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DOE/NASA CONTRACTOR REPORT

MASTER

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MASTER

SYSTEM DESIGN AND INSTALLATION FOR RS600 PROGRAMMABLE CONTROL SYSTEM FOR SOLAR HEATING AND COOLING

Prepared from documents furnished by

Rho Sigma, Inc.
11922 Valerio Street
North Hollywood, CA 91605

Under Contract NAS8-32256 with

National Aeronautics and Space Administration
George C. Marshall Space Flight Center, Alabama 35812

for the U. S. Department of Energy

U.S. Department of Energy

Solar Energy

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16. ABSTRACT This document contains the installation, operation and maintenance manual, the system design drawings, installation drawings and the system design data brochure. It provides detailed information necessary for the building/purchase and installation of the RS600 Programmable Control System for solar heating, combined heating and cooling and/or hot water systems. Included are such items as general specifications, user configuration and options, displays, theory of operation, trouble-shooting procedures, parts lists, drawings, diagrams, wiring lists and warranty and assistance.			
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SECTION A
INSTALLATION, OPERATION AND MAINTENANCE MANUAL

RS 600

PROGRAMMABLE CONTROL SYSTEM

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This warranty is void if the product is subjected to misuse, neglect, accident, or improper installation or application.

CAUTION

Always turn power "off" on the RS600 PCS before inserting or removing a card or component. Never force anything, use a screw-driver or other dull instrument to remove an I. C. from the socket.

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1.0 SPECIFICATIONS

1.1 Introduction

The RS 600 Programmable Control System (PCS) is a highly versatile, programmable controller. The RS 600 accepts inputs from a wide variety of sensors and converts them to engineering units. Control equations, customer designated, are then solved and the appropriate outputs occur. Typical of the equations are those used in a solar heating system which include: differential temperature measurement to turn the appropriate pumps on, turning back-up systems on when solar is not enough and off-peak control for back-up systems.

The RS 600 Programmable Control System utilizes a Fairchild F8 microprocessor to perform all timing, control and calculation functions. The microprocessor follows a program which is stored on plug-in, UV erasable prom's. These prom's are changed to customize the system's performance for individual control requirements.

1.2 General Specifications

The following specifications apply in general to all RS 600's. However, the exact specifications for any unit may vary depending upon the amount of customizing or options ordered. Check Section 1.3 for User Options and Specifications.

1.2.1 Analog Inputs

Eight single ended analog input channels, expandable to 16. Reed relay analog matrix for best noise and isolation. The inputs are used for thermistor, pyranometer, flowmeters and switched inputs. Conversion rate is 8 channels/2 sec. or every channel once every .25 seconds.

1.2.1.1 Thermistor Inputs

Optional Thermistor circuit card provides reference resistors for 10,000 ohm thermistors. Standard thermistor output linearized over a range of -40°F to +300°F. Each thermistor circuit card contains 8 thermistor reference resistors and a 1.7vdc reference supply. Power supply drift is 0.02%°C max. Linearization error is ± 1.0°F.

1.0 SPECIFICATIONS - Continued

1.2.1.2 Analog Flowmeter Input

The analog input can accomodate an input from an analog flowmeter where 0-2vdc is representative of the flow.

1.2.1.3 Isolation

The analog inputs can directly accomodate a solar cell type pyranometer input and with an optional amplifier can also handle a thermopile type pyranometer.

1.2.1.4 Switch Closures

The analog inputs can be utilized to handle a switch closure input. To debounce the switch, its input will be scanned twice separated by 200 milsec.

1.2.2 Logic Level Inputs

Eight TTL compatible inputs expandable to 16. Logic '0' is 0+0.5vdc @ 1.6ma or a contact closure of less than 300 ohms. Logic '1' is +2.4 to +5vdc or an open circuit. Debounce be requiring 2 consecutive inputs .3 sec apart to act upon new condition. A pulse type flowmeter can also be inputed to these inputs, provided its rate is less than 240 pulses per minute.

1.2.3 Outputs

There are sixteen relay driver type outputs available internally to the PCS. These outputs can drive either solid state or contact relays to provide sixteen different control functions. The types of relays used will depend upon the customer's system requirements.

1.2.3.1 Solid State Relays

Optical coupled solid state switches are available as control outputs. They can be used to run pumps, fans, and control valves. Outputs can also be proportionally controlled. The output is 120VAC at 10 amps.

1.0 SPECIFICATIONS - Continued

1.2.3.2 Contact Relays

Contact relays are available as controlled outputs. The type used (DP/DT, SP/ST, etc.) will depend on the customer's needs.

1.2.4 Controls

RS 600 controls include an inner panel power switch and an optional front panel keyboard and a keyboard protect keyswitch.

1.2.5 Display (Optional)

Multifunction display, uses large, 0.6 inch high, broad stroke LED's for good visibility at 25 feet. For each input channel, the display shows the two digit channel number, preceeded by the channel designator, [. The sequential display is the value of the channel in engineering units. The display also used for date entering and to show time and date functions. The display shows flashing time display after a power loss.

1.2.6 Internal Clock

Internal calendar clock operates for a 365 day year. User sets clock from switch at power turn-on or time can also be set from keyboard.

1.2.7 Physical

The PCS Enclosure is 20" wide x 10" deep x 30" high. Four mounting holes are on rear plane for wall mounting.

1.2.8 Environment

Operating temperature	0 to +50°C
Storage temperature	-20 to +70°C
Humidity (no condensation)	0 to 95% RH
Shock	normal handling
Vibration	normal handling

1.2.9 Power

115VAC $\pm$ 10%, 60 $\pm$ 3Hz, 100 watts nominal.

Figure 1.1
RS 600 Programmable Control System A-4

1.0 SPECIFICATIONS - Continued

1.3 User Configuration and Options

1.3.1 Inputs

<u>Channel</u>	<u>Type</u>	<u>Ref. Designation</u>	<u>Remarks</u>
00	01	T1	Temp Hot Tank
01		T2	Collector
02		T3	Cold Tank
03		T4	Dom. Hot Water
04		T5	Pool
05		T6	Ref.
06		T7	Spare
16		S1	Thermostat Heat
17		S2	Switch Summer/Winter
18		S3	Thermostat -Cool

1.3.2 Outputs

<u>Channel</u>	<u>Type</u>	<u>Ref. Designation</u>	<u>Remarks</u>
33	01	HCR	115 VAC
34		CCR	115 VAC
35		DWR	Contacts
36		PHR	"
37		HDR	"
38		HDB	"
39		BCR	"
40		CDR	"
41		BCRS	"

1.3.3 Constants

<u>Channel</u>	<u>Type</u>	<u>Ref. Designation</u>	<u>Value</u>
64	02	1K2	2°F
65		1K10	10°F
66		2K1	1°F
67		2K3	3°F
68		3K1	1°F
69		3K3	3°F
70		4K1	1°F
71		4K4	4°F
72		4K100	100°F
73		5K100	100°F
74	02	6K100	100°F
75	05	7K1	0800 (Time)
76	05	7K8	0800 (Time)
77	02	7K40	40°F
78	02	7K65	65°F
79	02	8K65	65°F
80	02	9K175	175°F
81	02	9K45	45°F

1.0 SPECIFICATIONS - Continued

1.3.4 Input Connections

RS 600 input terminal board S/N 0001 thru 0003
Date 8/27/77

<u>TB1</u>	<u>CH</u>		<u>TB6</u>	
1	00	T1	1	115VAC Black
2	01	T1	2	115VAC Ret. White
3	02	T2	3	Chassis GRD.
4	03	T2	4	
5	04	T3		
6	05	T3		
7	06	T4		
8	07	T4		
9	08	T5		
10	09	T5		
11	10	T6		
12	11	T6		

<u>TB2</u>	<u>CH</u>	
1	12	Spare
2	13	"
3	14	"
4	15	"
5	16	"
6	17	"
7	18	"
8	19	"
9	20	"
10	21	"
11	22	"
12	23	"

<u>TB3</u>	<u>CH</u>	
1		S1 GND
2	16	S1 COM
3		S2 GND
4	17	S2 COM
5		S3 GND
6	18	S3 COM
7		Spare
8		"
9		"
10		"

1.0 SPECIFICATIONS - Continued

1.3.5 Output Connections

<u>TB4</u>		<u>CH</u>	<u>Ref. Designation</u>
1		115VAC	33 HCR
2			
3			
4		115VAC	34 CCR
5			
6			
7	K1-NC	35	PWR
8	K1-C		
9	K1-NO		
10	K2-NC	36	PHR
11	K2-C		
12	K2-NO		
13	K3-NC	37	HDR
14	K3-C		
<u>TB5</u>			
1	K3-NO	38	HDB
2	K4-NC		
3	K4-C		
4	K4-NO	39	BCR
5	K5-NC		
6	K5-C		
7	K5-NO	40	CDR
8	K6-NC		
9	K6-C		
10	K6-NO	41	BCRS
11	K7-NC		
12	K7-C		
13	K7-NO		

1.3.6 Control Equations

1.3.6.1 Heat Collection: Pump will turn on when collector temperature (T2) is 10°F greater than the hot tank temperature (T1). The turn off is at a ΔT of 2°F.

$$HCR = (T2 - T1) \geq 10^{\circ}F$$

$$\overline{HCR} = (T2 - T1) \leq 2^{\circ}F$$

$$\text{Out } 32 = \text{out } 32.\text{and} .(IN01-IN00.GE.1K2) . \\ \text{or} .(IN01-IN00.GE.1K10)$$

1.0. SPECIFICATIONS - Continued

- 1.3.6.2 Nocturnal Radiation Pump will turn on at a ΔT of 3°F and off at a ΔT of 1°F between the cold tank and collector.

$$\text{CCR} = (T3 - T2) \geq 3^{\circ}\text{F}$$

$$\overline{\text{CCR}} = (T3 - T2) \leq 1^{\circ}\text{F}$$

Out 33 = out 33.and.(IN0 -IN0 .GE.2K1).
or.(IN02-IN01.GE.2K3)

- 1.3.6.3 Solar-Domestic Hot Water: Turn circulator pump to heat exchanger on a ΔT of 3°F and off a ΔT of 1°F between hot water tank and hot tank.

$$\text{DWR} = (T1 - T4) \geq 3^{\circ}\text{F}$$

$$\overline{\text{DWR}} = (T1 - T4) \leq 1^{\circ}\text{F}$$

Out 34 = out 34.and.(IN0 -IN03.GE.3K1).
or.(IN00-IN03.GE.3K3)

- 1.3.6.4 Solar-Swimming Pool - Open valve to heat exchanger when ΔT between pool and hot tank is 4°F and off when ΔT is 1°F . Also, heat will not be extracted for the pool if the hot tank is below 100°F or the pool is above the reference temp. that is settable from an inner panel potentiometer.

$$\text{PHR} = [(T1 - T5) \geq 4^{\circ}\text{F}] T1 > 100^{\circ}\text{F} [T5 < T6]$$

$$\overline{\text{PHR}} = (T1 - T5) \leq 1^{\circ}\text{F} \text{ and } T5 \leq T6$$

Out 35 = out 35.and.(IN00-IN04.GE.411).
and.(IN014 .LE. IN015).
or.(IN00-IN0 .GE.4K4).and.(IN00.GE.4K100)
and (IN04.LE.IN05).

- 1.3.6.5 Solar-Heat Distribution: The hot tank will be used for heating if heat is required and the H.T. is above 100°F .

$$\text{HDR} = S1 . (T1 > 100^{\circ}\text{F})$$

Out 36 = IN16.and.(IN00.GT.5K100)

1.0 SPECIFICATIONS - Continued

- 1.3.6.6 Back-Up Heat-To-Heat Distribution: Turn on back-up supply if the H.T. is less than 100°F.

HDB = S1 . (T1 $\leq$ 100°F)

Out 37 = IN16.and.(IN00.LE.6K100)

- 1.3.6.7 Back-Up Chiller: Cools cold tank (C.T.) if the C.T. temperature is greater than 65°F, cooling will be needed, and time is not in the peak loading hours. Tank will be cooled to 40°F.

BCR = (T3 $\geq$ 65°F) S2.(0100 $\geq$ t $\leq$ 0800).
(T3 $\geq$ 40°F)

Out 38 = (IN02.GE.7K65)OR.OUT38.and.
(IN02.GE.7K40).and.IN17.and.

(TIME.GE.7K1.).and.(TIME.LE.7K8).

- 1.3.6.8 Cool Distribution: Turns on if cold tank is below 65°F and "cool" is required.

CDR = S3 and (T3 $<$ 65°F)

Out 39 - IN18.AND.(IN02.LT.8K65)

- 1.3.6.9 Back-Up Chiller (Solar Assist): The absorption chiller will use solar if collector temperature is 175°F or greater, the cold tank is above 45°F and cooling will be required.

BCRS = (T2 $\geq$ 175°F) . (T3 $>$ 45°).S2

Out 40 = IN1 .and.(IN01.GE.9K175).
and.(IN02.GT.9K45)

2.0 INSTALLATION

2.1 Unpacking

Although the RS 600 PCS is a rugged instrument, care must be exercised to properly package the instrument for shipment to avoid damage in transit. When shipped from the factory, the unit was packaged with sufficient inserts and foam padding to cushion the shock and vibration normally encountered in transit.

2.0 INSTALLATION - Continued

2.1 Unpacking - Continued

When the unit is received, examine the shipping container for evidence of damage. If none found, unpack the unit carefully, watching for signs of damage. If evidence of any damage is found, notify Rho Sigma and the carrier immediately. Rho Sigma will start the necessary repair or replacement process immediately without waiting for the carrier to settle the damage claim.

Verify that the contents match the enclosed shipper and that there are no shortages or over shipments. Compare the serial and model numbers in the front of the manual against those on the nameplate on the rear of the unit. Notify Rho Sigma immediately of any shipping errors or discrepancies. Check all printed circuit cards to be sure they are completely plugged in prior to applying power to the unit.

2.2 Mounting

1. The standard RS 600 PCS is delivered in it NEMA 12 type cabinet and is for wall mounting. The hanging instructions are enclosed in the NEMA cabinet.
2. Connect power cord, cables, sensor inputs and controlled outputs as shown in Figure 1.3.

Although the RS 600 PCS does not require an air conditioned environment, do not place it where it will experience wide temperature changes or undue heat rise.

2.3 Repacking, Returning The Instrument

Notify Rho Sigma prior to returning the instrument to obtain return approval. If the unit is to be shipped by common carrier, it must be packed so that there is a minimum of 2 inches of packing material or space between the unit and the shipping case or carton. Include any cabling and auxiliary devices necessary to recreate the problem to be fixed. Also include your name, phone number, extension and a written description of the problem. This information will assist Rho Sigma in making a prompt and accurate repair of the unit.

2.0 INSTALLATION - Continued

2.4 Power Connections

The RS 600 PCS is designed to operate on 115VAC, 60Hz power. Any deviations from this type of power will damage the unit. To use, connect the supplied power cord to an outlet with an ampere capacity of 20 amps.

2.5 Sensor Input Connections

All sensor input connections are made on terminal strips or connectors mounted on the top of the inner panel. Refer to Section 1.3 for the exact input pin or terminal number designations. Use the following instructions to connect sensors to the PCS.

2.5.1 Thermistors

The PCS uses two wires to measure the resistance of 10K ohm thermistors. On units equipped with terminal strips, connect one side of the thermistor to Terminal 1, the other side of the thermistor to Terminal 2 for the appropriate input channel.

2.5.2 Voltages

Voltage outputs from sensors or other sources may be connected directly to the RS 600. Connect voltages only to those pins specifically designated as voltage inputs in Section 1.3.4. Use shielded lines for voltages less than 100mv full scale or on voltages less than 200mv full scale if the line length exceeds 25 feet. The RS600 can monitor D.C. voltage.

