FLUKE ®

5790A

AC Measurement Standard

Service Manual

PN 893292
January 1992 Rev.5, 1/07

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Chapter 1
Introduction and Specifications

1-1. Introduction

The 5790A makes AC-DC transfer measurements and accurate AC measurements from 700 µV to 1000 V (10 Hz to 1 MHz). The optional 5790A-03 Wideband Module increases the 5790A frequency range to 30 MHz for inputs connected to the WIDEBAND 50 Ω Type “N” connector. Accessory 5790A-7001 allows the use of Fluke A40 or A40A Current Shunts with 5790A for making accurate AC-DC current transfer measurements up to 20 A.

Refer to the 5790A Operator Manual for operating instructions, use of the front and rear panel features, remote programming, and all other information for the operator.

This service manual is a maintenance guide for the 5790A. The following topics are included:

- Theory of operation
- Calibration
- Performance testing
- Access procedures
- Troubleshooting
- Parts lists
- Schematic diagrams

1-2. Service Information

Factory authorized service for 5790A is available at selected Service Centers. For warranty or after-warranty service, contact the nearest Service Center for instructions. A complete list of Service Centers appears at the end of Chapter 6.

To reship the 5790A, use its original shipping carton. If the original carton is not available, use a container that provides adequate protection during shipment. Protect the 5790A with at least three inches of shock-absorbing material on all sides of the container. Do not use loose fill to pad the shipping container. Loose fill allows the instrument to settle to one corner of the shipping container, which could result in damage during shipment.

1-3. Symbols

Table 1-1 lists the symbols used on the instrument and/or in this manual.

Table 1-1. Symbols

Symbol	Description
⚡	Hazardous voltage.
|	Power On.
O	Power Off.
⏚	Earth ground.
⚠	Important information. See manual.

1-4. Safety Instructions

Please read this chapter carefully. It will familiarize you with important safety instructions for handling your 5790A instrument. In this manual a **Warning** identifies conditions and actions that pose hazard(s) to the user. A **Caution** identifies conditions and actions that may damage the test instrument

The instrument is designed and tested in accordance with IEC Publication 348, Safety Requirements for Electronics Measuring Apparatus 5790A. If the instrument is used improperly, there is risk damage to persons and property.

1-5. Input Source Limits

To avoid electrical shock or fire, connect the input terminals only to sources that do not exceed 1000 V RMS or DC, and that cannot exceed 200 mA operational or short circuit current.

1-6. Power Source

The 5790A is intended to operate from a power source that will not apply more than 264 V AC RMS between the supply conductors or between the supply conductor and ground. A protective ground connection through the grounding conductor in the power cord is essential for safe operation.

1-7. Proper Fuse Usage

To avoid fire hazard, use only a fuse identical in type, voltage rating and current rating as specified on the rear panel fuse rating label. Do not use makeshift fuses or short circuit the fuse holder.

1-8. Grounding of the 5790A

The 5790A instrument is a Safety Class I (grounded enclosure) instrument as defined in IEC 348. The enclosure is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired earth grounded receptacle before connecting anything to any of the binding posts, terminals or connectors. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

1-9. Proper Power Cord Usage

- Use only the power cord and connector appropriate for the voltage and plug configuration in your country.
- Use only a power cord that is in good condition.
- Refer cord and connector changes to qualified service personnel.

1-10. Do Not Operate in Explosive Atmosphere

To avoid explosion, do not operate the 5790A in an atmosphere of explosive gas.

1-11. Do Not Attempt to Operate if Protection may be Impaired

If the 5790A appears damaged or operates abnormally, protection may be impaired. Do not attempt to operate it. When in doubt, have the instrument serviced.

1-12. Do Not Remove the Cover unless Qualified

To avoid electric shock, do not remove the 5790A cover unless you are qualified to do so. Service procedures are for qualified service personnel only.

1-13. Do Not Service Alone

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

1-14. Use Care when Servicing with Power On

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

1-15. Specifications

Specifications are valid after allowing a warm-up period of 30 minutes, or twice the time the 5790A has been turned off, whichever is less. For example, if the 5790A has been turned off for 5 minutes, the warm-up period is 10 minutes.

To simplify the evaluation of how 5790A covers you workload, use the Absolute Uncertainty Specification. Those include stability, temperature coefficient, linearity, and traceability to external standards.

Note

When you use the 5790A within ±5 °C of the temperature of the last calibration, you do not need to add anything to the Absolute Uncertainty Specifications to determine the ratios between 5790A uncertainties and the uncertainties of a unit under test. The initial calibration at Fluke is done at 23 °C. (You can verify the temperature of the last calibration at any time by pressing the [SPEC] key.)

Use the Relative Uncertainty Specifications if you use a different procedure to calibrate the 5790A than is specified in the 5790A Service Manual. To calculate absolute uncertainty specifications under such conditions, combine the absolute uncertainty associated with your external equipment and calibration procedures with the Relative Uncertainty Specifications.

Secondary Performance and Operating Characteristics are provided for special calibration requirements such as stability or operation at temperature extremes.

Absolute Uncertainty Specifications

± 5 °C of Calibration Temperature

Voltage Range	Frequency Range	AC/DC Transfer Mode ± ppm 2 Years	Absolute Uncertainty Measurement Mode ± (ppm of Reading + μV) 90 Days	1 Year	2 Years
2.2 mV	10 Hz - 20 Hz		1700 + 1.3	1700 + 1.3	1700 + 1.3
	20 Hz- 40 Hz		740 + 1.3	740 + 1.3	740 + 1.3
	40 Hz - 20 kHz		420 + 1.3	420 + 1.3	420 + 1.3
	20 kHz - 50 kHz		810 + 2.0	810 + 2.0	820 + 2.0
	50 kHz - 100 kHz		1200 + 2.5	1200 + 2.5	1200 + 2.5
	100 kHz - 300 kHz		2300 + 4.0	2300 + 4.0	2300 + 4.0
	300 kHz - 500 kHz		2400 + 6.0	2400 + 8.0	2600 + 8.0
	500 kHz - 1 MHz		3200 + 6.0	3500 + 8.0	5000 + 8.0
7 mV	10 Hz - 20 Hz		850 + 1.3	850 + 1.3	850 + 1.3
	20 Hz - 40 Hz		370 + 1.3	370 + 1.3	370 + 1.3
	40 Hz - 20 kHz		210 + 1.3	210 + 1.3	210 + 1.3
	20 kHz - 50 kHz		400 + 2.0	400 + 2.0	410 + 2.0
	50 kHz - 100 kHz		600 + 2.5	600 + 2.5	610 + 2.5
	100 kHz - 300 kHz		1200 + 4.0	1200 + 4.0	1200 + 4.0
	300 kHz - 500 kHz		1300 + 6.0	1300 + 8.0	1400 + 8.0
	500 kHz - 1 MHz		2000 + 6.0	2300 + 8.0	3600 + 8.0
22 mV	10 Hz - 20 Hz		290 + 1.3	290 + 1.3	290 + 1.3
	20 Hz - 40 Hz		180 + 1.3	190 + 1.3	190 + 1.3
	40 Hz - 20 kHz		110 + 1.3	110 + 1.3	110 + 1.3
	20 kHz - 50 kHz		210 + 2.0	210 + 2.0	210 + 2.0
	50 kHz - 100 kHz		310 + 2.5	310 + 2.5	310 + 2.5
	100 kHz - 300 kHz		810 + 4.0	810 + 4.0	820 + 4.0
	300 kHz - 500 kHz		860 + 6.0	890 + 8.0	1000 + 8.0
	500 kHz - 1 MHz		1400 + 6.0	1700 + 8.0	2600 + 8.0
70 mV	10 Hz - 20 Hz[1]		240 + 1.5	240 + 1.5	240 + 1.5
	20 Hz - 40 Hz		120 + 1.5	120 + 1.5	130 + 1.5
	40 Hz - 20 kHz		64 + 1.5	65 + 1.5	69 + 1.5
	20 kHz - 50 kHz		120 + 2.0	130 + 2.0	130 + 2.0
	50 kHz - 100 kHz		260 + 2.5	260 + 2.5	260 + 2.5
	100 kHz - 300 kHz		510 + 4.0	510 + 4.0	530 + 4.0
	300 kHz - 500 kHz		660 + 6.0	670 + 8.0	680 + 8.0
	500 kHz - 1 MHz		1100 + 6.0	1100 + 8.0	1300 + 8.0
220 mV	10 Hz - 20 Hz[1]	210	210 + 1.5	210 + 1.5	210 + 1.5
	20 Hz - 40 Hz	82	84 + 1.5	85 + 1.5	87 + 1.5
	40 Hz - 20 kHz	34	37 + 1.5	38 + 1.5	43 + 1.5
	20 kHz - 50 kHz	67	69 + 2.0	69 + 2.0	73 + 2.0
	50 kHz - 100 kHz		160 + 2.5	160 + 2.5	160 + 2.5
	100 kHz - 300 kHz		240 + 4.0	250 + 4.0	280 + 4.0
	300 kHz - 500 kHz		360 + 6.0	380 + 8.0	400 + 8.0
	500 kHz - 1 MHz		940 + 6.0	1000 + 8.0	1200 + 8.0
700 mV	10 Hz - 20 Hz[1]	210	210 + 1.5	210 + 1.5	210 + 1.5
	20 Hz - 40 Hz	73	75 + 1.5	76 + 1.5	78 + 1.5
	40 Hz - 20 kHz	27	31 + 1.5	33 + 1.5	38 + 1.5
	20 kHz - 50 kHz	47	50 + 2.0	51 + 2.0	56 + 2.0
	50 kHz - 100 kHz		79 + 2.5	79 + 2.5	84 + 2.5
	100 kHz - 300 kHz		160 + 4.0	180 + 4.0	210 + 4.0
	300 kHz - 500 kHz		300 + 6.0	300 + 8.0	340 + 8.0
	500 kHz - 1 MHz		900 + 6.0	960 + 8.0	1200 + 8.0

[1] For 9.5 to 10 Hz, the specifications is ± (1000 ppm of reading + 1.5 μV)

Absolute Uncertainty Specifications (cont.)

± 5 °C of Calibration Temperature

Voltage Range	Frequency Range	Absolute Uncertainty			
		AC/DC Transfer Mode ± ppm 2 Years	Measurement Mode ± (ppm of Reading)		
			90 Days	1 Year	2 Years
2.2 V	10 Hz - 20 Hz[2]	200	200	200	200
	20 Hz - 40 Hz	63	65	66	69
	40 Hz - 20 kHz	18	22	24	29
	20 kHz - 50 kHz	43	45	46	52
	50 kHz - 100 kHz		70	71	76
	100 kHz - 300 kHz		150	160	200
	300 kHz - 500 kHz		250	260	310
	500 kHz - 1 MHz		840	900	1200
7 V	10 Hz - 20 Hz[2]	200	200	200	200
	20 Hz - 40 Hz	63	66	67	70
	40 Hz - 20 kHz	18	22	24	29
	20 kHz - 50 kHz	44	46	48	53
	50 kHz - 100 kHz		80	81	88
	100 kHz - 300 kHz		180	190	220
	300 kHz - 500 kHz		380	400	470
	500 kHz - 1 MHz		1100	1200	1500
22 V	10 Hz - 20 Hz[2]	200	200	200	200
	20 Hz - 40 Hz	63	66	67	70
	40 Hz - 20 kHz	21	25	27	31
	20 kHz - 50 kHz	44	46	48	53
	50 kHz - 100 kHz		80	81	85
	100 kHz - 300 kHz		180	190	220
	300 kHz - 500 kHz		380	400	470
	500 kHz - 1 MHz		1100	1200	1500
70 V	10 Hz - 20 Hz[2]	200	200	200	200
	20 Hz - 40 Hz	63	67	68	72
	40 Hz - 20 kHz	25	30	32	39
	20 kHz - 50 kHz	55	56	57	63
	50 kHz - 100 kHz		91	94	110
	100 kHz - 300 kHz		190	200	220
	300 kHz - 500 kHz		400	410	510
	500 kHz - 1 MHz		1100	1200	1500
220 V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	63	67	68	72
	40 Hz - 20 kHz	23	29	31	38
	20 kHz - 50 kHz	63	67	69	77
	50 kHz - 100 kHz		96	98	110
	100 kHz - 300 kHz		210	210	260
	300 kHz - 500 kHz		440	500	700
700 V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	92	96	99	110
	40 Hz - 20 kHz	36	39	41	47
	20 kHz - 50 kHz		120	130	150
	50 kHz - 100 kHz		400	500	850
1000 V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	92	96	99	110
	40 Hz - 20 kHz	33	37	38	44
	20 kHz - 50 kHz		120	130	150
	50 kHz - 100 kHz		400	500	850
[2]	For 9.5 to 10 Hz, the specifications is ± (1000 ppm of reading)				

Relative Uncertainty Specifications

± 5 °C of Calibration Temperature

Voltage Range	Frequency Range	Relative Uncertainty			
		AC/DC Transfer Mode ± ppm 2 Years	Measurement Mode ± (ppm of Reading + µV)		
			90 Days	1 Year	2 Years
2.2 mV	10 Hz - 20 Hz		100 + 1.3	110 + 1.3	110 + 1.3
	20 Hz - 40 Hz		54 + 1.3	64 + 1.3	68 + 1.3
	40 Hz - 20 kHz		44 + 1.3	57 + 1.3	61 + 1.3
	20 kHz - 50 kHz		57 + 2.0	67 + 2.0	110 + 2.0
	50 kHz - 100 kHz		79 + 2.5	86 + 2.5	120 + 2.5
	100 kHz - 300 kHz		190 + 4.0	230 + 4.0	390 + 4.0
	300 kHz - 500 kHz		590 + 6.0	720 + 8.0	1200 + 8.0
	500 kHz - 1 MHz		2200 + 6.0	2600 + 8.0	4400 + 8.0
7 mV	10 Hz - 20 Hz		80 + 1.3	83 + 1.3	86 + 1.3
	20 Hz - 40 Hz		33 + 1.3	39 + 1.3	45 + 1.3
	40 Hz - 20 kHz		29 + 1.3	36 + 1.3	42 + 1.3
	20 kHz - 50 kHz		40 + 2.0	4 + 2.0	63 + 2.0
	50 kHz - 100 kHz		53 + 2.5	57 + 2.5	72 + 2.5
	100 kHz - 300 kHz		110 + 4.0	130 + 4.0	210 + 4.0
	300 kHz - 500 kHz		370 + 6.0	450 + 8.0	740 + 8.0
	500 kHz - 1 MHz		1600 + 6.0	2000 + 8.0	3400 + 8.0
22 mV	10 Hz - 20 Hz		69 + 1.3	72 + 1.3	75 + 1.3
	20 Hz - 40 Hz		34 + 1.3	40 + 1.3	46 + 1.3
	40 Hz - 20 kHz		30 + 1.3	36 + 1.3	43 + 1.3
	20 kHz - 50 kHz		40 + 2.0	45 + 2.0	64 + 2.0
	50 kHz - 100 kHz		53 + 2.5	57 + 2.5	73 + 2.5
	100 kHz - 300 kHz		97 + 4.0	110 + 4.0	160 + 4.0
	300 kHz - 500 kHz		310 + 6.0	380 + 8.0	610 + 8.0
	500 kHz - 1 MHz		1200 + 6.0	1500 + 8.0	2500 + 8.0
70 mV	10 Hz - 20 Hz		60 + 1.5	61 + 1.5	62 + 1.5
	20 Hz - 40 Hz		27 + 1.5	30 + 1.5	37 + 1.5
	40 Hz - 20 kHz		22 + 1.5	25 + 1.5	34 + 1.5
	20 kHz - 50 kHz		34 + 2.0	36 + 2.0	44 + 2.0
	50 kHz - 100 kHz		53 + 2.5	54 + 2.5	62 + 2.5
	100 kHz - 300 kHz		110 + 4.0	120 + 4.0	170 + 4.0
	300 kHz - 500 kHz		270 + 6.0	290 + 8.0	320 + 8.0
	500 kHz - 1 MHz		910 + 6.0	970 + 8.0	1200 + 8.0
220 mV	10 Hz - 20 Hz	55	60 + 1.5	61 + 1.5	62 + 1.5
	20 Hz - 40 Hz	20	27 + 1.5	29 + 1.5	35 + 1.5
	40 Hz - 20 kHz	17	22 + 1.5	24 + 1.5	31 + 1.5
	20 kHz - 50 kHz	17	22 + 2.0	24 + 2.0	33 + 2.0
	50 kHz - 100 kHz		51 + 2.5	52 + 2.5	59 + 2.5
	100 kHz - 300 kHz		100 + 4.0	120 + 4.0	170 + 4.0
	300 kHz - 500 kHz		260 + 6.0	290 + 8.0	310 + 8.0
	500 kHz - 1 MHz		890 + 6.0	950 + 8.0	1200 + 8.0
700 mV	10 Hz - 20 Hz	55	60 + 1.5	61 + 1.5	62 + 1.5
	20 Hz - 40 Hz	20	27 + 1.5	29 + 1.5	34 + 1.5
	40 Hz - 20 kHz	15	22 + 1.5	24 + 1.5	31 + 1.5
	20 kHz - 50 kHz	15	22 + 2.0	24 + 2.0	33 + 2.0
	50 kHz - 100 kHz		51 + 2.5	52 + 2.5	59 + 2.5
	100 kHz - 300 kHz		100 + 4.0	120 + 4.0	170 + 4.0
	300 kHz - 500 kHz		260 + 6.0	270 + 8.0	310 + 8.0
	500 kHz - 1 MHz		890 + 6.0	950 + 8.0	1200 + 8.0

Relative Uncertainty Specifications (cont.)

± 5 °C of Calibration Temperature

Voltage Range	Frequency Range	Relative Uncertainty			
		AC/DC Transfer Mode ± ppm 2 Years	Measurement Mode ± (ppm of Reading + µV)		
			90 Days	1 Year	2 Years
2.2 V	10 Hz - 20 Hz	55	60	61	62
	20 Hz - 40 Hz	19	26	28	34
	40 Hz - 20 kHz	15	20	22	27
	20 kHz - 50 kHz	15	21	23	33
	50 kHz - 100 kHz		49	50	57
	100 kHz - 300 kHz		92	110	160
	300 kHz - 500 kHz		220	230	280
	500 kHz - 1 MHz		830	890	1200
7 V	10 Hz - 20 Hz	55	60	61	62
	20 Hz - 40 Hz	19	27	29	36
	40 Hz - 20 kHz	15	20	22	27
	20 kHz - 50 kHz	18	23	26	35
	50 kHz - 100 kHz		62	64	73
	100 kHz - 300 kHz		140	150	180
	300 kHz - 500 kHz		360	380	450
	500 kHz - 1 MHz		1100	1200	1500
22 V	10 Hz - 20 Hz	55	60	61	62
	20 Hz - 40 Hz	19	28	30	37
	40 Hz - 20 kHz	15	20	22	27
	20 kHz - 50 kHz	18	23	26	35
	50 kHz - 100 kHz		62	64	69
	100 kHz - 300 kHz		140	150	180
	300 kHz - 500 kHz		360	380	450
	500 kHz - 1 MHz		1100	1200	1500
70 V	10 Hz - 20 Hz	55	60	62	63
	20 Hz - 40 Hz	19	29	31	39
	40 Hz - 20 kHz	15	23	25	34
	20 kHz - 50 kHz	22	25	27	39
	50 kHz - 100 kHz		64	68	85
	100 kHz - 300 kHz		140	150	180
	300 kHz - 500 kHz		370	390	490
	500 kHz - 1 MHz		1100	1200	1500
220 V	10 Hz - 20 Hz	55	61	62	64
	20 Hz - 40 Hz	19	30	32	40
	40 Hz - 20 kHz	15	23	25	34
	20 kHz - 50 kHz	24	30	34	49
	50 kHz - 100 kHz		66	69	83
	100 kHz - 300 kHz		160	170	220
	300 kHz - 500 kHz		410	480	680
700 V	10 Hz - 20 Hz	55	62	63	65
	20 Hz - 40 Hz	19	31	33	41
	40 Hz - 20 kHz	19	24	25	31
	20 kHz - 50 kHz		100	110	140
	50 kHz - 100 kHz		390	500	850
1000 V	10 Hz - 20 Hz	55	62	63	65
	20 Hz - 40 Hz	19	31	33	41
	40 Hz - 20 kHz	19	24	25	31
	20 kHz - 50 kHz		100	110	140
	50 kHz - 100 kHz		390	500	850

Secondary Performance and Operating Characteristics

Voltage Range	Frequency Range	24 Hour AC Stability ± 1 °C Slow Filter Peak-Peak ± µV	Temperature Coefficient [1] 10 °C to 40 °C	Temperature Coefficient [1] 0 °C to 10 °C 40 °C to 50 °C	Input Resistance [2]
			ppm / °C	ppm / °C	
2.2 mV	10 Hz - 20 Hz	0.4	50	50	>10 MΩ
	20 Hz - 40 Hz	0.4	50	50	
	40 Hz - 20 kHz	0.4	50	50	
	20 kHz - 50 kHz	0.4	50	50	
	50 kHz - 100 kHz	0.8	75	75	
	100 kHz - 300 kHz	1.5	100	100	
	300 kHz - 500 kHz	3.0	150	150	
	500 kHz - 1 MHz	4.5	200	200	
7 mV	10 Hz - 20 Hz	0.4	15	15	>10 MΩ
	20 Hz - 40 Hz	0.4	15	15	
	40 Hz - 20 kHz	0.4	15	15	
	20 kHz - 50 kHz	0.4	15	15	
	50 kHz - 100 kHz	0.8	25	25	
	100 kHz - 300 kHz	1.5	60	60	
	300 kHz - 500 kHz	3.0	80	80	
	500 kHz - 1 MHz	4.5	125	125	
22 mV	10 Hz - 20 Hz	0.4	5	5	>10 MΩ
	20 Hz - 40 Hz	0.4	5	5	
	40 Hz - 20 kHz	0.4	5	5	
	20 kHz - 50 kHz	0.4	5	5	
	50 kHz - 100 kHz	0.8	8	8	
	100 kHz - 300 kHz	1.5	10	10	
	300 kHz - 500 kHz	3.0	40	40	
	500 kHz - 1 MHz	4.5	100	100	
		± (ppm of Reading)			
70 mV	10 Hz - 20 Hz	18	5	5	>10 MΩ
	20 Hz - 40 Hz	18	5	5	
	40 Hz - 20 kHz	18	5	5	
	20 kHz - 50 kHz	18	5	5	
	50 kHz - 100 kHz	24	8	8	
	100 kHz - 300 kHz	24	10	10	
	300 kHz - 500 kHz	48	30	30	
	500 kHz - 1 MHz	150	75	75	
220 mV	10 Hz - 20 Hz	12	1.5	3.0	>10 MΩ
	20 Hz - 40 Hz	8	1.5	3.0	
	40 Hz - 20 kHz	8	1.5	3.0	
	20 kHz - 50 kHz	8	2.0	3.0	
	50 kHz - 100 kHz	18	5.0	8.0	
	100 kHz - 300 kHz	24	10.0	10.0	
	300 kHz - 500 kHz	36	20.0	20.0	
	500 kHz - 1 MHz	120	50.0	50.0	

Secondary Performance and Operating Characteristics (cont.)

Voltage Range	Frequency Range	24 Hour AC Stability ± 1 °C Slow Filter ± (ppm of Reading)	Temperature Coefficient [1] 10 °C to 40 °C (ppm / °C)	Temperature Coefficient [1] 0 °C to 10 °C 40 °C to 50 °C (ppm / °C)	Input Resistance [2]
700 mV	10 Hz - 20 Hz	8	1.5	3.0	>10 MΩ
	20 Hz - 40 Hz	6	1.5	3.0	
	40 Hz - 20 kHz	6	1.5	3.0	
	20 kHz - 50 kHz	6	2.0	3.0	
	50 kHz - 100 kHz	12	5.0	8.0	
	100 kHz - 300 kHz	18	10.0	10.0	
	300 kHz - 500 kHz	36	20.0	20.0	
	500 kHz - 1 MHz	96	50.0	50.0	
2.2 V	10 Hz - 20 Hz	8	1.5	3.0	>10 MΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	10	5.0	8.0	
	100 kHz - 300 kHz	18	10.0	10.0	
	300 kHz - 500 kHz	30	20.0	20.0	
	500 kHz - 1 MHz	90	50.0	50.0	
7 V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	10	5.0	8.0	
	100 kHz - 300 kHz	18	15.0	15.0	
	300 kHz - 500 kHz	30	30.0	30.0	
	500 kHz - 1 MHz	90	65.0	65.0	
22 V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	10	5.0	8.0	
	100 kHz - 300 kHz	18	15.0	15.0	
	300 kHz - 500 kHz	30	30.0	30.0	
	500 kHz - 1 MHz	90	65.0	65.0	
70 V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	18	5.0	8.0	
	100 kHz - 300 kHz	36	15.0	15.0	
	300 kHz - 500 kHz	48	40.0	40.0	
	500 kHz - 1 MHz	120	75.0	75.0	

Secondary Performance and Operating Characteristics (cont)

Voltage Range	Frequency Range	24 Hour AC Stability ± 1 °C Slow Filter ± (ppm of Reading)	Temperature Coefficient [1] 10 °C to 40 °C	0 °C to 10 °C 40 °C to 50 °C	Input Resistance [2]
			PPM / °C		
220 V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	18	5.0	8.0	
	100 kHz - 300 kHz	36	15.0	15.0	
	300 kHz - 500 kHz	48	40.0	40.0	
700 V	10 Hz - 20 Hz	8	1.5	4.0	500 kΩ
	20 Hz - 40 Hz	5	1.5	4.0	
	40 Hz – 20 kHz	5	1.5	4.0	
	20 kHz – 50 kHz	18	5.0	7.0	
	50 kHz - 100 kHz	36	15.0	15.0	
1000 V	10 Hz - 20 Hz	8	1.5	4.0	500 kΩ
	20 Hz - 40 Hz	5	1.5	4.0	
	40 Hz - 20 kHz	5	1.5	4.0	
	20 kHz - 50 kHz	18	5.0	7.0	
	50 kHz - 100 kHz	36	15.0	15.0	

[1] Add to uncertainty when more than 5 °C from calibration temperature.

[2] Input capacitance approximately 100 pF.

Resolution and Range Limits

Voltage Range	Autorange Limits [1] Upper	Lower	Resolution Filter Fast	Filter Med/Slow
2.2 mV	2.2 mV	600 µV	0.1 µV	0.1 µV
7 mV	7 mV	1.9 mV	0.1 µV	0.1 µV
22 mV	22 mV	6 mV	0.1 µV	0.1 µV
70 mV	70 mV	19 mV	0.1 µV	0.1 µV
220 mV	220 mV	60 mV	0.1 µV	0.1 µV
700 mV	700 mV	190 mV	1.0 µV	0.1 µV
2.2 V	2.2 V	600 mV	1.0 µV	0.1 µV
7 V	7 V	1.9 V	10 µV	1.0 µV
22 V	22 V	6 V	10 µV	1.0 µV
70 V	70 V	19 V	100 µV	10 µV
220 V	220 V	60 V	100 µV	10 µV
700 V	700 V	190 V	1.0 mV	100 µV
1000 V	1050 V	600 V	1.0 mV	100 µV

[1] In locked ranges, readings may be made approximately 1 % beyond the autorange limits.

More Secondary Performance and Operating Characteristics

Maximum Non-destructive Input .... 1200 V rms
Guard Isolation .... 10 V peak
Volt-Hertz Product .... 1 x 10^8
Frequency Accuracy (from 0 °C to 50 °C)
10 Hz - 120 Hz .... 100 ppm + 10 digits
Above 120 Hz .... 100 ppm + 2 digits
Frequency Resolution .... 1.00 Hz to 119.99 Hz
0.1200 kHz to 1.1999 kHz
1.200 kHz to 11.999 kHz
12.00 kHz to 119.99 kHz
0.1200 MHz to 1.0000 MHz
1.000 MHz to 1.1999 MHz (Wideband only)
1.200 MHz to 11.999 MHz (Wideband only)
12.00 MHz to 30.0 Mhz (Wideband only
Reading Rate
<40 Hz .... 2 seconds per reading
40 Hz .... 2 seconds decreasing linearly to 1 second at 200 Hz
>200 Hz .... 1 second per reading
Maximum Settling Time to Full Specifications (in range lock)
Filter Off .... 1 sample
dc .... 6 seconds
<200 Hz .... 8 seconds
>200 Hz .... 4 seconds
Filter Fast .... 4 averaged samples
dc .... 10 seconds
<200 Hz .... 16 seconds
>200 Hz .... 8 seconds
Filter Medium .... 16 averaged samples
dc .... 22 seconds
<200 Hz .... 32 seconds
>200 Hz .... 16 seconds
Filter Slow .... 32 averaged samples
dc .... 40 seconds
<200 Hz .... 64 seconds
>200 Hz .... 32 seconds
Filter Buffer Restart Limits:
Fine: Fast: 10 counts
Medium/Slow
<220 mV .... 10 counts
>220 mV .... 100 counts
Medium: Fast: 100 counts
Medium/Slow
<220 mV .... 100 counts
>220 mV .... 1000 counts
Course: Fast: 1000 counts
Medium/Slow
<220 mV .... 1000 counts
>220 mV .... 10000 counts
Input Waveform... Specified for sinewave with THD less than 1%

Wideband Uncertainty Specifications (Option -03)

Voltage [1] Range	Frequency Range	Flatness [2] 1 year ± 3 °C ± (% of Reading + µV)	Flatness [3] Temperature Coefficient ppm / °C	Absolute Uncertainty 0 °C to 50 °C [4] ± (% of Reading + µV)			Resolution
				90 Days	1 Year	2 Years	
	10 Hz - 30 Hz	0.10 + 0	75	0.5 + 1.2	0.6 + 1.5	0.8 + 2	
	30 Hz - 120 Hz	0.05 + 0	75	0.5 + 1.2	0.6 + 1.5	0.8 + 2	
	120 Hz - 1.2 kHz	0.05 + 0	75	0.5 + 1.2	0.6 + 1.5	0.8 + 2	
	1.2 kHz - 120 kHz	0.05 + 0	75	0.5 + 1.2	0.6 + 1.5	0.8 + 2	
2.2 mV	120 kHz - 500 kHz	0.07 + 1	75	0.5 + 1.2	0.6 + 1.5	0.8 + 2	0.1 µV
	500 kHz - 1.2 MHz	0.07 + 1	75				
	1.2 MHz - 2 MHz	0.07 + 1	100				
	2 MHz - 10 MHz	0.17 + 1	200				
	10 MHz - 20 MHz	0.30 + 1	200				
	20 MHz - 30 MHz	0.70 + 2	400				
	10 Hz - 30 Hz	0.10 + 0	75	0.4 + 5	0.5 + 7	0.7 + 8	
	30 Hz - 120 Hz	0.05 + 0	75	0.4 + 5	0.5 + 7	0.7 + 8	
	120 Hz - 1.2 kHz	0.05 + 0	75	0.4 + 5	0.5 + 7	0.7 + 8	
	1.2 kHz - 120 kHz	0.05 + 0	75	0.4 + 5	0.5 + 7	0.7 + 8	
7 mV	120 kHz - 500 kHz	0.07 + 1	75	0.4 + 5	0.5 + 7	0.7 + 8	0.1 µV
	500 kHz - 1.2 MHz	0.07 + 1	75				
	1.2 MHz - 2 MHz	0.07 + 1	100				
	2 MHz - 10 MHz	0.1 + 1	200				
	10 MHz - 20 MHz	0.17 + 1	200				
	20 MHz - 30 MHz	0.37 + 1	300				
	10 Hz - 30 Hz	0.10	75	0.4 + 10	0.5 + 13	0.7 + 16	
	30 Hz - 120 Hz	0.05	75	0.4 + 10	0.5 + 13	0.7 + 16	
	120 Hz - 1.2 kHz	0.05	75	0.4 + 10	0.5 + 13	0.7 + 16	
	1.2 kHz - 120 kHz	0.05	75	0.4 + 10	0.5 + 13	0.7 + 16	
22 mV	120 kHz - 500 kHz	0.07	75	0.4 + 10	0.5 + 13	0.7 + 16	0.1 µV
	500 kHz - 1.2 MHz	0.07	75				
	1.2 MHz - 2 MHz	0.07	75				
	2 MHz - 10 MHz	0.1	100				
	10 MHz - 20 MHz	0.17	100				
	20 MHz - 30 MHz	0.37	200				
	10 Hz - 30 Hz	0.10	40	0.4 + 20	0.5 + 30	0.6 + 40	
	30 Hz – 120 Hz	0.05	40	0.4 + 20	0.5 + 30	0.6 + 40	
	120 Hz - 1.2 kHz	0.05	40	0.4 + 20	0.5 + 30	0.6 + 40	
	1.2 kHz - 120 kHz	0.05	40	0.4 + 20	0.5 + 30	0.6 + 40	
70 mV	120 kHz - 500 kHz	0.05	40	0.4 + 20	0.5 + 30	0.6 + 40	1.0 µV
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.1	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				
	10 Hz - 30 Hz	0.10	40	0.3 + 60	0.4 + 80	0.5 + 100	
	30 Hz - 120 Hz	0.04	40	0.3 + 60	0.4 + 80	0.5 + 100	
	120 Hz - 1.2 kHz	0.04	40	0.3 + 60	0.4 + 80	0.5 + 100	
	1.2 kHz - 120 kHz	0.04	40	0.3 + 60	0.4 + 80	0.5 + 100	
220 mV	120 kHz - 500 kHz	0.04	40	0.3 + 60	0.4 + 80	0.5 + 100	1.0 µV
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.1	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				

Wideband Uncertainty Specifications (Option -03) (cont.)

Voltage [1] Range	Frequency Range	Flatness [2] 1 year ± 3 °C ± (% of Reading + µV)	Flatness [3] Temperature Coefficient ppm / °C	Absolute Uncertainty 0 °C to 50 °C [4] ± (% of Reading + µV)			Resolution
				90 Days	1 Year	2 Years	
700 mV	10 Hz - 30 Hz	0.10	40	0.3 + 200	0.4 + 300	0.5 + 400	10.0 µV
	30 Hz - 120 Hz	0.03	40	0.3 + 200	0.4 + 300	0.5 + 400	
	120 Hz - 1.2 kHz	0.03	40	0.3 + 200	0.4 + 300	0.5 + 400	
	1.2 kHz - 120 kHz	0.03	40	0.3 + 200	0.4 + 300	0.5 + 400	
	120 kHz - 500 kHz	0.03	40	0.3 + 200	0.4 + 300	0.5 + 400	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.1	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				
2.2 V	10 Hz - 30 Hz	0.10	40	0.3 + 300	0.35 + 400	0.4 + 500	10.0 µV
	30 Hz - 120 Hz	0.03	40	0.3 + 300	0.35 + 400	0.4 + 500	
	120 Hz - 1.2 kHz	0.03	40	0.3 + 300	0.35 + 400	0.4 + 500	
	1.2 kHz - 120 kHz	0.03	40	0.3 + 300	0.35 + 400	0.4 + 500	
	120 kHz - 500 kHz	0.03	40	0.3 + 300	0.35 + 400	0.4 + 500	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.1	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				
7 V	10 Hz - 30 Hz	0.10	40	0.3 + 500	0.35 + 800	0.4 + 1000	100.0 µV
	30 Hz - 120 Hz	0.03	40	0.3 + 500	0.35 + 800	0.4 + 1000	
	120 Hz - 1.2 kHz	0.03	40	0.3 + 500	0.35 + 800	0.4 + 1000	
	1.2 kHz - 120 kHz	0.03	40	0.3 + 500	0.35 + 800	0.4 + 1000	
	120 kHz - 500 kHz	0.03	40	0.3 + 500	0.35 + 800	0.4 + 1000	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.1	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				

[1] Range limits same as INPUT 1 or INPUT 2.

[2] Relative to 1 kHz, for 2-year specification multiply by 1.5.

[3] Add to flatness specifications when more than 3 °C from calibration temperature.

[4] At input connector.

Wideband Characteristics

Maximum Non-Destructive Input .... 200 V rms

Guard Isolation .... 0.5 V peak

Input Impedance

1 kHz.. 50Ω (± 0.5 %)

30 MHz .... 50Ω (± 5 %)

Wideband VSWR with 50 Ω Source

1 kHz.. 50 Ω (± 0.5 %)

30 MHz .... 50 Ω (± 5 %)

Shunt Input Characteristics

- The shunt input was designed to allow ac/dc current transfers using the Fluke A40 Series current shunts.
- 5790A-7001 A40/A40A Current Shunt Adapter and Cable required.

Shunt Model Current Range

A40 .... 2.5 mA - 5A

A40A .... 5A - 20A

Input Resistance .... 91 Ω ± 1 %

Operating Input Voltage	250 mV to 500 mV
Maximum Non-Destructive Input	50V rms

General Specifications

Warm-up Time	30 minutes
Relative Humidity	
Operating	45 % to 50 °C 75 % to 45 °C 95 % to 30 °C
Storage	<95 % non-condensing
Altitude	
Operating	3,050 meters (10,000 feet)
Non-Operating	12,200 meters (40,000 feet)
Temperature	
Operating	0 °C to 50 °C
Calibration	15 °C to 35 °C
Storage	40 °C to 70 °C
EMI/RFI	
Complies with	FCC Part 15 Subpart B, Class B; VDE 0871, Class B; ESD: EIA PN-1361.
Surge	ANSI C62.41-1980, Category A
Reliability	MIL-T-2880D, paragraph 3.13.3
Size	
Height	17.8 cm (7 in) standard rackmount + 1.5 cm (0.6 in)
Width	43.2 cm (17 in)
Depth	63 cm (24.8 in)
Maximum Power Requirements	
5790A	95 VA
With Wideband Option	120 VA
Weight	
5790A	24 kg (53 lb)
With Wideband	24.5 kg (54 lb)
Line Power	47 Hz to 63 Hz; ± 10 % of selectable line voltages: 100 V, 110 V, 115 V, 120 V, 200 V, 220 V, 230 V, 240 V
Safety	Complies with UL1244 and IEC 348-1976 and IEC 1010 and CSA C22.2 No. 231 and ANSI/ISA S82
Remote Interfaces	RS-232, IEEE-488

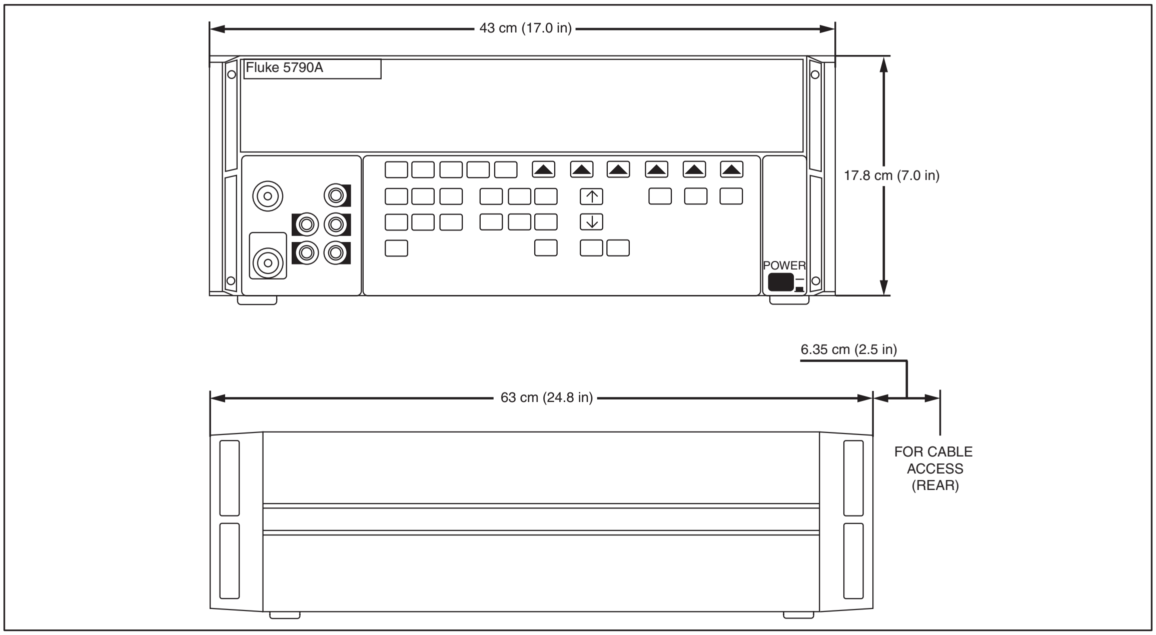

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Figure 1-1. Dimensions

Chapter 2
Theory of Operation

Title		Page

2-1. Introduction

This chapter provides theory of operation in increasing level of detail. The 5790A is first defined in terms of how it makes internal AC-DC transfers to measure unknown AC voltages. Detailed circuit descriptions follow, first for system interconnections including the motherboards, then for digital assemblies, and finally for the analog assemblies. The chapter ends with a discussion of how the 5790A uses calibration constants.

Most of this chapter is devoted to detailed circuit descriptions, first in the digital (unguarded) section, then in the analog (guarded) section.

2-2. 5790A Overview

The 5790A AC Measurement Standard is configured internally as an automated AC-DC transfer standard. All measurements are controlled by internal microprocessors. The following elements are among those critical to establishing the accuracy of the 5790A.

- The FTS (Fluke RMS Thermal Sensor) is the transfer element. It compares a precisely known adjustable DC voltage (or a square wave derived from DC) to an unknown AC voltage. If the FTS output remains unchanged when the input switches from the unknown AC voltage to the known DC voltage, the RMS value of the AC voltage is equal to the DC voltage. The FTS has extremely flat frequency response and has short term stability approaching 1 part per million (ppm).
- Highly stable thin-film resistor networks scale the 7 V range and higher to the FTS 2 V operating level and to scale the precision chopped reference to the 0.7 mV level.
- An ADC (analog to digital converter) measures the FTS output.
- A high-resolution DAC (digital to analog converter) generates precisely variable DC for the AC-DC transfer.
- An ultra-stable DC voltage reference establishes DAC accuracy.
- A DC-to-square-wave converter chops the DAC output to eliminate DC reversal error in the RMS sensor.

2-3. Functional Block Diagram Discussion

Refer to part 1 of Figure 2-1, the functional block diagram. The AC signal to be measured is applied to the FTS first through attenuators (precision resistor networks switched in or out depending on range), the transfer switch, and precision amplifiers (again depending on range). The A/D Amplifier (A15 assembly) measures the output of the FTS. In the block diagram this measurement is called M1.

The next step in the transfer process is shown in part 2 of Figure 2-1. The system takes another measurement, called M2. The CPU sets the precision DAC (digital to analog converter) to approximately the same voltage as the output of the divider network for M1. This voltage is converted to a 28 Hz square wave by the precision chopper circuit and applied to the FTS through the transfer switch and the same range amplifier. The output of the FTS is measured again to yield M2.

In Wideband mode, the option 5790A-03 Wideband module takes over the function of the Transfer assembly. The chopped reference from the A/D Assembly is 80 Hz for Wideband mode. The Wideband assembly is AC-coupled, therefore does not make AC-DC transfers.

Refer to the flowchart (part 3 of Figure 2-1) in the block diagram. After M1 and M2 are taken, the CPU computes the value of the unknown AC voltage at the input, called Vac, using the following formula:

$$Vac = Vdc + (M2 - M1)$$

If Vac and Vdc closely agree, the results are displayed on the front panel and the measurement is complete. If the difference between Vac and Vdc is too large, the CPU readjusts the DAC based on the above formula and begins another measurement cycle.

Calibration constants to correct for FTS and amplifier frequency response variations are stored in memory and applied to measurements before they are displayed. In order to apply the correct constants, a frequency counter measures the frequency of the incoming signal.

2-4. Digital Section Overview

The unguarded Digital Section contains the CPU assembly (A20), the Digital Power Supply assembly (A19), Front Panel assembly (A2), Keyboard assembly (A1), and the Rear Panel I/O assembly (A21). Figure 2-2 is a block diagram of the digital section of the 5790A.

Power for the digital assemblies and the cooling fans is supplied by the Digital Power Supply assembly.

The CPU (central processing unit) assembly is a single-board computer based on the 68000 microprocessor. It controls the local and remote interfaces, as well as serial communications over a fiber-optic link to the guard crossing the portion of the Regulator/Guard Crossing assembly (A17). The guard crossing controls the guarded analog circuitry.

A Keyboard assembly provides the user with front-panel control of the 5790A. It contains six keycap LEDs and a keypad. It connects to the Front Panel assembly via a cable.

The Front Panel assembly provides information to the user on an Measurement Display and a Control Display. The Front Panel also contains circuitry that scans the keyboard and encodes key data for the CPU.

The Rear Panel I/O assembly includes digital interfaces for the IEEE-488 bus and RS-232-C.

2-5. Analog Section Overview

The guarded analog section of the 5790A contains the following assemblies:

- Filter (A18)
- Regulator/Guard Crossing (A17)
- Transfer (A10)
- A/D Amplifier (A15)
- DAC (A16)
- Wideband (A6, Option -03)

These analog assemblies are interfaced to the Analog Motherboard assembly (A3). The guarded digital bus generated by the guard crossing portion of the Regulator/Guard Crossing assembly controls all analog assemblies except the Filter. The Guard Crossing interfaces with the unguarded CPU assembly via a fiber-optic link. The Transformer assembly, together with the Filter assembly and the regulator portion of the

Regulator/Guard Crossing assembly, create the system power supply for all the analog assemblies.

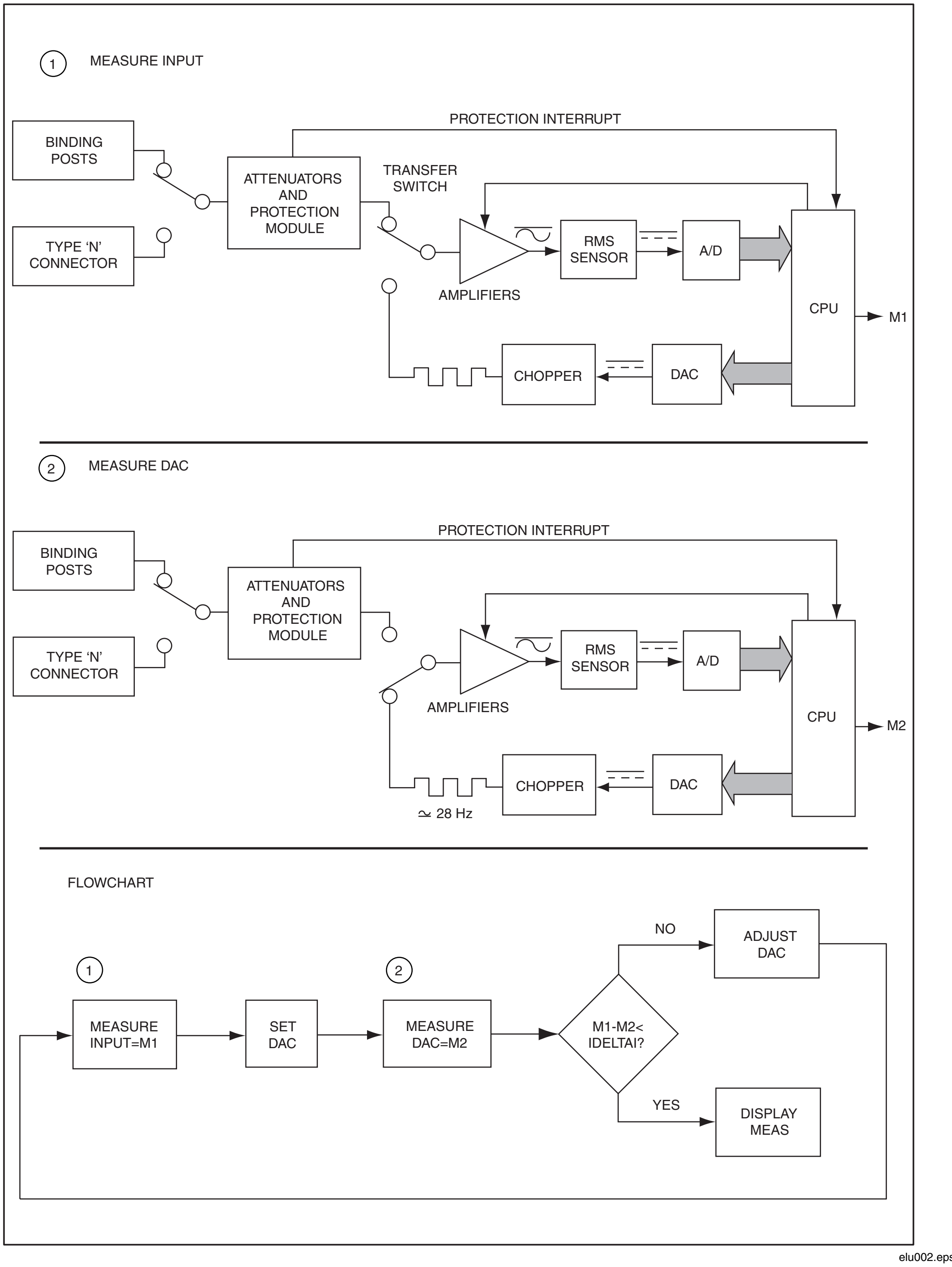

Figure 2-1. Functional Block Diagram

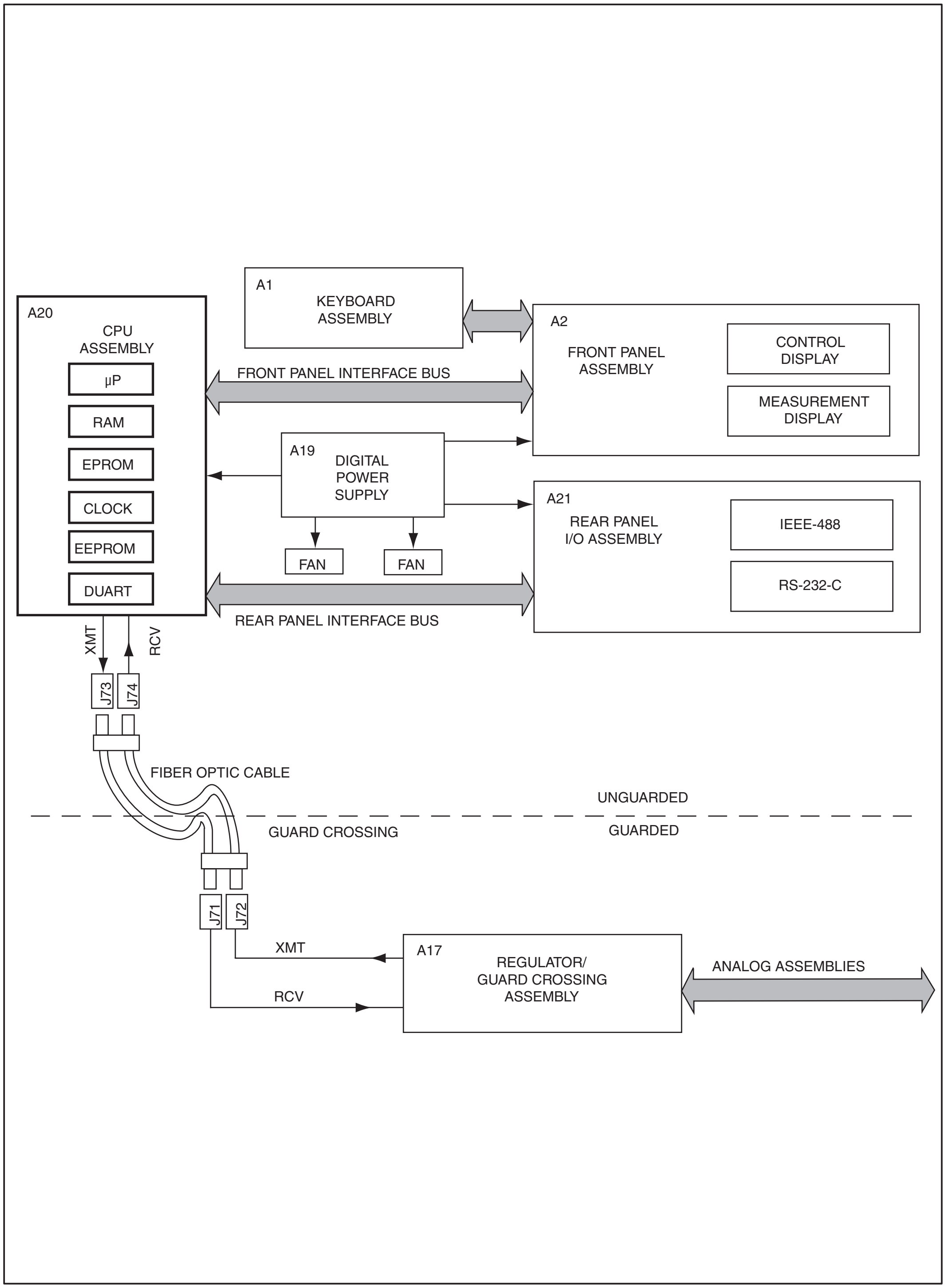

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Figure 2-2. Digital Section Block Diagram

2-6. System Interconnect Detailed Circuit Description

The motherboard assembly contains the Digital Motherboard assembly (A4), and the Analog Motherboard assembly (A3). These two Motherboards are mechanically fastened together with screws. They are electrically connected by the connectors P81 and P82 on the Digital Motherboard and connectors J81 and J82 on the Analog Motherboard. AC voltage taps from the Transformer assembly (A22) are connected to the Analog Motherboard through these connectors. Refer to the Motherboard and Input Block schematic diagrams for more information.

2-7. Digital Motherboard Assembly (A4)

The Digital Motherboard contains the line-select switches, line fuse, power switch, a fiber-optic transmitter (J73), and a fiber-optic receiver (J74). It also contains connectors for the Transformer assembly (A22), Digital Power Supply assembly (A19), CPU assembly (A20), Front Panel assembly (A2), Rear Panel assembly (A21), and the two 24 V DC fans mounted in the chassis.

The fiber-optic receiver and transmitter provide the serial communication link between the CPU on the unguarded Digital Motherboard and the Regulator/Guard Crossing on the guarded Analog Motherboard.

2-8. Transformer Assembly (A22)

The Transformer assembly receives AC line inputs routed through the A4 Digital Motherboard. This assembly supplies outputs throughout the 5790A, all of which are routed through the A4 Digital Motherboard.

The Transformer assembly, the Filter assembly (A18), and the regulator portion of the Regulator/Guard Crossing assembly (A17) create the system power supply for all analog assemblies. The Transformer assembly also supplies AC voltages to the Digital Power Supply assembly which generates five regulated DC voltages for use by the CPU, Front Panel assembly, Rear Panel I/O assembly, and the cooling fans.

2-9. Analog Motherboard Assembly (A3)

The Analog Motherboard contains the connectors for all assemblies in the guarded section of the 5790A. The Analog Motherboard also contains five relays, a fiber-optic transmitter, a fiber-optic receiver, and a cable for binding post connections. Table 2-1 lists Analog Motherboard connectors.

The fiber-optic transmitter (J72) and the fiber-optic receiver (J71) provide the serial communication link between the Regulator/Guard Crossing assembly and the CPU assembly on the unguarded Digital Motherboard.

The cable from the motherboard to the binding posts consists of three insulated wires and four shields.

Table 2-1. Analog Motherboard Connectors

Motherboard Connector	Connected to Assembly
J106 and J206	Wideband (A6, Option -03)
J110 and J210	Transfer (A10)
J115 and J215	A/D Amplifier (A15)
J116 and J216	DAC (A16)
J117 and J217	Regulator/Guard Crossing (A17)
J118 and J218	Filter (A18)

2-10. Rear Panel I/O Assembly (A21)

The Rear Panel I/O assembly provides the RS-232-C and IEEE-488 interface connections.

2-11. Rear Panel Power Supplies

Supplies +5 V LOGIC, +12 V, and -12 V are referenced to +5 V LOGIC COMMON and are generated on the Digital Power Supply assembly (A19). Some ICs on the A21 assembly do not have power and ground pins shown on the schematic. This information is included in the table on sheet 1 of the Rear Panel schematic.

2-12. Rear Panel Digital Control

The Rear Panel decodes address lines from the bus connected to the main CPU through the connector J121. Decoding is accomplished with C22V10 PLD (U8).

2-13. Clock Regeneration Circuit

In order to minimize EMI (electro-magnetic interference) inside the 5790A chassis, the rear panel accepts a low-level (~200 mV p-p sine wave) 3.68 MHz clock from the CPU assembly and conditions it to proper TTL clock levels.

This is done by a differential amplifier, U18, which amplifies the incoming signals 3.6864MHZCLK and 3.6864MHZCLK*. The output of U18 is a TTL level 3.68 MHz clock called RP3.68 MHZ that is buffered by PLD U8 creating RPCLK for use by DUART (dual universal asynchronous receiver/transmitter) U5, and IEEE interface IC U2.

2-14. IEEE-488 (GPIB) Interface

The IEEE-488 (GPIB) interface circuit provides the interface between the IEEE-488 connector (J1) and the 5790A processor on the CPU (A20) assembly. The circuitry uses a TMS9914 (U2) General Purpose Interface Bus (GPIB) adapter to meet the requirements for talker/listener operation on the IEEE-488 bus. This circuit translates asynchronous 8 bit data and control information, under control of an external controller, and converts this information to an acceptable format for the CPU.

The TMS9914 has internal circuitry which handshakes in the proper GPIB protocol and stores data in an internal buffer. This IC also has the capability of interrupting the CPU. The CPU can then handle the interrupt through its own handler routine. The data lines between U2 and J1 are buffered by a 75160A (U3) data buffer, and the command lines are buffered by a 75162A (U4) command buffer. J1 is a standard IEEE-488 connector. The shell of this connector is tied to chassis ground for EMI/RFI shielding.

2-15. RS-232-C Interface

The RS-232-C interface circuit uses a 68C681 DUART (U5), a 1488 line driver (U6), and a 1489 line receiver (U7). Figure 2-3 shows the RS-232 connector pinout (rear panel view).

The DUART does the parallel/serial data conversion and provides two channels of serial RS-232-C communication of which one channel is not used.

The other channel is available to RS-232-C connector J2 to meet serial interface needs between the 5790A and the external world. The transmit line (*TXDA) is driven by U6D to TX of J2, pin 2. The receive line RX goes from J2, pin 3 through receiver U7C to the receive line *RXDA of the DUART.

The DUART (U5) also has six input lines, three of which monitor signals CTSA*, CAL SWA*, and CAL SWB*. The CTS (clear to send) line from J2, pin 5 goes through receiver U7A becoming CTSA*. Line CAL SWA* connects to the rear panel CALIBRATION STORE switch. Line CAL SWB* connects to the rear panel CALIBRATION MODE switch. Output lines (transmitted data, RTS*, *DTR) are as shown in the connector pinout view.

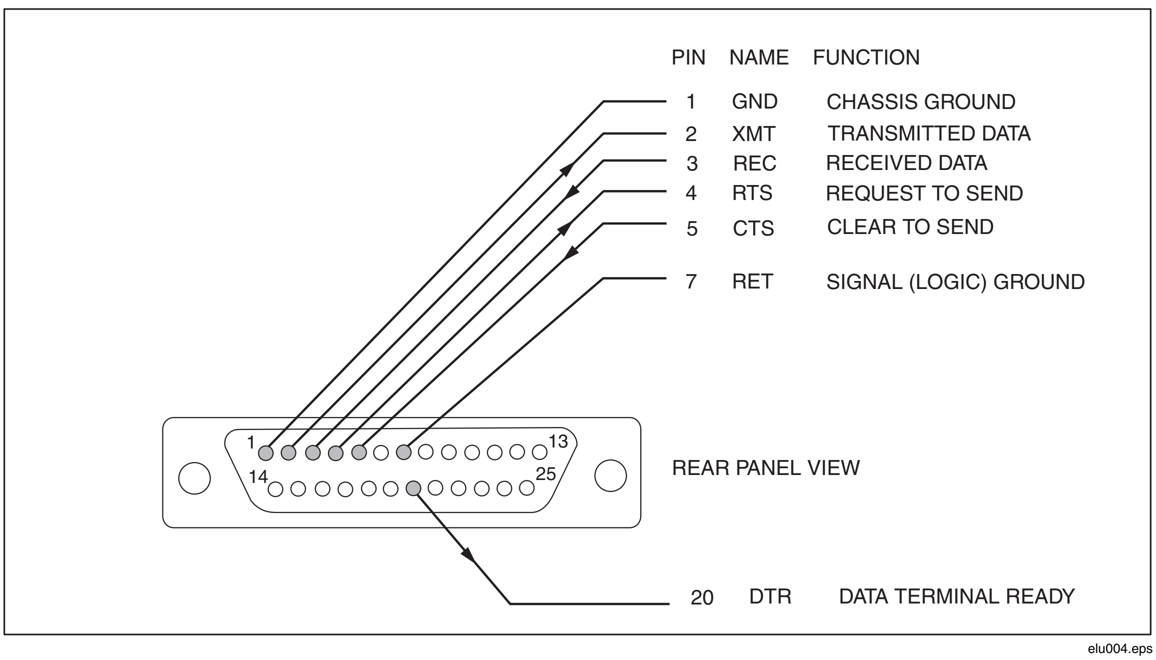


Figure 2-3. RS-232 Connector Pinout

2-16. Rear Panel CPU Interface

The rear panel is interfaced to the CPU assembly (A20) via connector J121 on the rear panel. The CPU has:

- Five address lines (RPA1-RPA5) which comprise the ADDRESS BUS
- Seven control lines which comprise the CONTROL BUS
- A low-level 3.6864 MHz clock (CLOCK, CLOCK*)
- Eight data lines RPD0-RPD7

Interfacing between the Rear Panel data bus (D100-D107) and the CPU data bus (RPD0-RPD7) is done with a bus transceiver U1.

2-17. Digital Section Detailed Circuit Description

Detailed descriptions of each assembly in the digital section are provided next.

2-18. Digital Power Supply Assembly (A19)

The Digital Power Supply assembly receives AC voltages from the transformer and provides five regulated DC voltages for use by the CPU, the Front Panel assembly, Rear Panel I/O assembly, and the cooling fans. All power supply voltages are referenced to COMMON, which is the transformer center tap for the ±12 V supplies. The test points at the top of the assembly can be used to check unregulated input voltages, and regulated DC output voltages. Table 2-2 lists the supplies generated by the Digital Power Supply.

Table 2-2. Supplies Generated by the Digital Power Supply

Signal Name	Test Point	Nominal Output	Tolerance	Current Limit	Rated Output
+75 V OUT	TP2	73 V	±8 %	121 mA	100 mA
+35 V OUT	TP5	35 V	±7 %	52 mA	40 mA
+12 VOLTS	TP8	12 V	±5 %	1.5 A	700 mA
−12 VOLTS	TP10	12 V	±5 %	1.5 A	450 mA
+5 V	TP12	5.2 V	±5 %	2.4 A	2.0 A
COMMON	TP13				

2-19. +5 V Power Supply

The unregulated +5 V supply uses CR25-CR28 in a full-wave rectifier configuration with filter capacitors C12, C13, and C14. Other components in the circuit filter high-frequency noise and provide a common-mode choke. Regulator U3 is fused by 3.15 A slow-blow fuse F5.

2-20. ±12 V Power Supplies

Full-wave rectifiers and filter capacitors generate the unregulated +12 V and −12 V supplies. AC inputs are fused by F3 and F4, both 2 A slow blow. Three-terminal +12 V and -12 V regulators (U1 and U2, respectively) are used. Diodes protect the regulator from input shorts and from reverse voltage. Inductors L3-L6 filter the regulated outputs. Resistor R7 further isolates the ±12 V FAN lines from the ±12 V power lines. The +12 V FAN and -12 V FAN lines power the two 24 V DC fans inside the 5790A.

2-21. +35 V Power Supply

The +35 V power supply powers the grid drivers and the anode drivers on the front panel Measurement Display circuitry. The +35 V supply is full-wave rectified, and regulated by Zener diodes VR14, VR15, and transistor Q5. The input is fused by F2, a 0.125 A slow-blow.

Components R5 and Q6 make up the current-limiting circuit. During an over-current condition, the voltage drop across R5 turns Q6 on, thus drawing the current away from the base of Q5 and limiting the current flow to the output. Diode CR16 protects this circuit from reverse voltage.

2-22. +75 V Power Supply

The +75 V power supply powers the grid drivers and anode drivers on the front panel control display circuitry. The +75 V supply is full-wave rectified, then regulated by 36 V zener diode VR6, 39 V zener diode VR7, and transistors Q1 and Q3. Zener diodes VR6 and VR7 set the output voltage. Transistors Q1 and Q3, in a Darlington configuration for current gain, are used as an emitter follower. Transistor Q4, zener diode VR5, and resistors R2 and R3 make up the constant current source supplying current to the zener diodes and the base of Q3. Current limiting is performed by R1 and Q2 in the same manner as in the +35 V supply. Diode CR8 protects the circuit from reverse voltage.

2-23. +35 V and +75 V Shut-Down Circuit

The +35 V and +75 V high voltage supplies are shut down when a fault occurs in the control display refresh circuitry. This shut-down circuit prevents the Control Display and Measurement Display from burning out, and also verifies that the master clock is generating control signals for both displays.

During normal operation, 75VSD is low, turning Q10 off. Line RESETL pulls the base of Q9 high through R9, turning Q9 on. This action in turn pulls the junctions of CR31-CR32 and CR33-CR34 low, turning Q7 and Q8 off. The +75 V and +35 V constant-current sources can then supply the appropriate zener diodes and drive the bases of the respective emitter followers.

When a display refresh fault occurs, the 75VSD line on P119 pin 5C, coming from the Front Panel assembly, goes high. This signal, pulled up by R4, drives the base of Q10 through base resistor R11. Transistor Q10 then pulls the base of Q9 near ground, turning Q9 off. On power-up or during a CPU reset, the RESETL signal is low, pulling the base of Q9 near ground through R9, also turning Q9 off. Resistor R12 is a turn-off resistor for Q9. Diodes CR31 and CR33 are in a wired-OR configuration. When Q9 is saturated (on), CR31 and CR33 pull their respective junctions to CR32 and CR34 near ground, turning Q7 and Q8 off. When Q9 is off, the junctions are pulled high through R8 and R10, saturating Q7 and Q8 (on). When on, Q7 removes the base drive from Q3, shutting down the +75 V supply. Similarly, Q8 removes the base drive from Q5, shutting down the +35 V supply.

Diodes CR32 and CR34 simply ensure that Q7 and Q8 are off when Q9 is on. Resistor R8 guarantees that Q7 will hold the +75 V supply off until it drops below 15.6 V, and R10 holds the +35 V supply off to 7.8 V.

2-24. CPU Assembly (A20)

The CPU (Central Processing Unit) for the 5790A is a single-board computer based on a 68HC000 microprocessor. Figure 2-4 is a block diagram of the CPU assembly. The CPU assembly communicates with the Guarded Digital section, the Front Panel assembly, and the Rear Panel assembly. The board can be divided into three primary areas:

- The microprocessor and its support circuitry
- Memory
- Peripheral ICs and I/O interfaces

Microprocessor support circuitry consists of a power-up and reset circuit, clock generation, a watchdog timer, address decoders and DTACK (data acknowledge) generator, bus error timeout, and interrupt controller.

2-25. Power-Up and Reset Circuit

The power-up and the reset circuitry consists of line monitor IC U1, C5, C6, CR1, R3, Z3, switch SW1, and inverters on U2. This circuit provides a 195 ms reset pulse at power-up or upon pressing and releasing SW1, placing the CPU assembly in a known safe condition. If the power supply glitches or falls below 4.55 V ± 0.05 V, U1 resets the 5790A. The reset pulse duration is determined by C5. Note that SW1 performs a different function than the front panel RESET button. SW1 is a hardware reset that is hard-wired to and directly read by the microprocessor. The front panel RESET button is a software reset; it tells the system software to restore the 5790A configuration to a default condition.

The heart of this circuit is the line monitor IC U1. On power-up or when SW1 is pushed, U1 forces an active-low reset pulse on RESETL and an active-high pulse on RESET. RESETL helps to prevent the accidental writes to EEPROM and drives an inverter in U2 to turn off LED CR1. CR1 indicates that the +5 V supply is on and that the CPU is operating, i.e. not reset. RESETL also resets the rear panel assembly. The other output, RESET, drives two inverters in U2. One of these inverters provides HALT*. The other generates IORESET*, which drives the processor's RESET and provides a reset for the front panel interface and DUARTs (dual universal asynchronous receiver/transmitter) circuitry.

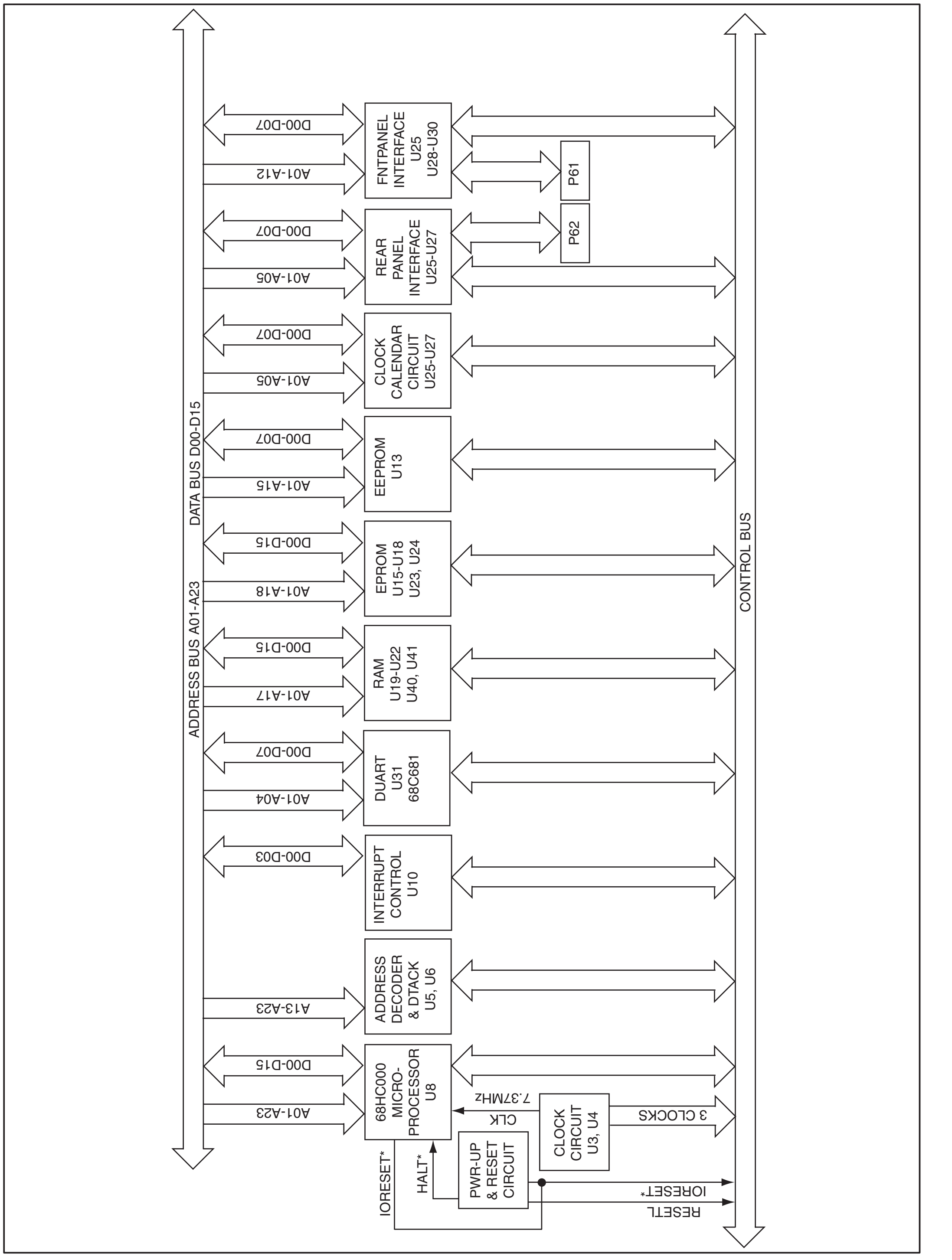


Figure 2-4. CPU Assembly Block Diagram

Table 2-3. CPU Acronym Glossary

Signal Name	Function
A01-A23	Address lines
ADCLCKCS*	Clock/calendar (U33) chip select
AS*	Address strobe
BERR*	Bus error
BGACK*	Bus grant acknowledge
BR*	Bus request
BRPDRTINT*	Rear panel DUART interrupt
BRPDTK*	Rear panel data transfer acknowledge
BRPIEEEINT*	Rear panel IEEE-488 interrupt
CLKCALINT*	Clock/calendar interrupt
D00-D15	Data lines
DOGCLR	Dog clear (clears watchdog timer)
DOGINTH	Dog interrupt (interrupt from watchdog timer)
DRTDTK*	DUART data transfer acknowledge
E	Enable fro 6800 family devices (737.28 kHz clock)
EXDUARTINT*	External DUART Interrupt
FAN1	Signal monitoring fan 1
FAN2	Signal monitoring fan 2
FANINT*	Fan monitor interrupt
FC0	Function code output 0
FC1	Function code output 1
FC2	Function code output 2
FPDTK*	Front panel data transfer acknowledge
FRNTPNLCS*	Front panel chip select
FRNTPNLEN*	Front panel enable
GCDRTCS*	Guard crossing DUART chip select
GCDUARTINT*	Guard crossing DUART Interrupt
INTRCNTL1	Interrupt control 1
INTRCNTL2	Interrupt control 2
IPL0*	Interrupt priority level 0
IPL1*	Interrupt priority level 1
IPL2*	Interrupt priority level 2
KEYBRDINT*	Keyboard interrupt
LDS*	Lower data strobe

Table 2-3. CPU Acronym Glossary (cont.)

