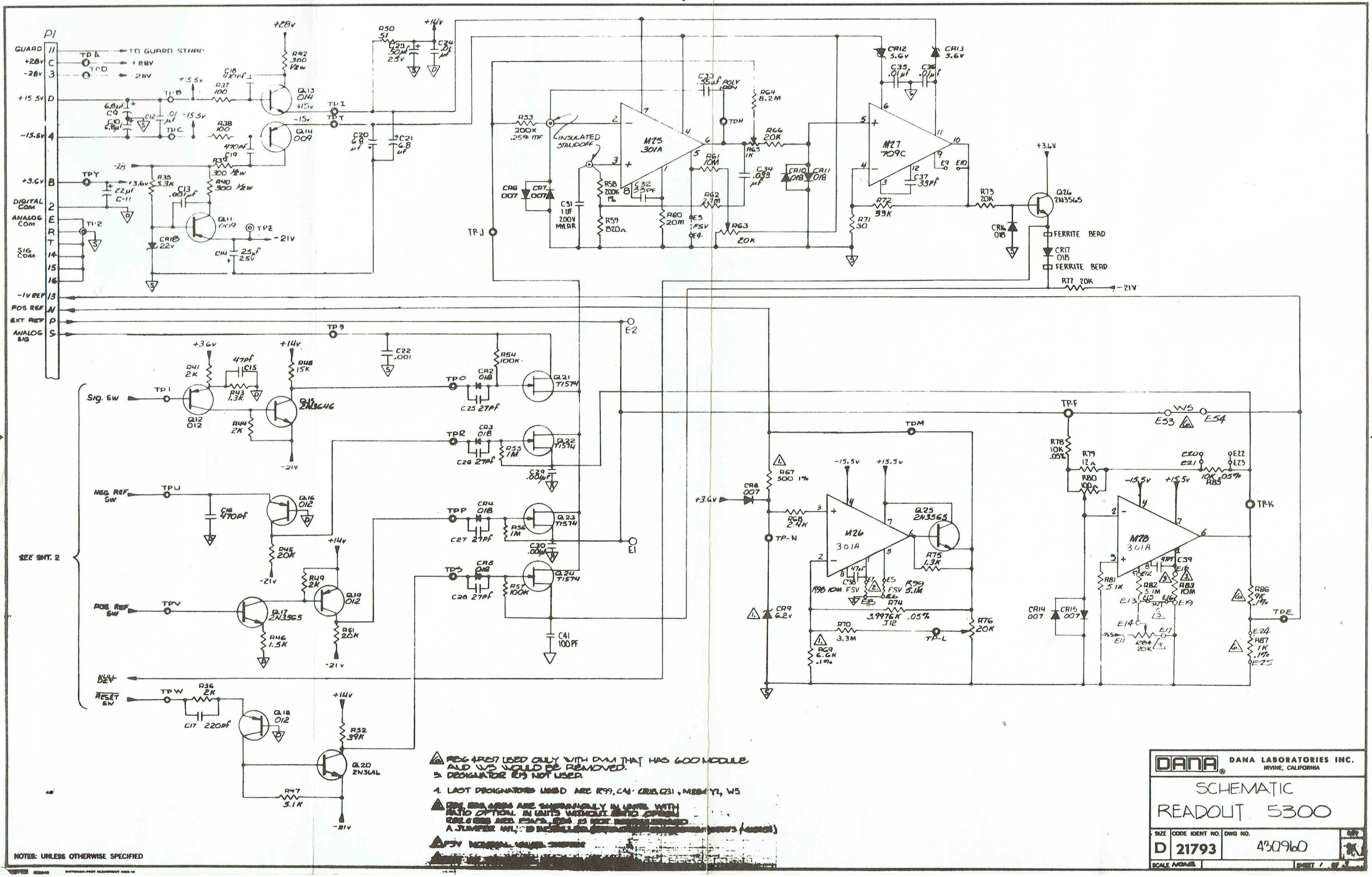
DANA DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ASSY P.C. BOARD READOUT

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	403446	L

SCALE 2:1 SHEET 1 OF 7

980346 DIETERICH POST CLEARPRINT 1000



⚠ R56 & R57 USED ONLY WITH DVM THAT HAS 600 MODULE AND W5 WOULD BE REMOVED.
5. DESIGNATOR R15 NOT USED.
4. LAST DESIGNATORS USED ARE R99, C41, CR18, Q31, M28, Y1, W5

⚠ R86, R88, ... ARE ... IN UNITS WITH RATIO OPTION. IN UNITS WITHOUT RATIO OPTION ... A JUMPER WILL BE INSTALLED ...

⚠ FSV NOMINAL VALUE ...

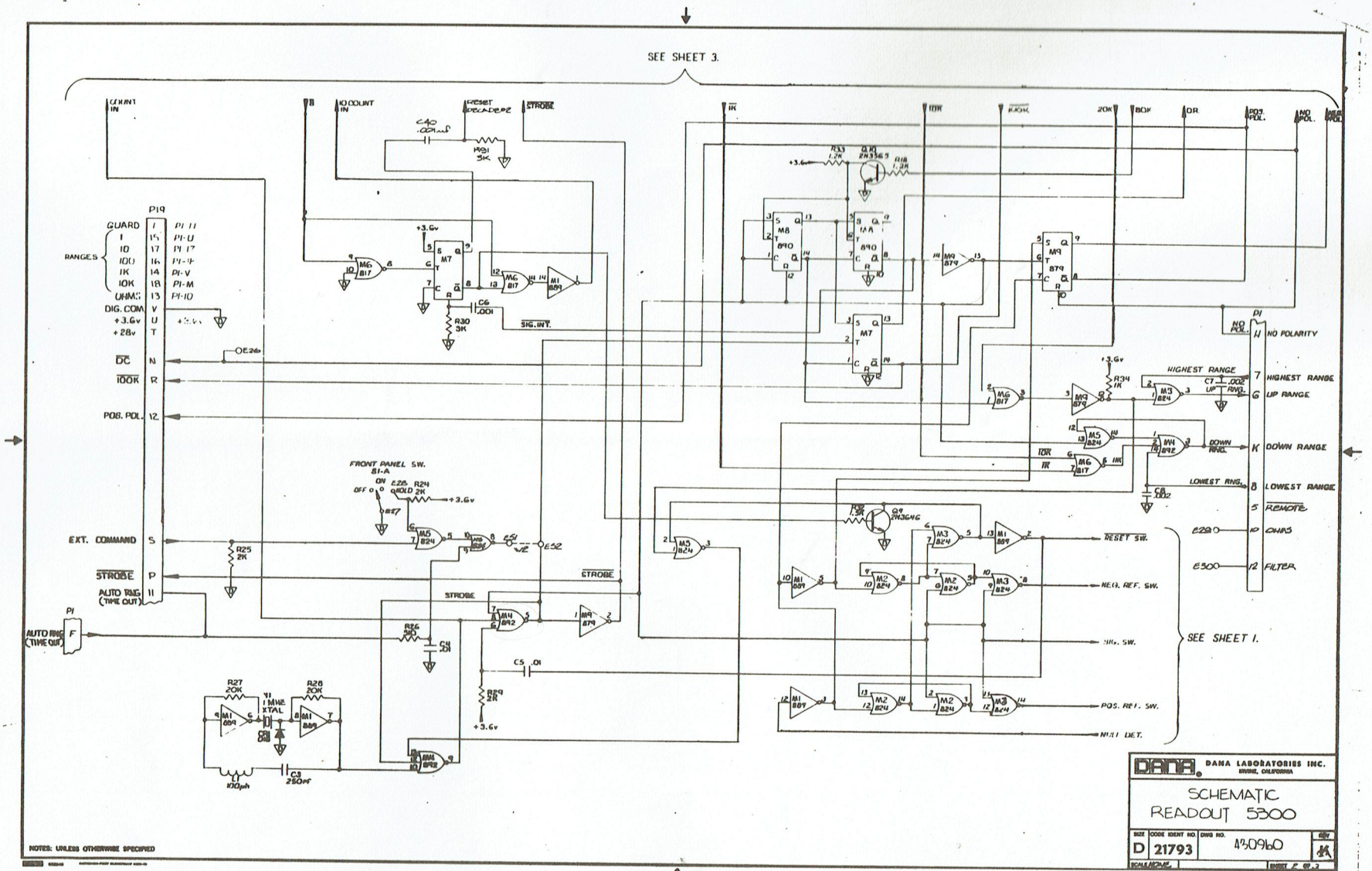
NOTES: UNLESS OTHERWISE SPECIFIED

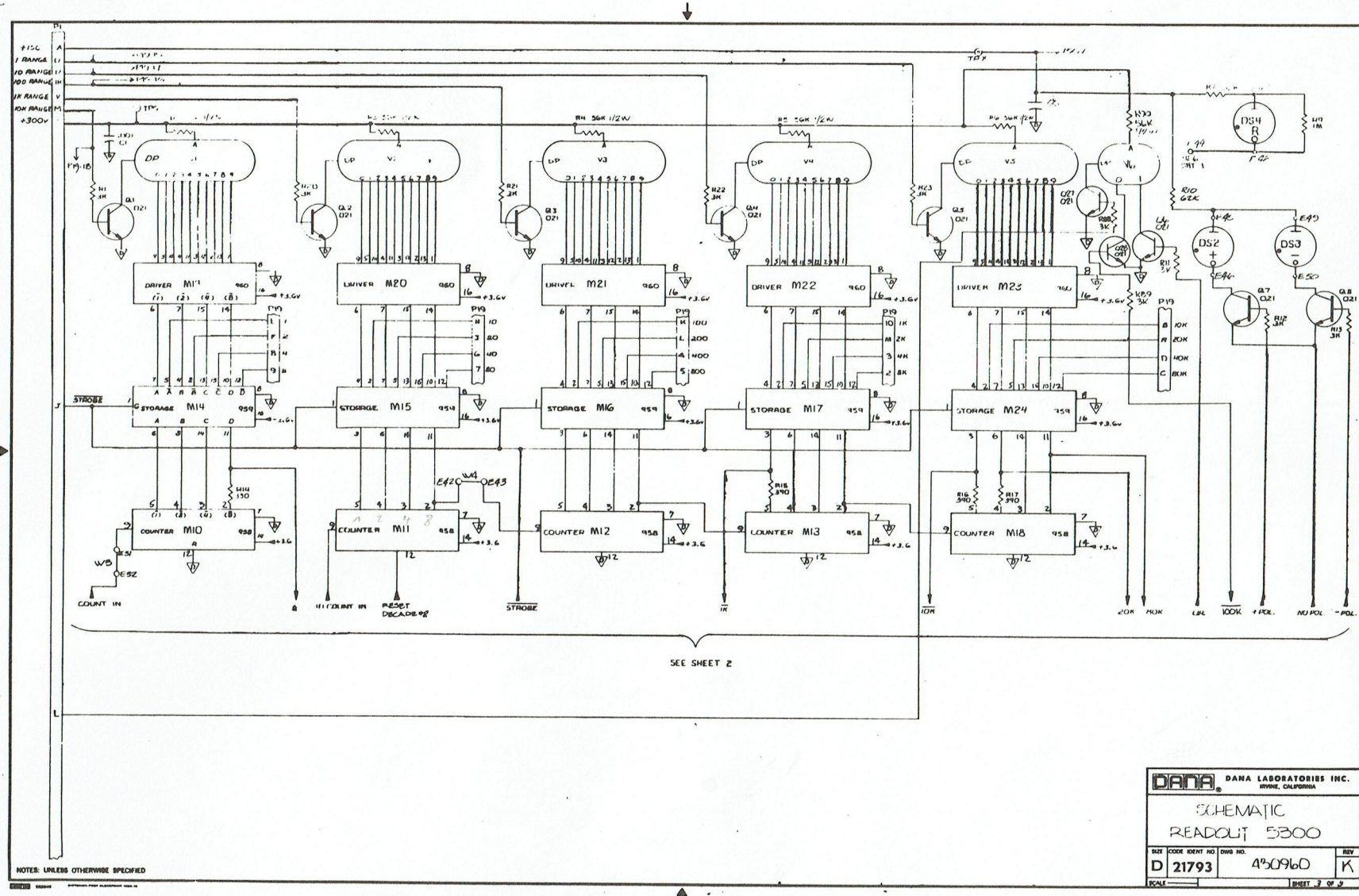
DANA® DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC
READOUT 5300

SIZE	CODE IDENT NO.	DWG NO.
D	21793	430960

SCALE NONE SHEET 1


SEE SHEET 3.
P19
GUARD
RANGES
DIG. COM
+3.6v
+28v
DC
100K
POS. POL.
EXT. COMMAND
STROBE
AUTO RNG (TIME OUT)
P1
FRONT PANEL SW. S1-A
HIGHEST RANGE
UP RANGE
DOWN RANGE
LOWEST RANGE
REMOTE
OHMS
FILTER
NO POLARITY
RESET SW.
NEG. REF. SW.
POS. REF. SW.
NULL DET.
SEE SHEET 1.
NOTES: UNLESS OTHERWISE SPECIFIED
DANA LABORATORIES INC.
IRVINE, CALIFORNIA
SCHEMATIC
READOUT 5300
D 21793
430960



DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC
READOUT 5300

SIZE	CODE IDENT NO	DWG NO.	REV
D	21793	450960	K

SCALE — SHEET 3 OF 3

600586 - BINDING POST WHITE - 2 PLACES
600022 - SOLDER LUG 2 PLACES

615045 - SCREW 4-40 x 7/16
617077 - WASHER LOCK #4
6 EACH REQ'D.

600587 - BINDING POST - BLACK 3 PLACES
600022 - SOLDER LUG 3 PLACES

E7 - RED
E2 - ORG
E3 - BRN
E1 - WHT
E4 - VIO
E5 - YEL
E6 - BLU
E9 - GRY
E10 - BLK

615074 SCR PPH 8-32 X 3/8
617080 WASHER - LOCK #8
4 REQD

600331 BINDING POST WHT.
600022 LUG

600231 - BINDING POST METAL
617081 - WASHER LOCK #10

J9
J10

610390 - PLUG
2 REQ'D.