2.5.3 Pulse Inputs (non-isolated)

Pulse inputs from flow sensors, counters, etc., may be connected directly to the RS 600 discrete inputs. All pulse inputs should be as specified in Section 1.2. A series dropping resistor or other technique should be used to reduce the amplitude of pulses greater than +5 volts peak. Pulses with amplitudes less than 2.5 volts should be amplified to assure consistent and accurate readings. Input frequency should not exceed 240 pulses per minute. Connect the positive sensor output line to the RS 600 + Flow

2.0 INSTALLATION - Continued

2.5.3 Pulse Inputs (non-isolated) - Continued

inputs, the negative sensor lead to - Flow input or Flow return.

2.5.4 Discrete Inputs

Contacts or voltage levels may be used as the source of discrete input levels for the RS 600 PCS. Controls may be SPDT or SPST type, switching between open and ground. Maximum contact resistance is 300 ohms. Connect arm to contact input, normally open contact to PCS contact common. Voltage inputs are similar to contacts. Input voltage levels should not be more positive than +5VDC or less than -0.5VDC. Shielded leads are not required for the discrete inputs.

2.6 Outputs

All control outputs are made on the terminal strips or connectors mounted on the bottom of the front panel. Refer to Section 1.3 for exact output pin or terminal number designations. Use the following instructions to connect the output controls to the PCS.

2.6.1 Solid State Relay

The output will be 120VAC when on and can be proportional. Connect the device requiring 120VAC control to two terminal designated in Section 1.3.

2.6.2 Contact Relays

The PCS uses double throw contact relays so that the terminals for each relay will be NC-C-NO. Wire the terminals to the appropriate contact in accordance with Section 1.3.

3.0 OPERATION

3.1 Controls

Controls for the RS 600 PCS consists of a keyboard (optional), a time set switch, a display mode switch, a keyboard enabling switch and a display on/off switch (optional). The controls perform the following functions:

3.0 OPERATION

3.1 Controls - Continued

POWER ON/OFF

Front panel toggle switch that applies 115 VAC power to the system.

KEYBOARD ON/OFF

Front panel key switch than enables the RS 600 keyboard when ON. OFF position disables all keyboard inputs.

KEYBOARD

Inner panel keyboard is grouped into two major functions: numeric data and auxiliary functions. The operator uses combinations of the various keys to control the RS600 PCS. Paragraphs 3.1.1 thru 3.1.4 describe the keyboard functions.

SET TIME FAST/SLOW

Switch will advance time in hours and minutes at either a fast or slow rate. Operator activates switch down until correct time is reached and then releases switch.

DISPLAY MODE

Sets the RS 600 display to either a sequential or time display

DISPLAY ON/OFF

Enables the display to function or disables.

OUTPUTS ON/OFF/AUTO

Manual override switch for all outputs. Switch for each channel will either turn the output on or off or place it under computer control (auto).

3.1.1 Numeric Keys

The numeric keys include ten numbers 0 thru 9.

Ten numbered keys that cause their respective number to appear in the active portion of the PCS display.

3.0 OPERATIONS - Continued

3.1.2 Auxiliary Functions

The auxiliary function keys are the alpha keys A thru F.

<u>Key</u>	<u>Function</u>	<u>Description</u>
A	Clear/reset	Sets PCS to normal sequence mode.
B	Enter	Causes the RS 600 to execute any display request or store the data entered.
C	Time	Designates the next numeric key as a time category.
D	Channel	Designates the next numeric key as a channel number.
E	Delimiter	Used in "entering data" mode.
F	Clear Entry	Clears last entry mode.

3.1.3 Time Category

C	Time	Designates the next numeric key as a time category. Time categories are: P 1. Seconds 2. Hours and Minutes 3. Day of Year 4. Manual Mode (equations not being solved) 5. Auto mode
---	------	---

3.1.4 Keyboard Control Examples

3.1.4.1 Display Time

To display any time parameter press the following keys:

C (TIME) P, B (ENTERED)

└ Time category code, 1 thru 5

3.0 OPERATION - Continued

3.1.4.2 Time Set

To set a time parameter, press the following keys:

C (TIME), P, ENNNN, B (ENTER)

└─ 2 or 4 digits

└─ Time category code, 1 thru 3

3.1.4.3 Display a Data Channel

To display an input/output channel or a constant, press the following keys:

D (CHANNEL), NN, B (ENTER)

└─ 2 digit channel number, 01 thru 99

0 - 31 input channels

32 - 47 output channels

48 - 99 constants

3.1.4.4 Enter Data

To change a constant or set or reset an output:

D (CHANNEL), NN, E(delimiter), XXXX, B (ENTER)

└─ 2 digit channel number

32 - 47 output channel

48 - 99 constant

XXXX

Output

0 = reset

200 = set

Constant

0-9999 = positive integers

32768-65536 = negative integers
(65536-N)

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3.0 OPERATION - Continued

3.2 Displays

RS 600 PCS has a multi-function display. The display is used to show time parameters, data channels, data units and to verify operator keyed-in data prior to its entry into the system. The display is continually serviced by a refresh program that updates the display at preset rate. To freeze or hold any value, use the keyboard to enter a display request as shown in 3.1.5.1 or 3.1.5.3. Press A(CLEAR) to resume the prior display operation.

For data, the display shows a two digit channel number, then sequences to a value of XX +.1999. For time, the display shows a two or four digit number with a colon for hours: minutes. Seconds appear as a two digit number.

3.2.1 Display Symbols

The display utilizes symbols to designate the units and type of display shown. The symbols and their description are:

<u>Symbols</u>	<u>Data</u>	<u>Description</u>
[		Channel
D		Temp. (°F or °C)
U		Isolation (BTU)
F		Flow rate-analog input
HI		Input at +5VDC level
LO		Input at GND level
P		Flow rate-D pulse input (GPM)
A		Constant
+ d		Time, day of year 0-364
+ H		Time, hours:min.
+ S		Time, seconds
E		Equation syntax error

3.3 Initialization Procedure

3.3.1 Pre Operation Setup

Connect outputs and inputs to terminal strips per Section 2.5. & 2.6.

3.0 OPERATION - Continued

3.2.2 Operation

Turn on POWER switch. Display should show a flashing display of + H XX:XX. Set internal calendar clock by Keying in:

C(TIME) 2,HHMM, B(ENTER) for Time //X hours:minutes

C(TIME) 3,DDD,B(ENTER) for Day of Year

The outputs can be set or reset via the keyboard. Section 3.1.4.4 explains the correct operation.

4.0 THEORY OF OPERATION

4.1 Block diagram Description

Figure 2 is the Block Diagram for the control section of the PCS. The inputs, both analog and discrete are multiplexed onto the common buss. The analog inputs are digitized by the A/D converter. The F8 micro-processor controls the inputs, outputs and all timing functions via the program stored in memory (4K Prom). The memory (1K RAM) is used for temporary storage by the F8. The keyboard communicates to the F8 via the common buss and the display is utilized by the F8 via the common buss.

4.2 Program Concept

A separate manual is available for ^{Rc} Rho Sigma of the complete program stored in the Prom's.

Figure 2.1.

PROGRAMMABLE CONTROL SYSTEM

5.0 MAINTENANCE

5.1 Introduction

This section describes the maintenance and troubleshooting procedures for the RS 600 PCS. Section 5.4 is an overview of the troubleshooting procedure to be followed in the event of a field failure.

5.2 Reference Designations

The RS 600 PCS is assembled on a single chassis as shown in Figure 5.2. Each PC card or sub-assembly has its own set of partial reference designators that refer only to the components on that particular sub-assembly. The same reference designator number may be repeated on different assemblies. All components on schematics, assembly drawings and schematics are cross referenced by partial reference designators. No attempt has been made to assign reference designators so that a connector on one assembly mates with corresponding numbered plug on another assembly. However, mating cable connectors are tagged "Mates to J" to aid in system assembly.

5.3 Calibration and Maintenance

Perform the calibration and maintenance listed below if necessary.

The instructions in Section 5.3 require that the calibrator be a qualified technician and has the following equipment available to him:

1. Oscilloscope, Tektronix Model 545 or equivalent.
2. DVM, 4 1/2 digit, 10uv resolution, accurate to 50uv.
3. Resistance standard with 0.1 ohm steps, accurate to 0.01 ohms.
4. Optional display and keyboard assembly if not on PCS.

The following basic instructions are to be followed when performing any of the calibration procedures. Always turn power off before inserting or removing a component or card. Never force anything. Use a screw driver or other dull instrument when removing an IC from a socket. Review the proper schematic before plunging into the calibration procedure. Be sure you have a good knowledge of the RS 600 PCS and its operation before starting.

5.0 MAINTENANCE - Continued

5.3 Calibration and Maintenance - Continued

TABLE 5.3 PERIODIC MAINTENANCE CHART

<u>UNIT</u>	<u>PERIOD</u>	<u>MAINTENANCE</u>
+5V Pwr Sup	1 yr.	Adjust to 5.0 $\pm$.1VDC
+12 Pwr Sup	1 yr.	Adjust to +12.0 $\pm$.1VDC
Universal Board	1 yr.	Adjust to +1.70 $\pm$.01VDC

5.3.1 Power Supply Adjustments

The RS 600 power supplies are adjusted in the following manner: Install an extender card in the chassis. Measure the power supply voltages on the extender card. (See 5.4 for connector pin layout). Use an insulated shaft screwdriver to avoid shorting the supply's regulator. Use a short screwdriver or a right angle driver to adjust the +12 & +5V supply. By turning VADJ on the appropriate power supply, adjust R1 on the universal board to get proper voltage on J1-B12.

5.4 Troubleshooting Procedures

This section describes procedures for locating circuit malfunction. It is assumed that all power supplies are properly functioning and there is only one malfunction in the unit. For multiple failures, use this guide to isolate one of the failures. Repair it and continue to find the remaining failures.

Troubleshooting can be broken down into fault isolation and repair. Successful fault isolation in a microprocessor based system requires a good understanding of the system's operation to determine whether the fault lies in the microprocessor proper or somewhere else in the system.

Due to the complex nature of a microprocessor based system, the conventional troubleshooting procedures will only find gross faults. Subtle errors can only be found with a good knowledge of the units program and a Program Analyzer. Before attempting any repairs, review the following manual sections:

Sections 1.0, 3.0 and 4.0
Section 5.5

5.0 MAINTENANCE - Continued

5.4 Troubleshooting Procedures - Continued

Repair consists of changing a card or component to put the unit back into operation. Consult the spare parts list, Section 6.0, when ordering any module, component or front panel replacement part.

As a guide, the basic fault isolation procedure for the unit is shown in Table 5.4. However, if obvious fault symptoms are present, skip the elementary fault-isolation steps and proceed directly to a diagnosis and repair of the fault area.

WARNING

If the fault-isolation procedure requires internal measurements, always remove power when disassembling or assembling the unit. Use extreme caution during troubleshooting, adjustment, or repair to prevent shorting components and further damage to the unit.

5.5 Logic Conventions

The unit uses positive logic, which means the normally active or high signal state is $+3.5 \pm 1$ volts and the inactive or low state is 0.0 ± 0.5 volt. The high state is referred to a logic 1 and the low state is logic 0. The terms true and false relate to the signal being in or out of its active state and normally correspond to logic 1 and 0.

Complements of signals are indicated by an F or N suffix or by an inversion dot on the logic symbol. Complemented signals are always low when the original signals are high and vice versa. See Figure 5.5 for the standard logic symbols.

TABLE 5.4 FAULT ISOLATION STEPS

<u>SYMPTOM</u>	<u>POSSIBLE FAULT</u>	<u>CHECK</u>
Initial Turn-On No operation		Loose control panel cable. Push cables into sockets on cards. Blown fuse

5.0 MAINTENANCE - Continued

TABLE 5.4 FAULT ISOLATION STEPS - Continued

<u>SYMPTOM</u>	<u>POSSIBLE FAULT</u>	<u>CHECK</u>
Flashing "Time"	Power Failure	Reset Times 2,3 and 4
Wrong Readings	Input fault	Check input connections. Use display to read inputs. Check input with DVM.
	Wrong Units	Check units assigned to channel.
	Flow channel error.	Check flow counter with scope or analyzer. Replace card.
	Discrete error	Check input gate. Check input for proper voltage swing.
Wrong Calculations	Wrong equation	Check Section 1.3.6.
Display	Defective LED or LED Driver	Check logic and signals on PCS Display Card.
	Defective output latch	Check latch output signals on card.

6.0 PARTS LIST AND LOCATION

6.1 Introduction

This section contains all information necessary to locate, identify and order parts. The listing of parts and information for an exact replacement is shown on pages 28 thru 49. Major sub-assembly locations are shown in Figure 5.2. All component locations are identified by reference designators in the parts list or upon their mounting surface.

6.2 Replacement Parts

6.2.1 Standard Parts

All parts can be purchased directly from Rho Sigma Inc. at current market price, plus a

6.0 PARTS LIST AND LOCATION - Continued

6.2.1 Standard Parts - Continued

handling charge. However, since most parts are standard electronic components, it is suggested that they be secured locally for prompt replacement. The parts list gives all pertinent information including the recommended manufacturers. Where not noted, equivalent parts meeting the original part specifications may be substituted. A list of manufacturers by abbreviations may be substituted.

6.2.2 Special Parts

Parts marked with a Rho Sigma part number should be procured directly from Rho Sigma. These parts are manufactured or selected to satisfy specific requirements. Substitution of other parts might not yield equivalent performance and will void any warranty.

6.3 Parts List

The parts lists contains all components and sub-assemblies that make up the system. Subsequent tables break the major sub-assemblies down to the component level.