Signal Name	Function
MISCCS*	Miscellaneous chip select enable (upper address bits decoder)
NVMCS*	Nonvolatile memory chip select
NVMOE*	Nonvolatile memory output enable
PROM0CS*	PROM 0 chip select (U15 and U16)
PROM1CS*	PROM 1 chip select (U17 and U18)
PROM2CS*	PROM 2 chip select (U23 and U24)
PSFAILINT*	Power supply fail interrupt
RAM0CS*	RAM chip select (U19 and U20)
RAM1CS*	RAM chip select (U21 and U22)
RAM2CS*	RAM chip select (U40 and U41)
R/WR*	Read/write
RDINT*	Read interrupt
RDL*	Read data lower
RDU*	Read data upper
RDY/BSYL	Ready/busy
RPSEL*	Rear panel chip select
RRPNLEN*	Rear panel enable
RXDA	Receive data Port A
RCVB	Receive data Port B
SCLK	Serial clock
TXDA	Transmit data Port A
TXDB	Transmit data Port B
UDS*	Upper data strobe
WRL*	Write lower
WRU*	Write upper
XDUARTCS*	External DUART chip select

2-26. Clock Generation

The clock generation circuit uses components Y1, Y2, U3, U4, R4, R5, C8, C9, and E5. The crystal Y1, along with the resistors, capacitors, and an inverter in U3 generates the 7.3728 MHz primary system clock CLK. This system clock is used by the processor and is divided down by a binary counter (U4) for clocks of 3.6864 MHz, 28.8 kHz, and 450 Hz. The 450 Hz clock is used by the watchdog timer, the 28.8 kHz is used by U6 in the decoding circuit, and the 3.6864 MHz is used by the DUARTs, and the clock filter circuit. Jumper E5 allows for selection of the alternate oscillator (Y2) as the system clock.

2-27. Watchdog Timer

The watchdog timer circuitry uses a 74HC4020 binary counter (U11) to divide the 450 Hz from the clock generation circuit to produce interrupt DOGINTH, signifying that the system may be locked up. This interrupt is generated 1.14 seconds after the last

DOGCLR2 signal from interrupt controller U10. Therefore, DOGCLR2 must occur more often than every 1.14 seconds to clear U11 and prevent the watchdog interrupt. Generation of DOGCLR2 is under software control. The watchdog timer can be disabled by cutting the jumper E1.

2-28. Address Decoding and DTACK (Data Acknowledge)

Two Programmable Logic Devices (PLDs) accomplish address decoding and DTACK (data acknowledge) generation. ICs U5 and U6 provide chip selects and generate acknowledgement signals for those devices without the DTACK lines. IC U5 receives the DTACK signals from the asynchronous devices and ORs these signals together to form DTACK*.Table 2-4 is the memory map for the system. It shows the chip select, address range, and notes whether AS* (address strobe) or the LDS* (lower data strobe) is required.

Table 2-4. CPU Memory Map

Chip Select	Read/Write	Address Range	AS* or LDS* Required?
PROM0CS*	R	0 to 3FFFF	no
PROM1CS*	R	40000 to 7FFFF	no
PROM2CS*	R	80000 to BFFFF	no
RAM0CS*		600000 to 60FFFF	no
RAM1CS*		610000 to 61FFFF	no
RAM2CS*		620000 to 623FFF	no
NVMCS*	R/W	C00000 to CFFFFF	no
MISCCS*	R/W	D00000 to DFFFFF	no
RPSEL*	R/W	D00000 to D01FFF	LDS*
RPDUARTCS*	R/W	D00000 to D0001F	LDS*
RPIEEECS*	R/W	D00020 to D0002F	LDS*
FRNTPNLCS*	R/W	D02000 to D03FFF	AS*
OTDCS*	R/W	D02000 to D027FF	AS*
DMDCS*	R/W	D02800 to D02FFF	AS*
LED-OUTPUT-CNTRL	R	D03400 to D037FF	AS*
LED-LATCH-EN	W	D03400 to D037FF	AS*
KEYBOARDCS*	R/W	D03800 to D038FF	AS*
GCDRTCS*	R/W	D04000 to D05FFF	LDS*
XDUARTCS*		D06000 to D07FFF	LDS*
RDINT*	R/W	D08000 to D09FFF	AS*
DOGCLR	W	D08000 to D09FFF	even only, AS*
ADCLKCS*		E00000 to EFFFFF	AS*

2-29. Interrupt Controller

The PLD U10 is the priority interrupt controller. The interrupt controller reads incoming interrupts and interrupt control lines, then encodes the highest priority interrupt into the interrupt level for the 68HC000. When the 68HC000 responds to an interrupt request, it asks the interrupt controller for an 8-bit vector that corresponds to the pending interrupt of the highest priority. The interrupt controller responds with the 4 LSBs of the vector according to how it is programmed. The 4 MSBs are pulled up on resistor network Z1.Table 2-5 shows the interrupts, their priority levels, and vectors.

Table 2-5. CPU Interrupts, Priorities, and Vectors

Interrupt	Priority Level	Vector (Hex)
NMI	7	- (not used)
DOGINTH	6	F4
BRPDRTINT*	5	F6
GCDUARTINT*	5	F7
EXDUARTINT*	5	F8
CLKCALINT*	4	F5
BRPIEEEINT*	4	F9
KEYBRDINT*	3	FA
BPSFAILINT*	2	FB
FANINT*	0	FF (not used)
RDY/BSYL	0	FF (not used)
No interrupt	0	FF

2-30. Glue Logic

The ICs U2, U3, and U9 form the glue logic circuit, which keeps various CPU functions running properly. The four OR gates in U9 and an inverter in U3 use control signals UDS*, LDS*, and R/WR* from the microprocessor to generate control signals WRU*, WRL*, RDL*, and RDU*.

2-31. RAM (Random-Access Memory)

Random-access memory is contained in three pairs of sockets, U19 and U20, U21 and U22, and U40 and U41. These sockets accommodate either 32 K X 8 or 128 K X 8 static CMOS RAM modules (32 KB or 128 KB each). The 5790A is shipped with U19-U22 installed, using 32 K X 8 parts and providing 128 KB of static RAM.

2-32. ROM (Read-Only Memory)

Read-only memory is contained in three pairs of sockets, U15-U16, U17-U18, and U23-U24. These sockets accommodate 27010 EPROMS, 128 K X 8 devices (128 KB each). The jumpers allow 256 KB devices to be used in their place. The 5790A is shipped with U15-U18 installed, providing 512 KB of EPROM.

2-33. Electrically-Erasable Programmable Read-Only Memory (EEPROM)

IC U13 is an EEPROM. The socket accommodates a 32 K X 8 device (32 KB of storage.) A jumper is provided to allow an 8 K X 8 (8 KB) device to be used in place of the 32 KB device. The 5790A is shipped with a 32 KB EEPROM installed.

The EEPROMs are designed so that writes to the device are prevented by holding the output enable line (NVMOE*) low. Diodes CR5, CR6 and CR8, together with the resistor R6, perform a wired-OR function for three signals that control NVMOE*. Components

R6, CR6 and C17 hold NVMOE* to a valid logic low for typically 37.3 ms during the power-up; 26.8 ms minimum, 49.6 ms maximum. Diode CR7 provides a discharge path for C17 on power-down, allowing the operator to quickly turn the 5790A off and then on again, without interfering with the power-up charge time of the capacitor. Diode CR8 allows the normal microprocessor read of the device to take place. And diode CR5 allows power monitoring IC U1 to hold NVMOE* low when the +5 V power supply drops below 4.5 V on power-down or during the power glitches.

2-34. DUART (Dual Universal Asynchronous Receiver/Transmitter) Circuit

The 68C681 DUART (U31) has several functions. Its primary function is to provide the asynchronous serial lines that communicate with the Guarded Digital Controller over the fiber-optic path off the Digital Motherboard. A 75451 driver IC (U32) drives the fiber-optic transmitter on the digital Motherboard.

The DUART has 8 output lines that perform various functions. INTRCNTL1 and INTRCNTL2 go to the interrupt controller and are fed back to the DUART inputs. These are used by the interrupt controller to enable certain interrupts. Line SCLK is a test output of the channel A serial clock.

The DUART monitors the EEPROM ready signal and the FANINT* signal. It also has a spare serial channel that goes to the connector J5. Components U44 and U43 convert the TTL-level signals at the DUART to RS-232-C-level signals at J5.

The DUART generates its own DTACK signal, DRTDTK*, which is used by U5 to generate system DTACK, DTACK*. A second DUART, U42, with associated RS-232-C drivers and receivers is used only for test purposes. It generates its own DTACK, wire-ORed to DRTDTK*.

2-35. Clock/Calendar Circuit

Time and date information is stored in a battery-backed clock/calendar circuit consisting of 32.768 kHz crystal Y3, 3 V lithium battery BT1, clock/calendar IC U33, and capacitors C10 and C11. The clock/calendar IC has the necessary circuitry internally to switch operation from the power supply to the battery BT1. Pull-up resistors in Z5 off U33 are to ensure the low power operation when the +5 V supply is off. U33 generates CLKCALINT* under software control.

2-36. Clock Filter Circuit

The clock filter circuit generates a 3.6864 MHz 200 mV sine wave for the Rear Panel I/O and Front Panel assemblies. This circuit buffers the 3.6864 MHz Clock with an inverter in U3. The circuit contains DC-blocking capacitor C80, two stages of a low pass LC filter (L80 and C81, L81 and C82), transformer T51, and termination resistor R82.

2-37. CPU to Rear Panel Interface

Components U25, U26, U27, and connector P220 interface the CPU to the rear panel. Bi-directional bus transceiver U26 buffers the data lines. Signal R/WR* controls the transmission direction of the data lines, and RRPNLEN* is the IC enable. The IC U25 buffers control lines BRPDRTINT*, BRPIEEEINT*, and BRPDTK*. U27, enabled by RRPNLEN*, buffers the address line A01-A05 and control lines WRL* and R/WR*. Control lines RESETL, RPSEL*, TXDB, RCVB, and XMT go directly to connector P220.

2-38. CPU to Front Panel Interface

Components U25, U28, U29, U30 and connector P120 interface the front panel to the CPU. Bi-directional bus transceiver U30 buffers the data lines. Control signal R/WR* controls the transmission direction of the data lines, and FRNTPNLEN* is the IC enable. IC U28, enabled by FRNTPNLEN*, buffers address lines A05-A12. IC U29, also enabled by FRNTPNLEN*, buffers address lines A01-A04 and control line R/WR*. Two sections of U25 in parallel buffer IORESET*, providing twice the drive current of a single section, generating BRESET*. Three other sections of U25 buffer FPINT*, FPDTK*, and PSFAILINT*. Control line FRNTPNLCS* goes directly to the connector P120.

2-39. Front Panel Assembly (A2)

The Front Panel assembly, operating in conjunction with the Keyboard assembly (linked by a cable), is the operator interface to the 5790A. This assembly contains two separate vacuum-fluorescent displays:

- The Control Display
- The Measurement Display

Each display has its own control, high voltage drive, and filament-switching circuits. This assembly also contains clock regeneration, refresh failure detect, keyboard scanner, LED drive, and decoding and timing circuitry.

Connector J1 interfaces with the CPU assembly and the Digital Power Supply assembly via the Digital Motherboard.

2-40. Clock Regeneration Circuitry

To minimize EMI (electro-magnetic interference), the Front Panel assembly accepts a low-level sine-wave (approximately 200 mV p-p) 3.6864 MHz clock from the CPU assembly and converts it to a TTL-acceptable level. This is done by high-speed differential comparator (U7A), operating on incoming signals 3.6864MHZCLK and 3.6864MHZCLK*. The output of U7A is the input to U8 and is also inverted by U11B to create the 3.6864 MHz clock signal CLOCK. Twelve-stage binary counter U8 divides the 3.6864 MHz clock by eight and U11A inverts the signal to create 460.8 kHz. The master clock is further divided by U8, producing a 900 Hz signal on pin 1. These clocks provide system timing for the other ICs on the assembly. A -5.2 V supply for U7 is provided by VR5, with C64 acting as the supply bypass.

2-41. Refresh Failure Deject Circuitry

If a clock failure were to occur, the refresh cycles of the vacuum-fluorescent displays would be interrupted. This condition could damage the tubes if not immediately detected. Refresh failure detect circuitry monitors the GRIDDATA output from the last high voltage driver (U23) for the Control Display. This output (REFRESH) is used to clear a watchdog timer (U6) during every refresh cycle. If the refresh is interrupted and GRIDDATA does not occur, the watchdog timer times out and latches U12.

Flipflop U12 generates control lines 75VSD and PSFAILINTR*. Control line 75VSD is routed to the Digital Power Supply assembly to shut down the +35 V and +75 V power supplies, thus preventing damage to the vacuum-fluorescent displays. Interrupt line PSFAILINTR* is used by PLD U3 to properly blank the Control Display and

Measurement Display through DMDBLANK and OTDBLANK, and alerts the CPU that this failure has occurred.

2-42. Decoding and Timing Circuitry

Main decoding and master timing functions for the Front Panel are accomplished by an EP900 PLD (Programmable Logic Device), U3. Two state machines control display refresh and filament switching. Filament switching is handled by two non-overlapping 57.6 kHz signals.

Signals GSTRBE and STROBE are master timing and synchronization signals used by the other ICs. Signal DMDBLANK controls the Control Display grid drivers, ABCLK and CDCLK control the Control Display anode drivers, and OTDBLANK controls the Measurement Display grid and anode drivers. Front panel DTACK and interrupt functions, and generation of the various chip select and reset signals are also provided by U3. Table 2-6 is a memory map for the front panel.

Table 2-6. Front Panel Memory Map

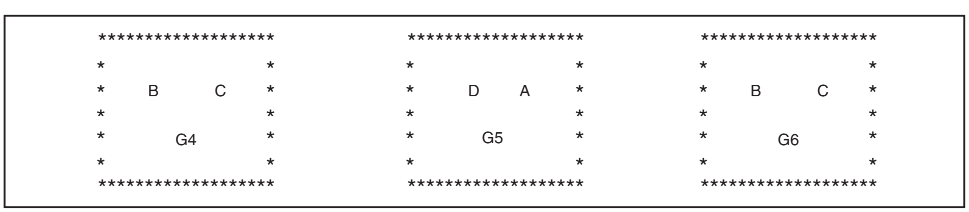
Name	Read/Write	Address
OTDCS*	R/W	D02000 to D027FF
DMDCS*	R/W	D02800 to D02FFF
LED_OUTPUT_CNTRL	R	D03400 to D037FF
LED_LATCH_EN	W	D03400 to D037FF
KEYBOARDCS*	R/W	D03800 to D03BFF

2-43. Control Display Circuitry

Control Display circuitry consists of a 26-row by 256-column vacuum-fluorescent dot matrix display under the control of PLD U4, four high voltage grid drivers (U20-U23), four high voltage anode drivers (U16-U19), a filament switching circuit, and 1 K X 8 (1 KB) dual-port RAM U1.

This display is divided into 129 grids; alternate grids contain two anode columns lettered B C or D A. Grid G129 and column C in grid G128 are not used. Each column contains 26 individual anodes.

IC U4 is an EP900 Programmable Logic Device (PLD). It provides the timing and control signals for Control Display circuitry. The display data written by the microprocessor into the Control Display's dual port RAM (U1) is read by U4 and sent serially to the high voltage anode drivers. Both the anode and grid drivers are serial TTL-level input, 3-bit parallel high voltage output devices. IC U4 also controls the grid timing and display refresh.



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Adjacent columns in adjacent grids are driven, while the opposite columns are turned off. For instance, grid G4 contains columns B and C, and grid G5 contains columns D and A.

G4 and G5 are driven simultaneously while anode columns G4-C and G5-D are activated, and G4-B and G5-A are driven off. Next, grids G5 and G6 are driven simultaneously, while columns G5-A and G6-B are activated, and G5-D and G6-C are driven off. This pattern is repeated for all 128 grids at a refresh rate of about 75 Hz.

Both the A and C (U16 and U18), and B and D (U17 and U19) anode drivers' input registers are latched with the same data, while the output drivers are appropriately enabled and displaying the data previously strobed to the driver outputs from the input registers. The input register data is strobed to the output drivers while all of the drivers are disabled, or blanked. Following this, either the A and B drivers are enabled to display the A-B data when the C and D drivers, latched with A-B data, are disabled, or the C and D drivers are enabled to display the C-D data when the A and B drivers, latched with C-D data, are disabled.

Control Display filament driver circuitry consists of transistors Q1 through Q6 and zener diodes VR1 and VR2, with associated resistors. The transistors are driven by 7406 open collector drivers U13B and U13A. These drivers are controlled by AOUT and BOUT. AOUT and BOUT are synchronous, non-overlapping, three-eighths duty cycle, 57.6 kHz timing signals generated by U3. Each signal is alternately active high for 6.51 µs, with a dead time between active signals of about 2.17 µs to allow the turn-off times of the drive transistors. When AOUT is high, U13B turns Q2 and Q4 on. Q4 turns Q6 on, providing a path for the filament current through Q2 and Q6. Zener diode VR2 provides the DC voltage offset necessary for proper filament operation. Then, when BOUT is high, U13A turns Q1 and Q3 on. Q1 turns Q5 on, providing a path for the filament current through Q3 and Q5, effectively reversing the direction of the voltage driving the filament. Zener diode VR1 provides the DC voltage offset necessary for proper filament operation.

PLD U4 also generates the 225 Hz square-wave SCAN signal used by PLD U9 to control front panel keypad scanning and key debounce.

Dual-port RAM U1 contains all the Control Display data written by the 68HC000 microprocessor on the CPU board. PLD U4 contains a 10-bit address counter which is used by U4 to read the contents of U1. U1 provides a BUSYD signal to U3, which is active low whenever the CPU and U4 try to access the same RAM location at the same time. If the microprocessor attempts to write to the RAM location that U4 is reading (as it refreshes the DMD), U3 uses BUSYD to hold off DTACK to the microprocessor. This prevents the written data from being lost. The other busy signal, generated when U4 attempts to read from a location being written to by the microprocessor, is ignored. Losing display data for one refresh cycle is insignificant.

2-44. Measurement Display Circuitry

Measurement Display circuitry consists of a custom 2-row, 22-character vacuum-fluorescent display under the control of PLD U5. The circuit contains high voltage grid driver U15, high voltage anode driver U14, a filament switching circuit, and a 1 K X 8 (1 KB) dual-port RAM, U2.

The custom display is divided into 24 grids. The 22 characters are made up of fourteen seven-segment digits and eight 14 segment characters. See the schematic diagram for more information.

IC U5 is an EP900 PLD, programmed to provide the timing and control signals for the Measurement Display circuitry. Display data written by the microprocessor into the Measurement Display's dual-port RAM U2, is read by U5 and sent serially to the high voltage anode driver. Both the anode and the grid drivers are serial TTL-level input, 32 bit parallel high voltage output devices. Only 31 anode driver outputs and 24 grid driver outputs are used, the remaining high voltage outputs are left unconnected. IC U5 also controls grid timing and display refresh.

Measurement Display filament driver circuitry centers on transistors Q7-Q12. The transistors are driven by 7406 open-collector drivers U13C and U13D. These drivers are controlled by AOUT and BOUT as in the Control Display. When AOUT is high,

U13C turns Q8 and Q10 on. Q10 turns Q12 on, providing a path for the filament current through Q8 and Q12. Zener diode VR4 provides the DC voltage offset necessary for proper filament operation. Then when BOUT is high, U13D turns Q7 and Q9 on. Q7 turns Q11 on, providing a path for the filament current through Q9 and Q11, effectively reversing the direction of the voltage driving the filament. Zener diode VR3 provides the DC voltage offset necessary for proper filament operation.

Dual-port RAM U2 contains all the Measurement Display data written by the 68HC000 microprocessor on the CPU board. U5 contains a 7-bit address counter which U5 uses to read the contents of U2. U2 provides a BUSYO signal to U3, which is active low whenever the CPU and U5 try to access the same RAM location at the same time. If the microprocessor attempts to write to the same RAM location U5 is reading as it refreshes the Control Display, U3 uses BUSYO to hold off DTACK to the microprocessor. This prevents written data from being lost. The other busy signal, generated when U5 attempts to read from a location being written to by the microprocessor, is ignored. Losing display data for one refresh cycle is insignificant.

IC U5 also generates the FPINTR* (front panel interrupt, active low) signal sent to the 68HC000 microprocessor, telling it there is a keyboard interrupt. Keyboard interrupt inputs to U5, KEYBOARDINTR (active high), is generated by PLD U9.

2-45. Keyboard Scanner Circuitry

The key matrix is scanned by PLD U9. It sequentially drives one of the eight columns for about 2.2 ms, then reads all the six rows of the matrix on each column scan. When a key is pressed and the column associated with that key is scanned, the row associated with that key goes low. If the key is still pressed after a 6.6 ms debounce period, U9 generates signal KEYBOARDINTR. This signal goes to U5 where it generates FPINTR*, which interrupts the 68HC000 microprocessor. The microprocessor generates KEYBOARDCS* through PLD U3 causing U9 to output encoded row and column data on the data bus for the microprocessor to read. This also resets the keyboard interrupt.

The microprocessor controls the speaker, also referred to as the beeper. Writing a logic high on the data line D6 to U9 enables the speaker, writing a logic low on D6 disables the speaker. When enabled, a 900 Hz square-wave signal generated by U8 is gated out to the speaker through U9.

2-46. LED Circuitry

The LED circuit controls the six keycap light-emitting diodes on the Keyboard assembly. It includes a 74LS373 8-bit latch (U10), and resistors R16 through R19 and R78 through R80. Keycap LEDs light to indicate which input is selected, and to indicate when external trigger mode (EX TRIG) or external guard (EX GRD) is selected.

Latch (U10) is controlled by the LED_LATCH_EN signal from the decoding PLD U3. Signal LED_LATCH_EN latches the CPU data bus into the internal latches of U10 on a write to the front panel LED memory space. This data appears at the output when control line LEDENABLE* goes low. Control line LED_OUTPUT_CNTRL from U3 is inverted by U11C to create LEDENABLE*. Table 2-7 shows which line activates each LED.

Table 2-7. Control Lines for the Keyboard LEDs

Keycap LED	Control Lines
INPUT 2	LED1A
EX GRD	LED2A
WBND	LED2B
SHUNT	LED1B
INPUIT 1	LED3A
EX TRIG	LED3B

2-47. Keyboard Assembly (A1)

The Keyboard assembly provides the operator with front panel control of the 5790A. It connects to the Front Panel assembly (A2) through a cable, and includes an elastomeric keypad, and six keycap LEDs.

The elastomeric keypad and the printed circuit board form a 45-switch keyboard arranged in eight columns and six rows (only 32 of these keys are used). The keyboard scanner circuit on the Front Panel assembly sequentially drives columns one through eight. When a key is pressed, a low appears on the corresponding row as the key's column is scanned. The keyboard scanner circuit encodes the key's row and the column location, then takes appropriate action.

The six keycap LEDs (CR1 through CR6) are controlled by the LED driver circuit on the Front Panel assembly. Refer to the Keyboard schematic for the name of the signal line that controls each keycap LED.

2-48. Analog Section Detailed Circuit Description

Detailed descriptions of each assembly in the analog section are provided in this section. Simplified schematics are provided to supplement the text.

2-49. Filter Assembly (A18)

The Filter assembly receives AC inputs from the main power transformer secondaries and provides unregulated DC to the Regulator/Guard Crossing assembly (A17) and regulated DC supplies to the DAC assembly. The unregulated supplies are listed in Table 2-8 and the regulated supplies are listed in Table 2-9.

Table 2-8. Unregulated Supplies from the Filter Assembly

Signal Name	Nominal Output	Tolerance	Max. P-P Ripple	Rated Output	Test Point
+15 CH	27 V	±8 V	2 V	200 mA	TP2
–15 CH	–27 V	±8 V	2 V	200 mA	TP5
OSC COM	RETURN				TP4
+5 LHR	12 V	±4 V	3 V	3.5 A	TP1
–5 LHR	–12 V	±4 V	2 V	400 mA	TP6
LH COM	RETURN				TP3
+17 SR	27 V	±8 V	3 V	1.3 A	TP10
–17 SR	–27 V	±8 V	3 V	1.3 A	TP14
17 S COM	RETURN				TP12
+5 FR1R	12 V	±4 V	2 V	400 mA	TP17
–18 FR1R	–27 V	±8 V	2 V	50 mA	TP20
FR1 COM	RETURN				TP19
+30 FR1R	50 V	±15 V	3 V	85 mA	TP15
FR1R COM	RETURN				TP16
+30 FR2R	–50 V	±15 V	3 V	85 mA	TP8
FR2 COM	RETURN				TP11

Table 2-9. Regulated Supplies from the Filter Assembly

Signal Name	Nominal Output	Tolerance	Current Limit	Rated Output	Test Point
–5 FR2	–5 V	±0.3 V	0.15 A	0.03 A	TP13
FR2 COM	RETURN				TP11
+5 FR1	+5 V	±0.3 V	2 A	0.1 A	TP18
–18 FR1	–18 V	±0.9 V	2 A	0.05 A	TP21
FR1 COM	RETURN				TP19

2-50. Unregulated CH Supplies

Line CH COM is the return path for the +15 CHR and -15 CHR supplies. These supplies use a full-wave center-tapped configuration. They consist of a bridge rectifier CR3 and two filter capacitors, C4 and C6 for +15 CHR and -15 CHR, respectively. Inputs are fused with 1.6 A slow-blow fuses F1 and F2.

2-51. Unregulated LH Supplies

Line 5 LH COM is the return path for the +5 LHR and -5 LHR supplies. These supplies use a full-wave center-tapped configuration, and consist of four diodes (CR1, CR2, CR4, CR5) configured as a bridge rectifier.

The capacitors C2 and C3 filter +5 LHR, and C5 filters -5 LHR. Capacitor C1 reduces the level of generated transients.

2-52. Unregulated ±17 SR Supplies

The ±17 SR supplies use a full-wave center-tapped rectifier consisting of four diodes (CR8, CR10, CR12, CR13) configured as a bridge rectifier. Capacitors C13 and C14 filter the +17 SR supply, while C15 and C16 filter the -17 SR supply.

2-53. Triac Circuit

The triac circuit protects the 5790A if it is inadvertently plugged into an excessively high line voltage. For example, it protects the 5790A if it is plugged into a 230 V line when the rear panel line voltage select switches are set for 115 V operation.

This circuit contains triac CR19, zener diodes VR20, VR21, resistor R1, and capacitor C23. The zener diodes set a trip voltage of 82 V. If the AC voltage across the main transformer secondary for the ±17 V supply exceeds 82 V, the triac fires, shorting out the winding, which causes the main transformer primary fuse to blow.

2-54. FR1 Supplies

Line FR1 COM is the return path for the unregulated +5 FR1R raw supply and the regulated +5 FR1, and the −18 FR1 supplies. Each supply uses a full-wave bridge configuration.

The unregulated +5 FR1R supply consists of bridge rectifier CR15 and filter capacitor C19. The input is fused with 1.6 A slow-blow fuse F8. The regulated +5 FR1 supply uses the unregulated +5 FR1R supply and contains regulator U2, filter capacitor C20, and protection diode CR16.

The -18 FR1 supply consists of bridge rectifier CR17 and filter capacitor C21. Its input is fused with 0.5 A slow-blow fuse F9. The regulated -18 FR1 supply uses the unregulated -18 FR1 supply and contains regulator U3, filter capacitor C22, and protection diode CR18.

2-55. Unregulated FR1 Supply

FR1R COM is the return path for the unregulated +30 FR1 supply. This supply uses full-wave bridge rectifier CR14 and filter capacitor C18. Its input is fused with 0.5 A slow-blow fuse F7.

2-56. FR2 Supplies

FR2 COM is the return path for unregulated +30 FR2R supply and regulated -5 FR2 supply. Each supply uses a full-wave, bridge configuration. The unregulated +30 FR2R supply consists of bridge rectifier CR7 and filter capacitor C9. Its input is fused with 0.5 A slow-blow fuse F4. The -5 FR2 supply consists of bridge rectifier CR11, filter capacitor C11, regulator U1, bypass capacitor C12, and protection diode CR9. The input is fused with 315 mA slow-blow fuse F6.

2-57. Regulator/Guard Crossing Assembly (A17)

The Regulator/Guard Crossing assembly (A17) provides two separate functions: voltage regulation for the analog power supplies and digital controller functions for the inguard. The voltage regulation portion is described first followed by the digital control portion. Refer to the schematic diagrams for the Regulator/Guard Crossing assembly for this discussion.

2-58. Voltage Regulator Circuitry

The Regulator Circuit receives unregulated DC from the regulator filter circuit on the Filter assembly (A18) and provides nine regulated DC outputs that power the analog assemblies. Table 2-10 lists the regulated supplies from the Regulator/Guard Crossing Assembly.

Table 2-10. Regulated Outputs from the Regulator/Guard Crossing Assembly

Signal Name	Nominal Output	Tolerance	Current Limit	Rated Output	Test Point
+15 CH	+15 V	±800 mV	2 A	200 mA	TP3 (common TP4)
-15 CH	-15 V	±800 mV	2 A	200 mA	TP5 (common TP4)
+5RLH	+5.975 V	±425 mV	2 A	600 mA	TP14 (common TP10)
+5LH	+5.1 V	±300 mV	2 A	600 mA	TP11 (common TP10)
-5LH	-5 V	±300 mV	2 A	400 mA	TP15 (common TP10)
+17S	+17.475 V	±475 mV	4 A	1.0 mA	TP8 (common TP9)
-17S	-17.885 V	±835 mV	6 A	1.0 mA	TP12 (common TP9)
+30FR1	+30.96 V	±1.7 mV	1 A	85 mA	TP2 (common TP1)
+30FR2	+30.96 V	±1.7 mV	1 A	85 mA	TP7 (common TP6)

2-59. Regulated LH Supplies

The +5 RLH supply used the unregulated +5 LHR supply from the Filter assembly. The +5 RLH supply uses three-terminal TO-3 regulator U11, bypass capacitors C20 and C70, protection diodes CR17 and CR20. Resistors R21 and R22 set the output voltage level of +5 RLH. LH COM is the return path.

The +5 LH supply used the unregulated +5 LHR supply from the Filter assembly. The +5 LH supply uses three-terminal TO-3 regulator U8 with heat sink, bypass capacitors C20 and C69, and protection diodes CR14 and CR16. LH COM is the return path.

The -5 LH supply uses the unregulated -5 LHR from the Filter assembly and consists of three-terminal TO-220 regulator U12, bypass capacitors C23 and C24, and protection diodes CR21 and CR24. RLH COM is the return path.

Capacitors C20, C23, C69, C70, and C24 improve the stability and provide filtering for U8, U11, and U12 respectively. Diodes CR14, CR17, and CR24 protect the regulators from input shorts. Diodes CR16, CR20, and CR21 protect the regulators from reverse voltage.

2-60. Regulated ±17 S Supplies

S COM is the return path for the +17 S, and -17 S supplies. S COM is also connected to LH COM. These signal lines can be found on the Motherboard and the Regulator/Guard Crossing assembly.

The +17 S supply uses the unregulated +17 SR supply from the Filter assembly. This supply uses three-terminal TO-3 regulator U6 with heat sink, and R5 and R6. The output voltage is set by the resistors R5 and R6. Capacitors C9 and C67 are for bypass. Capacitor C11 improves ripple rejection. Diode CR8 protects the regulator against shorts at the input, while CR11 and CR26 protect the regulated output from the reverse voltage.

The -17 S supply uses the unregulated −17 SR supply from the Filter assembly. It uses three-terminal TO-3 regulator U7 with heat sink, and R10 and R11. The output voltage is set by the resistors R10 and R11. Capacitors C68 and C15 are for bypass. Capacitor C14 improves ripple rejection. Diode CR15 protects the regulator against shorts at the input, while CR13 and CR27 protect the regulated output from reverse voltage.

2-61. Regulated ±15 CH Supplies

CH COM is the return path for the +15 CH and −15 CH supplies.

The +15 CH supply uses the unregulated +15 CHR supply from the Filter assembly. This supply uses three-terminal TO-220 regulator U2. Capacitors C1 and C2 are for bypass. Diode CR3 protects the regulator against shorts at the input, while CR2 protects the regulated output from reverse voltage.

The -15 CH supply uses the unregulated −15 CHR supply from the Filter assembly. This supply uses three-terminal TO-220 regulator U3. Capacitors C4 and C5 are for bypass. Diode CR7 protects the regulator against shorts at the input, while CR5 protects the regulated output from reverse voltage.

2-62. FR1 Supply

FR1 COM is the return path for the +30 FR1 supply. This supply uses the unregulated +30 FR1R supply from the Filter assembly and consists of three-terminal TO-39 regulator U1 with heat sink, bypass capacitors C3 and C6 and protection diodes CR1, CR4, and CR6. Resistors R1 and R2 set the output voltage. Capacitor C7 improves ripple rejection. Diodes CR1 and CR4 protect U1 against input shorts, while CR6 protects against reverse voltage.

2-63. FR2 Supply

FR2 COM is the return path for the +30 FR2 supply. This supply uses the unregulated +30 FR2R supply from the filter assembly and consists of three-terminal TO-39 regulator U5 with heat sink, bypass capacitors C10 and C28, and protection diodes CR9, CR10, and CR12. Resistors R4 and R8 set the output voltage in the same manner as the +44 S supply. Capacitor C12 improves ripple rejection. Diodes CR9 and CR10 protect U5 against the input shorts, while CR12 protects against the reverse voltage.

2-64. Guarded Digital Control Circuitry

The Inguard CPU controls all the analog assemblies. It communicates with the Unguarded CPU Assembly (A20) through a serial fiber-optic link. The Inguard CPU is a Hitachi 63B03Y0 CMOS microcontroller (U56). Support circuitry includes 32 K X 8 bit (32 KB) of external CMOS ERROM, 8 K X 8 bit (8 KB) of external CMOS static

RAM, watchdog timer circuitry, reset and power glitch detect circuitry, a serial fiber-optic link to the unguarded CPU, a DUART (dual asynchronous receiver transmitter) to provide two serial interface channels, and decoders and buffers to interface to the guarded digital bus.

2-65. Inguard CPU Memory Map

Table 2-11 shows the memory map of the Inguard processor.

Table 2-11. Inguard CPU Memory Map

Address Space (Hex)	Name	Use
0000 through 0027		Internal registers in the 6301
0028 through 003F		Unused
0040 through 013F		Internal RAM in the 6301 (256 Bytes)
0140 through 0FFF		Unused
1000 through 100F		DUART
1010 through 1FFF		Unused
2000 through 2007	CS0*	Motherboard assembly 82C55
2008 through 200F	CS1*	A/D assembly 82C55
2010 through 2017	CS2*	A/D Assembly NULL DAC
2018 through 201F	CS3*	Unused
2020 through 2027	CS4*	DAC Assembly 8254
2028 through 202F	CS5*	Unused
2030 through 2037	CS6*	Unused
2038 through 203F	CS7*	Unused
2040 through 2FFF		Unused
3000 through 7FFF		RAM
8000 through FFFF		ROM

2-66. Inguard Memory Configuration

The microcontroller (U56) has 32 KB of external EPROM program memory in IC U64. IC U62 provides 8 KB of external static CMOS RAM. Programmable Logic Device (PLD) U58 does the decoding of the microcontrollers address and the status lines to select the appropriate device.

2-67. Inguard Clock Circuit

Crystal Y52, resistors R54, R53, and R55, capacitors C61 and C62, along with inverters U51A and U51F provide the 7.3728 MHz system clock. Programmable Logic Device (PLD) U58 divides this by two to generate the 3.6864 MHz DUART clock called DUARTCLK.

2-68. Inguard Watchdog Timer

The watchdog timer circuit uses a 74HC4020 (U59) counter. The microcontroller (U56) generates a 19.2 kHz square wave (SCLK) on pin 11. Once the clock frequency is initialized, it runs without software supervision. This clock drives U59, which divides by 16384 to obtain a logic low interval of 427 ms followed by a logic high interval of 427 ms. The output of the U59 goes through inverter U51D to generate the NMIPOP* signal (a nonmaskable interrupt) to the microcontroller. Programmable Logic Device (PLD) U58 also gets NMIPOP* which it uses to generate POP. Circuitry on the analog assemblies use the POP signal to open all the input relays and clear other circuitry. The microcontroller must toggle pin 11 of U59 more frequently than 427 ms to prevent the watchdog timer from going off unless the watchdog is disabled by holding CLRCNTR high.

2-69. Power-Up and Reset Circuitry

This circuit consists of U60, SW51, C55, C56, R52, and Z51. The line monitor chip (U60) detects three events: the power supply falling below 4.5 V, reset being initiated by closure of momentary contact switch SW51, or BREAK being asserted from the break detection circuitry. If any of these conditions occurs, U60 resets the board for 130 spin 5 and 6 of U60 are open-collector outputs, pulled high by Z51 and low by Z55.

2-70. Break Detection

The break detect circuit acts as a serial communications break detector enabling the CPU Assembly (A20) to reset the microcontroller (U56) via the power-up and reset circuitry. This break detect circuit uses a 74HC4020 counter (U63) and an inverter U51C. The microcontroller (U56) outputs a 19.2 kHz square wave (SCLK) on pin 11. This signal clocks U63, which in turn divides the signal by 4096 to produce successive logic low and high intervals (each of 106 ms) at the BREAK output (U63, pin 1). Under normal conditions, the RCV (receive) line is high to hold U63 clear. The main 68HC000 CPU can force a reset of the Guard Crossing over the fiber-optic link by holding RCV low for more than 106 ms which causes BREAK to go high. BREAK, inverted by U51C, is used by the reset circuitry to force a Guard Crossing reset via RESET*.

2-71. Fiber-Optic Link to CPU

Guarded digital and analog circuits are isolated from the unguarded CPU assembly (A20) by a fiber-optic link that asynchronously transmits serial data. On the transmit side, the microcontroller transmit output (XMT) controls a 75451 (U57) which drives fiber-optic transmitter mounted on the Analog Motherboard. Receive signal RCV comes from fiber-optic receiver also mounted on the Analog Motherboard. The receiver converts the light signal to TTL levels that become the RCV signal at the microcontroller. A fiber-optic cable links the fiber-optic transmitter on the Analog Motherboard to the fiber-optic receiver on the Digital Motherboard. Another fiber-optic cable links the other receiver/transmitter pair on the motherboards.

2-72. Interface to Guarded Digital Bus

The interface to the guarded digital bus consists of a 74HCT245 (U55), a 74HCT244 (U52), a 74HC137 (U53), resistor packs Z52, Z53, and Z54, and the POP line from U58. U52A and U52B buffer various control and address lines. Resistors from Z52 pull the lines of U52A to the desired inactive states when BUSEN* is at a logic high, disabling the bus. U55 is a bi-directional data bus buffer (D0-D7). Resistor packs Z53 and Z54 match the lines of the buffered data bus, reducing reflected noise. IC U53 performs a 3-to-8 decode of the address lines AB3-AB5, generating 8 select lines (CS0*-CS7*) on the guarded digital bus. These 8 signals select the various components on the Analog

Motherboard. The POP signal from U58 is a reset line sent to the analog assemblies. DUART (dual asynchronous receiver transmitter) U65 provides the serial communication channel to the A/D chip on the A/D Amplifier (A15) Assembly. HGRCV and HGXMT are the serial communication lines from and to the A/D chip.

2-73. Inguard CPU Interrupts

The Inguard CPU microprocessor handles many different interrupts. These are listed in Table 2-12 in order of priority with the highest priority interrupts first.

Table 2-12. Inguard CPU Interrupts

Vector		Interrupt	Description
MSB	LSB		
FFFE	FFFF	RES*	Power up and Reset
FFEE	FFEF	TRAP	Address error or opcode error
FFFC	FFFD	NMI*	Nonmaskable interrupt (Watching NMIPOP*)
FFFA	FFFB	SWI	Software interrupt (unused)
FFF8	FFF9	IRQ1*	DUART (IRQ1*)
FFF6	FFF7	ICI	Timer 1 input capture (unused)
FFF4	FFF5	OCI	Timer 1 output capture 1,2 (software timers)
FFF2	FFF3	TOI	Timer 1 overflow (unused)
FFEC	FFED	CMI	Timer 2 counter match (unused)
FFEA	FFEB	IRQ2*	Input protection fault (IRQ2*)
FFF0	FFF1	SIO	RDRF + ORFE + TDRE + PER (internal UART)
RDRF = Receive Data Register Full ORFE = Overrun Framing Error TDRE = Transmit Data Registry Empty PER = Parity Error			

2-74. Transfer Assembly (A10)

Figure 2-5 is a block diagram of the A10 Transfer assembly. This assembly contains the transfer switches, 22 V/220 V dividers, precision AC amplifiers, FTS, and associated control and support circuitry. This assembly also contains input selection relays and provides the drive signals for the Analog Motherboard relays. The 700 V/1000 V divider is located on the Analog Motherboard.

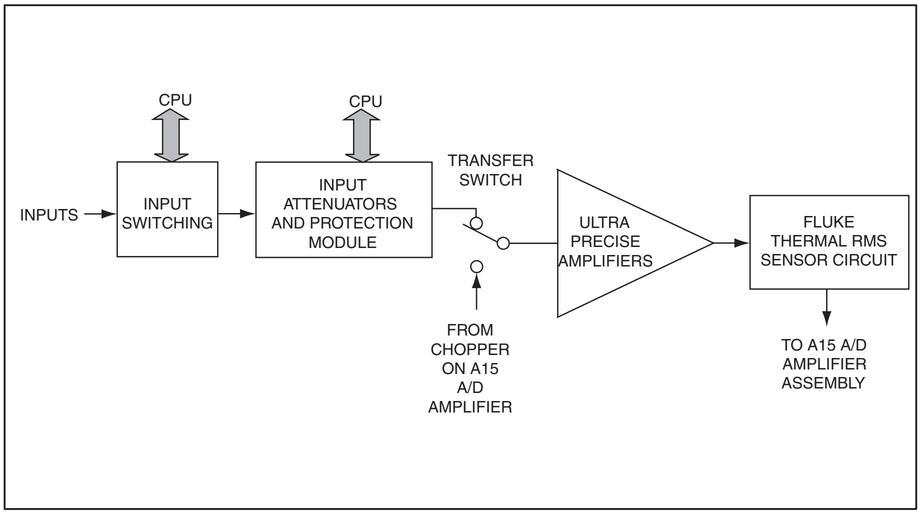

Figure 2-5. A10 Transfer Assembly Block Diagram

2-75. Input Signal Paths

The 5790A has two DC 1 MHz/700 µV to 1000 V inputs, one SHUNT input and one WIDEBAND input. All of these inputs except the WIDEBAND input are routed to the Transfer assembly. (The WIDEBAND input goes to the A6 Wideband assembly.) The two DC to 1 MHz inputs are identical internally, but use different external connector types. INPUT 1 is a Type 'N' coaxial connector and INPUT 2 consists of five-way binding posts.

Relays K1 through K4 on the Transfer assembly and K3 and K4 on the Analog Motherboard select the active input. These relays are wired as a 2 X 3 crosspoint switch having 2 inputs and 3 outputs with the input selected by the operator and the output determined by the selected range. Figure 2-6 is a simplified schematic of the input attenuator networks.

2-76. 700 and 1000 V Ranges

For input voltages greater than 220 V, i.e., the 700 V and 1000 V ranges, the selected input (INPUT 1 or INPUT 2) is routed to the 700 V/1000 V divider by Analog Motherboard relays K3 (INPUT 1) or K4 (INPUT 2). A divider attenuates the input signal by a factor of 1000 and routes the signal to the Transfer assembly through connector J110. Once on the Transfer assembly, the scaled input signal is switched into the precision amplifier by IC analog switches U2 and U1. In the 700 V and 1000 V ranges, U2 does the transfer switching between the input signal and the internally-generated chopped DC while U1 simply provides a continuous connection from U2 to the amplifier.

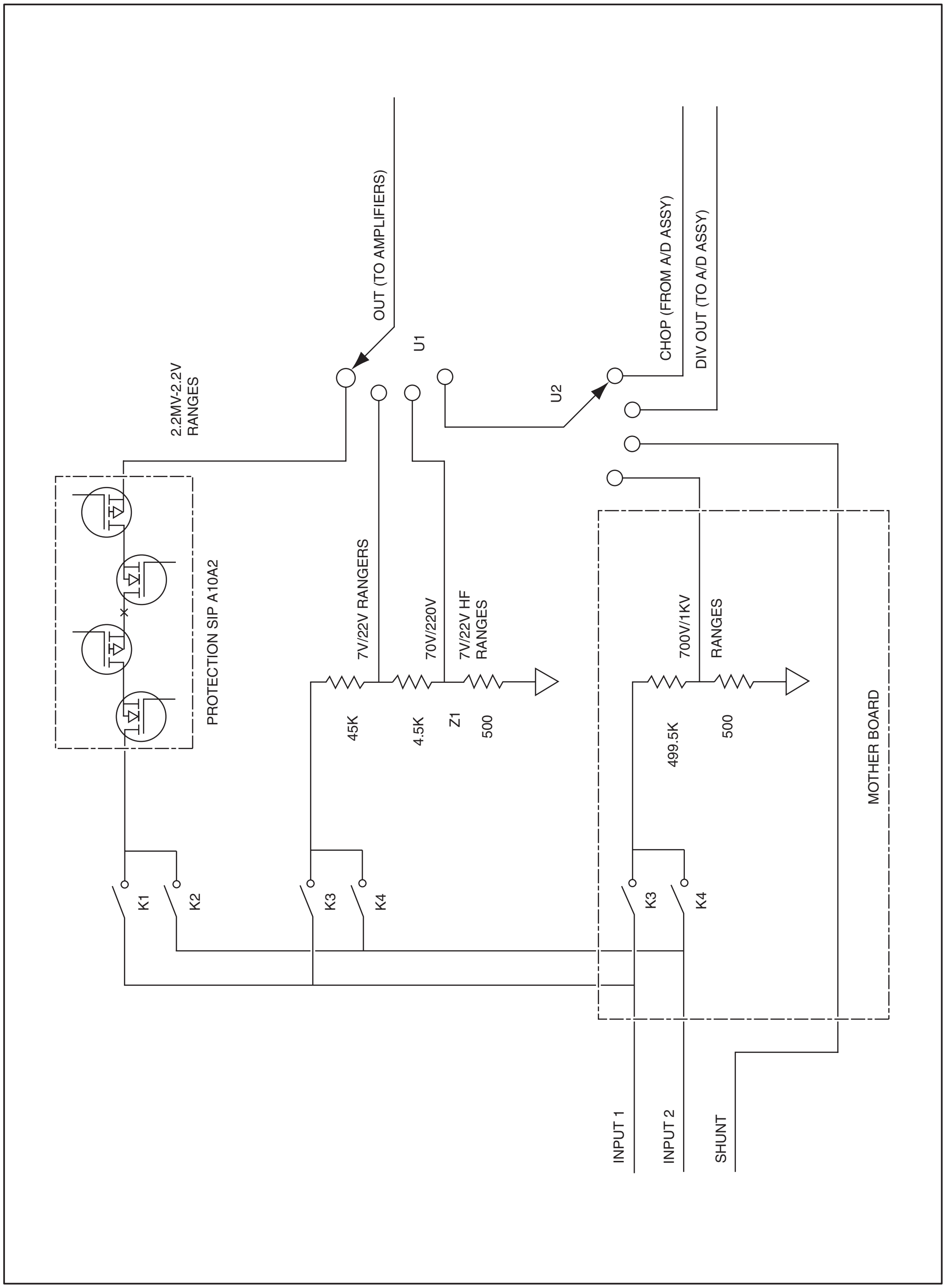

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Figure 2-6. Divider Network Simplified Schematic

2-77. 7 to 220 V Ranges

For inputs in the 7 V to 220 V ranges, relay K3 or K4 applies the selected input to 200 V/22 V divider Z1. This divider has 2 taps; a divide-by-100 for the 220 V and 70 V ranges, and a divide-by-10 for the 22 V and 7 V ranges for the frequencies below 100 kHz. The divide-by-100 tap is also used for the 7 V and 22 V ranges above 100 kHz. Relay K6 routes the output of the divide-by-10 tap to the input amplifier via U1. This relay prevents excessive voltage from appearing at the input of U1 while in the 220 V range. The divide-by-100 tap goes directly to U1. In the 7 to 220 V ranges, AC/chopped DC transfers are done by alternately closing the KV and DC, and either 220 V or 22 V channels of U1. In these ranges, the U2 CHOP switch is always closed.

2-78. Millivolt Ranges

For the 2.2 V range and below, relays K1 and K2 select the input. The output of these relays route the input signal through the protection circuit A10A2. The protection circuit output is switched into the precision amplifiers by U1 the same way as the 220 V/22 V divider taps. The protection circuit protects the precision amplifiers from destructive voltages. The circuit behaves like a 1 kΩ series resistance during normal operation and quickly changes to an extremely high resistance when the voltage exceeds about 4 V RMS.

2-79. SHUNT Input Signal Path

The SHUNT input is compatible with the Fluke series of A40 current shunts. These shunts, when used with the adapter shipped with the 5790A, allow you to measure relative current between 2.5 mA and 20 A with a full-scale output voltage of 0.5 V RMS. Relay K5 switches the SHUNT signal into the terminating 90.9 Ω resistor R7. The signal is then applied to the precision amplifiers through U1 and U2 in much the same way as in the 1000 V and 700 V ranges.

2-80. Precision Amplifiers

To maintain high input impedance at the 5790A INPUT terminals, an amplifier buffers input signals before they are applied to the FTS, which has an input impedance of 400 Ω (The input impedance specification of the 5790A varies from 50 kΩ to 10 MΩ, depending on the input voltage range.)

Amplifiers are also required in some ranges to boost the input signal to the appropriate level for the FTS. The optimum operating range for the FTS is between 0.7 V and 2.2 V (exactly a 10 dB range). Input signals below 0.7 V are amplified as well as buffered. As described under the previous heading, high-voltage divider outputs are in the range from 0.22 V to 2.2 V.

Amplifier A10A1 is a dual-gain, discrete, surface mount assembly, with 0 dB and 10 dB configurations. For the 0.22 V, 2.2 V, 22 V, 220 V, and 1000 V ranges, the gate of Q3 is high and the gate of Q2 is low, configuring A10A1 as a unity-gain buffer. For all of these ranges except the 0.22 V range and the 22 V range above 100 kHz, the output of A10A1 falls between 0.7 V and 2.2 V and is connected directly to the FTS, U5, by relay K7.

For the 70 mV, 700 mV, 7 V, 70 V, and 700 V ranges, A10A1 is configured as a 10 dB amplifier by reversing the drive signals to Q2 and Q3. In these ranges, except for the 70 mV range and the 7 V range above 100 kHz, the output of A10A1 is again between 0.7 V and 2.2 V and likewise connected to U5 through relay K7.

For 70 mV and 220 mV ranges and the 7 V and 22 V ranges above 100 kHz, an additional gain of 20 dB is needed to bring the input signal up to the 0.7 V to 2.2 V range required by U5. This is accomplished by switching the output of A10A1 into the input of

A10A3 with U12. A10A3 is a 20 dB, fixed-gain amplifier similar in design to A10A1. Relay K7 is toggled to disconnect A10A1 and connect the output of A10A3 to the sensor.

For inputs between 700 µV and 22 mV a different, high-gain signal path is employed. This path is switched by Q7 and Q8. For inputs in this range, the DISABLE* signal is held high, turning on Q7 and turning off Q8, allowing the AMP IN signal to be connected to U6. For voltages outside the 700 µV to 22 mV, the DISABLE* bit is driven negative, opening Q7 and closing Q8, shorting the input of U6 to ground.

A gain of 100 or 40 dB is required to meet the nominal FTS input voltage for input voltages between 7 mV and 22 mV. This is achieved by cascading U6 (gain of 10), and A10A3 (gain of 10) with U12 and K7 providing the necessary connections to the FTS, U5. The 2 mV and 7 mV ranges need an additional 20 dB and 10 dB of gain. This gain is provided by switching the output of U6 into the input of amplifier U11. U11 is configured with a gain of 10 (20 dB) and is switched into A10A3 by U12 for the 2 mV range. For the 7 mV range, the output of U11 is attenuated by 10 dB by R10 and R36 and switched into A10A3 by U12.

2-81. Thermal Sensor Circuit

The FTS circuit converts the AC or DC signal at its input into a DC voltage equal to the RMS value of the input. The FTS consists of two identical islands suspended in air, each containing a heater resistor and an NPN transistor. Each island provides close thermal coupling between the resistor and transistor. Between islands, there is high thermal isolation. As shown in the schematic, these two transistors are connected as a differential gain stage with a differential input voltage of zero volts. Applying a voltage to the resistor on one of the islands causes that island to heat up. This in turn heats the transistor, reducing its base-emitter voltage causing an imbalance in the differential collector current. This differential current change is converted to a single-ended error current by the current mirror consisting of the two PNP transistors of U101. Op-amp U102 integrates this error current, converting it to an error voltage. The output of U102 pin 1 is then passed through a square-root circuit consisting of the other half of U102 and U103. The resultant error signal is then applied to the other side of U5 through R103, heating up that side of the sensor. When the heat on both islands of the FTS is equal, the differential error current reaches zero and the circuit is in equilibrium.

An over-voltage protection circuit monitors the base-emitter voltage of the sensor transistors. As with other silicon junctions, the base-emitter junction on the FTS transistors exhibits a -2 mV/ °C temperature coefficient. When the base-emitter junction falls below 200 mV, the output of U4 goes from -15 V to +15 V, turning on Q1. This shorts the sensor input to ground through the diode bridge, CR7 through CR10 and allows the FTS to cool. When the temperature falls and the base-emitter voltage increases past the 200 mV threshold, U4 again changes the state and turns off the clamp. During a continuous overload, the protection circuit oscillates between these two states.

To facilitate rapid auto ranging, the output of U4 generates an interrupt signal for the CPU by turning on Q6. This way the CPU can react quickly to an overload at the FTS.

2-82. Digital Interface and Control

An 82C55 peripheral interface IC on the Analog Motherboard latches in the digital control signals. A pair of UCN5801 power drivers (U20 and U21) controls relays. Three octal latches (U22 through U24) control the solid-state switches. Components U34, U36, Q5, and Q6 process the overload and the protection interrupts.

2-83. A/D Amplifier Assembly (A15)

The A15 A/D Amplifier board contains circuitry for generating the chopped DC reference for the A10 Transfer assembly and circuitry for measuring the output of the Fluke Thermal Sensor circuit, also on the Transfer assembly. The chopper circuit is described first, followed by the A/D amplifier and then the frequency counter.

2-84. Chopper Circuit

Refer to Figure 2-7 for a block diagram of the chopper circuit. The chopper circuit contains the following main circuit blocks:

- 2 V divider/DC reference select
- Precision inverter
- Chopper oscillator
- Chopper switches
- Chopper attenuators

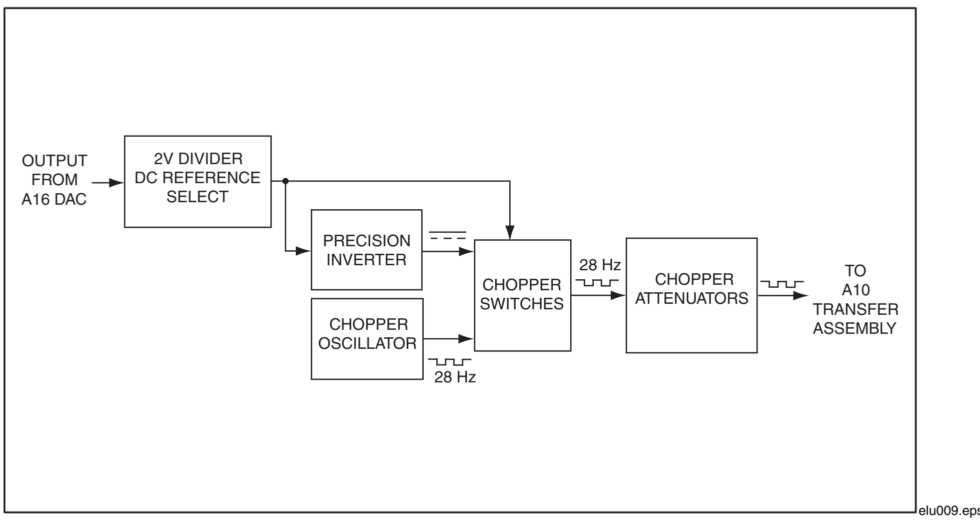

Figure 2-7. Chopper Circuit Block Diagram

2-85. 2 V Divider/DC Reference Select

Line S-COM is supplied through resistor R4 when the chopper is not in use. DAC-SNS-HI is supplied (2.2 to 7 V) on the 7x10^n ranges (available at TP8). A 5:1 divider (Z6 pins 8-10) is switched in to supply 0.7 to 2.2 V on the 2.2x10^n ranges (available at TP7). TP16 is at RCOM.

2-86. Precision Inverter

This block provides -0.7 to -7 V from a 0.7 to 7 V input using an LTC1043 (U9) as a switched-capacitor inverter. Capacitor C9 sets the frequency of an internal oscillator which continuously alternates the switches at about 400 Hz. Capacitor C5 is charged through R7 with a positive voltage, inverted, then discharged into C6. This provides a negative reference voltage without introducing the offset voltage of an op-amp or the temperature coefficient of a resistor network. The output of this circuit is available at TP3.

2-87. Chopper Oscillator

This block provides a pair of square waves (50 % duty cycle, 180 degrees out of phase) that clock the chopper switches. A 4047 (U8) is configured as an astable multivibrator. Resistor R2 and C4 control the 31.5 Hz rate except when wideband operation is selected, where U13 switches R15 in parallel with R2 to change the frequency to 80 Hz. Lines OSC-SET and OSC-RESET are normally low. Setting OSC-SET high stops the chopper in the inverting state. Setting OSC-RESET high stops the chopper in the non-inverting state.

2-88. Chopper Switches

This block provides a symmetrical square wave equal in RMS value to the DC input voltage (0.7 to 7 V). A square wave is used instead of DC for making the transfers for two main reasons:

- The square wave passes through the AC-coupled amplifiers on the wideband board, while DC would be blocked by the coupling caps.
- Errors caused by DC offsets which add directly to a DC reference tend to average out with a dual polarity input.

Op-amp U10 buffers the positive reference and Q3 increases current capability. Resistor R11 biases Q3 and R10 provides current limiting. IC U6 switches the output and sense alternately to a 20 dB divider (Z6) or a dummy load (R14). Similarly, the components U11, Q4, R12, R13, and U7 switch the negative reference between the dummy load and divider.

2-89. Chopper Attenuator

This block selects the output level of the chopper by switching in 20 and 40 dB attenuators. Total attenuation is:

- 0 dB for the 2.2 V, 22 V, 220 V, and 1000 V ranges (neither attenuator in)
- 20 dB for 220 mV, 700 mV, 7 V, 70 V, and 700 V ranges
- 40 dB for 22 mV and 70 mV ranges
- 60 dB for 2.2 mV and 7 mV ranges (both attenuators in)

Relay K1 selects either 0 or 20 dB output from Z6 pin 3 or 1. Most of the current from this attenuator is cancelled by an opposite current in the dummy load, R14. The remaining current returns to CH-COM through the mecca point at TP1. IC U13 pins 1-3 or pins 14-16 select the 0 or 40 dB output from Z2 pin 1 or 3. Capacitors C10 and C11 form a 40 dB capacitive divider to reduce the output impedance at high frequencies. Relay K2 routes the output to the A6 Wideband assembly for wideband operation, or to the A10 Transfer assembly for all other modes.

The following chart shows division ratio and attenuation for the various ranges:

- Input range 2.2 mV: divide by 5, 20 + 40 dB attenuators
- Input range 7 mV: no division by by 5, 20 + 40 dB attenuators
- Input range 22 mV: divide by 5, 40 dB attenuator
- Input range 70 mV: no division by by 5, 40 dB attenuators
- Input range 220 mV: divide by 5, 20 dB attenuator
- Input range 700 mV, 7 V, 70 V, and 700 V: no division by by 5, 20 dB attenuator
- Input range 2.2 V, 22 V, 220 V, and 1000 V: divide by 5, no attenuators

2-90. A/D Amplifier Circuits

Refer to Figure 2-8 a block diagram of the A/D amplifier circuit. The A/D amplifier circuit contains the following main circuit blocks:

- Null DAC
- Instrumentation amplifier
- Switchable active low-pass filter
- A/D converter
- Frequency counter with switchable low-pass filter

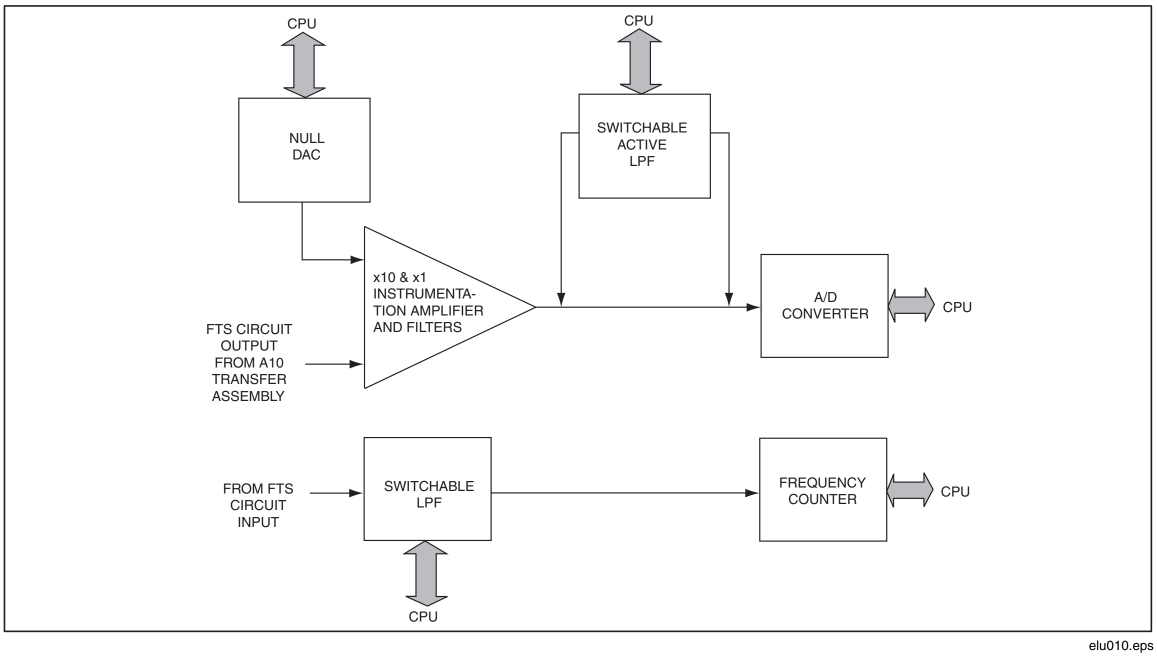

Figure 2-8. A15 A/D Amplifier Block Diagram

2-91. Null DAC

The Null DAC is set by the CPU to equal the A/D measurement taken with the instrumentation amplifier on the X1 setting (the first pass). This measurement shows on the display as the reading with lower resolution and the U indicator lit. This DAC has a 14-bit resolution, where 0 counts gives 0 V, 3fff hex counts gives +2.2 V full scale.

After the first pass, the instrumentation amp is set to X10 and the input signal is offset with the Null DAC to get higher resolution readings. The Null DAC circuit has a high degree of short-term stability, which is the critical parameter in its application.

IC U16 is an R-2R ladder DAC, using an internal feedback resistor and external op amp, U17. Since U16 is an R-2R ladder DAC, it injects a current which varies with DAC counts into the ground. IC U23 buffers R-COM to control the current from U16, preserving the DAC linearity.

A 0.5 mA reference current is produced by U23 pins 5 and 6 and R18 through 20. This current biases 6.4 V zener VR6. Z1 pins 1 through 3 divide down the zener voltage to provide a +1 V reference for U24. U27 pins 5 through 7 and R20 and R21 form an inverting amplifier that provides a –2.5 V reference for the NULL-DAC U16.

2-92. Instrumentation Amplifier

The instrumentation amplifier amplifies the difference between the output of the Null DAC and the output of the FTS circuit on the Transfer Assembly. The output of the instrumentation amplifier is fed directly into the A/D Amplifier IC, U24. The result of this system is greatly improved resolution from the A/D IC. The instrumentation amplifier is switched between a unity gain and an X10 configuration.

Components U14 and U15 are used as 4-to-1 multiplexers to select the input signal to the noninverting and inverting inputs to the instrumentation amp. The noninverting input can be connected to lines RCL, DAC-SNS-HI, R-COM or NULL-DAC. The inverting input can be connected to DIV-OUT, DAC-SNS-HI, R-COM or NULL-DAC.

Components U19 and U20 buffer the inputs. Components U21, Z2 and Z3 convert the differential input signal to a single-ended output, available at TP14. (Equivalent to TP10 minus TP9). The single-ended output is fed to the A/D IC through R27. If this voltage is too large for the A/D to read, a signal six times smaller is available through R29 and R30. Maximum resolution is obtained using U22, R24, and R25 as an X10 amplifier.

Capacitor C14 filters the high frequency noise, and VR2 and VR3 clamp the output to less than the A/D ICs power rails. Components U2, R45 through 47 and C42 through 44 form a three-pole Bessel active filter to reduce noise and ripple.

2-93. Switchable Active Low-Pass Filter

A five-pole Bessel active filter attenuates low frequency ripple. U24 pin 58 is the input to the filter and pin 56 is the output. Pins 59 and 60 connect to an internal op amp. This op amp together with U3, C1, 2, 18, 19, 23, R23, 38, 33, 40, and 41 comprise the filter. Switches inside the A/D IC can precharge C18 and 19 quickly to reduce the settling time.

2-94. A/D Converter

A proprietary Fluke IC (U24) containing an A/D converter and frequency Counter forms the basis for this circuit. Voltage is measured through pins 3, 14, 15, 16, 18, or 23. The following list describes the U24 pin functions:

- Pin 14 is the diagnostic input.
- Pin 15 is the divide-by-6 input. It measures larger voltages than the unity-gain and X10 inputs, but with the least resolution.
- Pin 18 is the unity-gain input. It measures voltages up to 3 V with less resolution than the X10 input, but more resolution than the divide-by-6 input.
- Pin 23 is the X10 input. It measures voltage up to 32 m.
- Pins 28 through 35 comprise an output port that control the inputs to the instrumentation amp through U14 and U15.
- Pins 36 and 37 connect to Y1, C15, and C16 to provide the clock for A/D timing and serial interface communication.
- Pins 39 and 40 are the serial interface, buffered by U25 pins 1 through 4.
- Pins 45 through 50, together with C17 and Z1 pins (4 through 8) form the integrator for the dual-slope A/D Converter.
- Pins 51 and 52 connect to a +1 V reference as described under “Null DAC.”

2-95. Frequency Counter and Low-Pass Filter

The Fluke A/D IC (U24) contains the frequency counter. Frequency is measured through pin 3. If the input signal is DC, its polarity is determined through this input.

The low-pass filter (R31 and C24) is switched in the frequency measurement line only to filter out high frequency noise. Transistor Q5 and R44 switch C41 in parallel with C24 for additional filtering for low-level input voltages at low frequencies.

2-96. Digital Control and Power Supply

An 82C55 peripheral interface IC (U26) latches in digital control signals. A UCN5801 power driver (U27) controls relays K1 and K2.

The power supply for the A/D Amplifier is comprised of the following components and circuits:

- Resistors R3 and 6 VR4 and 5 provide ±8 V supplies for U9
- Resistor R5 and VR1 provide a +5 V floating supply for ICs U8 and 13. Resistor R48 and regulator VR7 supply +15 V for U16
- Capacitors C7, 8, 12, 28 through 39, 50 through 55, 62 through 64, and 67 through 70 bypass the power rails

2-97. DAC Assembly (A16)

The DAC (digital-to-analog converter) provides a digitally adjustable precision DC voltage from 0 to 11 V. The DAC contains four assemblies:

- DAC Main Board (A16)
- DAC Filter SIP (A16A1)
- Reference Hybrid (4HR9)
- DC Amplifier Hybrid (4HR6)

The DAC uses a pulse-width-modulated scheme to vary its output. The main DAC circuits that work together for a stable and linear DC voltage are:

- A 13V temperature-controlled reference hybrid (4HR9)
- Duty-cycle control circuitry
- A five-pole active filter (A16A1 assembly)
- An output stage

Among the support circuits are:

- A sense-cancellation circuit
- Linearity control circuits
- Negative offset circuit

All these blocks are shown in Figure 2-9, the block diagram of the DAC assembly

The two inputs of the five-pole filter are two precision square waves with different fixed amplitudes and independently variable duty cycles controlled by software. The filter's first input square wave is called the first channel. It is switched between the reference voltage (13 V) and 0 V.

The filter's second input square wave is called the second channel. It is switched between approximately 0.78 mV and 0 V. Its amplitude is derived by resistively dividing the 13 V reference. This second channel is used for extra resolution.

The filter rejects all AC components of the waveforms above 30 Hz. Since the frequency of the square waves is 190 Hz, the output of the filter is a DC voltage which is the sum of the average voltages of the two waveforms. The Output Stage, which consists of the DC amplifier hybrid and the output buffer, isolates the filter output from the DAC output and gives current drive to the DAC output.

To change the DAC voltage, the average value of the two square waves must be varied. To determine the average value, multiply the waveforms amplitude by its duty cycle. Vary the duty cycle and keep the amplitude fixed to change the DAC voltage.

For example, if the duty cycle of the first channel is 10 % and the second channel 50 %, the overall average voltage would be:

$$(0.1\times 13V)+(0.5\times 0.78mV)=1.300390V$$

The duty cycle resolution is 0.0024 %, which gives a first channel resolution of 0.309 mV and second channel resolution of 18.5 nV.

The duty cycle control circuitry creates the two digital square waves for the first and second channels. These two waveforms are first run through the optocouplers for isolation and then into analog switching and level shifting circuits. These circuits derive the proper signals to switch the input of the filter at the levels explained above.

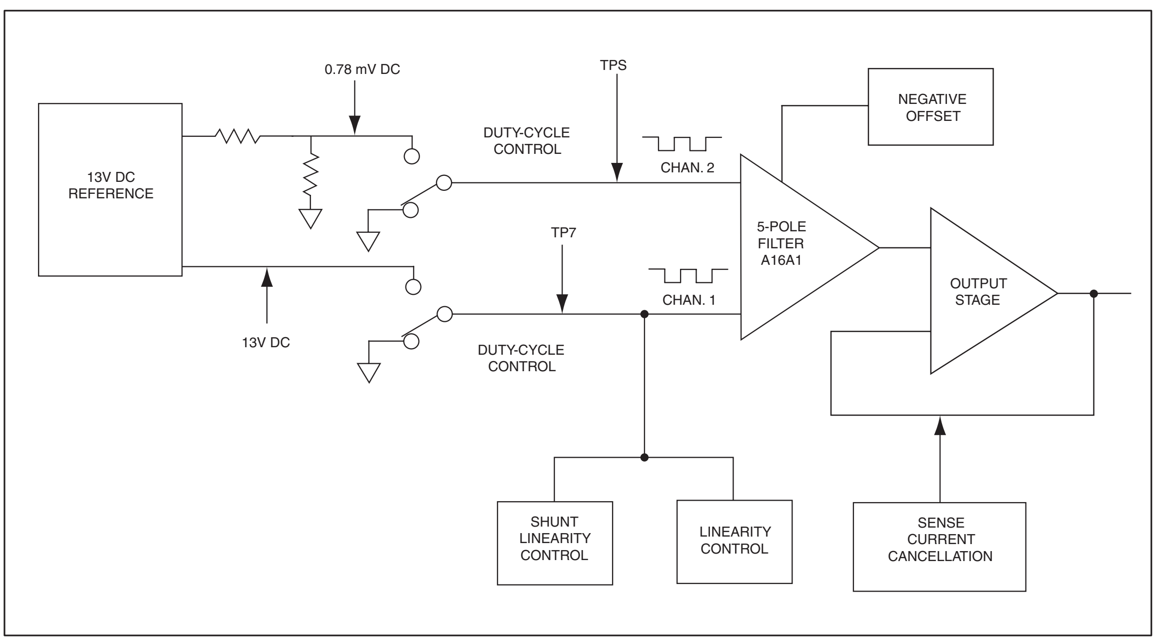

Figure 2-9. A16 DAC Assembly Block Diagram

2-98. DAC Assembly Reference Circuitry

As previously explained, the amplitudes of the pulse width modulated signals for the first and second channels are assumed to be fixed. Any change in amplitude shows up as an error on the output of the DAC. The DC reference circuitry is very stable and generate little noise.

The DC reference circuitry is on the reference hybrid, located on the 4HR9 assembly. The 4HR9 assembly contains a ceramic substrate reference hybrid bonded to a resistor network.

All components on this assembly are surface mount devices, except U6 and U7. The resistors are screened with a thick film paste. Associated resistors, capacitors, and zener diodes are mounted on the main board to supply this hybrid with operating power and ground returns.

The 13 V reference contains two cascaded 6.5 V temperature compensated transistor/zener diode pairs called ref amps (U6 and U7). The excellent temperature characteristics of the ref amps are obtained by biasing the collector current of their transistors with a value such that the TC (temperature coefficient) of its base-emitter junction cancels the TC of the zener diode. Since the base-emitter junction and the zener diode are in series, the result is a near zero TC. Correct bias currents are achieved with a thin-film resistor network in a surface-mount package mounted on the hybrid.

The reference circuit is designed such that the effects of the thin-film resistors and op amp errors are second order. Thus, accuracy is determined almost entirely by the ref amps.

To further reduce the effects of ambient temperature variations, the hybrid is heated to a constant 62 °C by the heater control circuitry on sheet 1 of the DAC schematic.

Temperature is sensed near the ref amps by a thermistor (RT1). If the substrate temperature changes, the thermistor resistance changes. This creates a correction voltage to the base of Q2 (on the main board). This, in turn, changes the power into the heater resistor screened on the back of the substrate as necessary to maintain a stable temperature.

Thermal runaway is prevented by a protection circuit. Once the substrate temperature reaches approximately 67 °C, the change in the resistance of RT2 causes Q9 to turn on. As transistor Q9 turns on, it steals the base current from Q1 on the main board, which brings it out of saturation. This breaks the current path through the heater resistor. This condition exists only if there is a failure.

2-99. Duty-Cycle Control Circuit

Refer to sheet 3 of the DAC schematic for the Cycle Control Circuitry. DAC output voltages are represented in software by what are called as first and second channel counts. Each count is a 16-bit number which is sent to the DAC Assembly via the guarded digital bus.