600330 BINDING POST BLK
600022 LUG

500100
TEFLON TUBING
TOP LEAD OF C1.

TOP

J3
J4
T1
C1
F1
S1

600619 RECEPTICAL - AC PWR
600032 SOLDER LUG #4
615045 SCR PPH 4-40 X 7/16 } 2 REQ'D
617004 HEX NUT #4
617077 LOCK WASHER #4

453234 BRKT - CONN, BLANK
615043 SCR PPH 4-40 X 5/16 } 2 REQ'D
617077 WASHER-LOCK #4

920099 FUSEHOLDER
920259 FUSE .5A

SEE DETAIL B
600379 CONN REC
600381 PIN REC 3 REQD

524999
WIRE 24GA WHT
A/R 3 PLACES

300037
TRANSFORMER

403539 REAR PANEL ASSY

600022
SOLDER LUG
2 PLACES REF.

J4
J3
SHLD
WHT
BLK
T1
F1
.5A
C1
.22UF

WIRING DETAIL

500025
WIRE 20 GA. BLK. A/R

524999
WIRE 24 GA. WHT. A/R

WIRING CHART			
E NO	P/N	COLOR	T1
E1		WHT	T1
E2		ORG	
E3		BRN	
E4		VIO	
E5		YEL	
E6		BLU	
E7		RED	
E8		GRN	
E9		GRY	
E10		BLK	T1
E17		WHT	J9
J2-3		BLK	J10

STANDOFF
FLAT WASHER NYLON
P.C. BOARD
SHOULDER WASH NYLON
SCREW

DETAIL C

TO PLUG SEE SHEET #2

T1

F2

J2
J1

610323 STANDOFF
4 40 X 3/4" LG
6 REQ'D

403081 PCB ASSY

C1 CAP .22UF
120007

501356 SHRINK TUBING A/R
524000 WIRE 24 GA BLK A/R

SEE TOP VIEW AND WIRING CHART FOR HOOKUP.

615076 SCR 8-32 X 1/2 LG
610387 WASHER #8 NYLON
610647 SHOULDER WASHER #8 NYLON
SEE DETAIL C
2 REQD

615077 SCR 4-40 X 1/2 LG
610379 WASHER #4 NYLON
3 REQD

615044 SCR 4-40 X 3/8
610379 WASHER #4 NYLON
610177 SHOULDER WASHER #4 NYLON
SEE DETAIL C
3 REQD

J4

DETAIL B
TOP VIEW

2. SCHEMATIC REF NO. 430842.
1. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.

NOTES: UNLESS OTHERWISE SPECIFIED

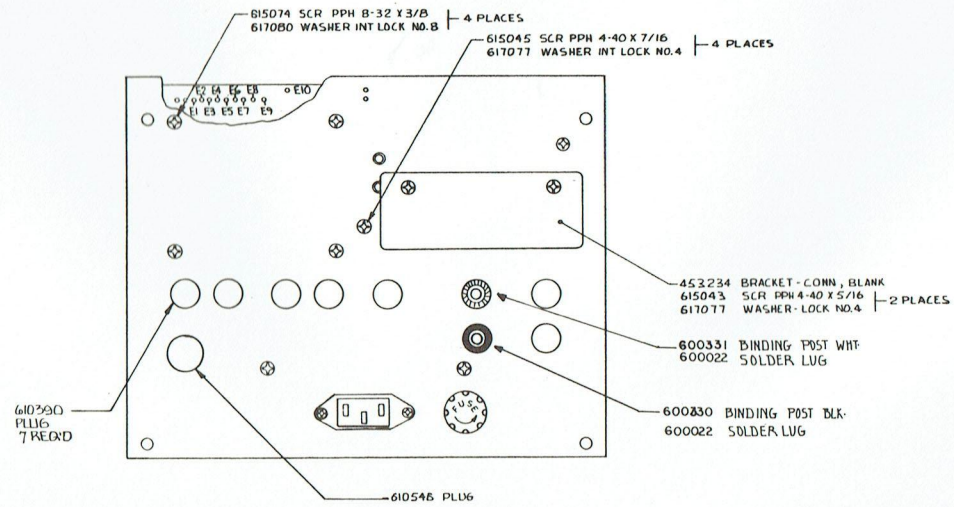
DANA 900346 DIETERICH POST CLEARPRINT 1080

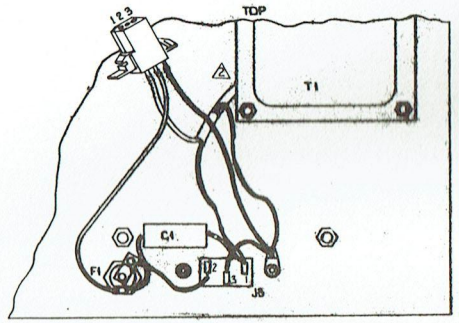
DANA DANA LABORATORIES INC.
IRVINE, CALIFORNIA

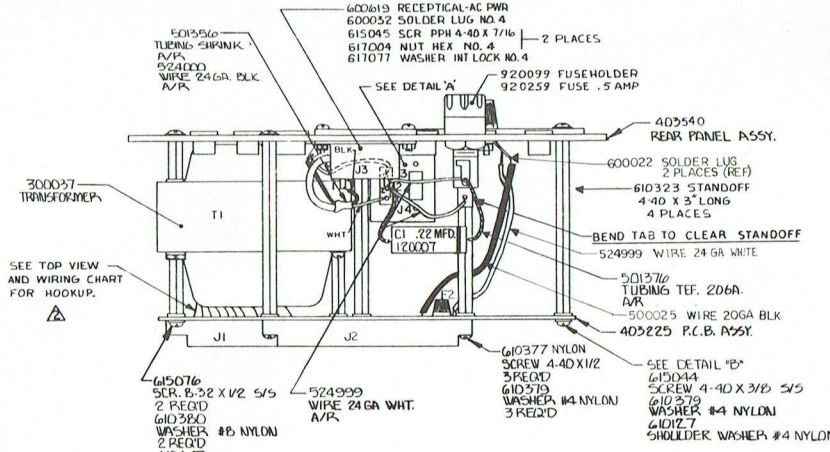
ASSY- POWER SUPPLY
FULL RACK

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	403543	E

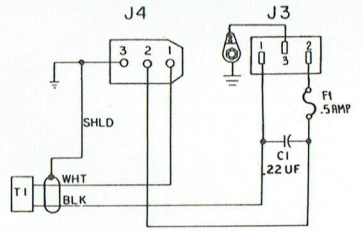
SCALE 1/1 SHEET 1 OF 5



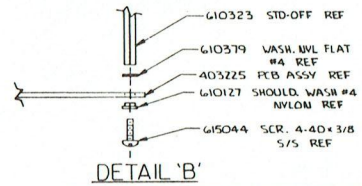




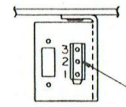
WIRING CHART			
E NO	P N	COLOR	TI
E1		WHT	T1
E2		ORG	
E3		BRN	
E4		VIO	
E5		YEL	
E6		BLU	
E7		RED	
E8		GRN	
E9		GRY	
E10		BLK	T1
E18		WHT	J9
E14		BLK	J10



WIRING DETAIL



DETAIL 'B'



DETAIL 'A'
TOP VIEW

⚠ ALLOW GENEROUS SERVICE LOOP IN PRIMARY & SECONDARY WHEN PREPARING XFMR. FOR ASSY.

1 ASSY PROCEDURES & PROCESSES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

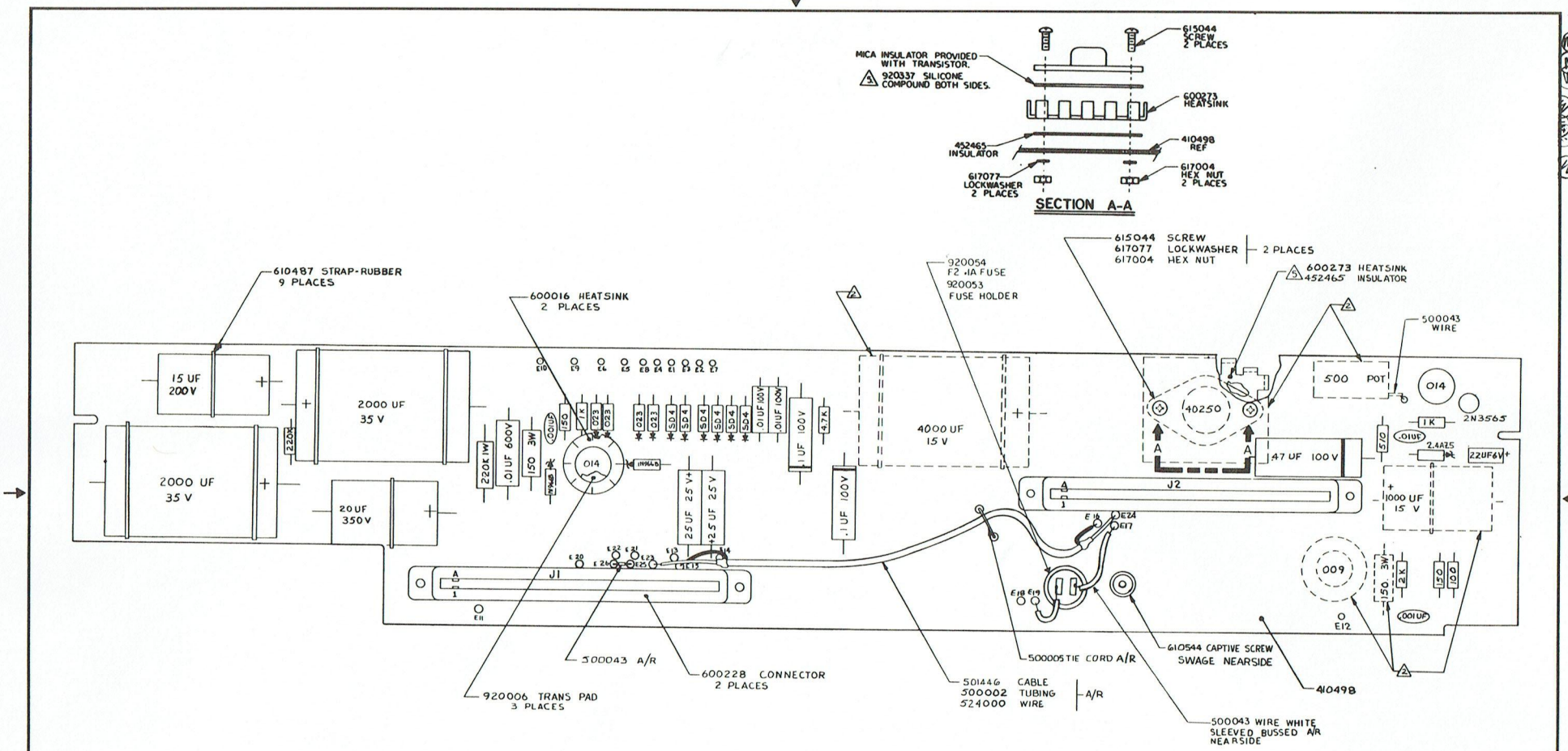
NOTES: UNLESS OTHERWISE SPECIFIED

DANA DANA LABORATORIES INC.
IRVINE, CALIFORNIA

POWER SUPPLY ASSY
HALF RACK

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	403542	

SCALE 2:1 SHEET / OF 3



5 PUT SILICONE COMPOUND 920327 ON BOTH SIDES OF THE MICA INSULATOR PROVIDED WITH THE 40250 PWR TRANSISTOR.
4 ALL RESISTORS ARE IN OHMS 1/4W, ± 5% CARBON
3 REF SCHEMATIC NO. 430842.
2 COMPONENTS LOCATED FARSIDE.
1. ASSEMBLY PROCESSES AND PROCEDURES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