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FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 1

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG ENG	DATE
97470106		-03	01	01	ASSY EROM BD					
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT			
							REV	EN NO		
001	40048469		001	EA	PCB EROM BD					
002	03291040		002	EA	CAP .1UF	C3, C7				
003	03279100		002	EA	CAP 10UF 15V	C2,				
004	03282560		001	EA	CAP 22UF 15V	C1				
005	26901040		004	EA	DIODE 1N914	D1A, 2A, 3A, 4A OR D1B, 2B, 3B, 4B				
006										
007	02354850		001	EA	RES 10K, 1/4W, 5%	R5				
A-311 008										
009										
010			001	EA	RES 3.9 Ω 1/4W 5%	R4				
011										
012										
013										
014			001	EA	DIODE ZENER 1N5231 5V	D2				
015	26905022		004	EA	IC 2708 UV PROM	U1 THRU U4				
016										
017	26905559		001	EA	IC 74LS138	U6				
018	26904816		001	EA	IC 4049	U8				
019			001	EA	CARD EJECTOR, SAE 6200					

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LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG	ENG	DATE
37470103		-03	01	0101	ASSY INPUT CARD 1,2						
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT				
							REV	EN	NO		
201	40048465		001	EA	PCB INPUT CARD						
202	03291040		001	EA	CAP .1UF	C1					
203	03282560		001	EA	CAP 22UF, 15V	C2					
204	03279100		001	EA	CAP 10UF, 15V	C3					
205	26901040		008	EA	DIODE 1N914	D1 THRU D8					
206	05036850		008	EA	RELAY	K1 THRU K8					
207	26904575		002	EA	IC 9LS05	U2, U3					
208			001	EA	IC 3861	U1					
209			004	EA	IC 75451	U4, 5, 6, 7					
210			001	EA	CARD EJECTOR, S.A.E. 6200						
211	09917022		001	EA	SOCKET 40 PIN	U1					

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FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 1

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG ENG	DATE
97A70110		-03	01	01	01	ASSY UNIVERSAL CARD				
ITEM	PART NO	REV	QTY PER ASSM	U	M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT		
001	40048473		001	EA		P.C.B. UNIVERSAL CARD		REV	EN NO	
002	26905801		001	EA		IC UA723	U1			
003			003	EA		TRANSISTOR 2N6124	Q1			
004			001	EA		POT 1K	R1			
005			001	EA		RES 1K	R2			
006			001	EA		RES 62Ω	R3			
007			001	EA		RES 5.1K	R4			
008			001	EA		RES .25Ω	R53			
009			048	EA		SELECTED	R5 THRU R52			
010			001	EA		CAP .001μF	C1			
011			001	EA		CARD EJECTOR, S.A.E. 6200				

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 2

LM NO	REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG	ENG	DATE
97470102	-03	01	0101	ASSY A/D CONTROL CARD						
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT			
							REV	EN	NO	
001	40048471		001	EA	P.C.B. A/D CONTROL CARD					
002	26905090		001	EA	IC 3851 PSU	U1				
003	26904564		001	EA	IC 74LS04	U2				
004	26904578		001	EA	IC 74LS00	U3				
005	26904590		001	EA	IC 74LS02	U4				
006	26905601		001	EA	IC 9602	U5				
007	26905605		003	EA	IC 75451	U6, U7, U8				
008	26901040		006	EA	DIODE 1N914	D1 THRU D6				
009	26012550		001	EA	ZENER 1W758A, 10V, 5%	D7				
010	26901016		001	EA	ZENER 1W4569, 6.4V, 5%	D8				
011	05036850		006	EA	RELAY	K1 THRU K6				
012	03291040		001	EA	CAP .1 μ F	C1				
013	03282560		001	EA	CAP 22 μ F, 15V	C2				
014	03279100		001	EA	CAP 10 μ F, 15V	C3				
015	03291850		001	EA	CAP .05 μ F	C4				
016	03870001		003	EA	CAP 1 μ F	C5, C6, C7				
017	02354850		003	EA	RES 10K, 1/4W, 5%	R5, R6, R7				
018			001	EA	RES 235R, 1%, 50PPM	R1				
019			001	EA	RES 2.4K, 1%, 25PPM	R2				

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FAIRCHILD LIST OF MATERIAL

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FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 2

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY <u>LC</u>	CHK	MFG ENG	DATE
97470100		-03	01	01	01 ASSY CPU BD		DATE <u>5/77</u>	DATE	ENGR	DATE
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT			
							REV	EN NO		
001	40048472	01	001	EA	PCB CPU CARD					
002	26905090	01	001	EA	IC 3851	U1				
003	26904805	01	001	EA	IC 3850	U2				
004	26905407	01	001	EA	IC MC1489	U3				
005		01	001	EA	IC 4066	U4				
006	26904823	01	001	EA	IC 4001	U5				
007	02354380	01	004	EA	RES 100Ω 1/4W 5%	R2,3,4,7				
A-44 008	02354620	01	002	EA	RES 1KΩ 1/4W 5%	R8,12				
009	02354780	01	001	EA	RES 5.1K 1/4W 5%	R10				
010	02354850	01	003	EA	RES 10K 1/4W 5%	R1,6,9				
011	02355330	01	001	EA	RES 1MΩ 1/4W 5%	R13				
012	03175060	01	002	EA	CAP 10PF	C5,6				
013	02379120	01	001	EA	CAP .22μF 35V TANT	C4				
014	03291040	01	001	EA	CAP .1μF CERAMIC	C2				
015	03855004	01	001	EA	CAP .47μF CERAMIC	C7				
016	03279100	01	002	EA	CAP 10μF 15V TANT	C3				
017	03282560	01	001	EA	CAP 22μF 15V TANT	C1				
018	26006930	01	001	EA	DIODE FDH600	D1				
019	26903006	01	002	EA	TRANSISTOR ZN3904	Q1,2				

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FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 1

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY <u>SK</u>	CHK	MFG ENG	DATE
97470111		-03	01	01	01	DISPLAY CARD				
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE OCCURE			
							REV	EN	NO	
001	40048491	01	001	EA	PCB DISPLAY CARD					
002	03291040	01	004	EA	CAP .1MF CERAMIC	C1,2,3,4				
003	03282560	01	001	EA	CAP 22MF 15V TANT	C5				
004		01	001	EA	DIODE 1N4002	D1				
005	26901040	01	002	EA	DIODE 1N914	D2,3				
006		01	002	EA	RES 9.1Ω 1/2W 1%	R20,21				
007	02354140	01	003	EA	RES 10Ω 1/4W 5%	R17,18,19				
008	02354400	01	006	EA	RES 120Ω 1/4W 5%	R1,2,3,10,11,12				
009	02354420	01	007	EA	RES 150Ω 1/4W 5%	R4,5,6,7,8,9,13				
010		01	006	EA	IC 4042	U9,10,11,12,13,14				
011	26904820	01	004	EA	IC 4511	U4,5,6,7				
012		01	001	EA	IC 9667	U2				
013		01	001	EA	IC 74LS42	U8				
014	26904594	01	001	EA	IC 7414	U1				
015		01	001	EA	IC 82S23 OR EQUIVALENT	U3 - PROM CODE #6177-				
016	26905223	01	004	EA	LED FND560	DS3,4,5,6				
017	26905224	01	001	EA	LED FND567	DS2				
018	26905225	01	001	EA	LED FND568	DS1				
019	26903502	01	003	EA	TRANSISTOR 2N3906	Q1,2,3				
020		01	004	EA	SWITCH TOGGLE	SW1,2,3,4				
021		01	001	EA	CARD EJECTOR, S.A.E. 6200					

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DRAWINGS, SCHEMATICS AND WIRING DIAGRAMS

This section includes the following figures:

Page No.	51	RS 600 Chassis Assy.
	52	RS 600 Inner panel assy.
	53	RS 600 System wiring diagram
	54	Mother board assy.
	55	Input sig. cond. schematics
	56	Input card
	57	A/D Control card schematics
	58	DPM Interface card schematics
	59	CPU Card schematics
	60	Display driver card schematics
	61	Memory Address card schematics
	62	4K EROM card schematics
	63	Output card schematics
	64	Keyboard card schematics

Figure 7.1

Figure² 7.2

RND SIGMA
AS600
SYSTEM WIRING DIAGRAM
PSPAL/7/77
DE NO. 600-1-4003

Figure 7.4

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REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION
40048473	A/W AND SPEC
97470110-04	SCHEMATIC
97470110	LIST OF MAT'L

UNLESS OTHERWISE SPECIFIED		DRAWN	DATE	FAIRCHILD INSTRUMENTATION TITLE ASSEMBLY - UNIVERSAL CARD		
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS ANGLES X .01 12° XX .03 XXX .010 BREAK SHARP EDGES .010 MAX.		CHEK	DATE			
		ENGR	DATE			
		MFG	DATE			
		PROJ. ENGR	DATE			
TRIAL SEE LIST OF MAT'L		APPVD.	A-54	SIZE A	CODE IDENT NO.	DWG NO. 97470110
NEXT ASSY 82						

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Figure 7.6

REV	QTY	PART NUMBER	DESCRIPTION
1	1	75451	P.I.O.
2	1	3861	P.I.O.
3	1	9NLS05	INVERTER
4	1	U3	INVERTER
5	1	U2	INVERTER
6	1	U1	P.I.O.
7	1	U4	P.I.O.
8	1	U5	P.I.O.
9	1	U6	P.I.O.
10	1	U7	P.I.O.
11	1	U8	P.I.O.
12	1	U9	P.I.O.
13	1	U10	P.I.O.
14	1	U11	P.I.O.
15	1	U12	P.I.O.
16	1	U13	P.I.O.
17	1	U14	P.I.O.
18	1	U15	P.I.O.
19	1	U16	P.I.O.
20	1	U17	P.I.O.
21	1	U18	P.I.O.
22	1	U19	P.I.O.
23	1	U20	P.I.O.
24	1	U21	P.I.O.
25	1	U22	P.I.O.
26	1	U23	P.I.O.
27	1	U24	P.I.O.
28	1	U25	P.I.O.
29	1	U26	P.I.O.
30	1	U27	P.I.O.
31	1	U28	P.I.O.
32	1	U29	P.I.O.
33	1	U30	P.I.O.
34	1	U31	P.I.O.
35	1	U32	P.I.O.
36	1	U33	P.I.O.
37	1	U34	P.I.O.
38	1	U35	P.I.O.
39	1	U36	P.I.O.
40	1	U37	P.I.O.
41	1	U38	P.I.O.
42	1	U39	P.I.O.
43	1	U40	P.I.O.
44	1	U41	P.I.O.
45	1	U42	P.I.O.
46	1	U43	P.I.O.
47	1	U44	P.I.O.
48	1	U45	P.I.O.
49	1	U46	P.I.O.
50	1	U47	P.I.O.
51	1	U48	P.I.O.
52	1	U49	P.I.O.
53	1	U50	P.I.O.
54	1	U51	P.I.O.
55	1	U52	P.I.O.
56	1	U53	P.I.O.
57	1	U54	P.I.O.
58	1	U55	P.I.O.
59	1	U56	P.I.O.
60	1	U57	P.I.O.
61	1	U58	P.I.O.
62	1	U59	P.I.O.
63	1	U60	P.I.O.
64	1	U61	P.I.O.
65	1	U62	P.I.O.
66	1	U63	P.I.O.
67	1	U64	P.I.O.
68	1	U65	P.I.O.
69	1	U66	P.I.O.
70	1	U67	P.I.O.
71	1	U68	P.I.O.
72	1	U69	P.I.O.
73	1	U70	P.I.O.
74	1	U71	P.I.O.
75	1	U72	P.I.O.
76	1	U73	P.I.O.
77	1	U74	P.I.O.
78	1	U75	P.I.O.
79	1	U76	P.I.O.
80	1	U77	P.I.O.
81	1	U78	P.I.O.
82	1	U79	P.I.O.
83	1	U80	P.I.O.
84	1	U81	P.I.O.
85	1	U82	P.I.O.
86	1	U83	P.I.O.
87	1	U84	P.I.O.
88	1	U85	P.I.O.
89	1	U86	P.I.O.
90	1	U87	P.I.O.
91	1	U88	P.I.O.
92	1	U89	P.I.O.
93	1	U90	P.I.O.
94	1	U91	P.I.O.
95	1	U92	P.I.O.
96	1	U93	P.I.O.
97	1	U94	P.I.O.
98	1	U95	P.I.O.
99	1	U96	P.I.O.
100	1	U97	P.I.O.
101	1	U98	P.I.O.
102	1	U99	P.I.O.
103	1	U100	P.I.O.

SCHEMATIC -
RHO SIGMA;
INPUT CARD

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REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV.
40048465	A/W AND SPEC	1
97470103-04	SCHEMATIC	RE
97470103	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED		DRAWN <i>11 Shuler</i> DATE 4/15/53	FAIRCHILD INSTRUMENTATION	
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS .XX ± .01 .XXX ± .03 .XXX ± .10 BREAK SHARP EDGES .10 MAX.		CHK ENGR MFG PROJ. ENGR	DATE DATE DATE DATE	TITLE ASSEMBLY - INPUT CARD
MATERIAL SEE LIST OF MAT'L		APPVD A-57	SIZE A	
NEXT ASSY 82		CONTR NO.	CODE IDENT NO. 97470103	REV. 1

J1
TO METER
15

PRINT

REVISIONS				
REV	DATE	DESCRIPTION	BY	APPROVAL
1		RELEASED TO MFG PER EN

Figure 7.7

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1977

ITEM NO	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES TOLERANCES ON			
DECIMALS			
F 2 .1			
IN 2 .00			
DEC 2 .010			
BREAK SHARP EDGES 90 DEG MAX			
MATERIAL			
FINISH			
TREATMENT			
APPLICATION			
DRAWN T. Shuler			DATE 4/1/77
ENGR D.W. CORBIN			DATE 7/1/77
PROJ ENGR			DATE
APPROV			DATE
APPROV			DATE
COTS NO DN-012477			SCALE NONE
BIC C			CODE IDENT NO 97470108-04
SHEET 1			OF 1

NOTE: J1 GOES TO METER (DPM READ CARD) J3.
METER INPUTS BY SEPARATE SHIELDED CABLE

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV.
40048471	A/W AND SPEC	1
97470108-04	SCHEMATIC	R
97470108	LIST OF MAT'L	

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES. TOLERANCES ON
 DECIMALS ANGLES
 .XX .03 2°
 XXX .010 BREAK SHARP EDGES .010 MAX.

SEE LIST OF MAT'L

NEXT ASSY
 82

USED ON

DRAWN 1- <i>Shuler</i>	DATE 5/14/77
CHEK	DATE
ENGR	DATE
MFG	DATE
PROJ. ENGR	DATE
APPROV. A-59	
CONTR. NO. 01/012477	

FAIRCHILD
 INSTRUMENTATION

TITLE
 ASSEMBLY -
 A/D CONTROL CARD

SIZE	CODE IDENT NO	DWG NO	REV.
A		97470108	1
SCALE	1/1		

REVISIONS				
REV	DESCRIPTION	BY	DATE	APPROVAL
1	RELEASED TO MFG PER EN

Figure 7.8

NOTE. J3 CONNECTS TO A/D CONTROL CARD "J1"

ITEM NO	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED			DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON			DATE
DECIMALS			DATE
FRACTIONS			DATE
BREAK SHARP EDGES AND MAX			DATE
MATERIAL			DATE
FINISH			DATE
TREATMENT			DATE
APPLICATION			DATE