For example, a first channel count of 20,000 (in decimal) represents a DAC output voltage of approximately 6.5 V (half the reference voltage).

The first function of the duty-cycle control circuitry is to convert each count into a stable TTL level square wave with a duty cycle proportional to the numeric value of the count. The 82C54 programmable interval timer (U6) and 8 MHz clock (U7) generate this signal.

The 82C54 programmable interval timer receives its input counts from the guarded digital bus and creates the second channel signal on OUT2 (pin 20) and the first channel signal on OUT 1 (pin 16).

The second channel signal is buffered by U8 (D and E) and runs through the opto-isolator U12 to become CH2 FLOATING. This signal alternately turns FETs Q30 and Q32 on and off to turn the 3 V source (called 3 V) into a floating 3 V pulse width modulated waveform called CH2 FILTER INPUT.

The 3 V source is created from the 13 V reference. The 13 V reference is buffered by op amp U1B, configured as a voltage follower. The output from U1B is divided down to 3 V by a 100 kΩ and 30 kΩ resistor in the 4HR9 assembly creating 3 V.

This 3 V is again buffered by op amp U11, configured as a voltage follower, to create the 3 V, which is switched by FETs Q30 and Q32. CH2 FILTER INPUT uses three resistors on the 4HR9 assembly to resistively divide its 3 V amplitude by an additional factor of approximately 3800.

The first channel signal is buffered by U8 (G and H) and run through the opto-isolator U13, to become CH1 FLOATING. Since the first channel is much more critical than the second, CH1 FLOATING is clocked into a flip-flop (U14) to ensure an accurate waveform.

To clock in this waveform, U7 generates the clock inputs for U14. The output Q1 (pin 5) from U14 creates CH1 SERIES A, which switches Q7. The output Q1* (pin 6) is inverted by Q35, creating CH1 SHUNT, which switches Q6. The output Q1*, which is a TTL level, is also amplified by components Q33, Q34, VR11, VR12, and R44-R46, so it switches from 0 to 18 V, creating CH1 SERIES B, which switches Q4 and Q5.

2-100. DAC Filter Circuit

The DAC Filter Circuit is located on the DAC Filter SIP Assembly. The dominant pole of the five-pole Bessel filter is near 30 Hz. This gives 80 dB of rejection at 190 Hz.

2-101. DAC Output Stage

The output stage of the DAC assembly consists of the DC Amplifier Hybrid Assembly (4HR6) and the output buffer circuitry. Like the Reference Hybrid, the DC Amplifier Hybrid is constructed of surface-mount the components (except the precision op amp U2), on a ceramic substrate hybrid, bonded to a resistor network. This hybrid is temperature-controlled by a heater control circuit in the same manner as explained on the Reference Hybrid. Transistor Q3 supplies appropriate power to the heater resistor.

The DC Amplifier Hybrid consists of a precision op amp U2, with a bootstrapped power supply (Q1, Q2, R1 through R4, and VR1 through VR2). The op amp has low noise and low offset. It is bootstrapped to improve the common-mode rejection in its noninverting configuration.

The DC Amplifier Assembly interfaces with the output buffer (U5) to create the output stage. The output buffer provides drive for the DAC output. It is used in a feedback loop with the DC Amplifier Hybrid so that the DC accuracy is dependent upon the DC amplifier, and the output drive capability is dependent on the output buffer.

2-102. Sense Current Cancellation Circuit

This circuit supplies the sense current of equal, but opposite, polarity to the current in the feedback resistors. This eliminates current in the sense connection DAC SNS HI. Components U1A and four resistors on the 4HR6 assembly do this task.

2-103. Linearity Control Circuit

The linearity control circuitry contains the series linearity control circuit and the shunt linearity control circuit, as labeled on the schematic. These linearity control circuits eliminate filter current in the series switch (Q5) and the shunt switch (Q6). This is necessary because Q5 and Q6 have finite resistance (3 to 5 Ω) and a small mismatch in the resistances can cause a linearity error.

The series linearity control circuit uses op amp U38, resistor network Z2, and a single 15.710 kΩ resistor on the 4HR9 assembly. This circuit eliminates filter current in the series switch Q5.

When the series switch (FET Q5) is on, it connects the 13 V reference to the first channel input of the filter, and FET Q4 is also turned on. This causes U38 to supply the current to the filter through the 15.710 kΩ resistor in 4HR9 and Q4, which makes the resistance from TP2 to TP5 look like near 0 ohms.

The shunt linearity control circuit uses op amp U2B, FET Q22, two 80 kΩ resistors on the 4HR6 assembly, and one resistor in the 4HR9 assembly. Op amp U2B is configured as an amplifier with an inverting gain of 1. This gain is determined by the two 80 kΩ resistors in the 4HR6 assembly.

When the shunt switch (FET Q6) is on, connecting the input of the filter to REFCOM, the current from the filter flows through the two 40 kΩ resistor (pin 7 to pin 8) on the 4HR6 assembly to the output of U2B. This cancels out the current that would flow through Q6 which makes it look like 0 Ω.

2-104. Negative Offset Circuit

This circuit creates a constant offset voltage of approximately -127 mV at the filter input. Thus, for a DAC output voltage of 0 V, the first channel count must be approximately 400 to offset this negative voltage. This guarantees a minimum duty cycle pulse width of approximately 50 µs.

This minimum duty cycle is necessary to overcome the offset of the output stage and to allow the reference voltage to settle out after being switched into the filter input. Op amp U2A and two 20 kΩ resistors in 4HR6 form an amplifier with an inverting gain of 1. This amplifier input is the 13 V reference which produces -13 V at its output. This -13 V is divided by resistors in the 4HR9 assembly to create the -127 mV on the filter input.

2-105. Wideband Module (A6, Option -03)

The 5790A Wideband option extends the 5790A operating range to accept signals from 600 µV to 7 V over a frequency range of 10 Hz to 30 MHz. The input impedance at the front panel WIDEBAND Type ‘N’ connector is 50 Ω on all ranges. Essentially, the Wideband Assembly takes over the function of the A10 Transfer Assembly when the 5790A is in the Wideband mode. Refer to Figure 2-10 and the Wideband Assembly schematic diagram for the remaining theory discussion.

Wideband inputs are made to the WIDEBAND 50 Ω Type “N” connector on the front panel, and the option is activated by pressing the [WBND] key. In Wideband mode, eight input ranges are available: 2.2 mV, 7 mV, 22 mV, 70 mV, 220 mV, 700 mV, 2.2 V, and 7 V. The operator selects the ranges the same way as in standard operation. Once the system has settled in the proper range, the displays show the amplitude and the frequency of the input.

The front panel WIDEBAND connector is connected by a cable to the Wideband (A6) assembly through board input connector J1. If the input exceeds approximately 14 V pk, the A6A2 Input Protection module clears relay driver U26, thereby dropping out all four input relays, protecting the circuit from damage. If the input is greater than full scale on the highest range (7 V), but less than the 14 V trip point of the Input Protection module, the Range Comparators detect an overrange condition. Digital control of Wideband circuit then clears relay driver U26, dropping out the input relays to open the input path.

Note

A detailed circuit description of the A6A2 Input Protection module is provided further on.

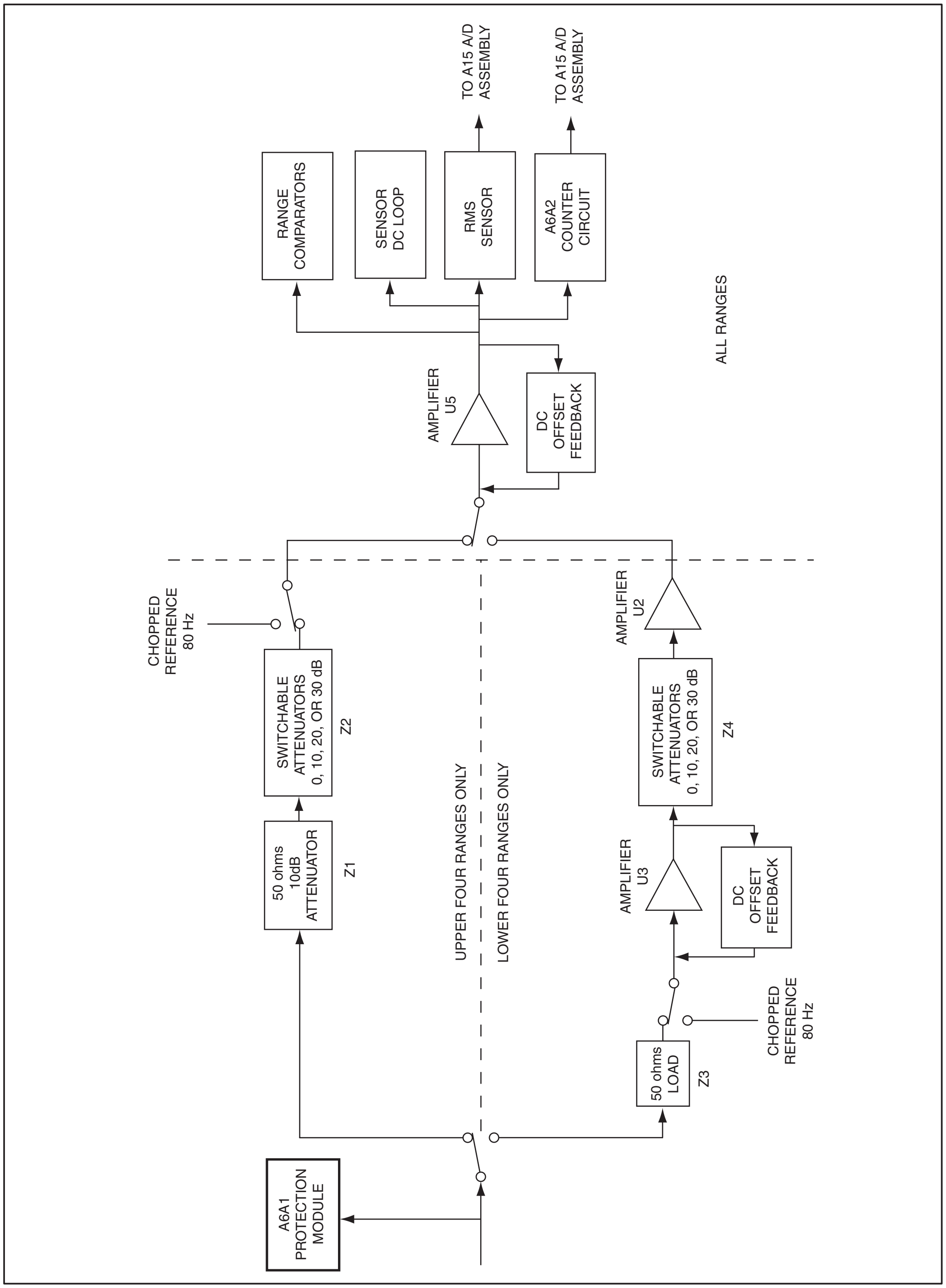

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Figure 2-10. A6 Wideband Assembly Block Diagram

2-106. Input Signal Path for the Upper Four Ranges

The following text describes the input signal path from the front panel to the input of RMS sensor buffer amplifier U5 as shown on the block diagram. Input signals on the upper four Wideband ranges (7 V, 2.2 V, 700 mV, and 220 mV) pass through relays K1 and K4 to resistor network Z1, which provides a 50 Ω load. The input signal is also sensed by the A6A2 Input Protection module through diodes CR1 and CR31 for positive voltages and through CR5 and CR30 for negative voltages.

Resistor network Z1 attenuates the upper four ranges 10 dB and passes the signal to relays K7, K2, K3, K8 and attenuator Z2, which has switchable 10 dB and 20 dB sections. The relays configure attenuator Z2 for the upper four ranges as necessary to produce a 70 mV full-scale input to buffer amplifier U5. The relays configure Z2 as follows:

- 7 V range: With 7 V input K7, K2, K3, K8 are reset, which switches in both 10 dB and 20 dB sections of Z2 into the path, providing 30 dB of attenuation. With a 7 V input to 10 dB attenuator Z1, the output of Z2 is therefore at 70 mV
- 2.2 V range: Relays K7 and K2 bypass the 10 dB section of Z2. A 2.2 V input results in a 70 mV RMS signal at the RMS sensor amplifier input (Q6 and U5), which is the same full scale value as in the 7 V range
- 700 mV range: Relays K7 and K2 switch in the 10 dB section of Z2 and relays K3 and K8 bypass the 20 dB section of Z2. A full-scale input of 700 mV gives 70 mV full scale at the RMS sensor amplifier input (Q6 and U5)
- 220 mV range: Relays K7, K2, K3, and K8 bypass both 10 dB and 20 dB sections of Z2 to give 70 mV full scale at the RMS sensor input

The 70 mV output of Z2 is connected by FET Q15 to the input of the RMS sensor amplifier Q6 and U5. When the 80 Hz chopped reference (WB CHOP) is needed in the signal path, Q15 opens the input signal path and Q16 switches in (WB CHOP.)

2-107. Input Signal Path for the Lower Four Ranges

The 70 mV, 22 mV, 7 mV, and 2.2 mV ranges follow a different path to sensor buffer amplifier U5 as shown in the block diagram. Relays K1 and K4 are deactivated and relays K9 and K10 are activated. A 50 Ω load is provided by Z3 and the signal passes through FET Q13 to an amplifier/attenuator network composed of 25 dB amplifier Q3 and U3, 10 to 30 dB attenuator Z4 (with relays K5 and K6), 17 dB amplifier U2, and then through FET switch Q17 to the RMS sensor amplifier (Q6 and U5).

When the 80 Hz chopped reference (WB CHOP) is needed in the signal path, Q13 opens the input signal path and Q14 switches in WB CHOP). FET switches for the upper four ranges, Q15 and Q16, are always turned off in the lower four ranges.]

The lower four ranges are input signal paths are configured as follows:

- 70 mV range: The signal is connected to 25 dB amplifier U3 through FET Q13 and amplified to 1.2 V. Resistor R29 (50 Ω) and load Z4 (50 Ω) drop the signal 6 dB to 600 mV at K5. Relays K5 and K6 are reset, which passes the signal through both the 10 dB and 20 dB sections of resistor network Z4, to give a signal level at the input of the 17 dB amplifier U2 (pin 3) of 19 mV. Amplifier U2 raises the signal level to 140 mV. Resistor divider R35 and R25 reduce the signal by 6 dB to 70 mV and the signal passes to the RMS sensor amplifier input (Q6 and U5) through FET Q17
- 22 mV, 7 mV, and 2.2 mV ranges: These are obtained by switching out the attenuator sections of resistor network Z4 in 10 dB steps down to zero attenuation in the 2.2 mV range

2-108. DC Offset Feedback for Amplifier U3 (Lower Ranges)

Amplifier U10 and associated parts provide a DC feedback loop to keep the DC voltage at the output of amplifier U3 (pin 6) near zero. The DC is sensed by resistor R68, amplified by U10 and feedback to FET pair Q3 at pin 6. The loop adjusts the voltage at Q3 pin 6 until the amplifier output DC voltage is near zero.

The transistors Q19, Q20, Q21, and Q22 in the sources of the dual FETS Q3 and Q6 are used to set the bias current to approximately 10 mA in each transistor and provide temperature compensation for the transconductance of the FETS. As the temperature increases, the base-emitter voltage of the transistors decreases and the current increases to keep the voltage between the base and the -6 V supply constant. The increased current compensates for the decrease in the FET transconductance as the temperature increases.

2-109. RMS Sensor Circuit

Buffer amplifier U5 amplifies the scaled inputs to 1.2 V RMS and passes the signal through the protection diode bridge (CR16 through CR19), and to RMS sensor U15 AC input (pin 10). The A6A1 module forces a DC voltage into the DC input of RMS sensor U15 pin 6 to balance the heating effect of the AC input. As in the A10 Transfer assembly, with the RMS sensor balanced, the DC input to the sensor is equal to the RMS of the AC input.

2-110. Transfer Methodology

The DC output from the RMS sensor is connected to the RCL line at P106 pins 12A and 12C by FET switch U16 (pins 3 to 2) and measured by the A15 A/D Amplifier assembly. System software takes the A/D measurement and programs the 80 Hz square wave signal (WB CHOP) from the A/D amplifier whose RMS value is approximately equal to the signal input at the RMS sensor amplifier input Q6.

System software switches the WB CHOP signal into either the upper-four-range or the lower-four-range signal path as previously described. The WB CHOP signal is then adjusted, if necessary, to give the same DC output of the RMS sensor U15 as the input is alternated between the input signal and the WB CHOP signal at a 1 Hz rate. After applying appropriate constants determined when the 5790A was calibrated, the RMS value of the input is displayed on the front panel.

2-111. DC Offset Feedback for the RMS Sensor Amplifier

Amplifier U12 and associated parts provide a DC feedback loop to keep the DC voltage on RMS sensor U15 AC input (pin 10) near zero. The DC is sensed by resistor R86, amplified by U12, and fed back to input FET pair Q6 at pin 6. The loop adjusts the voltage at Q6 pin 6 until the sensor DC voltage is approximately zero.

2-112. Range Comparator

Comparator U11 and U13, and associated parts form a circuit that indicates when the RMS sensor circuit is being driven beyond normal limits. Each of the 4 Schottky diodes CR16 through CR19 is biased by current sources Q7 and Q8 to 6 mA each. When the amplifier U5 is forced by the large input signals to drive more than +6 mA output, the diode CR16 and CR19 stop conducting. The 12 mA from Q7 flows through CR17 and split between the sensor input at U15 pin 10, and R126. The sensor receives 7.6 mA which gives +3 V across the 400 Ω input of RMS sensor U15 pin 10. The 3 V is a safe level for the sensor.

When amplifier U5 is forced to drive more than −6 mA output, diodes CR18 and CR17 stop conducting and the 12 mA from Q8 is split between the resistors and sensor input. The sensor voltage is thereby clamped at ±3 V. When the diodes stop conducting in either direction, the voltage at U5 pin 6 output jumps to the saturated level of ±5 V.

When the output of amplifier U5 reaches ±2.5 V comparator U11 pin 4 or pin 9 drops low (pin 4 for +2.5 V and pin 9 for -2.5 V) and pulls the voltage of capacitor C63 down to the trip level of 1.5 V at the input of U13 (pin 3). The output of U13 at pin 1 drops low and indicates the need to change to the next highest range. At this signal, the signal at TP9 (RANGE COMP) causes gate U27 pin 11 to go high and turn on FET Q11. With Q11 on, the interrupt line at P206 pin 1A is low, thereby telling the digital system to range up.

If the up-ranging mechanism reaches the 7 V range and U13 pin 1 does not indicate that the sensor amplifier is within the normal range, an overload condition exists and Wideband mode is turned off.

Diodes CR20, CR21, Q9, Q10 and associated components form a backup clamp for the RMS sensor and are activated only if the CR16 through CR19 protection bridge fails. It clamps the sensor AC input pin 10 to ±3.25 V.

2-113. Wideband Frequency Counter

A circuit on the A6A1 assembly conditions signals for use by the frequency counter circuit on the A15 A/D Amplifier assembly. The counter function for Wideband mode is provided by buffer Q23 and the counter section of the A6A1 assembly. The output of RMS sensor buffer amplifier U5 is connected to emitter follower Q23 through resistor R143. Q23 isolates the counter circuit from the signal measurement path. The output of Q23 is attenuated by R106 and R141 and passed to the A6A1 assembly input at pin 14 of the SIP connector. The input is sent to comparator U1 at pin 2. Comparator U1 produces an output of 3.4 V (HIGH) or 0.3 V (LOW) whenever the input exceeds the input threshold of about ±30 mV. The output of comparator U1 is therefore at normal logic levels and can be used by divider U2 to divide down by 16.

For frequencies greater than 1.99999 MHz, the output from the circuit is taken from the divider U2 when quad switch U3 closes the switch from pins 3 to 2 and connects the signal to output resistor R11. When quad switch U3 closes the switch from pins 14 to 15 the output is sent on the COUNTER line across the Motherboard to the frequency counter circuit of A15 A/D Amplifier assembly, where the frequency is measured for display on the Measurement Display.

For frequencies below 2 MHz, the output from the circuit is taken from comparator U1 when quad switch U3 closes the switch from pins 10 to 11 and passes the signal to R11 and out the COUNTER line as before. Resistors R6, R10, and resistor networks Z2 and Z3 set the bias and signal levels needed on the COUNTER output line. The signal level on the COUNTER output line is ±400 mV. Below 2 MHz, additional filtering of the input signal is provided by capacitor C14 which is switched into the circuit by PIN diode CR1. CR1 is turned on by Q2 when Q1 is turned off by the digital control signal FILT. The frequency on the COUNTER line is equal to the input frequency between 10 Hz and 1.99999 MHz, and divided by 16 from 2 MHz to 30 MHz (resulting in 125 kHz to 1.875 MHz).

2-114. Digital Control

Digital control of the Wideband assembly comes from the instrument digital bus and is stored in latches on the Wideband assembly. Relays K2, K7, K3, and K8 are controlled by driver/latch U25 when data is strobed in by bus line PB6. Relays K1, K4, K5, and K6 are controlled by driver/latch U26 with strobe PB7. FETs are controlled by latch U20 and strobe PC1. Switches are controlled by U21 and strobe PC2.

2-115. A6A2 Input Protection Module

The A6A2 Input Protection assembly drops out the Wideband input relays the input signal reaches approximately ±14 V in amplitude. Opening the input relays protects Wideband circuits from damage. The instrument drops out of Wideband mode and activates the INPUT 2 binding posts whenever the A6A2 circuit trips.

The A6A2 circuit is composed of dual comparator U1, transistors Q1 and Q2, zener diodes VR1 and VR2, and associated components. Zener diode VR1 biases the positive input at pin 1 to +12 V. Transistor Q1 is off until the Wideband input signal reaches about +14 V, which causes diodes CR1 and CR31, or CR24 and CR25 on the Wideband board to start conducting. When Q1 conducts about 5 mA, it turns on and starts to raise the voltage at comparator U1 pin 5. The other input of the comparator at U1 pin 4 is biased to +0.5 V. When the input at U1 pin 5 exceeds +0.5 V, the comparator output turns on and drops the voltage on the output connector pin 11 to 0 V. Zener diode VR2 biases the negative input at pin 3 to −12 V. Transistor Q2 is off until the Wideband input signal reaches about −14 V, which causes diodes CR5 and CR30, or CR14 and CR15 on the Wideband board to start conducting.

When Q2 conducts about 5 mA, it turns on and starts to lower the voltage at comparator U1 pin 9. The other input of the comparator at U1 pin 10 is biased to -0.5 V. When the input at U1 pin 9 drops below -0.5 V the comparator output turns on and drops the voltage on the output connector pin 11 to 0 V, just as with the positive signal.

The comparator output signal at pin 11 passes to the Wideband board as the INP PROT signal and connects to a latch composed of two sections of gate package U27. Normal operation of the latch has INP PROT high and RESET high with the output at U27 pin 6 low. The output at U27 pin 3 is high, which gives a stable latch condition. U27 pin 6 is also the CLR line which connects to relay driver U26 at pin 1. The output of U27 pin 8 is high. When INP PROT drops low, the output of the latch at U27 pin 6 and CLR goes high. The high CLR signal turns off all outputs on the U26 relay driver and thereby drops out all of the input relays K1, K4, K9, and K10. With U26 pin 15 now high, the output to PC4 digital line at connector P206 pin 10C is also high. The output of U27 pin 8 goes low and cause U27 pin 11 to go high and turn on FET Q11. Q11 pulls the INT line low at connector P206 pin 1A.

The digital system recognizes that the WIDEBAND input was over ±14 V when the INT line goes low at t\he same time that the level at PC4 (connector P206 pin 10C) went high. The system is returned to normal operation when the RESET line programmed from latch U21 pin 19 is momentarily set low to reset the U27 latch. Also PC4 is programmed low by U26 pin 15 and the circuit is back to normal operation.

Chapter 3
Calibration and Verification

Title		Page

3-1. Introduction

This chapter gives procedures for calibrating and verifying a normally operating 5790A. In case of malfunction, refer to Chapter 5.

This chapter defines the 5790A calibration methods, then presents step-by-step procedures for calibrating the main input. You can apply calibration voltages to either INPUT 1 or INPUT 2. Calibration is valid for both inputs after calibration is complete. Following main input calibration is the procedure to calibrate the WIDEBAND input (only if the Option 5790A-03 Wideband AC module is installed).

Verification is a procedure you can use to determine calibration status (in or out of tolerance) on recall. Procedures for verifying the main input and Wideband option are presented separately.

3-2. Calibration Cycle

Calibration is required as often as specified by your selected calibration cycle. You choose a 90 DAY, 1 YEAR, or 2 YEAR calibration cycle in a setup menu as described in Chapter 4, or using remote commands as described in Chapters 5 and 6. The calibration procedure is the same for all calibration intervals. Your calibration cycle selection determines which set of specifications from Chapter 1 is valid. It is also used for Cal Shift Reports and for display when you press the [SPEC] key.

3-3. Periodic and Service Calibration

Periodic calibration is what you perform at the end of each calibration cycle and is all that is required to keep a normally functioning 5790A operating within specifications. For this procedure, you set the rear panel CALIBRATION MODE switch to PERIODIC.

Service calibration is a more complex calibration procedure that is required only after hardware repair or replacement. Service calibration is similar to the procedure done at the factory when the 5790A is built. For this procedure, set the rear panel CALIBRATION MODE switch to SERVICE. This switch setting adds many calibration points to the software-controlled calibration routine. The CALIBRATION MODE switch setting has no effect on WIDEBAND input option calibration or verification.

3-4. Full or Range Calibration

When you perform a periodic calibration of the main input, you calibrate the DC measurement function first because subsequent AC calibration relies on 5790A DC measurement accuracy. Calibrating both the DC and AC functions is called full calibration.

Instead of full calibration, you can select the range calibration, which presents display prompts for calibrating the DC or AC functions of a single input range. This allows you to repeat portions of a just-completed calibration. You can use the “Skip Step” softkey to redo one or a few points, leaving the rest of the calibration points unchanged. Once you press a range cal softkey, you proceed with the calibration steps exactly as explained under “Calibrating the Main Input” or “Calibrating the WIDEBAND Input” heading.

3-5. Automating Calibration and Verification

Fluke uses an automated calibration and verification system to accomplish the procedures described here. To minimize time you spend on repetitive measurements and calculations, you may want to automate the following procedures to the greatest extent possible. Chapters 5 and 6 of the User Manual document the remote interfaces and commands that can help you with the calibration.

Note

A technical paper describes the system in use at Fluke to calibrate and verify the 5790A: Calibration and Traceability of a Fully Automatic AC Measurement Standard, by David Deaver, presented in the NCSL Workshop and Symposium, 1991. Reprints are available from Fluke.

3-6. How Calibration Memory is Organized

Three sets of calibration constants are maintained in memory. Associated with each set of constants is the date and ambient temperature of the calibration. Figure 3-1 shows the three sets of calibration constants and how they are purged following a calibration store operation. The three sets of constants are described below, from newest to oldest:

1. The "active" set. This is a volatile memory that normally contains a copy of the contents of the stored set of calibration constants. The only time it contains different data is after you perform calibration of one or more ranges, but before you store the updated constants. After calibration, you must either store or discard the updated constants before you resume normal operation.
2. The "stored" set. At each power up, the contents of this nonvolatile memory is copied into the active set memory. Therefore, the stored set is identical to the active set until you perform a new calibration.
3. The "old" set. Although it is no longer in use, the previous set of calibration constants is saved in nonvolatile memory. This set is kept in order to make comparisons in Cal Shift reports.

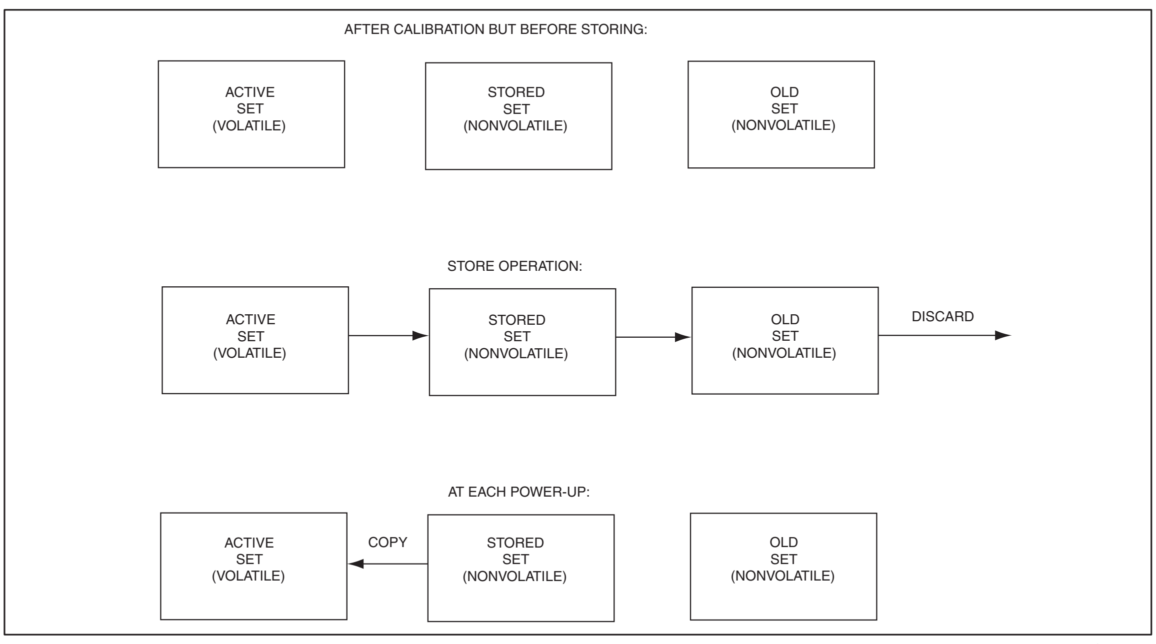


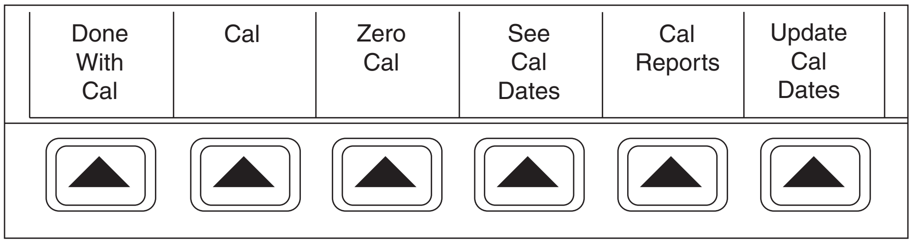
Figure 3-1. 5790A Calibration Memory Organization

Note

For a theoretical discussion of calibration constants, refer to Chapter 2.

3-7. How to Use the Calibration Menus

When you press the [UTIL MENUS] key followed by the “Cal” softkey. The top-level calibration menu appears as shown below:

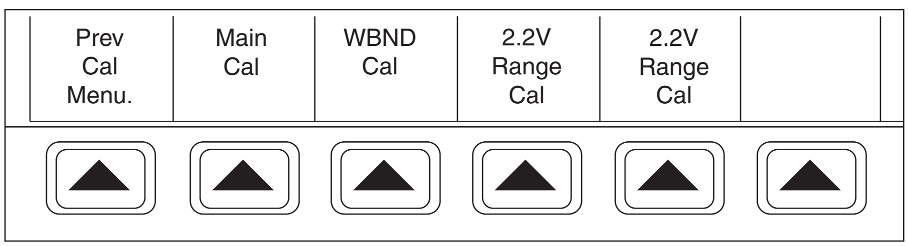


elu014.eps

The functions of the softkeys and the location of related instructions are described next.

3-8. The Cal Menu

Assuming that the CALIBRATION MODE switch is in the PERIODIC position, the “Cal” softkey produces the following menu:



elu015.eps

The functions of the softkeys in this menu are:

- Main Cal: starts DC and AC calibration of the main input. The procedure is described under “Calibrating the Main Input” in this chapter. (This softkey is “Service Cal” if the CALIBRATION MODE switch is in the SERVICE position.)
- WBND Cal: appears only if the Wideband AC option is installed. It starts absolute (gain) and flatness calibration of the Wideband option. The procedure is described under “Calibrating the Wideband AC Option” in this chapter.
- 2.2 V Range AC Cal: provides quick access to the main input AC calibration steps of a single range. The procedure is the same as for “Calibrating the Main Input” in this chapter. The range showing depends on the range that is presently selected.
- 2.2 V Range DC Cal: provides quick access to the main input DC calibration steps of a single range. The procedure is the same as for “Calibrating the Main Input” in this chapter. The range showing depends on the range that is presently selected.

Note

If the CALIBRATION MODE switch is in the SERVICE position, a softkey for "Xfer Offset Adjust" appears in the top-level calibration menu. It generates a display with a pointer that helps you make an internal adjustment on the Transfer assembly. The adjustment removes the offset in the millivolt input amplifier stage, and is required only following repair or replacement of that assembly. Instructions for this adjustment are described under "Service Calibration".

3-9. Zero Cal Softkey

Starts the Zero Calibration procedure described in Chapter 4 of the Operator Manual. It is recommended that you perform this brief, automatic procedure at least every 30 days. The setting of the CALIBRATION STORE or MODE switches does not matter for Zero Calibration.

3-10. See Cal Dates Softkey

This softkey displays the dates of the last zero calibration, main calibration, service calibration (normally when the 5790A was built), and Wideband option calibration (if installed).

3-11. Cal Reports Softkey

This softkey produces a menu that lets you print one of the following types of calibration reports through the serial interface:

- MEASUREMENT SHIFTS: STORED VS. OLD: Use this report at any time to see the shifts that occurred at the last stored calibration

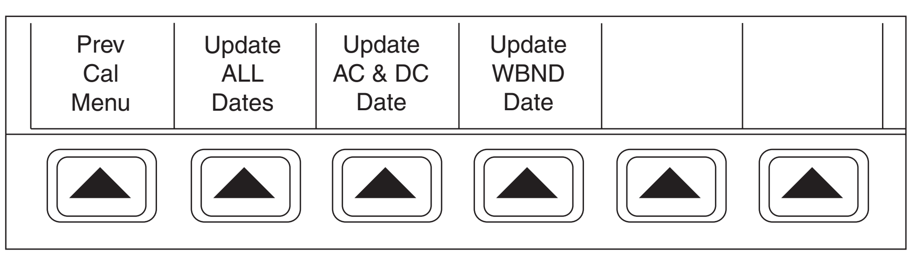
Note

A report of ACTIVE VS. STORED measurement shifts is offered only after you have completed a calibration process and not yet stored the updated constants.

- CALIBRATION CONSTANTS: Print this report to list the active, stored, and old set of calibration constant names and values. There are many different types of constants for each calibration point that correct gain, zero, DC turnover, and flatness errors

3-12. Update Cal Dates Menu

Pressing the Update Cal Dates softkey produces the following menu:



elu016.eps

There is only one case in which you would use these functions: If you perform a complete main input calibration or wideband calibration process and not a single significant shift was detected, you press one of these keys to update the date and temperature of the stored set of calibration constants to the current date. The rear panel

CALIBRATION STORE switch must be set to ENABLE to update the cal dates. Updating the calibration date in this way does not generate a new set of calibration constants.

3-13. Periodic Calibration

The following information describes how to calibrate the 5790A to external standards. You can substitute either manual or automated equivalent equipment and methods for the following calibration procedures, but only if the equipment and standards used have uncertainties equal to or better than specified. During 5790A calibration, select the fast, medium, or slow filter.

3-14. Calibrating the Main Input

Calibrate INPUT1 or INPUT2 by using the following sequence of procedures:

1. Characterize the DC source.
2. Perform DC calibration.
3. Perform AC calibration.

Throughout the DC and AC calibration, the Control Display prompts you with the next step and informs you about the progress of calibration. The number of calibration steps depends on whether the CALIBRATION MODE switch is set to PERIODIC or SERVICE. The cable connections for the DC and AC calibration are kept as similar as possible so that a minimum number of mechanical changes are required during the procedure.

3-15. Characterizing the DC Source

To meet the test uncertainty requirements for 5790A main input DC calibration, you must first characterize (i.e., calibrate to a higher uncertainty than the published specifications) the DC function of the 5700A at the required points. Table 3-1 lists the equipment required for DC source characterization. Tables 3-2 and 3-3 comprise the test record in which you will record the results of the following procedure. Make a photocopy of these two tables before you proceed.

Table 3-1. Equipment Required for 5790A DC Characterization

Equipment	Manufacturer and Model	Minimum Use Specifications
Multifunction Calibrator to Characterize for 5790A DC calibration	Fluke 5700A[2]	0 - 1000 V DC, short term stability better than 1 ppm
DC Voltage Calibrator	Fluke 5440B	0 to 11 V DC, short-term stability better than 1 ppm, 1 µV resolution
Kelvin - Varley Divider	Fluke 720A	0.1 ppm terminal linearity
Reference Divider	Fluke 752A	Uncertainty ±0.5 ppm @ 100:1, ±0.2 ppm @ 10:1
Null Detector	Fluke 845A( )[1]	0.1 µV resolution
10 V DC Reference Standard	Fluke 732A or B	10 V Uncertainty ±1 ppm

1. Throughout this manual, whenever 845( ) is referenced, 845AB or 845AR is applicable.
2. The 5700A must contain software Rev. E or higher. Rev. E and higher software includes the Xfer Off function, which is required during AC calibration of the 5790A main input.

Table 3-2. 5700A DC Characterization Test Record, Part 1

5790A Calibration DC Requirement (V)	845A() Final Null (± uV)	5700A Error Display Indication to obtain Characterized Nominal Output
+1000	1	
+600	1	
+200	1	
-200	1	
-600	1	
-1000	1	
-60	1	
-20	1	
+20	1	
+60	1	
+6	1	
+2	1	
-2	1	
-6	1	

Table 3-3. 5700A DC Characterization Test Record, Part 2

Characterized 5440B 6 V Output:		
Characterized 5440B 2 V Output:		
5790A Calibration DC Requirement (V)	**845A() Final Null (± uV)**	**5700A Error Display Indication to obtain Characterized Nominal Output**
+0.6	0.1	
-0.6	0.1	
+0.2	0.1	
-0.2	0.1	
+0.06	0.1	
-0.06	0.1	
+0.02	0.1	
-0.02	0.1	
+0.006	0.1	
-0.006	0.1	
+0.002	0.1	
-0.002	0.1	

⚠ ⚠ Warning

Some steps in the following procedure involve the calibrator outputs at lethal voltages. Use extreme care not to touch any exposed conductors.

1. Warm up all equipment for the period specified in the manufacturer's manual. The 720A and 752A should be allowed to “soak” in the lab environment for at least 8 hours prior to use for best results.
2. Self calibrate the 720A and 752A in accordance with their instruction manuals.
3. Connect the equipment as shown in Figure 3-2

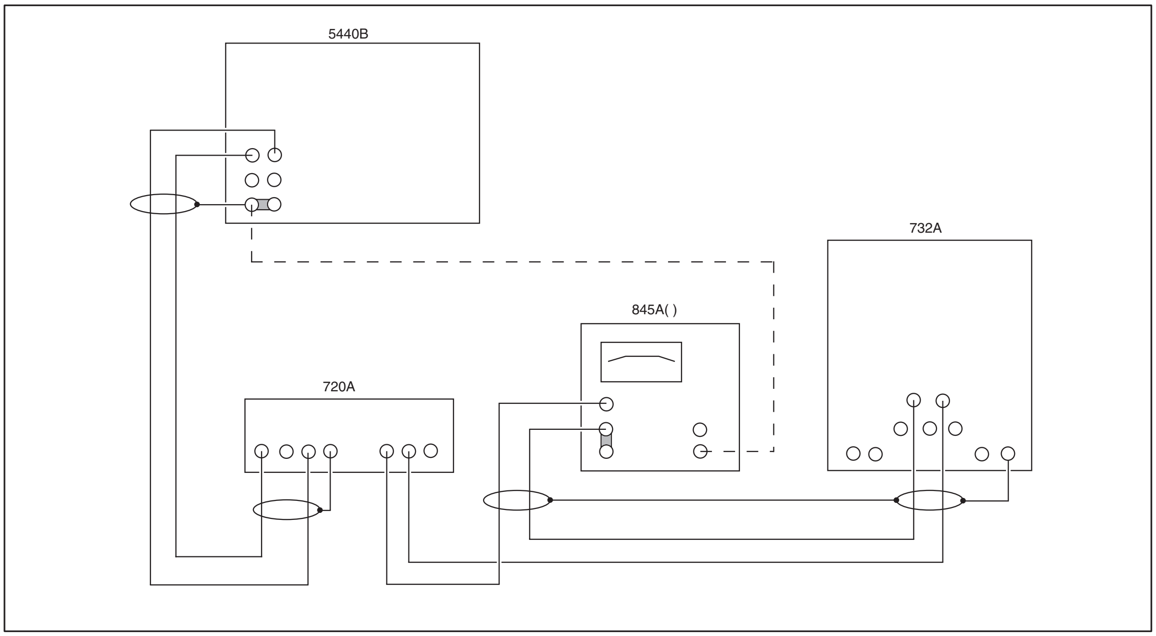


Figure 3-2. DC Source Characterization Setup, Part 1

Note

If the 845A( ) is not grounded through the power cord, a connection must be made to the 5440B ground as shown.

4. Set the ratio dials of the 720A to represent the certified value of the 732A. (For example, 10.000123 V becomes 1.0000123 on the 720A).
5. Set the 845A( ) to the 30 mV range and the OPR/ZERO switch to ZERO.
6. Set the 5440B to 11 V, OPERATE. Set the 845A( ) OPR/ZERO switch to OPR, reducing the range switch until the largest on-scale reading is obtained. Edit the 5440B output until a null is indicated on the 845A( ). Again reduce the range switch setting until the largest on-scale reading is obtained, editing the 5440B output for a null. Repeat this procedure until you obtain a null of ±1 μV. Set the 845A( ) OPR/ZERO switch to ZERO. The 5440B/720A combination is now calibrated in absolute voltage relative to the 732A.

Note

For the remainder of this procedure, the 5700A EXT GUARD must be selected (keycap LED lit), and the strap between V-GUARD and GROUND must be removed.

Whenever EXT Guard is activated (the green indicator on the EX GRD key is on), you must refresh the guard status after the instrument changes from the 220V range to any higher range. To refresh, push the EX GRD key two times (once to turn the indicator off, and once to turn the indicator on). If using the remote interface, send the commands EXTGUARD OFF, and followed by EXTGUARD ON.

7. Connect the equipment as shown in Figure 3-3.

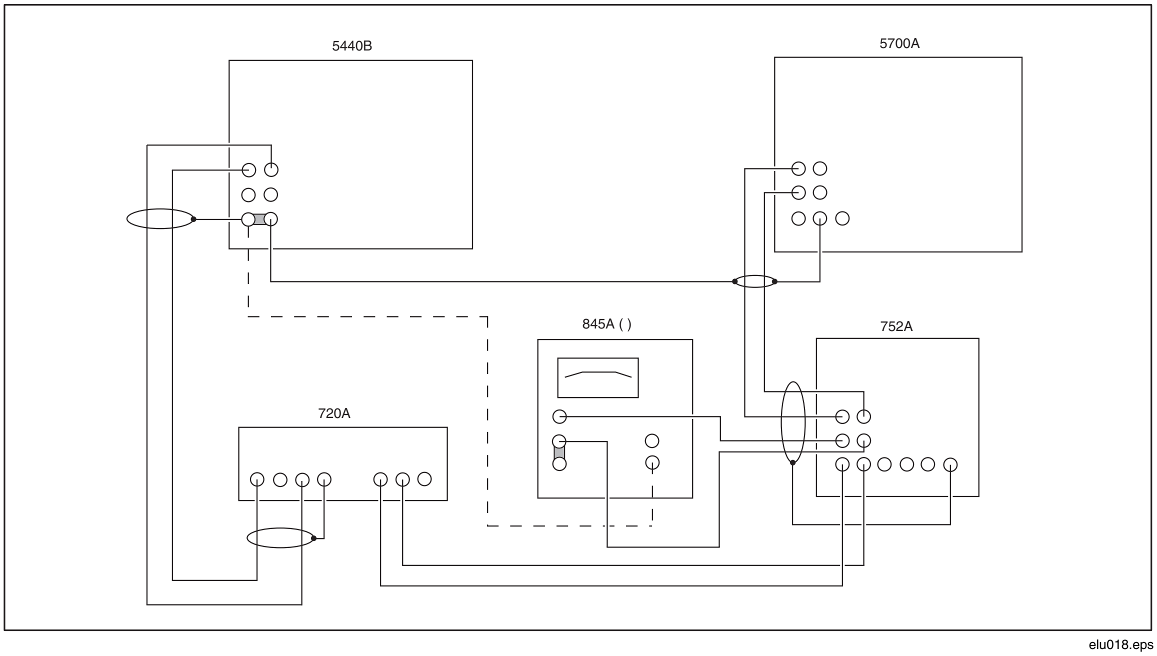


Figure 3-3. DC Source Characterization Setup, Part 2

Note

If the 845A( ) is not grounded through the power cord, a connection must be made to the 5440B ground as shown.

8. Set the 752A to OPERATE, MODE to 1000 V. Set the 720A dials to 1.0000000. Set the 845A( ) to the 10 mV range.
9. Set the 5700A to 1000 V, OPERATE. Set the 845A( ) to OPR. Reduce the 845A( ) range switch setting until the largest on-scale reading is obtained. Adjust the 5700A for a null. Repeat this procedure until you obtain a null of ±1 µV. Set the 845A( ) OPR/ZERO to ZERO and set the 5700A to STANDBY. Record the 5700A Error Display indication in Table 3-2 under the column "5700A ERROR DISPLAY INDICATION TO OBTAIN CHARACTERIZED NOMINAL OUTPUT," opposite +1000 V.
10. Set the 720A dials to 0.6000000. Set the 5700A to 600 V, OPERATE. Set the 845A( ) to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite +600 V in Table 3-2. Set the 5700A to STANDBY.
11. Set the 720A dials to 0.2000000. Set the 5700A to 200 V, OPERATE. Set the 845A( ) to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite +200 V in Table 3-2. Set the 5700A to STANDBY.

12. Press CHNG SIGN on the 5440B. Set the 845A( ) to the 10 mV range. Set the 5700A to -200 V, OPERATE. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite -200 V in Table 3-2. Set the 5700A to STANDBY.
13. Set the 720A dials to 0.6000000. Set the 5700A to -600 V, OPERATE. Set the 845A( ) to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite -600 V in Table 3-2. Set the 5700A to STANDBY.
14. Set the 720A dials to 1.0000000. Set the 5700A to -1000 V, OPERATE. Set the 845A( ) to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite -1000 V in Table 3-2. Set the 5700A to STANDBY.
15. Set the 752A MODE switch to 100 V.
16. Repeat steps 10 through 14 for 5700A outputs of -60, -20, +20, and +60 V DC entering the Error Display indications for each in Table 3-2.
17. Set the 752A MODE switch to 10 V.
18. Repeat steps 10 through 14 for 5700A outputs of +6, +2, -2, and -6 V DC entering the Error Display indications for each in Table 3-2.
19. Disconnect the 720A and 5440B from the 752A. Make the connections shown in Figure 3-4.

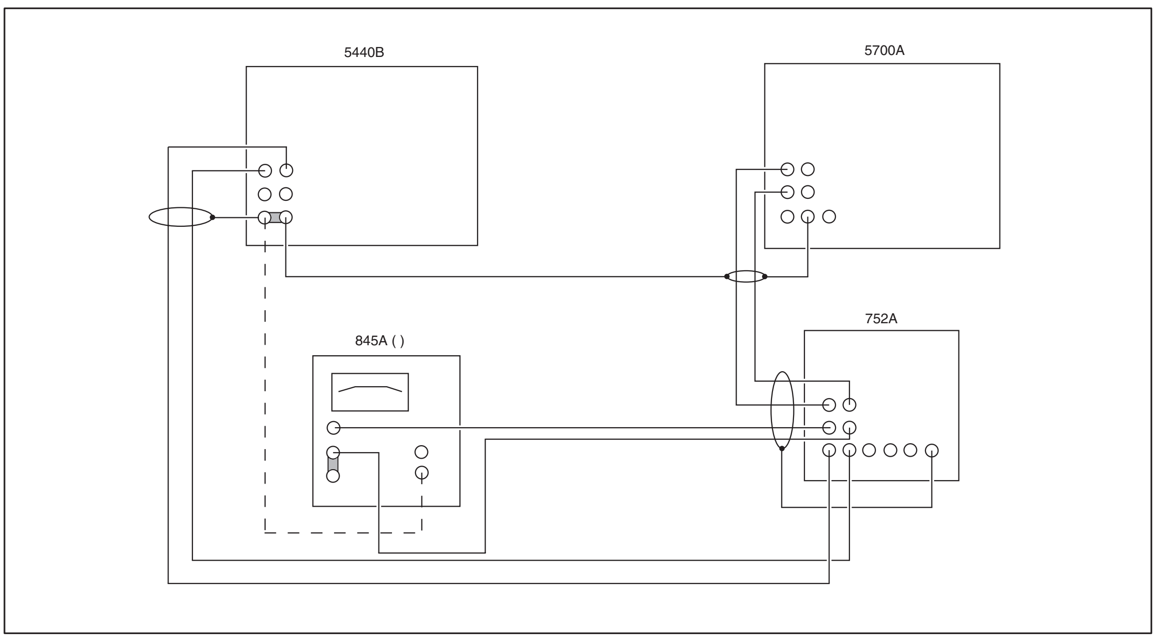


Figure 3-4. DC Source Characterization Setup, Part 3

Note

If the 845A( ) is not grounded through the power cord, a connection must be made to the 5440B ground as shown.

20. Set the 5700A to 6 V, OPERATE. Edit the 5700A output until the Error Display matches that recorded in Table 3-2 for a +6 V output. Set the 5440B to 6 V, OPERATE. Set the 845A( ) range to 10 mV. Set the 845A( ) to OPR. Reduce the 845A( ) range switch setting until the largest on-scale reading is obtained. Adjust

the 5440B output for a null. Repeat this procedure until you obtain a null of ±1 µV. Set the 845A( ) OPR/ZERO to ZERO and set the 5700A to STANDBY. Record the 5440B voltage indication in Table 3-3 after "5440B CHARACTERIZED 6 V OUTPUT". Set the 5440B to STANDBY.

21. Set the 5700A to 2 V, OPERATE. Set the 5440B to 2 V, OPERATE. Edit the 5700A output until the Error Display matches that recorded in Table 3-2 for a +2 V output. Set the 845A( ) range to 10 mV. Set the 845A( ) OPR/ZERO to OPR. Reduce the 845A( ) range switch setting until the largest on-scale reading is obtained. Adjust the 5440B for a null. Repeat this procedure until you obtain a null of ±1 µV. Set the 845A( ) OPR/ZERO to ZERO and set the 5700A to STANDBY. Record the 5440B Voltage indication in Table 3-3 after "5440B CHARACTERIZED 2 V OUTPUT". Set the 5440B to STANDBY.
22. Set the 752A MODE switch to 1 V.
23. Set the 5440B output to the characterized 6 V output recorded in Table 3-3, OPERATE. Set the 5700A to +0.6 V, OPERATE. Set the 845A( ) to the 10 mV range. Reduce the 845A( ) range switch setting until the largest on-scale reading is obtained. Adjust the 5700A for a null. Repeat this procedure until you obtain a null of ±0.1 µV. Record the 5700A Error Display indication opposite +0.6 V in Table 3-3. Set the 5700A to STANDBY.
24. Press CHNG SIGN on the 5440B. Set the 5700A to -0.6 V, OPERATE. Set the 845A( ) to 10 mV range. Repeat the nulling procedure of step 26, recording the 5700A Error Display indication opposite to -0.6 V in Table 3-3. Set the 5700A to STANDBY.
25. Set the 5440B output to the characterized 2 V output recorded in Table 3-3, OPERATE. Set the 5700A to +0.2 V, OPERATE. Set the 845A( ) to 10 mV range. Repeat the nulling procedure of step 26, recording the 5700A Error Display indication opposite to +0.2 V in Table 3-3. Set the 5700A to STANDBY.
26. Press CHNG SIGN on the 5440B. Set the 5700A to -0.2 V, OPERATE. Set the 845A( ) to the 10 mV range. Repeat the nulling procedure of step 26, recording the 5700A Error Display indication opposite to -0.2 V in Table 3-3. Set the 5700A to STANDBY.
27. Set the 752A MODE switch to 0.1 V.
28. Repeat the procedure described in steps 26 through 29 for 5700A outputs of +0.06, -0.06, +0.02, and -0.02 V, entering the Error Display indications in Table 3-3.

Note

It is not necessary to characterize the 5440B prior to performing the following steps in order to meet the test uncertainty requirements for the 5790A.

29. Set the 5440B to output 0.6 V. Repeat the procedure described in steps 26 and 27 for 5700A outputs of +0.006 and -0.006 V entering the Error Display indications in Table 3-3.
30. Set the 5440B to output 0.2 V. Repeat the procedure described in steps 27 and 28 for 5700A outputs of +0.002 and -0.002 V entering the Error Display indications in Table 3-3.
31. DC source characterization is now complete. Set all outputs to standby and remove all connections.

3-16. DC Calibration

Table 3-4 lists the equipment required for DC calibration of the main input. Proceed as follows to perform DC calibration of the main input, which is always the prerequisite for AC calibration. Use the 5700A you characterized in the previous procedure as the DC source.

Table 3-4. Equipment Required for 5790A Main Input DC Calibration

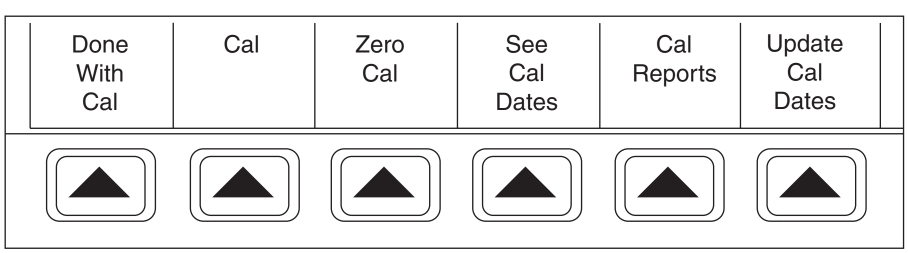
Equipment	Manufacturer and Model
Multifunction Calibrator	Fluke 5700A*
50 Ω Type “N” Coaxial Tee Male-Male-Male	Amphenol 4850 or equivalent
50 Ω Type “N” Female to Double Banana Plug Adapter	Pomona Model 1740 or Equivalent
Binding Posts to 50 Ω Type “N” Male Adapter	Pomona Model 1796 or Equivalent
Low-Thermal Test Leads	Fluke 5440B-7002 or equivalent (two sets)
*: The 5700A must be characterized for DC using the procedure in this section.	

1. Set the rear panel CALIBRATION MODE switch to PERIODIC. You do not need to change the setting of the CALIBRATION STORE switch yet.
2. Set up the equipment as shown in Figure 3-5. A shielded twisted pair is recommended for the 5700A SENSE leads.

Note

Thermal emf errors can adversely affect AC-DC transfers used in the following procedures. To minimize thermal emf errors, use low thermal emf cables and connectors and avoid changing the temperature of any connection during a procedure. It typically takes five minutes to thermally stabilize a connection after it has been touched.

3. Turn on the 5790A and 5725A and allow 30 minutes warmup time.
4. Set the 5700A to EXT SENSE. Verify that the shorting strap is connected between GUARD and GROUND. Set the 5790A to EXT GUARD.
5. Press the [UTIL MENUS] key followed by the “Cal” softkey. The top-level calibration menu appears:



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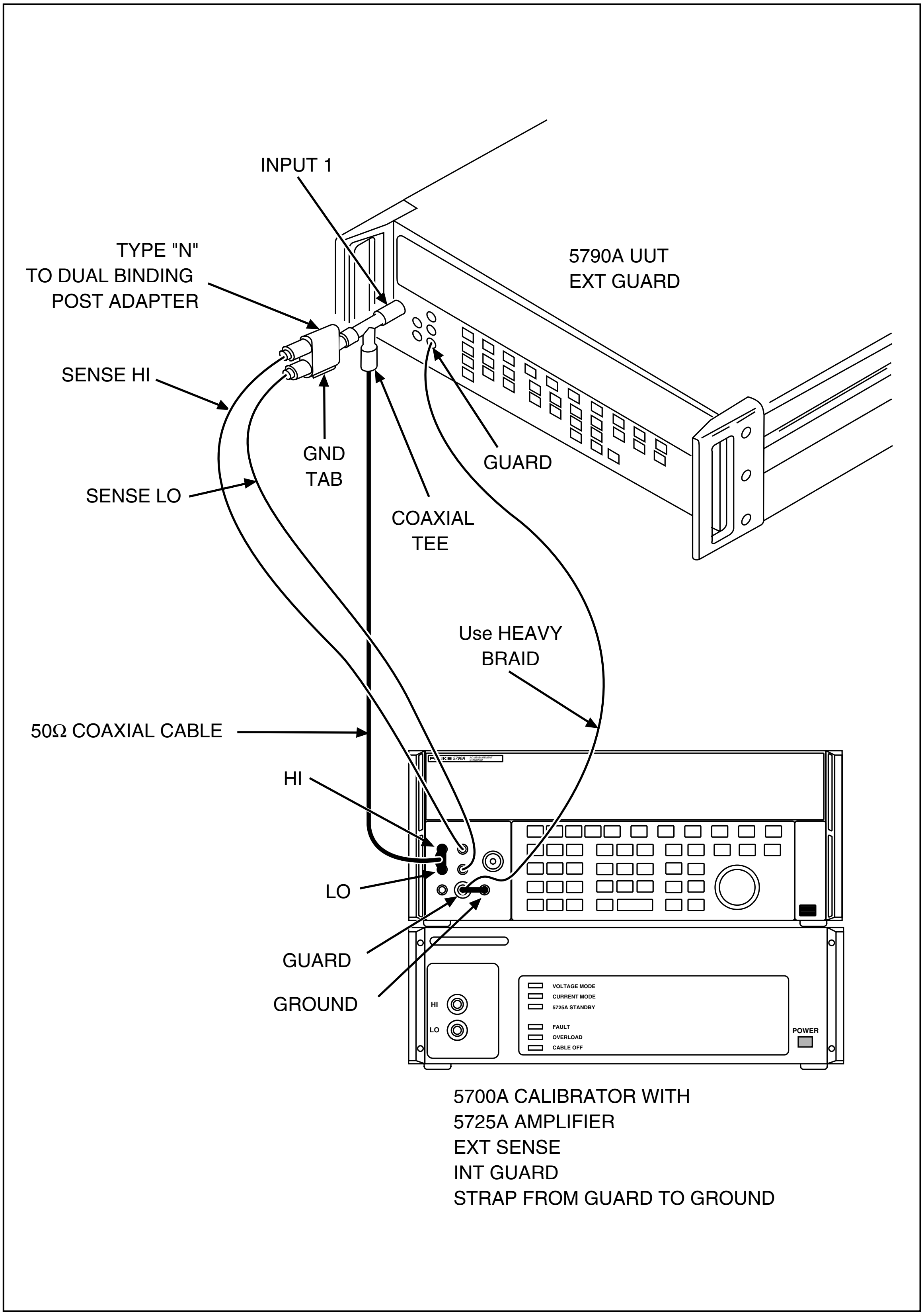
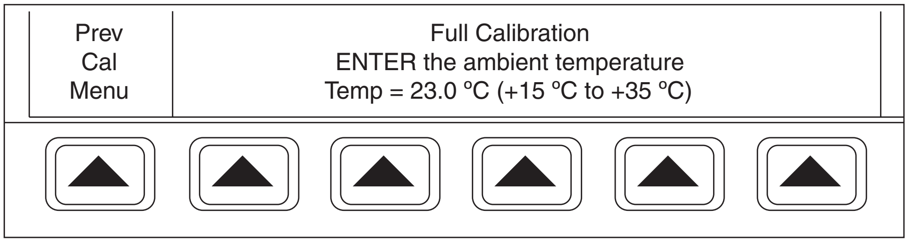


Figure 3-5. 5790A DC Calibration Test Setup

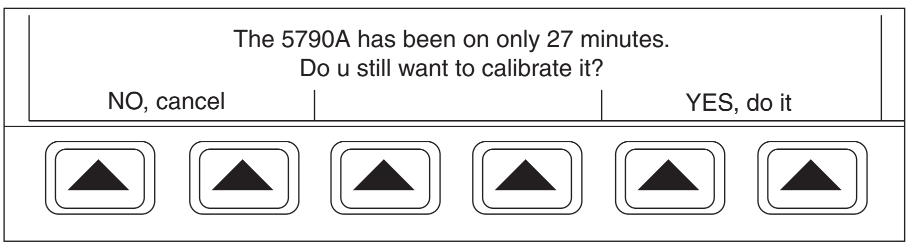
6. Press the “Main Cal” softkey. The display changes to:



elu023.eps

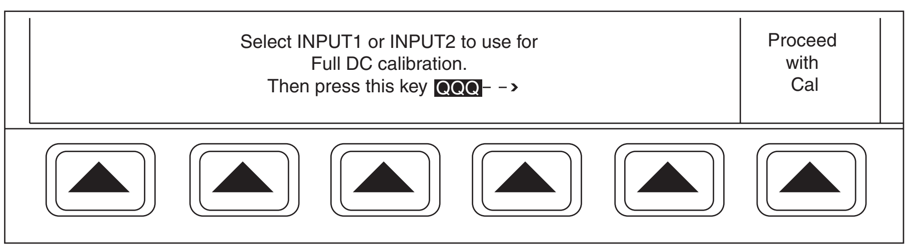
Note

The following display appears if the 5790A has not been turned on for at least 30 minutes. If you know that warmup requirements are met, for example if you briefly turned off the power, press “YES, do it” to override.



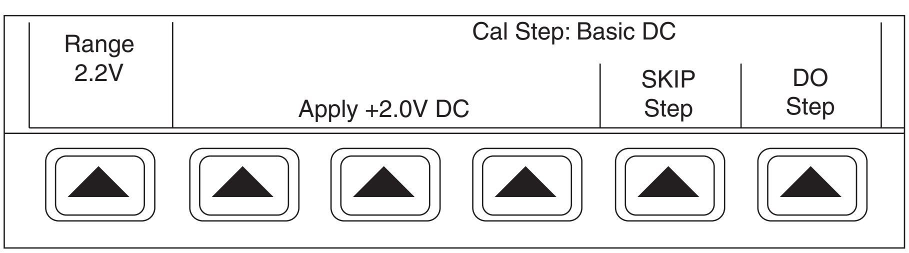
elu024.eps

7. Enter the ambient temperature using the numeric keypad (the numbers appear below the keys) and press the [ENTER] key. Or to accept the default of 23.0 °C, just press [ENTER].



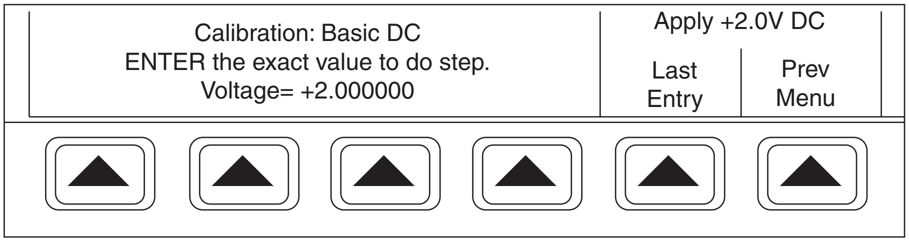
elu025.eps

8. Press the [INPUT1] key so that its keycap indicator is lit. Press the “Proceed With Cal” softkey. The display changes to:



elu026.eps

9. Set the 5700A to nominal, than use the knob to adjust for the error display you recorded in Table 3-3. Set the 5700A to operate. When the U (unsettled) indicator on the 5700A goes out, press the “DO Step” softkey. The Control Display changes to:



elu027.eps

10. At each step you accept the default value by pressing [ENTER]. You do this because you have already applied your correction in the adjusted 5700A setting. The display tells you that the calibration step is in progress and informs you with a beep when the step is complete.
11. When the 5790A completes the step, the next DC step which requires -2 V DC is presented on the display. Change the 5700A setting accordingly and do the calibration step as in the previous two steps.

⚠ ⚠ Warning

Some steps in the remainder of this procedure require application of lethal voltages. Use extreme caution to avoid contact with live conductors. Set the calibrator to standby and verify that voltage has returned to zero immediately after each high voltage calibration step is finished.

Note

For the 200 mV points and below, remove the external sense leads and set the 5700A to INT SENSE.

12. Continue until the DC calibration is finished. Table 3-5 lists the steps in periodic calibration of the main input. The 2.2 mV range is the last DC calibration step.

Table 3-5. Calibration Steps in Periodic Calibration

Step Name	Voltage to Apply	Tolerance Calibration Source (± PPM)	Purpose of Calibration Step
Basic DC	+2 V DC	3	Calibrates DACs and thermal sensor. (This is the unscaled range)
Sensor turnover –2.0	-2 V DC	3	Corrects DC turnover error
Sensor turnover +0.7	+0.7 V DC	5	Corrects turnover error of the RMS sensor at minimum scale. After the –0.7 V step, internally calibrates the range zeros
Sensor turnover –0.7	-0.7 V DC		

Table 3-5. Calibration Steps in Periodic Calibration (cont.)

Step Name	Voltage to Apply	Tolerance Calibration Source (± PPM)	Purpose of Calibration Step
1000 V Positive DC 1000 V Negative DC	+1000 V DC -1000 V DC	3	Establishes gain and DC offset for the 1000 V range
700 V Positive DC 700 V Negative DC	+600 V DC -600 V DC	3	Establishes gain and DC offset for the 700 V range
220 V Positive DC 220 V Negative DC	+200 V DC -200 V DC	3	Establishes gain and DC offset for the 220 V range
70 V Positive DC 70 V Negative DC	+60 V DC -60 V DC	3	Establishes gain and DC offset for the 70 V range
22 V Positive DC 22 V Negative DC	+20 V DC -20 V DC	3	Establishes gain and DC offset for the 22 V range
7 V Positive DC 7 V Negative DC	+6 V DC -6 V DC	3	Establishes gain and DC offset for the 7 V range
2.2 V Positive DC 2.2 V Negative DC	+2 V DC -2 V DC	3	Establishes gain and DC offset for the 2.2 V range
700 mV Positive DC 700 mV Negative DC	+600 mV DC -600 mV DC	5	Establishes gain and DC offset for the 700 mV range
220 mV Positive DC 220 mV Negative DC	+200 mV DC -200 mV DC	10	Establishes gain and DC offset for the 220 mV range
70 mV Positive DC 70 mV Negative DC	+60 mV DC -60 mV DC	35	Establishes gain and DC offset for the 70 mV range
22 mV Positive DC 22 mV Negative DC	+20 mV DC -20 mV DC	100	Establishes gain and DC offset for the 22 mV range
7 mV Positive DC 7 mV Negative DC	+6 mV DC -6 mV DC	350	Establishes gain and DC offset for the 7 mV range
2.2 mV Positive DC 2.2 mV Negative DC	+2 mV DC -2 mV DC	1000	Establishes gain and DC offset for the 2.2 mV range
LF (10 Hz) Linearity LF (10 Hz) Linearity	2 V RMS, 10 Hz 600 mV RMS, 10 Hz	190	Generates a correction for thermal sensor non-linearity at low F and f

Table 3-5. Calibration Steps in Periodic Calibration (cont.)

Step Name	Voltage to Apply	Tolerance Calibration Source (± PPM)	Purpose of Calibration Step
1000 V AC 100 kHz	600 V RMS, 100 kHz	70	Generates flatness calibration data for the 1000 V range
700 V AC 100 kHz	600 V RMS, 100 kHz	70	Generates flatness calibration data for the 700 V range
220 V AC 300 kHz	60 V RMS, 300 kHz	130	Generates flatness calibration data for the 220 V range
70 V AC 500 kHz 70 V AC 1 MHz	20 V RMS, 500 kHz 20 V RMS, 1 MHz	125 125	Generates flatness calibration data for the 70 V range
22 V AC 100 kHz 22 V AC 1 MHz	20 V RMS, 100 kHz 20 V RMS, 1 MHz	50 125	Generates flatness calibration data for the 22 V range
7 V AC 100 kHz 7 V AC 1 MHz	6 V RMS, 100 kHz 6 V RMS, 1 MHz	50 125	Generates flatness calibration data for the 7 V range
2.2 V AC 1 MHz	2 V RMS, 1 MHz	125	Generates flatness calibration data for the 2.2 V range
700 mV AC 1 MHz	600 mV RMS, 1 MHz	140	Generates flatness calibration data for the 700 mV range
220 mV AC 1 MHz	200 mV RMS, 1 MHz	300	Generates flatness calibration data for the 220 mV range
70 mV AC 300 kHz 70 mV AC 1 MHz	60 mV RMS, 300 kHz 60 mV RMS, 1 MHz	500 600	Generates flatness calibration data for the 70 mV range
22 mV AC 300 kHz 22 mV AC 1 MHz	20 mV RMS, 300 kHz 20 mV RMS, 1 MHz	720[1] 720[1]	Generates flatness calibration data for the 22 mV range
7 mV AC 300 kHz 7 mV AC 1 MHz	6 mV RMS, 300 kHz 6 mV RMS, 1 MHz	1200[1] 1200[1]	Generates flatness calibration data for the 7 mV range
2.2 mV AC 300 kHz	2 mV RMS, 300 kHz	2300[1]	Generates flatness calibration data for the 2.2 mV range
2.2 mV AC 1 MHz	2 mV RMS, 1 MHz	2300[1]	

[1] These uncertainities can be achieved using the “bootstrap” techniques described in the AC calibration procedure.

3-17. AC Calibration

Table 3-6 lists the equipment required to perform the AC calibration of the main input. Before you begin, make 12 copies of Figure 3-6 and 10 copies of Figure 3-7. Those are worksheets to help you calibrate the various AC points.

Table 3-6. Equipment Required for 5790A Main Input AC Calibration

Required Equipment	Manufacturer and Model	Minimum use Requirements
AC-DC Transfer Standard	Fluke 792A, with accessories	60 mV to 1000 Vrms, 10 Hz to 1 MHz[1]
Multifunction Calibrator	Fluke 5700A	2 mV to 1000 Vrms, 10 Hz to 1 MHz[1]
Amplifier for Above	Fluke 5725A (higher Volt-Hertz product)	600V to 1000 Vrms, 10 kHz to 100 kHz[1]
8-1/2 Digit Precision DMM	Hewlett Packard 3458A	0-2VDC, 10 nV resolution, 1 ppm linearity
50Ω Type “N” Tee, Male-Male-Male	Fluke P/N 912605 or equivalent	(Stainless Steel type recommended)
50Ω Type “N” Female to Double Banana Plug Adapter	Pomona Model 1740 or equivalent	1000 Vrms Breakdown Voltage, minimum
Frequency counter	PM6666	5ppm Frequency Uncertainty or Better
Binding Posts to 50Ω Type “N” Male Adapter	Pomona Model 1796 or equivalent	1000 Vrms Breakdown Voltage, minimum
[1] See Table 3-13, “AC SOURCE MAXIMUM UNCERTAINTY” for specific Voltage/Frequency and Uncertainty information.		