NOTES: UNLESS OTHERWISE SPECIFIED

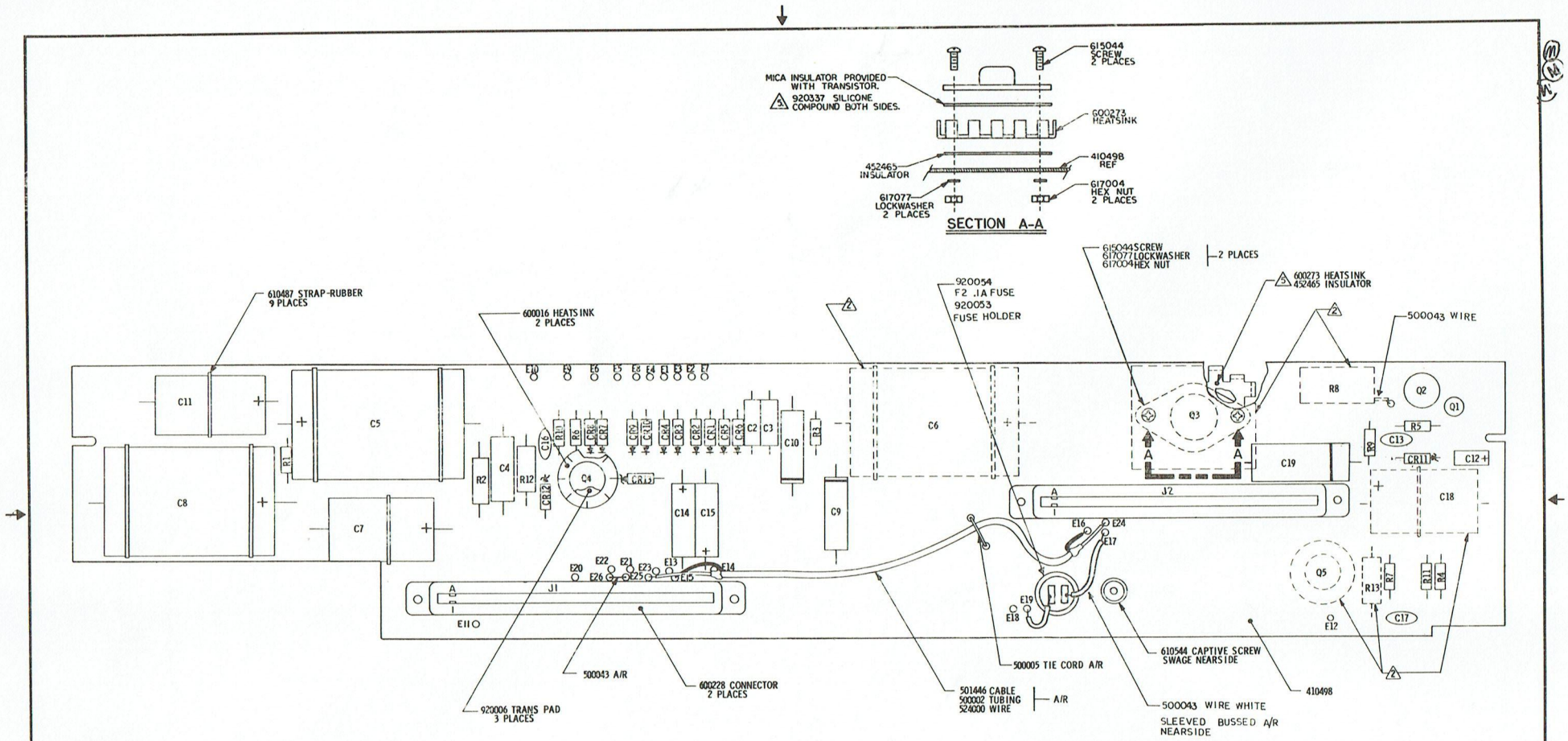
DANA DANA LABORATORIES INC. IRVINE, CALIFORNIA

P C BOARD ASSY POWER SUPPLY FULL RACK

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	403081	J

SCALE 2/1 SHEET 1 OF 3

SHEETS 3, 4, 5 ARE 'A' SIZE



△5 PUT SILICONE COMPOUND 920337 ON BOTH SIDES OF THE MICA INSULATOR PROVIDED WITH THE 40250 PWR TRANSISTOR.

4. ALL RESISTORS ARE IN OHMS 1/4W, ±5% CARBON.
3. REF SCHEMATIC NO. 430842.
△2 COMPONENTS LOCATED FARSIDE.
1. ASSEMBLY PROCESSES AND PROCEDURES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

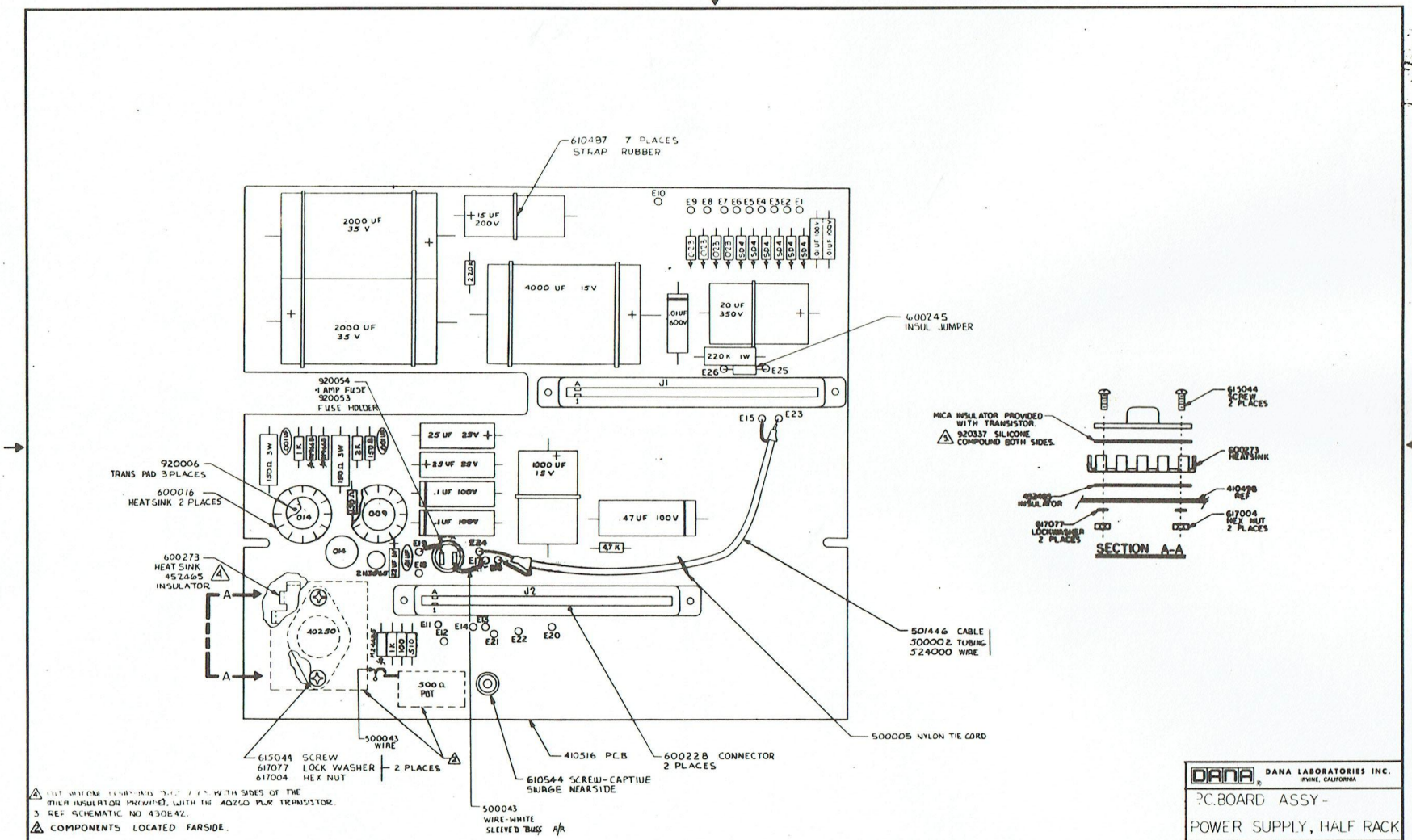
NOTES: UNLESS OTHERWISE SPECIFIED

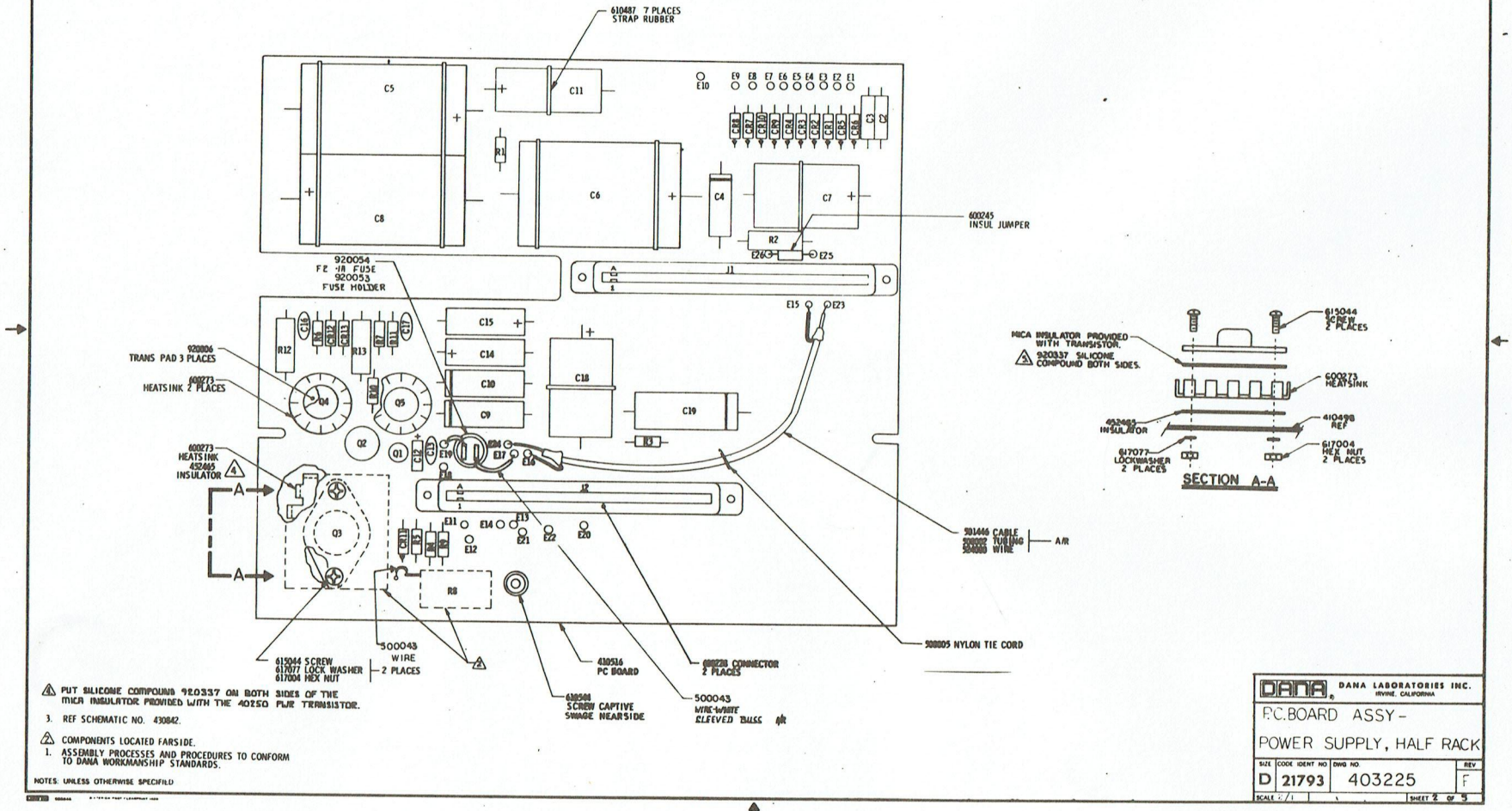
DANA DANA LABORATORIES INC. IRVINE, CALIFORNIA