FAIRCHILD INSTRUMENTATION	
SCHEMATIC - DPM READ CARD	
SIZE	CODE IDENT NO
C	97470109-04
SCALE	NOTE
SHEET	1 OF 1

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REV. NO.
40048486	A/W AND SPEC	1
97470109-04	SCHEMATIC	RE
97470109	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED		DRAWN <i>T. Spulas</i> CHK ENGR MFG PROJ. ENGR APPVD. CONTR. NO.	DATE <i>5/2/77</i> DATE DATE DATE DATE DATE DATE DATE	FAIRCHILD INSTRUMENTATION	
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS .01 .03 .05 .10 .15 .20 .25 .30 .35 .40 .45 .50 .55 .60 .65 .70 .75 .80 .85 .90 .95 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00 5.10 5.20 5.30 5.40 5.50 5.60 5.70 5.80 5.90 6.00 6.10 6.20 6.30 6.40 6.50 6.60 6.70 6.80 6.90 7.00 7.10 7.20 7.30 7.40 7.50 7.60 7.70 7.80 7.90 8.00 8.10 8.20 8.30 8.40 8.50 8.60 8.70 8.80 8.90 9.00 9.10 9.20 9.30 9.40 9.50 9.60 9.70 9.80 9.90 10.00 10.10 10.20 10.30 10.40 10.50 10.60 10.70 10.80 10.90 11.00 11.10 11.20 11.30 11.40 11.50 11.60 11.70 11.80 11.90 12.00 12.10 12.20 12.30 12.40 12.50 12.60 12.70 12.80 12.90 13.00 13.10 13.20 13.30 13.40 13.50 13.60 13.70 13.80 13.90 14.00 14.10 14.20 14.30 14.40 14.50 14.60 14.70 14.80 14.90 15.00 15.10 15.20 15.30 15.40 15.50 15.60 15.70 15.80 15.90 16.00 16.10 16.20 16.30 16.40 16.50 16.60 16.70 16.80 16.90 17.00 17.10 17.20 17.30 17.40 17.50 17.60 17.70 17.80 17.90 18.00 18.10 18.20 18.30 18.40 18.50 18.60 18.70 18.80 18.90 19.00 19.10 19.20 19.30 19.40 19.50 19.60 19.70 19.80 19.90 20.00 20.10 20.20 20.30 20.40 20.50 20.60 20.70 20.80 20.90 21.00 21.10 21.20 21.30 21.40 21.50 21.60 21.70 21.80 21.90 22.00 22.10 22.20 22.30 22.40 22.50 22.60 22.70 22.80 22.90 23.00 23.10 23.20 23.30 23.40 23.50 23.60 23.70 23.80 23.90 24.00 24.10 24.20 24.30 24.40 24.50 24.60 24.70 24.80 24.90 25.00 25.10 25.20 25.30 25.40 25.50 25.60 25.70 25.80 25.90 26.00 26.10 26.20 26.30 26.40 26.50 26.60 26.70 26.80 26.90 27.00 27.10 27.20 27.30 27.40 27.50 27.60 27.70 27.80 27.90 28.00 28.10 28.20 28.30 28.40 28.50 28.60 28.70 28.80 28.90 29.00 29.10 29.20 29.30 29.40 29.50 29.60 29.70 29.80 29.90 30.00 30.10 30.20 30.30 30.40 30.50 30.60 30.70 30.80 30.90 31.00 31.10 31.20 31.30 31.40 31.50 31.60 31.70 31.80 31.90 32.00 32.10 32.20 32.30 32.40 32.50 32.60 32.70 32.80 32.90 33.00 33.10 33.20 33.30 33.40 33.50 33.60 33.70 33.80 33.90 34.00 34.10 34.20 34.30 34.40 34.50 34.60 34.70 34.80 34.90 35.00 35.10 35.20 35.30 35.40 35.50 35.60 35.70 35.80 35.90 36.00 36.10 36.20 36.30 36.40 36.50 36.60 36.70 36.80 36.90 37.00 37.10 37.20 37.30 37.40 37.50 37.60 37.70 37.80 37.90 38.00 38.10 38.20 38.30 38.40 38.50 38.60 38.70 38.80 38.90 39.00 39.10 39.20 39.30 39.40 39.50 39.60 39.70 39.80 39.90 40.00 40.10 40.20 40.30 40.40 40.50 40.60 40.70 40.80 40.90 41.00 41.10 41.20 41.30 41.40 41.50 41.60 41.70 41.80 41.90 42.00 42.10 42.20 42.30 42.40 42.50 42.60 42.70 42.80 42.90 43.00 43.10 43.20 43.30 43.40 43.50 43.60 43.70 43.80 43.90 44.00 44.10 44.20 44.30 44.40 44.50 44.60 44.70 44.80 44.90 45.00 45.10 45.20 45.30 45.40 45.50 45.60 45.70 45.80 45.90 46.00 46.10 46.20 46.30 46.40 46.50 46.60 46.70 46.80 46.90 47.00 47.10 47.20 47.30 47.40 47.50 47.60 47.70 47.80 47.90 48.00 48.10 48.20 48.30 48.40 48.50 48.60 48.70 48.80 48.90 49.00 49.10 49.20 49.30 49.40 49.50 49.60 49.70 49.80 49.90 50.00 50.10 50.20 50.30 50.40 50.50 50.60 50.70 50.80 50.90 51.00 51.10 51.20 51.30 51.40 51.50 51.60 51.70 51.80 51.90 52.00 52.10 52.20 52.30 52.40 52.50 52.60 52.70 52.80 52.90 53.00 53.10 53.20 53.30 53.40 53.50 53.60 53.70 53.80 53.90 54.00 54.10 54.20 54.30 54.40 54.50 54.60 54.70 54.80 54.90 55.00 55.10 55.20 55.30 55.40 55.50 55.60 55.70 55.80 55.90 56.00 56.10 56.20 56.30 56.40 56.50 56.60 56.70 56.80 56.90 57.00 57.10 57.20 57.30 57.40 57.50 57.60 57.70 57.80 57.90 58.00 58.10 58.20 58.30 58.40 58.50 58.60 58.70 58.80 58.90 59.00 59.10 59.20 59.30 59.40 59.50 59.60 59.70 59.80 59.90 60.00 60.10 60.20 60.30 60.40 60.50 60.60 60.70 60.80 60.90 61.00 61.10 61.20 61.30 61.40 61.50 61.60 61.70 61.80 61.90 62.00 62.10 62.20 62.30 62.40 62.50 62.60 62.70 62.80 62.90 63.00 63.10 63.20 63.30 63.40 63.50 63.60 63.70 63.80 63.90 64.00 64.10 64.20 64.30 64.40 64.50 64.60 64.70 64.80 64.90 65.00 65.10 65.20 65.30 65.40 65.50 65.60 65.70 65.80 65.90 66.00 66.10 66.20 66.30 66.40 66.50 66.60 66.70 66.80 66.90 67.00 67.10 67.20 67.30 67.40 67.50 67.60 67.70 67.80 67.90 68.00 68.10 68.20 68.30 68.40 68.50 68.60 68.70 68.80 68.90 69.00 69.10 69.20 69.30 69.40 69.50 69.60 69.70 69.80 69.90 70.00 70.10 70.20 70.30 70.40 70.50 70.60 70.70 70.80 70.90 71.00 71.10 71.20 71.30 71.40 71.50 71.60 71.70 71.80 71.90 72.00 72.10 72.20 72.30 72.40 72.50 72.60 72.70 72.80 72.90 73.00 73.10 73.20 73.30 73.40 73.50 73.60 73.70 73.80 73.90 74.00 74.10 74.20 74.30 74.40 74.50 74.60 74.70 74.80 74.90 75.00 75.10 75.20 75.30 75.40 75.50 75.60 75.70 75.80 75.90 76.00 76.10 76.20 76.30 76.40 76.50 76.60 76.70 76.80 76.90 77.00 77.10 77.20 77.30 77.40 77.50 77.60 77.70 77.80 77.90 78.00 78.10 78.20 78.30 78.40 78.50 78.60 78.70 78.80 78.90 79.00 79.10 79.20 79.30 79.40 79.50 79.60 79.70 79.80 79.90 80.00 80.10 80.20 80.30 80.40 80.50 80.60 80.70 80.80 80.90 81.00 81.10 81.20 81.30 81.40 81.50 81.60 81.70 81.80 81.90 82.00 82.10 82.20 82.30 82.40 82.50 82.60 82.70 82.80 82.90 83.00 83.10 83.20 83.30 83.40 83.50 83.60 83.70 83.80 83.90 84.00 84.10 84.20 84.30 84.40 84.50 84.60 84.70 84.80 84.90 85.00 85.10 85.20 85.30 85.40 85.50 85.60 85.70 85.80 85.90 86.00 86.10 86.20 86.30 86.40 86.50 86.60 86.70 86.80 86.90 87.00 87.10 87.20 87.30 87.40 87.50 87.60 87.70 87.80 87.90 88.00 88.10 88.20 88.30 88.40 88.50 88.60 88.70 88.80 88.90 89.00 89.10 89.20 89.30 89.40 89.50 89.60 89.70 89.80 89.90 90.00 90.10 90.20 90.30 90.40 90.50 90.60 90.70 90.80 90.90 91.00 91.10 91.20 91.30 91.40 91.50 91.60 91.70 91.80 91.90 92.00 92.10 92.20 92.30 92.40 92.50 92.60 92.70 92.80 92.90 93.00 93.10 93.20 93.30 93.40 93.50 93.60 93.70 93.80 93.90 94.00 94.10 94.20 94.30 94.40 94.50 94.60 94.70 94.80 94.90 95.00 95.10 95.20 95.30 95.40 95.50 95.60 95.70 95.80 95.90 96.00 96.10 96.20 96.30 96.40 96.50 96.60 96.70 96.80 96.90 97.00 97.10 97.20 97.30 97.40 97.50 97.60 97.70 97.80 97.90 98.00 98.10 98.20 98.30 98.40 98.50 98.60 98.70 98.80 98.90 99.00 99.10 99.20 99.30 99.40 99.50 99.60 99.70 99.80 99.90 100.00 100.10 100.20 100.30 100.40 100.50 100.60 100.70 100.80 100.90 101.00 101.10 101.20 101.30 101.40 101.50 101.60 101.70 101.80 101.90 102.00 102.10 102.20 102.30 102.40 102.50 102.60 102.70 102.80 102.90 103.00 103.10 103.20 103.30 103.40 103.50 103.60 103.70 103.80 103.90 104.00 104.10 104.20 104.30 104.40 104.50 104.60 104.70 104.80 104.90 105.00 105.10 105.20 105.30 105.40 105.50 105.60 105.70 105.80 105.90 106.00 106.10 106.20 106.30 106.40 106.50 106.60 106.70 106.80 106.90 107.00 107.10 107.20 107.30 107.40 107.50 107.60 107.70 107.80 107.90 108.00 108.10 108.20 108.30 108.40 108.50 108.60 108.70 108.80 108.90 109.00 109.10 109.20 109.30 109.40 109.50 109.60 109.70 109.80 109.90 110.00 110.10 110.20 110.30 110.40 110.50 110.60 110.70 110.80 110.90 111.00 111.10 111.20 111.30 111.40 111.50 111.60 111.70 111.80 111.90 112.00 112.10 112.20 112.30 112.40 112.50 112.60 112.70 112.80 112.90 113.00 113.10 113.20 113.30 113.40 113.50 113.60 113.70 113.80 113.90 114.00 114.10 114.20 114.30 114.40 					

REVISIONS				
DATE	REV	DESCRIPTION	BY	DATE
	1	RELEASE TO MFG PER EN

Figure 7.9

		ITEM NO	QTY	PART NUMBER	DRAWING <i>447</i> DATE CDR	DESCRIPTION FAIRCHILD INSTRUMENTATION	
		UNLESS OTHERWISE SPECIFIED			DIMENSIONS ARE IN HUNDRED THOUSANDS OF INCHES ANGLES = 1°		
		DIMENSIONS ARE IN HUNDRED THOUSANDS OF INCHES DIM = .03 DIM = .010 SQUARE SHARP EDGED END MAX.			LEAD M.W. CORBIN DATE 12-77		
		MATERIAL			NFG DATE	TITLE	
					PROJ ENGR DATE	SCHEMATIC - CPU CARD	
		FINISH			APPYD DATE		
NEXT ASSY		USED ON			APPYD DATE	SIZE C	CODE IDENT NO 97470100-04
APPLICATION		TREATMENT			COSTS NO DN-C13477	SCALE NONE	QTY 1
					SHEET 1 OF 1		

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV. NO.
40048472	A/W AND SPEC	1
97470100-04	SCHEMATIC	RE.
97470100	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED	DRAWN <i>T. Sintes</i>	DATE 5/12/72
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS X .1 XX .03 XXX .010	CHE	DATE
ANGLES 32°	ENGR	DATE
BREAK SHARP EDGES .010 MAX.	MFG	DATE
MATERIAL SEE LIST OF MAT'L	PROJ. ENGR	DATE
NEXT ASST 82	APPVD. A-63	
USED ON PROGRAM CONTROLLER	CONTR NO. DN-012477	

FAIRCHILD INSTRUMENTATION		TITLE ASSEMBLY - CPU BOARD	
SIZE A	CODE IDENT NO.	DWG NO. 97470100	REV. 1
SCALE 1/1			SHEET 1 OF 1

ADDRESSES
DATA — FFFA (IN HEX)
CONTROL — FFFB " "

REVISIONS				
DATE	REV	DESCRIPTION	BY	APPROVAL
	1	RELEASE TO MFG PER EN

ITEM NO	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED:			
DIMENSIONS ARE IN INCHES TOLERANCES ON		DATE	FAIRCHILD INSTRUMENTATION
DECIMALS		DATE	
1/16 1/32 1/64		DATE	
BREAK SHARP EDGES 0.015 MAX		DATE	
MATERIAL		DATE	
FINISH		DATE	
TREATMENT		DATE	
NEXT ASSY		DATE	
USED ON		DATE	
APPLICATION		DATE	
DRAWN		DATE	
CHK		DATE	
ENGR		DATE	
MFG		DATE	
PROJ. ENGR		DATE	
APPROV		DATE	
APPROV		DATE	
CONTR NO		DATE	
DN-012477		DATE	
SIZE		CODE IDENT NO	97470105-04
SCALE		DATE	
SHEET		1 OF 1	

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV
40048467	A/W AND SPEC	1
97470105-04	SCHEMATIC	RE
97470105	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES. TOLERANCES ON
 DECIMALS .01 .02 .03 .04 .05 .06 .07 .08 .09 .10 .12 .15 .20 .25 .30 .35 .40 .45 .50 .60 .70 .80 .90 1.00 1.25 1.50 2.00 2.50 3.00 4.00 5.00 6.00 8.00 10.00 12.00 15.00 20.00 25.00 30.00 40.00 50.00 60.00 80.00 100.00
 ANGLES 2° 3° 4° 5° 6° 8° 10° 12° 15° 20° 25° 30° 35° 40° 45° 50° 55° 60° 65° 70° 75° 80° 85° 90°
 BREAK SHARP EDGES DID MAX.

DRAWN <i>T. Skidmore</i>	DATE <i>5/1/77</i>
CHK	DATE
ENGR	DATE
MFG	DATE
PROJ. ENGR	DATE
APPVD.	DATE

FAIRCHILD
 INSTRUMENTATION

TITLE
**ASSEMBLY -
 DISPLAY DRIVER CARD**

SEE LIST OF MAT'L

NEXT ASSY

82

A-65

SIZE
 A

CODE IDENT NO.

DWG NO

97470105

REV

1

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REVISIONS			
REV	DESCRIPTION	BY	DATE
1	RELEASED TO MFG PER EN

NOTE: A1, A2 CABLE GOES TO J6 ON DISPLAY DRIVER CARD.

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES TOLERANCES ON			
DECIMALS			
FRACTIONS			
BREAK SHARP EDGES .010 MAX			
MATERIAL			
FINISH			
TREATMENT			
NEXT ASSY			
USED ON			
APPLICATION			
DRAWN BY: T. Schulz			DATE: 1/28/77
ENGR: D.W. CORBIN			DATE: 1/28/77
MFG:			DATE:
APPROV:			DATE:
APPROV:			DATE:
CONTR NO: DN-012477			SCALE: NONE
FAIRCHILD INSTRUMENTATION			TITLE: SCHEMATIC - DISPLAY CARD
C			CODE IDENT NO: 97470111-04
SHEET 1 OF 1			REV: 1

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REV NO.
40048491	A/W AND SPEC	1
97470111-04	SCHEMATIC	REF
97470111	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED		DRAWN <i>T. Smith</i>		DATE		FAIRCHILD INSTRUMENTATION		NOV - 4 1971	
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS X ± .1 XX ± .03 XXX ± .010		CHK		DATE		TITLE ASSEMBLY - DISPLAY CARD			
MATERIAL SEE LIST OF MAT'L		ENGR <i>D.W. CORBIN</i>		DATE		SIZE A		CODE IDENT NO. 97470111	
NEXT ASSY 82		MFG		DATE		DWC NO. 97470111		REV 1	
USED ON PROGRAM CONTROLLED		PROJ. ENGR		DATE		SHEET 1 OF 1			
		APPVD. A-68		CONTR NO. DAL-012477					

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV.
40048470	A/W AND SPEC	1
97470107-04	SCHEMATIC	R
97470107-03	LIST OF MAT'L	

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. TOLERANCES ON
 DECIMALS
 X ±.1
 XX ±.03
 XXX ±.010
 BREAK SHARP EDGES .010 MAX.

MATERIAL

LIST OF MAT'L

NEXT ASSY

82

USED ON

DPOC RAM CONTROL FR

CONTR NO.

DN-012477

DRAWN

CHK

ENGR

MFG

PROJ. ENGR

APPVD.

A-70

DATE

DATE

DATE

DATE

DATE

~~FAIRCHILD~~
~~INSTRUMENTATION~~

TITLE

ASSEMBLY—
 MEMORY ADDRESS CAR

SIZE

A

CODE IDENT NO.

DWG NO.

97470107

REV.