VOLTAGE (NOMINAL) ____________________

FREQUENCY ____________________

792A CORRECTION (PPM) ____________________

	792A	5790A
+DC		
-DC		
$DC_{AVERAGE}$	DC_{792} =	DC_{5790} =
AC_{792}		X
AC_{MEAS}		

$$DC_{AVERAGE} = \left(\frac{|+DC| + |-DC|}{2} \right)$$

$$AC_{MEAS} = DC_{5790} \cdot \left(\frac{AC_{792}}{DC_{792}} + \frac{792\ CORR}{10^6} \right)$$

EXAMPLE:

VOLTAGE (NOMINAL) 2.0 V

FREQUENCY 10 Hz

792A CORRECTION (PPM) +14

	792A	5790A
+DC	1.713135	1.999799
-DC	1.713146	1.999801
$DC_{AVERAGE}$	DC_{792} = 1.713141	DC_{5790} - 1.999800
AC_{792}	1.713188	X
AC_{MEAS}	1.999858	

$$DC_{792} = \frac{1.713135+1.713146}{2} = 1.713141$$

$$DC_{5790} = \frac{1.999799+1.999801}{2} = 1.999800$$

$$AC_{MEAS} = 1.999800 \left(\frac{1.713188}{1.713141} + \frac{+14}{10^6} \right) = 1.999858$$

elu028.eps

Figure 3-6. Worksheet for 2 V to 1000 V AC Calibration Points

VOLTAGE (NOMINAL) ____________________

FREQUENCY ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, POSITIVE ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ____________________

792A CORRECTION (PPM) ____________________

	792A DMM READING
+DC	
-DC	
DC_{792}	
AC_{792}	
$AC_{MEAS} =$	

$$DC_{792} = \left(\frac{|{+DC}| + |{-DC}|}{2} \right)$$

$$AC_{MEAS} = NOMINAL \cdot \left(\frac{AC_{792}}{DC_{792}} + \frac{792\ CORR}{10^6} \right)$$

elu029.eps

Figure 3-7. Worksheet for 60 mV to 600 mV AC Calibration Points

Proceed as follows to perform AC calibration of the main input, which must always be preceded by DC calibration:

1. Set up the equipment as shown in Figure 3-8. Connect the 792A without the 1000 V range resistor first.

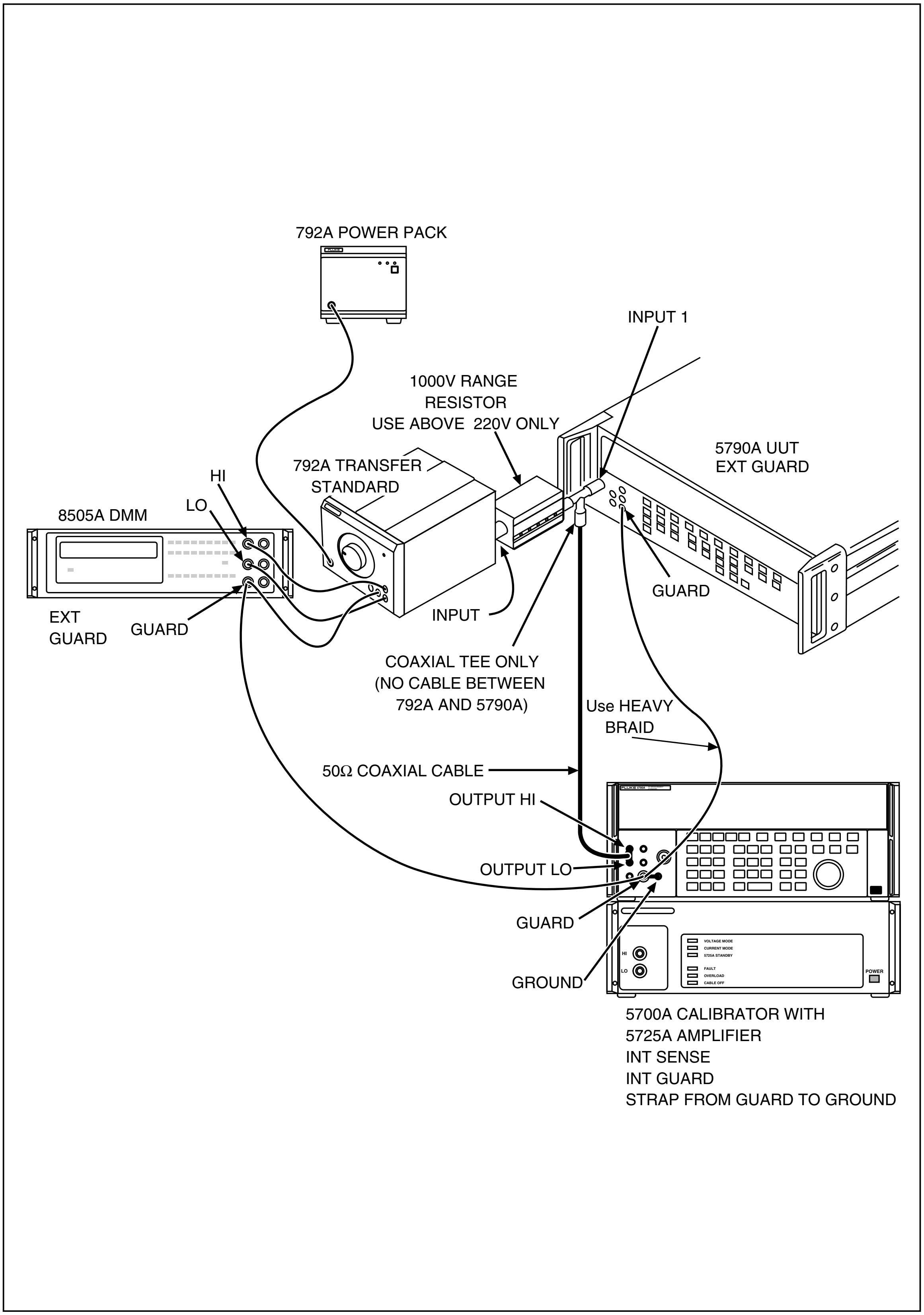


Figure 3-8. 5790A AC Calibration Test Setup

2. Set up the 5700A as follows so that its internal AC transfers are off:

a. Press the “Setup Menus” softkey.

b. Press the “Special Functns” softkey.

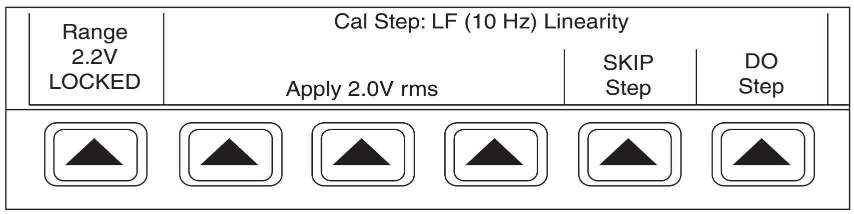
c. Press the “ACXfer Choice” softkey so that ON appears.

d. Press PREV MENU twice.

e. Set the 5700A to 1 V, 1 kHz, operate. Press the “Intrnl Xfers” softkey so that OFF appears. (The “Intrnl Xfers” softkey appears only in the 5700A ranges below 220 V and at frequencies below 120 kHz.)

f. Press 0,V, 0, Hz, ENTER, on the 5700A. Leave the 5700A in standby.

3. The display prompts you for INPUT1 or 2. Verify that the [INPUT1] keycap indicator is lit. Press the “Proceed With Cal” softkey. The display changes to:



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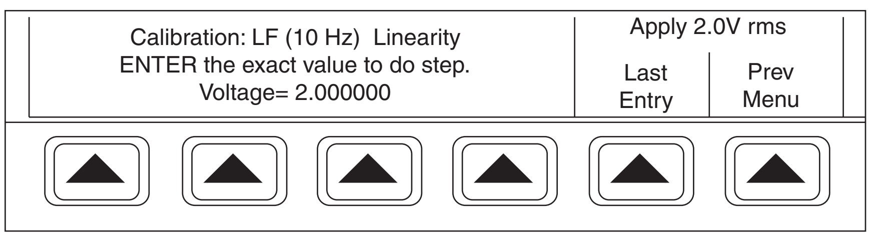
4. Press the “DO Step” softkey. The display changes to:



elu032.eps

5. For all the AC cal points down to the 70 mV range, use the Fluke 792A AC/DC Transfer Standard to adjust the AC voltage level being applied to the 5790A INPUT1 connector. There are three procedures for AC calibration points, depending on their amplitude. Go to the appropriate step as defined below:

   - Step 6: 2 V through 600 V
   - Step 7: 60 mV through 600 mV
   - Step 8: 2 mV through 20 mV

6. For an AC calibration point in the 2 V through 1000 V range, proceed as follows:

a. Obtain a copy of Figure 3-6, the worksheet for this group. Fill in the test voltage and frequency and the associated 792A correction.

b. If the test voltage is above 220 V, add the 792A 1000 V range resistor to the test setup as shown in Figure 3-8.

c. Press the “DO Step” softkey. This automatically selects the correct 5790A range.

d. Set the 792A INPUT RANGE knob to the appropriate position. Always use the lowest range that will accept the input.

⚠ Caution

Always ensure that the proper range has been selected before applying the voltage to the 792A input. Inputs that exceed the protection level shown on its rear panel label disrupt the state of calibration and can cause instrument damage.

e. Set the 5700A to the nominal test voltage, DC positive (Do not use a characterized setting as the 5790A is now used as the DC reference, thus allowing for any resistive drop caused by the 792A loading). Wait for the 5700A "U" annunciator to go out.

f. Wait for 30 seconds for the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for +DC. Record the reading on the 5790A Output Display under the 5790A column for +DC.

g. Press [±][ENTER] on the 5700A to toggle output polarity.

h. Again, allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for -DC. Record the reading on the 5790A Output Display under the 5790A column for -DC. Ignore polarity for the 5790A reading (Record the absolute value).

i. Apply the frequency required for the calibration step. Wait for the "U" annunciator on the 5700A to go out.

j. Allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for AC. Do not record a reading for the 5790A.

k. Now do a computation to get the measured AC using the formulas shown in the worksheet:

    1) Compute the average of the DC readings for the 5790A and the 792A as shown.

    2) Compute "AC MEAS" using the formula shown. Be sure to include the 792A correction as indicated in the formula.

l. Observe the default "EXACT VALUE" on the display. It shows the allowed number of decimal places for you to enter. Enter your computation of "AC MEAS" in the 5790A using the keypad, and press the [ENTER] key. After you press [ENTER], the Control Display shows the progress of the internal process of the calibration step.

Note

While a calibration step is in progress, inaccurate values may appear on the Measurement Display. This is normal. When the 5790A is finished with the step, the display will read accurately.

m. When the step has completed, set the 5700A to standby.

7. For an AC calibration point in the 60 mV through 600 mV group, you will need to adjust the 5700A in accordance with the error displays that you recorded in Table 3-3. Proceed as follows:

    a. Obtain a copy of Figure 3-7, the worksheet for this group. Fill in the voltage, frequency, 5700A error displays (positive and negative) from Table 3-3, and the associated 792A correction.

    b. Press the "DO Step" softkey. This automatically selects the appropriate 5790A range.

c. Set the 792A INPUT RANGE knob to the appropriate position. Always use the lowest range that will accept the input.

⚠ Caution

Always ensure that the proper range has been selected before applying voltage to the 792A input. Inputs that exceed the protection level shown on its rear panel label disrupt the state of calibration and can cause instrument damage.

d. Set the 5700A to nominal positive and then turn the knob to obtain the error display reading you recorded in Table 3-3. Wait for the 5700A “U” annunciator to go out.

e. Wait for 60 seconds for the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for +DC. Do not record a reading for the 5790A.

f. Set the 5700A to nominal negative, and then turn the knob to obtain the error display reading you recorded in Table 3-3. Wait for the 5700A “U” annunciator to go out.

g. Again, allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for -DC. Do not record a reading for the 5790A.

h. Apply the nominal voltage at the frequency required for the calibration step. Wait for the “U” annunciator on the 5700A to go out.

i. Allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for AC. Do not record a reading for the 5790A.

j. Now do a computation to get measured AC using the formulas shown in the worksheet:

   1) Compute the average of the 792A DC readings as shown.

   2) Compute “AC MEAS” using the formula shown. Be sure to include the 792A correction as indicated in the formula. Use nominal DC in the formula.

k. Observe the default “EXACT VALUE” on the display. It shows the allowed number of decimal places for you to enter. Enter your computation of “AC MEAS” in the 5790A using the keypad, and press the [ENTER] key. After you press [ENTER], the Control Display shows the progress of the internal process of the calibration step.

Note

While a calibration step is in progress, inaccurate values may appear on the Measurement Display. This is normal. When the 5790A is finished with the step, the display will read accurately.

l. When the step has completed, set the 5700A to standby.

8. For an AC calibration point in the 2 mV through 20 mV group, you use a bootstrapping technique. This procedure assumes the you have calibrated the 60 mV points. Each range is bootstrapped from the next higher range as shown in Figure 3-9.

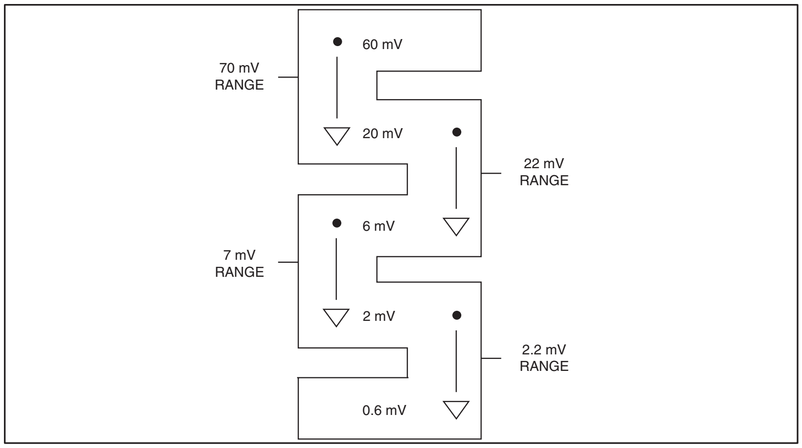


Figure 3-9. Millivolt Range Bootstrapping Technique

a. Calibrate the 22 mV range as follows:

1) Lock the 5790A in the 70 mV range. The 792A may be left attached, although it is not used.
2) Apply the requested voltage and frequency. When the reading on the 5790A Measurement Display settles, record the reading.
3) Press the “DO Step” softkey. This automatically selects the 22 mV range.
4) Enter the value you recorded in step 2 and press the ENTER softkey.
5) When the step is completed, set the 5700A to standby.
6) Repeat the previous steps 1 through 5 for the other 22 mV range point(s).

b. Calibrate the 7 mV range as follows:

1) Lock the 5790A in the 22 mV range. The 792A may be left attached, although it is not used.
2) Apply the requested voltage and frequency. When the reading on the 5790A Measurement Display settles, record the reading.
3) Press the “DO Step” softkey. This automatically selects the 7 mV range.
4) Enter the value you recorded in step 2 and press the ENTER softkey.
5) When the step is completed, set the 5700A to standby.
6) Repeat the previous steps 1 through 5 for the other 7 mV range point(s).

c. Calibrate the 2.2 mV range as follows:

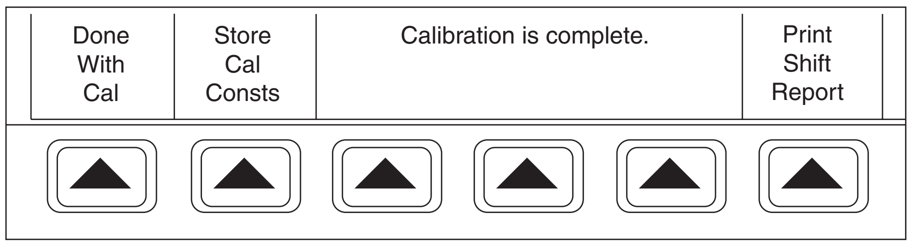
1) Lock the 5790A in the 7 mV range. The 792A may be left attached, although it is not used.
2) Apply the requested voltage and frequency. When the reading on the 5790A Measurement Display settles, record the reading.
3) Press the “DO Step” softkey. This automatically selects the 2.2 mV range.

4) Enter the value you recorded in step 2 and press the ENTER softkey.

5) When the step is completed, set the 5700A to standby.

6) Repeat the previous steps 1 through 5 for the other 2.2 mV range point(s).

9. When you finish the calibration, the display appears as follows:



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10. Nothing has been saved in nonvolatile memory yet. To make calibration valid, you need to store the constants. Set the rear panel CALIBRATION STORE switch to ENABLE. Press the “Store Cal Consts” softkey. Calibration is complete. For information about printing calibration reports, refer to Chapter 7 of the 5790A Operator Manual.

11. If you decide not to store the updated constants, press the “DONE with Cal” softkey. A menu warns you that if you quit at this point without storing the constants, the updated constants will be discarded. If you verify that you want to discard the constants, the 5790A copies the stored set of constants into the active constants memory. Figure 3-1 illustrates how calibration constant groups are manipulated.

3-18. Calibrating the Wideband AC Option

The following procedure is a part of periodic calibration only if a 5790A-03 Wideband Option is installed in your 5790A. If you are replacing or have repaired the Wideband assembly, perform the Wideband Amplifier Rolloff Adjustment as described in the Service Calibration part of this chapter before calibration. You calibrate the WIDEBAND input in four major steps:

1. Perform the main input calibration first.
2. Characterize the AC source (a 5700A with Wideband option and associated attenuators, cable, and connectors).
3. Calibrate the WIDEBAND input gain.
4. Calibrate the WIDEBAND input flatness.

Table 3-7 lists the equipment required to calibrate the WIDEBAND input. Before you proceed, make a copy of Table 3-8 which is the worksheet for WIDEBAND input calibration.

Table 3-7. Equipment Required for Wideband Calibration

Required Equipment	Manufacturer and Model	Minimum use Requirements
Multifunction Calibrator	Fluke 5700A with Wideband (-03) Option (incl. Cable and 50Ω term.)	3.2 Vrms, 10 Hz - 30 MHz[1] 32 mV - 3.2 Vrms, 1 kHz[1]
Thermal Voltage Converter	Fluke A55 3V	≈3 Vrms, 10 Hz - 30 MHz[1] 0.01 - 0.20% absolute uncertainty
874-TL Coaxial Tee, Locking	Fluke P/N 157248 or equivalent	Compatible with A55 input connector
874-QNJL, Adapter, Type “N” (F) to 874 (locking)	Gilbert Engineering 0874-9711 or equivalent	Facilitate connection of Wideband output cable to 874 Tee
874-QNPL, Adapter, Type “N” (M) to 874 (locking)	Gilbert Engineering 0874-9811 or equivalent	Facilitate connection of attenuators to 874 Tee.
8-1/2 Digit Precision DMM	Hewlett Packard 3458A	32 mV - 3.2 Vrms, 1 kHz, 0.01 % Uncertainty, 0 -7 mVDC, 20 nV short-term stability
50Ω Type “N” Tee, Male-Male-Male	Fluke P/N 912605 or equivalent	Functional (Stainless Steel type recommended)
20 dB type “N” RF Attenuator (3 each)	JFW Industries 50HFI-020N	0.0001dB/dB/°C Temperature Coefficient[2] 50Ω ± 0.5Ω DC Resistance
10 dB type “N” RF Attenuator (1 each)	JFW Industries 50HFI-010N	0.0001dB/dB/°C Temperature Coefficient, [2] 50Ω ± 0.5Ω DC Resistance
Cable Assy., 18” Type “N” (M) to Type “N” (F)	Pomona 4496-T-18 or equivalent	Facilitate connection to DMM for 1 kHz Wideband Gain verification
Adapter, Type “N” (F) to Double Banana Plug	Pomona 1740 or equivalent	Facilitate connection to DMM for 1 kHz Wideband Gain verification
Frequency counter	PM6666	5ppm Frequency Uncertainty or Better
RS-232 Video Display Terminal	Digital Equipment VT-100	RS-232 Serial communication[3]

[1] See Table 3-16, “IF USING METHODS OTHER THAN SPECIFIED, MAX. UNCERT.” for specific Voltage/Frequency and Uncertainty information.

[2] The JFW attenuators must be characterized by Fluke (see text).

[3] Required only for Service Calibration.

Table 3-8. Wideband Calibration Worksheet

				______Range					
Frequency	**A55 Corr. (PPM)**	**5790A Error (PPM)**	**5700A Error (PPM)**	**10 dB Error (PPM)**	**20 dB Error (PPM)**	**20 dB Error (PPM)**	**20 dB Error (PPM)**	**Total Error (PPM)**	**1 kHz Ref Error (Enter Once)**
10 Hz									
100 Hz									x
10 kHz									x
50 kHz									x
200 kHz									x
500 kHz									x
1 MHz									x
2 MHz									x
4 MHz									x
8 MHz									x
10 MHz									x
15 MHz									x
20 MHZ									x
26 MHz									x
30 MHz									x

3-19. Characterizing the AC Source

To meet the test uncertainty requirements for WIDEBAND input calibration, you must first characterize the AC source to be used in the procedure. The attenuators must be characterized before use. You must characterize the source and calibrate the WIDEBAND input in a temperature-controlled room. The A55 Thermal Converter will not stabilize in a drafty or unstable environment. In this procedure, you will fill in the 5700A ERROR column of Table 3-8 for later use during the WIDEBAND flatness calibration.

Note

Fluke offers a calibration service for NARDA Model 777C attenuators at the Everett, Service Center. For price and delivery of this calibration service, please call the Everett Service Center at (206) 356-5560.

1. Connect the equipment as shown in Figure 3-10. Make sure that all connections are tight. The A55 must be loaded with 50 Ω (by connecting it as shown in the figure) or it will be destroyed when the voltage is applied.

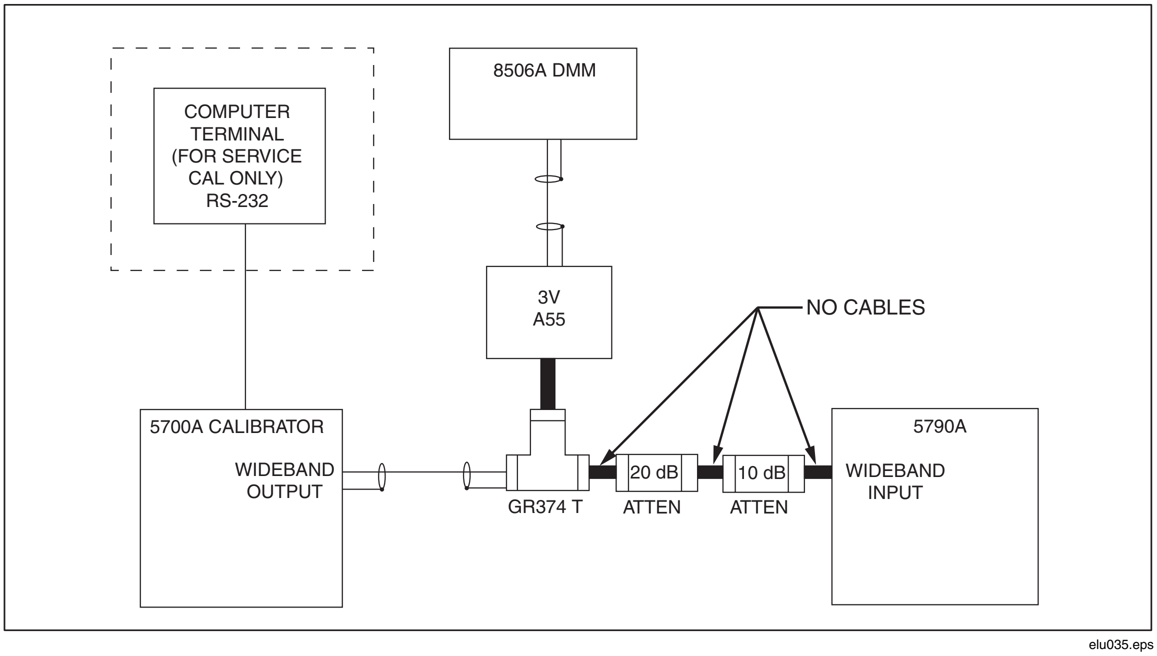


Figure 3-10. Wideband Calibration Source Characterization, Part 1

2. Make sure equipment warmup requirements are met.
3. Lock the 5790A on the 220 mV range.
4. Set the 5700A to output 3.2 V at 1 kHz. The 5790A will read approximately 100 mV, and the 3 V A55 output will be about 7 mV.
5. Allow the A55 to stabilize, then press the STORE and OFFSET keys on the 8506A DMM.
6. Press the “SET REF” softkey on the 5790A.
7. For each frequency in Table 3-8, set the 5700A frequency and perform steps 8, 9, and 10.
8. Apply any corrections for the response of the A55 TVC by first adjusting the 5700A output to bring the 8506A DMM offset reading to 0 ±3 counts, and then pressing the “NEW REF” key on the 5700A, and then further adjusting the 5700A to give the same error and sign as recorded on the A55 calibration sheet when it was calibrated. Also record the A55 correction in Table 3-8.
9. Record the error showing on the 5790A Control Display, including polarity, in Table 3-8.
10. Return to 3.2 V at 1 kHz after each frequency calibrated to verify that the 8506A is still reading 0. Rezero the 8506A if necessary by pressing the OFFSET, STORE, and OFFSET keys again. The 5790A display should read 0 ± 20 ppm. If it does not, press the “CLR REF WBND” softkey followed by “SET REF” softkey to rezero.
11. Set the 5700A to STANDBY.
12. Remove the DMM, A55, and the TEE, and connect the 5700A wideband cable to the attenuator input as shown in Figure 3-11.

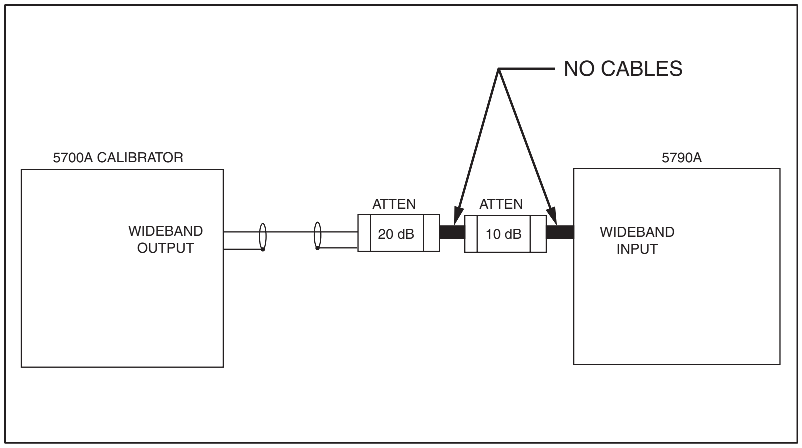


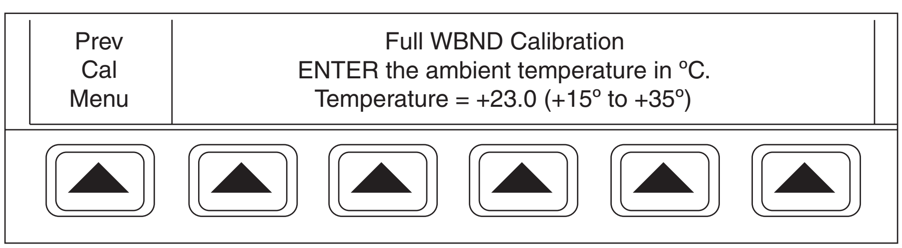
Figure 3-11. Wideband Calibration Source Characterization, Part 2

13. Set the 5700A to 3.2 V at 1 kHz and then press the "SET REF" softkey on the 5790A.
14. Proceed to each of the frequencies listed in Table 3-8. Set the 5700A frequency, and adjust the 5700A to give the same error on the 5790A display as recorded in the table from the previous steps. Record the error displayed by the 5700A (both magnitude and sign) in Table 3-8 in PPM.
15. The 5700A is now characterized and can be used to calibrate the 5790A.

3-20. Calibrating Wideband Input Gain at 1 kHz

Proceed as follows to perform gain (absolute) calibration at 1 kHz for each range. You do not need the worksheet for this part of WIDEBAND calibration.

1. Connect the equipment as shown in Figure 3-12. Set the 8506A in the HI ACCUR mode.
2. Press the 'UTIL MENUS' and then the 'CAL' softkeys.
3. Press the 'CAL' and then the 'WBND CAL' softkeys. This produces the following display:



4. Enter the ambient temperature on the number keys and then press ENTER, or press ENTER to accept 23.0 °C.
5. The 5790A will step to the first calibration point on the 7 V range.
6. Apply 3.0 V at 1 kHz and then press the 'DO STEP' softkey.

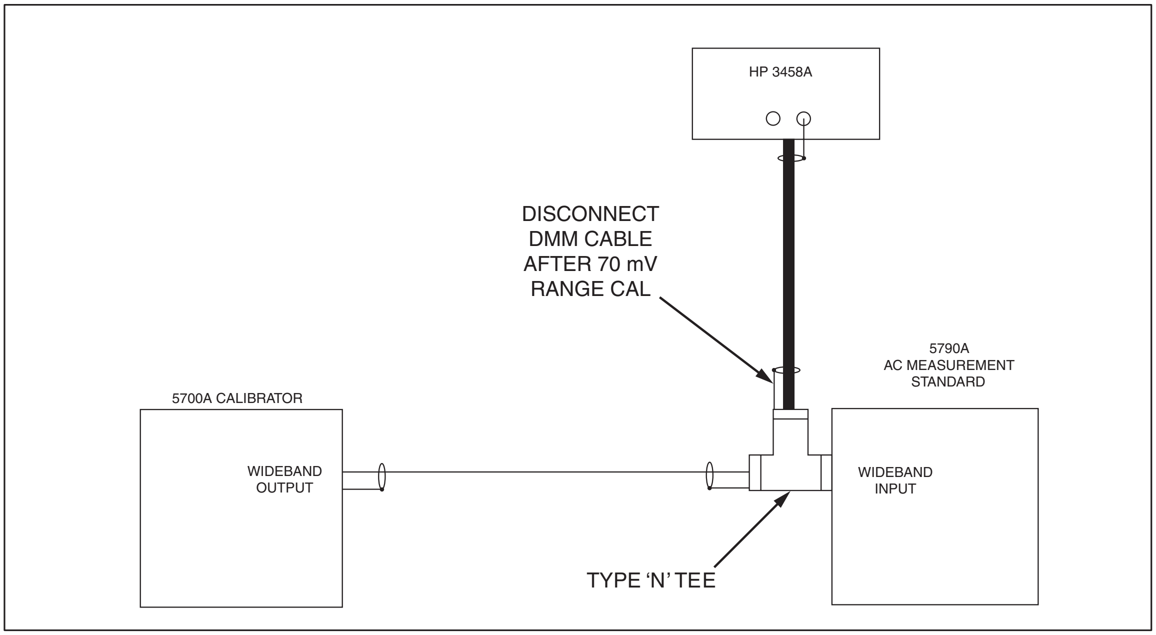


Figure 3-12. Gain Calibration Setup for 70 mV and Above

7. Use the number keys to enter the value displayed on the 8506A DMM into the 5790A, then press [ENTER].
8. The 5790A will calibrate the 7 V range and proceed to the 2.2 V range.
9. Apply 2.0 V at 1 kHz and press “DO STEP” as before.
10. Enter the value from the 8506A into the 5790A as before and press [ENTER].
11. The 5790A will calibrate the 2.2 V range and step to the 700 mV range.
12. The 700 mV, 220 mV, and 70 mV ranges are done in a similar way; just enter the exact value of the voltage as requested for each range and press [ENTER].
13. Disconnect the 8506A DMM after calibration of the 70 mV range. It is not accurate enough to calibrate the lower three ranges and it adds noise to the system.
14. If an accurate millivolt AC source is available, use it to calibrate the 22 mV, 7 mV, and 2.2 mV ranges in the same manner as the other ranges. Just enter the exact value when requested by the display and press [ENTER].
15. If an accurate millivolt source is not available, use a bootstrapping technique. Record the 5790A reading on the range above the one to be calibrated, and enter the recorded value as the “EXACT VALUE” when the display asks for it.
16. To calibrate the 22 mV range, connect the equipment as shown in Figure 3-11. Apply 20 mV at 1 kHz when the display asks for it (The 5700A will need to be set to about 600 mV due to the 30 dB of attenuation).
17. Press the 70 mV range key and measure and record the value.
18. Press the “DO STEP” softkey and enter the number just measured on the 70 mV range. Now press the [ENTER] key and the 5790A will calibrate the 22 mV range and step to the 7 mV calibration display.
19. Calibrate the 7 mV range by applying 6 mV at 1 kHz and then pressing the 22 mV range key to measure and record the value. Press the “DO STEP” softkey and enter the value just measured on the 22 mV range. Press the [ENTER] key

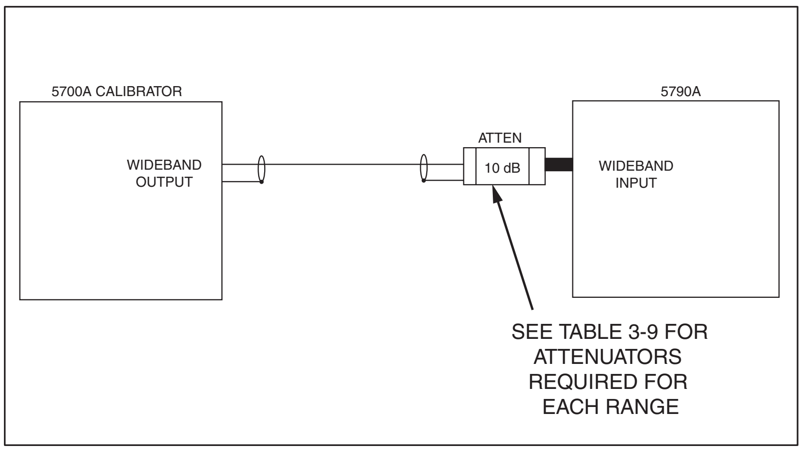
and the 5790A will calibrate the 7 mV range and step to the 2.2 mV calibration display.

20. The 2.2 mV range is done in a similar manner by reading the value on the 7 mV range and entering the value when requested and then pressing the [ENTER] key.
21. The absolute calibration on all ranges is now complete and the 5790A is ready for flatness calibration.

3-21. Calibrating Wideband Input Flatness

The wideband source characterization must be done within 30 minutes of beginning flatness calibration. Before you start, make 8 copies of Table 3-8 with the 5700A error column filled in (Recorded entries into the 5700A error column during in the first part of WIDEBAND calibration.)

1. Connect the equipment as shown in Figure 3-13.



elu039.eps

Figure 3-13. WIDEBAND Input Flatness Calibration Test Setup

2. The 5700A will be set to a nominal 3.2 V for all flatness calibration. The only deviation from the nominal value will be for calibration corrections for the 5700A and the attenuators.
3. Enter a range voltage at the top of each copy you made of Table 3-8 (7 V, 2.2 V, 700 mV, 220 mV, 70 mV, 22 mV, 7 mV, and 2.2 mV). Also enter the attenuator corrections as required for each range. Add the total error for each frequency and enter the result in the TOTAL ERROR column in each copy. The total error equals the sum of errors of the 5700A and all attenuators used for that frequency.

Table 3-9 shows the combination of the attenuators required to scale the input signal properly for each range.

Table 3-9. Attenuators Required for Each Range

Range	Attenuators	5790A Input
7 V	None	3.2 V
2.2 V	(1) 10 dB	1 V
700 mV	(1) 20 dB	320 mV
220 mV	(1) 20 dB + (1) 10 dB	100 mV
70 mV	(2) 20 dB	32 mV
22 mV	(2) 20 dB + (1) 10 dB	10 mV
7 mV	(3) 20 dB	3.2 mV
2.2 mV	(3) 20 dB + (1) 10 dB	1 mV

4. All ranges are calibrated in the similar manner. The calibration program will prompt you at each step as to what frequency to apply.
5. The flatness calibration program starts with the 7 V range at a frequency of 10 Hz.
6. To establish a 1 kHz reference at the beginning of each range, set the 5700A to 3.2 V and 1 kHz and set the 5790A to the 7 V range in this case. The 5790A will measure the magnitude. Record this value in Table 3-8.
7. Press the “DO STEP” softkey and enter the 1 kHz reference value measured for the “APPLIED VALUE”.
8. Set the 5700A to 3.2 V at 10 Hz and adjust the 5700A to the total error value at 10 Hz that was recorded in Table 3-8 during source characterization.
9. Press the [ENTER] key and the system will calibrate the range at 10 Hz and step to the 100 Hz calibration point.
10. Set the 5700A to 100 Hz and adjust the 5700A to the total error value at 100 Hz that was recorded in Table 3-8 during source characterization.
11. Press “DO STEP” and “LAST ENTRY” keys to enter the current “APPLIED VALUE”.
12. Press the [ENTER] key and the system will calibrate the range at 100 Hz and step to the 10 kHz calibration point.
13. Proceed through the range at each calibration point frequency in the same manner as steps 10, 11, and 12 by applying the proper frequency and total error values (Note that the total error value is the sum of the errors of the 5700A and all attenuators used for that range and frequency).
14. When the calibration program has completed all the steps in the 7 V range, it will step to the beginning of the 2.2 V range at 10 Hz.
15. Install the 10 dB attenuator as required by Table 3-9 for the 2.2 V range.
16. Establish the 1 kHz reference for this range by again setting the 5700A to 3.2 V at 1 kHz and the 5790A to the 2.2 V range. The 5790A will measure the magnitude. Record this value in Table 3-8.

17. Press the “DO STEP” softkey and enter the 1 kHz reference value just measured for the “APPLIED VALUE”.
18. Set the 5700A to 3.2 V at 10 Hz and adjust the 5700A to the total error value at 10 Hz for the 2.2 V range as recorded in Table 3-8.
19. Press the [ENTER] key and the system will calibrate the range at 10 Hz and step to the 100 Hz calibration point as before.
20. Set the 5700A to 100 Hz and adjust for errors. Press “LAST ENTRY”, then press [ENTER] as before.
21. The system will calibrate the 100 Hz point and step to the 10 kHz point.
22. Proceed through the range at each calibration point as before by applying the proper frequency and error values.
23. All remaining ranges are done in a similar manner by installing the proper attenuators establishing the 1 kHz reference and adjusting for errors at each frequency.
24. When all the ranges are calibrated, store the calibration constants to complete the calibration procedure. The rear panel CALIBRATION STORE switch must be in the ENABLE position to store the calibration constants. Return the switch to the NORMAL position after the constants are stored.

3-22. Service Calibration

Service Calibration is a more complete calibration that should be done only after repair or replacement of an analog module. Service calibration is the procedure done at the factory when the 5790A is built (However, Fluke uses an automated calibration system.)

Use the same procedure as for periodic calibration, as previously defined, except set the rear panel CALIBRATION MODE switch to SERVICE and the CALIBRATION STORE switch to ENABLE. This switch setting generates prompts that request many more stimuli points than used in periodic calibration, plus the “Xfer Offset Adjustment” and the “Wideband Amplifier Rolloff Adjustment” (the latter only if a Wideband Option is installed). Table 3-10 lists the main input calibration steps called for in service calibration. (WIDEBAND Service Calibration uses the same steps as the Periodic Calibration.). Note that the “I2/I1” steps, at the beginning of AC calibration have only a 1 % absolute tolerance, but a very tight drift requirement.

Table 3-10. Calibration Steps in Service Calibration

Step Name	Voltage to Apply	Tolerance of Calibration Source (± PPM)	Purpose of Calibration Step
Basic DC	+2 V DC	3	Calibrates DACs and thermal sensor. (This is the unscaled range)
Sensor turnover -2.0	-2 V DC	3	Corrects DC turnover error
Sensor turnover +0.7 Sensor turnover –0.7	+0.7 V DC -0.7 DC	5	Corrects turnover error of the RMS sensor at minimum scale. After the -0.7 V step, internally calibrates the range zeros
1000 V Positive DC 1000 V Negative DC	+1000 V DC -1000 V DC	3	Establishes gain and DC offset for the 1000 V range
700 V Positive DC 700 V Negative DC	+600 V DC -600 V DC	3	Establishes gain and DC offset for the 700 V range
220 V Positive DC 220 V Negative DC	+200 V DC -200 V DC	3	Establishes gain and DC offset for the 220 V range
70 V Positive DC 70 V Negative DC	+60 V DC -60 V DC	3	Establishes gain and DC offset for the 70 V range
22 V Positive DC 22 V Negative DC	+20 V DC -20 V DC	3	Establishes gain and DC offset for the 22 V range
7 V Positive DC 7 V Negative DC	+6 V DC -6 V DC	3	Establishes gain and DC offset for the 7 V range
2.2 V Positive DC 2.2 V Negative DC	+2 V DC -2 V DC	3	Establishes gain and DC offset for the 2.2 V range
700 mV Positive DC 700 mV Negative DC	+600 mV DC -600 mV DC	5	Establishes gain and DC offset for the 700 mV range
220 mV Positive DC 220 mV Negative DC	+200 mV DC -200 mV DC	10	Establishes gain and DC offset for the 220 mV range
70 mV Positive DC 70 mV Negative DC	+60 mV DC -60 mV DC	35	Establishes gain and DC offset for the 70 mV range
22 mV Positive DC 22 mV Negative DC	+20 mV DC -20 mV DC	100	Establishes gain and DC offset for the 70 mV range
7 mV Positive DC 7 mV Negative DC	+6 mV DC -6 mV DC	350	Establishes gain and DC offset for the 7 mV range

Table 3-10. Calibration Steps in Service Calibration (cont.)

Step Name	Voltage to Apply	Tolerance of Calibration Source (± PPM)	Purpose of Calibration Step
2.2 mV Positive DC 2.2 mV Negative DC	+2 mV DC -2 mV DC	1000	Establishes gain and DC offset for the 2.2 mV range
700 V I2/I1 100 kHz (Input 1)	219 V RMS, 100 kHz	1 %, and 1 minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 1 kV divider
700 V I2/I1 100 kHz (Input 2)	219 V RMS, 100 kHz	1 %, and 1 minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 1 kV divider
22 V I2/I1 1 MHz (Input 1)	20 V RMS, 1 MHz	1 %, and 1 minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 220 V divider
22 V I2/I1 1 MHz (Input 2)	20 V RMS, 1 MHz	1 %, and 1 minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 220 V divider
2.2 V I2/I1 1 MHz (Input 1)	2.0 V RMS, 1 MHz	1 %, and 1 minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the protection circuit
2.2 V I2/I1 1 MHz (Input 2)	2.0 V RMS, 1 MHz	1 %, and 1 minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the protection circuit
Frequency Adjustment	2V rms, 1 kHz (measure with PM6666 counter)	10 ppm or better	calibrates timebase accuracy
LF (10 Hz) Linearity LF (10 Hz) Linearity	2 V RMS, 10 Hz 0.6 V RMS, 10 Hz	190	Generates a correction for thermal sensor non-linearity at low V and f
1 kV AC 1 kHz 1 kV AC 20 kHz 1000 V AC 100 kHz	1000 V RMS, 1 kHz 1000 V RMS, 20 kHz 1000 V RMS, 100 kHz	25 27 70	Generates flatness calibration data for the 1000 V range
700 V AC 1 kHz 700 V AC 20 kHz 700 V AC 100 kHz	600 V RMS, 1 kHz 600 V RMS, 20 kHz 200 V RMS, 100 kHz	27 30 70	Generates flatness calibration data for the 1000 V range
220 V AC 1 kHz 220 V AC 20 kHz 220 V AC 300 kHz	200 V RMS, 1 kHz 200 V RMS, 20 kHz 60 V RMS, 300 kHz	18 18 130	Generates flatness calibration data for the 220 V range

Table 3-10. Calibration Steps in Service Calibration (cont.)

Step Name	Voltage to Apply	Tolerance of Calibration Source (± PPM)	Purpose of Calibration Step
70 V AC 1 kHz	60 V RMS, 1 kHz	20	Generates flatness calibration data for the 70 V range
70 V AC 20 kHz	60 V RMS, 20 kHz	20	
70 V AC 500 kHz	20 V RMS, 500 kHz	125	
70 V AC 1 MHz	20 V RMS, 1 MHz	125	
22 V AC 1 kHz	20 V RMS, 1 kHz	15	Generates flatness calibration data for the 22 V range
22 V AC 20 kHz	20 V RMS, 20 kHz	15	
22 V AC 100 kHz	20 V RMS, 100 kHz	50	
22 V AC 300 kHz	20 V RMS, 300 kHz	120	
22 V AC 500 kHz	20 V RMS, 500 kHz	125	
22 V AC 1 MHz	20 V RMS, 1 MHz	125	
7 V AC 1 kHz	6 V RMS, 1 kHz	10	Generates flatness calibration data for the 7 V range
7 V AC 20 kHz	6 V RMS, 20 kHz	10	
7 V AC 100 kHz	6 V RMS, 100 kHz	50	
7 V AC 300 kHz	6 V RMS, 300 kHz	120	
7 V AC 500 kHz	6 V RMS, 500 kHz	125	
7 V AC 800 kHz	6 V RMS, 800 kHz	125	
7 V AC 1 MHz	6 V RMS, 1 MHz	125	
2.2 V AC 10 Hz	2 V RMS, 10 Hz	190	Generates flatness calibration data for the 2.2 V range
2.2 V AC 1 kHz	2 V RMS, 1 kHz	10	
2.2 V AC 20 kHz	2 V RMS, 20 kHz	10	
2.2 V AC 300 kHz	2 V RMS, 300 kHz	115	
2.2 V AC 1 MHz	2 V RMS, 1 MHz	125	
700 mV AC 10 Hz	600 mV RMS, 10 Hz	200	Generates flatness calibration data for the 700 mV range
700 mV AC 1 kHz	600 mV RMS, 1 kHz	22	
700 mV AC 20 kHz	600 mV RMS, 20 kHz	22	
700 mV AC 300 kHz	600 mV RMS, 300 kHz	130	
700 mV AC 1 MHz	600 mV RMS, 1 MHz	140	
220 mV AC 10 Hz	200 mV RMS, 10 Hz	200	Generates flatness calibration data for the 220 mV range
220 mV AC 1 kHz	200 mV RMS, 1 kHz	30	
220 mV AC 20 kHz	200 mV RMS, 20 kHz	30	
220 mV AC 300 kHz	200 mV RMS, 300 kHz	220	
220 mV AC 1 MHz	200 mV RMS, 1 MHz	300	

Table 3-10. Calibration Steps in Service Calibration (cont.)

Step Name	Voltage to Apply	Tolerance of Calibration Source (± PPM)	Purpose of Calibration Step
70 mV AC 10 Hz	60 mV RMS, 10 Hz	230	Generates flatness calibration data for the 60 mV range
70 mV AC 1 kHz	60 mV RMS, 1 kHz	60	
70 mV AC 20 kHz	60 mV RMS, 20 kHz	60	
70 mV AC 300 kHz	60 mV RMS, 300 kHz	500	
70 mV AC 1 MHz	60 mV RMS, 1 MHz	600	
22 mV AC 10 Hz	20 mV RMS, 10 Hz	280[1]	Generates flatness calibration data for the 22 mV range
22 mV AC 1 kHz	20 mV RMS, 1 kHz	100[1]	
22 mV AC 20 kHz	20 mV RMS, 20 kHz	100[1]	
22 mV AC 300 kHz	20 mV RMS, 300 kHz	720[1]	
22 mV AC 500 kHz	20 mV RMS, 500 kHz	720[1]	
22 mV AC 1 MHz	20 mV RMS, 1 MHz	720[1]	
7 mV AC 10 Hz	6 mV RMS, 10 Hz	840[1]	Generates flatness calibration data for the 7 mV range
7 mV AC 1 kHz	6 mV RMS, 1 kHz	200[1]	
7 mV AC 20 kHz	6 mV RMS, 20 kHz	200[1]	
7 mV AC 300 kHz	6 mV RMS, 300 kHz	1200[1]	
7 mV AC 500 kHz	6 mV RMS, 500 kHz	1200[1]	
7 mV AC 800 kHz	6 mV RMS, 800 kHz	1200[1]	
7 mV AC 1 MHz	6 mV RMS, 1 MHz	1200[1]	
2.2 mV AC 10 Hz	2 mV RMS, 10 Hz	1700[1]	Generates flatness calibration data for the 2.2 mV range
2.2 mV AC 1 kHz	2 mV RMS, 1 kHz	400[1]	
2.2 mV AC 20 kHz	2 mV RMS, 20 kHz	400[1]	
2.2 mV AC 300 kHz	2 mV RMS, 300 kHz	2300[1]	
2.2 mV AC 500 kHz	2 mV RMS, 500 kHz	2300[1]	
2.2 mV AC 800 kHz	2 mV RMS, 800 kHz	2300[1]	
2.2 mV AC 1 MHz	2 mV RMS, 1 MHz	2300[1]	

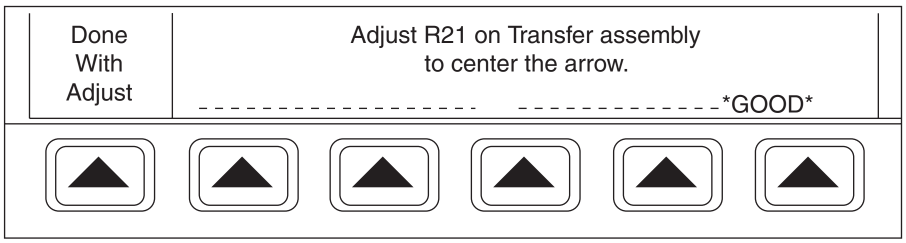
[1] These uncertainties can be achieved using the "bootstrap" techniques described in the AC calibration procedure

3-23. Xfer Offset Adjustment

If you repaired or replaced the Transfer assembly, adjust the millivolt-range amplifier offset for zero as follows:

1. Turn off the power and unplug the 5790A.
2. Remove the eight flat-head machine screws from the top cover and remove the top cover.
3. Locate the access hole for potentiometer R27 on the guard cover as shown in Figure 3-14.

4. Set the CALIBRATION MODE switch to SERVICE.
5. Set the CALIBRATION STORE switch to ENABLE.
6. Turn on the 5790A power and allow it to warmup for 30 minutes.
7. Press the [UTIL MENUS] key followed by the “Cal” softkey. Press the “Service Cal” and “Xfer Offset Adjust” softkeys. The Control Display changes to:



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8. Adjust R27 if necessary to center the pointer. Note the reading on the Measurement Display. It shows the offset in mV. Try to obtain as close to a zero reading.
9. Press “Done With Adjust” and replace the top cover.

3-24. Wideband Amplifier Rolloff Adjustment

If you repaired or replaced the A6 Wideband assembly, adjust the amplifier rolloff as follows:

1. Turn off power and unplug the 5790A.
2. Remove the top cover.
3. Remove the guard cover.
4. Referring to Figure 3-14, locate trimmer caps C24 and C20. C20 is accessed through a hole in the top of the small shield cover.
5. Replace the guard cover, but do not reinstall the screws.
6. Turn on the 5790A and allow 30 minutes for warmup.
7. Set up the equipment as shown in Figure 3-10, including the RS-232 video display terminal.
8. Set up the terminal and the 5790A serial interface parameters. Use the TERMINAL mode rather than COMPUTER. Chapter 7 of the 5790A Operator Manual describes how to do this.
9. Type the following commands on the terminal followed by the Return key:

```
CAL_CONST? F16_220MV_WB
CAL_CONST? F16_70MV_WB
```

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10. Enter the results in Table 3-11. Use only the first 6 digits to the right of the decimal point. Make the calculations shown in the table for use in steps 16 and 26.
11. Set the 5790A to WBND and the 220 mV range.
12. Set the 5700A to 3.2 V at 1 kHz, operate. The 5790A will read approximately 100 mV.

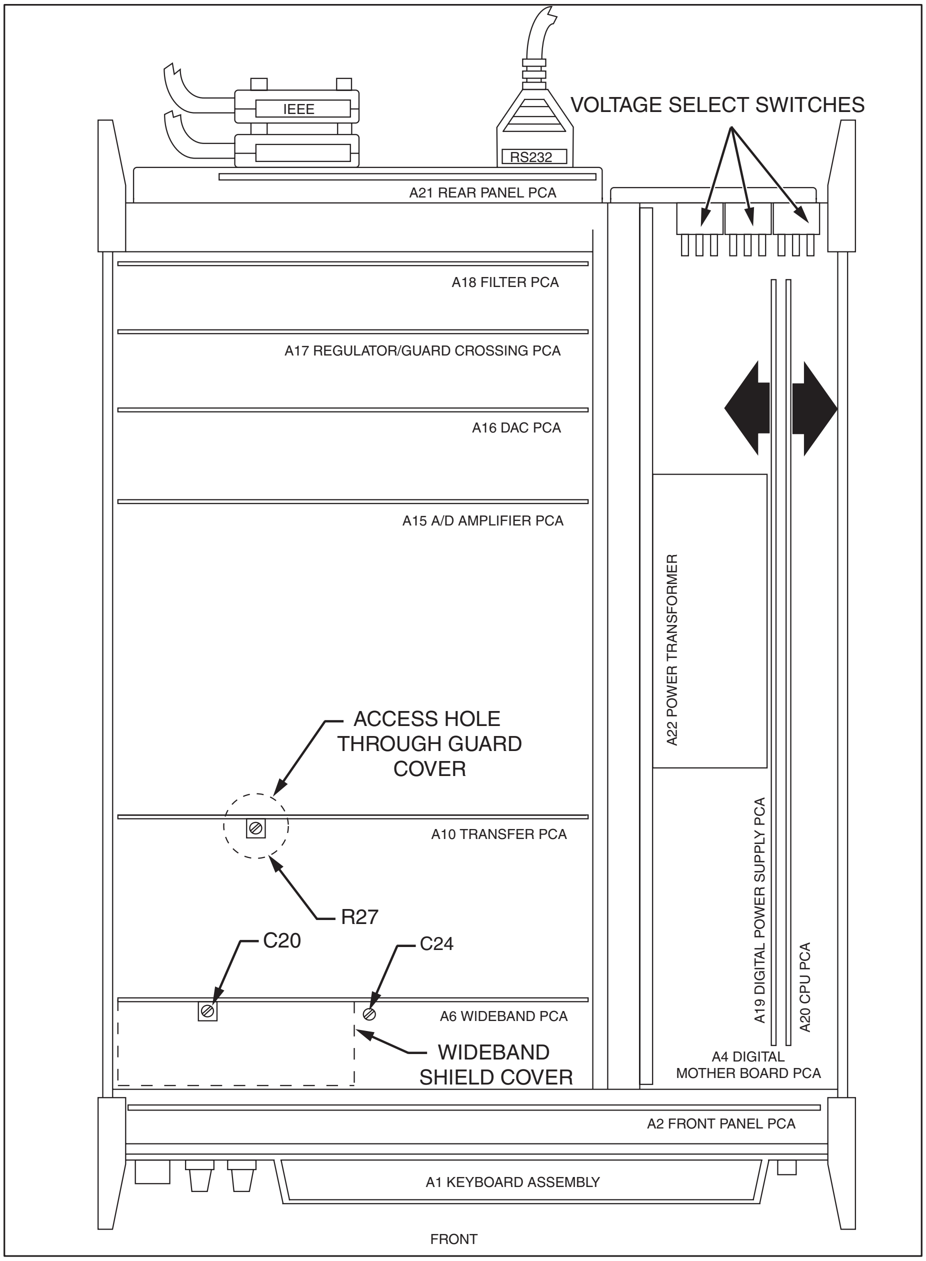

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Figure 3-14. Location of R27 (Transfer), and C20 and C24 (Wideband)

Table 3-11. Wideband Amplifier Rolloff Adjustment Worksheet

Rolloff Worksheet Entry	220 mV Range	70 mV range
30 MHz CAL Constant Name	F16_220MV_WB	F16_70MV_WB
Active Value		
Default		
(1) Active - Default (PPM)		
(2) A55 Correction (PPM)		
(3) Attenuator #1 Error (PPM)		
(4) Attenuator #2 Error (PPM)		
Total 1 + 2 + 3 + 4 (PPM)		

13. Allow the A55 to stabilize, and then press the STORE and OFFSET keys on the 8506A DMM.
14. Press the “SET REF” softkey on the 5790A.
15. Set the 5700A to 30 MHz, and adjust the 5700A to bring the 8506A reading to 0.
16. Press the [NEW REF] button on the 5700A and dial in the 30 MHz correction for the A55, the attenuators, and the current active calibration constant. You do this by adjusting the 5700A knob for a 5700A error display of the same sign and magnitude as the total error entry 220 mV range at the bottom of Table 3-11.
17. Raise the front of the guard cover and adjust C24 for a 5790A display of -3500 PPM ±1000 PPM. (Use a Johanson #8777 tool or equivalent).
18. Set the 5700A to standby.
19. Replace the 10 dB attenuator with a 20 dB attenuator to give a total attenuation of 40 dB.
20. Set the 5790A to the 70 mV range.
21. Set the 5700A to 3.2 V at 1 kHz, operate.
22. The 5790A will read approximately 32 mV.
23. Allow the A55 to stabilize and then press the STORE and OFFSET buttons on the 8506A DMM.
24. Press the “SET REF” softkey on the 5790A.
25. Set the 5700A to 30 MHz, and adjust the 5700A to bring the 8506A reading to 0.
26. Press the [NEW REF] button on the 5700A and dial in the 30 MHz correction for the A55, the attenuators, and the current active calibration constant. You do this by adjusting the 5700A knob for a 5700A error display of the same sign and magnitude as the total error entry 70 mV range at the bottom of Table 3-11.
27. Raise the front of the guard cover and adjust C20 for -3500 PPM ± 1000 PPM.
28. Set the 5700A to standby and remove the A55 and attenuators.
29. Replace the covers and screws.

3-25. Verification

Main input verification is presented first, followed by WIDEBAND input verification.

Note

All performance limits specified in the test records apply to 90-day specifications for the 5790A. For Wideband verification, the 2 year or 1 year specifications are used where there are no 90 day specifications. If limits to other specifications are desired, the test records must be modified.

Note

Equivalent equipment and methods, either manual or automated, may be substituted for the following verification tests as long as the same points are tested, and equipment and standards used are at least as accurate as those specified. If standards are less accurate than specified, appropriate tolerance limit and/or accuracy reductions must be made to achieve equivalent results.

3-26. Verifying the Main Input (INPUT 1 or 2)

Verifying the Main Input requires measurements and calculations that result in over 400 entries in a test record. At Fluke, an automated procedure is used as described in the introduction to this section. Test voltages and frequencies are divided into five regions as defined in Table 3-12. The procedures you use for each region are described next

Note

Refer to Figures 3-5 and 3-8 for test setups.

Table 3-12. Main Input Verification Regions

Ranges	AC-DC Difference Error	Absolute AC Error
2.2 V through 1000 V	Region I	Region II
70 mV through 700 mV	Region III	Region IV
7 mV through 22 mV	No spec	Region V

To do the procedure manually, make copies of the rest of the worksheets in this section before you proceed. Table 3-13 is the overall test record for main input verification.

Table 3-13. Test Record for Main Input Verification

Step No.	5790A Range	Test Voltage (V)	Frequency	AC Source Max. Uncertainty (Note)	90 Day Absolute AC Error Spec (± ppm)	1 Yr Absolute AC Error Spec (± ppm)	Measured Absolute AC Error (PPM)	2 Yr AC-DC Error Spec (± ppm)	Measured AC-DC Error (PPM)
1	0.0022	0.002	10 Hz	1700[1]	2350	2350		No spec	
2	0.0022	0.002	20 Hz	700[1]	1390	1390		No spec	
3	0.0022	0.002	100 Hz	400[1]	1070	1070		No spec	
4	0.0022	0.002	1 kHz	400[1]	1070	1070		No spec	
5	0.0022	0.002	10 kHz	400[1]	1070	1070		No spec	
6	0.0022	0.002	20 kHz	400[1]	1070	1070		No spec	
7	0.0022	0.002	50 kHz	800[1]	1810	1810		No spec	
8	0.0022	0.002	100 kHz	1200[1]	2450	2450		No spec	
9	0.0022	0.002	300 kHz	2300[1]	4300	4300		No spec	
10	0.0022	0.002	500 kHz	2300[1]	5400	6400		No spec	
11	0.0022	0.002	1 MHz	2300[1]	6200	7500		No spec	
12	0.007	0.006	10 Hz	840[1]	1070	1070		No spec	
13	0.007	0.006	20 Hz	360[1]	587	587		No spec	
14	0.007	0.006	100 Hz	200[1]	427	427		No spec	
15	0.007	0.006	1 kHz	200[1]	427	427		No spec	
16	0.007	0.006	10 kHz	200[1]	427	427		No spec	
17	0.007	0.006	20 kHz	200[1]	427	427		No spec	
18	0.007	0.006	50 kHz	400[1]	733	733		No spec	
19	0.007	0.006	100 kHz	600[1]	1020	1020		No spec	
20	0.007	0.006	300 kHz	1200[1]	1870	1870		No spec	
21	0.007	0.006	500 kHz	1200[1]	2300	2600		No spec	
22	0.007	0.006	1 MHz	1200[1]	3000	3600		No spec	
23	0.022	0.02	10 Hz	280[1]	355	355		No spec	
24	0.022	0.02	20 Hz	180[1]	245	245		No spec	
25	0.022	0.02	100 Hz	100[1]	175	175		No spec	
26	0.022	0.02	1 kHz	100[1]	175	175		No spec	
27	0.022	0.02	10 kHz	100[1]	175	175		No spec	
28	0.022	0.02	20 kHz	100[1]	175	175		No spec	
29	0.022	0.02	50 kHz	200[1]	310	310		No spec	
30	0.022	0.02	100 kHz	300[1]	435	435		No spec	

Table 3-13. Test Record for Main Input Verification (cont.)

Step No.	5790A Range	Test Voltage (V)	Frequency	AC Source Max. Uncertainty (Note)	90 Day Absolute AC Error Spec (± ppm)	1 Yr Absolute AC Error Spec (± ppm)	Measured Absolute AC Error (PPM)	2 Yr AC-DC Error Spec (± ppm)	Measured AC-DC Error (PPM)
31	0.022	0.02	300 kHz	720[1]	1010	1010		No spec	
32	0.022	0.02	500 kHz	720[1]	1160	1290		No spec	
33	0.022	0.02	1 MHz	720[1]	1700	2100		No spec	
34	0.07	0.06	10 Hz	230	265	265		No spec	
35	0.07	0.06	20 Hz	120	145	145		No spec	
36	0.07	0.06	100 Hz	60	89	90		No spec	
37	0.07	0.06	1 kHz	60	89	90		No spec	
38	0.07	0.06	10 kHz	60	89	90		No spec	
39	0.07	0.06	20 kHz	60	89	90		No spec	
40	0.07	0.06	50 kHz	120	153	163		No spec	
41	0.07	0.06	100 kHz	250	302	302		No spec	
42	0.07	0.06	300 kHz	500	577	577		No spec	
43	0.07	0.06	500 kHz	600	760	803		No spec	
44	0.07	0.06	1 MHz	600	1200	1230		No spec	
45	0.22	0.2	10 Hz	200	218	218		210	
46	0.22	0.2	20 Hz	80	92	93		82	
47	0.22	0.2	100 Hz	30	45	46		34	
48	0.22	0.2	1 kHz	30	45	46		34	
49	0.22	0.2	10 kHz	30	45	46		34	
50	0.22	0.2	20 kHz	30	45	46		34	
51	0.22	0.2	50 kHz	65	79	79		67	
51A	0.22	0.2	100 kHz						
52	0.22	0.2	300 kHz	220	260	270		No spec	
53	0.22	0.2	500 kHz	250	390	420		No spec	
54	0.22	0.2	1 MHz	300	970	1040		No spec	
55	0.7	0.6	10 Hz	200	213	213		210	
56	0.7	0.6	20 Hz	70	78	79		73	
57	0.7	0.6	100 Hz	22	34	36		27	
58	0.7	0.6	1 kHz	22	34	36		27	
59	0.7	0.6	10 kHz	22	34	36		27	

Table 3-13. Test Record for Main Input Verification (cont.)

Step No.	5790A Range	Test Voltage (V)	Frequency	AC Source Max. Uncertainty (Note)	90 Day Absolute AC Error Spec (± ppm)	1 Yr Absolute AC Error Spec (± ppm)	Measured Absolute AC Error (PPM)	2 Yr AC-DC Error Spec (± ppm)	Measured AC-DC Error (PPM)
60	0.7	0.6	20 kHz	22	34	36		27	
61	0.7	0.6	50 kHz	45	53	54		47	
62	0.7	0.6	100 kHz	60	83	83		No spec	
63	0.7	0.6	300 kHz	130	167	187		No spec	
64	0.7	0.6	500 kHz	140	310	313		No spec	
65	0.7	0.6	1 MHz	140	910	973		No spec	
66	2.2	2.0	10 Hz	190	200	200		200	
67	2.2	2.0	20 Hz	60	65	66		63	
68	2.2	2.0	100 Hz	10	22	24		18	
69	2.2	2.0	1 kHz	10	22	24		18	
70	2.2	2.0	10 kHz	10	22	24		18	
71	2.2	2.0	20 kHz	10	22	24		18	
72	2.2	2.0	50 kHz	40	45	46		43	
73	2.2	2.0	100 kHz	50	70	71		No spec	
74	2.2	2.0	300 kHz	115	150	160		No spec	
75	2.2	2.0	500 kHz	125	250	260		No spec	
76	2.2	2.0	1 MHz	125	840	900		No spec	
77	7.0	6.0	10 Hz	190	200	200		200	
78	7.0	6.0	20 Hz	60	66	67		63	
79	7.0	6.0	100 Hz	10	22	24		18	
80	7.0	6.0	1 kHz	10	22	24		18	
81	7.0	6.0	10 kHz	10	22	24		18	
82	7.0	6.0	20 kHz	10	22	24		18	
83	7.0	6.0	50 kHz	40	46	48		44	
84	7.0	6.0	100 kHz	50	80	81		No spec	
85	7.0	6.0	300 kHz	120	180	190		No spec	
86	7.0	6.0	500 kHz	125	380	400		No spec	
87	7.0	6.0	1 MHz	125	1100	1200		No spec	
88	22	20.0	10 Hz	190	200	200		123	
89	22	20.0	20 Hz	60	66	67		123	

Table 3-13. Test Record for Main Input Verification (cont.)

Step No.	5790A Range	Test Voltage (V)	Frequency	AC Source Max. Uncertainty (Note)	90 Day Absolute AC Error Spec (± ppm)	1 Yr Absolute AC Error Spec (± ppm)	Measured Absolute AC Error (PPM)	2 Yr AC-DC Error Spec (± ppm)	Measured AC-DC Error (PPM)
90	22	20.0	100 Hz	15	25	27		21	
91	22	20.0	1 kHz	15	25	27		21	
92	22	20.0	10 kHz	15	25	27		21	
93	22	20.0	20 kHz	15	25	27		21	
94	22	20.0	50 kHz	40	46	48		44	
95	22	20.0	100 kHz	50	80	81		No spec	
96	22	20.0	300 kHz	120	180	190		No spec	
97	22	20.0	500 kHz	125	380	400		No spec	
98	22	20.0	1 MHz	125	1100	1200		No spec	
99	70	60.0	10 Hz	190	200	200		200	
100	70	60.0	20 Hz	60	67	68		63	
101	70	60.0	100 Hz	20	30	32		25	
102	70	60.0	1 kHz	20	30	32		25	
103	70	60.0	10 kHz	20	30	32		25	
104	70	60.0	20 kHz	20	30	32		25	
105	70	60.0	50 kHz	50	56	57		55	
106	70	60.0	100 kHz	65	91	94		No spec	
107	70	60.0	300 kHz	130	190	200		No spec	
108	220	200.0	10 Hz	190	200	200		200	
109	220	200.0	20 Hz	60	67	68		63	
110	220	200.0	100 Hz	18	29	31		23	
111	220	200.0	1 kHz	18	29	31		23	
112	220	200.0	10 kHz	18	29	31		23	
113	220	200.0	20 kHz	18	29	31		23	
114	220	200.0	50 kHz	60	67	69		63	
115	220	200.0	100 kHz	70	96	98		No spec	
116	700	600.0	100 Hz	27	39	41		36	
117	700	600.0	1 kHz	27	39	41		36	
118	700	600.0	10 kHz	30	39	41		36	
119	700	600.0	20 kHz	30	39	41		36	

Table 3-13. Test Record for Main Input Verification (cont.)

Step No.	5790A Range	Test Voltage (V)	Frequency	AC Source Max. Uncertainty (Note)	90 Day Absolute AC Error Spec (± ppm)	1 Yr Absolute AC Error Spec (± ppm)	Measured Absolute AC Error (PPM)	2 Yr AC-DC Error Spec (± ppm)	Measured AC-DC Error (PPM)
120	700	600.0	50 kHz	60	120	130		No spec	
121	700	600.0	100 kHz	70	400	500		No spec	
122	1000	1000.0	100 Hz	25	37	38		33	
123	1000	1000.0	1 kHz	25	37	38		33	
124	1000	1000.0	10 kHz	27	37	38		33	
125	1000	1000.0	20 kHz	27	37	38		33	
126	1000	600.0	50 kHz	60	120	130		No spec	
127	1000	600.0	100 kHz	70	400	500		No spec	

[1] The AC source maximum uncertainty can be met by measuring down scale on the next higher range of the 5790A as described in the procedure.

Table 3-13a. Main Input Frequency Verification

STEP NO.	5790A RANGE	VOLTAGE (V)[1]	TEST FREQUENCY	1 YEAR FREQUENCY SPEC	MEASURED FREQUENCY ERROR
1	2.2	2	10 Hz	.01 Hz	
2	2.2	2	1 kHz	.0003 kHz	
3	2.2	2	1 MHz	.0003 MHz	

[1] Apply the test voltage into the 5790A (INPUT 1 or INPUT 2) and PM6666 counter. The “Measured Error” is the deviation of the 5790A from the counter.

3-27. Verifying AC-DC Difference for Regions I and III (220 mV through 1000 V Range)

You calculate the AC-DC difference error by comparing the AC-DC difference of the source as measured by the 5790A and the 792A. To do this, use the instrument setup and technique as described under “AC Calibration”.

Proceed as follows to verify AC-DC difference in regions I and III:

1. Use the setup in Figure 3-8 and the procedure under “AC Calibration”.
2. For each point, take AC and DC measurements and enter them in copies of worksheet Figure 3-15 or Figure 3-16. Use Figure 3-15 and characterized DC settings for the 700 mV, 220 mV and 70 mV ranges as follows: Set the 5700A to nominal, than use the knob to adjust for the error display you recorded in Table 3-3. The procedure to obtain those settings is described under “Characterizing the DC Source” at the beginning of the calibration instructions in this chapter. Use Figure 3-16 and nominal DC outputs for ranges other than those listed earlier in this step.
3. Calculate the AC-DC difference error as shown in Figure 3-15 or 3-16. Enter the result in the Table 3-13.

3-28. Verifying Absolute AC Error for Region IV (70 mV through 700 mV Range)

You calculate absolute AC error by measuring the absolute AC of the source signal and comparing it to the AC measured by the 5790A.

Proceed as follows to verify absolute AC for Region IV:

1. Use the setup in Figure 3-8 and the procedure under “AC Calibration”.
2. For each point, take the AC and DC measurements and enter them in Figure 3-17. To verify the 5790A to its specifications, the tolerance of calibration source must meet or exceed the tolerances shown in Table 3-13. Use characterized DC settings as follows: Set the 5700A to nominal, then use the knob to adjust for the error display recorded in Table 3-3.
3. Calculate the absolute AC error as shown in Figure 3-17. Enter the result in Table 3-13.

VOLTAGE (NOMINAL) ______________________

FREQUENCY ______________________

5700A ERROR DISPLAY FROM TABLE 3-3, POSITIVE ______________________

5700A ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ______________________

792A CORRECTION (PPM) ______________________

	792A	5790A
+DC		
-DC		
$DC_{AVERAGE}$	DC_{792} =	DC_{5790} =
AC	AC_{792} =	AC_{5790} =
AC-DC ERROR =		

$$DC_{AVERAGE} = \left(\frac{|+DC| + |-DC|}{2} \right)$$

$$\text{AC - DC ERROR (PPM)} = \left(\left[\frac{DC_{5790} - AC_{5790}}{DC_{5790}} \right] - \left[\frac{DC_{792} - AC_{792}}{DC_{792}} \right] \right) * 10^6 + 792\ \text{CORR}$$

elu043.eps

Figure 3-15. Worksheet for AC-DC Error, 70 mV through 700 mV Ranges

VOLTAGE (NOMINAL) ____________________

FREQUENCY ____________________

792A CORRECTION (PPM) ____________________

	792A	5790A
+DC		
-DC		
$DC_{AVERAGE}$	DC_{792} =	DC_{5790} =
AC	AC_{792} =	AC_{5790} =
AC-DC ERROR =		

$$DC_{AVERAGE} = \left(\frac{|+DC| + |-DC|}{2} \right)$$

$$\text{AC - DC ERROR (PPM)} = \left(\left[\frac{DC_{5790} - AC_{5790}}{DC_{5790}} \right] - \left[\frac{DC_{792} - AC_{792}}{DC_{792}} \right] \right) \cdot 10^6 + 792\ \text{CORR}$$

elu044.eps

Figure 3-16. Worksheet for AC-DC Error, All Other Ranges

VOLTAGE (NOMINAL) ____________________

FREQUENCY ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, POSITIVE ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ____________________

792A CORRECTION (PPM) ____________________

	792A	5790A
+DC		
-DC		
$DC_{AVERAGE}$	DC_{792} =	
AC	AC_{792} =	AC_{5790} =
AC ERROR =		

$$DC_{AVERAGE} = \left(\frac{|{+DC}| + |{-DC}|}{2}\right)$$

$$\text{AC ERROR (PPM)} = \left[\frac{AC_{5790} - DC_{NOMINAL} * \left(\frac{AC_{792}}{DC_{792}} + \frac{792\ CORR}{10^6}\right)}{DC_{NOMINAL}}\right] * 10^6$$

elu045.eps

Figure 3-17. Worksheet for Absolute AC Error, 70 mV through 700 mV Ranges

3-29. Verifying Absolute AC Error for Region II (2.2 V through 1000 V Range)

Because of the loading of 792A in its 700 mV to 1000 V ranges, the DC voltage at the reference point of the calibration (center of the tee) is not the same as the DC voltage at the output terminals of the source unless sense terminals are provided for the source to the tee. If sense terminals are provided for DC, the absolute AC error may be determined as for region II; however, the sense connections should be removed when the AC measurements are being made.

Alternatively, you can determine DC errors and AC-DC errors independently, then combine them. This is the procedure presented here.

In this case, you take the measurements and make calculations in the same way as Regions I and III to obtain the AC-DC errors (You may have already calculated these errors if you are verifying both the AC-DC and the absolute AC performance of the instrument). You then take DC measurements and calculate DC errors. Combine the errors to obtain absolute AC error.

Proceed as follows to use the error combination method:

1. To determine the DC errors, connect the test equipment as shown in Figure 3-5.
2. Use characterized 5700A DC settings as follows: Set the 5700A to nominal, than use the knob to adjust for the error display you recorded in Table 3-3. Take dual polarity DC readings and record them in Figure 3-18. To verify the 5790A to its specifications, the tolerance of the DC source must meet or exceed the tolerances shown in Table 3-10.
3. Calculate the DC error as shown in Figure 3-18.
4. Combine the DC errors and the AC-DC errors using the following equation to obtain the absolute AC reading error and enter the result in Table 3-13. AC READING ERROR = DC ERROR - (AC - DC ERROR).

3-30. Verifying Absolute AC Error for Region V (2.2 mV through 22 mV)

For the 7 mV through the 22 mV ranges, use a bootstrapping technique. After you verify the 70 mV range, apply each test voltage and frequency to both the verified range and the range under test. Accept the reading on the verified range after showing that it is operating within specifications. Step down through the ranges as described in the calibration procedures and shown in Figure 3-9 until the 2.2 mV range is verified. On each range tested, use the following formula and enter the results in Table 3-13.

Note

In the following formula, "AC VERIFIED RANGE ERROR (PPM)" is previously determined error for the verified range at the frequency being tested.

$$AC\ ERROR\ (PPM) = \left[\left(\frac{AC\ UUT\ RANGE - AC\ VERIFIED\ RANGE}{AC\ NOMINAL}\right) X\ 10^6\right] - AC\ VERIFIED\ RANGE\ ERROR\ (PPM)$$

3-31. Verifying the Wideband AC Option

Wideband verification is an optional test for those who want to verify that the 5790A WIDEBAND input (requires Option 5790A-03) is within tolerance. There are two worksheets and one test record to facilitate this procedure. You will need 1 copy of Table 3-14, 8 copies of Table 3-15 (one for each voltage range) and 1 copy of the overall test record, Table 3-16.