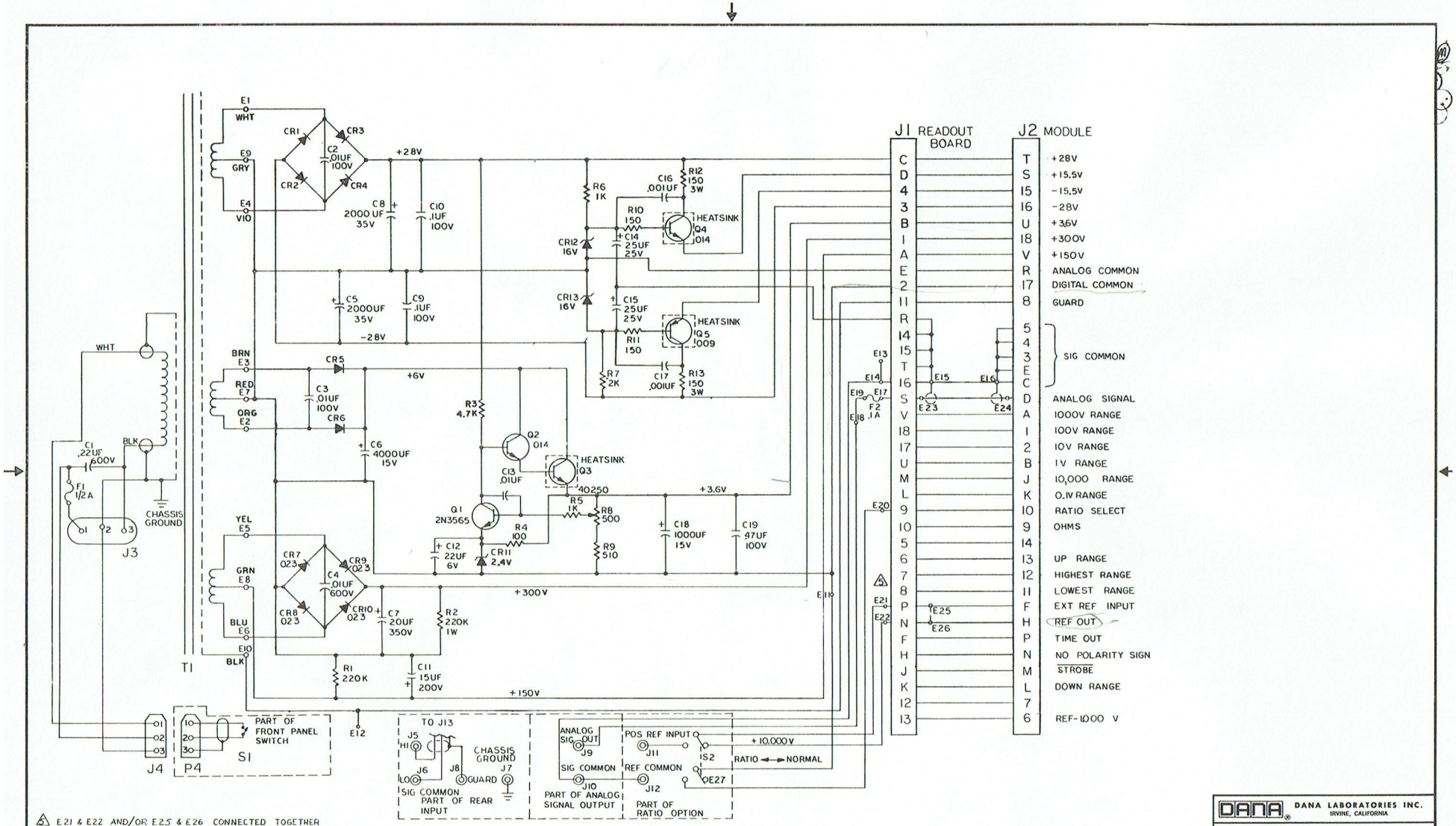
PC BOARD ASSY POWER SUPPLY FULL RACK

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	403081	J

SCALE 2/1 SHEET 2 OF 5


610487 7 PLACES
STRAP RUBBER
2000 UF 35 V
2000 UF 35 V
15 UF 200V
4000 UF 15V
20 UF 350V
.01UF 600V
220K 1W
E10
E9 E8 E7 E6 E5 E4 E3 E2 E1
E26
E25
600245 INSUL JUMPER
920054 1 AMP FUSE
920053 FUSE HOLDER
J1
E15
E23
MICA INSULATOR PROVIDED WITH TRANSISTOR.
920337 SILICONE COMPOUND BOTH SIDES.
615044 SCREW 2 PLACES
600273 HEATSINK
410498 REF
617004 HEX NUT 2 PLACES
617077 LOCKWASHER 2 PLACES
SECTION A-A
920006 TRANS PAD 3 PLACES
600016 HEATSINK 2 PLACES
25 UF 25V
2.5 UF 88V
.1 UF 100V
.1UF 100V
1000 UF 15V
.47UF 100V
47K
600273 HEAT SINK 952465 INSULATOR
402.50
J2
E11 E12 E14 E18 E21 E22 E20
300Ω POT
500043 WIRE
615044 SCREW
617077 LOCK WASHER
617004 HEX NUT
2 PLACES
610544 SCREW-CAPTIVE SWAGE NEARSIDE
410516 P.C.B
600228 CONNECTOR 2 PLACES
501446 CABLE
300002 TUBING
524000 WIRE
500005 NYLON TIE CORD
500043 WIRE-WHITE SLEEVED BUSS A/R
3 REF SCHEMATIC NO 430842.
COMPONENTS LOCATED FARSIDE.
1 ASSEMBLY PROCESSES AND PROCEDURES TO CONFORM TO DANA WORKMANSHIP STANDARDS.
NOTES: UNLESS OTHERWISE SPECIFIED
DANA DANA LABORATORIES INC.
IRVINE, CALIFORNIA
P.C.BOARD ASSY-
POWER SUPPLY, HALF RACK
SIZE D
CODE IDENT NO 21793
DWG NO 403225
REV F
SCALE 2/1
SHEET 1 OF 3


610487 7 PLACES
STRAP RUBBER
600245
INSUL JUMPER
920054
FE 4A FUSE
920053
FUSE HOLDER
920806
TRANS PAD 3 PLACES
600273
HEATSINK 2 PLACES
600273
HEATSINK
452465
INSULATOR
615044 SCREW
617077 LOCK WASHER
617004 HEX NUT
500043
WIRE
2 PLACES
610516
PC BOARD
610508
SCREW CAPTIVE
SWAGE NEARSIDE
500043
WIRE-WRITE
SLEEVED BLUE
600228 CONNECTOR
2 PLACES
500005 NYLON TIE CORD
501446 CABLE
500002 TUBING
500003 WIRE
A/R
MICA INSULATOR PROVIDED WITH TRANSISTOR.
920337 SILICONE COMPOUND BOTH SIDES.
615044
SCREW
2 PLACES
600273
HEATSINK
452465
INSULATOR
410498
REF
617077
LOCKWASHER
2 PLACES
617004
HEX NUT
2 PLACES
SECTION A-A
PUT SILICONE COMPOUND 920337 ON BOTH SIDES OF THE MICA INSULATOR PROVIDED WITH THE 40250 PWR TRANSISTOR.
3. REF SCHEMATIC NO. 430842.
COMPONENTS LOCATED FARSIDE.
1. ASSEMBLY PROCESSES AND PROCEDURES TO CONFORM TO DANA WORKMANSHIP STANDARDS.
NOTES: UNLESS OTHERWISE SPECIFIED
DANA LABORATORIES INC.
IRVINE, CALIFORNIA
P.C.BOARD ASSY-
POWER SUPPLY, HALF RACK
SIZE D
CODE IDENT NO 21793
DWG NO. 403225
REV F
SCALE 2/1
SHEET 2 OF 3



△ E21 & E22 AND/OR E25 & E26 CONNECTED TOGETHER WITHOUT RATIO OPTION.

4. HIGHEST REF DES USED : C19 ; CR13; E27 ; Q5 ; R13; J12; S2; T1; F2
3. ALL VOLTAGES ARE APPROX VALUES MEASURED WITH RESPECT TO ANALOG COMMON.
2. ALL RESISTOR VALUES ARE IN OHMS 1/4 W ±5% CARBON.
1. ALL DIODES ARE SD4

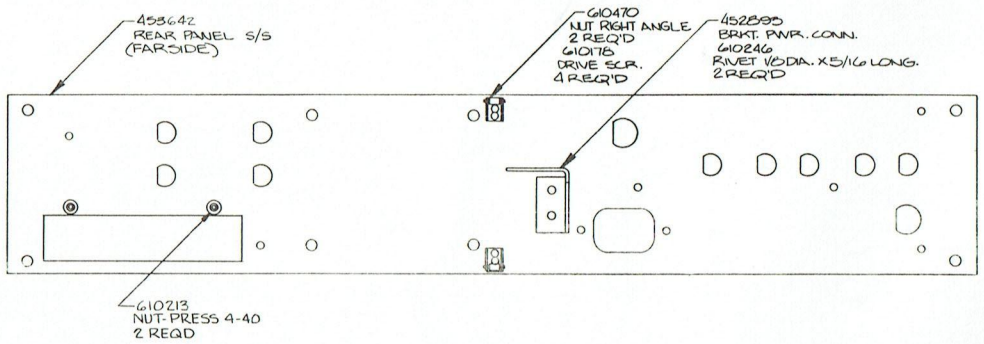
NOTES: UNLESS OTHERWISE SPECIFIED

DANA DANA LABORATORIES INC. IRVINE, CALIFORNIA

POWER SUPPLY
4500

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	430842	E

SCALE | SHEET 1 OF



1. ASSY. PROCEDURES AND PROCESSES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

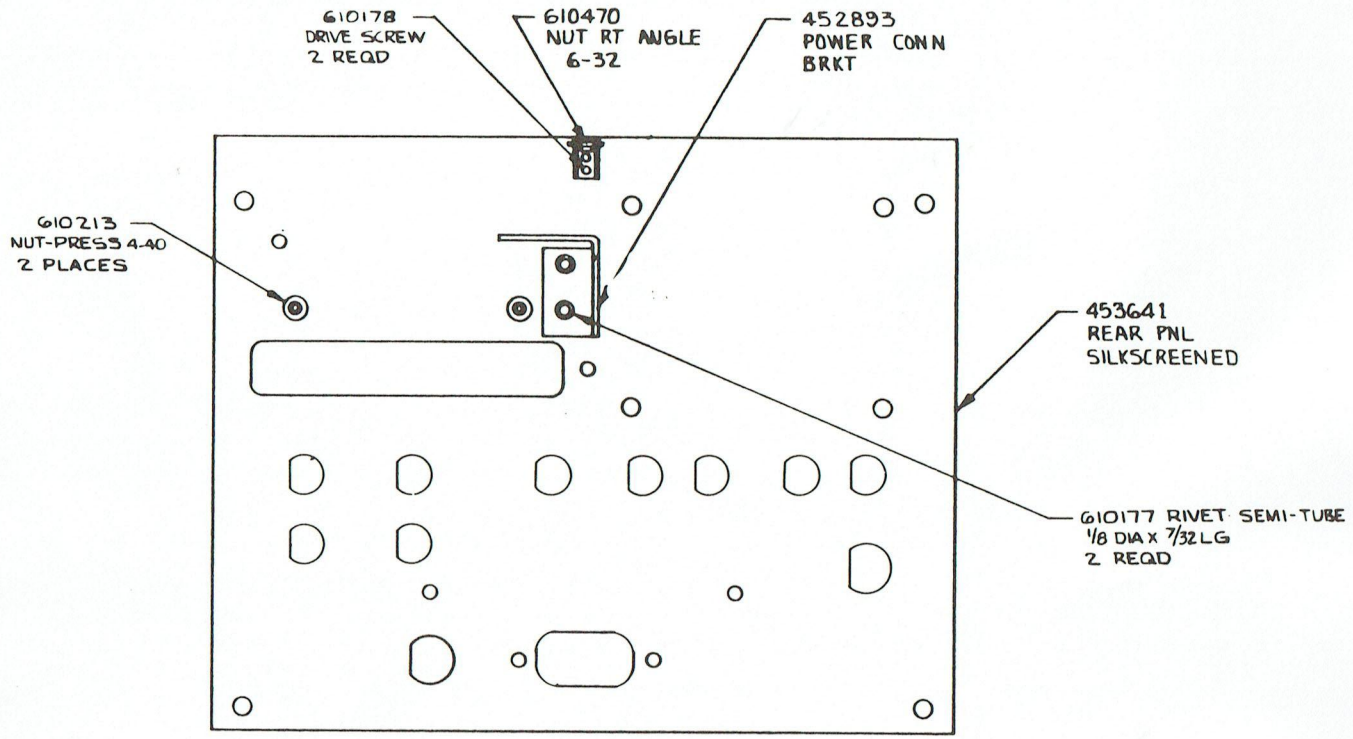
NOTES: UNLESS OTHERWISE SPECIFIED

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ASSY
REAR PANEL

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	403539	A

SCALE 1:1 | SHEET 1 OF 2



1. ASSY PROCEDURES AND PROCESSES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

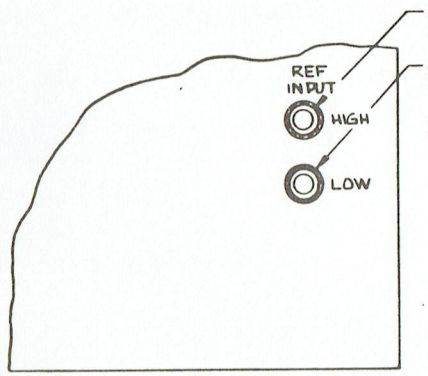
NOTES: UNLESS OTHERWISE SPECIFIED

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ASSY- REAR PANEL
HALF RACK

SIZE	CODE IDENT NO.	DWG NO.	REV
C	21793	403540	A

SCALE 1/1 SHEET 1 OF 2



600586
BINDING POST (WHITE)

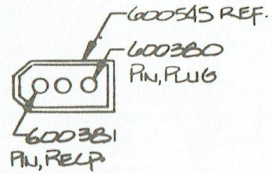
600587
BINDING POST (BLACK)

600022
#6 SOLDER LUG
2 REQ'D

453555
FRONT POLAROID

600510
SWITCH

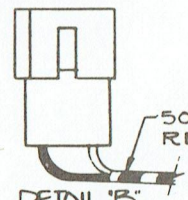
DETAIL "A"



600545 REF.

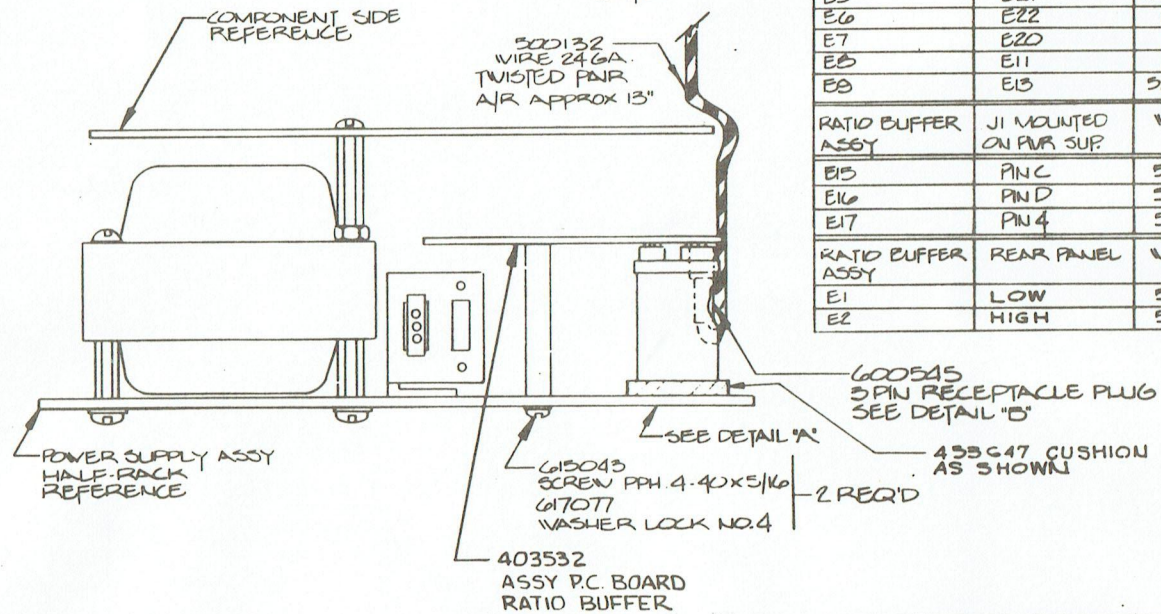
600380
PIN, PLUG

600381
PIN, RECP



500132
REF.

DETAIL "B"
SCALE 2:1



WIRE SCHEMATIC 3.