SCALE

1/1

SHEET 1 OF 1

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REVISION
40048469	A/W AND SPEC	1
97470106-04	SCHEMATIC	RE
97470106	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS
XX .01
XX .03
XXX .010
BREAK SHARP EDGES .010 MAX.
SEE LIST OF MAT'L
NEXT ASSY
82
USED ON
012477

DRAWN	DATE
CHK	DATE
ENGR	DATE
MFG	DATE
PROJ. E	DATE
APPR	
COH	

FAIRCHILD INSTRUMENTATION			
TITLE ASSEMBLY — 4K EPROM CARD			
SIZE A	CODE IDENT NO.	DWG NO 97470106	REV. 1
SCALE			

REVISIONS					
QD#	REV	DESCRIPTION	BY	DATE	APPROVAL
	1	RELEASE TO MFG PER EN

Figure 7.13

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REVISION
40048466	A/W AND SPEC	1
97470104-04	SCHEMATIC	RE
97470104	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED		DRAWN <i>T. Shuler</i>		DATE <i>5/12/77</i>		FAIRCHILD INSTRUMENTATION	
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS X .1 XX .03 XXX .010		CHK		DATE			
ANGLES 22° BREAK SHARP EDGES .010 MAX.		ENGR		DATE			
		MFG		DATE			
SEE LIST OF MAT'L		PROJ. ENGR		DATE		ASSEMBLY - OUTPUT CARD	
NEXT ASSY 82		APPVD. A-74		DATE			
USED ON PROGRAM CONTROLLER		CONTR NO. DN-012477		SIZE A		CODE IDENT NO. 97470104	
				SCALE 1/1		DYC NO. 97470104	
						REV 1	
						SHEET 1 OF 1	

REVISIONS			
REV	DESCRIPTION	BY	APPROVAL
1	RELEASE TO MRS FOR EN	CC

Figure 7.14

ITEM NO	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES 2°			
MATERIAL			
FINISH			
TREATMENT			
APPLICATION			
NEXT ASSY USED ON			
DRAWN DATE			
CHK DATE			
ENGR DATE			
MFG DATE			
PROJ ENGR DATE			
APPROV			
APPROV			
CONTR NO			
DNC12477			
FAIRCHILD INSTRUMENTATION			
TITLE			
SCHEMATIC-RHO SIGMA KEYBOARD			
SIZE CODE IDENT NO DWS NO			
C 97470112-04 1			
SHEET OF			

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	REL TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO
40048507	A/W AND SPEC	1
97470112-04	SCHEMATIC	RE
97470112-03	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED	DRAWN <i>T. Shuler</i>	DATE <i>3/17/77</i>
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS XX ± .03 XXX ± .010	CHE	DATE
BREAK SHARP EDGES .010 MAX.	ENGR	DATE
R/L	HFG	DATE
SEE LIST OF MAT'L	PROJ. ENGR	DATE
NEXT ASSY 82	APPVD. A-76	

FAIRCHILD
INSTRUMENTATION

TITLE

ASSEMBLY -
KEY BOARD CARD

NASA-MSFC

SIZE	CODE IDENT NO.	DWG NO.	REV
A		97470112	1

SECTION B

SYSTEM DESIGN DRAWINGS

RS600

PROGRAMMABLE CONTROL SYSTEM

SECTION B

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No number	1 of 1 Final Assembly Parts List	B- 15
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35108125	1 of 1 Bracket, Side - Card Cage	B- 19
35108126	1 of 1 Brace, Card Cage	B- 20
35108130	1 of 1 Bracket, Mounting - DDM	B- 21
97470101	1 of 2 Assembly, Mother Board	B- 22
97470101	2 of 2 Material List, Mother Board	B- 23
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40048468	2 of 2 Mother Board, Bottom Side	B- 25
97470110-04	1 of 1 Schematic Universal Board	B- 26
97470110	1 of 2 Assembly Universal Board	B- 27
97470110	2 of 2 Material List, Universal Board	B- 28
97470103-04	1 of 1 Schematic, Input Card	B- 29
97470103	1 of 2 Assembly Input Card	B- 30
97470103	2 of 2 Material List, Input Card	B- 31
97470108-04	1 of 1 Schematic A/D Control Card	B- 32
97470108-03	1 of 2 Material List, Assy A/D Control Card	B- 34
97470108-03	2 of 2 Material List, Assy A/D Control Card	B- 35
97470100-04	1 of 1 Schematic, CPU Card	B- 36
97470100	1 of 1 Assembly, CPU Board	B- 37
97470100-03	1 of 2 Material List, CPU Board	B- 38
97470100-03	2 of 2 Material List, CPU Board	B- 39

<u>Drawing No.</u>		<u>Title</u>	<u>Page No.</u>
97470105-04	1 of 1	Schematic, Display Driver	B-40
97470105	1 of 1	Assembly, Driver Display Card	B-41
97470105-03	1 of 1	Material List, Assy Driver Display	B-42
97470107-04	1 of 1	Schematic Memory Address Card	B-43
97470107	1 of 1	Assembly, Memory Address Card	B-44
97470107-03	1 of 1	Material List, Memory Address Card	B-45
97470106-04	1 of 1	Schematic, 4K EROM	B-46
97470106	1 of 1	Assembly, 4K EROM Card	B-47
97470106-03	1 of 1	Materials List, 4K EROM Card	B-48
97470104-04	1 of 1	Schematic, Output Card	B-49
97470104	1 of 1	Assembly, Output Card	B-50
97470104-03	1 of 1	Materials List, Output Card	B-51
82540520	1 of 1	4 1/2 AC DPM Assembly	B-52
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97401119-04	1 of 1	Schematic, DPM 4-1/2 AC	B-54
40048395	1 of 1	Baseboard Assembly	B-55
97400312-03	1 of 2	Materials List, Baseboard Assy	B-56
97400312-03	2 of 2	Materials List, Baseboard Assy	B-57
40048396	1 of 1	Analog Assembly	B-58
97400309	1 of 2	Materials List, Analog Assembly	B-59
97400309	2 of 2	Materials List, Analog Assembly	B-60
97470109-04	1 of 1	Schematic, DPM Read Card	B-61
97470109	1 of 1	Assembly, DPM Read Card	B-62
97470109-03	1 of 1	Materials List, DPM Read Card	B-63
600-3001	1 of 1	RS600 Bracket Dim.	B-64
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97470111-04	1 of 1	Schematic Display Card	B-66
97470111	1 of 1	Assembly Display Card	B-67
97470111-03	1 of 1	Materials List, Display Card	B-68
97470112-04	1 of 1	Schematic, Keyboard	B-69
97470112	1 of 1	Assembly, Keyboard Card	B-70
97470112-03	1 of 1	Materials List, Keyboard Card	B-71
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600-3000	4 of 6	Hole Patterns for Switches, Lights, Fuse, Key Switch	B-75
600-3000	5 of 6	Diagram RS600 Controller	B-76
600-3000	6 of 6	CCO-3000	B-77

**RS 600
PROGRAMMABLE
CONTROL
SYSTEM**

RHO SIGMA
11922 VALERIO
NO. HOLLYWOOD CA. 91605

① ENCLOSURE

INNER PANEL ②
ASSY

③ PCS CHASSIS ASSY

APPROVED

		TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± . XXX ±		APPROVALS	DATE	RHO SIGMA INC.	
		MATERIAL	DRAWN JLI	8/18	RS 600 PCS ASSEMBLY		
			CHECKED				
			FINISH				
NEXT ASSY	USED ON	APPLICATION	DO NOT SCALE DRAWING	SIZE B	CODE IDENT NO.	DRAWING NO. 600-1000	
				SCALE	SHEET 1 OF 2		

[illegible]

(FURNISHED BY CUSTOMER)

REVISIONS				
DATE	BY	DESCRIPTION	BY	DATE
1		RELEASED TO MFG PER EN	CE	

D

C

B

A

B-5

ITEM NO	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED			DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON			DATE
DECIMALS			DATE
FRACTIONS			DATE
MATERIAL			DATE
FINISH			DATE
TREATMENT			DATE
NEXT ASSY			DATE
USED ON			DATE
APPLICATION			DATE
DRAWN BY			DATE
CHECKED BY			DATE
APPROVED BY			DATE
TITLE			DATE
CAGE IDENT NO			DATE
DWG NO			DATE
SCALE			DATE
SHEET			DATE

1977

FAIRCHILD INSTRUMENTATION

ELOCK DIAGRAM-
RS-600 CONTROLLER
SYSTEM INTERCONNECT

CAGE IDENT NO 80000600-20

DWG NO 1

SCALE

SHEET

DN-012477

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048464	A/W AND SPEC	1
97470102	LIST OF MAT'L	1

FAIRCHILD INSTRUMENTATION NOV - 1971

TITLE
ASSEMBLY -
EXTENDER CARD

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. TOLERANCES ON
DECIMALS ANGLES
X ± .1 ± 2°
XX ± .03
XXX ± .010 BREAK SHARP EDGES .010 MAX.

MATERIAL
SEE LIST OF MAT'L

NEXT ASSY
82

DRAWN <i>T. Shingles</i>	DATE <i>8/1/71</i>
CHK	DATE
ENGR <i>D. W. CORBIN</i>	DATE <i>10/21/71</i>
MFG	DATE
PROJ. ENGR	DATE
APPROV.	DATE

B-6

SIZE
A

CODE IDENT NO

DWG NO

97410102

REV

1

PAGE 1 OF 1

[illegible]

450

6.85

325 TYP

200

3860 ± .005

0.030 x 45°
CHAMFER
2 PLCS

40048464
REV: 1
DATE FILMED

DRILL PATTERN
FIG. 10.07
3012 230.002

[illegible]

9. GOLD PLATE FINGERS PAR 6.2
 8. FINGER EDGES PAR 4.0
 7. HOLE SIZE PAR 2.9
 6. SILKSCREEN PAR 5.0
 5. SOLDER RESIST PAR 8.1
 4. SOLDER PLATE PAR 6.9, 6.11
 3. NOTCH - PAR 8.1, 4 EACH
 2. MATERIAL PAR 7.1.1, 7.2.4, 7.3.1
 1. GENERAL PAR 1.0, 2.0, 3.0

NOTES, PER FS 67095639

HOLE SCHEDULE				TOLERANCE
SYM	LOCATION	DY	DEPTH	
UNMARKED	04 - 000 DIA	PC		DECIMAL
E	06 - 000 DIA			.5 ± .1
F	12 - 000 DIA			.XX ± .01
G	18 - 000 DIA			.X1 ± .005
				ANGLES
				22°

FILM REQUIRED		APPLICATION
BAR GRAPH	X	NEW ACRY
STAPLER	X	NEW ACRY
COMPONENT SIDE	X	NEW ACRY
GROUND LAYER		
SOLDER STRIP	X	
SOLDER MASK	X	

SEARCHED	INDEXED	FBI - MEMPHIS MAY 10 1968 TELETYPE UNIT - 404-402
T. SHIELDS	4-17-77	
ONE	THREE	
FOUR	SIX	
SEVEN	EIGHT	11 MAY 1968 SPEED DWG PCB - EXTENDER CARD
NINE	TEN	12 MAY 1968 B 4004B464
TELETYPE	TELETYPE	13 MAY 1968 B 4004B464

APPLICATION			REVISION		
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED

NOTE: TWO OF EACH PER BOX

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± .03 ± .XXX ± MATERIAL 304 ALUM. 1 IN CHANNEL FINISH NONE	CONTRACT NO.		RHO SIGMA INC	
	APPROVALS	DATE		
	DRAWN D.G.	11/1/77	RS 600 FRONT PANEL MOUNTING BRACKET	
	CHECKED			
		SIZE A	CODE IDENT NO.	DRAWING NO. 600-3003
DO NOT SCALE DRAWING	SCALE FULL		SHEET 1 OF 1

[illegible]

REVISIONS					
NO.	REV	DESCRIPTION	BY	DATE	APPROVAL
	1	RELEASE TO MFG PER EN	CC

B-14

1971

ITEM NO.		QTY.	PART NUMBER	DESCRIPTION			
			UNLESS OTHERWISE SPECIFIED	DRAWN	DATE		
			DIMENSIONS ARE IN INCHES TOLERANCES ON	CHE	DATE		
			DECIMALS	FAIRCHILD			
			1/16 .001	INSTRUMENTATION			
			1/32 .002	MADE	DATE		
			1/64 .003	BY W. CORBIN	DATE		
			BREAK SHARP EDGES 50 DIAE	NFG	DATE		
			MATERIAL	PROJ. LENS	DATE		
			SEE LIM	UNPES			
			FINISH	APPROV	SIC	CODE IDENT NO.	QTY REQ
					C	97472000	1
NEXT ASST		USED ON	TREATMENT	COPIES TO	SCALE	SHEET 1 OF 1	
				LIN-012477	FULL		
APPLICATION							

PAGE 1 OF 1

[illegible]

20-77		R40-SIGMA CARD CASE	
MECHANICAL ASSY,			
R40-SIGMA CARD CASE			
B		97472053	
NONE			

PAGE 1 OF 1

- 31 -

APPLICATION

REVISION

NEXT ASSY

USED ON

LTR

DESCRIPTION

DATE

APPROVED

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:

FRACTIONS DECIMALS ANGLES

± .XX ± ±

.XXX ± .020

MATERIAL

16 GAGE

FINISH

NONE

CONTRACT NO.

APPROVALS

DATE

DRAWN

D.G.

11/1/77

CHECKED

RHO SIGMA INC

RS 600 CARD CAGE
MOUNTING BRACKET

SIZE

A

CODE IDENT NO.

DRAWING NO.

600-3004

DO NOT SCALE DRAWING

SCALE FULL

SHEET 1 OF 1

ITEM NO	QTY	PART NUMBER	DESCRIPTION			
MATERIAL 1/2 31 (.059) CRS		TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED DECIMAL ANGLES X ± 1 ± 2° X ± 03 X ± 010	DRAWN J.C. 5-77 CRO MECH ENGR DATE	FAIRCHILD INSTRUMENTATION		
TREATMENT		⊥ PERPENDICULAR PARALLEL ⊙ CONCENTRIC — FLAT OR STRAIGHT ✓ SURFACE ROUGHNESS	ELEC ENGR DATE MFG DATE	TITLE BRACE, CARD CAGE		
FINISH PAINT SLACK		BREAK ALL SHARP EDGES DTD HAS DO NOT SCALE THIS DRAWING	PROJ. ENGR DATE	SIZE B	NO 35108126	
NEXT ASSY		MODEL		SCALE	SHEET	OF
						REV.

B-21

35108130

ITEM NO.		QTY	PART NUMBER	DESCRIPTION	
MATERIAL		TOLERANCES AND NOTES		DATE	
12 GA. (.081)		UNLESS OTHERWISE SPECIFIED		DRAWN J.C.	
ALUM 5052-H32		DECIMAL ANGLES		CHK	
		X ± .1 ± 2°		MECH. ENGR. DATE	
		XX ± .03		ELEC. ENGR. DATE	
		XXX ± .010		MFG DATE	
TREATMENT		1 PERPENDICULAR		PROJ ENGR DATE	
		II PARALLEL		SCALE 1/1	
		III CONCENTRIC		QTY 1	
		IV FLAT OR STRAIGHT		REV.	
		V SURFACE ROUGHNESS			
FINISH		BREAK ALL SHARP EDGES 0.10 MAX			
PAINT BLACK		DO NOT SCALE THIS DRAWING			
		NEXT ASS Y			
		MODEL			
		SCALE 1/1			
		QTY 1			
		REV.			