VOLTAGE (NOMINAL) ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, POSITIVE ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ____________________

	5790A READING
+DC	
-DC	
$DC_{5790} =$	
DC ERROR =	

$$DC_{5790} = \left(\frac{|+DC| + |-DC|}{2} \right)$$

$$\text{DC ERROR (PPM)} = \left(\frac{DC_{5790} - DC_{NOMINAL}}{DC_{NOMINAL}} \right) * 10^{6}$$

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Figure 3-18. Worksheet for DC Error, 2.2 V through 1000 V Ranges

Table 3-14. Worksheet for Wideband 22 mV, 7 mV, and 2.2 mV 1 kHz Gain

Range	Input Voltage	Measured by 5790A at INPUT 1	Measured by 8506A/8920A at INPUT 1	
22 mV	10 mV			
7 mV	3.2 mV			
2.2 mV	1 mV			

Table 3-15. Wideband Flatness Verification Worksheet

				___________Range					
Frequency	A55 Corr. (PPM)	5790A Error (PPM)	5700A Error (PPM)	10 dB Error (PPM)	20 dB Error (PPM)	20 dB Error (PPM)	20 dB Error (PPM)	Total Error(PPM)	1 kHz Ref Error (Enter Once)
10 Hz									X
20 Hz									X
50 Hz									X
100 Hz									X
200 Hz									X
2 kHz									X
10 kHz									X
20 kHz									X
50 kHz									X
100 kHz									X
200 kHz									X
500 kHz									X
700 kHz									X
1 MHz									X
1.2 MHz									X
2 MHz									X
3 MHz									X
4 MHz									X
6 MHz									X
8 MHz									X
9 MHz									X

Table 3-15. Wideband Flatness Verification Worksheet (cont.)

				___________Range					
Frequency	A55 Corr. (PPM)	5790A Error (PPM)	5700A Error (PPM)	10 dB Error (PPM)	20 dB Error (PPM)	20 dB Error (PPM)	20 dB Error (PPM)	Total Error(PPM)	1 kHz Ref Error (Enter Once)
10 MHz									X
12 MHz									X
15 MHz									X
17 MHz									X
20 MHz									X
23 MHz									X
26 MHz									X
28 MHz									X
30 MHz									X

Table 3-16. Wideband Verification Test Record

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
1	7 V	3.2 V	10 Hz	0.012[1]	0.10		0.31	
2	7 V	3.2 V	20 Hz	0.007[1]	0.10		0.31	
3	7 V	3.2 V	50 Hz	0.007[1]	0.03		0.31	
4	7 V	3.2 V	100 Hz	0.007[1]	0.03		0.31	
5	7 V	3.2 V	200 Hz	0.007[1]	0.03		0.31	
6	7 V	3.2 V	1 kHz	0.08[2]	N/A		0.31	
7	7 V	3.2 V	2 kHz	0.007[1]	0.03		0.31	
8	7 V	3.2 V	10 kHz	0.007[1]	0.03		0.31	
9	7 V	3.2 V	20 kHz	0.007[1]	0.03		0.31	
10	7 V	3.2 V	50 kHz	0.007[1]	0.03		0.31	
11	7 V	3.2 V	100 kHz	0.007[1]	0.03		0.31	
12	7 V	3.2 V	200 kHz	0.020[1]	0.03		0.31	
13	7 V	3.2 V	500 kHz	0.020[1]	0.03		0.31	
14	7 V	3.2 V	700 kHz	0.025[1]	0.05		No Spec	No Spec

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
15	7 V	3.2 V	1 MHz	0.025[1]	0.05		No Spec	No Spec
16	7 V	3.2 V	1.2 MHz	0.050[1]	0.05		No Spec	No Spec
17	7 V	3.2 V	2 MHz	0.050[1]	0.05		No Spec	No Spec
18	7 V	3.2 V	3 MHz	0.100[1]	0.10		No Spec	No Spec
19	7 V	3.2 V	4 MHz	0.100[1]	0.10		No Spec	No Spec
20	7 V	3.2 V	6 MHz	0.100[1]	0.10		No Spec	No Spec
21	7 V	3.2 V	8 MHz	0.100[1]	0.10		No Spec	No Spec
22	7 V	3.2 V	9 MHz	0.100[1]	0.10		No Spec	No Spec
23	7 V	3.2 V	10 MHz	0.100[1]	0.10		No Spec	No Spec
24	7 V	3.2 V	12 MHz	0.100[1]	0.15		No Spec	No Spec
25	7 V	3.2 V	15 MHz	0.100[1]	0.15		No Spec	No Spec
26	7 V	3.2 V	17 MHz	0.150[1]	0.15		No Spec	No Spec
27	7 V	3.2 V	20 MHz	0.150[1]	0.15		No Spec	No Spec
28	7 V	3.2 V	23 MHz	0.200[1]	0.35		No Spec	No Spec
29	7 V	3.2 V	26 MHz	0.200[1]	0.35		No Spec	No Spec
30	7 V	3.2 V	28 MHz	0.200[1]	0.35		No Spec	No Spec
31	7 V	3.2 V	30 MHz	0.200[1]	0.35		No Spec	No Spec
32	2.2 V	1.0 V	10 Hz	0.013[1]	0.10		0.33	
33	2.2 V	1.0 V	20 Hz	0.009[1]	0.10		0.33	
34	2.2 V	1.0 V	50 Hz	0.009[1]	0.03		0.33	
35	2.2 V	1.0 V	100 Hz	0.009[1]	0.03		0.33	
36	2.2 V	1.0 V	200 Hz	0.009[1]	0.03		0.33	
37	2.2 V	1.0 V	1 kHz	0.08[2]	N/A		0.33	
38	2.2 V	1.0 V	2 kHz	0.009[1]	0.03		0.33	
39	2.2 V	1.0 V	10 kHz	0.009[1]	0.03		0.33	
40	2.2 V	1.0 V	20 kHz	0.009[1]	0.03		0.33	
41	2.2 V	1.0 V	50 kHz	0.009[1]	0.03		0.33	
42	2.2 V	1.0 V	100 kHz	0.009[1]	0.03		0.33	
43	2.2 V	1.0 V	200 kHz	0.021[1]	0.03		0.33	
44	2.2 V	1.0 V	500 kHz	0.021[1]	0.03		0.33	

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
45	2.2 V	1.0 V	700 kHz	0.025[1]	0.05		No Spec	No Spec
46	2.2 V	1.0 V	1 MHz	0.025[1]	0.05		No Spec	No Spec
47	2.2 V	1.0 V	1.2 MHz	0.050[1]	0.05		No Spec	No Spec
48	2.2 V	1.0 V	2 MHz	0.050[1]	0.05		No Spec	No Spec
49	2.2 V	1.0 V	3 MHz	0.100[1]	0.10		No Spec	No Spec
50	2.2 V	1.0 V	4 MHz	0.100[1]	0.10		No Spec	No Spec
51	2.2 V	1.0 V	6 MHz	0.100[1]	0.10		No Spec	No Spec
52	2.2 V	1.0 V	8 MHz	0.100[1]	0.10		No Spec	No Spec
53	2.2 V	1.0 V	9 MHz	0.100[1]	0.10		No Spec	No Spec
54	2.2 V	1.0 V	10 MHz	0.100[1]	0.10		No Spec	No Spec
55	2.2 V	1.0 V	12 MHz	0.101[1]	0.15		No Spec	No Spec
56	2.2 V	1.0 V	15 MHz	0.101[1]	0.15		No Spec	No Spec
57	2.2 V	1.0 V	17 MHz	0.151[1]	0.15		No Spec	No Spec
58	2.2 V	1.0 V	20 MHz	0.151[1]	0.15		No Spec	No Spec
59	2.2 V	1.0 V	23 MHz	0.201[1]	0.35		No Spec	No Spec
60	2.2 V	1.0 V	26 MHz	0.202[1]	0.35		No Spec	No Spec
61	2.2 V	1.0 V	28 MHz	0.202[1]	0.35		No Spec	No Spec
62	2.2 V	1.0 V	30 MHz	0.202[1]	0.35		No Spec	No Spec
63	700 mV	320 mV	10 Hz	0.013[1]	0.10		0.36	
64	700 mV	320 mV	20 Hz	0.009[1]	0.10		0.36	
65	700 mV	320 mV	50 Hz	0.009[1]	0.03		0.36	
66	700 mV	320 mV	100 Hz	0.009[1]	0.03		0.36	
67	700 mV	320 mV	200 Hz	0.009[1]	0.03		0.36	
68	700 mV	320 mV	1 kHz	0.08[2]	N/A		0.36	
69	700 mV	320 mV	2 kHz	0.009[1]	0.03		0.36	
70	700 mV	320 mV	10 kHz	0.009[1]	0.03		0.36	
71	700 mV	320 mV	20 kHz	0.009[1]	0.03		0.36	
72	700 mV	320 mV	50 kHz	0.009[1]	0.03		0.36	
73	700 mV	320 mV	100 kHz	0.009[1]	0.03		0.36	
74	700 mV	320 mV	200 kHz	0.012[1]	0.03		0.36	
75	700 mV	320 mV	500 kHz	0.012[1]	0.03		0.36	

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
76	700 mV	320 mV	700 kHz	0.025[1]	0.05		No Spec	No Spec
77	700 mV	320 mV	1 MHz	0.025[1]	0.05		No Spec	No Spec
78	700 mV	320 mV	1.2 MHz	0.050[1]	0.05		No Spec	No Spec
79	700 mV	320 mV	2 MHz	0.051[1]	0.05		No Spec	No Spec
80	700 mV	320 mV	3 MHz	0.100[1]	0.10		No Spec	No Spec
81	700 mV	320 mV	4 MHz	0.100[1]	0.10		No Spec	No Spec
82	700 mV	320 mV	6 MHz	0.100[1]	0.10		No Spec	No Spec
83	700 mV	320 mV	8 MHz	0.101[1]	0.10		No Spec	No Spec
84	700 mV	320 mV	9 MHz	0.101[1]	0.10		No Spec	No Spec
85	700 mV	320 mV	10 MHz	0.101[1]	0.10		No Spec	No Spec
86	700 mV	320 mV	12 MHz	0.101[1]	0.15		No Spec	No Spec
87	700 mV	320 mV	15 MHz	0.102[1]	0.15		No Spec	No Spec
88	700 mV	320 mV	17 MHz	0.152[1]	0.15		No Spec	No Spec
89	700 mV	320 mV	20 MHz	0.153[1]	0.15		No Spec	No Spec
90	700 mV	320 mV	23 MHz	0.203[1]	0.35		No Spec	No Spec
91	700 mV	320 mV	26 MHz	0.204[1]	0.35		No Spec	No Spec
92	700 mV	320 mV	28 MHz	0.205[1]	0.35		No Spec	No Spec
93	700 mV	320 mV	30 MHz	0.206[1]	0.35		No Spec	No Spec
94	220 mV	100 mV	10 Hz	0.014[1]	0.10		0.36	
95	220 mV	100 mV	20 Hz	0.010[1]	0.10		0.36	
96	220 mV	100 mV	50 Hz	0.010[1]	0.04		0.36	
97	220 mV	100 mV	100 Hz	0.010[1]	0.04		0.36	
98	220 mV	100 mV	200 Hz	0.010[1]	0.04		0.36	
99	220 mV	100 mV	1 kHz	0.08[2]	N/A		0.36	
100	220 mV	100 mV	2 kHz	0.010[1]	0.04		0.36	
101	220 mV	100 mV	10 kHz	0.010[1]	0.04		0.36	
102	220 mV	100 mV	20 kHz	0.010[1]	0.04		0.36	
103	220 mV	100 mV	50 kHz	0.010[1]	0.04		0.36	
104	220 mV	100 mV	100 kHz	0.010[1]	0.04		0.36	
105	220 mV	100 mV	200 kHz	0.021[1]	0.04		0.36	

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
106	220 mV	100 mV	500 kHz	0.021[1]	0.04		0.36	
107	220 mV	100 mV	700 kHz	0.026[1]	0.05		No Spec	No Spec
108	220 mV	100 mV	1 MHz	0.026[1]	0.05		No Spec	No Spec
109	220 mV	100 mV	1.2 MHz	0.051[1]	0.05		No Spec	No Spec
110	220 mV	100 mV	2 MHz	0.051[1]	0.05		No Spec	No Spec
111	220 mV	100 mV	3 MHz	0.101[1]	0.10		No Spec	No Spec
112	220 mV	100 mV	4 MHz	0.101[1]	0.10		No Spec	No Spec
113	220 mV	100 mV	6 MHz	0.101[1]	0.10		No Spec	No Spec
114	220 mV	100 mV	8 MHz	0.101[1]	0.10		No Spec	No Spec
115	220 mV	100 mV	9 MHz	0.101[1]	0.10		No Spec	No Spec
116	220 mV	100 mV	10 MHz	0.101[1]	0.10		No Spec	No Spec
117	220 mV	100 mV	12 MHz	0.102[1]	0.15		No Spec	No Spec
118	220 mV	100 mV	15 MHz	0.103[1]	0.15		No Spec	No Spec
119	220 mV	100 mV	17 MHz	0.153[1]	0.15		No Spec	No Spec
120	220 mV	100 mV	20 MHz	0.154[1]	0.15		No Spec	No Spec
121	220 mV	100 mV	23 MHz	0.205[1]	0.35		No Spec	No Spec
122	220 mV	100 mV	26 MHz	0.206[1]	0.35		No Spec	No Spec
123	220 mV	100 mV	28 MHz	0.207[1]	0.35		No Spec	No Spec
124	220 mV	100 mV	30 MHz	0.208[1]	0.35		No Spec	No Spec
125	70 mV	32 mV	10 Hz	0.014[1]	0.10		0.46	
126	70 mV	32 mV	20 Hz	0.010[1]	0.10		0.46	
127	70 mV	32 mV	50 Hz	0.010[1]	0.05		0.46	
128	70 mV	32 mV	100 Hz	0.010[1]	0.05		0.46	
129	70 mV	32 mV	200 Hz	0.010[1]	0.05		0.46	
130	70 mV	32 mV	1 kHz	0.10[2]	N/A		0.46	
131	70 mV	32 mV	2 kHz	0.010[1]	0.05		0.46	
132	70 mV	32 mV	10 kHz	0.010[1]	0.05		0.46	
133	70 mV	32 mV	20 kHz	0.010[1]	0.05		0.46	
134	70 mV	32 mV	50 kHz	0.010[1]	0.05		0.46	
135	70 mV	32 mV	100 kHz	0.010[1]	0.05		0.46	
136	70 mV	32 mV	200 kHz	0.021[1]	0.05		0.46	

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
137	70 mV	32 mV	500 kHz	0.021[1]	0.05		0.46	
138	70 mV	32 mV	700 kHz	0.026[1]	0.05		No Spec	No Spec
139	70 mV	32 mV	1 MHz	0.051[1]	0.05		No Spec	No Spec
140	70 mV	32 mV	1.2 MHz	0.051[1]	0.05		No Spec	No Spec
141	70 mV	32 mV	2 MHz	0.101[1]	0.05		No Spec	No Spec
142	70 mV	32 mV	3 MHz	0.101[1]	0.10		No Spec	No Spec
143	70 mV	32 mV	4 MHz	0.101[1]	0.10		No Spec	No Spec
144	70 mV	32 mV	6 MHz	0.101[1]	0.10		No Spec	No Spec
145	70 mV	32 mV	8 MHz	0.101[1]	0.10		No Spec	No Spec
146	70 mV	32 mV	9 MHz	0.101[1]	0.10		No Spec	No Spec
147	70 mV	32 mV	10 MHz	0.101[1]	0.10		No Spec	No Spec
148	70 mV	32 mV	12 MHz	0.102[1]	0.15		No Spec	No Spec
149	70 mV	32 mV	15 MHz	0.104[1]	0.15		No Spec	No Spec
150	70 mV	32 mV	17 MHz	0.154[1]	0.15		No Spec	No Spec
151	70 mV	32 mV	20 MHz	0.156[1]	0.15		No Spec	No Spec
152	70 mV	32 mV	23 MHz	0.206[1]	0.35		No Spec	No Spec
153	70 mV	32 mV	26 MHz	0.209[1]	0.35		No Spec	No Spec
154	70 mV	32 mV	28 MHz	0.210[1]	0.35		No Spec	No Spec
155	70 mV	32 mV	30 MHz	0.212[1]	0.35		No Spec	No Spec
156	22 mV	10 mV	10 Hz	0.015[1]	0.10		0.5	
157	22 mV	10 mV	20 Hz	0.011[1]	0.10		0.5	
158	22 mV	10 mV	50 Hz	0.011[1]	0.05		0.5	
159	22 mV	10 mV	100 Hz	0.011[1]	0.05		0.5	
160	22 mV	10 mV	200 Hz	0.011[1]	0.05		0.5	
161	22 mV	10 mV	1 kHz	0.10[2]	N/A		0.5	
162	22 mV	10 mV	2 kHz	0.011[1]	0.05		0.5	
163	22 mV	10 mV	10 kHz	0.011[1]	0.05		0.5	
164	22 mV	10 mV	20 kHz	0.011[1]	0.05		0.5	
165	22 mV	10 mV	50 kHz	0.011[1]	0.05		0.5	
166	22 mV	10 mV	100 kHz	0.011[1]	0.05		0.5	

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
167	22 mV	10 mV	200 kHz	0.022[1]	0.07		0.5	
168	22 mV	10 mV	500 kHz	0.022[1]	0.07		0.5	
169	22 mV	10 mV	700 kHz	0.026[1]	0.07		No Spec	No Spec
170	22 mV	10 mV	1 MHz	0.026[1]	0.07		No Spec	No Spec
171	22 mV	10 mV	1.2 MHz	0.051[1]	0.07		No Spec	No Spec
172	22 mV	10 mV	2 MHz	0.052[1]	0.07		No Spec	No Spec
173	22 mV	10 mV	3 MHz	0.101[1]	0.10		No Spec	No Spec
174	22 mV	10 mV	4 MHz	0.101[1]	0.10		No Spec	No Spec
175	22 mV	10 mV	6 MHz	0.101[1]	0.10		No Spec	No Spec
176	22 mV	10 mV	8 MHz	0.102[1]	0.10		No Spec	No Spec
177	22 mV	10 mV	9 MHz	0.102[1]	0.10		No Spec	No Spec
178	22 mV	10 mV	10 MHz	0.102[1]	0.10		No Spec	No Spec
179	22 mV	10 mV	12 MHz	0.103[1]	0.17		No Spec	No Spec
180	22 mV	10 mV	15 MHz	0.105[1]	0.17		No Spec	No Spec
181	22 mV	10 mV	17 MHz	0.155[1]	0.17		No Spec	No Spec
182	22 mV	10 mV	20 MHz	0.157[1]	0.17		No Spec	No Spec
183	22 mV	10 mV	23 MHz	0.208[1]	0.37		No Spec	No Spec
184	22 mV	10 mV	26 MHz	0.210[1]	0.37		No Spec	No Spec
185	22 mV	10 mV	28 MHz	0.212[1]	0.37		No Spec	No Spec
186	22 mV	10 mV	30 MHz	0.214[1]	0.37		No Spec	No Spec
187	7 mV	3.2 mV	10 Hz	0.015[1]	0.10		0.55	
188	7 mV	3.2 mV	20 kHz	0.011[1]	0.10		0.55	
189	7 mV	3.2 mV	50 kHz	0.011[1]	0.05		0.55	
190	7 mV	3.2 mV	100 kHz	0.011[1]	0.05		0.55	
191	7 mV	3.2 mV	200 kHz	0.011[1]	0.05		0.55	
192	7 mV	3.2 mV	1 kHz	0.10[2]	N/A		0.55	
193	7 mV	3.2 mV	2 kHz	0.011[1]	0.05		0.55	
194	7 mV	3.2 mV	10 kHz	0.011[1]	0.05		0.55	
195	7 mV	3.2 mV	20 kHz	0.011[1]	0.05		0.55	
196	7 mV	3.2 mV	50 kHz	0.011[1]	0.05		0.55	
197	7 mV	3.2 mV	100 kHz	0.011[1]	0.05		0.55	

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
198	7 mV	3.2 mV	200 kHz	0.022[1]	0.10		0.55	
199	7 mV	3.2 mV	500 kHz	0.022[1]	0.10		0.55	
200	7 mV	3.2 mV	700 kHz	0.026[1]	0.10		No Spec	No Spec
201	7 mV	3.2 mV	1 MHz	0.026[1]	0.10		No Spec	No Spec
202	7 mV	3.2 mV	1.2 MHz	0.051[1]	0.10		No Spec	No Spec
203	7 mV	3.2 mV	2 MHz	0.052[1]	0.10		No Spec	No Spec
204	7 mV	3.2 mV	3 MHz	0.101[1]	0.13		No Spec	No Spec
205	7 mV	3.2 mV	4 MHz	0.101[1]	0.13		No Spec	No Spec
206	7 mV	3.2 mV	6 MHz	0.101[1]	0.13		No Spec	No Spec
207	7 mV	3.2 mV	8 MHz	0.102[1]	0.13		No Spec	No Spec
208	7 mV	3.2 mV	9 MHz	0.102[1]	0.13		No Spec	No Spec
209	7 mV	3.2 mV	10 MHz	0.102[1]	0.13		No Spec	No Spec
210	7 mV	3.2 mV	12 MHz	0.104[1]	0.20		No Spec	No Spec
211	7 mV	3.2 mV	15 MHz	0.106[1]	0.20		No Spec	No Spec
212	7 mV	3.2 mV	17 MHz	0.156[1]	0.20		No Spec	No Spec
213	7 mV	3.2 mV	20 MHz	0.159[1]	0.20		No Spec	No Spec
214	7 mV	3.2 mV	23 MHz	0.209[1]	0.40		No Spec	No Spec
215	7 mV	3.2 mV	26 MHz	0.213[1]	0.40		No Spec	No Spec
216	7 mV	3.2 mV	28 MHz	0.215[1]	0.40		No Spec	No Spec
217	7 mV	3.2 mV	30 MHz	0.218[1]	0.40		No Spec	No Spec
218	2.2 mV	1 mV	10 Hz	0.016[1]	0.10		0.62	
219	2.2 mV	1 mV	20 Hz	0.012[1]	0.10		0.62	
220	2.2 mV	1 mV	50 Hz	0.012[1]	0.05		0.62	
221	2.2 mV	1 mV	100 Hz	0.012[1]	0.05		0.62	
222	2.2 mV	1 mV	200 Hz	0.012[1]	0.05		0.62	
223	2.2 mV	1 mV	1 kHz	0.15[2]	N/A		0.62	
224	2.2 mV	1 mV	2 kHz	0.012[1]	0.05		0.62	
225	2.2 mV	1 mV	10 kHz	0.012[1]	0.05		0.62	
226	2.2 mV	1 mV	20 kHz	0.012[1]	0.05		0.62	
227	2.2 mV	1 mV	50 kHz	0.012[1]	0.05		0.62	

Table 3-16. Wideband Verification Test Record (cont.)

Step No.	5790A Range	Test Voltage	Frequency	If Using Methods Other Than Specified, Max. Uncert (Note)	1 Yr Flatness Specification	Measured Flatness Error (%)	90 Days Absolute Error Spec (%)	Measured Absolute Error (%)
228	2.2 mV	1 mV	100 kHz	0.012[1]	0.05		0.62	
229	2.2 mV	1 mV	200 kHz	0.022[1]	0.16		0.62	
230	2.2 mV	1 mV	500 kHz	0.022[1]	0.16		0.62	
231	2.2 mV	1 mV	700 kHz	0.027[1]	0.16		No Spec	No Spec
232	2.2 mV	1 mV	1 MHz	0.027[1]	0.16		No Spec	No Spec
233	2.2 mV	1 mV	1.2 MHz	0.051[1]	0.16		No Spec	No Spec
234	2.2 mV	1 mV	2 MHz	0.052[1]	0.16		No Spec	No Spec
235	2.2 mV	1 mV	3 MHz	0.101[1]	0.26		No Spec	No Spec
236	2.2 mV	1 mV	4 MHz	0.102[1]	0.26		No Spec	No Spec
237	2.2 mV	1 mV	6 MHz	0.102[1]	0.26		No Spec	No Spec
238	2.2 mV	1 mV	8 MHz	0.102[1]	0.26		No Spec	No Spec
239	2.2 mV	1 mV	9 MHz	0.102[1]	0.26		No Spec	No Spec
240	2.2 mV	1 mV	10 MHz	0.103[1]	0.26		No Spec	No Spec
241	2.2 mV	1 mV	12 MHz	0.104[1]	0.39		No Spec	No Spec
242	2.2 mV	1 mV	15 MHz	0.107[1]	0.39		No Spec	No Spec
243	2.2 mV	1 mV	17 MHz	0.157[1]	0.39		No Spec	No Spec
244	2.2 mV	1 mV	20 MHz	0.160[1]	0.39		No Spec	No Spec
245	2.2 mV	1 mV	23 MHz	0.211[1]	0.88		No Spec	No Spec
246	2.2 mV	1 mV	26 MHz	0.214[1]	0.88		No Spec	No Spec
247	2.2 mV	1 mV	28 MHz	0.217[1]	0.88		No Spec	No Spec
248	2.2 mV	1 mV	30 MHz	0.220[1]	0.88		No Spec	No Spec

Note: You do not need to use the information in this column if you use the specified equipment and methods. These are minimum use specifications that you can use for planning Wideband calibration or verification using alternate equipment and methods.
[1] Minimum use uncertainty relative to the 1 kHz point in this range.
[2] Minimum use uncertainty.

Table 3-16a. Wide Band Frequency Verification

Step No.	5790a Range	Voltage (V) [1]	Test Frequency	1 year Frequency Spec	Measured Frequency Error
1	2.2	2	10 Hz	.10 Hz	
2	2.2	2	1 MHz	.0003 MHz	
3	2.2	2	10 MHz	.003 MHz	
4	2.2	2	30 MHz	.02 MHz	

[1] Apply the test voltage into the 5790A wideband input and PM6666 counter. The "Measured Error" is the deviation of the 5790A from the counter.

3-32. Wideband 1-kHz Gain VerificatioN, 7V, 2.2V, 700 mV, and 70 mV Ranges

1. Connect the equipment as shown in Figure 3-12. Set the HP 3458A to ACV, "SETACV SYNC," "RES.001."
2. Set the 5790A to the WIDEBAND 7V range.
3. Apply 3.2V at 1kHz from the 5700A, then adjust the 5700A until the 5790A reads 3.2000.
4. Press "SET REF" soft key on the 5790A.
5. Readjust the 5700A until the HP 3458A reads 3.20000V.
6. Read the error on the 5790A display and record on the 1 kHz line in Table 3-16.
7. Proceed to the 2.2V, 700 mV, 220 mV, and 70 mV ranges, repeating steps 2 through 6, applying the voltages listed in Table 3-9 under 5790A INPUT for each range and adjusting the 5700A for the nominal value for each range.

3-33. WIDEBAND 1-kHz GAIN VERIFICATION, 22 mV RANGE

1. Connect the equipment as shown in Figure 3-20, using the attenuators specified in Table 3-9. DO NOT CONNECT the HP 3458A input to the Type "N" tee at this time Set the HP 3458Ato ACV, "SETACV SYNC," "RES .001."
2. Set the 5790A to the WIDEBAND 22 mV range.
3. Apply 3.2V at 1 kHz from the 5700A, then adjust the 5700A until the 5790A reads10.0000 mV.
4. Connect the HP 3458A to the Type "N" tee. Calculate the 5790A error using the following formula:

$$\text{5790A ERROR} = \left(\frac{\text{3458A MEASURED VALUE}}{\text{5790s READING}} - 1 \right) \bullet (-100)$$

5. Record the calculated error on the 1 kHz line in Table 3-16.
6. Disconnect the HP 3458A input from the Type "N" tee.
7. Proceed to the 7 mV and 2.2 mV ranges, repeating steps 2 through 6, applying the voltages and attenuation listed in Table 3-9 for each range and adjusting the 5700A for the nominal value indication on the 5790A.

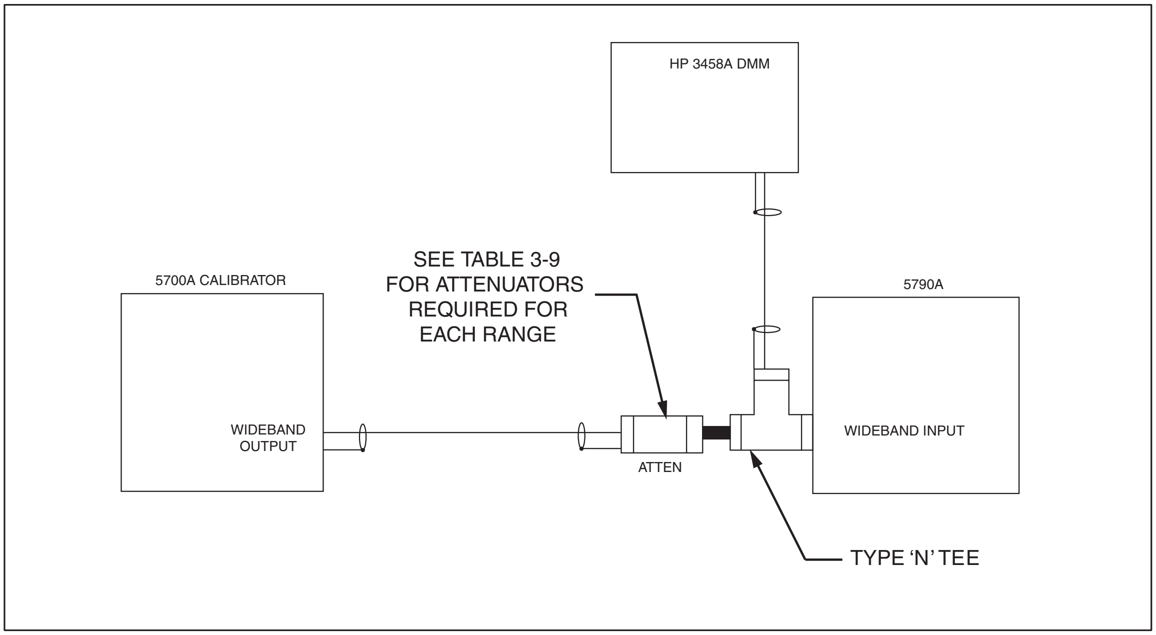

Figure 3-19. Wideband Verification Test Setup, Part 2

3-34. Wideband Gain Verification, 10 Hz to 500 kHz

Gain errors at frequencies other than 1 kHz can be determined by adding the error measured at 1 kHz for that range to the error measured during wideband flatness verification. See Table 3-16.

3-35. Wideband Flatness Verification

Proceed as follows to verify WIDEBAND input flatness:

1. Characterize the AC source by following the procedure under the heading "Characterizing the AC Source" in the Wideband Calibration procedure, earlier in this chapter. Use the Wideband Flatness Verification Worksheet, Table 3-15 instead of Table 3-8. (More frequencies are verified than are calibrated).
2. Connect the equipment as shown in Figure 3-13.
3. The 5700A will be set to a nominal 3.2 V for all flatness verifications. The only deviation from the nominal value will be for calibration corrections for the 5700A and the attenuators.
4. Table 3-9 shows the combinations of attenuators required to scale the input signal properly for each range.
5. All ranges are verified in a similar manner.
6. Obtain 8 copies of Table 3-15 with the 5700A errors recorded in the table; one for each of the 8 voltage ranges.
7. Enter the range (7 V, 2.2 V, 700 mV, 220 mV, 70 mV, 22 mV, 7 mV, and 2.2 mV) in the box at the top of each table.
8. Enter the attenuator corrections as required for each range and add up the errors and enter in the "TOTAL ERROR" column. The total error is the sum of the errors of the 5700A and all attenuators used for that frequency.
9. Proceed to verify each range by first establishing the 1 kHz reference at the beginning of each range.

10. To establish the 1 kHz reference, set the 5700A to 3.2 V and 1 kHz. Let the 5790A measure this value. Record the value in Table 3-15.
11. Press the “SET REF” soft key on the 5790A.
12. Proceed to the first frequency listed in Table 3-15 and adjust the 5700A to the TOTAL ERROR value (sign and magnitude) listed in Table 3-15.
13. Read the error on the 5790A error display and record in the WIDEBAND input verification test record, Table 3-16.
14. Proceed to the next frequency in the table and set the 5700A to 3.2 V. (the error values are set relative to the nominal 3.2 V level). Adjust the 5700A to the TOTAL ERROR value (sign and magnitude) listed in Table 3-15, and read and record the error in Table 3-16.
15. Repeat step 14 for all frequencies in Table 3-15 for that range.
16. Proceed to the next range and establish the 1-kHz reference at 3.2 V as in step 10. Press the “SET REF” soft key on the 5790A, and proceed through each frequency in the table. Reset the 5700A to 3.2 V after each frequency is measured. The error values are set relative to the nominal 3.2 V level.
17. Verify all other ranges in the same way.

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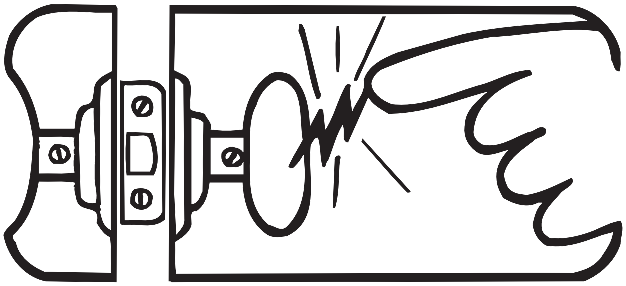
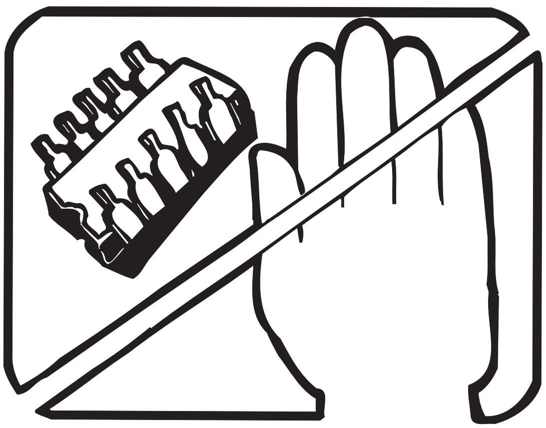


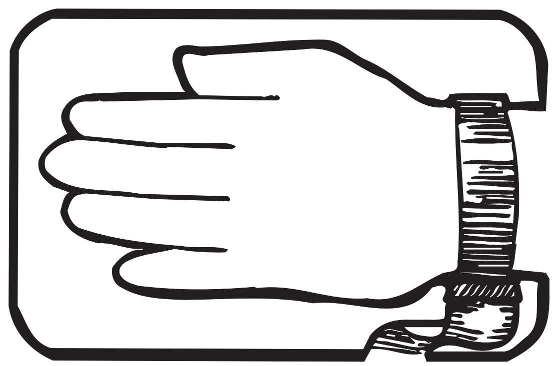
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, packaging, and bench techniques that are recommended.

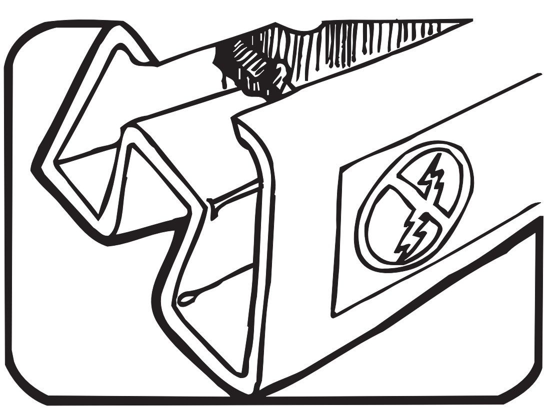
The following practices should be followed to minimize damage to S.S. (static sensitive) devices.



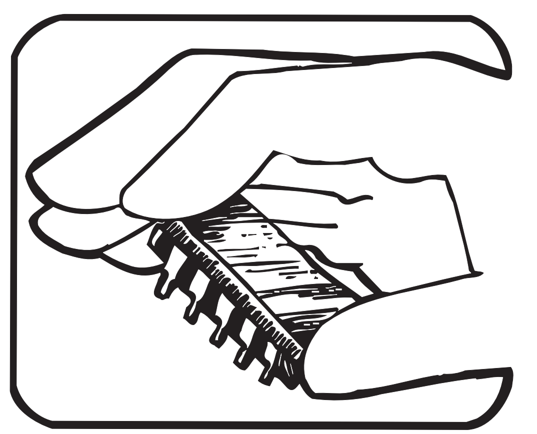
1. MINIMIZE HANDLING



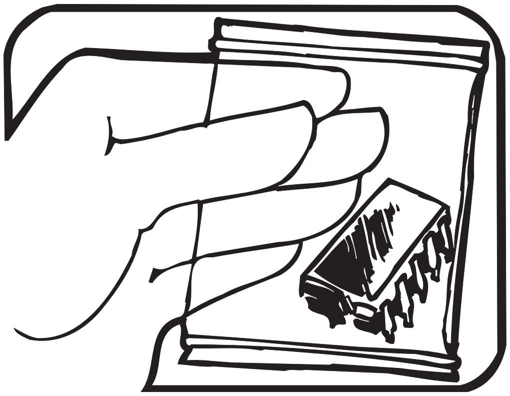
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.

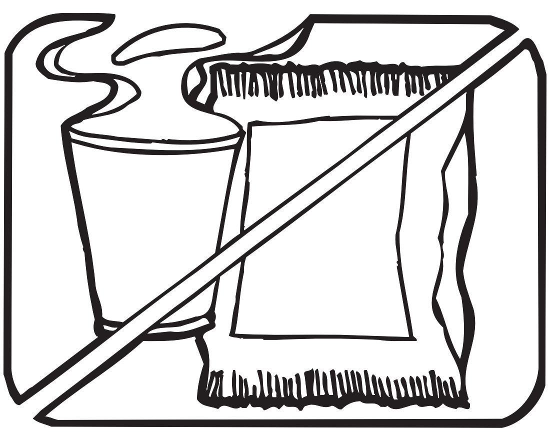


4. HANDLE S.S. DEVICES BY THE BODY.

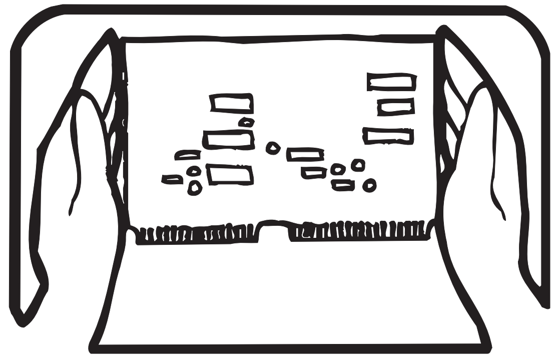


5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT.

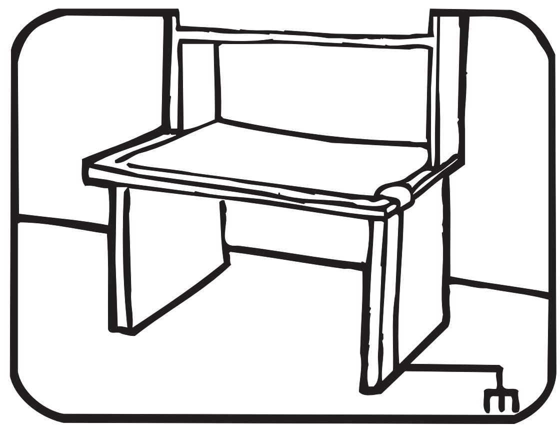
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE.



7. AVOID PLASTIC,VINYL AND STYROFOAM® IN WORK AREA.



8. WHEN REMOVING PLUG-IN ASSEMBLIES HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS PROTECT INSTALLED S.S. DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION.

10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

11. ONLY GROUNDED-TIP SOLDERING IRONS SHOULD BE USED.

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Chapter 4
Maintenance

4-1. Introduction

This chapter covers procedures that do not fall into the category of troubleshooting or repair. This includes access procedures, installation of the Wideband module (Option-03), periodic cleaning, and other special service procedures.

4-2. Cleaning the Air Filter

⚠ Caution

Damage caused by overheating may occur if the area around the fan is restricted, the intake air is too warm, or the air filter becomes clogged.

The air filter must be removed and cleaned every 30 days or more frequently if the 5790A is operated in a dusty environment. The air filter is accessible from the rear panel.

To clean the air filter, refer to Figure 4-1 and proceed as follows:

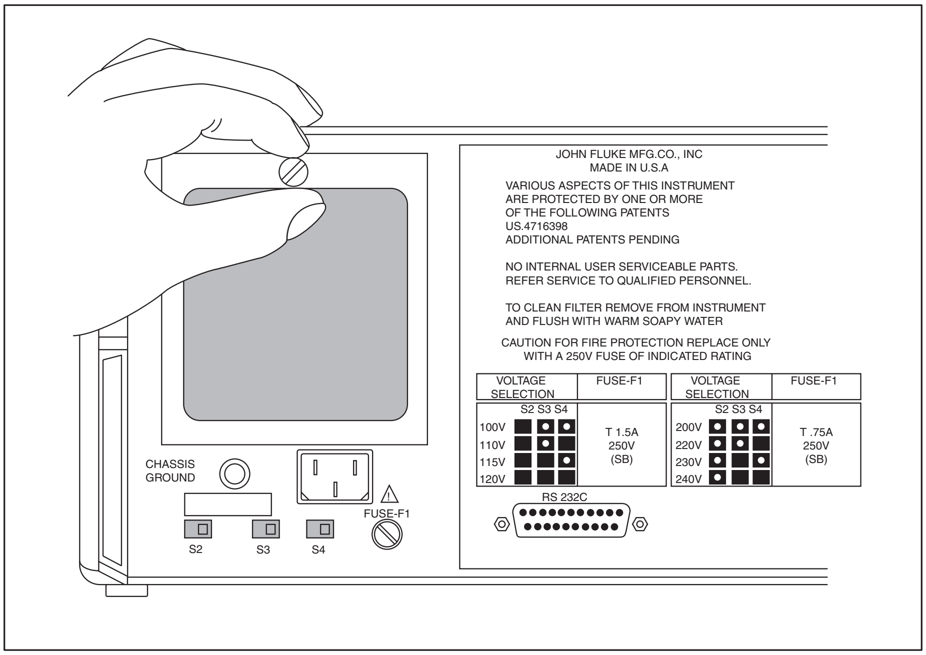
1. Remove the filter element.
    a. Unscrew the knurled screw at the top of the air filter (counterclockwise).
    b. Pull the air filter retainer downward; it hinges at the bottom.
    c. Remove the filter element.
2. Clean the filter element.
    a. Wash the filter element in soapy water.
    b. Rinse the filter element in fresh running water.
    c. Shake out the excess water, then allow the filter element to dry thoroughly before reinstalling it.
3. Reinstall the filter element, its retainer, and the knurled screw.

4-3. General Cleaning

To keep the 5790A looking like new, clean the case, front panel keys, and lens using a soft cloth slightly dampened with water or a non-abrasive mild cleaning solution that does not harm plastics.

⚠ Caution

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. They can damage the plastic materials used in the 5790A.



elu049.eps

Figure 4-1. Accessing the Air Filter

4-4. Cleaning PCA's

Printed circuit assemblies only need cleaning after repair work. After soldering on a pca, remove flux residue using isopropyl alcohol and a cotton swab.

4-5. Access Procedures

⚠ ⚠ Warning

Servicing described in this chapter is to be performed by qualified service personnel only. To avoid electrical shock, do not perform any servicing unless qualified to do so.

4-6. Top and Bottom Covers

Check that power is not connected to 5790A; the power control must be off, and the line power cord must be disconnected. Top and bottom covers are each secured with eight Phillips head screws (four front, four rear).

4-7. Digital Section Cover

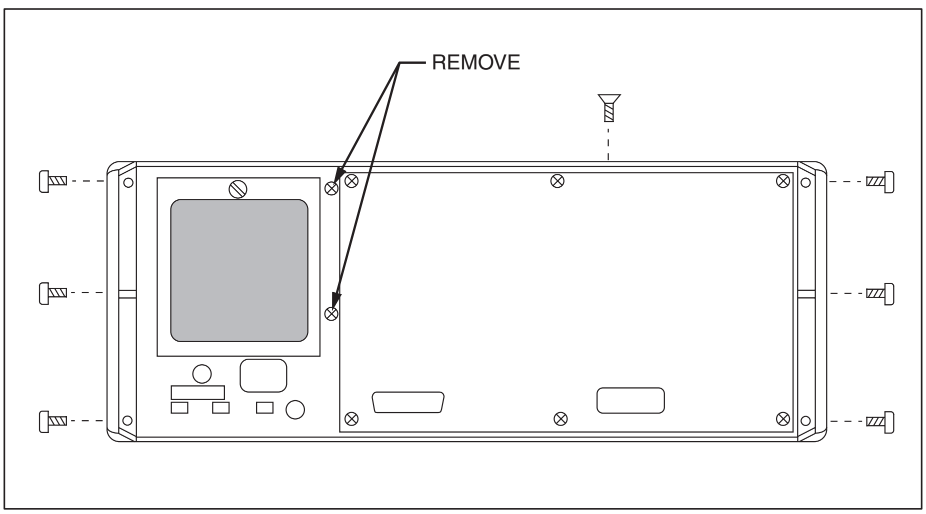
The Digital Section is accessed through one top cover that is secured by six Phillips head screws.

4-8. Analog Section Covers

The Analog Section is enclosed with separate covers on top and bottom. The top cover is secured with six Phillips head screws. The bottom Analog Section cover is secured with eight Phillips head screws (three short, five longer).

4-9. Rear Panel Removal and Installation

Detach the Rear Panel by removing the six hex head screws (three on each rear handle side) and the two Phillips head screws found along the side of the Fan Assembly. Refer to Figure 4-2 for screw locations.



elu050.eps

Figure 4-2. Rear Panel Removal

4-10. Rear Panel Assembly Access

Refer to Figure 4-3 during the following procedure:

1. Remove the screws that secure the Rear Panel assembly housing.
2. Gently pull the rear panel housing from the Rear Panel.
3. Allow the rear panel housing to lay flat on the work surface by removing the two ribbon cables from the Rear Panel board.
4. Remove the jack screws for each connection on the rear panel housing, then gently lift the Rear Panel assembly out from the housing.

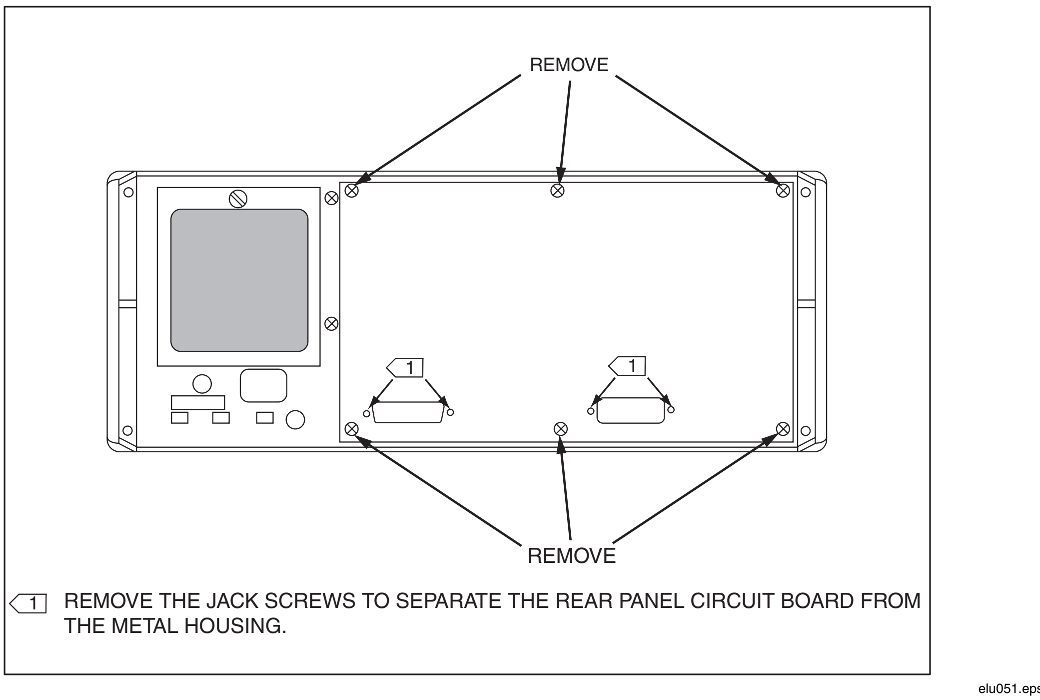


Figure 4-3. Rear Panel Assembly Access

4-11. Front Panel Removal and Installation

Refer to Figure 4-4 during the following procedure:

1. Remove the 5790A top and bottom covers.
2. Remove the single screw at the top of the Front Panel and the six hex screws on the front handle sides. Then grasp both handles and gently tilt the Front Panel down and away from the mainframe, disengaging the green power button. Position the Front Panel on its handles, in front of the instrument.
3. If you need to completely detach the Front Panel from the 5790A, you can remove the paddle board from the Analog Motherboard, or you can disconnect the input cables from the Front Panel assembly.

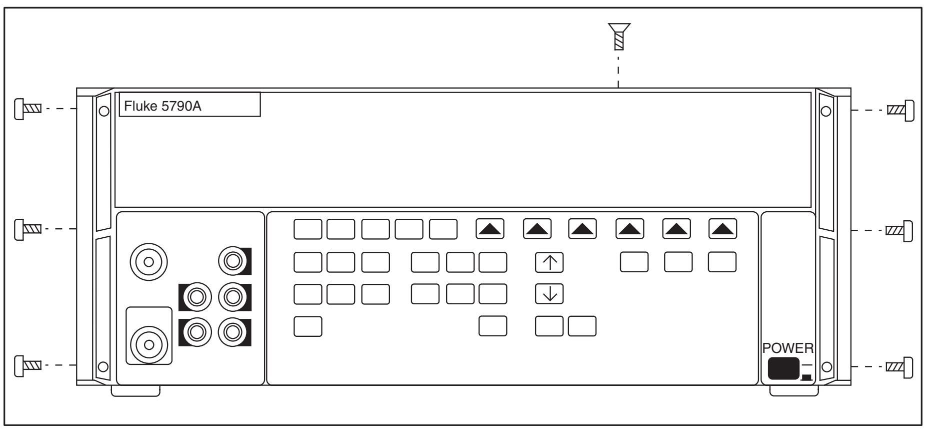


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Figure 4-4. Front Panel Removal

4-12. Display Assembly Removal and Installation

Once the Front Panel has been removed, use the following procedure to access the Display assembly.

1. Remove the ribbon cable connecting the Display assembly to the Motherboard.
2. Remove the six screws securing the Front Panel Display assembly cover shield. Three of these screws are accessed from the inside, and the other three are accessed along the top of the front panel.
3. Remove the seven screws securing the Front Panel Display assembly to the Front Panel. Gently lift the Front Panel Display assembly up, and remove the keyboard ribbon cable. Now remove the Front Panel Display assembly.

4-13. Keyboard Assembly Removal and Installation

The following procedure assumes that the Display Assembly Removal procedure has already been completed.

1. Remove all output cable connections (including GROUND-to-metal) from the front panel binding posts. Save all removed hardware.
2. Remove the two hex screws at the front of each handle. Then remove the front handles.
3. Gently release the eight plastic hook catches, and separate the front panel plastic from the sheet metal.

4. Remove the nine self-tapping screws connecting the Keyboard assembly to the front panel plastic.
5. Remove the Keyboard assembly by gently releasing the seven plastic hook catches. Work from one side of the board to the other. Start at either side by simultaneously releasing a catch and lifting on the board.

Reverse this procedure to install the Keyboard assembly. When reconnecting the wires to the binding posts, be sure to include a washer on each side of the ring terminals. Refer to the nearby decal or see sheet 4 of the Analog Motherboard schematic in chapter 8 of this manual for proper connection of the output cable to the front binding posts.

⚠ Caution

Do not tighten the nuts that hold the wires to the binding posts more than 7 in-lb. Force exceeding 7 in-lb can destroy the binding posts.

4-14. Analog Assembly Removal and Installation

The analog assemblies are installed in the sequence shown in Figure 4-5. Note that each module cannot be positioned in any other slot and that identifying information on the tab for each module faces forward. In all cases, the component side of each module also faces toward the front panel.

⚠ Caution

Do not touch any circuit area on an analog assembly. Contamination from skin oil can produce high resistance paths, with resulting leakage currents and possible erroneous readings. Always grasp an analog assembly by its upper corner ears.

4-15. Digital Assembly Removal and Installation

Remove the CPU Assembly or the Digital Power Supply Assembly by pulling straight up at the top corners of the assembly. In relation to the chassis side, the CPU Assembly components face toward, and the Digital Power Supply Assembly components face away. See Figure 4-5.

4-16. Power Transformer Removal and Installation

Use the following procedure to remove the Power Transformer assembly:

1. Remove the 5790A Front and Rear Panels.
2. Remove the Digital Power Supply (A19) and CPU (A20) assemblies.
3. Detach the five connectors leading from the Power Transformer assembly to the Digital Motherboard. The three connectors at the rear of the assembly may not be accessible without first removing the rear fan. With the two digital assemblies (A19 and A20) removed, the four Phillips head screws securing this fan can be accessed through holes in the chassis side.

   Note that no two Power Transformer connectors are the same size and that each connector is keyed; re-connection only involves matching appropriate connectors.
4. Working from the bottom of the instrument, remove the Digital Motherboard (A4) assembly.

5. Remove the eleven screws securing the Power Transformer assembly, as follows:
   - Rear Panel: two screws, which were removed along with the Rear Panel
   - Front Panel: two screws
   - Top Edge: four screws
   - Bottom Edge: three screws
6. Remove the Power Transformer assembly.

To install the Power Transformer assembly, reverse the preceding six steps.

4-17. Hybrid Cover Removal

When removing the plastic covers from the hybrid assemblies, push the ends of the cover retainer pins through from the back of the circuit board. The retainer pins can be damaged by attempting to pull the covers off.

4-18. Installing a Wideband AC Module (Option -03)

⚠ Caution

The wideband option circuit board assembly contains static-sensitive components. Use caution to avoid static discharge when handling the board.

The procedure that follows can be used to install a 5790A-03 Wideband AC Voltage module in a 5790A. The option consists of one circuit board. This procedure is to be done only at Service Centers.

1. Remove the top and bottom covers and analog section cover as described in paragraphs 4-5 and 4-7.
2. Referring to Figure 4-5, locate the slot for the A6 Wideband Module.
3. Seat the Wideband assembly in the slot.
4. Connect the input cable supplied with the option from J1 on Wideband assembly to the front panel WIDEBAND 50 Ω Type "N" connector.

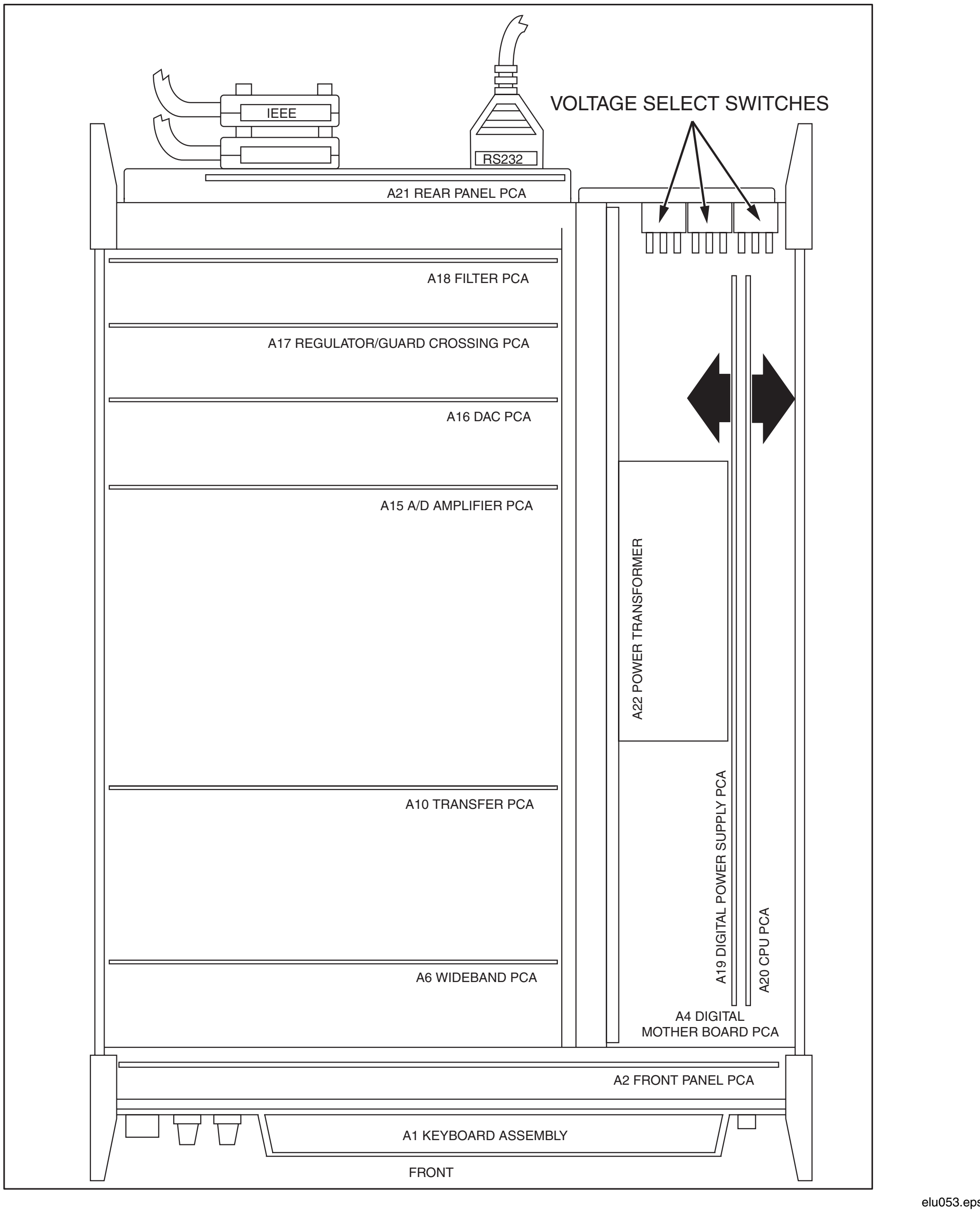


Figure 4-5. Analog and Digital Assemblies

4-19. Clearing Ghost Images from the Control Display

After prolonged periods of displaying the same message on the Control Display, you may notice a non-uniform brightness of pixels across the display. This phenomenon can be cleared up by lighting up the whole display and leaving it on overnight (or at least several hours). Proceed as follows to burn in the Control Display:

1. Turn on the 5790A and press the "Setup Menus" softkey.
2. Press [UTIL MENUS] followed by the "Diags" softkey.
3. Press the "Front Panel Tests" softkey.
4. Under the "Display" label, press the "Control" softkey.

5. Press the "All On" softkey. This causes all Control Display pixels to light. Press the RESET key or press PREV MENU six times to return to normal operation after an overnight or equivalent burn in period.

4-20. Replacing the Clock/Calendar Backup Battery

To replace the lithium button-type battery on the CPU Assembly (A20), proceed as follows:

Note

After you replace the battery, the setting of the time and date the elapsed time counter (read by the remote query ETIME? and set by ETIME) will need to be reprogrammed. Query the ETIME setting before you proceed.

1. Make sure the power is off and the line power cord disconnected.
2. Follow the access procedures to remove the digital side cover.
3. Remove the CPU Assembly (A20).
4. Desolder and remove battery BT1.
5. Solder a replacement battery in place (refer to the parts list for replacement information if necessary.)

4-21. Using Remote Commands Reserved for Servicing

This information documents remote commands not described in the 5790A Operator Manual, Chapters 5 and 6. The commands described here are useful for servicing the instrument.

4-22. Using the FATALITY? and FATALCLR Commands

The FATALITY? query recovers fault codes that were logged when a fatal problem occurred. These faults are logged into a separate fault queue. Once the faults are read from the queue, you can clear the queue by sending the FATALCLR command. The syntax for these remote commands are as follows:

FATALITY?

Returns the list of the fatal faults logged since the list was last cleared by the FATALCLR command. (Sequential command.)

Parameter

None.

Response

(String) The list of faults, one per line in the following format:

Example

" 8/30/91 6:33:49 Fault 4301: Rom Checksum 8/30/91 6:34:05 Fault 4301: Rom Checksum 8/30/91 6:34:12 Fault 4301: Rom Checksum 8/30/91 6:34:13 Fault 4301: Rom Checksum 8/30/91 6:34:14 Fault 4301: Rom Checksum 8/30/91 6:34:15 Fault 4301: Rom Checksum 8/30/91 6:34:16 Fault 4301: Rom Checksum ".

FATALCLR?

Clears the list of the fatal faults logged since the list was last cleared by the FATALCLR command. The list is read by the FATALITY? query. (Sequential command.)

Parameter

None.

4-23. Error Codes

The 5790A error codes are listed below.

0	ERR	.	No errors
1	ERR	.	Error queue is full
100	CAL	.	Invalid procedure number
101	CAL	.	No such step in procedure
102	CAL	.	No Cal/Diag procedure underway
103	CAL	.	Cal/Diag not halted
104	CAL	.	No cal step to which to back up
105	CAL	.	No such position for range under cal
106	CAL	.	No such range for cal procedure
107	CAL	.	External DAC calibration failed
108	CAL	.	Entered reference outside of limits
109	CAL	.	Measured and entered input don't match
110	CAL	.	Frequency doesn't match expected
111	CAL	.	Input is of wrong polarity
112	CAL	.	Input is changing during call
113	CAL	.	Input tripped protection circuit
114	CAL	.	Constant %s out of limits
115	CAL	.	Flatness constant out of limits
116	CAL	.	Range gain constant out of limits
117	CAL	.	Rough gain constant out of limits
118	CAL	.	Offset constant out of limits
119	CAL	.	Low F constant out of limits
120	CAL	.	%s range Zero out of limits
121	CAL	.	%s range shunt offset out of limits
122	CAL	.	Divide by zero %s IA update
123	CAL	.	Old %s IA is WAY OFF do a DC cal
124	CAL	.	Temperature gain is zero
125	CAL	.	New temperature Zero out of limits
126	CAL	.	CAL switches must be ENABLE and SERVICE

127	CAL	.	INPUT2 Correction factor out of limits
128	CAL	.	Calibration step in progress
199	CAL	.	Cal error occurred; Already reported
200	CNF	.	Need A %s to do that
201	CNF	.	Need Wideband AC option to do that
202	CNF	.	IG Software out of date: Use %s or newer
300	IG	.	A17 guardcrossing: ROM checksum
301	IG	.	A17 guardcrossing: RAM
302	IG	.	A17 guardcrossing: DUART
303	IG	.	A17 guardcrossing: Watchdog
304	IG	.	Hardware initialization
400	DIAG	.	%s
401	DIAG	.	A16 DAC: %s channel
402	DIAG	.	%s
403	DIAG	.	A15 A/D: %s self test
404	DIAG	.	A15 A/D: %s Zero
405	DIAG	.	A15 A/D: Null DAC %s
406	DIAG	.	A15 A/D: DAC %s
407	DIAG	.	A15 A/D: Chopper %s
408	DIAG	.	A10 Transfer: %s Range
409	DIAG	.	A10 Transfer: %s Protection check
410	DIAG	.	A10 Transfer: Overload check
411	DIAG	.	A10 Transfer: Sensor input/output match
412	DIAG	.	A10 Transfer: %s Range Zero
413	DIAG	.	A10 Transfer: %s Input path
414	DIAG	.	A10 Transfer: %s Frequency measurement
415	DIAG	.	A6 Wideband: %s Range
416	DIAG	.	A6 Wideband: Overload check
417	DIAG	.	A6 Wideband: %s Frequency measurement
418	DIAG	.	A3 Motherboard: DV Divider %s
419	DIAG	.	A10 Transfer: Sensor loop settling
420	DIAG	.	A6 Wideband: Sensor loop settling
421	DIAG	.	A16 DAC: DAC settling
422	DIAG	.	A6 Wideband: Dormant protection check
423	DIAG	.	A15 A/D: %s linearity
500	STA	.	Bad Delta Unit

501	STA	.	Invalid range
503	STA	.	Can't get Ref
504	STA	.	Can't set average Ref
505	STA	.	Can't decode learned string
506	STA	.	Learned sting checksum bad
507	STA	.	Recalling unsaved instrument state
508	STA	.	Already printing a report
509	STA	.	Eternal guard not available
700	GX	.	ACK queue full
701	GX	.	Both sides of GX want to be master
702	GX	.	Both sides of GX want to be slave
703	GX	.	Couldn't ACK packet from inguard
704	GX	.	Bad packet number from inguard
705	GX	.	Multiple timeouts sending to inguard
706	GX	.	Inguard indefinite ACKWAIT holdoff
707	GX	.	Packet too large for inguard
708	GX	.	Bad ACK packet number from inguard
709	GX	.	Received invalid control byte
710	GX	.	Received invalid acknowledgement
711	GX	.	Link quality indicator below limit
712	GX	.	Inguard CPU Reset
900	NRM	.	A/D measurement failed
901	NRM	.	Protection activated
902	NRM	.	Over voltage for input
1000	NV	.	EEPROM write failed
1001	NV	.	EEPROM read checksum error (%s)
1002	NV	.	Block %s would not format
1003	NV	.	Bad NV selector %d
1004	NV	.	%d Blocks failed post-format check
1100	OPM	.	Guard crossing protocol failed to start
1101	OPM	.	Analog hardware initialization failed
1102	OPM	.	Giving up on initializing hardware
1103	OPM	.	NV Memory check found %d bad block(s)
1104	OPM	.	Analog hardware control inoperative
1300	REM	.	Bad Syntax
1301	REM	.	Unknown command

1302	REM	.	Bad parameter count
1303	REM	.	Bad keyword
1304	REM	.	Bad parameter type
1305	REM	.	Bad parameter unit
1306	REM	.	Bad parameter value
1307	REM	.	488.2 I/O deadlock
1308	REM	.	488.2 Interrupted Query
1309	REM	.	488.2 Unterminated command
1310	REM	.	488.2 Query after indefinite response
1311	REM	.	Invalid from GPIB interface
1312	REM	.	Invalid from serial interface
1313	REM	.	Service Only
1314	REM	.	Parameter tool long
1315	REM	.	Invalid device trigger
1316	REM	.	*DDT recursion
1317	REM	.	Macro calls too deep
1337	REM	.	Already executing a procedure
1338	REM	.	Already writing to NV memory
1339	REM	.	MEAS? timed-out
1360	REM	.	Bad binary number
1361	REM	.	Bad binary block
1362	REM	.	Bad character
1363	REM	.	Bad decimal number
1364	REM	.	Exponent magnitude too large
1365	REM	.	Bad hexadecimal block
1366	REM	.	Bad hexadecimal number
1368	REM	.	Bad octal number
1369	REM	.	Too many characters
1370	REM	.	Bad string
1500	RTC	.	Invalid time
1501	RTC	.	Invalid date
1502	RTC	.	Can't set date, CAL STORE switch NORMAL
1602	SEQ	.	Bad reply size from inguard
1603	SEQ	.	False MSG semaphore from inguard
1604	SEQ	.	Inguard CPU A/D error
1605	SEQ	.	Inguard CPU timer out on main CPU

1606	SEQ	.	Inguard CPU command error
1607	SEQ	.	Timed out waiting for inguard reply
1608	SEQ	.	Sequence name too long
1609	SEQ	.	Element array full
1610	SEQ	.	Name array full
1611	SEQ	.	Already defining a sequence
1612	SEQ	.	Not defining a sequence
1613	SEQ	.	Command failed
1700	SER	.	Bad virtual channel %d
1701	SER	.	%d framing
1702	SER	.	%d input queue overflow
1703	SER	.	%d overrun
1704	SER	.	%d Parity
1705	SER	.	%d UART failed self test
1900	SYS	.	Bad interrupt vect #h%02x
2100	TST	.	A20 main CPU: ROM checksum
2101	TST	.	A20 main CPU: RAM
2102	TST	.	A20 main CPU: Real time clock
2103	TST	.	A01 Keyboard: keyboard
2104	TST	.	A02 Display: Output display
2105	TST	.	A02 Display: Control display
2106	TST	.	A21 Rear panel: IEEE488
2107	TST	.	A21 Rear panel: Rear panel DUART
2108	TST	.	A20 main CPU: Guard crossing DUART
2109	TST	.	A20 main CPU: Watchdog timer
2110	TST	.	A20 main CPU Watchdog
2111	TST	.	A2 Display: Refresh
2201	UT	.	To format, set switches to ENABLE and SERVICE
2202	UT	.	Can't store, CAL STORE switch NORMAL
2203	UT	.	Cant' set string, CAL STORE switch NORMAL
2204	UT	.	Domain error %s()
2205	UT	.	Singularity %s()
2206	UT	.	Overflow %s()
2207	UT	.	Underflow %s()
2208	UT	.	Error %s()
2209	UT	.	%s

2300	WD	.	Watchdog timed out (tid=%d)
65535	ERR	.	Unknown error

Chapter 5
Troubleshooting

Title		Page

5-1. Introduction

This chapter describes the processes that take place during power-up self tests and during diagnostics. By understanding the diagnostics test processes, error messages can provide more information.

Run self diagnostics by pressing [UTIL MENUS] followed by the “Diags” softkey. During all diagnostic procedures all the input relays are open. The instrument is disconnected from the outside world. There are no diagnostic procedures that require an external input.

When a diagnostic fault occurs during remote operation the instrument logs an error and then continues, halts, or aborts, depending on the setting of the remote command DIAGFLT. When a diagnostic fault occurs during front panel operation, the instrument halts, displays the error, and prompts the user to continue or abort diagnostics. While the instrument is in the halted state the hardware is setup per the test configuration. This allows a technician to probe the hardware.

5-2. Main CPU (A20) Power-Up Tests

The following list identifies the test name and process associated with error codes for Main CPU tests.

- *Error Code 2100:* *A20 Main CPU ROM Checksum*, 16-bit CRC check
- *Error Code 2101:* *A20 Main CPU RAM*, read/write/pattern test
- *Error Code 2110:* *A20 Main CPU Watchdog*, test that Watchdog goes off
- *Error Code 2107:* *A21 Rear Panel Rear Panel DUART*, DUART internal loopback test
- *Error Code 2102:* *A20 Main CPU Real Time Clock*, RTC running and valid date/time
- *Error Code 2108:* *A20 Main CPU Guard Crossing DUART*, DUART internal loopback test
- *Error Code 2106:* *A21 Rear Panel IEEE488*, GPIB interface chip
- *Error Code 2104:* *A2 Display Output Display*, read/write/pattern test
- *Error Code 2105:* *A2 Display Control Display*, read/write/pattern test

5-3. A17 Guard Crossing Processor Power-Up Tests

The following list identifies the test name and process associated with error codes for Guard Crossing Processor tests.

- *Error Code 3500:* *A17 Guard Crossing ROM*, checksum 16-bit CRC check
- *Error Code 3501:* *A17 Guard Crossing RAM*, read/write/pattern test
- *Error Code 3503:* *A17 Guard Crossing Watchdog*, test that watchdog goes off
- *Error Code 3502:* *A17 Guard Crossing DUART*, DUART internal loopback test
- *Error Code 3504:* *Hardware Initialization*, initialization test. The hardware initialization test is indicates the success of resetting communication with U24, setting all the virtual registers to dormant values, and setting some of the real hardware addresses to operational values.

5-4. System Startup Tests

During power-up, the integrity of starting and maintaining a communication link with the Guard Crossing processor is done. All the nonvolatile constants are checked for CRC errors.

5-5. Diagnostic Tests

Diagnostics start with the lowest level of hardware and work up to testing the basic functionality of each range. Diagnostics are done using no calibration information. This requires tests to have large tolerances.

In general, you should repair errors in the same sequence that they were reported. Two exceptions to this rule would be if all the digital tests failed (8255 and 8254), indicating that you should suspect the interface to guarded bus from Guard Crossing CPU or if massive analog tests fail check all the power supplies.

When the diagnostics are run in “HALT” mode, i.e. either remotely via the DIAGFLT HALT command or from the front panel, when a fault occurs the hardware is left in the test state to facility debugging by the technician.

The following list gives the test description for each step in the built-in diagnostics routine. Comments on each of the test steps are provided next in this chapter.

- *MAMA8255*, Motherboard 8255
- *DAC8254*, DAC 8254
- *AD8255*, A/D 8255
- *SERIAL*, A/D Serial Interface
- *ADSELFTEST*, A/D Internal Self Test
- *ADZEROS*, A/D Zeros
- *ADNULLDAC*, A/D NULL DAC
- *ADDAC*, A/D DAC Output
- *CHOPPER*, A/D Chopper
- *PROT*, Protection
- *OVLD*, Overload
- *ZEROS*, Zeros
- *DIVIDERS*, Test that 1000 V and 220 V dividers plugged in
- *X2_2V*, 2.2 V Range
- *X7V*, 7 V Range
- *X7VHF*, 7 V HF Range
- *X22V*, 22 V Range
- *X22VHF*, 22 V HF Range
- *X70V*, 70 V Range
- *X220V*, 220 V Range
- *X700V*, 700 V Range
- *X1000V*, 1000 V Range
- *X700MV*, 700 mV Range

- *X220MV*, 220 mV Range
- *X70MV*, 70 mV Range
- *X22MV*, 22 mV Range
- *X7MV*, 7 mV Range
- *X2_2MV*, 2.2 mV Range
- *MATCH*, Sensor Match
- *XFREQ*, Measure chopper frequency
- *LOOPFILT*, Sensor Loop

The following steps are only done if the Wideband option is installed:

- *WOVLD*, Wideband Overload
- *W7V*, Wideband 7 V Range
- *W2_2V*, Wideband 2.2 V Range
- *W700MV*, Wideband 700 mV Range
- *W220MV*, Wideband 220 mV Range
- *W70MV*, Wideband 70 mV Range
- *W22MV*, Wideband 22 mV Range
- *W7MV*, Wideband 7 mV Range
- *W2_2MV*, Wideband 2.2 mV Range
- *WFREQ*, Measure chopper frequency
- *WLOOPFILT*, Wideband Sensor Loopfilt

5-6. Test Step: MAMA8255 (Motherboard 8255)

This tests the motherboard 82C55. The test proceeds as follows:

1. Set CTRL register to default value, read, and check.
2. Set A register to default value, read, and check.
3. Set B register to default value, read, and check.
4. Set C register to default value, read, and check.
5. Execute pattern write/read test on port A.