ALL WIRE AWG #24 VINYL INSULATION

RATIO BUFFER ASSY	POWER SUPPLY	WIRE P/N
E5	E21	524000
E6	E22	111
E7	E20	222
E8	E11	333
E9	E13	524444
RATIO BUFFER ASSY	J1 MOUNTED ON PWR SUP	WIRE P/N
E15	PIN C	524555
E16	PIN D	524666
E17	PIN 4	524777
RATIO BUFFER ASSY	REAR PANEL	WIRE P/N
E1	LOW	524888
E2	HIGH	524999

3. REMOVE JUMPER BETWEEN E25 & E26 ON POWER SUPPLY ASSY, 403225
2. SCHEMATIC #430973
1. ASSY PROCESSES TO PROCEDURES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.

NOTES: UNLESS OTHERWISE SPECIFIED

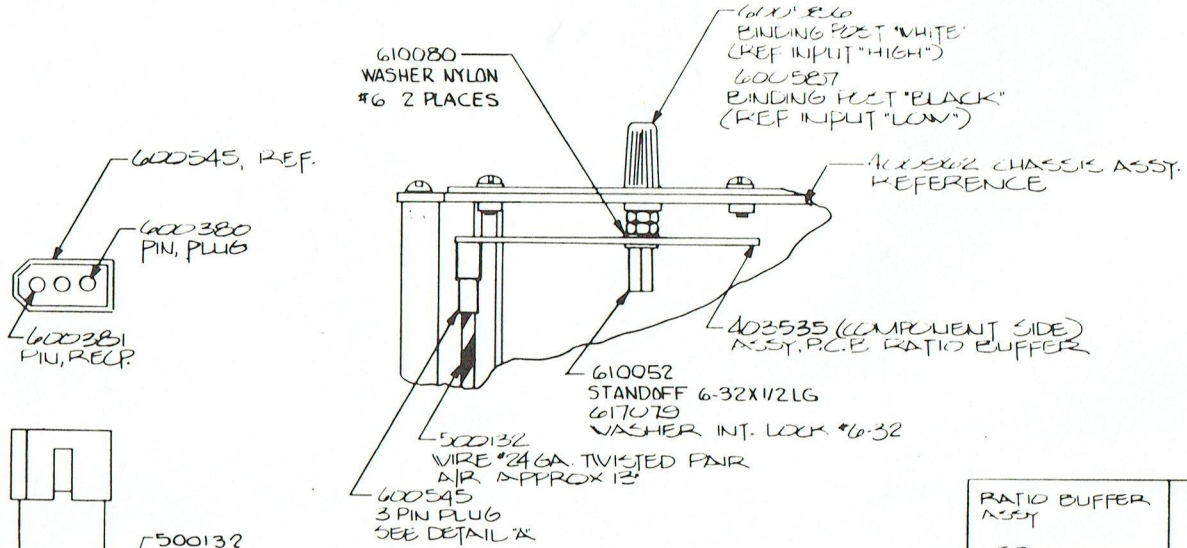
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ASSY RATIO BUFFER OPTION HALF-RACK

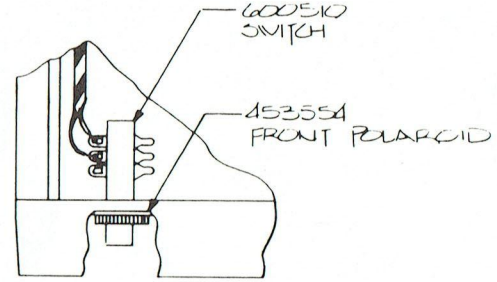
SIZE	CODE IDENT NO.	DWG NO.	REV
C	21793	403533	B

SCALE 1:1 SHEET 1 OF 2

SHEET 2 IS "A" SIZE



DETAIL "A"
SCALE 2:1



RATIO BUFFER ASSY	POWER SUPPLY ASSY 403081	WIRE P/N
E5	E21	524000
E6	E22	524111
E7	E20	524222
E8	E11	524333
E9	E13	524444

RATIO BUFFER ASSY	J1 (READOUT BD) MOUNTED ON PWR SUP. BD.	WIRE P/N
E15	PIN C	524555
E16	PIN D	524666
E17	PIN 4	524777

3. WIRING SCHEMATIC

ALL WIRE AWG #24 VINYL INSULATION

3. REMOVE JUMPER BETWEEN E25 & E26 ON POWER SUPPLY ASSY, 403081.

2. SCHEMATIC REF #430973

1. ASSY PROCESS & PROCEDURES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

NOTES: UNLESS OTHERWISE SPECIFIED

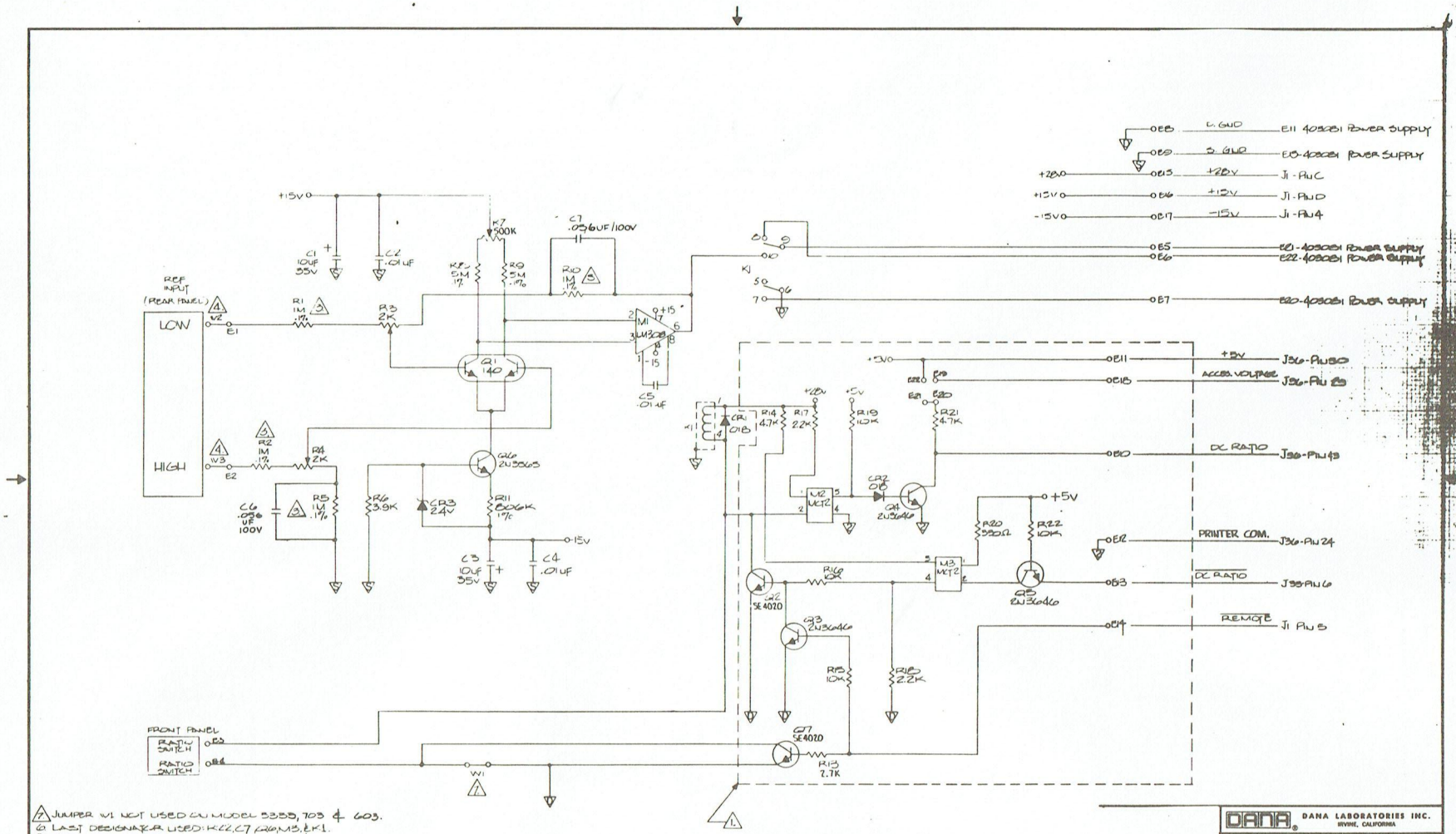
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ASSY RATIO BUFFER OPTION

SIZE	CODE IDENT NO.	DWG NO.	REV
C	21793	403536	B

SCALE 1:1 SHEET 1 OF 2

SHEET 2 IS "A" SIZE



1. JUMPER W1 NOT USED ON MODEL 5353, 703 & 603.
2. LAST DESIGNATOR USED: K22, C7, R20, M3, Q7, K1.
3. R12 DESIGNATOR NOT USED.
4. JUMPERS W2 & W3 USED ON 5353/5330 ONLY.
5. MATCHED RESISTOR SET P/N
6. ALL RESISTORS VALUES 1/4W 1% CARBON COMP.
7. COMPONENTS IN DOTTED AREA USED ONLY ON MODEL 5353, 703 & 603.