TITLE
BRACKET, MOUNTING -
DPM

SIZE NO
B 35108130

FAIRCHILD
INSTRUMENTATION

REVISIONS				
REV	DESCRIPTION	BY	DATE	APPROV
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REV
40048468	AN AND SPEC. DRG	1
9M70101	LIST OF MATL	1

ITEM NO.	QTY	PART NUMBER
UNLESS OTHERWISE SPECIFIED		
DIMENSIONS ARE IN INCHES TOLERANCES ON		
DECIMALS		
FRACTIONS		
ANGLES		
RADIUS		
HOLE SHARP EDGES 90 DEG		
MATERIAL		
FINISH		
TREATMENT		
HEAT ASBY		
USED ON		
APPLICATION		

PART NUMBER		DESCRIPTION	
UNLESS OTHERWISE SPECIFIED		DRAWN	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON		CWA	DATE
DECIMALS		ENGR	DATE
FRACTIONS		APP'D	DATE
ANGLES		APPROV	DATE
RADIUS			
HOLE SHARP EDGES 90 DEG			
MATERIAL			
FINISH			
TREATMENT			
HEAT ASBY			
USED ON			
APPLICATION			

FAIRCHILD
NATIONAL SEMICONDUCTOR

ASSEMBLY -
MOTHER BOARD

SIZE	CODE IDENT NO	DATE NO	REV
C		97470101	1
SCALE	1/1		1

1977

PAGE 1 OF 1

[illegible]

B-23

40048468
REV-1
DATE FILMED 4.13.77

COMPONENT SIDE
DRILL PATTERN

MOTHER BOARD

TOP SIDE

4004846E
REV-1
DATE FILMED 4.10.77

DRILL PATTERN

3012 R3QJ02

MOTHER BOARD - BOTTOM SIDE AS IF
VIEWED THROUGH THE TOP.

REVISIONS				
REV	DATE	DESCRIPTION	BY	APPROVAL
1		RELEASED TO MFG PER EN

1. ALL RESISTOR VALUES NOT SHOWN
MAY BE CUSTOMER SELECTED AND INSTALLED.

NOTES:

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED:			
DIMENSIONS ARE IN INCHES TOLERANCES ON:			
FRACTIONS DECIMALS			
1/16 ± .005 1/32 ± .003 1/64 ± .002			
BREAK SHARP EDGES AND RAS.			
MATERIAL			
FINISH			
TYPICAL			
APPROVED			
DATE			
BY			
TITLE			
SCHEMATIC — UNIVERSAL BOARD			
C 97470110-04 1			
DRAWN BY DN-012477			
SCALE NONE			
SHEET 1 OF 1			

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048473	A/W AND SPEC	1
97470110-04	SCHEMATIC	REF
97470110	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED		DRAWN	DATE	FAIRCHILD INSTRUMENTATION NOV - 4 1977				
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS		CHK	DATE					
X .1		ENGR	DATE					
XX .03		MFG	DATE					
XXX .010		PROJ. ENGR	DATE	TITLE ASSEMBLY - UNIVERSAL CARD				
BREAK SHARP EDGES .010 MAX.		APPVD.	DATE					
MATERIAL		USED ON 82			SIZE	CODE IDENT NO.	DWG NO.	REV.
SEE LIST OF MAT'L		CONTO NO. DN-012477			A		97470110	1
		B-27			1/1		SHEET 1 OF 1	

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 1

[illegible]

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048465	A/W AND SPEC	1
97470103-04	SCHEMATIC	REF
97470103	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. TOLERANCES ON
DECIMALS ANGLES
X = .1 32°
XX = .03
XXX = .010 BREAK SHARP EDGES .010 MAX.

MATERIAL
SEE LIST OF MAT'L

NEXT ASSY
82

USED BY PROGRAM CONTROLLED

DRAWN <i>11 Shuler</i>	DATE 8/14/77
CHK	DATE
ENGR D.W. CORBIN	DATE 10/23/77
MFG	DATE
PROJ. ENGR	DATE
APPRD.	
CONTR NO. DAL-012477	

FAIRCHILD
INSTRUMENTATION DIV - 4 1977

TITLE
ASSEMBLY -
INPUT CARD

SIZE	CODE IDENT NO.	DWG NO.	REV.
A		97470103	1
SCALE 1/1			

PAGE 1 OF 1

LM NO	REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG ENG	DATE
97470103	-03	01	0101	ASSY INPUT CARD 1,2					
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT		
							REV	EN	NO
001	40048465		001	EA	P.C.B INPUT CARD				
002	03291040		001	EA	CAP .1UF	C1			
003	03282560		001	EA	CAP 22UF, 15V	C2			
004	03279100		001	EA	CAP 10UF, 15V	C3			
005	26901040		008	EA	DIODE 1N914	D1 THRU D8			
006	05036850		008	EA	RELAY	K1 THRU K8			
007	26904575		002	EA	IC 9LS05	U2, U3			
008			001	EA	IC 3861	U1			
009			004	EA	IC 75451	U4, 5, 6, 7			
010			001	EA	CARD EJECTOR, S.A.E. 6200				
011	09917022		001	EA	SOCKET 40 PIN	U1			

- UNLESS OTHERWISE SPECIFIED - DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS ANGLES X .5:1 XX .03 ± 2° XXX .010 BREAK SHARP EDGES .010 MAX.	DRAWN <i>1. J. J. J.</i> CHK.	DATE <i>5/14/77</i> DATE
MATERIAL "EE LIST OF MAT'L	ENGR <i>D.W. CORBIN</i> MFG	DATE <i>1/24/77</i> DATE
NEXT ASSY <i>82</i>	PROJ. ENGR	DATE
USED BY	APPVD.	

TITLE ASSEMBLY—
A/D CONTROL CARD

SIZE A	CODE IDENT NO.	DWG NO. 97470108	REV. 1
-----------	----------------	---------------------	-----------

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 2

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG	ENG	DATE
97470108		-03	01	0101	ASSY A/D CONTROL CARD						
							DATE	DATE	ENGR		DATE
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT				
							REV	EN NO			
001	40048471		001	EA	P.C.B. A/D CONTROL CARD						
002	26905090		001	EA	IC 3851 PSU	U1					
003	26904564		001	EA	IC 74LS04	U2					
004	26904578		001	EA	IC 74LS00	U3					
005	26904590		001	EA	IC 74LS02	U4					
006	26905601		001	EA	IC 9602	U5					
007	26905605		003	EA	IC 75451	U6, U7, U8					
008	26901040		006	EA	DIODE 1N914	D1 THRU D6					
009	26012550		001	EA	ZENER 1N758A, 10V, 5%	D7					
010	26901016		001	EA	ZENER 1N4569, 6.4V, 5%	D8					
011	05036850		005	EA	RELAY	K1 THRU K6					
012	03291040		001	EA	CAP .1 μ F	C1					
013	03282560		001	EA	CAP 22 μ F, 15V	C2					
014	03279100		001	EA	CAP 10 μ F, 15V	C3					
015	03291851		001	EA	CAP .05 μ F	C4					
016	03370001		003	EA	CAP 1 μ F	C5, C6, C7					
017	02354850		003	EA	RES 10K, 1/4W, 5%	R5, R6, R7					
018			001	EA	RES 235 Ω , 1%, 50PPM	R1					
019			001	EA	RES 2.4K, 1%, 25PPM	R2					

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B-36

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048472	A/W AND SPEC	1
97470100-04	SCHEMATIC	REF
97470100	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS XX ± .03 XXX ± .010 BREAK SHARP EDGES .010 MAX	DRAWN <i>T. Sintes</i>	DATE 5/1/72
	CHK	DATE
	ENGR <i>D.W. CORBIN</i>	DATE 7/2/72
	MFG	DATE
	PROJ. ENGR	DATE
MATERIAL SEE LIST OF MAT'L	APPVD.	
NEXT ASSY 82	CONTR NO.	

FAIRCHILD
INSTRUMENTATION

TITLE

**ASSEMBLY -
CPU BOARD**

SIZE
A

CODE IDENT NO.

DWG NO.

97470100

REV.

1

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 2

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY <u>RC</u>	CHK	MFG ENG	DATE
97470100		-03	01	01	01 ASSY CPU BD		DATE <u>5/77</u>	DATE	ENGR	DATE
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUME			
							REV	EN	NO	
001	40048472	01	001	EA	PCB CPU CARD					
002	26905090	01	001	EA	IC 3851	U1				
003	26904805	01	001	EA	IC 3850	U2				
004	26905407	01	001	EA	IC MC1489	U3				
005		01	001	EA	IC 4066	U4				
006	26904823	01	001	EA	IC 4001	U5				
007	02354380	01	004	EA	RES 100Ω 1/4W 5%	R2,3,4,7				
008	02354620	01	002	EA	RES 1KΩ 1/4W 5%	R8,12				
009	02354780	01	001	EA	RES 5.1K 1/4W 5%	R10				
010	02354850	01	003	EA	RES 10K 1/4W 5%	R1,6,9				
011	02355330	01	001	EA	RES 1MΩ 1/4W 5%	R13				
012	03175060	01	002	EA	CAP 10PF	C5,6				
013	02379120	01	001	EA	CAP .22μF 35V TANT	C4				
014	03291040	01	001	EA	CAP .1μF CERAMIC	C2				
015	03855004	01	001	EA	CAP .47μF CERAMIC	C7				
016	03279100	01	002	EA	CAP 10μF 15V TANT	C3				
017	03282560	01	001	EA	CAP 22μF 15V TANT	C1				
018	26006930	01	001	EA	DIODE FDP4600	D1				
019	26903006	01	002	EA	TRANSISTOR 2N3904	Q1,2				

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PAGE 2 OF 2

BISHOP GRAPHICS/ACCUPRESS
DECEMBER NO. 1 1988

1977 - 4 1977

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REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048467	A/W AND SPEC	1
97470105-04	SCHEMATIC	REF
97470105	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS .X ± .01 .XX ± .03 .XXX ± .10 BREAK SHARP EDGES .100 MAX. MATERIAL SEE LIST OF MAT'L NEXT ASSY 82	DRAWN <i>T. Skutso</i> DATE 7/1/77	FAIRCHILD INSTRUMENTATION		
	ENGR D.W. CORBIN DATE 12/28/77			
	PFC DATE	SIZE A	CODE IDENT NO. 97470105	REV. 1
	PROJ. ENGR DATE			
	APPVD. DATE			

PAGE 1 OF 1

[illegible]

REVISION				
REV	DATE	DESCRIPTION	BY	APP
1		RELEASE TO MFG PER EN		

NOV - 4 1977

ITEM NO		QTY	PART NUMBER	DESCRIPTION	
UNLESS OTHERWISE SPECIFIED:				DATE	BY
DIMENSIONS ARE IN INCHES, TOLERANCES UNLESS OTHERWISE SPECIFIED:				DATE	BY
FRACTIONS				DATE	BY
DECIMALS				DATE	BY
SMALLER DIMENSIONS GOVERN				DATE	BY
FINISH				DATE	BY
TREATMENT				DATE	BY
APPLICATION				DATE	BY
NEXT ASST				DATE	BY
USED ON				DATE	BY
PART NUMBER				DATE	BY
DESCRIPTION				DATE	BY
SCHEMATIC - RHO SIGMA; MEMORY ADDRESS				DATE	BY
97470107-04				DATE	BY
DN-012477				DATE	BY
HOLD				DATE	BY
1 of 1				DATE	BY

REVISIONS'

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048470	A/W AND SPEC	1
97470107-04	SCHEMATIC	REF
97470107-03	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. TOLERANCES ON
DECIMALS .010 ANGLES 2°
XX .03
XXX .010 BREAK SHARP EDGES DID MAX.

MATERIAL

SEE LIST OF MAT'L

NEXT ASSY

82

DRAWN

CHK

ENGR

MFG

PROJ. ENGR

APPVD.

CONTR NO.

DATE

DATE

DATE

DATE

DATE

DATE

FAIRCHILD
INSTRUMENTATION

TITLE

ASSEMBLY -
MEMORY ADDRESS CAR

SIZE

A

CODE IDENT NO.

DWG NO.

97470107

REV.

1

USED ON 2006 DATA CONTROLLER

PAGE 1 OF 1

[illegible]

REVISIONS				
REV	DESCRIPTION	BY	DATE	APPROVAL
1	RELEASE TO MPG PER EN			

- ADDRESS AS SHOWN FOR EROM CARD #1 (CARDSLOT B) (HEX 0000)
- FOR EROM CARD #2 (CARDSLOT A) D4 IS MOVED FROM B TO A (HEX 1000)

NOV - 4 1977

ITEM NO	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED:			
DIMENSIONS ARE IN INCHES, TOLERANCES ON:			
FRACTIONS DECIMALS ANGLES			
MATERIAL			
FINISH			
TREATMENT			
NEXT ASST USED ON			
APPLICATION			
DRAWN BY		DATE	
CHECKED BY		DATE	
DESIGNED BY		DATE	
APP'D		DATE	
TITLE		DATE	
C		97470106-04	1
DN-012477		CLASS	NONE
PAGE		1	1

SCHEMATIC -
RHO SIGMA
4K EROM

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048469	A/W AND SPEC	1
97470106-04	SCHEMATIC	REF
97470106	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS .01 .03 .10 .15 .20 .25 .30 .35 .40 .45 .50 .55 .60 .65 .70 .75 .80 .85 .90 .95 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00 5.10 5.20 5.30 5.40 5.50 5.60 5.70 5.80 5.90 6.00 6.10 6.20 6.30 6.40 6.50 6.60 6.70 6.80 6.90 7.00 7.10 7.20 7.30 7.40 7.50 7.60 7.70 7.80 7.90 8.00 8.10 8.20 8.30 8.40 8.50 8.60 8.70 8.80 8.90 9.00 9.10 9.20 9.30 9.40 9.50 9.60 9.70 9.80 9.90 10.00 10.10 10.20 10.30 10.40 10.50 10.60 10.70 10.80 10.90 11.00 11.10 11.20 11.30 11.40 11.50 11.60 11.70 11.80 11.90 12.00 12.10 12.20 12.30 12.40 12.50 12.60 12.70 12.80 12.90 13.00 13.10 13.20 13.30 13.40 13.50 13.60 13.70 13.80 13.90 14.00 14.10 14.20 14.30 14.40 14.50 14.60 14.70 14.80 14.90 15.00 15.10 15.20 15.30 15.40 15.50 15.60 15.70 15.80 15.90 16.00 16.10 16.20 16.30 16.40 16.50 16.60 16.70 16.80 16.90 17.00 17.10 17.20 17.30 17.40 17.50 17.60 17.70 17.80 17.90 18.00 18.10 18.20 18.30 18.40 18.50 18.60 18.70 18.80 18.90 19.00 19.10 19.20 19.30 19.40 19.50 19.60 19.70 19.80 19.90 20.00 20.10 20.20 20.30 20.40 20.50 20.60 20.70 20.80 20.90 21.00 21.10 21.20 21.30 21.40 21.50 21.60 21.70 21.80 21.90 22.00 22.10 22.20 22.30 22.40 22.50 22.60 22.70 22.80 22.90 23.00 23.10 23.20 23.30 23.40 23.50 23.60 23.70 23.80 23.90 24.00 24.10 24.20 24.30 24.40 24.50 24.60 24.70 24.80 24.90 25.00 25.10 25.20 25.30 25.40 25.50 25.60 25.70 25.80 25.90 26.00 26.10 26.20 26.30 26.40 26.50 26.60 26.70 26.80 26.90 27.00 27.10 27.20 27.30 27.40 27.50 27.60 27.70 27.80 27.90 28.00 28.10 28.20 28.30 28.40 28.50 28.60 28.70 28.80 28.90 29.00 29.10 29.20 29.30 29.40 29.50 29.60 29.70 29.80 29.90 30.00 30.10 30.20 30.30 30.40 30.50 30.60 30.70 30.80 30.90 31.00 31.10 31.20 31.30 31.40 31.50 31.60 31.70 31.80 31.90 32.00 32.10 32.20 32.30 32.40 32.50 32.60 32.70 32.80 32.90 33.00 33.10 33.20 33.30 33.40 33.50 33.60 33.70 33.80 33.90 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67.20 67.30 67.40 67.50 67.60 67.70 67.80 67.90 68.00 68.10 68.20 68.30 68.40 68.50 68.60 68.70 68.80 68.90 69.00 69.10 69.20 69.30 69.40 69.50 69.60 69.70 69.80 69.90 70.00 70.10 70.20 70.30 70.40 70.50 70.60 70.70 70.80 70.90 71.00 71.10 71.20 71.30 71.40 71.50 71.60 71.70 71.80 71.90 72.00 72.10 72.20 72.30 72.40 72.50 72.60 72.70 72.80 72.90 73.00 73.10 73.20 73.30 73.40 73.50 73.60 73.70 73.80 73.90 74.00 74.10 74.20 74.30 74.40 74.50 74.60 74.70 74.80 74.90 75.00 75.10 75.20 75.30 75.40 75.50 75.60 75.70 75.80 75.90 76.00 76.10 76.20 76.30 76.40 76.50 76.60 76.70 76.80 76.90 77.00 77.10 77.20 77.30 77.40 77.50 77.60 77.70 77.80 77.90 78.00 78.10 78.20 78.30 78.40 78.50 78.60 78.70 78.80 78.90 79.00 79.10 79.20 79.30 79.40 79.50 79.60 79.70 79.80 79.90 80.00 80.10 80.20 80.30 80.40 80.50 80.60 80.70 80.80 80.90 81.00 81.10 81.20 81.30 81.40 81.50 81.60 81.70 81.80 81.90 82.00 82.10 82.20 82.30 82.40 82.50 82.60 82.70 82.80 82.90 83.00 83.10 83.20 83.30 83.40 83.50 83.60 83.70 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FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 1