Possible errors include:

```
Error Code 3000 : A3 Motherboard 8255 Control Word Test Failed
Error Code 3000 : A3 Motherboard 8255 Port A Test Failed
Error Code 3000 : A3 Motherboard 8255 Port B Test Failed
Error Code 3000 : A3 Motherboard 8255 Port C Test Failed
```

elu054.eps

These errors indicate a possible fault in the A3 Motherboard 8255 chip. Note that if all the digital tests fail (8255 and 8254 tests), it is more likely that there is a problem with the guard bus interface from the A17 Guard Crossing assembly.

5-7. Test Step: DAC8254 (DAC 8254)

This test checks the DAC 8254 counter. Counter 0, 1, and 2 registers are checked to see if they equal the appropriate default setting.

Possible errors include:

```
Error Code 3002 : A16 DAC 8254 Counter 0 Test Failed
Error Code 3002 : A16 DAC 8254 Counter 1 Test Failed
Error Code 3002 : A16 DAC 8254 Counter 2 Test Failed
```

elu055.eps

These errors suggest the A16 DAC 8254 is faulty. Note that if all the digital tests fail (8255 and 8254 tests), it is more likely that there is a problem with the guard bus interface from the A17 Guard Crossing assembly.

5-8. Test Step: AD8255 (A/D 8255)

This test the A/D 82C55. It sets the CTRL register to default value, reads, and verifies. The process is as follows:

1. Set A register to default value, read, and check.
2. Set B register to default value, read, and check.
3. Set C register to default value, read, and check.
4. Execute pattern write/read test on port A.

Possible errors include:

```
Error Code 3000 : A15 A/D 8255 Control Word Test Failed
Error Code 3000 : A15 A/D 8255 Port A Test Failed
Error Code 3000 : A15 A/D 8255 Port B Test Failed
Error Code 3000 : A15 A/D 8255 Port C Test Failed
```

elu056.eps

Failure of this test suggests a bad A15 A/D 8255 chip. Note that if all the digital tests fail (8255 and 8254 tests), it is more likely that there is a problem with the guard bus interface from the A17 Guard Crossing assembly.

5-9. Test Step: ADSELFTEST (A/D Internal Selftest)

When diagnostics are first started, the communication channel with the A/D chip is restarted. If you get an Error Code 1604: Guard Crossing CPU A/D Error, suspect the serial communication hardware between the DUART on the A17 Guard Crossing assembly and U24 on the A15 A/D Amplifier assembly. This test proceeds as follows:

1. Test U24 by measuring reference and ground internally.
2. U24 measures reference internally.
3. U24 measures ground connection internally.
4. Precharge U24 filter to zero, then remeasure reference internally with filter connected.

Possible errors include:

```
Error Code 3003 : A15 A/D Reference Selftest Failed
Error Code 3003 : A15 A/D Reference + Filter Selftest Failed
Error Code 3003 : A15 A/D Zero Selftest Failed
```

elu057.eps

These errors indicate a possible fault on the A15 A/D Amplifier assembly. On the A15 A/D Amplifier assembly check RCOM and reference voltages. Connect the DMM LOW to the RCOM test point.

5-10. Test Step: ADZEROS (A/D Zeros)

This tests the instrumentation amplifier and A/D range zeros. The test proceeds as follows:

1. Connect both inputs of instrumentation amplifier to RCOM.
2. Measure each range, /10, /1, *10.

Possible errors include:

```
Error Code 3004 : A15 A/D *100 Zero Failed
Error Code 3004 : A15 A/D /1 Zero Failed
Error Code 3004 : A15 A/D /10 Zero Failed
```

elu058.eps

These errors indicate a possible fault on the A15 A/D Amplifier assembly. Referencing to the RCOM test point, check for 0 V from the inputs of instrumentation amplifier to the inputs of U24.

5-11. Test Step: ADNULLDAC (A/D Null DAC)

This tests the interface and the output of the NULL DAC.The test proceeds as follows:

1. Connect NULLDAC to positive input and negative inputs of instrumentation amplifier. Program NULLDAC to output 0.0. Measure with x1 A/D range.
2. Connect NULLDAC to positive input of instrumentation amplifier, minus input to RCOM. Program NULLDAC to output 0.0. Measure with x1 A/D range.

3. Connect NULLDAC to positive input of instrumentation amplifier, minus input to RCOM. Program NULLDAC to output 1.0. Measure with x1 A/D range.
4. Connect NULLDAC to negative input of instrumentation amplifier, positive input to RCOM. Program NULLDAC to output 1.0. Measure with x1 A/D range.
5. Connect NULLDAC to negative input of instrumentation amplifier, positive input to RCOM. Program NULLDAC to output 2.0. Measure with x1 A/D range.

Possible errors include:

```
Error Code 3005 : A15 A/D Null DAC -1.0 Failed
Error Code 3005 : A15 A/D Null DAC -2.0 Failed
Error Code 3005 : A15 A/D Null DAC 0.0 Failed
Error Code 3005 : A15 A/D Null DAC 1.0 Failed
Error Code 3005 : A15 A/D Null DAC NULLDAC Failed
```

elu059.eps

These errors indicate a possible fault on the A15 A/D Amplifier assembly. Check the Null DAC reference and Null DAC output through the instrumentation amplifier input switching, then through the instrumentation amplifier to the A/D chip (U24) inputs.

5-12. Test Step: ADDAC (A/D DAC Output)

Tests the DAC, DAC to DIVOUT, and DAC to DIVOUT5 outputs on A/D Amplifier assembly. This test proceeds as follows:

1. Connect DACHI to positive and negative inputs of instrumentation amplifier. Program DAC to output 0.0. Measure with x1 A/D range.
2. Connect DACHI to positive and negative inputs of instrumentation amplifier. Program DAC to output 2.0. Measure with x1 A/D range.
3. Connect DACHI to positive input of instrumentation amplifier, minus input to RCOM. Program DAC to output 0, 1.0, and 2.0. Measure with x1 A/D range.
4. Connect RCOM to positive input of instrumentation amplifier, minus input to DIVOUT. Connect DACHI to DIVOUT. Program DAC to output 1.0. Measure with x1 A/D range.
5. Connect DACHI divided by 5 to DIVOUT. Program DAC to output 10.0. Measure with x1 A/D range.

Possible errors include:

```
Error Code 3006 : A15 A/D DAC DACHI 0.0 Failed
Error Code 3006 : A15 A/D DAC DACHI 2.0 Failed
Error Code 3006 : A15 A/D DAC DIVOUT 1.0 Failed
Error Code 3006 : A15 A/D DAC DIVOUT5 2.0 Failed
```

elu060.eps

These errors indicate a possible fault on the A15 A/D Amplifier assembly or the A16 DAC assembly. Check the A16 DAC output to A15 A/D Amplifier assembly through the instrumentation amplifier input switching, then through the instrumentation amplifier to the A/D chip (U24) inputs.

5-13. Test Step: CHOPPER (A/D Chopper)

This tests the chopper in 0 dB, 20 dB, 40 dB, and 60 dB ranges. Since the A/D can only measure DC, chopper ranges are tested by stopping the chopper in either the high or low state. With the chopper running, the A/D should measure about 0.0. This tests both the fast and slow frequency chop rates. It leaves A/D Amplifier assembly in the dormant state on exit. The test proceeds as follows:

1. Configure with DAC set to 1.0, driving DIVOUT, which drives the chopper. Stop chopper with output in high state. Chopper set in 0 dB range. Route chopper output to SDL. Measure chopper output with SDL A/D range.
2. Stop chopper with output in low state. Measure chopper output with SDL A/D range.
3. Set chopper in 20 dB range. Stop chopper with output in high state. Measure chopper output with SDL A/D range.
4. Set chopper in 40 dB range. Stop chopper with output in high state. Measure chopper output with SDL A/D range.
5. Set chopper in 60 dB range. Stop chopper with output in high state. Measure chopper output with SDL A/D range.
6. Set chopper in 0 dB range. Start chopper running at slow rate. Measure chopper output with SDL A/D range. Should be about 0.
7. Use A/D to check chopper frequency at slow rate.
8. Set chopper to 0 dB range. Start chopper running at fast rate. Measure chopper output with SDL A/D range. Should be about 0.
9. Use A/D to check chopper frequency at fast rate.

Possible errors include:

Error Code 3007 : A15 A/D Chopper 0 dB High Failed
Error Code 3007 : A15 A/D Chopper 0 dB Low Failed
Error Code 3007 : A15 A/D Chopper 20 dB Failed
Error Code 3007 : A15 A/D Chopper 40 dB Failed
Error Code 3007 : A15 A/D Chopper 60 dB Failed
Error Code 3007 : A15 A/D Chopper FAST Failed
Error Code 3007 : A15 A/D Chopper FAST Frequency Failed
Error Code 3007 : A15 A/D Chopper SLOW Failed
Error Code 3007 : A15 A/D Chopper SLOW Frequency Failed

elu061.eps

These errors all suggest a fault on the A15 A/D Amplifier assembly. Use an oscilloscope in addition to a DMM to troubleshoot the fault. Check the chopper input, through chopper to SDL line, to U24.

5-14. Test Step: PROT (Protection)

Tests part of the protection circuitry on the transfer assembly. The software can only test the section that detects multiple input relays being closed. The spark gaps that detect over voltage can not be exercised. The test proceeds as follows:

1. Program the hardware to close RLY3 (IN1 High to KV Rnet) and K3 (IN1 High to 220 V Rnet).
2. Check trip status (The relays should have tripped.).

The error from this test is:

Error Code 3009 : A10 Transfer Protection Check Failed

elu062.eps

This error indicates a possible fault in the protection circuit on the A10 Transfer assembly.

5-15. Test Step: OVLD (Overload)

Tests the sensor input overvoltage circuitry. This test proceeds as follows:

1. Configure per 2.2 V range, no inputs.
2. Set up with chopper connected to sensor.
3. Program DAC to 5.0 V. Check trip status. There should be an overload indication.

The error from this test is:

Error Code 3010 : A10 Transfer Overload Check Failed

elu063.eps

This error indicates a fault in the overload circuitry on A10 Transfer assembly. The overload interrupt should toggle on and off at a slow rate as the overload detection circuitry detects sensor overheating and clamps the sensor input. When the sensor cools down the clamp circuitry releases. Check that indicated DAC voltage is at sensor input.

5-16. Test Step: ZEROS

Test bottom three ranges front end amplifier zeros. The test proceeds as follows:

1. Configure instrument in 2.2 mV range with no input, use relay in front of protection SIP to short input to ground. Measure input of sensor.
2. Configure instrument in 7 mV range with no input, use relay in front of protection SIP to short input to ground. Measure input of sensor.
3. Configure instrument in 22 mV range with no input, use relay in front of protection SIP to short input to ground. Measure input of sensor.

Possible errors include:

```
Error Code 3012 : A10 Transfer 2.2 mV Range Zero Failed
Error Code 3012 : A10 Transfer 22 mV Range Zero Failed
Error Code 3012 : A10 Transfer 7 mV Range Zero Failed
```

elu064.eps

These errors indicate a fault on A10 Transfer assembly. Trace from short to ground through the amplifiers to the input of the RMS sensor.

5-17. Test Step: DIVIDERS (Input Dividers)

Tests that the 1000 V and 220 V input dividers are accessible in the circuit. The test proceeds as follows:

1. Configure instrument in 1000 V range with no input. Inject the chopper. Measure the input of the sensor. Close the switch that hooks up KV DIV input on the transfer board (note that a relay still keeps the input terminals open). Again measure the output of the sensor. The divider affect of the 500 Ω of the input divider and the switch impedance will shift the reading.
2. Configure instrument in 220 V range with no input. Inject the chopper. Measure input of sensor. Close the switch that hooks up the 220 V tap on the input divider (note that a relay still keeps the input terminals open). Again measure the output of the sensor. The divider affect of the 5000 Ω of the input divider and the switch impedance will shift the reading.
3. Configure instrument in 22 V range with no input. Inject the chopper. Measure input of sensor. Close the switch that hooks up the 22 V tap on the input divider (note that a relay still keeps the input terminals open). Again measure the output of the sensor. The divider effect of the 500 Ω input divider and the switch impedance will shift the reading.

Possible errors include:

```
Error Code 3013 : A10 Transfer 22 V Divider Test Failed
Error Code 3013 : A10 Transfer 220 V Divider Test Failed
Error Code 3013 : A3 Motherboard 1000 V Divider Test Failed
```

elu065.eps

For the A3 Motherboard 1000 V Divider error, the most likely problem is that the cable from the divider the motherboard is not connected. If the A10 Divider tests fail check the input switching on the A10 Transfer assembly.

5-18. Test Steps: X2_2V through X2_2MV

Tests each range to the point where the chopper is injected. This test proceeds as follows:

1. Configure instrument as per normal setup for range but with open input.
2. Set the DAC so that the input of the instrumentation amplifier should be 1.0. This is done by multiplying the desired A/D input by IA to reflect to input terminals and then multiply by DI to determine the DAC setting. This implies that the input of the sensor should also be 1.0.
3. Measure sensor output with x1 A/D range. Chopper is in HIGH state (DC output). Output of sensor is feed via RCL to A/D for measuring.

Possible errors include:

```
Error Code 3008 : A10 Transfer 1000 V Range Failed
Error Code 3008 : A10 Transfer 2.2 mV Range Failed
Error Code 3008 : A10 Transfer 2.2 V Range Failed
Error Code 3008 : A10 Transfer 22 mV Range Failed
Error Code 3008 : A10 Transfer 220 mV Range Failed
Error Code 3008 : A10 Transfer 220 V Range Failed
Error Code 3008 : A10 Transfer 22 V Range Failed
Error Code 3008 : A10 Transfer 22 V HF Range Failed
Error Code 3008 : A10 Transfer 7 mV Range Failed
Error Code 3008 : A10 Transfer 70 mV Range Failed
Error Code 3008 : A10 Transfer 700 mV Range Failed
Error Code 3008 : A10 Transfer 700 V Range Failed
Error Code 3008 : A10 Transfer 70 V Range Failed
Error Code 3008 : A10 Transfer 7 V Range Failed
Error Code 3008 : A10 Transfer 7 V HF Range Failed
```

elu066.eps

These errors indicate that a fault probably exists on A10 Transfer assembly. Trace from point where chopper is input (XF CHOP HI) through amplifiers to input of sensor to output of sensor.

5-19. Test Step: MATCH (Sensor Match)

This tests that input and output sections of the RMS sensor match. The test proceeds as follows:

1. Configure instrument in 2.2 V range with no input.
2. Hook chopper to Transfer assembly stopped in the high state.
3. Configure DAC to output 1.0.
4. Measure output of sensor, via RCL. Connect input of sensor to RCL instead of output.

The error from this test is:

Error Code 3011 : A10 Transfer Sensor Input/Output Match Failed

elu067.eps

This error indicates a fault on A10 Transfer assembly. Check the input and output voltages on the sensor. Should both be approximately the same. If they differ, the RMS sensor itself is most likely bad part.

5-20. Test Step: XFREQ (Frequency Measuring)

This measure the chopper frequency via the Transfer assembly. The Transfer assembly is configured for the 2.2 V range with no input.

The error from this test is:

Error Code 3014 : A10 Transfer Frequency Measurement Failed

elu068.eps

This error indicates that a fault probably exists on the A10 Transfer assembly, or less likely, on the A15 A/D Amplifier assembly. Check that the chopper (AC signal) is being transmitted to A10 Transfer assembly. Trace through the amplifiers to the input of sensor. From there, the chopped reference is switched onto the COUNT motherboard line back to the A15 A/D Amplifier assembly to U24.

5-21. Test Step: LOOPFILT (Sensor Filter)

Tests slow mode sensor loop filter settling time.

Fault 3019: A10 Transfer: Sensor Loop Settling

Transfer board configured in 1000 V range, no inputs. Connect sensor output to RCL. Positive instrumentation amplifier input to RCL, negative to RCOM. Configure DAC to driver chopper. Sensor loop filter in slow mode. Set DAC to 2.0 V. Let the sensor output settle. Measure sensor output with x1 A/D range. Switch chopper to be driven by DAC divided by 5 (0.4 V). Let it settle. Again switch chopper to be driven by DAC directly and then immediately take 8 sample A/D reading. Compare this reading with first settled reading.

5-22. Test Step: WOVLD (Wideband Overload)

Tests the sensor input overvoltage circuitry.

Configure per 2.2 V range, no inputs. Set up with chopper connected to sensor. Program DAC to 0.5 V. Check trip status. Should indicate overload.

The error from this test is:

```
Error Code 3016 : A6 Wideband Overload Check Failed
```

elu069.eps

This error indicates that the fault is probably on A6 Wideband assembly. Check that indicated voltage (DC from chopper) appears on the A6 Wideband assembly to the input of the sensor. Check the overload detection circuitry.

5-23. Test Steps: W7V through W2_2MV (Wideband 2.2 mV Range)

Tests each range to the point where the chopper is injected. The test proceeds as follows:

1. Configure instrument per normal setup for range but with open input.
2. Set the DAC so that the input of the instrumentation amplifier should be 1.0. This is done by multiplying the desired A/D input by IA to reflect to input terminals and then multiply by DI to figure what the DAC should be set to.
3. Measure sensor output with x1 A/D range.

Possible errors include:

```
Error Code 3015 : A6 Wideband 2.2 mV Range Failed
Error Code 3015 : A6 Wideband 2.2 V Range Failed
Error Code 3015 : A6 Wideband 22 mV Range Failed
Error Code 3015 : A6 Wideband 220 mV Range Failed
Error Code 3015 : A6 Wideband 7 mV Range Failed
Error Code 3015 : A6 Wideband 70 mV Range Failed
Error Code 3015 : A6 Wideband 700 mV Range Failed
Error Code 3015 : A6 Wideband 7 V Range Failed
```

elu070.eps

These errors indicate a fault on the A6 Wideband assembly. Trace from the point where the chopper comes in (WB CHOP HI), through the amplifiers, to the input of sensor.

5-24. Test Step: WFREQ (Wideband Frequency Measuring)

This measures the chopper frequency via the Wideband assembly.

The error from this test is:

```
Error Code 3017 : A6 Wideband Frequency Measurement Failed
```

elu071.eps

This error indicates that the fault is probably on A6 Wideband assembly. There is a slight chance the fault is on A15 A/D Amplifier assembly. Check that the chopper (AC signal) is being transmitted to the A6 Wideband assembly. Trace through amplifiers to input of sensor. From there it is routed through prescalers and filters to the COUNT motherboard line back to the A15 A/D Amplifier assembly to U24.

5-25. Test Step: WLOOPFILT (Wideband Sensor Filter)

Tests slow mode sensor loop filter settling time.

Fault 3020: A10 Wideband: Sensor Loop Settling

Transfer board configured in 7 V wideband range, no inputs. Special chopper setup, 0 dB attenuation. Connect sensor output to RCL. Positive instrumentation amplifier input to RCL, negative to RCOM. Sensor loop filter in slow mode. Set DAC to 70 mV. Let the sensor output settle. Measure sensor output with x1 A/D range. Switch in 40 dB attenuation in chopper. Let it settle. Again switch out the 40 dB attenuation and then immediately take 8 sample A/D readings. Compare this reading with first settled reading.

Chapter 6
List of Replacable Parts

Title		Page

6-1. Introduction

This chapter contains an illustrated list of replacement parts for the 5790A. Parts are list by assembly; alphabetized by reference designator. Each assembly is accompanied by an illustration showing the location of each part and its reference designator. The parts lists give the following information:

- Reference designator
- An indication if the part is subject to damage by static discharge
- Description
- Fluke part number
- Total quantity
- Any special notes (i.e., factory-selected part)

⚠Caution

A ϟsymbol indicates a device that may be damaged by static discharge.

6-2. How to Obtain Parts

Electrical components may be ordered from the Fluke Corporation and its authorized representatives by using the part number under the heading Fluke Stock No. In the U.S., order directly from the Fluke Parts Dept. by calling 1-800-526-4731. Parts price information is available in a Fluke Replacement Parts Catalog which is available on request.

In the event that the part ordered has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt delivery of the correct part, include the following information when you place an order.

- Instrument model and serial number
- Part number and revision level of the pca containing the part.
- Reference designator
- Fluke stock number
- Description (as given under the Description heading)
- Quantity

6-3. Manual Status Information

The Manual Status Information table that precedes the parts list defines the assembly revision levels that are documented in the manual. Revision levels are printed on the component side of each pca.

6-4. Newer Instruments

Changes and improvements made to the instrument are identified by incrementing the revision letter marked on the effected pca. These changes are documented on a supplement manual sheet which, when applicable, is included with the manual.

Table 6-1. Manual Status Information

Ref or Option No.	Assembly Name	Fluke Part No.	Revision Level
A1	Keyboard PCA	880687	B
A2	Front Panel PCA	85587	105
A3	Analog Motherboard PCA	885590	100
A4	Digital Motherboard PCA	885595	102
A6	Wideband PCA (Option -03)	885660	109
A6A1	RMS Support PCA	893268	D
A6A2	WB Input Protection PCA	893271	100
A10	Transfer PCA	885603	110
A10A1	Precision Amplifier PCA	893300	101
A10A2	High Voltage Protection Amplifier PCA	893305	102
A10A3	High-Gain Precision Amplifier PCA	893313	106
A15	A/D Amplifier PCA	885608	105
A16	DAC PCA	885611	105
A16A1	DAC Filter PCA	893276	C
A17	Regulator/Guard Crossing PCA	874859	105
A18	Filter PCA	885616	104
A19	Digital Power Supply PCA	885624	104
A20	CPU PCA	885629	114
A21	Rear Panel I/O PCA	885632	102

6-5. Service Centers

A list of service centers is located on www.fluke.com.

6-6. Parts Lists

The parts lists are provided on the following pages.

Table 6-2. Final Assembly

Ref Des	Description	Part Number	Qty	Notes
A1	KEYBOARD PCA	880687	1	ϟ
A2	FRONT PANEL PCA	885587	1	ϟ
A3	ANALOG MOTHERBOARD PCA	885590	1	ϟ
A4	DIGITAL MOTHERBOARD PCA	885595	1	ϟ
A10	TRANSFER ASSY PCA	885603	1	ϟ
A15	A/D AMPLIFIER PCA	885608	1	ϟ
A16	DAC PCA	885611	1	ϟ
A17	REGULATOR/GUARD CROSSING PCA	874859	1	ϟ
A18	FILTER PCA	885616	1	ϟ
A19	DIGITAL POWER SUPPLY PCA	885624	1	ϟ
A20	CPU PCA	885629	1	ϟ
A21	REAR PANEL PCA	885632	1	ϟ
A22	5700A-4201,TRANSFORMER/MODULE ASSY	813527	1	
A23	5700A-4210,AC LINE FILTER ASSY	775445	1	
A62	5790A-4244,ASSEMBLY, INPUT BLOCK	1645207	1	
E401	5440A-8197-01,BINDING HEAD, PLATED	102889	1	
F401	FUSE,FUSE,.25X1.25,1.5A,250V,SLOW	109231	1	
F402-403	FUSE,FUSE,.25X1.25,0.75A,250V,SLOW	109256	2	
H82	NUT,NUT,EXT LOCK,STL,6-32	152819	1	
H83	NUT,NUT,HEX,BR,1/4-28	110619	1	
H85	WASHER,WASHER,LOCK,INTRNL,STL,.267ID	110817	1	
H101-104	SCREW,8-32,.375,PAN,PHILLIPS,STEEL,ZINC-CLEAR,LOCK	114124	4	
H12-013, H301, H482-483, H485, H491-492	SCREW,6-32,.375,PAN,PHILLIPS,STAINLESS STEEL,LOCK	334458	8	
H302	SCREW,4-40,.625,PAN,PHILLIPS,STEEL,ZINC-CLEAR,LOCK	145813	1	
H305-313	SCREW,5-20,.312,WASHER HEAD,PHILLIPS,STEEL,ZINC-CHROMATE,HI-LO THD FORM	494641	9	
H314	SCREW,SCREW,PH,P,LOCK,SS,6-32,.625	412841	1	
H315	WASHER,WASHER,FLAT,BR,.119,.281,.025	110775	1	
H325-328,	SCREW,SCREW,CAP,SCKT,SS,8-32,.375	295105	20	

H445-456, H503-506				
H329-331, H440-442, H457-472, H493-496	SCREW,SCREW,FHU,P,LOCK,MAG SS,6-32,.250	320093	26	
H414-420 H484, H501-502, H507-510, H15-16	SCREW,SCREW,PH,P,LOCK,SS,6-32,.750	376822	16	
H473, H490, H514-522	WASHER,WASHER,FLAT,STL,.160,.281,.010	111005	11	
H474-481	SCREW,6-32,1.250,PAN,PHILLIPS,STEEL,ZINC-CLEAR,LOCK	159756	8	
H523-524	WASHER,WASHER,FLAT,STL,.191,.289,.010	111047	2	
H525	5790A-8027,SPACER	902924	1	
MP3	5440A-8198-01,BINDING POST, STUD, PLATED	102707	1	
MP101-102	5790A-8014 GASKET	885715	2	
MP104	5790A-4405,4R01 BASE/CABLE	893321	1	
MP108	5790A-2710,RN/SUBSTRATE ASSY, 4R01	893180	1	ϟ
MP301	5700A-8039,CALIBRATION CERTIFICATION DECAL	891718	1	
MP302	5790A-2502,FRONT PANEL, MODIFIED	880737	1	
MP303	5700A-8005,LENS, SHIELD	760843	1	
MP305	5790A-8001,KEYPAD,ELASTOMERIC	1623584	1	
MP306 MP504	GROMMET,GROMMET,EXTRUDED,POLYETHYLENE,.085	854351	2	
MP307	5790A-8007,LENS, DISPLAY	880752	1	
MP308	5790A-8008,NAMEPLATE, ELECTROFORM	885657	1	
MP309	ADAPTER,ADAPTER,COAX,N(F),N(M)	875443	1	
MP325	5700A-8072,DECAL, POWER ON/OFF	886312	1	
MP327	5790A-8003,DECAL, INPUT	880570	1	
MP328	5790A-8002,DECAL, KEYPAD	880526	1	
MP337-338, MP531-532	5700A-2053-01,HANDLE,INSTRUMENT, GRAY #7	886333	4	
MP401, MP425	5700A-8067,SIDE EXTRUSION	886288	2	
MP402, MP424	5700A-8066,INSERT EXTRUSION	886283	2	
MP404-405	5790A-2501,FAN/CONNECTOR ASSEMBLY	885652	2	

MP411	5700A-2046,POWER BUTTON, ON/OFF	775338	1	
MP412-415	5700A-2043-01,BOTTOM FOOT, MOLDED, GRAY #7	868786	4	
MP417-418, MP505, MP539	FTCL-8001-01,LABEL,CALIB, CERTIFICATION SEAL	802306	4	
MP420	5700A-8021,FILTER, AIR	813493	1	
MP422-423	5700A-8036,DECAL, CAUTION 240V	760926	2	
MP454-455	6070A-2063,AIDE,PCB PULL	541730	2	
MP504	5790A-4021,SUB-ASSY, REAR PANEL	885582	1	
MP511-512	CONNECTOR ACCESSORY,MICRO-RIBBON,SCREW LOCK,M3.5,6-32,STEEL,BLACK ZINC	854737	2	
MP513-514	CONNECTOR ACCESSORY,D-SUB JACK SCREW,4-40,.250 L,W/FLAT WASHER	1777348	2	
MP540	LABEL,LABEL,VINYL,1.500,.312	844712	1	
MP543-544	WASHER,WASHER,FLAT,SS,.119,.187,.010	853296	2	
MP545	M00-800-429-01,DECAL, CSA	864470	1	
MP656	CE MARK LABEL BLK ,LABEL, CE MARK, BLACK	600707	1	
P21-22	HEADER,HEADER,2 ROW,.100CTR,RT ANG,6 PIN	912217	8	
TM1	5790A SERVICE MANUAL	893292	1	
TM2	5790A OPERATOR MANUAL	893284	1	
TM3	PROGRAMMERS GUIDE	893375	1	
W203	LC1 LINE CORD, NORTH AM, 10A,5-15/IEC,1	284174	1	
	5700A-4403, CABLE, KEYBOARD/REAR PANEL	802710	1	
	5700A-4404, CABLE, REAR PANEL-CPU	802728	1	
	5700A-4408, CABLE, FIBER OPTIC	802710	1	
Notes	ϟ Static sensitive part.			

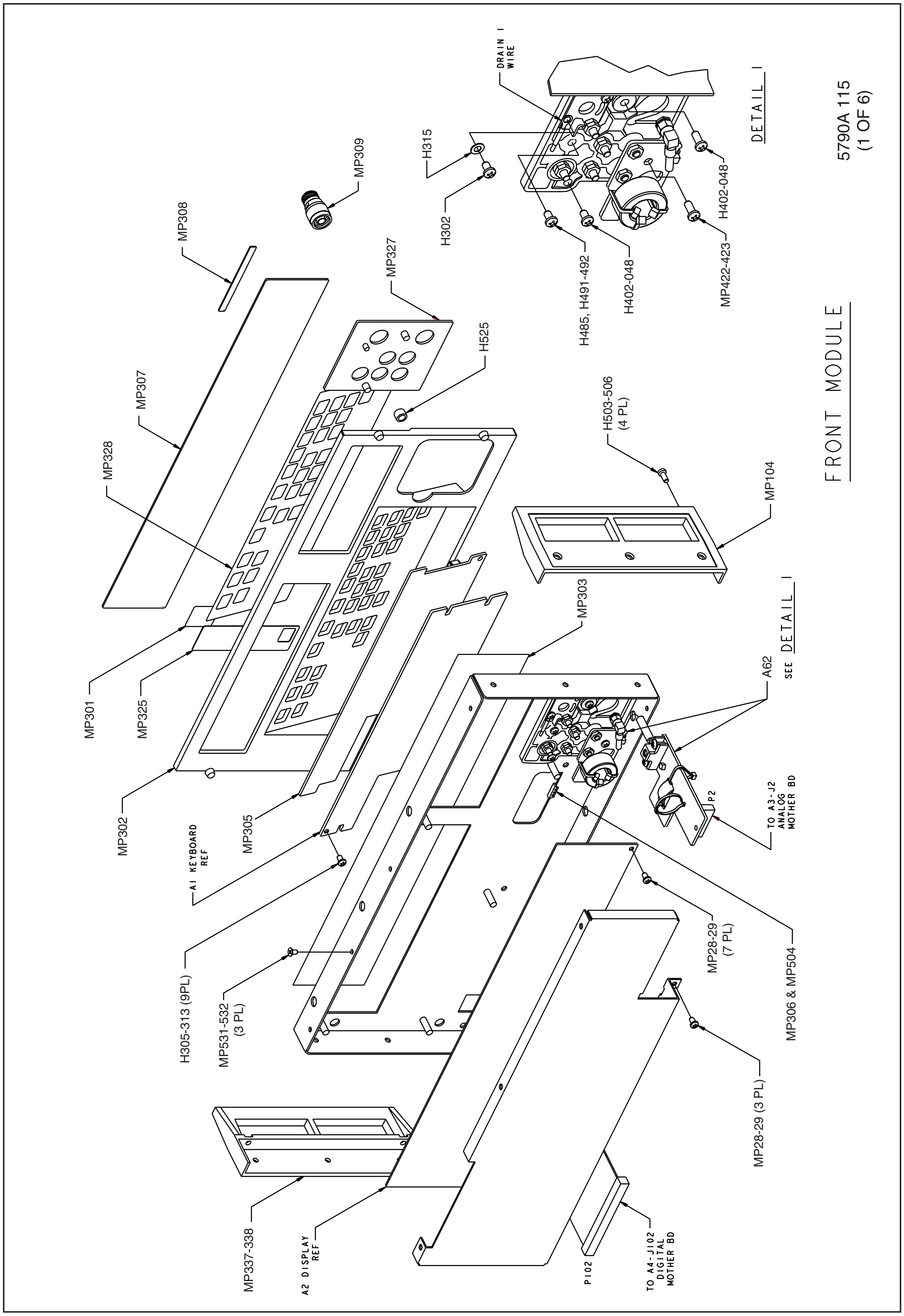


Figure 6-1. Final Assembly

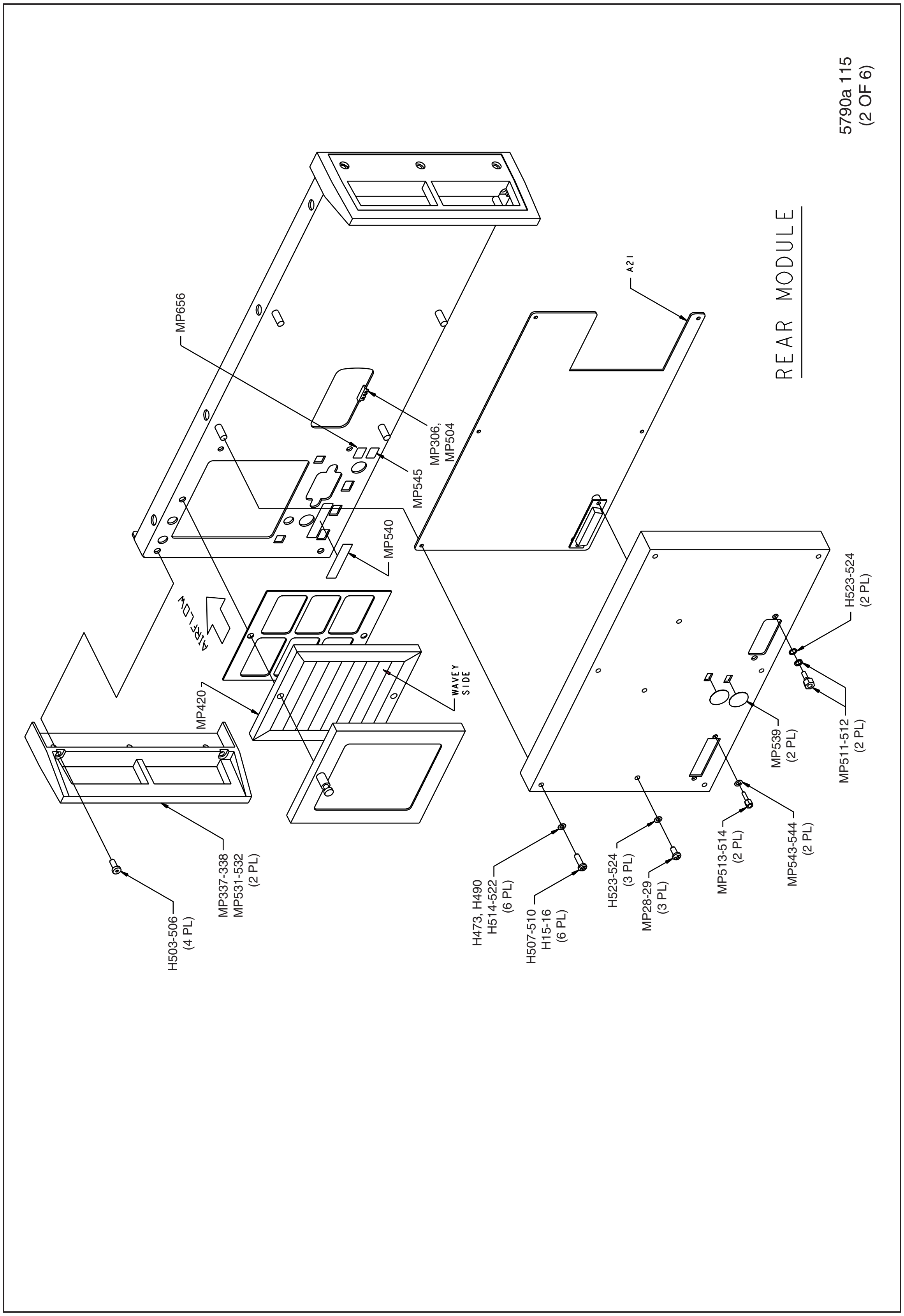


Figure 6-1. Final Assembly (Cont)

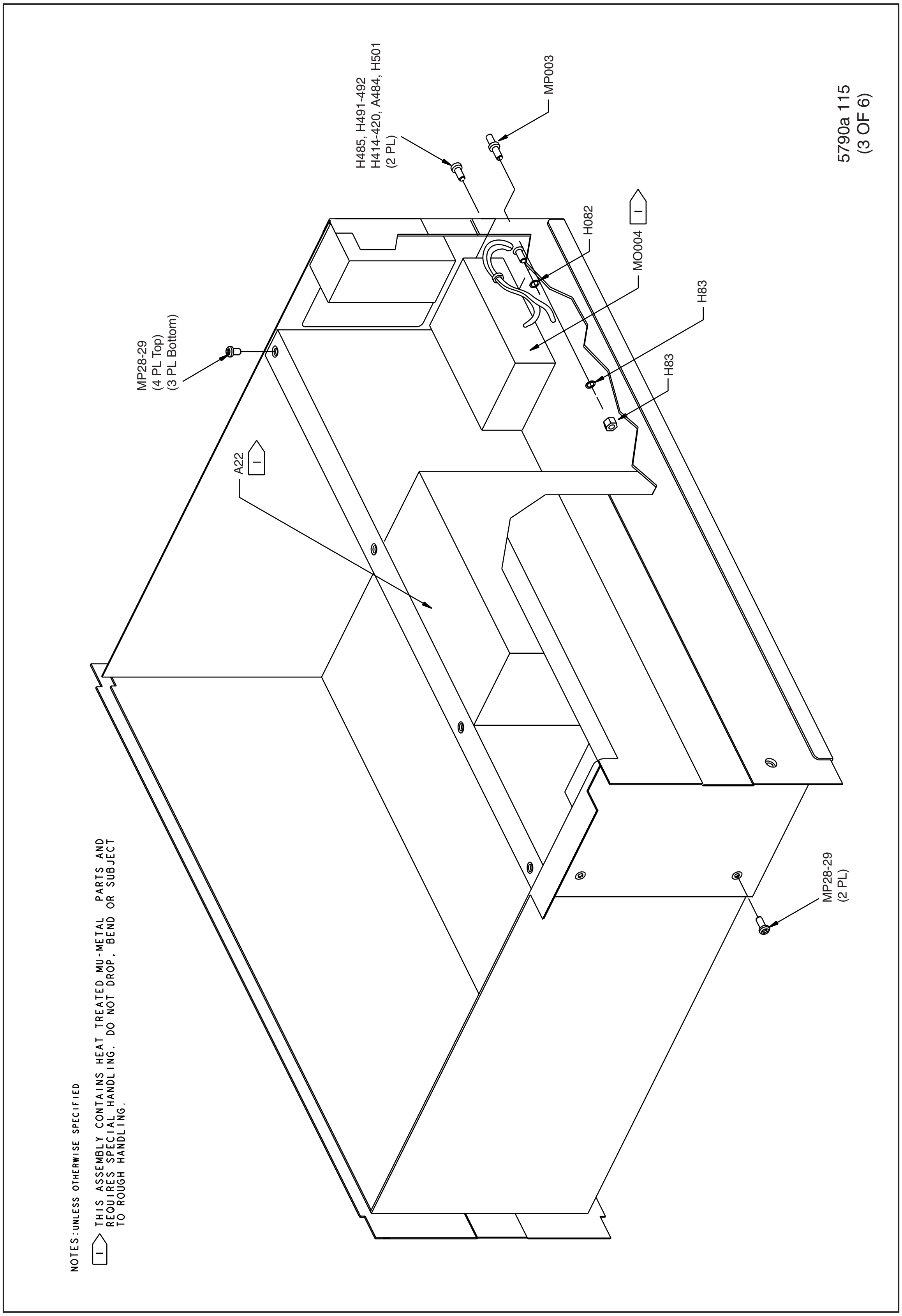


Figure 6-1. Final Assembly (Cont)

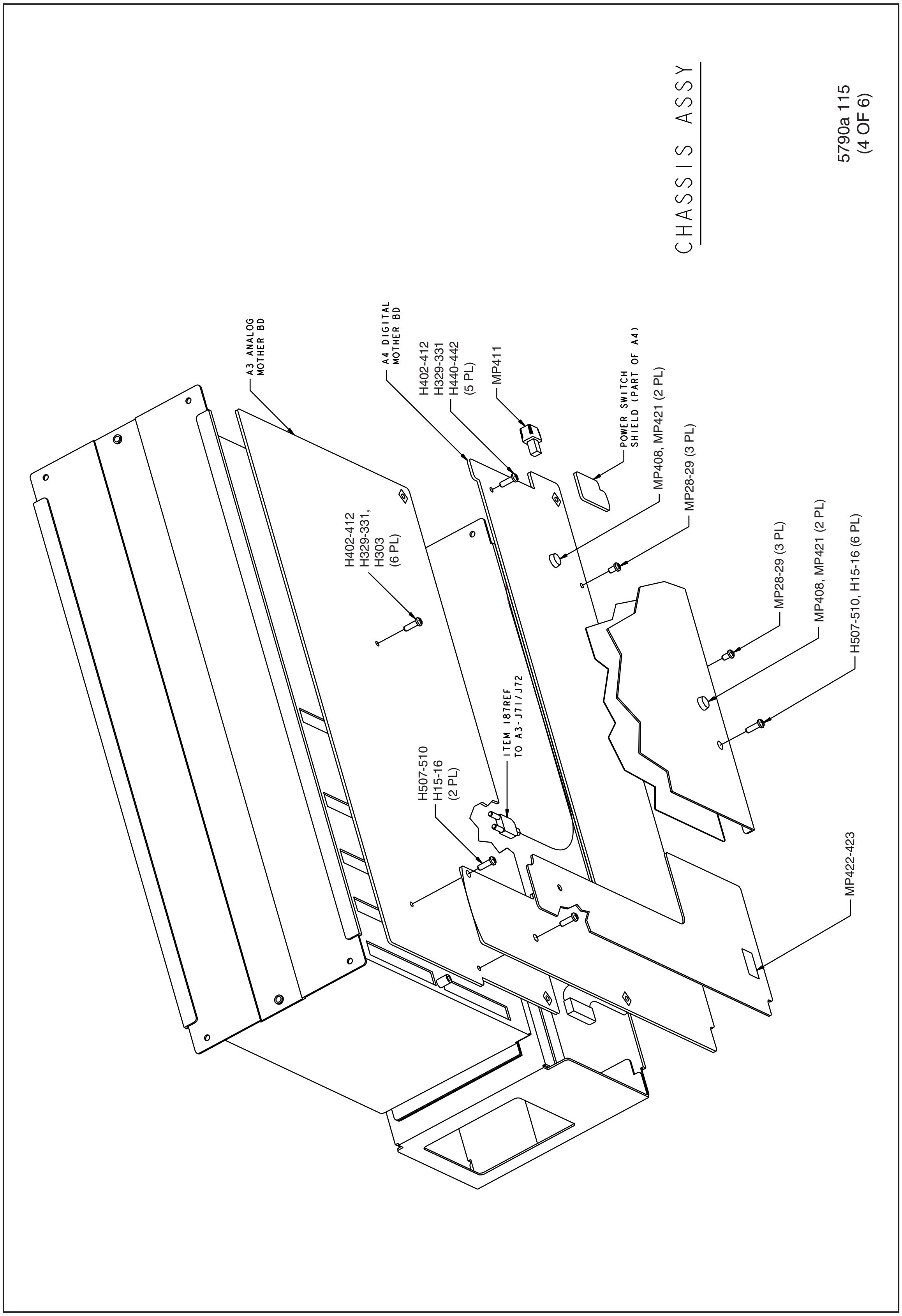


Figure 6-1. Final Assembly (Cont)

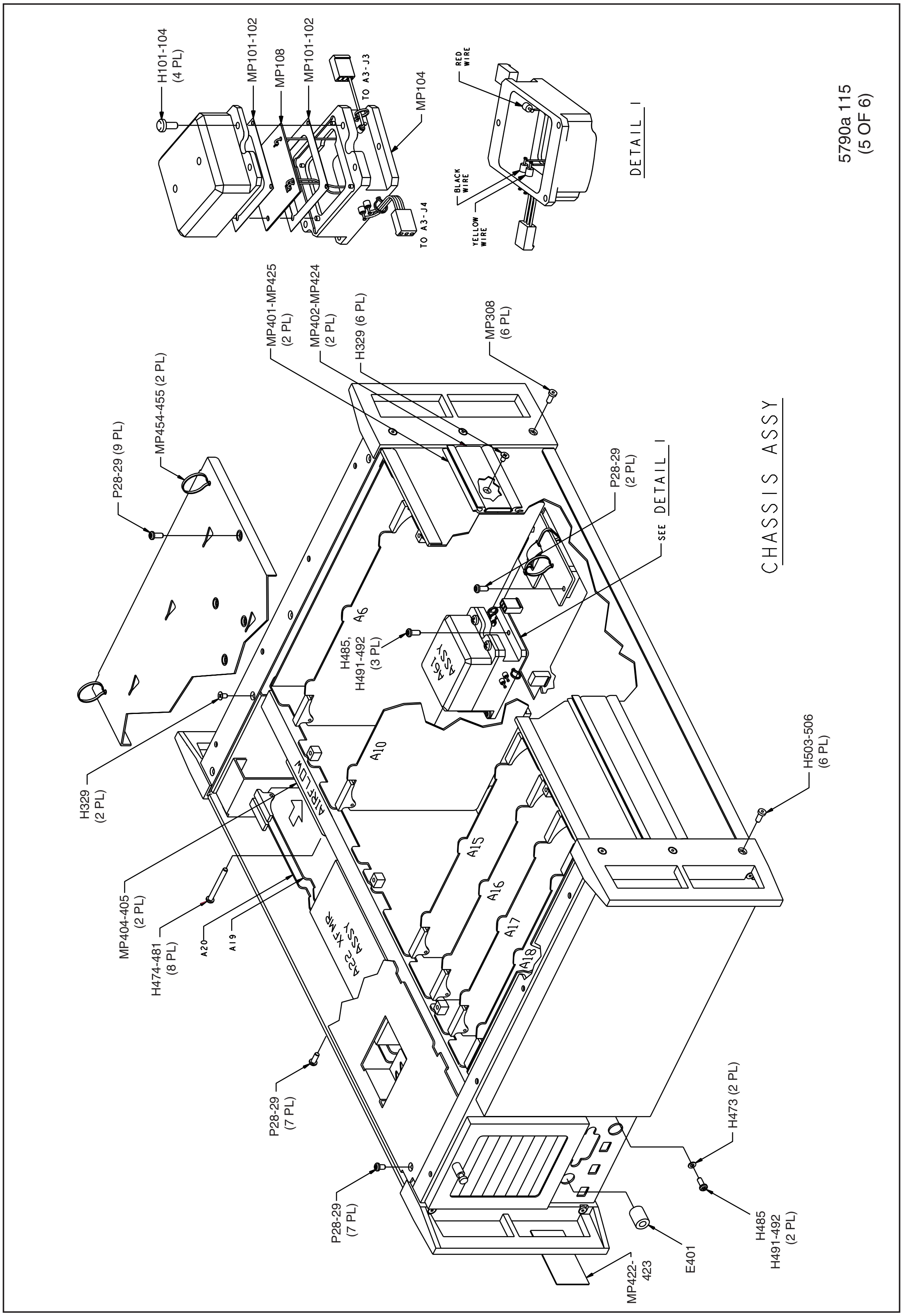


Figure 6-1. Final Assembly (Cont)

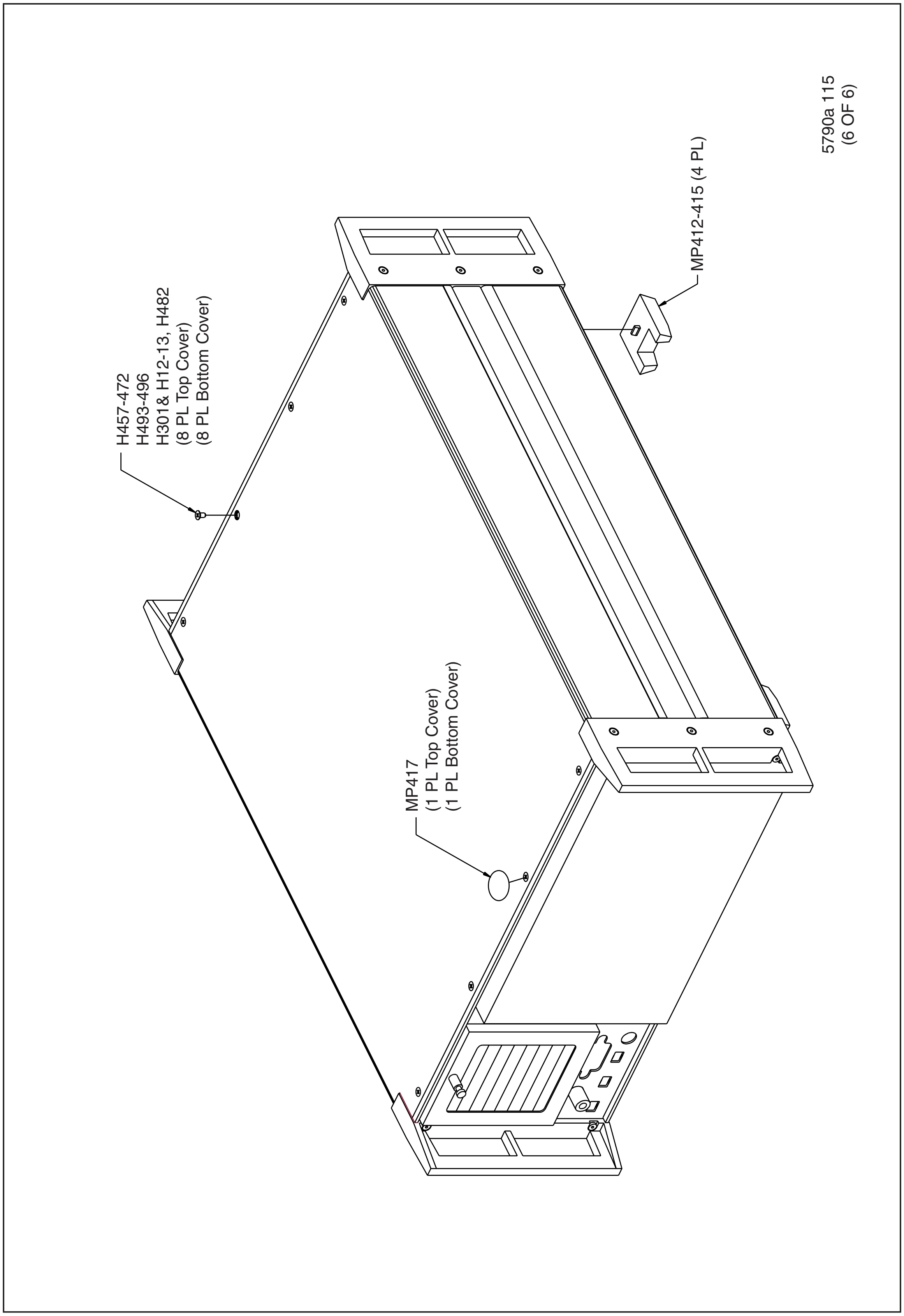
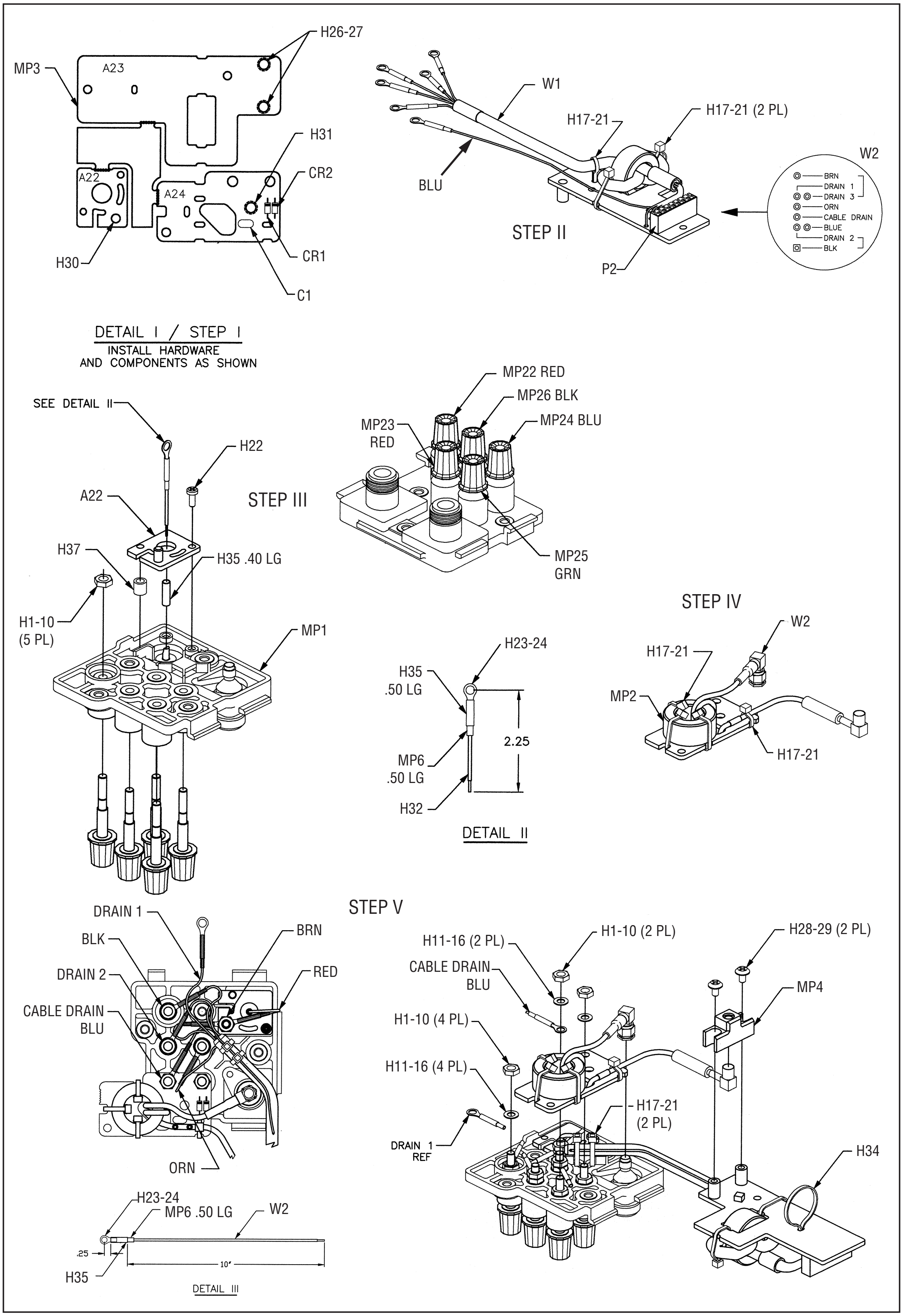


Figure 6-1. Final Assembly (Cont)

Table 6-3. A62 Input Block Assembly

Ref Des	Description	Part Number	Qty	Notes
C1	CAPACITOR R05R,CAP,CER,0.01UF,+-10%,100V,X7R	557587	1	
CR1-2	DIODE,1N4002 A52R,DIODE,SI,100V,1A,DO-41	698555	2	
H1-10,H36	5725A-8019,NUT, LOW THERMAL, 8-32	850334	11	
H11-16	5700A-8058,WASHER, LOW THERMAL #8	859939	6	
H17-21,H25 H33,H38-39	CABLE ACCESSORY,CABLE ACCESS,TIE,4.00L,.10W,.75 DIA	172080	9	
H22	SCREW,5-20,.312,WASHER HEAD,PHILLIPS,STEEL,ZINC-CHROMATE,HI-LO THD FORM	494641	1	
H23-24	TERMINAL,TERM,RING,#6,26-22AWG,CRIMP,GOLD	832667	2	
H26-27	STANDOFF,ROUND,6-32,.375,.250 OD,BRASS,TIN,SWAGE,.094 PANEL THK	877019	2	
H28-29	SCREW,6-32,.312,TRUSS,PHILLIPS,STAINLESS STEEL,PASSIVATED	335174	2	
H30	STUD,STUD,BROACH,PH BRNZ,8-32,.312	876409	1	
H31	SPACER,SPACER,SWAGE,.250 RND,BR,.140,.125	905351	1	
H32	WIRE,WIRE,TEF,UL1180,22AWG,STRN,RED	115576	0.3	
H34	6070A-2063,AIDE,PCB PULL	541730	1	
H35	SLEEVING,SLEEV,POLYOL,SHRINK,.125-.062ID,BLACK	149450	0.2	
H37	SPACER,SPACER,.250 RND,AL,.156ID,.250	153155	1	
MP1	5790A-2016,INPUT BLOCK, MOLDED	880724	1	
MP3	5790A-3122,PWB, INPUT BLOCK	885637	1	1
MP2	CORE,CORE,TOROID,FERRITE,.630X1.10X.512	474908	1	
MP4	5790A-2021,WIDEBAND CONNECTOR	893193	1	
MP6	SLEEVING,SLEEV,POLYOL,SHRINK,.046-.023ID,BLACK	144410	0.05	
MP22-23	5725A-2703-11,BINDING POST-RED	886382	2	
MP24	5725A-2703-13,BINDING POST-BLUE	886366	1	
MP25	5725A-2703-14,BINDING POST-GREEN	886374	1	
MP26	5725A-2703-15,BINDING POST-BLACK	886379	1	
P2	SOCKET,SOCKET,1 ROW,PWB,.156CTR,8 POS	886820	1	
W201	5790A-4444,CABLE ASSEMBLY, FRONT INPUT	1645218	1	

W202	5790A-4406,CABLE, WIDEBAND	893201	1	
Notes	1. Consists of A22, A23 and A24 PCA's			



5790a4204.eps

Figure 6-2. A62 Input Block Assembly

Table 6-4. A1 Keyboard PCA

Ref Des	Description	Part Number	Qty	Notes
CR1-6	LED, GREEN, SUBMINIATURE			
W1	5700A-4401, CABLE, MOTHER BD TO DISPLAY	802694	1	

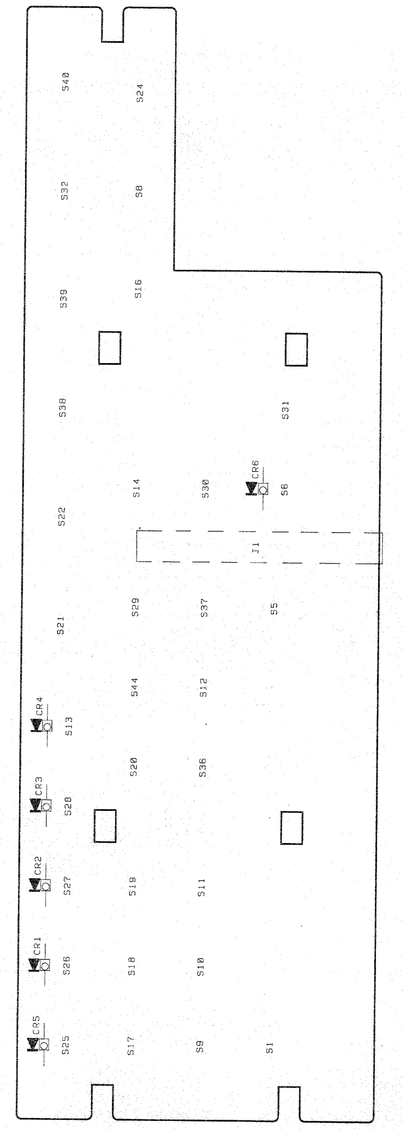


Figure 6-3. A1 Keyboard PCA

Table 6-5. A2 Front Panel PCA

Ref Des	Description	Part Number	Qty	Notes
C1	CAPACITOR SMR,CAP,TA,47UF,+-20%,10V	746990	1	
C2,C4,C9-20, C28,C30,C35, C37,C39-46,C64	CAPACITOR SMR,CAP,CER,0.1UF,+-10%,25V,X7R,1206	747287	27	
C3, C21-27, C29,C31,C36,C38, C47-50,C66	CAPACITOR SMR,CAP,TA,10UF,+-20%,25V,6032	927814	17	
C6,C8,C32,C34, C51-54	CAPACITOR,CERAMIC,0.01UF,+-20%,100V,X7R,1206,TAPE	742981	8	
C7	CAPACITOR ,CAP,AL,10UF,+-20%,100V,SOLV PROOF	820738	1	
C10-11	CAPACITOR ,CAP,POLYPR,0.33UF,+-5%,50V,HERMETIC	876367	2	
C33,C65	CAPACITOR SMR,CAP,TA,1.5UF,+-20%,50V,6032	929302	3	
C55-59,C61-62	CAPACITOR,R05A ,CAP,POLYES,0.68UF,+-20%,100V	912506	7	
C60	CAPACITOR,R05A ,CAP,POLYES,0.68UF,+-20%,100V	912506	1	
CR5-6	DIODE,SI,PN,JPAD5,35V,10MA,5PA REVERSE LEAKAGE,2 LEAD TO-92,TAPE	723817	2	
DS1	TUBE, DISPLAY, VAC FLOR,2-ROW,22-CHAR	806976	1	
DS2	TUBE,DISPLAY ,TUBE,DISPLAY,VAC FLUOR,256X26 GRAPHIC	832543	1	
J2	CONNECTOR,HEADER,2 ROW,.100CTR,VERT PWB,40 PIN,LATCHING	807453	1	
M1-010	BUMPER,RUBBER,BLACK,.50 SQ,.12 THK,ADHESIVE	543488	10	
MP1	BAG,MYLAR,STATIC SHIELD,OPEN TOP,.0031,18.00,18.00	680991	1	
Q1-4,Q7-10	PNP,BCX17 SMR,TRANSISTOR,SI,PNP,50V,350MW,SOT-23	742023	8	ϟ
Q5-6,Q11-12	NPN,BCX19 SMR,TRANSISTOR,SI,NPN,50V,350MW,SOT-23	742031	4	ϟ
R1,R3, R5-6, R8, R10-12, R20, R28-30, R55-59,R61, R63,R65,R72, R76	RESISTOR SMR,RES,CERM,4.7K,+-5%,.125W,200PPM,1206	740522	22	ϟ
R2,R4,R7,R9, R40-41,R52-53	RESISTOR SMR,RES,CERM,1.1K,+-5%,.125W,200PPM,1206	746008	8	ϟ
R13-15,R24-25, R70,R73-75	RESISTOR SMR,RES,CERM,39K,+-5%,.125W,200PPM,1206	746677	9	ϟ
R16-19,R78-80	RESISTOR SMR,RES,CERM,150,+-1%,.125W,100PPM,1206	772780	7	ϟ
R22,R26,R39,R42, R51,R54	RESISTOR SMR,RES,CERM,6.8K,+-5%,.125W,200PPM,1206	746024	6	ϟ
R23,R27,R71	RESISTOR SMR,RES,CERM,82K,+-5%,.125W,200PPM,1206	811794	3	ϟ
R31-34,R43-46,	RESISTOR SMR,RES,CERM,1K,+-	745992	12	ϟ

R60,R62,R64,R66	5%,.125W,200PPM,1206			
R35-36,R68	RESISTOR SMR,RES,CERM,620,+-5%,.125W,200PPM,1206	745984	3	ϟ
R37-38	RESISTOR SMR,RES,CERM,470,+-5%,.125W,200PPM,1206	740506	2	ϟ
R47-48	RESISTOR SMR,RES,CERM,453,+-1%,.125W,100PPM,1206	801415	2	ϟ
R49-50	RESISTOR SMR,RES,CERM,1.5K,+-5%,.125W,200PPM,1206	746438	2	ϟ
R67	RESISTOR SMR,RES,CERM,200,+-5%,.125W,200PPM,1206	746339	1	ϟ
R77	RESISTOR SMR,RES,CERM,91,+-5%,.125W,200PPM,1206	756338	1	ϟ
R81-82	RESISTOR SMR,RES,CERM,10,+-5%,1W,200PPM,2512	886705	2	ϟ
R83	RESISTOR,CERMET,200,+-5%,0.5W,200PPM,2010,TAPE	886952	1	ϟ
SP1	AUDIO TRANSDUCER,PIEZO,SOUNDER, 4KHZ,25V,22MM RND,BULK	602490	1	
U1-2	NMOS 2130 SM,IC,NMOS,1K X 8 DUAL PORT SRAM,PLCC	806653	2	ϟ
U3	IC, PROG ARRAY LOGIC, 5C090/EP900, PRGMD, 5700A-90720, PLCC44	838607	1	ϟ
U4	CMOS 5C090 SM,IC,CMOS,PLD,PROGRAMD,5700A-90721,PLCC	838615	1	ϟ
U5	CMOS 5C090 SM,IC,CMOS,PLD,PROGRAMD,5700A-90722,PLCC	845375	1	ϟ
U6	CMOS 74HC4060 SMR,IC,CMOS,14 STAGE BINARY COUNTER,SOIC	831081	1	ϟ
U7	BIPOLAR NE522 SMR,IC,COMPARATOR,DUAL,HIGH SPEED,SOIC	831271	1	ϟ
U8	CMOS 74HC4040 SMR,IC,CMOS,12 STAGE BIN RIPPLE CNTR,SOIC	831636	1	ϟ
U9	CMOS 5C090 SM,IC,CMOS,PLD,PROGRAMD,5700A-90723,PLCC	845383	1	ϟ
U10	LSTTL 74LS373 SMR,IC,LSTTL,OCTL D TRNSPRNT LATCHES,SOIC	742726	1	ϟ
U12	CMOS 74HC74 SMR,IC,CMOS,DUAL D F/F,+EDG TRG,SOIC	782995	1	
U13	TTL 7406 SMR,IC,TTL,HEX INVERTER,W/OPEN COLL,SOIC	741249	1	
U14-23	IC,DISPLAY DRIVER,HV518,5.0V,80V,PLCC44,TAPE	741231	10	
U24	CMOS 5C060 SM,IC,CMOS,PLD,PROGRAMD,5700A-90724,PLCC	837369	1	
U110	CMOS 74HCT04 SMR,IC,CMOS,HEX INVERTER,SOIC	742585	1	
VR3-4	ZENER,UNCOMP,1SMB5920,6.2V,5%,60.5MA,3W,SMB ,TAPE	886700	2	
VR5	ZENER,UNCOMP,MMBZ5231B,5.1V,5%,20MA,225MW, SOT-23,TAPE	837179	1	
W1	5700A-4401 ,CABLE, MOTHER BD TO DISPLAY	802694	1	
Notes	ϟ Static sensitive part.			

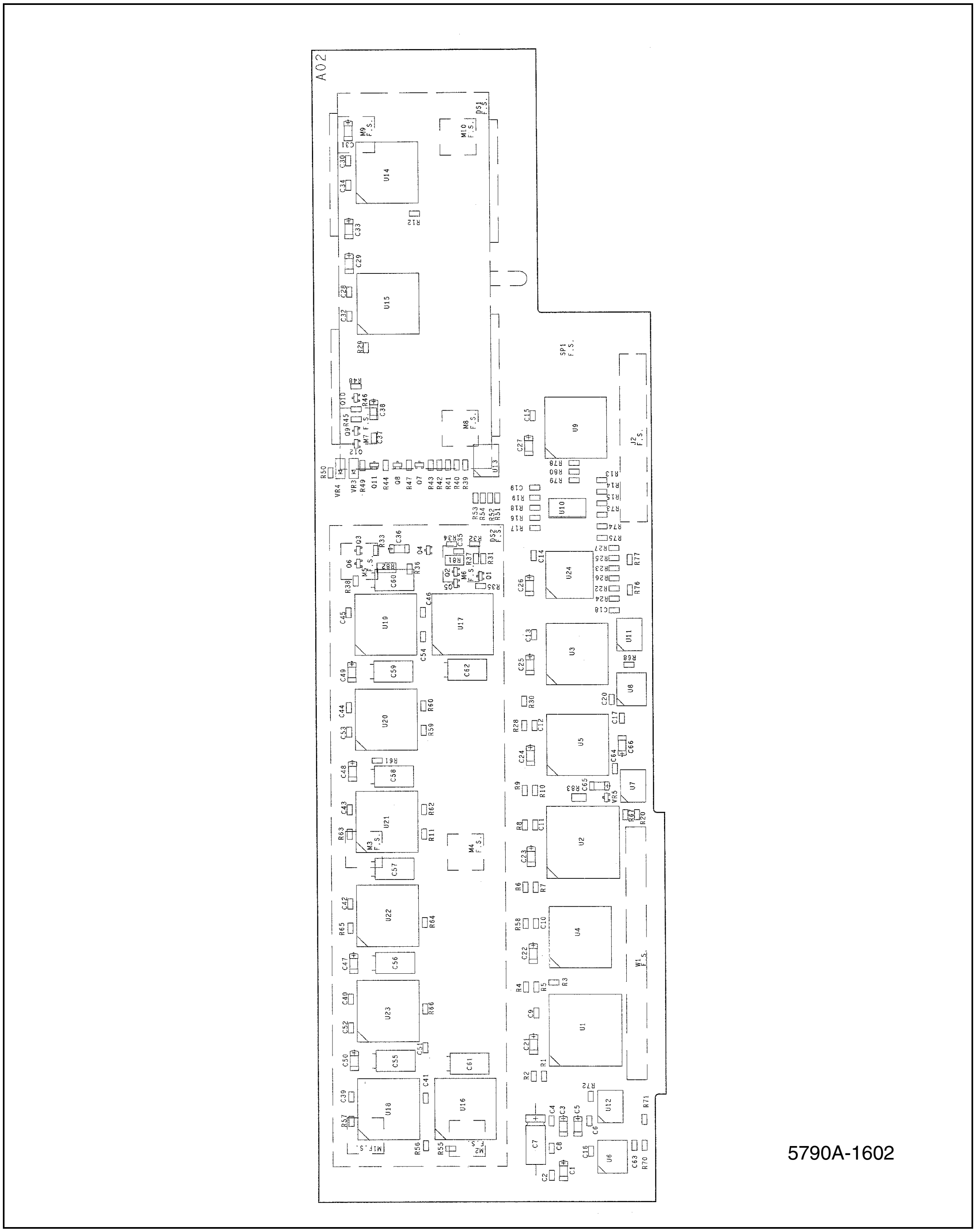


Figure 6-4. A2 Front Panel PCA

Table 6-6. A3 Analog Motherboard PCA

Ref Des	Description	Part Number	Qty	Notes
C1,C3	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	2	
C4	CAPACITOR R05R,CAP,TA,22UF,+-20%,25V	845149	1	
C5	CAPACITOR,R05A,CAP,POLYES,0.001UF,+-10%,50V	720938	1	
C6-7	CAPACITOR R05R,CAP,CER,33PF,+-5%,50V,C0G	714543	2	
CR1-4	BRIDGE,DB101,DIODE BRIDGE,SI,50V,1A,DIP	418582	4	
E1	SURGE PROTECTOR,SURGE PROTECTOR,90V,+-20%	198507	1	
H1-2	SPACER,SPACER,SWAGE,.250 RND,BR,6-32,.625	877063	2	
H3-5	STANDOFF,ROUND,6-32,.375,.250 OD,BRASS,SWAGE,.094 PANEL THK	877019	3	
H7-20	CONNECTOR ACC,CONN ACC,DIN41612,KEY	832733	14	
J2	HEADER,HEADER,1 ROW,.156CTR,8 PIN	886812	1	
J34	HEADER,HEADER,1 ROW,.156CTR,3 PIN	380022	2	
J71	FIBER OPTIC,FIBER OPTIC,RECEIVER,1MBD	822148	1	
J72	FIBER OPTIC,FIBER OPTIC,TRANSMITTER,1MBD	822155	1	
J106, J110, J113, J115-118, J206, J210, J213, J215-218	CONNECTOR,DIN41612,TYPE C(F),VERTICAL,64 POS	807818	14	
J811-812, J821-822	SOCKET,SOCKET,1 ROW,PWB,.156CTR,10 POS	851183	4	
K1-4	RELAY,RELAY,ARMATURE,2 FORM C,4.5 V,SEALED	875638	4	
K7	RELAY,RELAY,ARMATURE,2 FORM C,5VDC	876854	1	
MP1-28	RIVET,AL,.089 DIA,.250 L,SEMI-TUBULAR,OVAL HEAD,DEEP HOLE	838482	28	
R1, R3	RESISTOR A52R,RES,CF,750,+-5%,0.25W	441659	2	
R2	RESISTOR A52R,RES,CF,91,+-5%,0.25W	441683	1	
R4	RESISTOR A52R,RES,CF,16K,+-5%,0.25W	442376	1	
U1	CMOS 82C55A,IC,CMOS,PROGRMBL PERIPHERAL INTERFACE	780650	1	ϟ
VR1-2	ZENER,UNCOMP,1N5349B,12V,5%,100MA,5W,AXIAL,BULK	876862	2	ϟ
XU1	SOCKET,SOCKET,IC,40 PIN	429282	1	
Z1	RESISTOR,RES,CERM,SIP,10 PIN,9 RES,3K,+-2%	501528	1	
Z2	RESISTOR,RES,CERM,SIP,6 PIN,5 RES,10K,+-2%	500876	1	
Notes	ϟ Static sensitive part.			