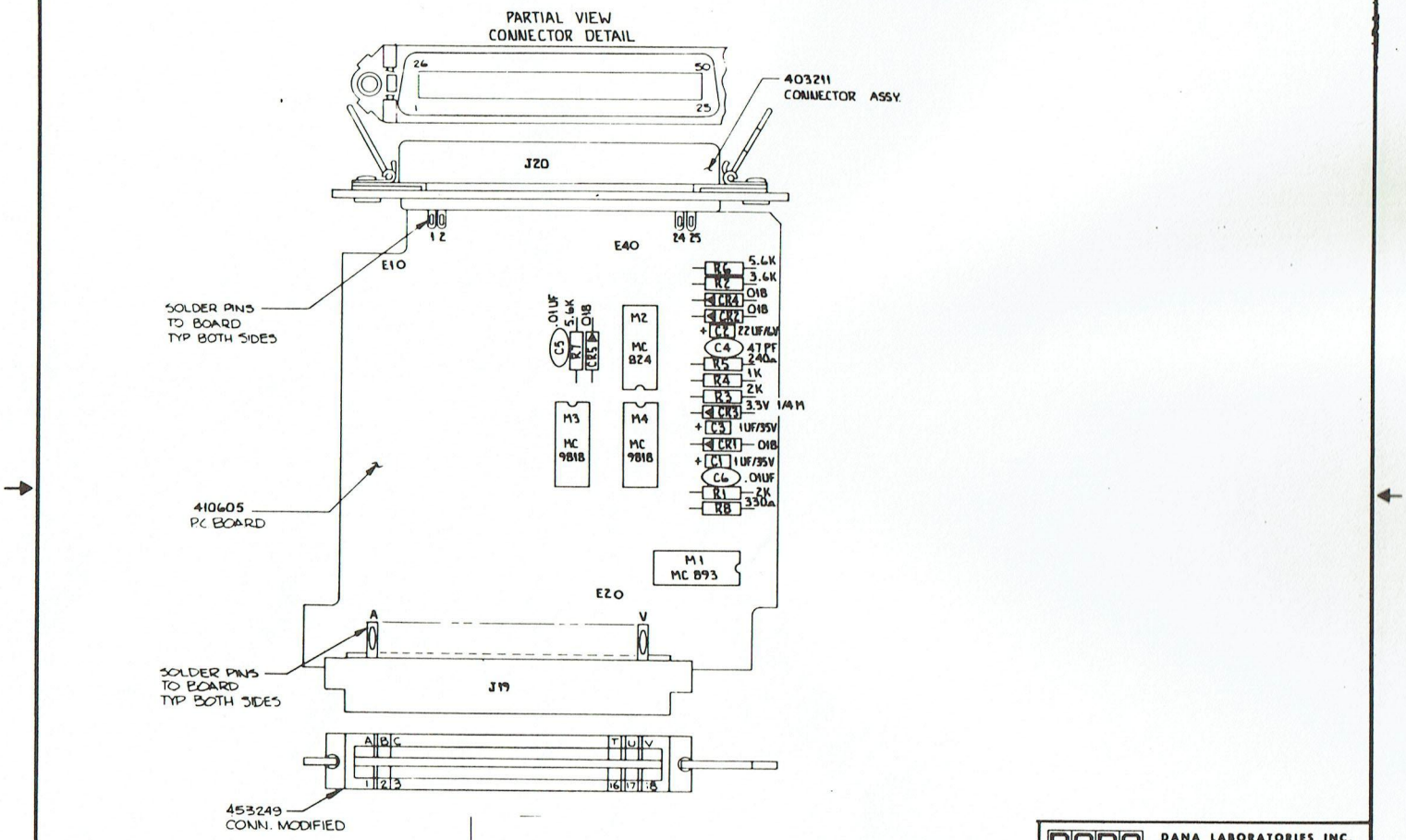
NOTES: UNLESS OTHERWISE SPECIFIED

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC RATIO BUFFER OPTION

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	430975	C

SCALE —— SHEET 1 OF 1



2. SCHEMATIC # 430967

1. ASSY PROCESSES AND PROCEDURES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

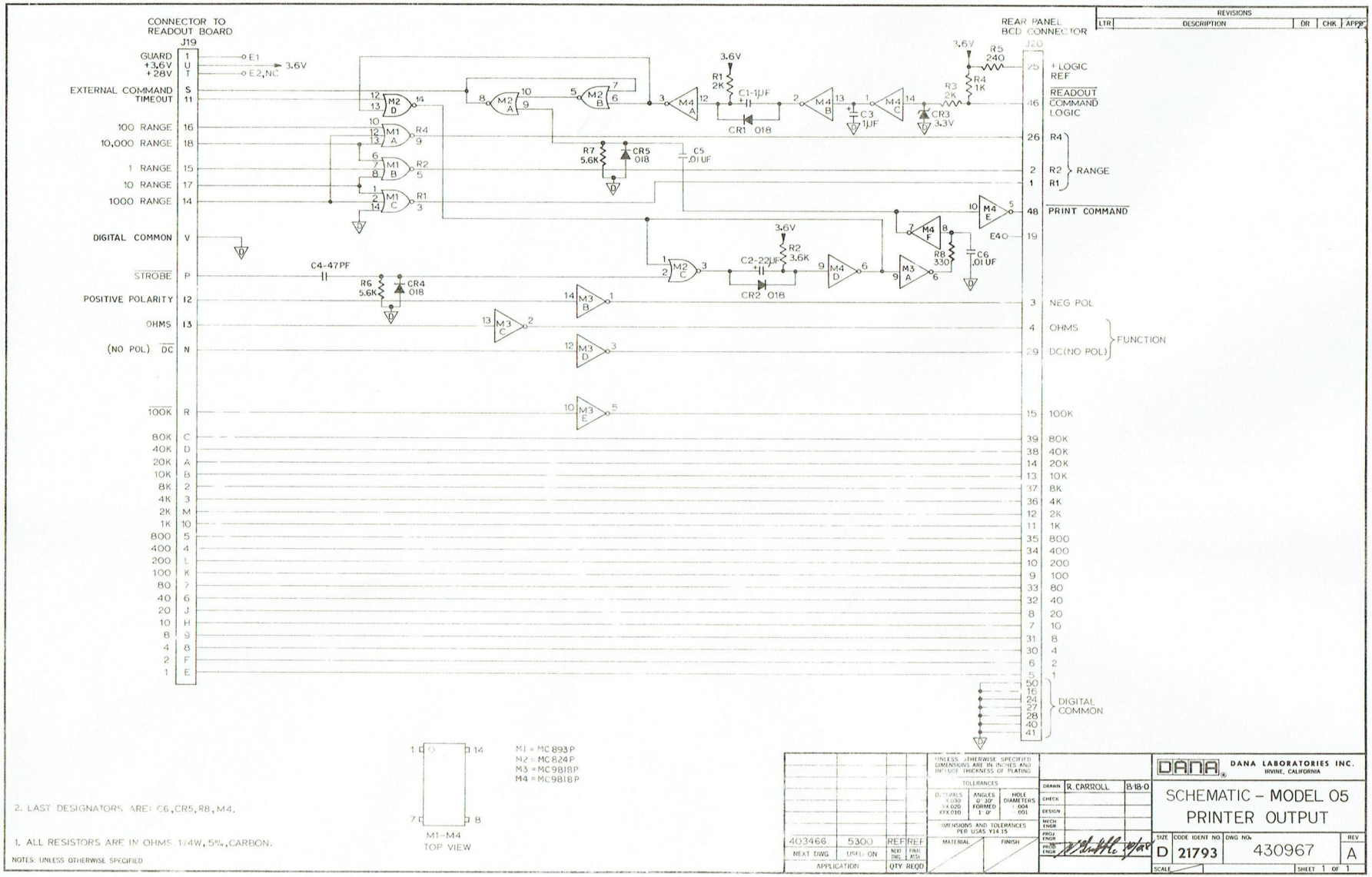
NOTES: UNLESS OTHERWISE SPECIFIED

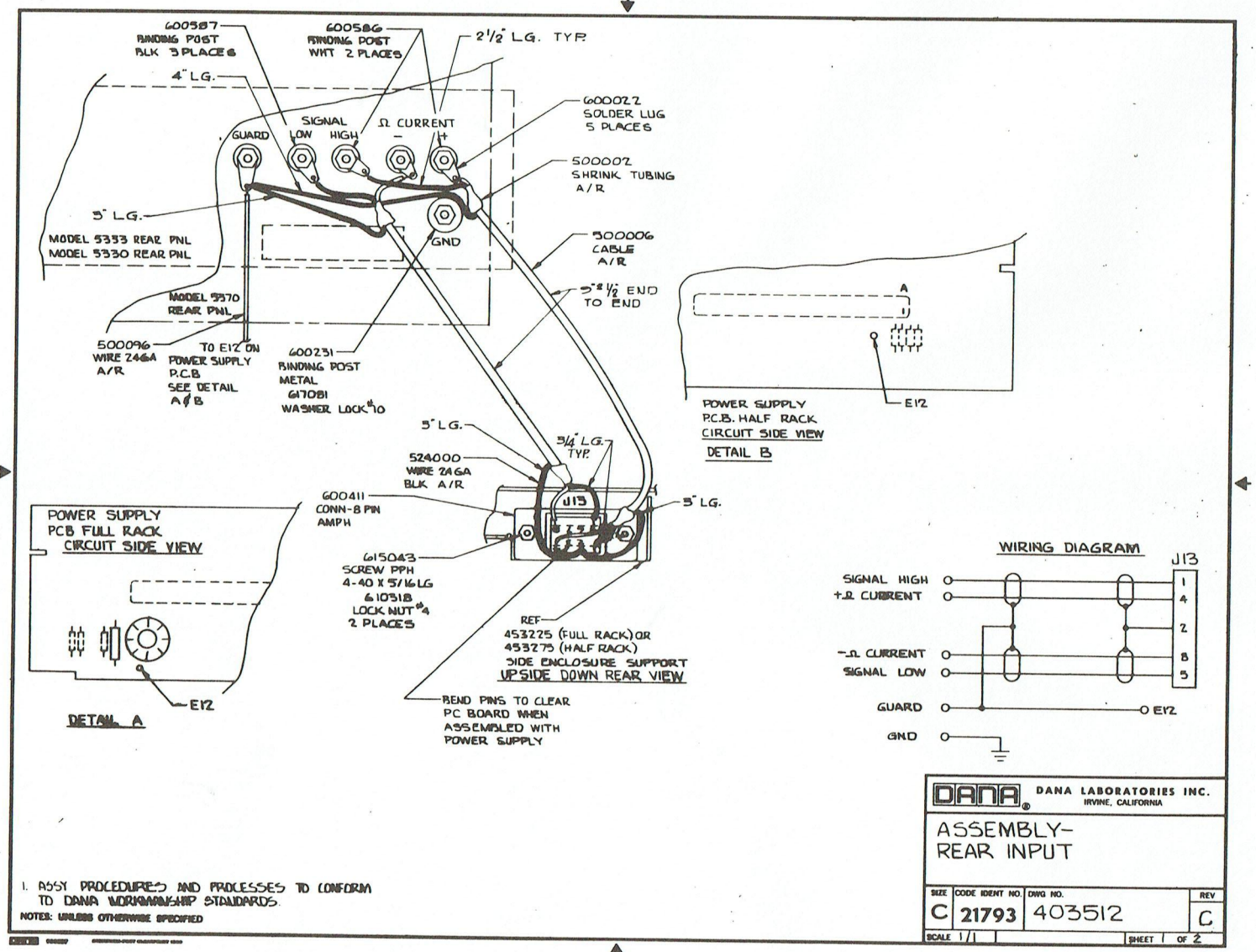
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

PC BOARD ASSY
BCD OUTPUT

SIZE	CODE IDENT NO	DWG NO.	REV
C	21793	403466	A

SCALE 2/1 SHEET 1 OF 2


CONNECTOR TO READOUT BOARD
J19
REAR PANEL BCD CONNECTOR
J20
GUARD 1
+3.6V U
+28V T
E1
E2,NC
3.6V
EXTERNAL COMMAND TIMEOUT S 11
100 RANGE 16
10,000 RANGE 18
1 RANGE 15
10 RANGE 17
1000 RANGE 14
DIGITAL COMMON V
STROBE P
POSITIVE POLARITY 12
OHMS 13
(NO POL) DC N
100K R
80K C
40K D
20K A
10K B
8K 2
4K 3
2K M
1K 10
800 5
400 4
200 L
100 K
80 7
40 6
20 J
10 H
8 9
4 8
2 F
1 E
M2 D
M2 A
M2 B
M4 A
M4 B
M4 C
M1 A
M1 B
M1 C
M2 C
M4 D
M4 E
M4 F
M3 A
M3 B
M3 C
M3 D
M3 E
R1 2K
C1-1UF
CR1 018
R2 3.6K
C2-22UF
CR2 018
C3 1UF
CR3 3.3V
R3 2K
R4 1K
R5 240
R6 5.6K
CR4 018
C4-47PF
R7 5.6K
CR5 018
C5 .01 UF
R8 330
C6 .01 UF
25 +LOGIC REF
16 READOUT COMMAND LOGIC
26 R4
2 R2
1 R1
RANGE
48 PRINT COMMAND
19 E40
3 NEG POL
4 OHMS
29 DC(NO POL)
FUNCTION
15 100K
39 80K
38 40K
14 20K
13 10K
37 8K
36 4K
12 2K
11 1K
35 800
34 400
10 200
9 100
33 80
32 40
8 20
7 10
31 8
30 4
6 2
5 1
50
16
24
27
28
40
41
DIGITAL COMMON
M1 = MC 893P
M2 = MC 824P
M3 = MC 9818P
M4 = MC 9818P
M1-M4 TOP VIEW
2. LAST DESIGNATORS ARE: C6, CR5, R8, M4.
1. ALL RESISTORS ARE IN OHMS, 1/4W, 5%, CARBON.
NOTES: UNLESS OTHERWISE SPECIFIED
REVISIONS
LTR DESCRIPTION DR CHK APP'D
DANA DANA LABORATORIES INC. IRVINE, CALIFORNIA
SCHEMATIC – MODEL 05
PRINTER OUTPUT
DRAWN R. CARROLL 8-18-0
CHECK
DESIGN
MECH ENGR
PROJ ENGR
PROD ENGR
403466 5300 REF REF
NEXT DWG USED ON NEXT DWG FINAL
APPLICATION QTY REQD
SIZE D
CODE IDENT NO. 21793
DWG NO. 430967
REV A
SCALE
SHEET 1 OF 1



1. ASSY PROCEDURES AND PROCESSES TO CONFORM TO DANA WORKMANSHIP STANDARDS.

NOTE: UNLESS OTHERWISE SPECIFIED

DANA® DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ASSEMBLY-
REAR INPUT

SIZE	CODE IDENT NO.	DWG NO.	REV
C	21793	403512	C

SCALE 1/1 SHEET 1 OF 2

PARTS LIST

ASSEMBLY 403446 - Model 5330/5370

A

REF. DESIG.	PART NO.	DESCRIPTION						
CR01	211083	DIODE SILICO	018			DANA	211083	
CR02	211083	DIODE SILICO	018			DANA	211083	
CR03	211083	DIODE SILICO	018			DANA	211083	
CR04	211083	DIODE SILICO	018			DANA	211083	
CR05	211083	DIODE SILICO	018			DANA	211083	
CR06	211236	DIODE SILICO	007			DANA	211236	
CR07	211236	DIODE SILICO	007			DANA	211236	
CR08	211236	DIODE SILICO	007			DANA	211236	
CR09	403294	BRIDGE ELEMENT				DANA	403294	
CR10	211083	DIODE SILICO	018			DANA	211083	
CR11	211083	DIODE SILICO	018			DANA	211083	
CR12	220019	DIODE SILICO ZENER	1N752A			MOTOROLA	1N752A	
CR13	220019	DIODE SILICO ZENER	1N752A			MOTOROLA	1N752A	
CR14	211236	DIODE SILICO	007			DANA	211236	
CR15	211236	DIODE SILICO	007			DANA	211236	
CR16	211083	DIODE SILICO	018			DANA	211083	
CR17	211083	DIODE SILICO	018			DANA	211083	
CR18	221255	DIODE SILICO ZENER	1N969A			MOTOROLA	1N969A	
C01	101174	CAP CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C02	101174	CAP CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C03	101646	CAP CERAM	250 PFD		10%	AEROVOX	TCDN4700	
C04	100023	CAP	.01 MF TYPE TTP			AEROVOX	100V	
C05	100023	CAP	.01 MF TYPE TTP			AEROVOX	100V	
C06	101174	CAP CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C07	100019	CAP CERAM	.002 MFD	10000V		SPRAGUE	5GA-D20	
C08	100019	CAP CERAM	.002 MFD	10000V		SPRAGUE	5GA-D20	
C09	110001	CAP TANTA	6.8 MFD	35 V	10%	KEMET	K6R8C35K	
C10	110001	CAP TANTA	6.8 MFD	35 V	10%	KEMET	K6R8C35K	
C11	110032	CAP TANTA	22 MFD	15 V	10%	KEMET	K22C15K	
C12	100023	CAP	.01 MF TYPE TTP			AEROVOX	100V	
C13	101174	CAP CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C14	110043	CAP ELECT	25 MFD	25 V	20%	DUCATI	25-25	
C15	101182	CAP CERAM	47 PFD	500 V	10%	AEROVOX	TCD-N750	
C16	101641	CAP CERAM	470 PFD	500 V	10%	AEROVOX	SCD1X5F	
C17	101175	CAP CERAM	220 PFD	500 V	10%	AEROVOX	SCD1X5F	
C18	101641	CAP CERAM	470 PFD	500 V	10%	AEROVOX	SCD1X5F	