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG	ENG	DATE
97470106		-03	01	01	ASSY EPROM 80						
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT				
							REV	EN	NO		
201	40048469		001	EA	PCB EPROM 80						
002	03291040		002	EA	CAP .1UF	C3, C7					
003	03279100		002	EA	CAP 10UF 15V	C2					
004	03282560		001	EA	CAP 22UF 15V	C1					
005	26901040		004	EA	DIODE 1N914	D1A, 2A, 3A, 4A OR D1B, 2B, 3B, 4B					
006											
207	02354850		001	EA	RES 10K, 1/4W, 5%	R5					
008											
009											
010			001	EA	RES 3.9 Ω 1/4W 5%	R4					
011											
012											
013											
014			001	EA	DIODE ZENER 1N5231 5V	D2					
015	26905022		004	EA	IC 2708 UV PROM	U1 THRU U4					
016											
017	26905559		001	EA	IC 74LS138	U6					
018	26904816		001	EA	IC 4049	U8					
019			001	EA	CARD EJECTOR, S.A.E. 6200						

B-48

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048466	A/W AND SPEC	1
97470104-04	SCHEMATIC	REF
97470104	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. TOLERANCES ON
DECIMALS ANGLES
XX ± .01 ± 2°
XXX ± .010 BREAK SHARP EDGES .010 MAX.

MATERIAL

SEE LIST OF MAT'L

NEXT ASSY

82

USED ON

PROGRAM CONTRAILER

DRAWN

CHE

ENGR

MFG

PROJ. ENGR

APPROV.

CONTR NO.

DATE

DATE

DATE

DATE

DATE

DATE

FAIRCHILD
INSTRUMENTATION

TITLE

ASSEMBLY -
OUTPUT CARD

SIZE
A

CODE IDENT NO.

DWG NO.

97470104

REV.

1

SCALE

1/1

SHEET 1 OF 1

PAGE 1 OF 1

[illegible]

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
3	REVISED AND REDRAWN PER EN6464	TS-		D.P. 1-3-77

PRINCIPLE DRAWING TABLE

DRAWING NO.	DESCRIPTION	REV.
82540520-03	LIST OF MAT'L	3
97401119-04	SCHEMATIC AC 4 1/2	REF

UNIT CONFIGURATION TABLE

PART NO.	DESCRIPTION	REV.
97400312	ASSY BASE BD	1
97400309	ASSY ANALOG BD (2V)	1
97400402	ASSY DISPLAY BD 4 1/2	1
97401055		1

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. TOLERANCES ON
DECIMALS
1 1/2
2 1/2
3 1/2
4 1/2
5 1/2
6 1/2
7 1/2
8 1/2
9 1/2
10 1/2
11 1/2
12 1/2
13 1/2
14 1/2
15 1/2
16 1/2
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87 1/2
88 1/2
89 1/2
90 1/2
91 1/2
92 1/2
93 1/2
94 1/2
95 1/2
96 1/2
97 1/2
98 1/2
99 1/2
100 1/2

BREAK SHARP EDGES DIC MAX.

MATERIAL

NEXT ASSY

USED ON DPM

DRAWN

CHK

ENGR

PROJ. ENGR

APPROV.

CONTR NO.

DATE

DATE

DATE

DATE

DATE

FAIRCHILD
SYSTEMS TECHNOLOGY

TITLE

4 1/2 AC DPM ASSY
CONN (2V)

SIZE

A

CODE IDENT NO

25677

DWG NO.

82540520

REV.

3

SCALE

NONE

SHEET 1 OF 1

PAGE 1 OF 1

[illegible]

REV	NO	DESCRIPTION	BY	CHK	DATE
1		RELEASE TO MFG PER EN 6469	4C		11-13
2		REVISED PER EN 6506	4C		11-13
3		REVISED PER EN 6851	4C		11-13

TABLE I

	4 1/2 (2V)	4 1/2 (20V)	4 1/2 (200V)
A R25	1.5K, 1/4 W 1%, 10PPM	23.7K, 1/4 W 1%, 10PPM	1.5K, 1/4 W 1%, 10PPM
B RA	JUMPED	10 MEG 50PPM	10 MEG 50PPM
C RB	OPEN	100 K 10 PPM	100 K 10 PPM
D R21	100K, 1/4 W 1%, 100PPM	JUMPED	JUMPED

2. ALL RESISTORS ARE .25W, 5%.

1. USAGE AND VALUE TO BE DETERMINED AT TEST.

NOTES: UNLESS OTHERWISE SPECIFIED

PART NUMBER		SCHEMATIC	
DPM		4 1/2 AC	
97401119-04		D	

B-54

BASE BD. ASS'Y

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REV
4004B355-4	A/W & SPEC	4
97400312-05	LIST OF MAT'L	1

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 2

LM NO	REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG ENG	DATE
7400312	-03	02	01	01 AC BASE BD ASSY VA/V E CONN					
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT		
							REV	EN NO	
01	40048395	01	001	EA	PCB BASE BOARD CONN	N/A			
02	26904584	01	001	EA	IC 74LS74	QA1	02	6506	
03	26904874	01	001	EA	IC 4077	QA3			
04	26904815	01	001	EA	IC 4024 CMOS	QA2			
05	26904817	01	002	EA	IC 4518 CMOS	QA4, QA5			
06	26904820	01	003	EA	IC 4511 CMOS	QA6, QA7, QA8			
07	26902006	01	004	EA	DIODE 1N4002	D1 THRU D4			
08	26006930	01	004	EA	DIODE FD11600	D7, D9, D5, D6			
09	26905800	01	001	EA	TRANSISTOR 79M08	Q1			
10	26905810	01	001	EA	TRANSISTOR 79M05	Q1			
11	26903006	01	001	EA	TRANSISTOR 2N3904	Q2			
12	27903007	01	001	EA	XTAL 3.579MHZ	Y1			
13	03924003	02	002	EA	CAP .01UF	C7, C8			
14	03282520	01	002	EA	CAP 3.3UF, 15V, 10%	C2, C5, C6			
15	03980001	01	001	EA	CAP 1000UF, 16V ELE	C1			
16	03980002	01	002	EA	CAP 330UF	C3, C4			
17	03291060	01	001	EA	CAP 1UF, 50V, 20%	C9			
18	03024007	02	001	EA	CAP 470PF	C11			
19	03175190	01	002	EA	CAP 47PF	C12, C13			
20	03924007	01	002	EA	CAP .047UF	C14, C10			
21	11009540	01	001	EA	THERMAL SW	SW1			

PAGE 2 OF 2

ISHOP GRAPHICS/ACCUPRE 3
ORDER NO. A-5209

ANALOG ASS'y

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REV
40048396	A/W & SPEC LKS	4
97400301-03	LIST OF MAT'L	1

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 2

LM NO		REV	QTY	U#	DESCRIPTION	NEXT ASSY	BY <u>T. Shulco</u>	CHK <u>DJP</u>	MFG ENG	DATE
1400309		-03	02	01	01	ANALOG ASSY, 4 1/2 (2V)				
EN	PART NO	REV	QTY PER ASSM	U	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT			
							REV	EN NO		
01	40048396	01	001	EA	PCB ANALOG BD	N/A	0.1	6469		
02	26905332	01	001	EA	OP AMP 308A	A1	0.2	6501		
03	26905326	01	002	EA	OP AMP 201A	A2, A4				
04	26905327	01	001	EA	OP AMP 307	A3				
05	26012320	01	003	EA	DIODE FD 300	D23, D21, D20				
06	26006930	01	001	EA	DIODE FDH600	D24				
07	26901016	01	001	EA	DIODE 1N4569	D22				
08	03870001	01	001	EA	CAP 1UF 100V 10%	C20				
09	03932004	01	001	EA	CAP .47UF POLY S	C23				
10	03175190	01	001	EA	CAP 47PF	C21				
11	03924007	01	004	EA	CAP .047UF	C25, C26, C24, C22				
12	02909002	01	002	EA	RES 100K, 1/4W, 1%, 100PPM	R21, R39				
13	02354460	01	001	EA	RES 220Ω, 1/4W, 5%	R30				
14	02936022	01	001	EA	RES 124K, 1/4W, 1%, 10PPM	R34				
15	02354920	01	001	EA	RES 20K, 1/4W, 5%	R35				
16	02372290	01	001	EA	RES 200Ω, 1/4W, 1%	R23				
17	02354770	01	003	EA	RES 4.7K, 1/4W, 5%	R28, R24, R31				
18	02936011	01	001	EA	RES 1K, 1/4W, 1%, 10PPM	R27				
19	02373340	01	001	EA	RES 249K, 1/4W, 1%	R37				
20	02936013	01	001	EA	RES 1.5K, 1/4W, 1%, 10PPM	R25				
21	02355190	01	002	EA	RES 270K, 1/4W, 5%	R38, R36				

PAGE 2 OF 2

[illegible]

REVISIONS				
REV	DATE	DESCRIPTION	BY	APPROVAL
1		RELEASED TO MFG PER EN

NOTE. J3 CONNECTS TO A/D CONTROL CARD "J1"

REV - 4 1977

PART NUMBER		DESCRIPTION	
81LS96		SCHEMATIC - DPM READ CARD	
DATE	BY	DATE	BY
1977	T. J. L.		
FAIRCHILD INSTRUMENTATION		TITLE	
C		97470109-04 1	
DN-012477		PAGE 1 OF 1	

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE

DRAWING NO.	DOCUMENTATION	REV NO.
40048486	A/W AND SPEC	1
97470109-04	SCHEMATIC	REF
97470109	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. TOLERANCES ON
DECIMALS
X : .1
XX : .03
XXX : .010
ANGLES : 2°
BREAK SHARP EDGES DID MAX.

DRAWN <i>T. Shuler</i>	DATE 5/1/77
CHK	DATE
ENGR <i>D.W. Corbin</i>	DATE 10-28-77
MFG	DATE
PROJ. ENGR	DATE
APPVD.	

FAIRCHILD
INSTRUMENTATION

TITLE

ASSEMBLY—
DPM READ BOARD

MATERIAL

SEE LIST OF MAT'L

EXT ASSY

82

SIZE
A

CODE IDENT NO.

DWG NO

97470109

REV.
1

PAGE 1 OF 1

[illegible]

APPLICATION			REVISION		
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± ± .XXX ±	CONTRACT NO.		RHO SIGMA INC		
	APPROVALS	DATE			
	DRAWN <i>D.G.</i>		10/12/77		
	CHECKED				
MATERIAL ALUM. 18 GAGE			RS 600 BRACKET DIM		
FINISH NONE			SIZE A	CODE IDENT NO.	DRAWING NO. 600-3001
DO NOT SCALE DRAWING	B-64		SCALE FULL		SHEET 1 OF 1

REVISIONS				
REV	DESCRIPTION	BY	DATE	APPROVAL
1	RELEASED TO MFG PER EN

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES TOLERANCES ON			
FRACTIONS			
DECIMALS			
FRACTIONS			
BREAK SHARP EDGES 90 DEG.			
MATERIAL			
FINISH			
VENDOR			
APPLICATION			
NEXT ASSY			
USED ON			
DATE			
BY			
CHECKED			
DRAWN			
FAIRCHILD INSTRUMENTATION			
SCHEMATIC - DISPLAY CARD			
C 97470111-04 1			
DN-012477			
SCALE			
SHEET 1 OF 1			

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	RELEASED TO MFG PER EN

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REV NO.
40048491	A/W AND SPEC	1
97470111-04	SCHEMATIC	REF
97470111	LIST OF MAT'L	1

<p>UNLESS OTHERWISE SPECIFIED</p> <p>DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS</p> <p>X .1</p> <p>XX .03</p> <p>XXX .010</p> <p>BREAK SHARP EDGES .010 MAX.</p> <p>MATERIAL</p> <p>SEE LIST OF MAT'L</p> <p>NEXT ASSY</p> <p>82</p>	<p>DRAWN</p> <p><i>T. Shultz</i></p> <p>DATE</p>	<p>FAIRCHILD</p> <p>INSTRUMENTATION</p> <p>TITLE</p> <p>ASSEMBLY -</p> <p>DISPLAY CARD</p>	
	<p>ENG</p> <p>DATE</p>		
	<p>ENGR</p> <p><i>D.W. CORBIN</i></p> <p>DATE</p> <p>9/30/77</p>		
	<p>MFG</p> <p>DATE</p>		
<p>PROJ. ENGR</p> <p>DATE</p>		<p>SIZE</p> <p>A</p>	<p>CODE IDENT NO.</p> <p>97470111</p>
<p>APPVD.</p>		<p>DWG NO.</p> <p>97470111</p>	<p>REV.</p> <p>1</p>

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 1

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY <u>KE</u>	CHK	MFG ENG	DATE
97470111		-03	01	01	01	DISPLAY CARD				
							DATE <u>5/77</u>	DATE	ENGR	DATE
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT			
							REV	EN NO		
001	40048491	01	001	EA	PCB DISPLAY CARD					
002	03291040	01	004	EA	CAP .1MF CERAMIC	C1,2,3,4				
003	03282560	01	001	EA	CAP 22MF 15V TANT	C5				
004		01	001	EA	DIODE 1N4002	D1				
005	26901040	01	002	EA	DIODE 1N914	D2,3				
006		01	002	EA	RES 9.1Ω 1/2W 1%	R20,21				
007	02354140	01	003	EA	RES 10Ω 1/4W 5%	R17,18,19				
008	02354400	01	006	EA	RES 120Ω 1/4W 5%	R1,2,3,10,11,12				
009	02354420	01	007	EA	RES 150Ω 1/4W 5%	R4,5,6,7,8,9,13				
010		01	006	EA	IC 4042	U9,10,11,12,13,14				
011	26904820	01	004	EA	IC 4511	U4,5,6,7				
012		01	001	EA	IC 7667	U2				
013		01	001	EA	IC 74LS42	U8				
014	26904594	01	001	EA	IC 7414	U1				
015		01	001	EA	IC 82S23 OR EQUIVALENT	U3 - PROM CODE #6177 -				
016	26905223	01	004	EA	LED FND560	DS3,4,5,6				
017	26905224	01	001	EA	LED FND567	DS2				
018	26905225	01	001	EA	LED FND568	DS1				
019	26903502	01	003	EA	TRANSISTOR 2N3906	Q1,2,3				
020		01	004	EA	SWITCH TOGGLE	SW1,2,3,4				
021		01	001	EA	CARD EJECTOR, S.A.E. 6200					

REVISIONS				
DATE	REV	DESCRIPTION	BY	APPROVAL
	1	RELEASE TO MRS FOR EN	CE

KEYBOARD
DATA TO J4 ON CPU
(CPU PORT 1)

KEYBOARD
CONTROL
(CPU PORT 2)

KEYBOARD
DATA

NOTE: +5VOLT AND GND RETURN SUPPLIED
BY TWISTED PAIR TO POWER SUPPLY.