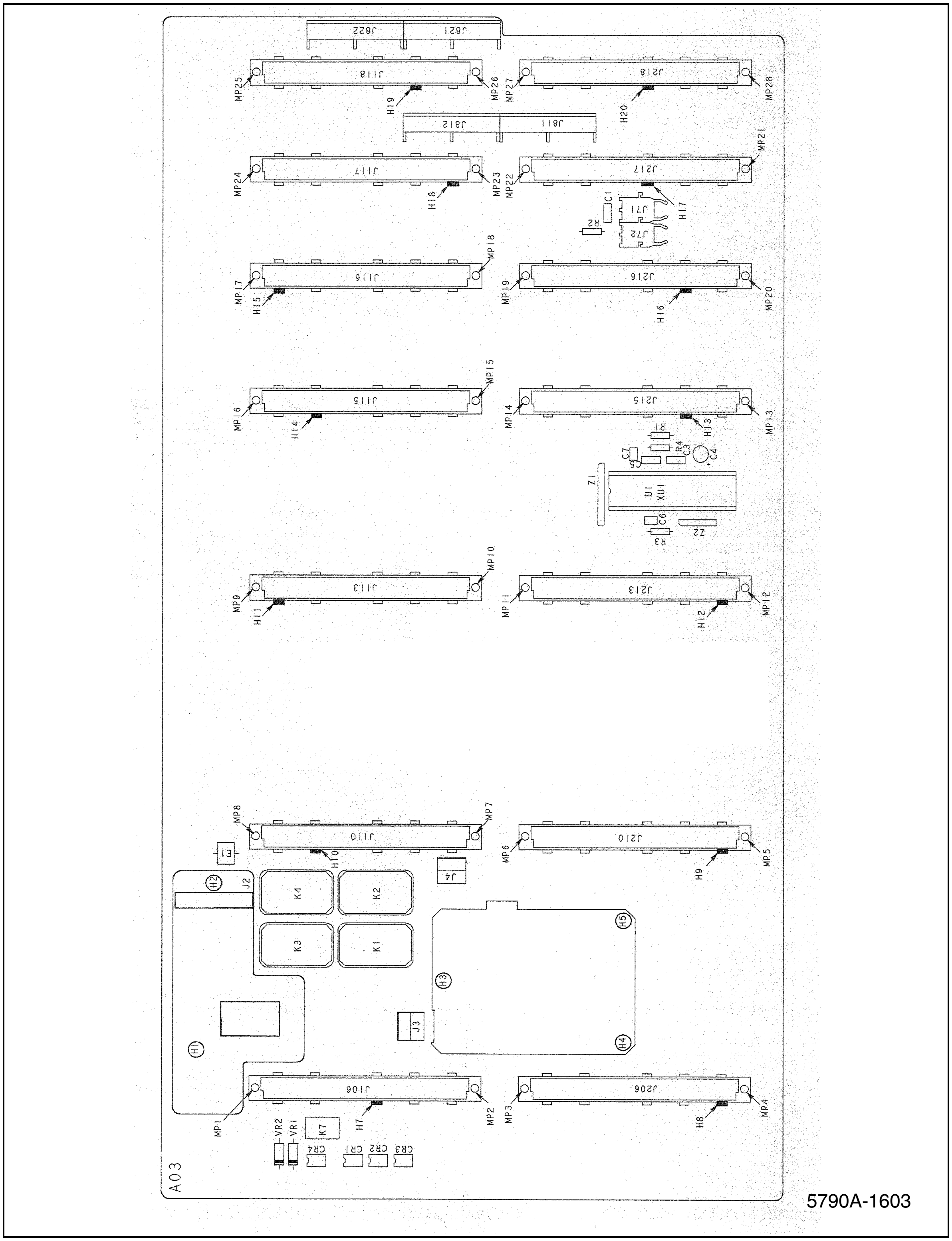


Figure 6-5. A3 Analog Motherboard PCA

Table 6-7. A4 Digiital Motherboard PCA

Ref Des	Description	Part Number	Qty	Notes
C1,C4	CAPACITOR R05R,CAP,TA,10UF,+-20%,35V	816512	2	
C3	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	1	
C5	CAPACITOR,CAP,POLYES,0.1UF,+-20%,250VAC	542233	1	
C6	CAPACITOR R05A,CAP,CER,6800PF,+-5%,100V,C0G	816710	1	
CR1-2	BRIDGE,DB101,DIODE BRIDGE,SI,50V,1A,DIP	418582	2	
CR3-4	DIODE,1N4002 A52R,DIODE,SI,100V,1A,DO-41	698555	2	
F1	FUSE ,FUSE,.25X1.25,1.5A,250V,SLOW	109231	1	
H1-2	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	2	
H3-5	CONNECTOR ACC ,CONN ACC,DIN41612,KEY	832733	3	
H6-7	WASHER,WASHER,FLAT,STL,.093,.219,.020	306415	2	
H8-14	CABLE ACCESSORY,CABLE ACCESS,TIE,4.00L,.10W,.75 DIA	172080	7	
H15-17	SPACER,ROUND,.187 L,AL,SNAP-TOP,BROACH	820639	3	
J11	HEADER ,HEADER,1 ROW,.156CTR,12 PIN	831354	1	
J13	HEADER,HEADER,1 ROW,.156CTR,10 PIN	446724	1	
J14	HEADER ,HEADER,1 ROW,.156CTR,16 PIN	831370	1	
J15	HEADER ,HEADER,1 ROW,.156CTR,14 PIN	831362	1	
J16	HEADER,HEADER,1 ROW,.156CTR,8 PIN	385435	1	
J31	CONNECTOR,HEADER,1 ROW,.156 INCH CENTERS,LOCKING RAMP,RIGHT ANGLE,TIN,5 PIN,BULKPurchased Item	844717	1	
J51-52	HEADER ,HEADER,1 ROW,.156CTR,3 PIN	380022	2	
J73	FIBER OPTIC,FIBER OPTIC,TRANSMITTER,1MBD	822155	1	
J74	FIBER OPTIC,FIBER OPTIC,RECEIVER,1MBD	822148	1	
J102	CONNECTOR CONN,DIN41612,TYPE C,RT ANG,64 PIN	853437	1	
J119-120, J220	CONNECTOR,DIN41612,TYPE C(F),VERTICAL,64 POS	807818	3	
J121	HEADER,HEADER,2 ROW,.100CTR,34 PIN	851696	1	
MP1	HOLDER PART,HLDR PART,FUSE,BODY,PWB MT	602763	1	
MP2	HOLDER PART,HLDR PART,FUSE,CAP,1/4X1-1/4	460238	1	
MP3-10	RIVET,AL,.089 DIA,.250 L,SEMI-TUBULAR,OVAL HEAD,DEEP HOLE	838482	8	
MP17-18, MP20	SPACER,SPACER,SWAGED,.312 RND,BR,.177ID,.093	837864	3	

MP22-23	BUMPER,HI-TEMP SILICONE,.44 DIA,.188 THK,ADHESIVE	1601870	2	
P81-82	HEADER,HEADER,1 ROW,.156CTR,20 PIN	831222	2	
R1	RESISTOR A52R,RES,CF,91,+-5%,0.25W	441683	1	
R2-3	RESISTOR,RES,WW,2,+-1%,.7W	255646	2	
R4	RESISTOR,CARBON FILM,68,+-5%,0.25W,+350 TO -450PPM,AXIAL,TAPE	414532	1	
RV2	VARISTOR,VARISTOR,430V,+-10%,1.0MA	519355	1	
SW1	5700A-4323,POWER SWITCH ASSY	665513	1	
SW2-4	SWITCH,SWITCH,SLIDE,DPDT,LINE SELECT,RT ANG	817353	3	
VR1-2	ZENER,UNCOMP,1N5349B,12V,5%,100MA,5W,AXIAL,BULK	876862	2	ϟ
W15	5700A-4408,CABLE, FIBER OPTIC	802769	1	
W90	5700A-4404,CABLE, REAR PANEL-CPU	802728	1	
Notes	ϟ Static sensitive part.			

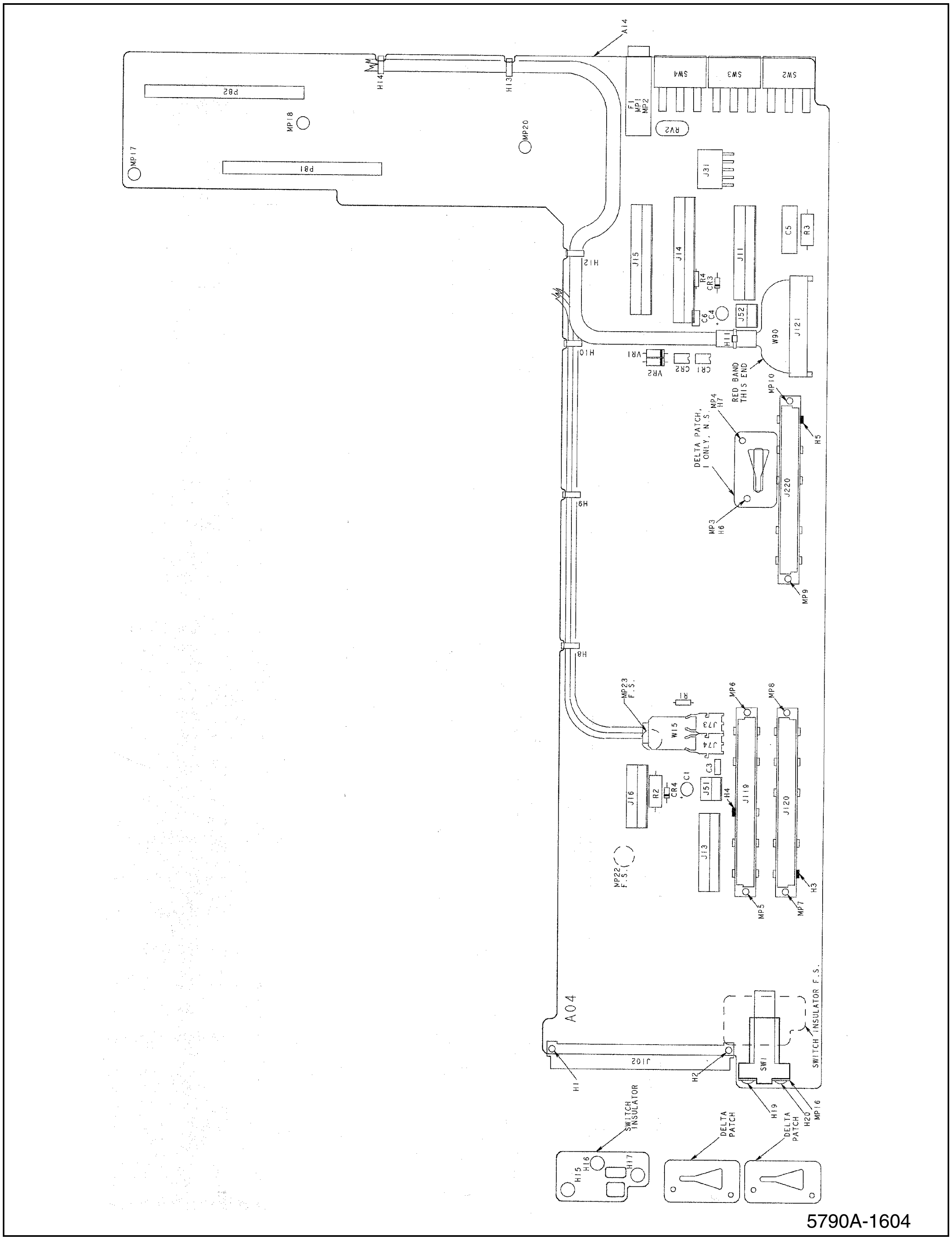


Figure 6-6. A4 Digital Motherboard PCA

Table 6-8. A6 Wideband PCA (Option -03)

Ref Des	Description	Part Number	Qty	Notes
A1	RMS SUPPORT PCA	893268	1	ϟ
A2	WB INPUT PROTECTION PCA	893271	1	ϟ
C1-3,C5-8,C110	CAPACITOR R05R,CAP,TA,6.8UF,+-20%,10V	655043	8	
C4,C111,C113	CAPACITOR R05R,CAP,TA,22UF,+-20%,10V	658971	3	
C9-19,C21-22,C29,C32-34, C36,C40, C1, C84-85	CAPACITOR R05R,CAP,TA,4.7UF,+-20%,25V	807644	22	
C20,C24	CAPACITOR ,CAP,VAR,0.35-3.5PF,250V,AIR	603456	2	
C23,C114,C9, C11	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	4	
C25	CAPACITOR R02R,CAP,CER,82PF,+-2%,100V,C0G	512350	1	
C26,C28,C31,C35, C37,C41,C43,C46, C48,C53,C59,C61, C63,C66-67, C73-75,C77-78, C82-83,C87, C90-92, C95-96 C98-99, C101-103, C105-106	CAPACITOR R05R,CAP,CER,0.10UF,+-20%,50V,X7R	853650	35	
C27,C44-45, C47, C50,C57	CAPACITOR R05R,CAP,CER,1000PF,+-20%,50V,X7R	697458	6	
C30	CAPACITOR R05A,CAP,CER,18PF,+-2%,100V,C0G	830638	1	
C38,C55,C79,C93	CAPACITOR,R05A,CAP,POLYES,0.47UF,+-10%,50V	697409	6	
C39	CAPACITOR,R05A,CAP,POLYES,1UF,+-10%,50V	733089	2	
C49	CAPACITOR R05R,CAP,CER,68PF,+-2%,50V,C0G	715300	1	
C51,C54	CAPACITOR R05R,CAP,CER,1000PF,+-2%,50V,C0G	807966	2	
C64,C71,C76, C86,C88-89,C94, C100	CAPACITOR R05R,CAP,CER,100PF,+-5%,50V,C0G	831495	8	
C80,C97	CAPACITOR R05R,CAP,CER,180PF,+-2%,50V,C0G	820522	2	
C104	CAPACITOR R05R,CAP,CER,22PF,+-2%,50V,C0G	714832	1	
C107-108	CAPACITOR R05R,CAP,TA,22UF,+-20%,25V	845149	2	
C115	CAPACITOR R05R,CAP,CER,0.22UF,+80-20%,50V,Z5U	733386	1	
CR1,R5, CR14-15, CR24-25, CR30-31	DIODE,FDH400,DIODE,SI,200V,500MA,DO-35	876867	8	ϟ
CR9-12,CR20-21, CR26-29, CR2, CR2-4, CR6-8	DIODE,1N4448 A52R,DIODE,SI,75V,150MA,DO-35	203323	17	ϟ

CR16-19,CR22-23	DIODE,5082-2800,DIODE,SI,SCHOTTKY,70V,20MA,DO-35	535195	6	ϟ
E1	SURGE PROTECTOR SURGE PROTECTOR,90V,+-20%	198507	1	
H1-4	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	4	
J1	CONNECTOR ,CONN,COAX,SMB(M),PWB,RT ANG	353243	1	
K1,K4,K9-10	RELAY,RELAY,ARMATURE,2 FORM C,5VDC	876854	4	
K2-3,K5-8	RELAY,RELAY,ARMATURE,2 FORM C,5V,LATCH	875356	6	
L1	INDUCTOR,44NH,15%,2ADC,25MOHM,SHIELDED,AXIAL,BUL K	249110	1	
L2	INDUCTOR,82NH,10%,1.79ADC,29MOHM,SHIELDED,AXIAL, BULK	256289	1	
L3,L14,TP1-7,TP9, TP11-17 JM1, TP2-3	JUMPERR05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	20	
L5-13,L16-17	CHOKE,38.4UH,6TURN,6160A-8002,BULK	320911	11	
MP5-6	INSULATION PART,INSUL PT,TRANSISTOR,NYL,8PIN	348581	2	
MP7-8	EJECTOR ,EJECTOR,PWB,NYLON	494724	2	
MP9	5700A-2064,OSCILLATOR THERMAL COVER	797696	1	
MP10	5790A-2088,SHIELD, WIDEBAND REAR	869081	1	
MP11	5790A-2089,SHIELD, WIDEBAND FRONT	869078	1	
MP12-13	SCREW,6-32,.500,PAN,PHILLIPS,STEEL,ZINC-CLEAR,LOCK	152173	2	
P106,P206	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	807800	2	
Q3,Q6	JFET,SI,N,U430,25V,15MA,DUAL,SELECTED,TO-78,BULK	876859	2	ϟ
Q9, Q1	PNP,2N2905A,TRANSISTOR,SI,PNP,60V,600MW,TO-39	402586	2	ϟ
Q10, Q2	TRANSISTOR,SI,NPN,2N2219A,75V,800MA,300MHZ,800MW, TO-39,BULK	346916	2	ϟ
Q11	FET,PWR,N-CHL R05A,TRANSISTOR,SI,N-DMOS PWR FET,TO-92	782565	1	ϟ
Q12-17	MOSFET,SI,N,SD210,30V,50MA,45 OHMS,300MW,DMOS,LOW CAPACITANCE,TO-72,BULK	394122	6	ϟ
Q19-22, Q1-2	NPN,MPSH34 R05A,TRANSISTOR,SI,NPN,40V,350MW,TO-92	820407	6	ϟ
Q23	PNP,BFQ52 ,TRANSISTOR,SI,PNP,20V,150MW,TO-72	876870	1	ϟ
R1-2,R8, ,R34 R51, R55,R80, R123, R5	RESISTOR A52R,RES,MF,1K,+-1%,0.125W,100PPM	168229	9	
R3-4,R6,R95, R131,R4, R1-3, R5, R9, R12, R15	RESISTOR A52R,RES,MF,10K,+-1%,0.125W,100PPM	168260	13	
R5,R140	RESISTOR A52R,RES,CF,5.1K,+-5%,0.25W	368712	2	
R7	RESISTOR A52R,RES,MF,24.9,+-1%,0.125W,100PPM	296657	1	
R9,R144-145	RESISTOR A52R,RES,MF,15,+-1%,0.125W,100PPM	296434	3	
R18,R62	RESISTOR A52R,RES,MF,499K,+-1%,0.125W,100PPM	268813	2	
R19,R132-133	RESISTOR A52R,RES,CF,100,+-5%,0.25W	348771	3	

R21	RESISTOR A52R,RES,MF,442K,+-1%,0.125W,100PPM	375956	1	
R25,R29,R35	RESISTOR A52R,RES,MF,49.9,+-1%,0.125W,100PPM	305896	3	
R28,R117,R119, R139, R9	RESISTOR A52R,RES,CF,2M,+-5%,0.25W	442582	5	
R37	RESISTOR,CARBON COMPOSITION,51,+-5%,1W,AXIAL,TAPE	157586	1	
R38,R48,R65,R73, R83,R96,R99, R105,R143	RESISTOR A52R,RES,CF,51,+-5%,0.25W	414540	9	
R43	RESISTOR ,RES,MF,50,+-0.05%,0.125W,15PPM	500264	1	
R44	RESISTOR A52R,RES,MF,154,+-1%,0.125W,100PPM	447987	1	
R45,R87	RESISTOR,METAL FILM,1.27K,\+-1%,0.5W,100PPM,AXIAL,TAPE	245753	2	
R46,R54,R60, R67,R115,R120	RESISTOR A52R,RES,CF,5.1,+-5%,0.25W	441287	6	
R49,R106,R126, R141	RESISTOR A52R,RES,MF,499,+-1%,0.125W,50PPM	289256	4	
R53,R94	RESISTOR A52R,RES,MF,30.9,+-1%,0.125W,100PPM	321315	2	
R57,R6, R3, R15	RESISTOR A52R,RES,CF,1.5K,+-5%,0.25W	343418	4	
R58,R110	RESISTOR A52R,RES,CF,3K,+-5%,0.25W	441527	2	
R68	RESISTOR A52R,RES,MF,54.9K,+-1%,0.125W,100PPM	271353	1	
R69-70,R92,R114, R116	RESISTOR,METAL FILM,909,+-1%,0.125W,100PPM,AXIAL,TAPE	312629	5	
R71,R77,R84,R97, R121,R125	RESISTOR A52R,RES,MF,82,+-5%,2W,100PPM	876875	6	
R72,R111	RESISTOR A52R,RES,MF,3.32K,+-1%,0.125W,100PPM	312652	2	
R74,R109	RESISTOR A52R,RES,MF,392,+-1%,0.125W,100PPM	260299	2	
R75	RESISTOR A52R,RES,CF,330K,+-5%,0.25W	376640	1	
R76	RESISTOR A52R,RES,MF,1.5K,+-1%,0.125W,100PPM	313098	1	
R78	RESISTOR A52R,RES,CF,3.6K,+-5%,0.25W	442343	1	
R79,R93	RESISTOR,METAL FILM,237,+-1%,0.125W,100PPM,AXIAL,TAPE	328005	2	
R81	RESISTOR A52R,RES,MF,332,+-1%,0.125W,100PPM	192898	1	
R82	RESISTOR A52R,RES,CF,82K,+-5%,0.25W	348912	1	
R85,R88	RESISTOR A52R,RES,CF,68K,+-5%,0.25W	376632	2	
R86	RESISTOR A52R,RES,MF,26.7K,+-1%,0.125W,100PPM	245779	1	
R89,R91	RESISTOR A52R,RES,MF,6.49K,+-1%,0.125W,100PPM	294900	2	
R90	RESISTOR A52R,RES,MF,301,+-1%,0.125W,100PPM	267740	1	
R100,R104,R122, R124	RESISTOR A52R,RES,MF,243,+-0.1%,0.125W,50PPM	512228	4	
R103	RESISTOR 52R,RES,MF,110K,+-1%,0.125W,100PPM	234708	1	
R118	RESISTOR A52R,RES,MF,10,+-1%,0.125W,100PPM	268789	1	

R129, R12, R17	RESISTOR A52R,RES,CF,2.4K,+-5%,0.25W	441493	3	
R134-135	RESISTOR A52R,RES,MF,34.8,+-1%,0.125W,100PPM	343897	2	
R136	RESISTOR A52R,RES,MF,84.5,+-1%,0.125W,100PPM	236851	1	
R137,R147	RESISTOR A52R,RES,MF,357,+-1%,0.125W,100PPM	443036	2	
R142	RESISTOR A52R,RES,MF,536,+-1%,0.125W,100PPM	500892	1	
R146	RESISTOR A52R,RES,MF,66.5,+-1%,0.125W,100PPM	305987	1	
R148-149	RESISTORA52R,RES,CF,1,+-5%,0.25W	357665	2	
U1,U10,U12	BIFET LF412A ,IC,OP AMP,DUAL,LO OFFST VOLT,LO-DRIFT	851704	3	ϟ
U2-3,U5	IC,OP AMP,AD9618,+-5V,2.2MV OFFSET,130MHZ,LO DISTORTION,I FEEDBACK,DIP8,TUBE	886684	3	ϟ
U4	BIPOLAR 7805,IC,VOLT REG,FIXED,+5 VOLTS,1.5 AMPS	355107	1	ϟ
U6,U8	BIPOLAR 317,IC,VOLT REG,ADJ,1.2 TO 37 V,1.5 AMPS	460410	2	ϟ
U7,U9	BIPOLAR LM337,IC,VOLT REG,ADJ,NEG,-1.2VTO-37V,1.5A	772996	2	ϟ
U11	IC,COMPARATOR,NE521,+-5V,7.5MV OFFSET,HI-SPEED,DUAL,DIP14,TUBE	556449	1	ϟ
U13	BIPOLAR 393,IC,COMPARATOR,DUAL,LO-PWR,8 PIN DIP	478354	1	ϟ
U14	BIPOLAR 7905,IC,VOLT REG,FIXED,-5 VOLTS,1.5 AMPS	394551	1	ϟ
U15	5700A-4H09T,RMS CONVERTER TESTED 400 OHM-A GRADE	842591	1	ϟ
U16 U3	IC,ANALOG SWITCH,ADG201HS,+-15V,75 OHMS,SPST,QUAD,DIP16,TUBES	875328	2	ϟ
U20-21	CMOS 74HCT374,IC,CMOS,OCTL D F/F W/3-STATE,+EDG TRG	585364	2	ϟ
U23-24	BIPOLAR 339,IC,COMPARATOR,QUAD,14 PIN DIP	387233	2	ϟ
U25-26	BIMOS 5801,IC,BIMOS,8 CHNL HI-VOLT DRVR W/LATCH	782912	2	ϟ
U27	CMOS 74HC00,IC,CMOS,QUAD 2 INPUT NAND GATE	707323	1	ϟ
VR3-4	ZENER,UNCOMP,1N4730A,3.9V,5%,64MA,1W,DO-41,BULK	535641	2	ϟ
VR7	ZENER,UNCOMP,1N5256B,30V,5%,4.2MA,500MW,DO-35,TAPE	634121	1	ϟ
Z1,Z3	5790A-2703,RN/SUPPORT ASSY-4R03H	885512	2	ϟ
Z2	5790A-2704,RN/SUPPORT ASSY-4R04H	885517	1	ϟ
Z4	5790A-2705,RN/SUPPORT ASSY-4R05H	885520	1	ϟ
Z5,Z9-10	RESISTOR,RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	3	
Z6	RESISTOR,RES,CERM,SIP,8 PIN,7 RES,10K,+-2%	412924	1	
Z7	RESISTOR,NETWORK,CERMET,ISOLATED,8 PIN,4 RES,1K,+-2%,0.2W,100PPM,SIP8,BULK	714345	1	
Notes	ϟ Static sensitive part.			

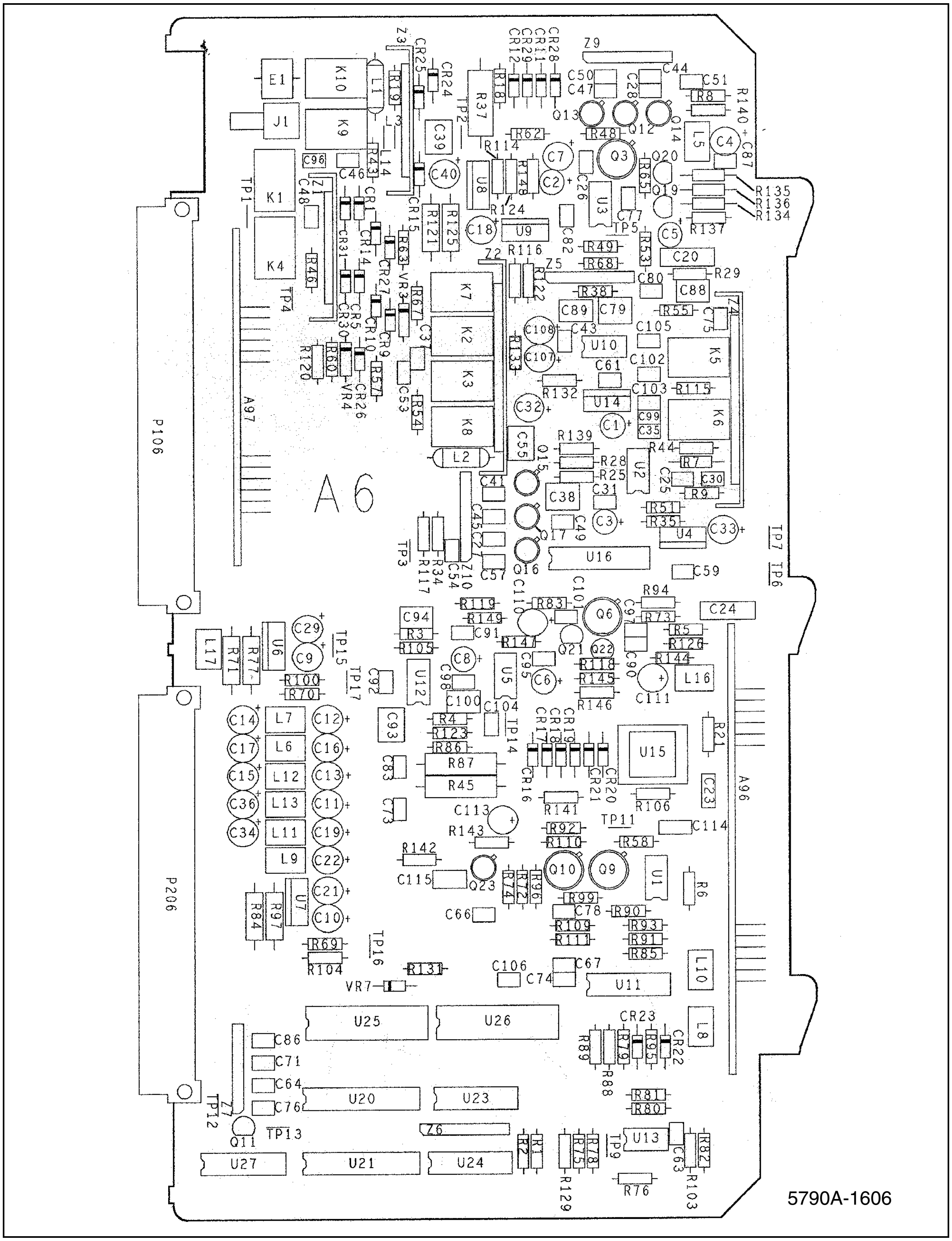


Figure 6-7. A6 Wideband PCA (Option -03)

Table 6-9. A6A1 RMS Support PCA

Ref Des	Description	Part Number	Qty	Notes
C1	CAPACITOR R05R,CAP,TA,4.7UF,+-20%,25V	807644	1	
C2,C7-8,C10, C12-13,C16, C24-25	CAPACITOR,R05A,CAP,POLYES,0.01UF,+-10%,50V	715037	9	
C3-4	CAPACITOR,R05A,CAP,POLYES,0.47UF,+-10%,50V	697409	2	
C5	CAPACITOR,R05A,CAP,POLYES,1UF,+-10%,50V	733089	1	
C6	CAPACITOR,R05A,CAP,POLYES,0.047UF,+-10%,50V	820548	1	
C9,C11	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	2	
C14	CAPACITOR R05R,CAP,CER,330PF,+-5%,50V,C0G	697441	1	
C15,C17	CAPACITOR R05R,CAP,CER,82PF,+-2%,50V,C0G	714857	2	
CR1	DIODE,BA483 A52A,DIODE,SI,PIN,35V,100MA,DO-7	806646	1	ϟ
CR2	DIODE,1N4448 A52R,DIODE,SI,75V,150MA,DO-35	203323	1	ϟ
JM1,TP2-3	JUMPER R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	3	
P1-2	HEADER ,HEADER,2 ROW,.100CTR,RT ANG,12 PIN	806935	2	
Q1-2	NPN,MPSH34 R05A,TRANSISTOR,SI,NPN,40V,350MW,TO-92	820407	2	ϟ
Q3	N-JFET R05R,TRANSISTOR,SI,N-JFET,SEL,TO-92	832162	1	ϟ
R1	RESISTOR A52R,RES,CF,1K,+-5%,0.25W	343426	1	
R2	RESISTOR A52R,RES,CF,36,+-5%,0.25W	442236	1	
R3,R15	RESISTOR A52R,RES,CF,1.5K,+-5%,0.25W	343418	2	
R4	RESISTOR A52R,RES,MF,10K,+-1%,0.125W,100PPM	168260	1	
R5	RESISTOR A52R,RES,MF,1K,+-1%,0.125W,100PPM	168229	1	
R6,R10	RESISTOR A52R,RES,CF,750,+-5%,0.25W	441659	2	
R7	RESISTOR A52R,RES,CF,62K,+-5%,0.25W	348904	1	
R8	RESISTOR A52R,RES,MF,2K,+-1%,0.125W,100PPM	235226	1	
R9	RESISTOR A52R,RES,CF,2M,+-5%,0.25W	442582	1	
R11	RESISTOR A52R,RES,CF,330,+-5%,0.25W	368720	1	
R12	RESISTOR A52R,RES,CF,2.4K,+-5%,0.25W	441493	1	
R13	RESISTOR A52R,RES,CF,200K,+-5%,0.25W	441485	1	
R14	RESISTOR A52R,RES,MF,1.43K,+-1%,0.125W,25PPM	447995	1	
U1	BIPOLAR LT1016C,IC,COMPARATOR,HI-SPEED,PRECISION	822197	1	ϟ
U2	FTTL 74F161A,IC,FTTL,SYNC DIV BY 16 BINARY CNTR	876883	1	ϟ
U3	IC,ANALOG SWITCH,ADG201HS,+-15V,75 OHMS,SPST,QUAD,DIP16,TUBES	875328	1	ϟ

U4	BIPOLAR 3096,IC,ARRAY,5 TRANS,5 ISO: 2-PNP,3-NPN	418954	1	ϟ
U5	BIPOLAR LT1013C,IC,OP AMP,DUAL,PRECISION,8-PIN DIP	783696	1	ϟ
U6	BIPOLAR AD633 ,IC,BPLR,ANALOG MULTIPLIER	845151	1	ϟ
VR1	ZENER A52R,ZENER,COMP,6.4V,5%,20PPM,4MA	381988	1	ϟ
Z1-3	RESISTOR,NETWORK,CERMET,ISOLATED,8 PIN,4 RES,1K,+-2%,0.2W,100PPM,SIP8,BULK	714345	3	
Z4-5	RESISTOR,RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	2	
Notes	ϟ Static sensitive part.			

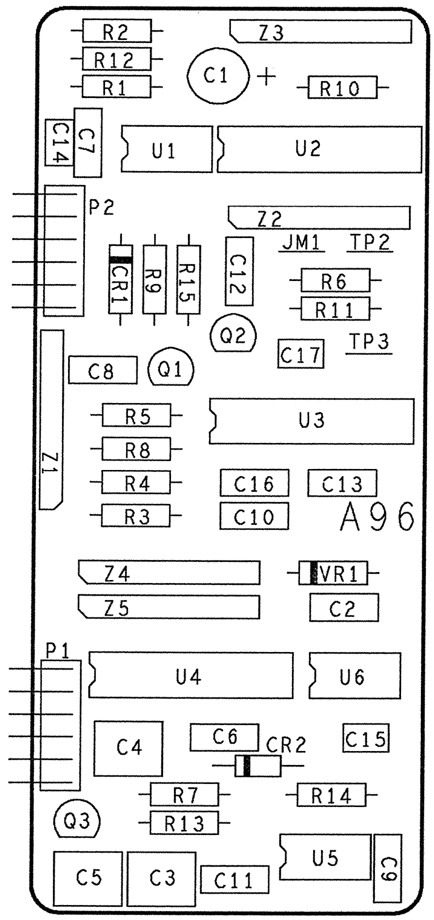


Figure 6-8. A6A1 RMS Support PCA

Table 6-10. A6A2 WB Input Protection PCA

Ref Des	Description	Part Number	Qty	Notes
C24-25	CAPACITOR,R05A,CAP,POLYES,0.01UF,+-10%,50V	715037	2	
C84-85	CAPACITOR R05R,CAP,TA,4.7UF,+-20%,25V	807644	2	
CR2-4,CR6-8	DIODE,1N4448 A52R,DIODE,SI,75V,150MA,DO-35	203323	6	ϟ
MP1-2	INSULATION PART,INSUL PT,TRANSISTOR MOUNT,DAP,TO-5	152207	2	
P1-2	HEADER,HEADER,2 ROW,.100CTR,RT ANG,12 PIN	806935	2	
Q1	PNP,2N2905A ,TRANSISTOR,SI,PNP,60V,600MW,TO-39	402586	1	ϟ
Q2	TRANSISTOR,SI,NPN,2N2219A,75V,800MA,300MHZ,800MW,TO-39,BULK	346916	1	ϟ
R1-3,R5,R9, R12,R15	RESISTOR A52R,RES,MF,10K,+-1%,0.125W,100PPM	168260	7	
R4,R7	RESISTOR,CARBON COMPOSITION,130,+-5%,1W,AXIAL,TAPE	163055	1	
R6,R10	RESISTOR A52R,RES,CF,130,+-5%,0.25W	442301	2	
R8,R13	RESISTOR A52R,RES,CF,16K,+-5%,0.25W	442376	2	
R11,R14	RESISTOR A52R,RES,CF,470,+-5%,0.25W	343434	2	
R17	RESISTOR A52R,RES,CF,2.4K,+-5%,0.25W	441493	1	
R20	RESISTOR A52R,RES,CF,100K,+-5%,0.25W	348920	1	
R24	RESISTOR A52R,RES,CF,1.8M,+-5%,0.25W	442574	1	
U1	BIPOLAR 319 ,IC,COMPARATOR,DUAL,HI-SPEED,14 DIP	647123	1	ϟ
VR1-2	ZENER,UNCOMP,1N5349B,12V,5%,100MA,5W,AXIAL,BULK	876862	2	ϟ
Notes	ϟ Static sensitive part.			

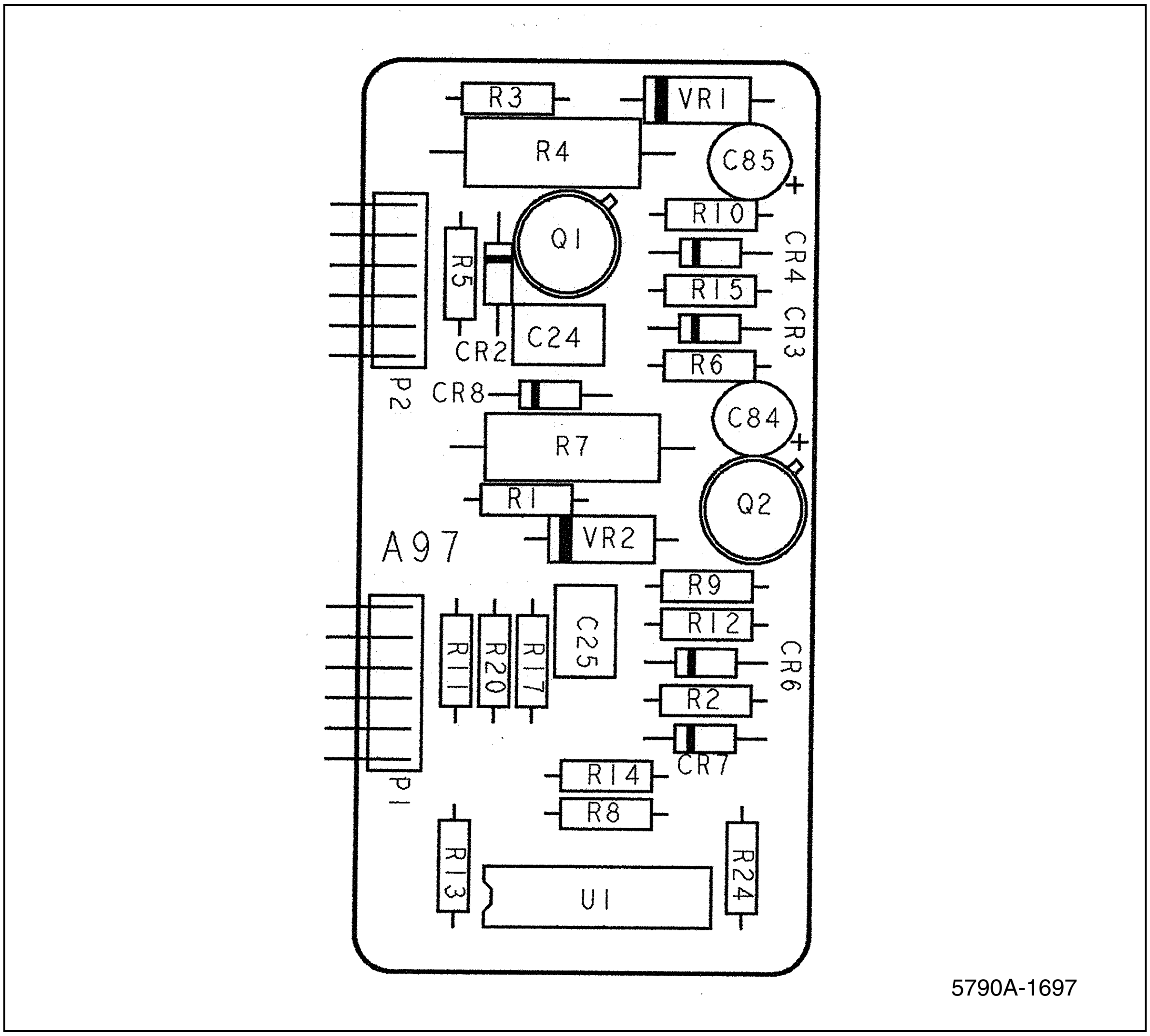


Figure 6-9. A6A2 WB Input Protection PCA

Table 6-11. A10 Transfer PCA

Ref Des	Description	Part Number	Qty	Notes
A1	PRECISION AMPLIFIER PCA	893300	1	ϟ
A2	HIGH VOLTAGE PROTECTION PCA	893305	1	ϟ
A3	5790A-7695,ASSEMBLY,HIGH GAIN PRECISION AMP	893313	1	ϟ
C1	CAPACITOR,R05A,CAP,POLYES,0.047UF,+-10%,50V	820548	1	
C2	CAPACITOR,R05A,CAP,POLYES,1UF,+-10%,50V	733089	1	
C3	CAPACITOR R05R,CAP,CER,100PF,+-20%,50V,C0G	721605	1	
C4, C9, C21, C24-28, C101-108, C112-113, C116-117, C130-132, C140-143, C150-151	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	29	
C5	CAPACITOR ,CAP,CER,120PF,+-5%,100V,C0G	543819	1	
C6	CAPACITOR R05R,CAP,CER,4.7PF,+-0.25PF,50V,C0G	721837	1	
C7, C13-14, C16, C18	CAPACITOR R05R,CAP,CER,470PF,+-5%,50V,C0G	830430	5	
C8	CAPACITOR,CERAMIC,10PF,+-0.25PF,50V,C0G,5MM LS,RADIAL,TAPE	713875	1	
C10-11, C120-124	CAPACITOR R05R,CAP,TA,10UF,+-20%,35V	816512	7	
C12	CAPACITOR,FILM,POLYESTER,0.22UF,\+-5%,50V,5MM LS,RADIAL,TAPE	747519	1	
C15, C17	CAPACITOR,R05A,CAP,POLYES,0.47UF,+-10%,50V	697409	2	
C19	CAPACITOR R05R,CAP,CER,1.8PF,+-0.25PF,100V,C0K	816660	1	
C20	CAPACITOR R05R,CAP,CER,82PF,+-2%,50V,C0G	714857	1	
C22-23	CAPACITOR R05R,CAP,CER,1000PF,+-20%,50V,X7R	697458	2	
C29	CAPACITOR R02R,CAP,CER,2.7PF,+-0.25PF,100V,C0J	816231	1	
C30	CAPACITOR R05R,CAP,CER,33PF,+-5%,50V,C0G	714543	1	
C31	CAPACITOR R05R,CAP,CER,270PF,+-5%,50V,C0G	658898	1	
C110-111, C114-115	CAPACITOR R05R,CAP,TA,4.7UF,+-20%,25V	807644	4	
C152	CAPACITOR,CERAMIC,0.22UF,+80-20%,50V,Z5U,RADIAL,TAPE	649939	1	
CR1-3	DIODE,SI,PN,JPAD5,35V,10MA,5PA REVERSE LEAKAGE,2 LEAD TO-92,TAPE	723817	3	ϟ
CR5-24, CR26-27, CR30-33	DIODE,SI,1N4448,75V,150MA,4NS,RADIAL LEAD PREP,DO-35,TAPE	659516	26	ϟ
CR28-29	DIODE,SI,PN,FDH300,125V,200MA,RADIAL LEAD PREP,DO-35,TAPE	844647	2	ϟ

E1-2	SURGE PROTECTOR,420V,+-15%,AXIAL,BULK	442723	2	
H1-4	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	4	
H7-8,H11-12	SCREW,6-32,.250,PAN,PHILLIPS,STEEL,ZINC-CLEAR,LOCK	152140	4	
H13-14	SCREW,6-32,.375,PAN,PHILLIPS,STEEL,ZINC-CLEAR,LOCK	152165	2	
H15-16	SCREW ,SCREW,PH,P,LOCK,SS,6-32,.750	376822	2	
H17-18	SPACER,SPACER,SWAGE,.250 RND,BR,.150,.400	743229	2	
K1-4	RELAY,RELAY,ARMATURE,2 FORM C,4.5 V,SEALED	875638	4	
K5,K8	RELAY ,RELAY,ARMATURE,2 FORM C,5V	733063	2	
K6	RELAY,RELAY,ARMATURE,2 FORM C,5 VDC,LATCH	910773	1	
K7	RELAY,RELAY,ARMATURE,2 FORM C,5V,LATCH	875356	1	
L1	INDUCTOR,12UH,5%,368MADC,1.76OHM,SHIELDED,AXIAL,BUL K	820720	1	
L2	INDUCTOR,8.2UH,5%,535MADC,828MOHM,SHIELDED,AXIAL,BU LK	806521	1	
MP1	5700A-2064,OSCILLATOR THERMAL COVER	797696	1	
MP2-3	EJECTOR ,EJECTOR,PWB,NYLON	494724	2	
MP4	BAG,MYLAR,STATIC SHIELD,OPEN TOP,.0031,10.00,14.00	680967	1	
MP8	5700A-2056,SHIELD, HIGH VOLTAGE, REAR	791921	1	
MP13-14	5790A-8024,FOAM, THERMAL COVER	893362	2	
P110,P210	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	807800	2	
Q1	FET,PWR,N,IRFD120 ,TRANSISTOR,SI,N-MOS,1W,4PDIP	853692	1	ϟ
Q2-3	N-JFET,J310 R05R,TRANSISTOR,SI,N-JFET,TO-92	851972	2	ϟ
Q4,Q7	MOSFET,SI,N,SD210,30V,50MA,45 OHMS,300MW,DMOS,LOW CAPACITANCE,TO-72,BULK	394122	2	ϟ
Q5-6,Q9,Q12	FET,PWR,N-CHL R05A,TRANSISTOR,SI,N-DMOS PWR FET,TO-92	782565	4	ϟ
Q8	MOSFET,P-CHANNEL,TRANSISTOR,SI,P-MOS,ENHANCEMENT,TO-72	741058	1	ϟ
Q10	TRANSISTOR,SI,PNP,MAT03,36V,20MA,190MHZ,DUAL,TO-78,BULK	875752	1	ϟ
Q11	TRANSISTOR,SI,NPN,LM394,20V,20MA,DUAL,TO-5-6,BULK	640656	1	ϟ
Q101	N-JFET ,TRANSISTOR,SI,N-JFET,SEL,TO-92	477448	1	ϟ
R1-4	RESISTOR R05A,RES,CF,390K,+-5%,0.25W	706754	4	
R5-6	RESISTOR R05A,RES,CF,6.2M,+-5%,0.25W	772327	2	
R7	RESISTOR,RES,MF,90.9,+-1%,3W,25PPM	886791	1	
R8	RESISTOR R05A,RES,MF,499,+-1%,0.25W,100PPM	866686	1	
R9	RESISTOR,METAL FILM,806,+-1%,0.25W,100PPM,RADIAL,TAPE	810531	1	
R10,R31,R42	RESISTOR,METAL FILM,150,+-1%,0.25W,100PPM,RADIAL,TAPE	822171	3	
R11,R20	RESISTOR R05A,RES,MF,1K,+-1%,0.25W,100PPM	816595	2	

R12,R29,R34	RESISTOR,CARBON FILM,100K,+-5%,0.25W,RADIAL,TAPE	658963	3	
R14-15	RESISTOR R05A,RES,MF,75K,+-1%,0.25W,100PPM	851902	2	
R16	RESISTOR,CARBON FILM,62K,+-5%,0.25W,RADIAL,TAPE	713941	1	
R17	RESISTOR R05A,RES,CF,430,+-5%,0.25W	817577	1	
R18-19,R22, R24-26,R51, R70-71, R80-81	RESISTOR R05A,RES,CF,1K,+-5%,0.25W	780585	11	
R21	RESISTOR R05A,RES,MF,100,+-1%,0.25W,100PPM	817627	1	
R23	RESISTOR,METAL FILM,453K,+-1%,0.125W,100PPM,AXIAL,TAPE	295709	1	
R27	RESISTOR,VAR ,RES,VAR,CERM,10K,+-10%,0.5W	285171	1	
R28	RESISTOR,CARBON FILM,62K,+-5%,0.25W,RADIAL,TAPE	713941	1	
R30,R41	RESISTOR,METAL FILM,1.37K,+-1%,0.125W,50PPM,RADIAL,TAPE	875369	2	
R32	RESISTOR,METAL FILM,432,+-1%,0.25W,50PPM,RADIAL,TAPE	875364	1	
R33,R44, R61-62	RESISTOR R05A,RES,MF,200,+-1%,0.25W,100PPM	820282	4	
R35,R54-56	RESISTOR R05A,RES,CF,4.7K,+-5%,0.25W	721571	4	
R36	RESISTOR A52R,RES,MF,69.8,+-1%,0.125W,100PPM	306001	1	
R37	RESISTOR,METAL FILM,909,+-1%,0.25W,100PPM,RADIAL,TAPE	820308	1	
R38	RESISTOR R05A,RES,CF,200,+-5%,0.25W	810390	1	
R43	RESISTOR A52R,RES,MF,1.82K,+-1%,0.125W,100PPM	293670	1	
R50	RESISTOR R05A,RES,CF,470,+-5%,0.25W	854567	1	
R52	RESISTOR R05A,RES,MF,15K,+-1%,0.25W,100PPM	866702	1	
R53	RESISTOR R05A,RES,MF,3.83K,+-1%,0.25W,100PPM	821827	1	
R60,R63	RESISTOR R05A,RES,MF,12.1K,+-1%,0.25W,100PPM	927454	2	
R101	RESISTOR R05A,RES,CF,200K,+-5%,0.25W	681841	1	
R103	RESISTOR A52R,RES,MF,1.43K,+-1%,0.125W,25PPM	447995	1	
R105	RESISTOR R05A,RES,CF,10K,+-5%,0.25W	697102	1	
R106-107	RESISTOR R05A,RES,CF,47,+-5%,0.25W	822189	2	
R108	RESISTOR A52R,RES,CF,4.7M,+-5%,0.25W	543355	1	
TP1-2,TP4-9	JUMPER R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	8	
U1	DMOS 5400 SMR,IC,DMOS,QUAD ANALOG SWITCH,SOIC	928291	1	ϟ
U2-3	IC,ANALOG SWITCH,DG444,+12 TO +-20V,85 OHMS,SPST,QUAD,NC,DIP16,TUBE	910708	2	ϟ
U3, U34	BIPOLAR 339,IC,COMPARATOR,QUAD,14 PIN DIP	387233	2	ϟ
U4	BIFET LF356N,IC,OP AMP,JFET INPUT,8 PIN DIP	472779	1	ϟ
U5	5700A-4H09T,RMS CONVERTER TESTED 400 OHM-A GRADE	842591	1	

U6	BIFET OPA637 ,IC,OP AMP,HIGH SPEED,LOW NOISE,8 DIP	876081	1	ϟ
U11	BIPOLAR AD846 ,IC,OP AMP,CURRENT FB,HI SPEED,DIP	875414	1	ϟ
U12	IC,ANALOG SWITCH,SD5000,1.5-20V,70 OHMS,QUAD,BILATERAL,LO CAPACITANCE,DIP16,TUBE	876420	1	ϟ
U15	BIPOLAR 78L12,IC,VOLT REG,FIXED,+12 VOLTS,0.1 AMPS	408138	1	ϟ
U16	BIPOLAR 79L12,IC,VOLT REG,FIXED,-12 VOLTS,0.1 AMPS	473819	1	ϟ
U20-21	BIMOS 5801,IC,BIMOS,8 CHNL HI-VOLT DRVR W/LATCH	782912	2	ϟ
U22-23	CMOS 74HC374,IC,CMOS,OCTAL D F/F,+EDG TRG	811166	2	ϟ
U24	LSTTL 74LS374,IC,LSTTL,OCTAL D F/F,+EDG TRG	473223	1	ϟ
U30	IC,OP AMP,TL074,+-15V,10MV OFFSET,4MHZ,QUAD,JFET INPUT,DIP14,TUBE	659748	1	ϟ
U32-33	ISOLATOR,OPTO,ISOLATOR,OPTO,LED TO TRANSISTOR,DUAL	454330	2	ϟ
U36	CMOS 74HC00,IC,CMOS,QUAD 2 INPUT NAND GATE	707323	1	ϟ
U102	BIPOLAR LT1013C,IC,OP AMP,DUAL,PRECISION,8-PIN DIP	783696	1	ϟ
U103	BIPOLAR AD633,IC,BPLR,ANALOG MULTIPLIER	845151	1	ϟ
VR1-2	ZENER,UNCOMP,1N5239B,9.1V,5%,20MA,400MW,RADIAL LEAD PREP,AMMO BOX,DO-35,TAPE	853788	2	ϟ
VR101	ZENER,A52R,ZENER,COMP,6.4V,5%,20PPM,4MA	381988	1	ϟ
W1	SLEEVING,SLEEV,TEFLON,0.027ID,NATURAL	196717	1	
Z1	5790A-4337,R-NET ASSY	665539	1	ϟ
Z2	RESISTOR,RES,CERM,SIP,6 PIN,5 RES,330,+-2%	408302	1	
Z3	RESISTOR,RES,CERM,SIP,6 PIN,5 RES,10K,+-2%	500876	1	
Z4	RESISTOR,RES,CERM,SIP,6 PIN,5 RES,100K,+-2%	412726	1	
Z6	RESISTOR ,RES,CERM,SIP,8 PIN,7 RES,10K,+-2%	412924	1	
Z101-102	RESISTOR,RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	2	
Notes	ϟ Static sensitive part.			

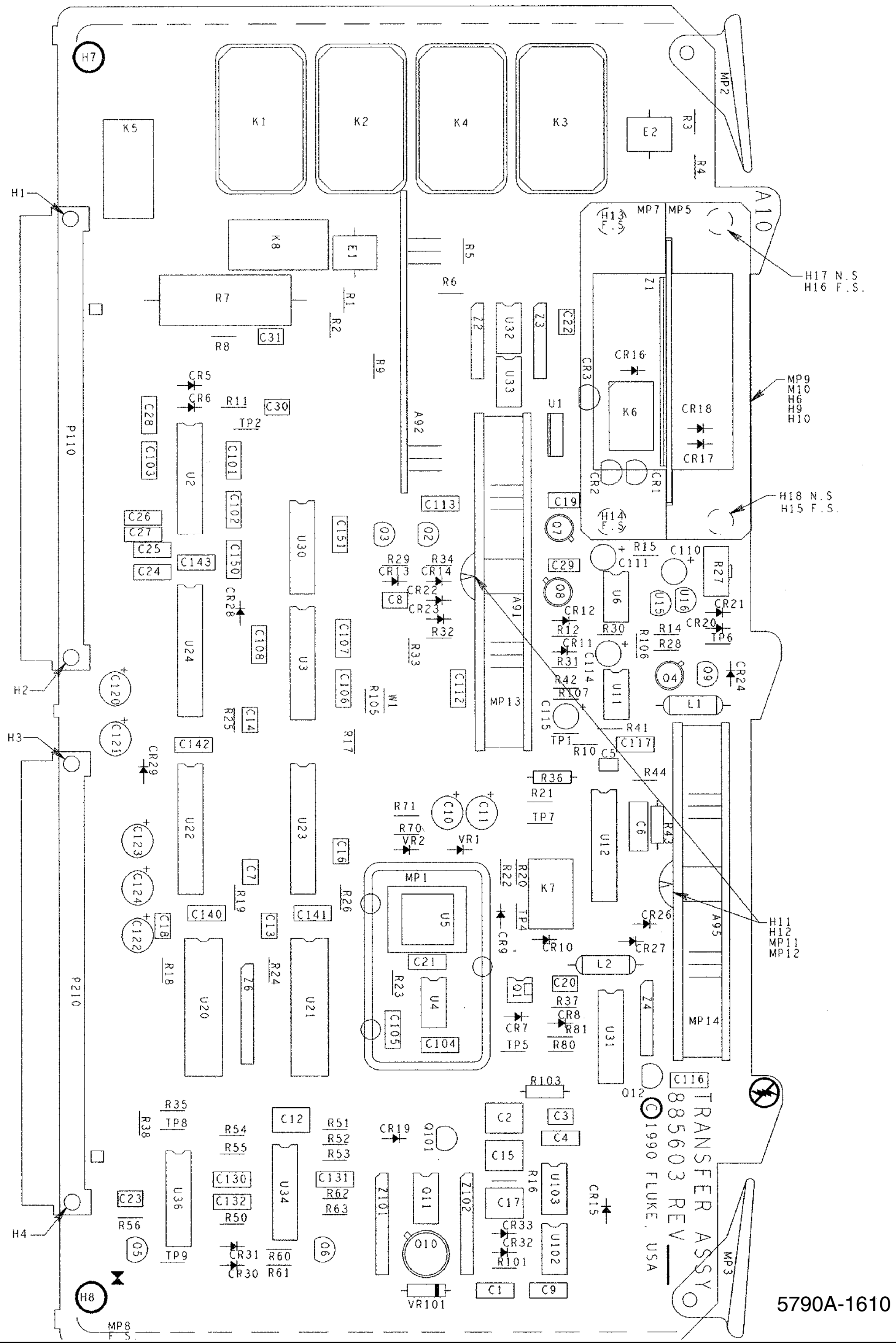


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Figure 6-10. A10 Transfer PCA

Table 6-12. A10A1 Precision Amplifier PCA

Ref Des	Description	Part Number	Qty	Notes
C1-2	CAPACITOR SMR,CAP,CER,270PF,+-10%,50V,C0G,1206	837385	2	
C3	CAPACITOR SMR,CAP,TA,4.7UF,+-20%,10V,3528	867262	1	
C4	CAPACITOR,FILM,POLYESTER,0.47UF,+-10%,50V,5MM PCM,RADIAL,BULK	913736	1	
CR1-2,CR5	DIODE,SI,PN,BAV99,70V,215MA,6NS,DUAL,SERIES,SOT-23,TAPE	742320	3	ϟ
CR3,CR6	CRD ,I-REG DIODE,2MA,10%,SEL,TO-226AC	284927	2	ϟ
CR4	CURRENT REGULATOR DIODE,J511,5.3MA,21%,3.1-50V,2 LEAD,TO-92,TAPE	852116	1	ϟ
H1	STANDOFF,ROUND,6-32,.325 HEIGHT,.250 OD,BRASS,SWAGE,.062 PANEL THK	296137	1	
P1-2,P21-22	HEADER ,HEADER,2 ROW,.100CTR,RT ANG,6 PIN	912217	6	
Q1	JFET,DUAL,ST441SMR,TRANSISTOR,SI,N-JFET,DUAL,SO8	876425	1	ϟ
Q2-3,Q8-9, Q13-16	TRANSISTOR,SI,PNP,MMBT3906,40V,200MA,250MHZ,225MW,SOT-23,TAPE	742684	8	ϟ
Q4-6	NPN,MMBT3904 SMR,TRANSISTOR,SI,NPN,60V,350MW,SOT-23	742676	3	ϟ
Q7,Q10	JFET,SI,N,SST4416,30V,5MA,500OHMS,SELECTED RDS(ON),SOT-23,TAPE	844584	2	ϟ
R1	RESISTOR SMR,RES,CERM,180,+-5%,.125W,200PPM,1206	746321	1	ϟ
R1, R19	RESISTOR SMR,RES,CERM,1M,+-5%,.125W,200PPM,1206	746826	2	ϟ
R10-11	RESISTOR,CERMET,432,+-1%,0.25W,100PPM,1206,TAPE	811885	2	ϟ
R12	RESISTOR SMR,RES,CERM,1K,+-5%,.125W,200PPM,1206	745992	1	ϟ
R14	RESISTOR SMR,RES,CERM,1.5K,+-5%,.125W,200PPM,1206	746438	1	ϟ
R16	RESISTOR SMR,RES,CERM,390,+-5%,.125W,200PPM,1206	740498	1	ϟ
R2	RESISTOR SMR,RES,CERM,6.2K,+-5%,.125W,200PPM,1206	746016	1	ϟ
R3	RESISTOR SMR,RES,CERM,12,+-5%,.125W,200PPM,1206	845458	1	ϟ
R4, R8	RESISTOR SMR,RES,CERM,10K,+-5%,.125W,200PPM,1206	746610	2	ϟ
R5	RESISTOR SMR,RES,CERM,18K,+-5%,.125W,200PPM,1206	746636	1	ϟ
R6-7	RESISTOR SMR,RES,CERM,124,+-1%,.125W,100PPM,1206	867499	2	ϟ
U1	BIPOLAR AD707K SMR,IC,OPAMP,ULOW DRIFT,LOW NOISE,SO8	887120	1	ϟ
U2	BIPOLAR LT1223,IC,OP AMP,CURRENT FEEDBACK,100MHZ,DIP	914130	1	ϟ
VR1-2	ZENER,UNCOMP,MMBZ5231B,5.1V,5%,20MA,225MW,SOT-23,TAPE	837179	2	ϟ
VR3	ZENER,UNCOMP,BZX84C12,12V,5%,5MA,225MW,SOT-23,TAPE	866822	1	ϟ
	ZENER,UNCOMP,MMBZ5248B,18V,5%,7MA,225MW,SOT-23,TAPE	876433	1	ϟ
Notes	ϟ Static sensitive part.			

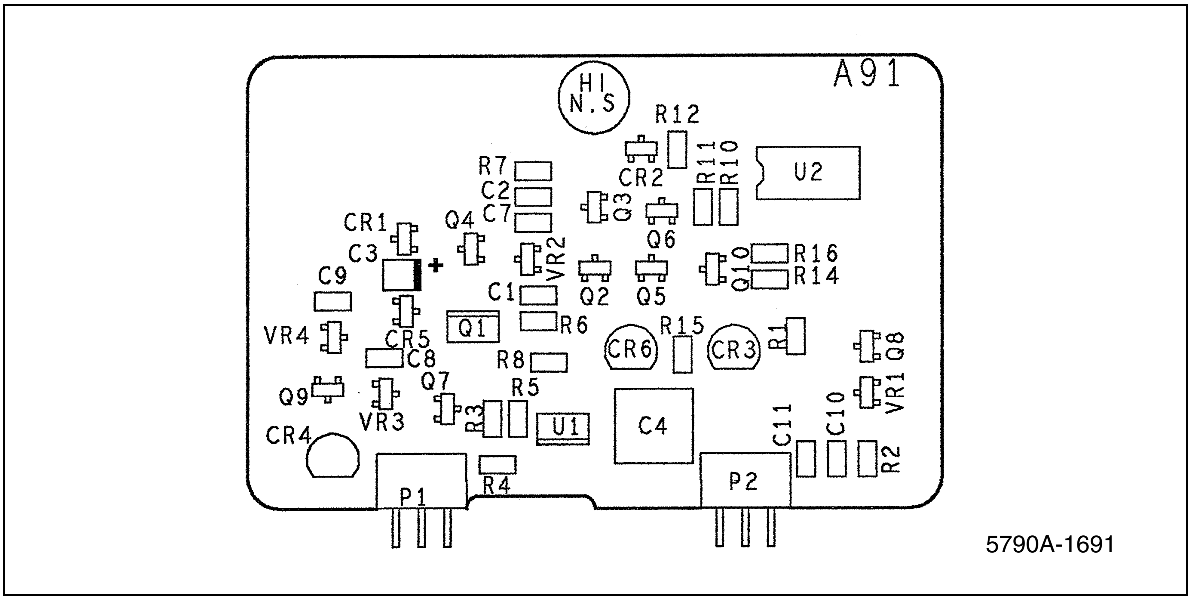

Figure 6-11. A10A1 Precision Amplifier PCA

Table 6-13. A10A2 HV Protection PCA

Ref Des	Description	Part Number	Qty	Notes
CR1-2	DIODE,SI,PN,FDH300,125V,200MA,RADIAL LEAD PREP,DO-35,TAPE	844647	2	ϟ
CR3,CR7-8	DIODE,MMBD1501 SMR,DIODE,SI,150V,200MA,SOT-23	867072	3	ϟ
Q1-4	FET,DMOS,N-CH R05A,TRANSISTOR,SI,N-DMOS,500V,TO-92	782490	4	ϟ
Q5-8	MOSFET,P-CHN R05A,TRANSISTOR,SI,P-MOS,500V,TO-92	782508	4	ϟ
R1-16	RESISTOR SMR,RES,CERM,330K,+-5%,.125W,200PPM,1206	746776	16	ϟ
R17,R20	RESISTOR SMR,RES,CERM,510K,+-5%,.125W,200PPM,1206	746800	2	ϟ
R18,R30	RESISTOR SMR,RES,CERM,220,+-5%,.125W,200PPM,1206	746347	2	ϟ
R21-28	RESISTOR SMR,RES,CERM,10,+-5%,.125W,200PPM,1206	746214	8	ϟ
RT1	THERMISTOR,THERMISTOR,DISC,NEG,200,+-5%,25C	886960	1	
U1-4	BIPOLAR 385,IC, 2.5V,100 PPM T.C.,BANDGAP REF	723478	4	ϟ
U5-7	OPTOCOUPLER,PVI5080,LED TO PHOTOVOLTAIC SOURCE,OUTPUT=5V/8UA,DIP8(4),BULK	1280931	3	ϟ
Notes	ϟ Static sensitive part.			

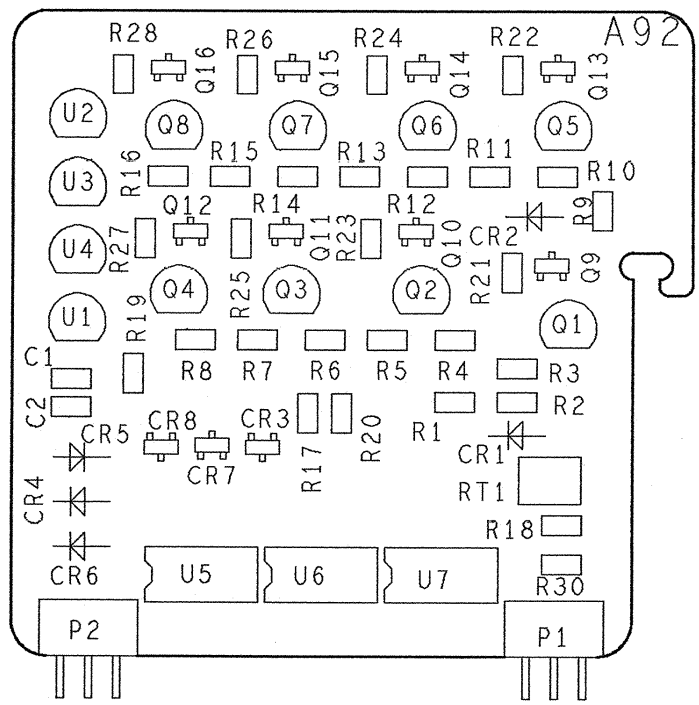

Figure 6-12. A10A2 High Voltage Protection Amplifier PCA

Table 6-14. A10A3 High-Gain Precision Amplifier PCA

Ref Des	Description	Part Number	Qty	Notes
C1,C2	CAPACITOR SMR,CAP,CER,270PF,+-10%,50V,C0G,1206	837385	2	
C3	CAPACITOR SMR,CAP,TA,4.7UF,+-20%,10V,3528	867262	1	
C4	CAPACITOR,FILM,POLYESTER,0.47UF,+-10%,50V,5MM PCM,RADIAL,BULK	913736	1	
C7-11	CAPACITOR SMR,CAP,CER,0.22UF,+80-20%,50V,Y5V,1206	740597	5	
C12	CAPACITOR R05R,CAP,CER,0.22UF,+80-20%,50V,Z5U	733386	1	
CR1-2,CR5	DIODE,SI,PN,BAV99,70V,215MA,6NS,DUAL,SERIES,SOT-23,TAPE	742320	3	ϟ
CR3,CR6	CRD,I-REG DIODE,2MA,10%,SEL,TO-226AC	284927	2	ϟ
CR4	CURRENT REGULATOR DIODE,J511,5.3MA,21%,3.1-50V,2 LEAD,TO-92,TAPE	852116	1	ϟ
H1	STANDOFF,ROUND,6-32,.325 HEIGHT,.250 OD,BRASS,SWAGE,.062 PANEL THK	296137	1	
P1-2	HEADER,HEADER,2 ROW,.100CTR,RT ANG,6 PIN	912217	2	
Q1	JFET,DUAL,ST441SMR,TRANSISTOR,SI,N-JFET,DUAL,SO8	876425	1	ϟ
Q2-3,Q8-9	TRANSISTOR,SI,PNP,MMBT3906,40V,200MA,250MHZ,225MW,SOT-23,TAPE	742684	4	ϟ
Q4-6	NPN,MMBT3904 SMR,TRANSISTOR,SI,NPN,60V,350MW,SOT-23	742676	3	ϟ
Q7	JFET,SI,N,SST4416,30V,5MA,500OHMS,SELECTED RDS(ON),SOT-23,TAPE	844584	1	ϟ
R1	RESISTOR SMR,RES,CERM,180,+-5%,.125W,200PPM,1206	746321	1	ϟ
R2	RESISTOR SMR,RES,CERM,6.2K,+-5%,.125W,200PPM,1206	746016	1	ϟ
R3	RESISTOR SMR,RES,CERM,680,+-5%,.125W,200PPM,1206	746396	1	ϟ
R4, R8	RESISTOR SMR,RES,CERM,10K,+-5%,.125W,200PPM,1206	746610	2	ϟ
R5	RESISTOR SMR,RES,CERM,18K,+-5%,.125W,200PPM,1206	746636	1	ϟ
R6-7	RESISTOR SMR,RES,CERM,124,+-1%,.125W,100PPM,1206	867499	2	ϟ
R10, R11	RESISTOR,CERMET,432,+-1%,0.25W,100PPM,1206,TAPE	811885	2	ϟ
R12	RESISTOR SMR,RES,CERM,1K,+-5%,.125W,200PPM,1206	745992	1	ϟ
R14	RESISTOR SMR,RES,CERM,150,+-5%,.125W,200PPM,1206	746313	1	ϟ
U1	BIPOLAR AD707K SMR,IC,OPAMP,ULOW DRIFT,LOW NOISE,SO8	887120	1	ϟ
U2	IC,OP AMP,LT1227,+-2 TO +-15V,10MV OFFSET,140MHZ,WIDEBAND,W.DISABLE,DIP8,TUBE	1644445	1	ϟ
VR1,VR2	ZENER,UNCOMP,MMBZ5231B,5.1V,5%,20MA,225MW,SOT-23,TAPE	837179	2	ϟ
VR3	ZENER,UNCOMP,BZX84C12,12V,5%,5MA,225MW,SOT-23,TAPE	866822	1	ϟ
VR4	ZENER,UNCOMP,MMBZ5248B,18V,5%,7MA,225MW,SOT-23,TAPE	876433	1	ϟ
VR10	ZENER,UNCOMP,IN746,33V,10% 20MA,DO-35,TAPE	309799	1	ϟ
Notes	ϟ Static sensitive part.			