PARTS LIST

ASSEMBLY 403446 - Model 5330/5370

A

REF. DESIG.	PART NO.	DESCRIPTION							
C19	101641	CAP	CERAM	470 PFD	500 V	10%	AEROVOX	SCD1X5F	
C20	110001	CAP	TANTA	6.8 MFD	35 V	10%	KEMET	K6R8C35K	
C21	110001	CAP	TANTA	6.8 MFD	35 V	10%	KEMET	K6R8C35K	
C22	101174	CAP	CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C23	110047	CAP	ELECT	50 MFD	50 V	20%	DUCATI	50-50	
C24	100023	CAP		.01 MF TYPE TTP			AEROVOX	100V	
C25	100016	CAP	CERAM	27 PFD			AEROVOX	N750	
C26	100016	CAP	CERAM	27 PFD			AEROVOX	N750	
C27	100016	CAP	CERAM	27 PFD			AEROVOX	N750	
C28	100016	CAP	CERAM	27 PFD			AEROVOX	N750	
C29	101174	CAP	CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C30	101174	CAP	CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C31	120003	CAP	MYLAR	.1 MFD	100 V	10%	CDE	WMF1P1	
C32	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750	
C33	120208	CAP	POLYS	55 MFD	63 V	5%	MIAL	602	
C34	121091	CAP	MYLAR	.033 MFD	100 V	10%	CDE	WMF1533	
C35	100023	CAP		.01 MF TYPE TTP			AEROVOX	100V	
C36	100023	CAP		.01 MF TYPE TTP			AEROVOX	100V	
C37	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750	
C38	101182	CAP	CERAM	47 PFD	500 V	10%	AEROVOX	TCD-N750	
C39	101182	CAP	CERAM	47 PFD	500 V	10%	AEROVOX	TCD-N750	
C40	101174	CAP	CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F	
C41	101145	CAP	CERAM	100 PFD	500 V	10%	AEROVOX	SCD1X5F	
L01	310033	CHOKE		U1100 MH			MILLER	9210-76	
M01	230022	INTEGRATED CIRCUIT		MC889P			M MOTOROLA	MC889P	
M02	230019	INTEGRATED CIRCUIT		MC824P			MOTOROLA	MC824P	
M03	230019	INTEGRATED CIRCUIT		MC824P			MOTOROLA	MC824P	
M04	230053	INTEGRATED CIRCUIT		MC892P			MOTOROLA	MC892P	
M05	230019	INTEGRATED CIRCUIT		MC824P			MOTOROLA	MC824P	
M06	230018	INTEGRATED CIRCUIT		MC817P			MOTOROLA	MC817P	
M07	230023	INTEGRATED CIRCUIT		MC890P			MOTOROLA	MC890P	
M08	230023	INTEGRATED CIRCUIT		MC890P			MOTOROLA	MC890P	
M09	230052	INTEGRATED CIRCUIT		MC879P			MOTOROLA	MC879P	
M10	230049	INTEGRATED CIRCUIT		CUL9958			FAIRCHILD	CUL9958	
M11	230049	INTEGRATED CIRCUIT		CUL9958			FAIRCHILD	CUL9958	
M12	230049	INTEGRATED CIRCUIT		CUL9958			FAIRCHILD	CUL9958	

PARTS LIST

ASSEMBLY 403446 - Model 5330/5370

A

REF. DESIG.	PART NO.	DESCRIPTION		
M13	230049	INTEGRATED CIRCUIT	CUL9958	FAIRCHILD CUL9958
M14	230050	INTEGRATED CIRCUIT	CUL9959	FAIRCHILD CUL9959
M15	230050	INTEGRATED CIRCUIT	CUL9959	FAIRCHILD CUL9959
M16	230050	INTEGRATED CIRCUIT	CUL9959	FAIRCHILD CUL9959
M17	230050	INTEGRATED CIRCUIT	CUL9959	FAIRCHILD CUL9959
M18	230049	INTEGRATED CIRCUIT	CUL9958	FAIRCHILD CUL9958
M19	230014	INTEGRATED CIRCUIT	UL9960	FAIRCHILD UL9960
M20	230014	INTEGRATED CIRCUIT	UL9960	FAIRCHILD UL9960
M21	230014	INTEGRATED CIRCUIT	UL9960	FAIRCHILD UL9960
M22	230014	INTEGRATED CIRCUIT	UL9960	FAIRCHILD UL9960
M23	230014	INTEGRATED CIRCUIT	UL9960	FAIRCHILD UL9960
M24	230050	INTEGRATED CIRCUIT	CUL9959	FAIRCHILD CUL9959
M25	230054	INTEGRATED CIRCUIT	LM301A	NAT SEMI LM301A
M26	230054	INTEGRATED CIRCUIT	LM301A	NAT SEMI LM301A
M27	230026	INTEGRATED CIRCUIT	MC709C	MOTOROLA MC709C
M28	230054	INTEGRATED CIRCUIT	LM301A	NAT SEMI LM301A
Q01	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q02	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q03	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q04	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q05	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q06	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q07	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q08	200087	TRANS SILICO	021	MOTOROLA SPS1226
Q09	200037	TRANS SILICO NPN	2N3646	FAIRCHILD 2N3646
Q10	200043	TRANS SILICO NPN	2N3565	FAIRCHILD 2N3565
Q11	200052	TRANS SILICO PNP	009	DANA 200052
Q12	200022	TRANS SILICO PNP	012	DANA 200022
Q13	200035	TRANS SILICO NPN	014	DANA 200035
Q14	200052	TRANS SILICO PNP	009	DANA 200052
Q15	200037	TRANS SILICO NPN	2N3646	FAIRCHILD 2N3646
Q16	200022	TRANS SILICO PNP	012	DANA 200022
Q17	200043	TRANS SILICO NPN	2N3565	FAIRCHILD 2N3565
Q18	200022	TRANS SILICO PNP	012	DANA 200022
Q19	200022	TRANS SILICO PNP	012	DANA 200022

PARTS LIST

ASSEMBLY 403446 - Model 5330/5370

A

REF. DESIG.	PART NO.	DESCRIPTION							
Q20	200037	TRANS	SILICO	NPN	2N3646			FAIRCHILD	2N3646
Q21	200103	TRANS			TIS 74			TI	TIS 74
Q22	200103	TRANS			TIS 74			TI	TIS 74
Q23	200103	TRANS			TIS 74			TI	TIS 74
Q24	200103	TRANS			TIS 74			TI	TIS 74
Q25	200043	TRANS	SILICO	NPN	2N3565			FAIRCHILD	2N3565
Q26	200043	TRANS	SILICO	NPN	2N3565			FAIRCHILD	2N3565
Q27	200087	TRANS	SILICO		021			MOTOROLA	SPS1226
Q28	200087	TRANS	SILICO		021			MOTOROLA	SPS1226
Q31	200087	TRANS	SILICO		021			MOTOROLA	SPS1226
R01	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R02	001745	RES	CARBON	56 K	5%	1/2 W		OHMITE	RC20GF563J
R03	001745	RES	CARBON	56 K	5%	1/2 W		OHMITE	RC20GF563J
R04	001745	RES	CARBON	56 K	5%	1/2 W		OHMITE	RC20GF563J
R05	001745	RES	CARBON	56 K	5%	1/2 W		OHMITE	RC20GF563J
R06	001745	RES	CARBON	56 K	5%	1/2 W		OHMITE	RC20GF563J
R07	000623	RES	CARBON	62 K	5%	1/4 W		OHMITE	RC07GF623J
R09	000105	RES	CARBON	1 M	5%	1/4 W		OHMITE	RC07GF105J
R10	000623	RES	CARBON	62 K	5%	1/4 W		OHMITE	RC07GF623J
R11	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R12	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R13	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R14	000331	RES	CARBON	330 OHM	5%	1/4 W		OHMITE	RC07GF331J
R15	000391	RES	CARBON	390 OHM	5%	1/4 W		OHMITE	RC07GF391J
R16	000391	RES	CARBON	390 OHM	5%	1/4 W		OHMITE	RC07GF391J
R17	000391	RES	CARBON	390 OHM	5%	1/4 W		OHMITE	RC07GF391J
R18	000122	RES	CARBON	1.2 K	5%	1/4 W		OHMITE	RC07GF122J
R20	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R21	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R22	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R23	000302	RES	CARBON	3 K	5%	1/4 W		OHMITE	RC07GF302J
R24	000202	RES	CARBON	2 K	5%	1/4 W		OHMITE	RC07GF202J
R25	000202	RES	CARBON	2 K	5%	1/4 W		OHMITE	RC07GF202J
R26	000511	RES	CARBON	510 OHM	5%	1/4 W		OHMITE	RC07GF511J
R27	000203	RES	CARBON	20 K	5%	1/4 W		OHMITE	RC07GF203J
R28	000203	RES	CARBON	20 K	5%	1/4 W		OHMITE	RC07GF203J

PARTS LIST

ASSEMBLY 403446 - Model 5330/5370

REF. DESIG.	PART NO.	DESCRIPTION							
R29	000202	RES	CARBON	2	K	5%	1/4 W	OHMITE	RC07GF202J
R30	000302	RES	CARBON	3	K	5%	1/4 W	OHMITE	RC07GF302J
R32	000152	RES	CARBON	1.5	K	5%	1/4 W	OHMITE	RC07GF152J
R33	000122	RES	CARBON	1.2	K	5%	1/4 W	OHMITE	RC07GF122J
R34	000102	RES	CARBON	1	K	5%	1/4 W	OHMITE	RC07GF102J
R35	000332	RES	CARBON	3.3	K	5%	1/4 W	OHMITE	RC07GF332J
R36	000202	RES	CARBON	2	K	5%	1/4 W	OHMITE	RC07GF202J
R37	000101	RES	CARBON	100	OHM	5%	1/4 W	OHMITE	RC07GF101J
R38	000101	RES	CARBON	100	OHM	5%	1/4 W	OHMITE	RC07GF101J
R39	001742	RES	CARBON	300	OHM	5%	1/2 W	OHMITE	RC20GF301J
R40	001742	RES	CARBON	300	OHM	5%	1/2 W	OHMITE	RC20GF301J
R41	000202	RES	CARBON	2	K	5%	1/4 W	OHMITE	RC07GF202J
R42	001742	RES	CARBON	300	OHM	5%	1/2 W	OHMITE	RC20GF301J
R43	000132	RES	CARBON	1.3	K	5%	1/4 W	OHMITE	RC07GF132J
R44	000202	RES	CARBON	2	K	5%	1/4 W	OHMITE	RC07GF202J
R45	000203	RES	CARBON	20	K	5%	1/4 W	OHMITE	RC07GF203J
R46	000152	RES	CARBON	1.5	K	5%	1/4 W	OHMITE	RC07GF152J
R47	000512	RES	CARBON	5.1	K	5%	1/4 W	OHMITE	RC07GF512J
R48	000153	RES	CARBON	15	K	5%	1/4 W	OHMITE	RC07GF153J
R49	000202	RES	CARBON	2	K	5%	1/4 W	OHMITE	RC07GF202J
R50	000510	RES	CARBON	51	OHM	5%	1/4 W	OHMITE	RC07GF510J
R51	000203	RES	CARBON	20	K	5%	1/4 W	OHMITE	RC07GF203J
R52	000393	RES	CARBON	39	K	5%	1/4 W	OHMITE	RC07GF393J
R53	010292	RES	METAL	200	K	.25%	1/2 W	PYROFILM	PME65T200K
R54	000104	RES	CARBON	100	K	5%	1/4 W	OHMITE	RC07GF104J
R55	000105	RES	CARBON	1	M	5%	1/4 W	OHMITE	RC07GF105J
R56	000105	RES	CARBON	1	M	5%	1/4 W	OHMITE	RC07GF105J
R57	000104	RES	CARBON	100	K	5%	1/4 W	OHMITE	RC07GF104J
R58	010158	RES	METAL	200	K	1%	1/4 W	ELECTRA	RN60D2003F
R59	000821	RES	CARBON	820	OHM	5%	1/4 W	OHMITE	RC07GF821J
R60	000206	RES	CARBON	20	M	5%	1/4 W	OHMITE	RC07GF206J
R61	000106	RES	CARBON	10	M	5%	1/4 W	OHMITE	RC07GF106J
R62	000275	RES	CARBON	2.7	M	5%	1/4 W	OHMITE	RC07GF275J
R63	040092	RES	VARI	20	K			SPECTRO	50-3-1-203
R64	000825	RES	CARBON	8.5	MEG	5%	1/4 W	OHMITE	RC07GF825J

PARTS LIST

ASSEMBLY 403446 - Model 5330/5370

A

REF. DESIG.	PART NO.	DESCRIPTION					
R65	040123	RES VARI	1 K			BECKMAN	62PRIK
R66	000203	RES CARBON	20 K	5%	1/4 W	OHMITE	RC07GF203J
R67	403294	BRIDGE ELEMENT				DANA	403294
R68	000242	RES CARBON	2.4 K	5%	1/4 W	OHMITE	RC07GF242J
R69	403294	BRIDGE ELEMENT				DANA	403294
R70	000335	RES CARBON	3.3 M	5%	1/4 W	OHMITE	RC07GF335J
R71	000300	RES CARBON	30 OHM	5%	1/4 W	OHMITE	RC07GF300J
R72	000333	RES CARBON	33 K	5%	1/4 W	OHMITE	RC07GF333J
R73	000203	RES CARBON	20 K	5%	1/4 W	OHMITE	RC07GF203J
R74	020552	RES WW	3.9976 K	.05%	1/4 W	JORDAN	J12
R75	000132	RES CARBON	1.3 K	5%	1/4 W	OHMITE	RC07GF132J
R76	040092	RES VARI	20 K			SPECTRO	50-3-1-203
R77	000203	RES CARBON	20 K	5%	1/4 W	OHMITE	RC07GF203J
R78	020571	RES WW MATCH SET				DANA	020571
R79	000120	RES CARBON	12 OHM	5%	1/4 W	OHMITE	RC07GF120J
R80	040028	RES VARI	100 OHM			SPECTROL	51-3-11-101
R81	000512	RES CARBON	5.1 K	5%	1/4 W	OHMITE	RC07GF512J
R85	020571	RES WW MATCH SET				DANA	020571
R88	000302	RES CARBON	3 K	5%	1/4 W	OHMITE	RC07GF302J
R89	000302	RES CARBON	3 K	5%	1/4 W	OHMITE	RC07GF302J
R90	001745	RES CARBON	56 K	5%	1/2 W	OHMITE	RC20GF563J
R91	000302	RES CARBON	3 K	5%	1/4 W	OHMITE	RC07GF302J
R98	001737	RES FSV		5%	1/4 W	DANA	001737
R99	001737	RES FSV		5%	1/4 W	DANA	001737
V01	920506	TUBE DISPLAY				AMPEREX	ZM1000
V02	920506	TUBE DISPLAY				AMPEREX	ZM1000
V03	920506	TUBE DISPLAY				AMPEREX	ZM1000
V04	920506	TUBE DISPLAY				AMPEREX	ZM1000
V05	920506	TUBE DISPLAY				AMPEREX	ZM1000
V06	920506	TUBE DISPLAY				AMPEREX	ZM1000
W01 thru W05	600245	JUMPER				GETTIG	L-2007-1