NOV - 4 1977

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	74C522	74C522
2	1	4049	4049
3	1	4001	4001
4	1	75451	75451
5	1	120	120
6	1	.1uF	.1uF
7	1	.001uF	.001uF
8	1	10V	10V
9	1	10V	10V
10	1	10V	10V
11	1	10V	10V
12	1	10V	10V
13	1	10V	10V
14	1	10V	10V
15	1	10V	10V
16	1	10V	10V
17	1	10V	10V
18	1	10V	10V
19	1	10V	10V
20	1	10V	10V
21	1	10V	10V
22	1	10V	10V
23	1	10V	10V
24	1	10V	10V
25	1	10V	10V
26	1	10V	10V
27	1	10V	10V
28	1	10V	10V
29	1	10V	10V
30	1	10V	10V
31	1	10V	10V
32	1	10V	10V
33	1	10V	10V
34	1	10V	10V
35	1	10V	10V
36	1	10V	10V
37	1	10V	10V
38	1	10V	10V
39	1	10V	10V
40	1	10V	10V
41	1	10V	10V
42	1	10V	10V
43	1	10V	10V
44	1	10V	10V
45	1	10V	10V
46	1	10V	10V
47	1	10V	10V
48	1	10V	10V
49	1	10V	10V
50	1	10V	10V
51	1	10V	10V
52	1	10V	10V
53	1	10V	10V
54	1	10V	10V
55	1	10V	10V
56	1	10V	10V
57	1	10V	10V
58	1	10V	10V
59	1	10V	10V
60	1	10V	10V
61	1	10V	10V
62	1	10V	10V
63	1	10V	10V
64	1	10V	10V
65	1	10V	10V
66	1	10V	10V
67	1	10V	10V
68	1	10V	10V
69	1	10V	10V
70	1	10V	10V
71	1	10V	10V
72	1	10V	10V
73	1	10V	10V
74	1	10V	10V
75	1	10V	10V
76	1	10V	10V
77	1	10V	10V
78	1	10V	10V
79	1	10V	10V
80	1	10V	10V
81	1	10V	10V
82	1	10V	10V
83	1	10V	10V
84	1	10V	10V
85	1	10V	10V
86	1	10V	10V
87	1	10V	10V
88	1	10V	10V
89	1	10V	10V
90	1	10V	10V
91	1	10V	10V
92	1	10V	10V
93	1	10V	10V
94	1	10V	10V
95	1	10V	10V
96	1	10V	10V
97	1	10V	10V
98	1	10V	10V
99	1	10V	10V
100	1	10V	10V

FAIRCHILD
INSTRUMENTATION

SCHEMATIC-
RHO SIGMA;
KEYBOARD

DATE	CHG	REV	DATE	REV
NOV 4 1977	C	1	NOV 4 1977	1

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVED
1	REL TO MFG PER EN

PRINCIPLE DRAWING TABLE		
DRAWING NO.	DOCUMENTATION	REV NO.
40048507	A/W AND SPEC	1
97470112-04	SCHEMATIC	REF
97470112-03	LIST OF MAT'L	1

UNLESS OTHERWISE SPECIFIED		DRAWN <i>T. Shuler</i>		DATE <i>3/2/77</i>		FAIRCHILD INSTRUMENTATION	
DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS X .1 XX .03 XXX .010 ANGLES ±2° BREAK SHARP EDGES .010 MAX.		CHK		DATE			
MATERIAL <i>SEE LIST OF MAT'L</i>		ENGR <i>D.W. Corbin</i>		DATE <i>10-23-77</i>		TITLE <i>ASSEMBLY - KEY BOARD CARD</i>	
NEXT ASSY <i>82</i>		MFG		DATE		SIZE <i>A</i>	
USED ON <i>PROGRAM CONTROLLER</i>		PROJ. ENGR		DATE		CODE IDENT NO.	
CONTR NO. <i>DU-012477</i>		APPRD.		DWG NO. <i>97470112</i>		REV. <i>1</i>	
		SCALE <i>1/1</i>				SHEET 1 OF 1	

FAIRCHILD LIST OF MATERIAL

PAGE 1 OF 1

LM NO		REV	QTY	UM	DESCRIPTION	NEXT ASSY	BY	CHK	MFG ENG	DATE
97470112		-03	01		KEYBOARD ASSY		SC			
							DATE	DATE	ENGR	DATE
ITEM	PART NO	REV	QTY PER ASSM	U M	DESCRIPTION	REFERENCE DESIGNATION	CHANGE DOCUMENT			
							REV	EN NO		
001	40048507	01	001	01	PCB KEYBOARD					
002	26905605	01	001	01	IC 75451	QA1				
003		01	001	01	IC 74C922	QA2				
004	26904816	01	001	01	IC 4049	QA3				
005	26904823	01	001	01	IC 4001	QA4				
006	03291040	01	002	01	CAP .1MF CERAMIC DISC	C1,3				
007	03282560	01	001	01	CAP 22MF 15V TANT.	C2				
008		01	001	01	CAP 5.6MF TANT	C4				
009		00	002	01	LED, RED	DS1,2				
010	09917009	01	001	01	SOCKET, IC, 16PIN DIP	J1				
011		01	001	01	SWITCH SPDT, TOGGLE	SW1				
012		01	001	01	SWITCH SPDT, TOG, CENTER OFF	SW2				
013	02354400	01	002	01	RESISTOR, 120Ω 1/4 5% CMB.	R1,2				
014		01	001	01	KEYBOARD, DIGITRAN KL	0042				
015		01	001	01	LED, GRN	DS				
016		01	001	01	RESISTOR 15K 1/4w 5%	R3				
017		01	001	01	CAP. .001μF CER.	C5				
018										
019

APPLICATION			REVISION		
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:

FRACTIONS DECIMALS ANGLES
± .XX ± .01 ±
.XXX ± .010

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS

DRAWN D.G.

CHECKED

DATE

8/4/77

RHO SIGMA INC.

MOUNTING PATTERN
DISPLAY PCB

SIZE

A

CODE IDENT NO.

DRAWING NO.

600-3000

SCALE

SHEET 2

OF 6

APPLICATION			REVISION		
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:

FRACTIONS DECIMALS ANGLES
± .XX ± .01 ±
XXX ± .010

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS

DATE

DRAWN

CHECKED

RHO SIGMA INC.

MOUNTING PATTERN
KEYBOARD

SIZE

A

CODE IDENT NO.

DRAWING NO.

600-3000

SCALE

SHEET 3 OF 6

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .015 ± .010 ± .015 ± .005 ± .005 ± .005 MATERIAL T6 ALUM. FINISH NEXT ASST. USED ON APPLICATION		CONTRACT NO.		RHO SIGMA INC		
		APPROVALS				
		DRAWN D.G.		DATE 10/6/77	HOLE PAT. FOR SWITCHES; LIGHTS; FUSE; KEY-SWITCH	
		CHECKED				
		SIZE B	CODE IDENT NO.	DRAWING NO. 600-3000		
		SCALE 1/4"		SHEET 4 OF 6

NOTE: ALL DIM IN INCHES
±.010

SECTION C

SYSTEM DESIGN DATA BROCHURE

RS600

PROGRAMMABLE CONTROL SYSTEM

RS 600 PROGRAMMABLE CONTROL SYSTEM

SEPT., 1, 1977

Rho Sigma, Inc., a leading manufacturer of solar controls, has developed the RS600 Programmable Control System (PCS) as its newest generation of controls. The RS600 is designed for use with commercial, multi-family dwelling, and complex residential HVAC systems. Its versatility allows it to be programmed to control any type system where multiple sensor inputs and control outputs are needed.

The RS600 PCS is a programmable microprocessor-based control system. It can scan sensor inputs such as temperature, pressure, flow, relay and switch closures. The controller solves the system functional equations which may be a combination of arithmetic functions, time and switch logic. The outputs can be in the form of relay closures or solid state devices which can pulse a damper system or operate fractional HP motors.

Figure 1 shows the general block diagram of the PCS. Figure 2 shows the front panel of the PCS with the keyboard/display and the output monitor and control switches.

The RS600 has a "front end conditioning" module which is designed to allow the use of thermistors as temperature sensors. There are 16 such inputs available along with 16 discrete inputs.

Mounted inside the RS600 enclosure is an optional 5 digit LED display and the 16-key keyboard as shown in Figure 2. This display will automatically sequence through all input channels or can be set to monitor one channel via the keyboard. The display is in engineering units for the analog channels. The discrete input channels will be represented by a "HI" or "LO" for "ON" and "OFF".

The display also will show the time, day of year, hour and minute. Time can be changed via the keyboard for initialization and updating in the event of start-up and power outage.

FIGURE 2

The keyboard, besides allowing the user to monitor a particular input or output channel, can be used to change up to fifty-two (52) constants used in the programmed equations. This feature of the RS600 is ideal for prototype or first time systems. The program constants can be changed via the keyboard to modify any of the equations. In this manner system changes can be tried without any hardware modifications.

On the same panel as the display/keyboard are 16 optional LED's and 3 position toggle switches. The LED's will indicate an output in the "ON" stage; the toggle switches will allow the user to manually turn each output to either "ON" or "OFF", or to put the output in the "AUTO" state, which is then under computer control.

The RS600 has sixteen output control signals which can be used either to drive contact relays or solid state relays.

The RS600 PCS will be programmed to solve a set of logical/arithmetic equations. The equations will be contained in programmable read only memories (PROM's). The associated constants for each equation are temporarily held in the random access memory (RAM's) which will allow the user to alter and experiment with the constants via the keyboard.

RS 600
PROGRAMMABLE CONTROL SYSTEM

FIGURE 1

RS600 TECHNICAL SPECIFICATIONS

AUG. 15, 1977

RS600 PROGRAMMABLE CONTROL SYSTEM

INPUTS:

Sensors: 8 Channels expandable to 16

Sensor types:

1. Temperature — Thermistors or RTD's
2. Insolation — Photovoltaic Pyranometer
3. Flow — 0-2 VDC
4. Pressure Transducer — 0-2 VDC
5. Any analog voltage input ± 2.0 VDC

Resolution of input: 1 mv

Discrete: 8 channels expandable to 16

Sensor types:

1. Switch closure
2. Relay closure
3. Pulse flow meter — 200 pulse/min. Max.

Input signal: contact open or 5 VDC
closed — ground

Power: 105-130 VAC 50-60 Hz 100 watts

OUTPUTS: 16 channels available

Output types. (selectable by design)

1. 10 Amp solid state switch
2. 10 Amp contact relay
3. 200 ma 24 VDC relay driver

COMPUTER FUNCTIONS:

- a. Conversions of inputs to engineering units
 1. Thermistor inputs to temperature $^{\circ}\text{C}$ or $^{\circ}\text{F}$
Accuracy $0-100^{\circ}\text{C} \pm 1^{\circ}\text{C}$, -40 to $140^{\circ}\text{C} \pm 2^{\circ}\text{C}$
 $32-212^{\circ}\text{F} \pm 1^{\circ}\text{F}$, -40 to $300^{\circ}\text{F} \pm 3^{\circ}\text{F}$
 2. Photocell input to insolation (Btu/ft²-Hr)
 3. Flow rates to GPM or GPH
 4. Calculates real time: 365 day clock time to nearest second.
- b. Solves logical and arithmetic equations of the type:
Output = F (temperature, time, flow, switch closure, etc.)

PHYSICAL SIZE:

- a. 30 in. high x 20 in. wide x 10 in. deep enclosure
(NEMA — 12 type)
- b. Approximate weight- 80 lbs.

ENVIRONMENT:

Controller will operate from 0° to 120°F
and from 0 to 95% Rh without condensation

OPTIONS:

Keyboard:

Mounted on the inner panel, allows the user to

1. Select input channels for continuous monitoring
2. Set time
3. Alter specified constants used in the program
4. Set/reset outputs

Display:

A 6-digit LED display mounted on the inner panel. The display will either sequence through all inputs or monitor one input or output continuously (via keyboard command). 12 symbols designate the type of data being displayed.

Manual Override Switches:

Each output has a 3-position switch that allows the user to select the on-off-auto state for each output. A LED designates the outputs ON/OFF state.

PROGRAMMABLE DATA ACQUISITION SYSTEMS

for Energy-related Engineering Studies.

One of PG&E's three Solar Energy conservation homes. This one is heated by Solaron; all three are instrumented by Rho Sigma.

See Reverse Side for Technical Specifications

Microprocessor on-site at the Pacific Gas & Electric Company's Solar Energy Conservation Home, (San Jose, CA). Rho Sigma is instrumenting two additional homes in PG & E's ambitious solar program designed to study how the energy of the sun may become one part of the solution to the nation's problem of diminishing supplies of natural gas.

Rho Sigma is a complete, single source for controls and instrumentation designed specifically for the solar energy industry. Our in-field experience and close customer-contact has guided the development of our product lines and has resulted in the increasing selection of Rho Sigma's solar controls and instruments to meet the special needs of our customers.

For example, Rho Sigma's Programmable Data Acquisition Systems (PDAS), is monitoring all the energy-related parameters in the Pacific Gas & Electric Company's three-house solar energy evaluation program. The RS5080 was programmed to PG & E's specifications. Rho Sigma also supplied all the sensors necessary to measure the temperatures, flow rates, energy consumption of various back-up systems, and the meteorological conditions of interest to engineers at PG & E. Installation of the package by Rho Sigma's field engineers assured turn-key operation for PG & E.

During the *three year* monitoring period, the RS5080 is providing PG & E with answers to the following questions:

- 1.) How much energy is consumed by the house?
- 2.) What percentage of the total is supplied by the solar system?
- 3.) How much energy is consumed to heat domestic water, space and the swimming pool?
- 4.) What percentage of the energy used for each purpose comes from solar sources?
- 5.) What is the efficiency of the collectors under conditions actually encountered in residential applications?

Rho Sigma's solar controls are in the field regulating the conversion of solar energy to forms useful to man. Rho Sigma's instruments are at the sites answering the questions which are under study.

Energy Flow through the House during Heating Cycle

Inputs:

- 1.) 20 analog channels to monitor
 - a) Temperature inputs from RTD's, thermocouples and thermistors, and
 - b) Solar inputs from pyranometers
- 2.) 5 pulsed inputs (expandable in groups of five) to monitor
 - a) flowmeters and
 - b) instrumented gas and watt-hour meters
- 3.) 8 discrete inputs to monitor
 - a) relay closures signaling states of operation and
 - b) switch positions

Outputs:

- 1.) broad-stroke LED display of all inputs in either engineering units or raw data
- 2.) printer output of
 - a) all inputs,
 - b) energy flow calculations based on inputs,
 - c) performance efficiencies, and
 - d) other energy-related quantities of interest to engineers.
- 3.) capability to interface with
 - a) cassette record
 - b) teletype terminal
 - c) acoustical coupler (telephone)

Internal Capabilities:

- 1.) scans all channels once per second.
- 2.) solves energy flow equations once per minute,

Typical equations:

$$Q = C_p \int \dot{m} \Delta T dt$$

$$Q = \text{Area} \int \text{Insolation (T)} dt$$

- 3.) solves performance efficiency formulas at each customer-selected print-out time.

Typical formulas:

$$\eta_{\text{collector}} = \frac{Q_{\text{collector}}}{Q_{\text{solar}}}$$

$$\% \text{ solar} = \frac{Q_{\text{solar}}}{Q_{\text{solar}} + Q_{\text{back-up}}}$$