PARTS LIST

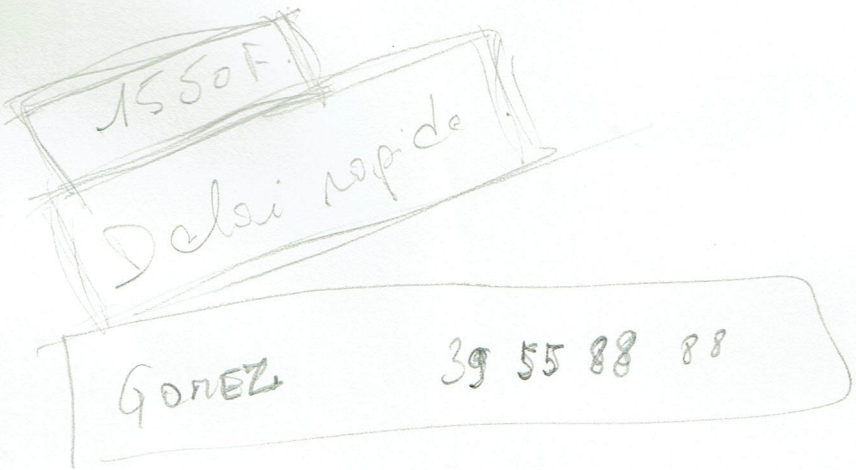
ASSEMBLY 403446 - Model 5330/5370

REF. DESIG.	PART NO.	DESCRIPTION			
Y01	920301	CRYSTAL	1MHZ	DANA	920301

PARTS LIST

ASSEMBLY 403543 – Model 5330/5370 Series

REF DES	PART NO.	DESCRIPTION						
C01	120007	CAP	MYLAR	.22 MFD	600 V	20%	ELEC. CUBE	210B1F224
F01	920259	FUSE		.5 AMP				
J03	600619	CONN	RECEPTACLE		AC POWER		SWITCHCRAFT	EAC-301
J04	600379	RECEPTACLE			1625-3R		MOLEX	1625-3R
J13	600411	CONN			8 PIN			
T01	300037	TRANSFORMER					AZTEC	10043



PARTS LIST

ASSEMBLY 403081 - Model 5330/5370

A

REF. DESIG.	PART NO.	DESCRIPTION						
CR01	210004	DIODE SILICO	SD4				DIODES IN SD4	
CR02	210004	DIODE SILICO	SD4				DIODES IN SD4	
CR03	210004	DIODE SILICO	SD4				DIODES IN SD4	
CR04	210004	DIODE SILICO	SD4				DIODES IN SD4	
CR05	210004	DIODE SILICO	SD4				DIODES IN SD4	
CR06	210004	DIODE SILICO	SD4				DIODES IN SD4	
CR07	210014	DIODE SILICO	023				DANA	210014
CR08	210014	DIODE SILICO	023				DANA	210014
CR09	210014	DIODE SILICO	023				DANA	210014
CR10	210014	DIODE SILICO	023				DANA	210014
CR11	221177	DIODE SILICO ZENER			1/4 W		MOTOROLA	M.2.4A25
CR12	220035	DIODE ZENER	IN966B				MOTOROLA	IN966B
CR13	220035	DIODE ZENER	IN966B				MOTOROLA	IN966B
C02	121088	CAP MYLAR	.01 MFD	100 V	10%		CDE	WMF1S1
C03	121088	CAP MYLAR	.01 MFD	100 V	10%		CDE	WMF1S1
C04	120072	CAP MYLAR	.01 MFD	600 V	10%		CDE	WMF651
C05	110067	CAP ELECT	2000 MFD	35 V	20%		DUCATI	2000-35
C06	110107	CAP ELECT	4000 MFD	15 V			DUCATI	4000DX1512-10
C07	110065	CAP ELECT	20 MFD	350 V	20%		DUCATI	20-350
C08	110067	CAP ELECT	2000 MFD	35 V	20%		DUCATI	2000-35
C09	120003	CAP MYLAR	.1 MFD	100 V	10%		CDE	WMF1P1
C10	120003	CAP MYLAR	.1 MFD	100 V	10%		CDE	WMF1P1
C11	110066	CAP ELECT	15 MFD	200 V	20%		DUCATI	15-200
C12	110070	CAP ELECT	22 MFD	6 V	10%		KEMET	K22W6K
C13	100017	CAP CERAM	.01 MFD	200 V	10%		SPRAGUE	TH-S10
C14	110043	CAP ELECT	25 MFD	25 V	20%		DUCATI	25-25
C15	110043	CAP ELECT	25 MFD	25 V	20%		DUCATI	25-25
C16	101174	CAP CERAM	.001 MFD	500 V	10%		AEROVOX	SCD3X5F
C17	101174	CAP CERAM	.001 MFD	500 V	10%		AEROVOX	SCD3X5F
C18	110077	CAP ELECT	1000 MFD	15 V			AMPEREX	C437PR/E1000
C19	120019	CAP MYLAR	.47 MFD	100 V	10%		CDE	WMF1P47
Q01	200043	TRANS SILICO NPN	2N3565				FAIRCHILD	2N3565
Q02	200035	TRANS SILICO NPN	014				DANA	200035
Q03	200030	TRANS SILICO NPN	40250				RCA	40250
Q04	200035	TRANS SILICO NPN	014				DANA	200035
Q05	200052	TRANS SILICO PNP	009				DANA	200052

PARTS LIST

ASSEMBLY 403081 - Model 5330/5370 A

REF. DESIG.	PART NO.	DESCRIPTION							
R01	000224	RES	CARBON	220	K	5%	1/4	W	OHMITE RC07GF224J
R02	030014	RES	CARBON	220	K	5%	1	W	OHMITE RC32GF224J
R03	000472	RES	CARBON	4.7	K	5%	1/4	W	OHMITE RC07GF472J
R04	000101	RES	CARBON	100	OHM	5%	1/4	W	OHMITE RC07GF101J
R05	000102	RES	CARBON	1	K	5%	1/4	W	OHMITE RC07GF102J
R06	000102	RES	CARBON	1	K	5%	1/4	W	OHMITE RC07GF102J
R07	000202	RES	CARBON	2	K	5%	1/4	W	OHMITE RC07GF202J
R08	040063	RES	VARI	500	OHM	10%	1.5	W	CTS 110
R09	000511	RES	CARBON	510	OHM	5%	1/4	W	OHMITE RC07GF511J
R10	000151	RES	CARBON	150	OHM	5%	1/4	W	OHMITE RC07GF151J
R11	000151	RES	CARBON	150	OHM	5%	1/4	W	OHMITE RC07GF151J
R12	030007	RES	CARBON	150	OHM	5%	3	W	OHMITE 4396
R13	030007	RES	CARBON	150	OHM	5%	3	W	OHMITE 4396

PARTS LIST

ASSEMBLY 403225 – Model 5330/5370 Series

REF DES	PART NO.	DESCRIPTION						
C02	121088	CAP	MYLAR	.01 MFD	100 V	10%	CDE	WMF1S1
C03	121088	CAP	MYLAR	.01 MFD	100 V	10%	CDE	WMF1S1
C04	120072	CAP	MYLAR	.01 MFD	600 V	10%	CDE	WMF651
C05	110067	CAP	ELECT	2000 MFD	35 V	20%	DUCATI	2000-35
C06	110107	CAP	ELECT	4000 MFD	15 V		DUCATI	4000DX1512-10
C07	110065	CAP	ELECT	20 MFD	350 V	20%	DUCATI	20-350
C08	110067	CAP	ELECT	2000 MFD	35 V	20%	DUCATI	2000-35
C09	120003	CAP	MYLAR	.1 MFD	100 V	10%	CDE	WMF1P1
C10	120003	CAP	MYLAR	.1 MFD	100 V	10%	CDE	WMF1P1
C11	110066	CAP	ELECT	15 MFD	200 V	20%	DUCATI	15-200
C12	110070	CAP	ELECT	22 MFD	6 V	10%	KEMET	K22W6K
C13	100017	CAP	CERAM	.01 MFD	200 V	10%	SPRAGUE	TH-S10
C14	110043	CAP	ELECT	25 MFD	25 V	20%	DUCATI	25-25
C15	110043	CAP	ELECT	25 MFD	25 V	20%	DUCATI	25-25
C16	101174	CAP	CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F
C17	101174	CAP	CERAM	.001 MFD	500 V	10%	AEROVOX	SCD3X5F
C18	110077	CAP	ELECT	1000 MFD	15 V		AMPEREX	C437PR/E1000
C19	120019	CAP	MYLAR	.47 MFD	100 V	10%	CDE	WMF1P47
CR01	210004	DIODE	SILICO		SD4		DIODES, INC.	SD4
CR02	210004	DIODE	SILICO		SD4		DIODES, INC.	SD4
CR03	210004	DIODE	SILICO		SD4		DIODES, INC.	SD4
CR04	210004	DIODE	SILICO		SD4		DIODES, INC.	SD4
CR05	210004	DIODE	SILICO		SD4		DIODES, INC.	SD4
CR06	210004	DIODE	SILICO		SD4		DIODES, INC.	SD4
CR07	210014	DIODE	SILICO		023		DANA	210014
CR08	210014	DIODE	SILICO		023		DANA	210014
CR09	210014	DIODE	SILICO		023		DANA	210014
CR10	210014	DIODE	SILICO		023		DANA	210014
CR11	221177	DIODE	SILICO	ZENER		1/4W	MOTOROLA	M.2.4A25
CR12	220035	DIODE	ZENER		1N966B		MOTOROLA	1N966B
CR13	220035	DIODE	ZENER		1N966B		MOTOROLA	1N966B
Q01	200043	TRANS	SILICO	NPN	2N3565		FAIRCHILD	2N3565
Q02	200035	TRANS	SILICO	NPN	014		DANA	200035
Q03	200030	TRANS	SILICO	NPN	40250		RCA	40250
Q04	200035	TRANS	SILICO	NPN	014		DANA	200035

PARTS LIST

ASSEMBLY 403225 – Model 5330/5370 Series

REF DES	PART NO.	DESCRIPTION						
Q05	200052	TRANS	SILICO	PNP	009		DANA	200052
R01	000224	RES	CARBON	220 K		5% 1/4W	OHMITE	RC07GF224J
R02	030014	RES	CARBON	220 K		5% 1 W	OHMITE	RC32GF224J
R03	000472	RES	CARBON	4.7 K		5% 1/4W	OHMITE	RC07GF472J
R04	000101	RES	CARBON	100 OHM		5% 1/4W	OHMITE	RC07GF101J
R05	000102	RES	CARBON	1 K		5% 1/4W	OHMITE	RC07GF102J
R06	000102	RES	CARBON	1 K		5% 1/4W	OHMITE	RC07GF102J
R07	000202	RES	CARBON	2 K		5% 1/4W	OHMITE	RC07GF202J
R08	040063	RES	VARI	500 OHM		10% 1.5 W	CTS	110
R09	000511	RES	CARBON	510 OHM		5% 1/4W	OHMITE	RC07GF511J
R10	000151	RES	CARBON	150 OHM		5% 1/4W	OHMITE	RC07GF151J
R11	000151	RES	CARBON	150 OHM		5% 1/4W	OHMITE	RC07GF151J
R12	030007	RES	CARBON	150 OHM		5% 3 W	OHMITE	4396
R13	030007	RES	CARBON	150 OHM		5% 3 W	OHMITE	4396

PARTS LIST

ASSEMBLY 403466 - Model 5330/5370

REF. DESIG.	PART NO.	DESCRIPTION							
CR01	211083	DIODE SILICO	018					DANA	211083
CR02	211083	DIODE SILICO	018					DANA	211083
CR03	220031	DIODE SILICO ZENER	1/4M3.3AZ5					MOTOROLA	1/4M3.3AZ5
CR04	211083	DIODE SILICO	018					DANA	211083
CR05	211083	DIODE SILICO	018					DANA	211083
C01	110071	CAP ELECT	.1	MFD	35	V	10%	KEMET	K1W35K
C02	110070	CAP ELECT	22	MFD	6	V	10%	KEMET	K22W6K
C03	110071	CAP ELECT	.1	MFD	35	V	10%	KEMET	K1W35K
C04	101182	CAP CERAM	47	PFD	500	V	10%	AEROVOX	TCD-N750
C05	100017	CAP CERAM	.01	MFD	200	V	10%	SPRAGUE	TH-S10
C06	100017	CAP CERAM	.01	MFD	200	V	10%	SPRAGUE	TH-S10
M01	230024	INTEGRATED CIRCUIT	MC893P					MOTOROLA	MC893P
M02	230019	INTEGRATED CIRCUIT	MC824P					MOTOROLA	MC824P
M03	230061	INTEGRATED CIRCUIT						MOTOROLA	MC9818P
M04	230061	INTEGRATED CIRCUIT						MOTOROLA	MC9818P
R01	000202	RES CARBON	2	K	5%	1/4	W	OHMITE	RC07GF202J
R02	000362	RES CARBON	3.6	K	5%	1/4	W	OHMITE	RC07GF362J
R03	000202	RES CARBON	2	K	5%	1/4	W	OHMITE	RC07GF202J
R04	000102	RES CARBON	1	K	5%	1/4	W	OHMITE	RC07GF102J
R05	000241	RES CARBON	240	OHM	5%	1/4	W	OHMITE	RC07GF241J
R06	000562	RES CARBON	5.6	K	5%	1/4	W	OHMITE	RC07GF562J
R07	000562	RES CARBON	5.6	K	5%	1/4	W	OHMITE	RC07GF562J
R08	000331	RES CARBON	330	OHM	5%	1/4	W	OHMITE	RC07GF331J