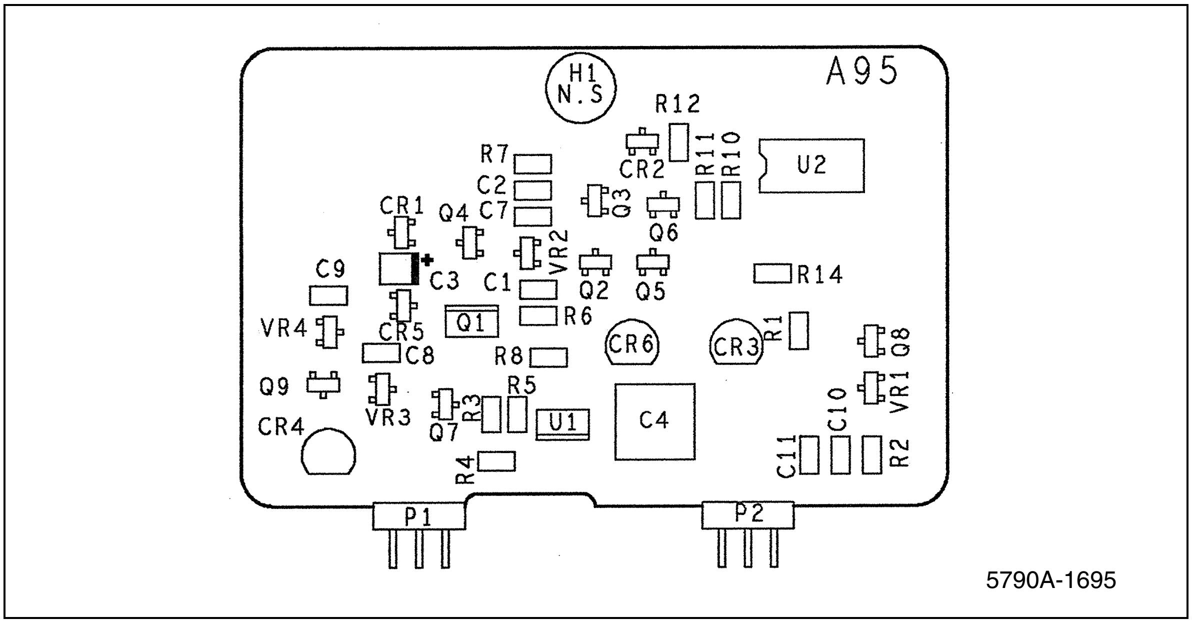

Figure 6-13. A10A3 High-Gain Precision Amplifier PCA

Table 6-15. A15 A/D Amplifier PCA

Ref Des	Description	Part Number	Qty	Notes
C1-2,C4, C23,C25, C44	CAPACITOR,FILM,POLYESTER,0.22UF,\+-5%,50V,5MM LS,RADIAL,TAPE	747519	6	
C3,C21	CAPACITOR R05R,CAP,CER,1000PF,+-20%,50V,X7R	697458	2	
C5-6	CAPACITOR,R05A,CAP,POLYES,1UF,+-10%,50V	733089	2	
C7-8,C12-13	CAPACITOR R05R,CAP,TA,4.7UF,+-20%,25V	807644	4	
C9,C14	CAPACITOR,R05A,CAP,POLYES,0.01UF,+-10%,50V	715037	2	
C10	CAPACITOR R05R,CAP,CER,4.7PF,+-0.25PF,50V,C0G	721837	1	
C11	CAPACITOR R05R,CAP,CER,470PF,+-5%,50V,C0G	830430	1	
C15-16	CAPACITOR R05R,CAP,CER,15PF,+-20%,50V,C0G	697524	2	
C17	CAPACITOR,POLYPROPYLENE,0.033UF,+-10%,63V,5MM LS,RADIAL,TAPE	721050	1	
C18-19	CAPACITOR,CAP,POLYPR,0.33UF,+-5%,50V,HERMETIC	876367	2	
C20,C22	CAPACITOR, R05R,CAP,CER,33PF,+-5%,50V,C0G	714543	2	
C24	CAPACITOR R05R,CAP,CER,82PF,+-2%,50V,C0G	714857	1	
C26-27	CAPACITOR R05A,CAP,POLYES,2200PF,+-10%,50V	832683	2	
C28-29, C36-37	CAPACITOR R05R,CAP,TA,10UF,+-20%,35V	816512	4	
C30-33	CAPACITOR R05R,CAP,TA,22UF,+-20%,10V	658971	4	
C38-40, C50-55, C62-64, C67-70	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	16	
C41	CAPACITOR,CERAMIC,4700PF,+-20%,100V,C0G,RADIAL,TAPE	743427	1	
C42-43	CAPACITOR R05A,CAP,POLYPR,0.15UF,+-10%,100V	912688	2	
CR1-2	DIODE,SI,1N4448,75V,150MA,4NS,RADIAL LEAD PREP,DO-35,TAPE	659516	2	
H1-4	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	4	
K1-2	RELAY,RELAY,ARMATURE,2 FORM C,5V,LATCH	769307	2	
L3-4	CHOKE,38.4UH,6TURN,6160A-8002,BULK	320911	2	
MP1	BAG,MYLAR,STATIC SHIELD,OPEN TOP,.0031,10.00,14.00	680967	1	
MP2-3	EJECTOR ,EJECTOR,PWB,NYLON	494724	2	
MP4	8840A-8019,PAD, ADHESIVE	735365	1	
P115,215	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	807800	2	
Q3	TRANSISTOR,SI,NPN,2N3904,60V,200MA,300MHZ,625MW,AMMO BOX,TO-92,TAPE	698225	1	
Q4	TRANSISTOR,SI,PNP,2N3906,40V,200MA,250MHZ,625MW,AMMO BOX,TO-92,TAPE	698233	1	

Q5	P-JFET R05A,TRANSISTOR,SI,P-JFET,SEL,TO-92	852111	1	ϟ
R1,R4, R8-9,R17, R28,R31	RESISTOR R05A,RES,CF,1K,+-5%,0.25W	780585	7	
R2	RESISTOR A52R,RES,MF,33.2K,+-1%,0.125W,100PPM	291393	1	
R3,R6	RESISTOR R05A,RES,CF,2K,+-5%,0.25W	810457	2	
R5	RESISTOR,CARBON FILM,560,+-5%,0.25W,RADIAL,TAPE	810440	1	
R7	RESISTOR R05A,RES,CF,200,+-5%,0.25W	810390	1	
R10,R13, R48	RESISTOR,CARBON FILM,330,+-5%,0.25W,RADIAL,TAPE	830596	3	
R11-12, R22,R39	RESISTOR R05A,RES,CF,10K,+-5%,0.25W	697102	4	
R14	RESISTOR A52R,RES,MF,562,+-0.1%,0.125W,25PPM	375519	1	
R15	RESISTOR A52R,RES,MF,19.6K,+-1%,0.125W,100PPM	293746	1	
R16,R34	RESISTOR R05A,RES,CF,47K,+-5%,0.25W	721787	2	
R18-20	RESISTOR A52R,RES,MF,11.8K,+-0.1%,0.125W,25PPM	344408	3	
R21	RESISTOR A52R,RES,MF,4.53K,+-1%,0.125W,25PPM	376921	1	
R23	RESISTOR A52R,RES,MF,40.2K,+-1%,0.125W,100PPM	235333	1	
R24	RESISTOR A52R,RES,MF,3.92K,+-0.1%,.125W,25PPM	844662	1	
R25	RESISTOR A52R,RES,MF,39.2K,+-0.1%,0.125W,25PPM	344507	1	
R26-27	RESISTOR R05A,RES,CF,4.7K,+-5%,0.25W	721571	2	
R29	RESISTOR A52R,RES,MF,10K,+-0.1%,0.125W,25PPM	435065	1	
R30	RESISTOR A52R,RES,MF,2K,+-0.1%,0.125W,25PPM	340174	1	
R32	RESISTOR R05A,RES,CF,1.5K,+-5%,0.25W	810432	1	
R33	RESISTOR A52R,RES,MF,124K,+-1%,0.125W,100PPM	288407	1	
R35-36	RESISTOR R05A,RES,CF,750,+-5%,0.25W	810374	2	
R37	RESISTOR R05A,RES,CF,16K,+-5%,0.25W	714303	1	
R38,R40	RESISTOR,METAL FILM,68.1K,+-1%,0.125W,100PPM,AXIAL,TAPE	236828	2	
R41	RESISTOR A52R,RES,MF,147K,+-1%,0.125W,100PPM	291344	1	
R42	RESISTOR A52R,RES,MF,1.27K,+-1%,0.125W,100PPM	267369	1	
R43	RESISTOR A52R,RES,MF,6.34K,+-1%,0.125W,100PPM	267344	1	
R44	RESISTOR R05A,RES,CF,1M,+-5%,0.25W	649970	1	
R45	RESISTOR A52R,RES,MF,63.4K,+-1%,0.125W,100PPM	235382	1	
R46	RESISTOR A52R,RES,MF,84.5K,+-0.5%,0.125W,100PPM	229492	1	
R47	RESISTOR A52R,RES,MF,17.4K,+-1%,0.125W,100PPM	236802	1	
TP1-16	JUMPER R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	16	
U2	BIFET LF412A,IC,OP AMP,DUAL,LO OFFST VOLT,LO-DRIFT	851704	1	ϟ

U3,U19-22	IC,OP AMP,OP07,+-3V TO +-18V,150UV OFFSET,0.4MHZ,DIP8,TUBE	605980	5	ϟ
U5,U13-15	IC,ANALOG SWITCH,DG444,+12 TO +-20V,85 OHMS,SPST,QUAD,NC,DIP16,TUBE	910708	4	ϟ
U6-7	IC,ANALOG SWITCH,ADG201HS,+-15V,75 OHMS,SPST,QUAD,DIP16,TUBES	875328	2	ϟ
U8	CMOS 4047B,IC,CMOS,MONOSTABL/ASTABL MULTIVIBRATR	535575	1	ϟ
U9	CMOS 1043 ,IC,CMOS,QUAD SPDT ANALOG SW,LOW CHRG	875641	1	ϟ
U10-11	CMOS MAX430C,IC,OP AMP,CHOPPER STABILIZED,8 PIN	875596	2	ϟ
U16	CMOS 7534JN,IC,CMOS,14BIT DAC,12BIT ACC,CUR OUT	773101	1	ϟ
U17	BIPOLAR LT1013C,IC,OP AMP,DUAL,PRECISION,8-PIN DIP	783696	1	ϟ
U23	BIPOLAR LT1078,IC,OP AMP,MICROPOWER,DUAL,8 PIN DIP	876495	1	ϟ
U24	MERC5-IC SM,MEAS PROCESSOR & A/D CONV, CMOS IC.	776195	1	
U25	CMOS 74HCU04,IC,CMOS,HEX INVERTER,UNBUFFERED	741199	1	ϟ
U26	CMOS 82C55A,IC,CMOS,PROGRMBL PERIPHERAL INTERFACE	780650	1	ϟ
U27	BIMOS 5801,IC,BIMOS,8 CHNL HI-VOLT DRVR W/LATCH	782912	1	ϟ
VR1	ZENER,UNCOMP,1N752A,5.6V,5%,20MA,DO-35,TAPE	277236	1	ϟ
VR2-3	ZENER,UNCOMP,1N749A,4.3V,5%,20MA,DO-35,TAPE	180455	2	ϟ
VR4-5	ZENER,UNCOMP,1N755A,7.5V,5%,20MA,DO-35,TAPE	256446	2	ϟ
VR6	ZENER,COMP,1N4567,6.4V,500UA,2%,20PPM,DO-7,BULK	393579	1	ϟ
VR7	ZENER,UNCOMP,1N965B,15V,5%,8.5MA,400MW,DO-35,TAPE	266601	1	ϟ
XU24	SOCKET ,SOCKET,PLCC,68 PIN	876334	1	
Y1	CRYSTAL,CRYSTAL,3.84MHZ,+-0.05%,HC-18/U	650390	1	
Z1	SATRN-4R03T-N ,RNET,MF,POLY,SIP,FLUKE 45 A TO D CONV	833921	1	
Z2	5790A-2711,SUBSTRATE ASSY, 4R02H	893248	1	ϟ
Z3-4	54-4111T-N,RNET,MF,POLY,SIP,1752 LO V DIVIDER	645341	2	ϟ
Z6	5790A-2712,SUBSTRATE ASSY, 4R06H	893250	1	
Notes	ϟ Static sensitive part.			

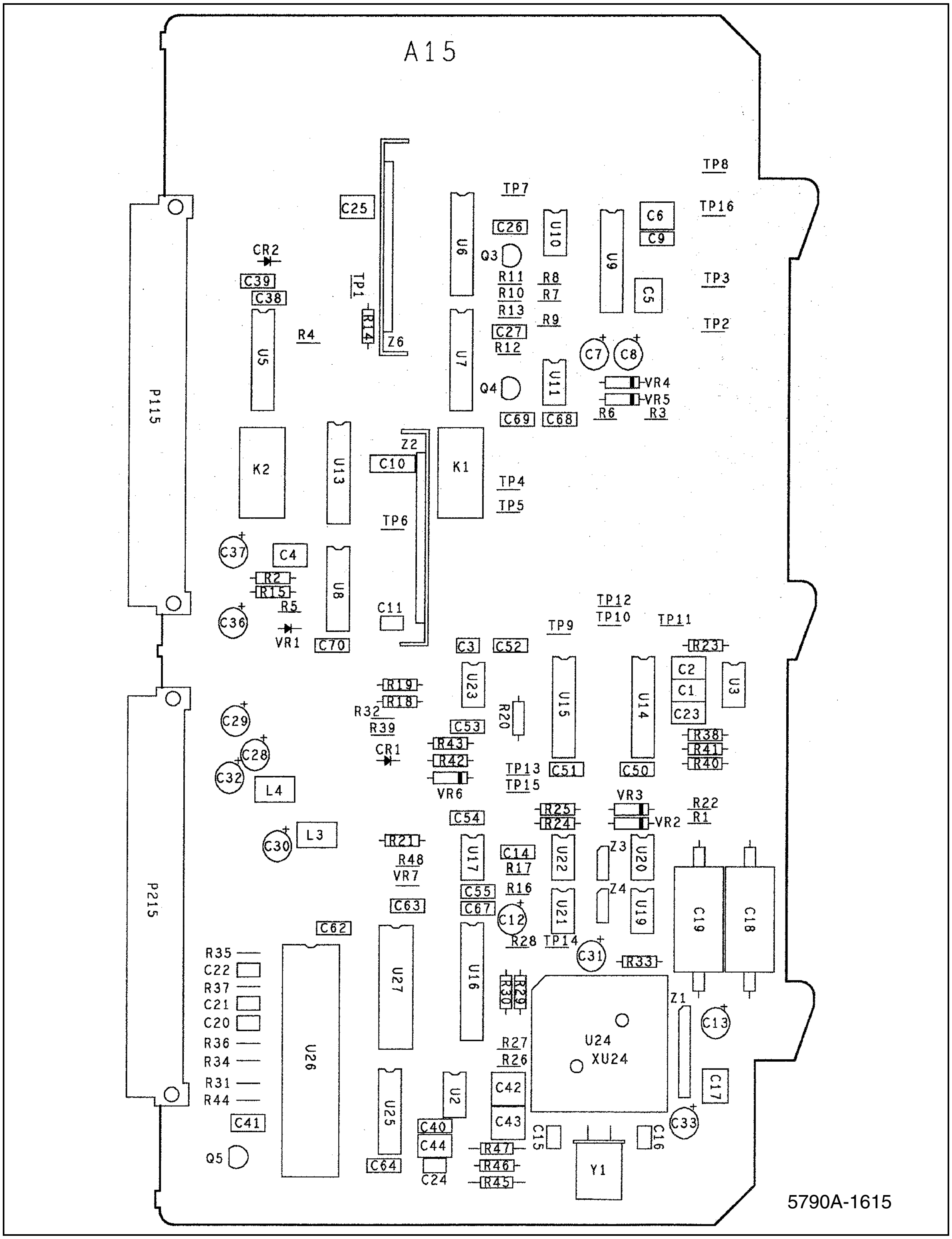

Figure 6-14. A15 A/D Amplifier PCA

Table 6-16. A16 DAC PCA

Ref Des	Description	Part Number	Qty	Notes
A1	PCA,DAC FILTER SIP BURN-IN	893276	1	ϟ
C10-11	CAPACITOR,CAP,POLYPR,0.33UF,+-5%,50V,HERMETIC	320051	2	
C12	CAPACITOR R05A,CAP,AL,10UF,+-20%,63V,SOLV PROOF	876433	2	
C19-20	CAPACITOR R05R,CAP,TA,2.2UF,+-10%,35V	761411	1	
C27	CAPACITOR R05R,CAP,CER,15PF,+-20%,50V,C0G	820423	2	
C29	CAPACITOR R05A,CAP,CER,220PF,+-2%,100V,C0G	697524	1	
C32	CAPACITOR SMR,CAP,CER,0.1UF,+-10%,25V,X7R,1206	714550	1	
C44,C60	CAPACITOR,CERAMIC,1000PF,+-10%,50V,C0G,1206,TAPE	816843	2	
C52,C103	CAPACITOR SMR,CAP,CER,33PF,+-10%,50V,C0G,1206	747378	1	
C57	CAPACITOR R05R,CAP,CER,22PF,+-5%,50V,C0G	747519	1	
C110-111	CAPACITOR,FILM,POLYESTER,0.22UF,\+-5%,50V,5MM LS,RADIAL,TAPE	769257	5	
CR1,CR4-5	DIODE,SI,1N4448,75V,150MA,4NS,RADIAL LEAD PREP,DO-35,TAPE	740522	2	ϟ
CR7	CRD ,I-REG DIODE,1MA,10%,SEL,TO-226AC	665448	1	ϟ
H1	SCREW,SCREW,PH,P,LOCK,SS,6-32,.500	386128	1	
H9-12	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	320911	2	
HR6	5700A-4HR6 ,DC AMP HYBRID ASSY	838516	1	ϟ
HR9	5790A-4HR9,REFERENCE HYBRID ASSY	761429	1	ϟ
L5	CHOKE,38.4UH,6TURN,6160A-8002,BULK	912217	1	
MP1	5700A-2018,MOLDED COVER, HYBRID, R-NET	334839	1	
MP2	BAG,MYLAR,STATIC SHIELD,OPEN TOP,.0031,10.00,14.00	782565	1	
MP3	5700A-2045 ,SHIELD, DAC REAR	797746	1	
MP4	5700A-2037 ,MOLDED COVER, REFERENCE HYBRID	802892	1	
MP5-6	EJECTOR,EJECTOR,PWB,NYLON	697433	1	
MP11	5700A-2019,SHIELD, DAC, FRONT, SMALL	769240	1	
MP12	5700A-2038,SHIELD, DAC, FRONT	797761	1	
P21-22	HEADER ,HEADER,2 ROW,.100CTR,RT ANG,6 PIN	584169	1	
P116,P216	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	810366	2	
Q1	NPN,PWR,TIP120,TRANSISTOR,SI,NPN,60V,65W,TO-220	441469	1	ϟ
Q2-3	5700A-4312,HEAT SINK ASSY	838458	4	ϟ
Q4-7	FET,PWR,N-CHL R05A,TRANSISTOR,SI,N-DMOS PWR FET,TO-92	680967	1	ϟ
Q12-13,Q16-17, Q23-24	N-JFET R05R,TRANSISTOR,SI,N-JFET,SEL,TO-92	845458	3	ϟ

Q30,Q32,Q7, Q10	JFET,SI,N,SST4416,30V,5MA,500OHMS,SELECTED RDS(ON),SOT-23,TAPE	806612	1	ϟ
Q31,Q33,Q35	NPN,MMBT2369 SMR,TRANSISTOR,SI,NPN,40V,300MW,SOT-23	844584	4	ϟ
Q34	PNP,MMBTH81 SMR,TRANSISTOR,SI,PNP,20V,300MW,SOT-23	782938	1	ϟ
R1,R28,R33, R39,R44	RESISTOR SMR,RES,CERM,4.7K,+-5%,.125W,200PPM,1206	740548	1	ϟ
R2	RESISTOR R05A,RES,CF,3K,+-5%,0.25W	816090	4	
R3	RESISTOR A52R,RES,CF,2K,+-5%,0.25W	746610	4	
R6	RESISTOR SMR,RES,CERM,910,+-5%,.125W,200PPM,1206	746354	1	ϟ
R7	RESISTOR SMR,RES,CERM,620,+-5%,.125W,200PPM,1206	746297	1	ϟ
R9	RESISTOR,CERMET,1.8K,+-5%,0.25W,200PPM,1206,TAPE	810523	2	ϟ
R10,R27	RESISTOR,METAL FILM,2.49K,+-1%,0.25W,100PPM,RADIAL,TAPE	746412	2	
R12	RESISTOR SMR,RES,CERM,200,+-5%,.125W,200PPM,1206	810390	1	ϟ
R13	RESISTOR SMR,RES,CERM,22,+-5%,.125W,200PPM,1206	806463	3	ϟ
R15	RESISTOR,METAL FILM,1.21K,+-1%,0.25W,100PPM,RADIAL,TAPE	747287	1	
R16	RESISTOR SMR,RES,CERM,750,+-5%,.125W,200PPM,1206	454330	1	ϟ
R24	RESISTOR SMR,RES,CERM,2.49K,+-1%,.125W,100PPM,1206	746230	1	ϟ
R29,R41,R4, R8	RESISTOR SMR,RES,CERM,10K,+-5%,.125W,200PPM,1206	746453	1	ϟ
R32,R21-28	RESISTOR SMR,RES,CERM,10,+-5%,.125W,200PPM,1206	851704	1	ϟ
R36,R105	RESISTOR SMR,RES,CERM,1.2K,+-5%,.125W,200PPM,1206	746214	9	ϟ
R37,R110,R3	RESISTOR SMR,RES,CERM,12,+-5%,.125W,200PPM,1206	742817	1	ϟ
R38,R12	RESISTOR SMR,RES,CERM,1K,+-5%,.125W,200PPM,1206	746560	2	ϟ
R40	RESISTOR SMR,RES,CERM,100K,+-5%,.125W,200PPM,1206	746511	1	ϟ
R43	RESISTOR SMR,RES,CERM,3K,+-5%,.125W,200PPM,1206	783696	1	ϟ
R45	RESISTOR SMR,RES,CERM,2.7K,+-5%,.125W,200PPM,1206	746339	1	ϟ
R46	RESISTOR SMR,RES,CERM,360,+-5%,.125W,200PPM,1206	746388	1	ϟ
R47	RESISTOR SMR,RES,CERM,100,+-5%,.125W,200PPM,1206	746404	1	ϟ
R49	RESISTOR SMR,RES,CERM,270,+-5%,.125W,200PPM,1206	775619	1	ϟ
R50	RESISTOR SMR,RES,CERM,510,+-5%,.125W,200PPM,1206	746586	4	ϟ
R51	RESISTOR SMR,RES,CERM,150,+-1%,.125W,100PPM,1206	772780	1	ϟ
R53,R71	RESISTOR SMR,RES,CERM,5.1K,+-5%,.125W,200PPM,1206	745992	2	ϟ
R72	RESISTOR R05A,RES,CF,200,+-5%,0.25W	810507	1	
R117-119,R123	RESISTOR SMR,RES,CERM,7.5K,+-5%,.125W,200PPM,1206	746503	1	ϟ
T1	5700A-6303 ,PULSE TRANSFORMER	806448	1	

TP1, TP3, TP8, TP12	JUMPER R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816728	1	
U1	BIFET LF412A,IC,OP AMP,DUAL,LO OFFST VOLT,LO-DRIFT	876367	2	ϟ
U2	BIPOLAR LT1013C,IC,OP AMP,DUAL,PRECISION,8-PIN DIP	659516	3	ϟ
U5,U38	BIFET LF356N ,IC,OP AMP,JFET INPUT,8 PIN DIP	797720	1	ϟ
U6	CMOS 82C54 SMR,IC,CMOS,PROGRMBL INTERVAL TIMER,PLCC	459974	1	ϟ
U7	OSCILLATOR,TTL CLOCK,8MHZ,5V,1000PPM,10 TTL LOAD,DIP4/14,TUBE	745984	1	
U8	CMOS 74HC240 SMR,IC,CMOS,OCTL INV LINE DRVR,SOIC	783290	1	ϟ
U10	BIPOLAR 522,IC,COMPARATOR,HI-SPEED,14 PIN DIP	783704	5	ϟ
U11	BIFET LF351 SMR,IC,OP AMP,SINGLE,LOW NOISE FAST,SOIC	494724	2	ϟ
U12	ISOLATOR,OPTO,ISOLATOR,OPTO,LED TO TRANSISTOR,DUAL	807800	2	ϟ
U13	ISOLATOR,HCPL-2400,ISOLATOR, 20 MHZ OPTOCOUPLER	642477	1	ϟ
U14	CMOS 74HC74 SMR,IC,CMOS,DUAL D F/F,+EDG TRG,SOIC	782995	1	ϟ
VR2,VR8, VR10-12	ZENER,UNCOMP,MMBZ5240B,10V,5%,20MA,225MW,SOT-23,TAPE	642485	1	ϟ
VR3	ZENER,UNCOMP,MMBZ5246B,16V,5%,7.8MA,225MW,SOT-23,TAPE	783720	1	ϟ
VR4,	ZENER,UNCOMP,MMBZ5248B,18V,5%,7MA,225MW,SOT-23,TAPE	647115	1	ϟ
VR5	ZENER,UNCOMP,1N746A,3.3V,5%,20MA,400MW,RADIAL LEAD PREP,DO-35,TAPE	885496	1	ϟ
VR7	ZENER,UNCOMP,MMBZ5251B,22V,5%,5.6MA,225MW,SOT-23,TAPE	831230	1	ϟ
VR13	ZENER,UNCOMP,MMBZ5243B,13V,5%,9.5MA,225MW,SOT-23,TAPE	832147	6	ϟ
Z2	5700A-4R30T-N,RNET,MF,POLY,SIP,5700 LO V DIVIDER	893334	1	
Z5	RESISTOR,RES,CERM,SIP,6 PIN,5 RES,510,+-2%	472779	2	
Notes	ϟ Static sensitive part.			

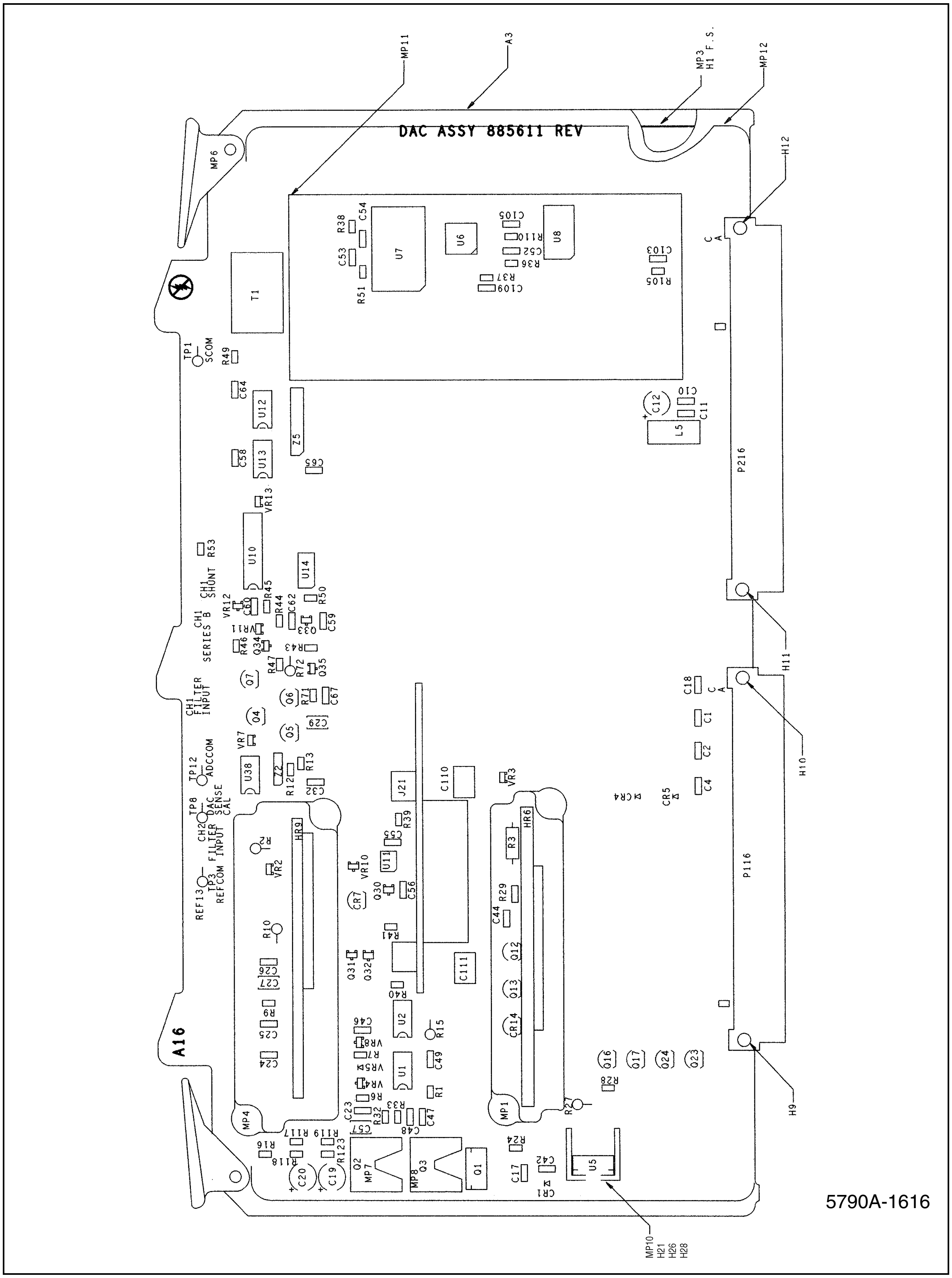

Figure 6-15. A16 DAC PAC

Table 6-17. A16A1 DAC Filter PCA

Ref Des	Description	Part Number	Qty	Notes
C1,C3,C5	CAPACITOR,FILM,POLYESTER,0.33UF,+-20%,50V,RADIAL,BULK	853903	3	
C10-011	CAPACITOR POLYESTER,0.33UF+-5%, 50V,HERMETIC	876367	1	
C12-13,C7-11 C1-2	CAPACITOR SMR,CAP,CER,0.22UF,+80-20%,50V,Y5V,1206	740597	9	
C14, C63	CAPACITOR SMR,CAP,CER,100PF,+-10%,50V,C0G,1206	740571	2	
CR02	DIODE,SI,PN,FJH1100,15V,150MA,RADIAL LEAD PREP,DO-35,TAPE	853523	1	
R1	RESISTOR,CERMET,15K,+-1%,0.25W,100PPM,1206,TAPE	769810	1	ϟ
R2	RESISTOR SMR,RES,CERM,8.06K,+-1%,.125W,100PPM,1206	806356	1	ϟ
R3	RESISTOR SMR,RES,CERM,61.9K,+-1%,.125W,100PPM,1206	821330	1	ϟ
R4	RESISTOR SMR,RES,CERM,22K,+-5%,.125W,200PPM,1206	746651	1	ϟ
R5	RESISTOR SMR,RES,CERM,11K,+-1%,.125W,100PPM,1206	867291	1	ϟ
U1	BIPOLAR OP07C SMR,IC,OP AMP,ULTRA-LOW-NOISE,SOIC	783001	1	ϟ
U2	BIPOLAR LT1007C ,IC,OP AMP,PRECISION,LOW NOISE	782920	1	ϟ
VR1	ZENER,UNCOMP,1N965B,15V,5%,8.5MA,400MW,DO-35,TAPE	266601	1	ϟ
Notes	ϟStatic sensitive note.			

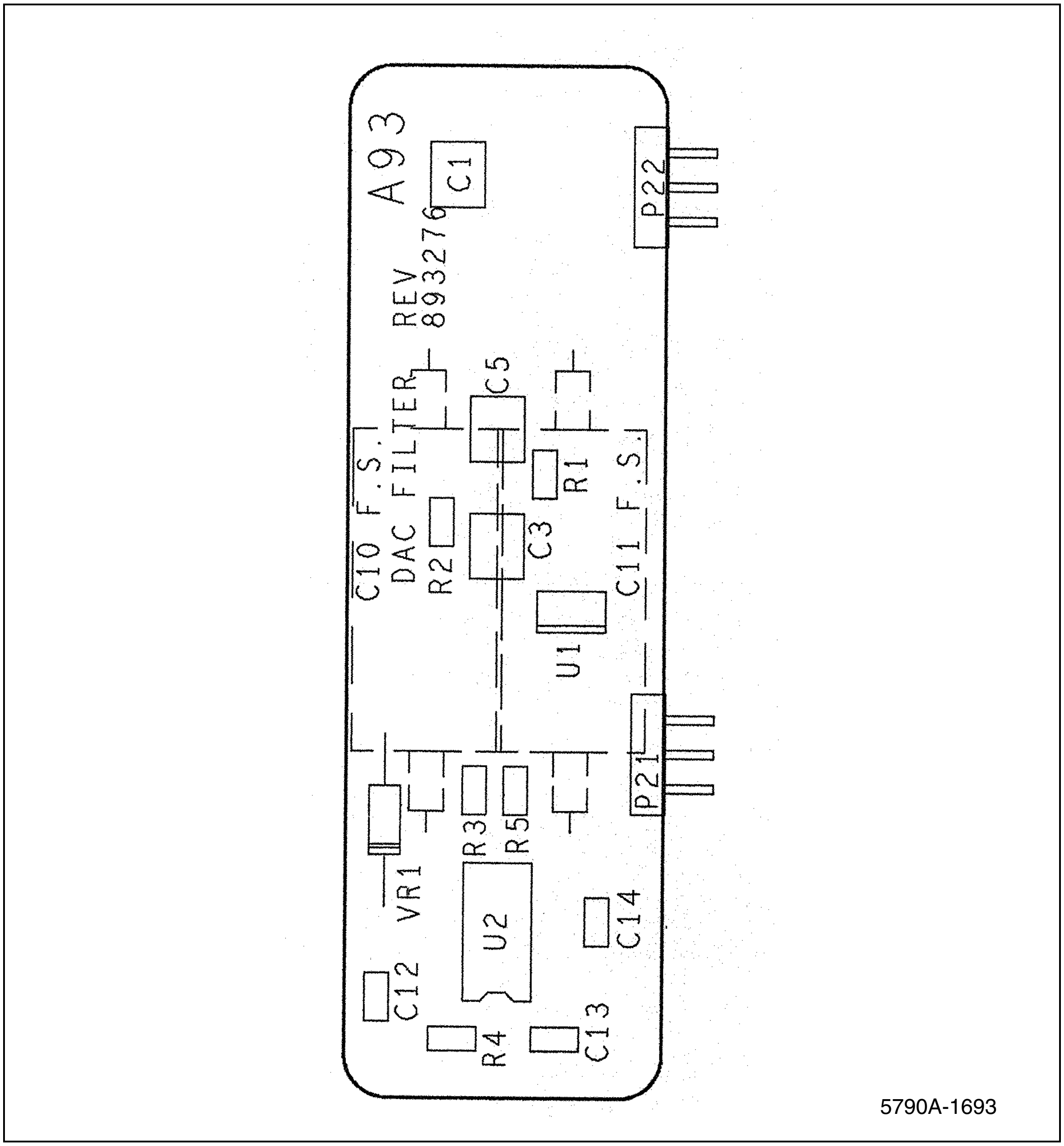

Figure 6-16. A16A1 DAC Filter PCA

Table 6-18. A17 Regulator/Guard Crossing PCA

Ref Des	Description	Part Number	Qty	Notes
C1-2,C4,C6-7,C9, C11-12,C14-15, C20,C23,C28	CAPACITOR,ELECTROLYTIC,ALUMINUM,10UF,+-20%,50V,SOLV PROOF,2.5MM LS,RADIAL,TAPE	799437	13	
C3, C10	CAPACITOR,CAP,CER,0.05UF,+-20%,100V,Z5V	149161	2	
C5,C24,C102	CAPACITOR R02A,CAP,AL,22UF,+-20%,35V,SOLV PROOF	851766	3	
C54, C56, C59-60, C101,C104-107 C109-110, C112-113	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	13	
C55,C58	CAPACITOR R05R,CAP,TA,10UF,+-20%,10V	714766	2	
C57	CAPACITOR R05R,CAP,TA,47UF,+-20%,10V	733246	1	
C61-62	CAPACITOR R05R,CAP,CER,22PF,+-5%,50V,C0G	714550	2	
C67-70	CAPACITOR ,CAP,TA,22UF,+-20%,25V	357780	4	
C71	CAPACITOR R02R,CAP,CER,68PF,+-2%,100V,C0G	362756	1	
CR1-17,CR20-21, CR24,CR26-27	DIODE,1N4007 A52R,DIODE,SI,1KV,1A,DO-41	707075	22	
CR36	DIODE,SI,1N4448,75V,150MA,4NS,RADIAL LEAD PREP,DO-35,TAPE	659516	1	ϟ
CR37	THYRISTOR,SCR,THYRISTOR,SI,SCR,VBO=200V,8.0A	634147	1	
H19-22	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	4	
H45-48	SCREW ,SCREW,PH,P,LOCK,SS,6-32,.500	320051	4	
L51	5100A-8103,,CHOKE, 3 TURN	452888	1	
MP1,MP5	HEAT DISSIPATOR,HEAT DIS,PRESS ON,.315ID,.750OD,TO-5	418384	2	
MP16	5700A-2708,RIVETED, VOLTAGE REGULATOR AIR DUCT	802777	1	
MP28	BAG,MYLAR,STATIC SHIELD,OPEN TOP,.0031,10.00,14.00	680967	1	
MP35-36	EJECTOR,EJECTOR,PWB,NYLON	494724	2	
MP59-60	INSULATION PART ,INSUL PT,TRANSISTOR MOUNT,DAP,TO-5	152207	2	
MP71	8840A-8019,PAD, ADHESIVE	735365	1	
P117,P217	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	807800	2	
R1,R4,R59	RESISTOR A52R,RES,MF,113,+-0.1%,0.125W,100PPM	484238	3	
R2, R8	RESISTOR A52R,RES,MF,2.67K,+-1%,0.5W,100PPM	161430	2	
R5,R11	RESISTOR,METAL FILM,203,+-0.1%,0.125W,100PPM,AXIAL,TAPE	851191	2	
R6	RESISTOR,METAL FILM,2.61K,+-0.1%,0.125W,100PPM,AXIAL,TAPE	851571	1	
R10	RESISTOR A52R,RES,MF,2.67K,+-0.1%,0.125W,25PPM	340596	1	
R13	RESISTOR A52R,RES,CF,10,+-5%,O.25W	340075	1	

R21	RESISTOR R05A,RES,MF,200,+-1%,0.25W,100PPM	820282	1	
R22	RESISTOR,METAL FILM,806,+-1%,0.25W,100PPM,RADIAL,TAPE	810531	1	
R23	RESISTOR R05A,RES,MF,1K,+-1%,0.25W,100PPM	816595	1	
R24	RESISTOR R05A,RES,CF,12K,+-5%,0.25W	757799	1	
R50,R55-57	RESISTOR A52R,RES,CF,620,+-5%,0.25W	442319	4	
R52	RESISTOR A52R,RES,MF,1K,+-1%,0.125W,100PPM	168229	1	
R53	RESISTOR,CARBON FILM,10M,+-5%,0.25W,AXIAL,TAPE	875257	1	
R54	RESISTOR A52R,RES,CF,1.8K,+-5%,0.25W	441444	1	
R58	RESISTOR A52R,RES,CF,3K,+-5%,0.25W	441527	1	
SW51	SWITCH,SWITCH,PUSHBUTTON,SPST,MOMENTARY	782656	1	
TP1,TP4,TP6, TP8-10,TP12, TP55,TP58	JUMPER,R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	9	
U1,U5	BIPOLAR 317HVH,IC,VOLT REG,HIGH VOLTAGE	723445	2	ϟ
U2	BIPOLAR 7815,IC,VOLT REG,FIXED,+15 VOLTS,1.5 AMPS	413187	1	ϟ
U3	BIPOLAR 7915,IC,VOLT REG,FIXED,-15 VOLTS,1.5 AMPS	413179	1	ϟ
U6	5700A-4325,HEAT SINK ASSY	665398	1	ϟ
U7	5700A-4326,HEAT SINK ASSY	665406	1	ϟ
U8	5700A-4311,HEAT SINK ASSY	665414	1	ϟ
U11	5700A-4336,HEAT SINK ASSY	665403	1	ϟ
U12	BIPOLAR 7905 ,IC,VOLT REG,FIXED,-5 VOLTS,1.5 AMPS	394551	1	ϟ
U51	CMOS 74HCU04,IC,CMOS,HEX INVERTER,UNBUFFERED	741199	1	ϟ
U52	CMOS 74HCT244,IC,CMOS,OCTL LINE DRVR W/3-ST OUT	741892	1	ϟ
U53	CMOS 74HC137 ,IC,CMOS,3-8 LINE DECODER/DEMUX	799478	1	ϟ
U55	CMOS 74HCT245,IC,CMOS,OCTAL BUS TRANSCEIVER	722017	1	ϟ
U56	CMOS 63B03Y,IC,CMOS,8-BIT MPU,2.0 MHZ,256 BYT RAM	876326	1	ϟ
U57	TTL 75451,IC,TTL,DUAL AND DRVR W/OPEN COLLECTOR	393959	1	ϟ
U58	CMOS 22V10,IC,PROG ARRAY LOGIC,PRGMD,5790A-90780	904719	1	ϟ
U59,U63	CMOS 74HC4020,IC,CMOS,14 STAGE BINARY COUNTER	807701	2	ϟ
U60	BIPLOAR TL7705A,IC,VOLT SUPERVISOR,4.55V SENSE INPUT	780577	1	ϟ
U62	IC,MEMORY,SRAM,6264,64KB,8KX8,5V,100NS,DIP28,TUBE	783332	1	ϟ
U64	5790A-99264 ,EPROM, PROGRAMMED 27C256, U64	885673	1	ϟ
U65	CMOS 2692,IC,CMOS,DUAL ASYNC REC/TRAN,28 PIN	876318	1	ϟ
XU58	CONNECTOR,SOCKET,DIP,.300CTR,24 PIN	812198	1	
XU64	CONNECTOR,SOCKET,DIP,.600CTR,28 PIN	448217	1	

Y52	CRYSTAL,CRYSTAL,7.3728MHZ,+-1,%,HC-18U	742049	1	
Z1,Z3	RESISTOR,RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	2	
Z2	RESISTOR,RES,CERM,SIP,10 PIN,5 RES,10K,+-2%	529990	1	
Z51	RESISTOR,RES,CERM,DIP,16 PIN,15 RES,10K,+-5%	355305	1	
Z52	RESISTOR,RES,CERM,SIP,8 PIN,4 RES,4.7K,+-2%	573881	1	
Z53-54	RESISTOR,RES,CERM,SIP,10 PIN,5 RES,33,+-2%	622761	2	
Z55	RESISTOR,RES,CERM,SIP,6 PIN,5 RES,22K,+-2%	520122	1	
Notes	ϟ Static sensitive part.			

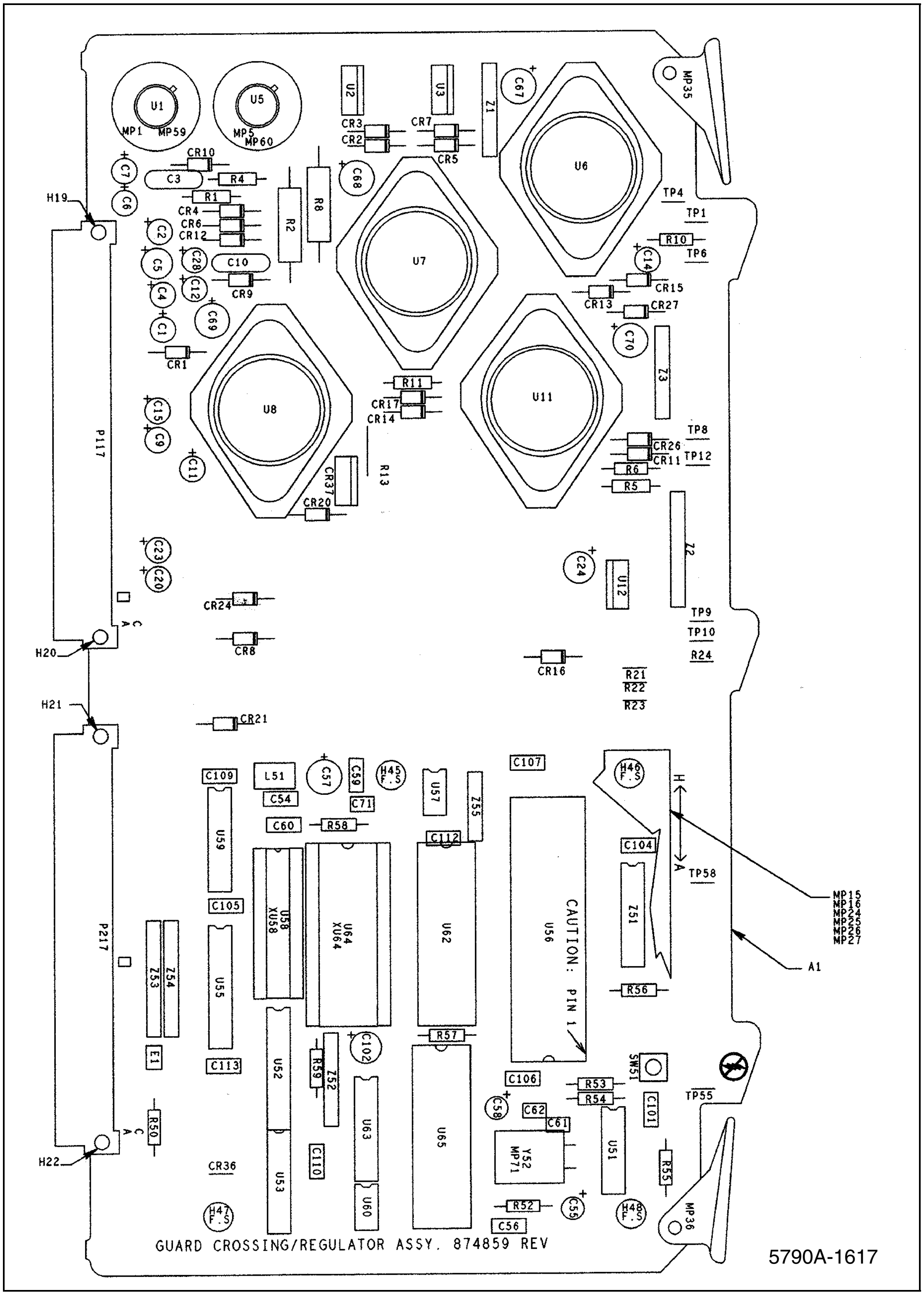

Figure 6-17. A17 Regulator/Guard Crossing PCA

Table 6-19. A18 Filter PCA

Ref Des	Description	Part Number	Qty	Notes
C1,C10,C17	CAPACITOR,FILM,POLYESTER,0.22UF,\+-5%,50V,5MM LS,RADIAL,TAPE	747519	3	
C2-3	CAPACITOR,CAP,AL,6800UF,+-20%.25V	782466	2	
C4,C6	CAPACITOR ,CAP,AL,1000UF,+-20%,50V,SOLV PROOF	782391	2	
C5,C19	CAPACITOR,ELECTROLYTIC,AL,2200UF,+-20%,25V,SOLV PROOF,27X16.5MM,RADIAL,BULK	782383	2	
C9,C18	CAPACITOR,ELECTROLYTIC,ALUMINUM,330UF,+-20%,100V,16.5X27MM,7.5MM LS,RADIAL,BULK	816785	2	
C11	CAPACITOR R05A,CAP,AL,220UF,+-20%,25V,SOLV PROOF	816793	1	
C12,C22	CAPACITOR,ELECTROLYTIC,ALUMINUM,22UF,+-20%,35V,5MM LS,LOW PROFILE,RADIAL,TAPE	817056	2	
C13-16	CAPACITOR ,CAP,AL,3300UF,+-20%,50V	782458	4	
C20	CAPACITOR R05A,CAP,AL,10UF,+-20%,63V,SOLV PROOF	816843	1	
C21	CAPACITOR,ELECTROLYTIC,ALUMINUM,470UF,+-20%,50V,SOLVENT PROOF,16X25,RADIAL,BULK	747493	1	
C23	CAPACITOR,R05A,CAP,POLYES,1UF,+-10%,50V	733089	1	
CR1-2,CR4-5, CR8,CR10, CR12-13	DIODE,UES1303 A52R,DIODE,SI,150V,5A,AXIAL	523720	8	
CR3, CR14	BRIDGE,2KBP01,DIODE BRIDGE,SI,100V,2A,SIP	392910	2	
CR7	BRIDGE,KBP04M,DIODE BRIDGE,SI,200V,1.5A,SIP	296509	1	
CR9,CR16,CR18	DIODE,1N4007 A52R,DIODE,SI,1KV,1A,DO-41	707075	3	
CR11,CR15,CR17	BRIDGE,GBL005,DIODE BRIDGE,SI,50V,3A,SIP	586115	3	
CR19	THYRISTOR,TRIAC,THYRISTOR,SI,TRIAC,VBO=200V,8.0A	413013	1	ϟ
F1-2,F8	FUSE R05A,FUSE,8X8.5MM,1.6A,250V,SLOW,RADIAL	816488	3	
F4,F7,F9	FUSE R05A,FUSE,8X8.5MM,0.5A,250V,SLOW,RADIAL	831990	3	
F6	FUSE R05A,FUSE,8X8.5MM,0.315A,250V,SLOW,RADIAL	832337	1	
H6-9	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	4	
MP1,MP3,MP5	HEAT DISSIPATOR,HEAT DIS,PRESS ON,.315ID,.750OD,TO-5	418384	3	
MP2	BUMPER,RUBBER,BLACK,.50 SQ,.12 THK,ADHESIVE	543488	1	
MP6-7	EJECTOR,EJECTOR,PWB,NYLON	494724	2	
MP10	INSULATION PART,INSUL PT,TRANSISTOR MOUNT,DAP,TO-5	152207	1	
P118,P218	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	807800	2	
R1	RESISTOR A73R,RES,CERM,560,+-5%,2W,100PPM	643764	1	

R2,R5	RESISTOR A52R,RES,CF,20K,+-5%,0.5W	641099	2	
TP1-6,TP8, TP10-21	JUMPER R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	19	
U1	BIPOLAR 7905,IC, VOLT REG,FIXED,-5 VOLTS,0.5 AMPS	816322	1	ϟ
U2	IC,VOLTAGE REGULATOR,LINEAR,LM340L,5V,100MA,TO-39,BULK	816355	1	ϟ
U3	BIPOLAR 7918,IC,VOLT REG,FIXED,-18 VOLTS,1.5AMPS	845474	1	ϟ
VR20-21	ZENER 1N5268B A52R,ZENER,UNCOMP,82.0V,5%,1.5MA,0.5W	844977	2	ϟ
Z1-3	RESISTOR,RES,CERM,SIP,10 PIN,5 RES,10K,+-2%	529990	3	
	BAG,MYLAR,STATIC SHIELD,OPEN TOP,.0031,10.00,14.00	680967	1	
Notes	ϟ Static sensitive part.			

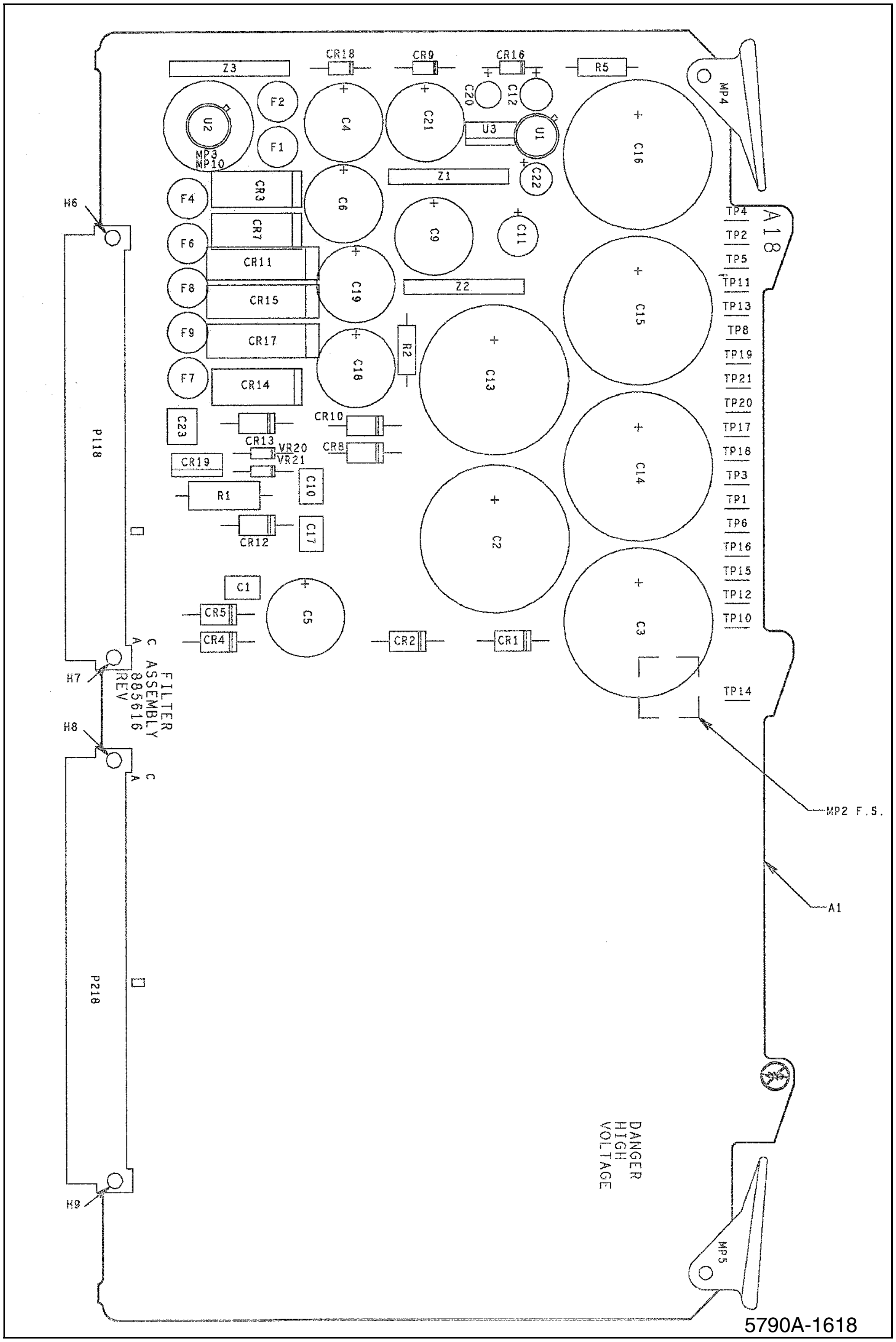

Figure 6-18. A18 Filter PCA

Table 6-20. A19 Digital Power Supply PCA

Ref Des	Description	Part Number	Qty	Notes
C1	CAPACITOR,CAP,AL,470UF,+-20%,160V	816835	1	
C2	CAPACITOR,ELECTROLYTIC,ALUMINUM,10UF,\+- 20%,160V,10.5X17.5MM,5MM LS,RADIAL,BULK	817064	1	
C3	CAPACITOR,ELECTROLYTIC,ALUMINUM,330UF,+- 20%,100V,16.5X27MM,7.5MM LS,RADIAL,BULK	816785	1	
C4,C9	CAPACITOR R05A,CAP,AL,10UF,+-20%,63V,SOLV PROOF	816843	2	
C5,C11	CAPACITOR R05R,CAP,CER,0.10UF,+-20%,50V,X7R	853650	2	
C6	CAPACITOR ,CAP,AL,10000UF,+-20%,25V	816819	1	
C7	CAPACITOR ,CAP,AL,6800UF,+-20%.25V	782466	1	
C8	CAPACITOR R05A,CAP,AL,2.2UF,+-20%,50V,SOLV PROOF	816868	1	
C10	CAPACITOR,ELECTROLYTIC,ALUMINUM,22UF,+- 20%,35V,5MM LS,LOW PROFILE,RADIAL,TAPE	817056	1	
C12-13	CAPACITOR,CAP,AL,22000UF,+-20%,16V	822379	2	ϟ
C14,C16,C19-23	CAPACITOR,CERAMIC,0.22UF,+- 20%,50V,X7R,RADIAL,TAPE	853648	7	
C15	CAPACITOR R05A,CAP,AL,100UF,+-20%,16V,SOLV PROOF	816850	1	
C17	CAPACITOR ,CAP,POLYPR,0.047UF,+-10%,630V	500827	1	
C18	CAPACITOR,FILM,POLYPROPYLENE,0.047UF,+- 10%,160V,13.5X9.7MM,10MM LS,RADIAL,BULK	446773	1	
C24-25	CAPACITOR R05R,CAP,CER,0.022UF,+80-20%,500V,Z5U	740340	2	
CR1-4,CR9-12	DIODE,1N4935 A52R,DIODE,SI,200V,1A,DO-41	586644	8	
CR8,CR16,CR21, CR23-24,CR29-34	DIODE,1N4007 A52R,DIODE,SI,1KV,1A,DO-41	707075	11	
CR13	CRD R05R,I-REG DIODE,3MA,10%,SEL,TO-226AC	852137	1	
CR17-20	DIODE,1N4933 A52R,DIODE,SI,50V,1A,DO-41	379412	4	
CR22	DIODE,1N4007 A52R,DIODE,SI,1KV,1A,DO-41	707075	1	
CR25-28	DIODE,UES1303 A52R,DIODE,SI,150V,5A,AXIAL	523720	4	
CR35	DIODE ,DIODE,GE,SELECTED,50V,40MA,DO-7	180505	1	ϟ
F1	FUSE R05A,FUSE,8X8.5MM,0.315A,250V,SLOW,RADIAL	832337	1	
F2	FUSE R05A,FUSE,8X8.5MM,0.125A,250V,SLOW,RADIAL	832261	1	
F3-4	FUSE R05A,FUSE,8X8.5MM,2A,250V,SLOW,RADIAL	806331	2	
F5	FUSE R05A,FUSE,8X8.5MM,3.15A,250V,SLOW,RADIAL	832253	1	
H3-4	HEAT DISSIPATOR,TO-220,18 C/W,CLIP,1.00,1.18,.50	643353	2	
H6-7	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	2	

L1-6	CHOKE,38.4UH,6TURN,6160A-8002,BULK	320911	6	
L7	5700A-6401,INDUCTOR, 33 UH	813485	1	
L8	8840A-6310,TRANSFORMER, PULSE	660589	1	
M1-2	BUMPER,HI-TEMP SILICONE,.44 DIA,.188 THK,ADHESIVE	1601870	2	
MP11-12	GROMMET ,GROMMET,SLOT,RUBBER,.438,.062	853291	2	
MP13-14	EJECTOR,EJECTOR,PWB,NYLON	494724	2	
MP28-29	SCREW,6-32,.250,PAN,PHILLIPS,STEEL,ZINC-CLEAR,LOCK	152140	2	
MP30-31	SPACER ,SPACER,SWAGE,.250 RND,BR,6-32,.125	435578	2	
P119	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	807800	1	
Q1	5700A-4310,HEAT SINK ASSY	665422	1	ϟ
Q2,Q6	NPN,MPSA42,TRANSISTOR,SI,NPN,300V,1W,TO-92	370684	2	ϟ
Q3,Q7-10	NPN,PWR,MPS-U10,TRANSISTOR,SI,NPN,300V,10W,TO-202	107646	5	ϟ
Q4	PNP,PWR,2N5415,TRANSISTOR,SI,PNP,200V,1W,TO-39	276899	1	ϟ
Q5	NPN,PWR,TIP120,TRANSISTOR,SI,NPN,60V,65W,TO-220	386128	1	ϟ
R1	RESISTOR A52R,RES,CF,5.1,+-5%,0.25W	441287	1	
R2	RESISTOR A52R,RES,CF,2K,+-5%,0.25W	441469	1	
R3,R12	RESISTOR A52R,RES,CF,100K,+-5%,0.25W	348920	2	
R4	RESISTOR A52R,RES,CF,4.7K,+-5%,0.25W	348821	1	
R5	RESISTOR A52R,RES,CF,12,+-5%,0.25W	442178	1	
R6	RESISTOR A52R,RES,MOX,10K,+-5%,2W	641123	1	
R7	RESISTOR A52R,RES,CF,2,+-5%,O.5W	641057	1	
R8	RESISTOR A52R,RES,CF,120K,+-5%,0.25W	441386	1	
R9,R11	RESISTOR A52R,RES,CF,33K,+-5%,0.25W	348888	2	
R10	RESISTOR A52R,RES,CF,51K,+-5%,0.25W	376434	1	
R13	RESISTOR A52R,RES,CC,10K,+-5%,0.25W	148106	1	
TP1-5,TP8,TP10, TP12-13	JUMPER R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	9	
U1	5700A-4319,HEAT SINK ASSY	665471	1	ϟ
U2	BIPOLAR 7912,IC,VOLT REG,FIXED,-12 VOLTS,1.5 AMPS	381665	1	ϟ
U3	5700A-4320,HEAT SINK ASSY	665478	1	ϟ
VR5	ZENER,UNCOMP,1N753A,6.2V,5%,20MA,DO-35,TAPE	325811	1	ϟ
VR6	ZENER,UNCOMP,1N974B,36V,5%,3.4MA,400MW,DO-35,TAPE	186163	1	ϟ

VR7	ZENER,UNCOMP,1N975B,39V,5%,3.2MA,400MW,DO-35,TAPE	831248	1	ϟ
VR14-15	ZENER,UNCOMP,1N967B,18V,5%,7MA,400MW,DO-35,TAPE	327973	2	ϟ
Notes	ϟ Static sensitive part.			

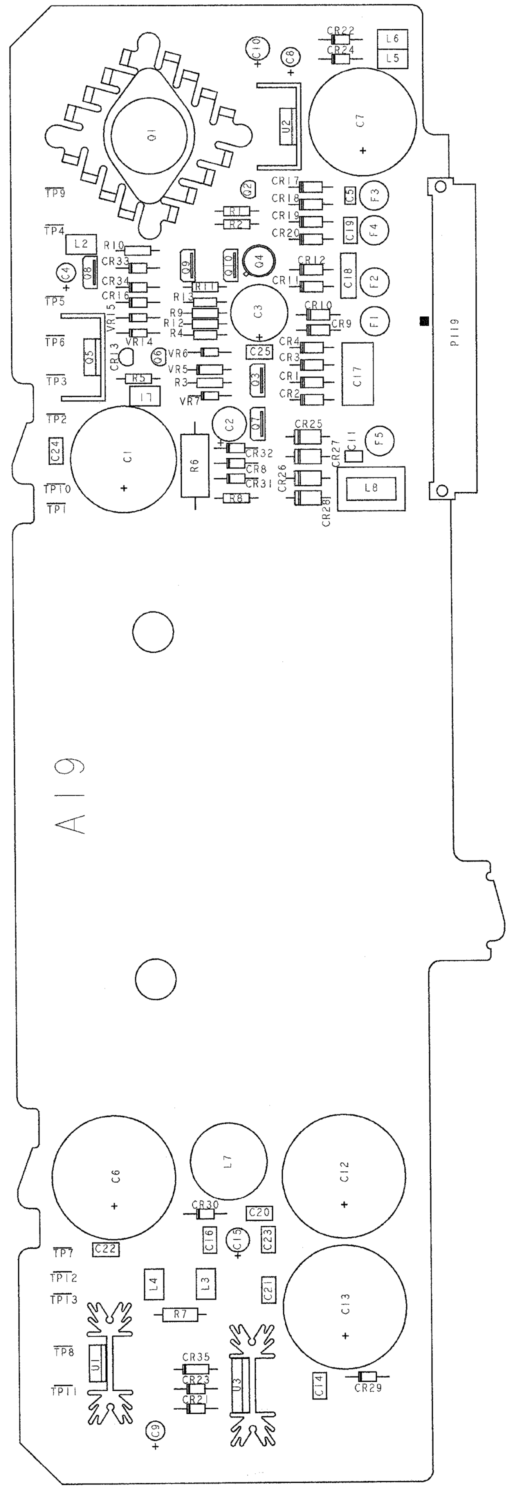

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Figure 6-19. A19 Digital Power Supply PCA

Table 6-21. A20 CPU PCA

Res Des	Description	Part Number	Qty	Notes
BT1	BATTERY,PRIMARY,LITHIUM-MNO2,3.0V,0.560AH,CR2450,COIN,PC PINS,24X5MM,BULK	821439	1	
C1	CAPACITOR SMR,CAP,TA,220UF,+-20%,10V,7343H	106021	1	
C2-4,C6-7, C14-16, C18, C101-111,C113, C115, C116, C119-120, C125-133, C142-143,C152	CAPACITOR SMR,CAP,CER,0.1UF,+-10%,50V,X7R,0805	690500	37	
C5	CAPACITOR SMR,CAP,TA,15UF,+-20%,35V,7343	690252	1	
C8-11	CAPACITOR SMR,CAP,CER,22PF,+-1%,50V,C0G,0805	867663	4	
C12-13,C80	CAPACITOR SMR,CAP,CER,0.22UF,+-10%,25V,X7R,1206	106625	3	
C17	CAPACITOR SMR,CAP,TA,47UF,+-20%,16V,7343	644994	1	
C81	CAPACITOR SMR,CAP,CER,330PF,+-5%,50V,C0G,0805	512038	1	
C82	CAPACITOR SMR,CAP,CER,150PF,+-5%,50V,C0G,0805	866533	1	
C100	CAPACITOR SMR,CAP,TA,2.2UF,+-20%,20V,3528	854760	1	
CR2-3,CR7	DIODE,GF1B SMR,DIODE,SI,100V,1A,DO-214	912451	3	
CR4-6,CR8	DIODE,BAT54A SMR,DIODE,SI,SCHOTT,DUAL,30V,200MA,SOT-23	942594	4	ϟ
DS1	LED,RED,BR1101W,1.6 MCD,20MA,1.7V,1206,TAPE	804788	1	
H3-6	RIVET,AL,.089 DIA,.344 L,SEMI-TUBULAR,OVAL HEAD	838458	4	
L80-81	INDUCTOR,10UH,10%,15MADC,1.15OHM,SHIELDED,0805,TAPE	105965	2	
M3-4	BUMPER,HI-TEMP SILICONE,.44 DIA,.188 THK,ADHESIVE	1601870	2	
MP1-2	EJECTOR ,EJECTOR,PWB,NYLON	494724	2	
MP7	8840A-8019,PAD, ADHESIVE	735365	1	
P61-62	CONNECTOR,DIN41612,TYPE C(M),RT ANG,64 PIN	807800	2	
R1,R3	RESISTOR SMR,RES,CERM,470,+-5%,.125W,200PPM,1206	740506	2	
R2,R7	RESISTOR SMR,RES,CERM,0,+.05 MAX,.125W,1206	810747	2	
R4	RESISTOR,CERMET,10M,+-5%,0.25W,400PPM,1206,TAPE	783274	1	
R5	RESISTOR,CERMET,1.8K,+-5%,0.25W,200PPM,1206,TAPE	746453	1	
R6	RESISTOR SMR,RES,CERM,6.2K,+-%,.125W,200PPM,1206	746016	1	
R8-9	RESISTOR SMR,RES,CERM,75,+-5%,.125W,200PPM,1206	811323	2	
R10-16	RESISTOR SMR,RES,CERM,10K,+-1%,.125W,100PPM,1206	769794	7	
R51-54	RESISTOR SMR,RES,CERM,5.11K,+- 1%,.125W,100PPM,1206	810663	4	
R56,R17	RESISTOR SMR,RES,CERM,1K,+-1%,.125W,100PPM,1206	783241	2	

R58-59	RESISTOR,CERMET,39.2K,+-1%,0.1W,100PPM,0805,TAPE	943092	2	
R60-61	RESISTOR,CERMET,1M,+-1%,0.25W,100PPM,1206,TAPE	836387	2	
SW1	SWITCH, MICRO, PUSHBUTTON, SPST, MOMENTARY, 24VDC@30MA, SMT, TAPE	1589043	1	
T1	TRANSFORMER,SIGNAL,1:1,0.3-150MHZ,1515,TAPE	690669	1	
TP1,TP3-14	CONNECTOR,TERMINAL,TEST POINT,SMD,510 PH BRONZE,TAPE	602125	13	
U1	BPLR TL7705A SMR,IC,VOLT SUPERVISOR,5V SENSE,SOIC	780502	1	ϟ
U2	IC, LOGIC, 74AC05, 2.0V-6.0V, HEX INVERTER W/OPEN DRAIN OUTPUTS, SOIC14, TAPE	1589152	1	ϟ
U3	CMOS 74HCU04 SMR,IC,CMOS,HEX INVERTER,UNBUFFERED,SOIC	806893	1	ϟ
U4,U11	IC, LOGIC, 74HC4020, 2.0V-6.0V, 14-STAGE BINARY COUNTER, CLR, SOIC16, TAPE	1589004	2	ϟ
U5	IC, PLD, ATF22V10C, 5.0V, 500-GATE, EE, PROGRAMMED, U5, SOICW24, TAPE	1609625	1	ϟ
U6	IC, PLD, ATF22V10C, 5.0V, 500-GATE, EE, PROGRAMMED, U6, SOICW24, TAPE	1609633	1	ϟ
U8	IC,MICROPROCESSOR,MC68HC000,16 BIT,5V,10 MHZ,PLCC68,TUBE	866777	1	ϟ
U9	CMOS 74HC32 SMR,IC,CMOS,QUAD 2 INPUT OR GATE,SOIC	783712	1	ϟ
U10	IC, PLD, ATF22V10C, 5.0V, 500-GATE, EE, PROGRAMMED, U10, SOICW24, TAPE	1609640	1	ϟ
U13	IC,MEMORY,EEPROM,28C256,256KB,32KX8,5V,250NS,HIGH ENDURANCE,PLCC32,TAPE	1588978	1	
U15	IC,MEMORY,FLASH,28F800,8MB,512KX16,5V,80NS,BOTTOM BOOT,PROGRAMMED,SO44,TAPE	2061507	1	ϟ
U19	IC,MEMORY,SRAM,7C1021,1MB,64KX16,5V,15NS,TSOP44,TAP E	1609432	1	ϟ
U25,U27-29	CMOS 74HCT244 SMR,IC,CMOS,OCTL LINE DRVR,SOIC	742593	4	ϟ
U26,U30	CMOS 74HCT245 SMR,IC,CMOS,OCTAL BUS TRANSCEIVER,SOIC	742577	2	ϟ
U31	IC,CMOS,68C681,DUAL CHANNEL UART,PLCC,TAPE	866785	1	ϟ
U32	IC, LOGIC, DS75451, 5.0V, SERIES DUAL PERIPHERAL DRIVERS, SOIC8, TAPE	1589055	1	ϟ
U33	IC,REAL TIME CLOCK-CALENDAR,ICM7170,5V,PARALLEL,ALARM,SO24,TAPE	1588991	1	ϟ
U52	BIPOLAR LM324 SMR,IC,OP AMP,QUAD,LOW POWER,SOIC	742569	1	ϟ
Y1	CRYSTAL,7.3728MHZ,50/100PPM,20PF,PLASTIC ENCAPSULATED,SMD,TAPE	106648	1	
Y3	CRYSTAL,32.768KHZ,20/169PPM,12.5PF,PLASTIC ENCAPSULATED,SMD,TAPE	106754	1	
Z1	RESISTOR NETWORK,CERMET,BUSSED,15 RES,16 TERM,3.3K,+-5%,0.125W,200PPM,4012,TAPE	1589028	1	
Z2-3	RESISTOR SMR,RES,CERM,SOIC,16 PIN,15 RES,4.7K,+-2%	838060	2	
Z5	RESISTOR SMR,RES,CERM,SOIC,16 PIN,15 RES,100K,+-2%	910745	1	
Notes	ϟ Static sensitive part.			

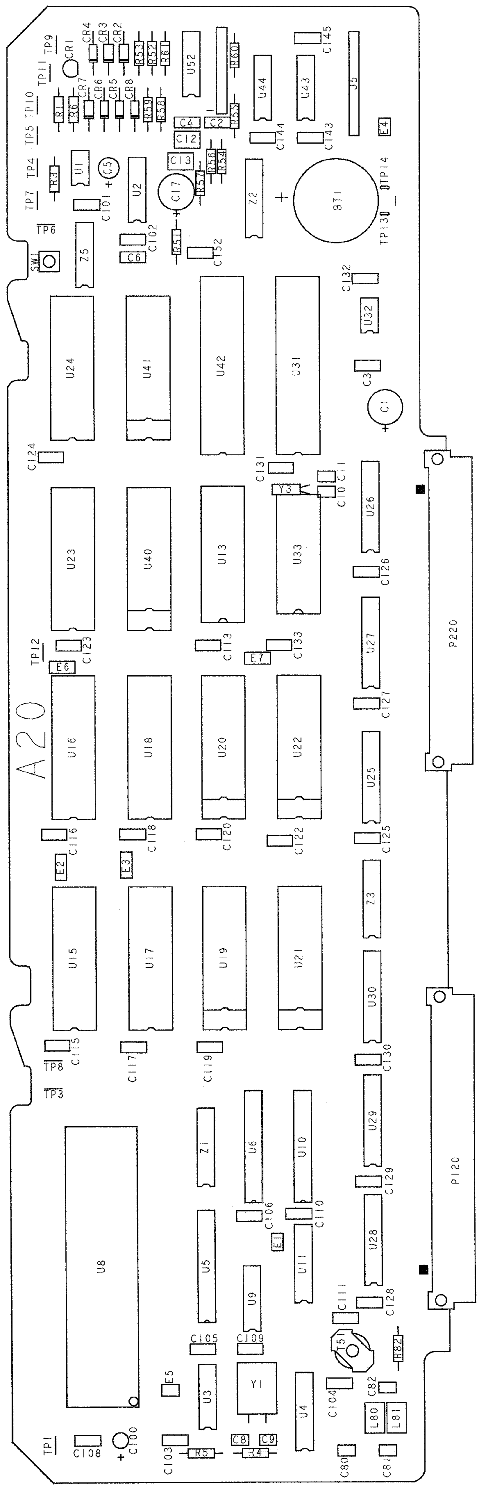

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Figure 6-20. A20 CPU PCA

Table 6-22. A21 Rear Panel I/O PCA

Ref Des	Description	Part Number	Qty	Notes
C1,C3,C5	CAPACITOR R05R,CAP,CER,330PF,+-5%,50V,C0G	697441	3	
C4,C21-22,C24-28, C40-42,C48-49	CAPACITOR,FILM,POLYESTER,0.1UF,+-10%,50V,5MM LS,RADIAL,TAPE	649913	13	
C10,C70	CAPACITOR ,CAP,TA,68UF,+-20%,15V	193615	2	
C11-12	CAPACITOR R05R,CAP,TA,10UF,+-20%,25V	714774	2	
C46,C50	CAPACITOR,ELECTROLYTIC,TANTALUM,1UF,+-20%,35V,5MM LS,RADIAL,TAPE	697417	2	
J1	CONNECTOR,CONN,MICRO-RIBBON,REC,PWB,24 POS	851675	1	
J2	CONNECTOR,CONN,D-SUB,PWB,25 PIN	845214	1	
J10	HEADER,HEADER,1 ROW,.100CTR,4 PIN	631184	1	
J121	CONNECTOR,HEADER,2 ROW,.100CTR,VERTICAL PWB,34 PIN,LATCHING,BULK	807446	1	
MP1-2	STANDOFF,ROUND,6-32,.220 HEIGHT,.250 OD,BRASS,SWAGE,.062 PANEL THK	261727	2	
MP3-4	SPACER,SPACER,SWAGE,.250 RND,BR,4-40,.234	385310	2	
MP5-7	SPACER ,SPACER,SWAGE,.250 RND,BR,6-32,.250	446351	3	
MP8	BAG,MYLAR,STATIC SHIELD,OPEN TOP,.0031,10.00,14.00	680967	1	
R1	RESISTOR A52R,RES,MF,1K,+-1%,0.125W,100PPM	168229	1	
R2	RESISTOR A52R,RES,MF,332,+-1%,0.125W,100PPM	192898	1	
R8-9	RESISTOR A52R,RES,CF,200,+-5%,0.25W	441451	2	
R11	RESISTOR A52R,RES,CF,1K,+-5%,1W	641073	1	
R12-13	RESISTOR A52R,RES,MF,200,+-1%,0.125W,100PPM	245340	2	
S1-2	SWITCH SSSS9,SWITCH,SLIDE,SPDT,LOW PROFILE	911250	2	
TP1-9	JUMPER R05R,JUMPER,WIRE,NONINSUL,0.200CTR	816090	9	
U1	CMOS 74HCT245,IC,CMOS,OCTAL BUS TRANSCEIVER	722017	1	ϟ
U2	IC,INTERFACE,9914,GPIB CONTROLLER,5V,DIP40,TUBE	585240	1	ϟ
U3	LSTTL 75160,IC,LSTTL,OCTAL GPIB XCVR W/OPEN COL	585224	1	ϟ
U4	LSTTL 75162A/B,IC,LSTTL,OCTAL IEEE-488 BUS TRANSCVR	686022	1	ϟ
U5	CMOS 68C681,IC,CMOS,DUAL CHANNEL UART (DUART)	799494	1	ϟ
U6	IC,INTERFACE,MAX1488E,QUAD RS-232 LINE DRIVER,+-15KV ESD,LOW-POWER,PDIP14,TUBE	1622757	1	ϟ
U7	IC,INTERFACE,MAX1489E,QUAD RS-232 LINE RECEIVER,+-15KV ESD,LOW-POWER,PDIP14,TUBEPurchased Item	1622769	1	ϟ
U8	CMOS 22V10,IC,CMOS,PAL,PROGRAMD,35NS,5700A-90790	845255	1	ϟ
U18	IC,COMPARATOR,NE521,+-5V,7.5MV OFFSET,HI-SPEED,DUAL,DIP14,TUBE	556449	1	ϟ

VR3	ZENER,UNCOMP,1N750,4.7V,10%,20MA,DO-35,TAPE	387084	1	ϟ
XU8	CONNECTOR,SOCKET,DIP,.300CTR,24 PIN	812198	1	
Z1-2	RESISTOR,RES,CERM,SIP,10 PIN,9 RES,4.7K,+-2%	484063	2	
Z5	RESISTOR,RES,CERM,SIP,6 PIN,5 RES,10K,+-2%	500876	1	
Notes	ϟ Static sensitive part.			

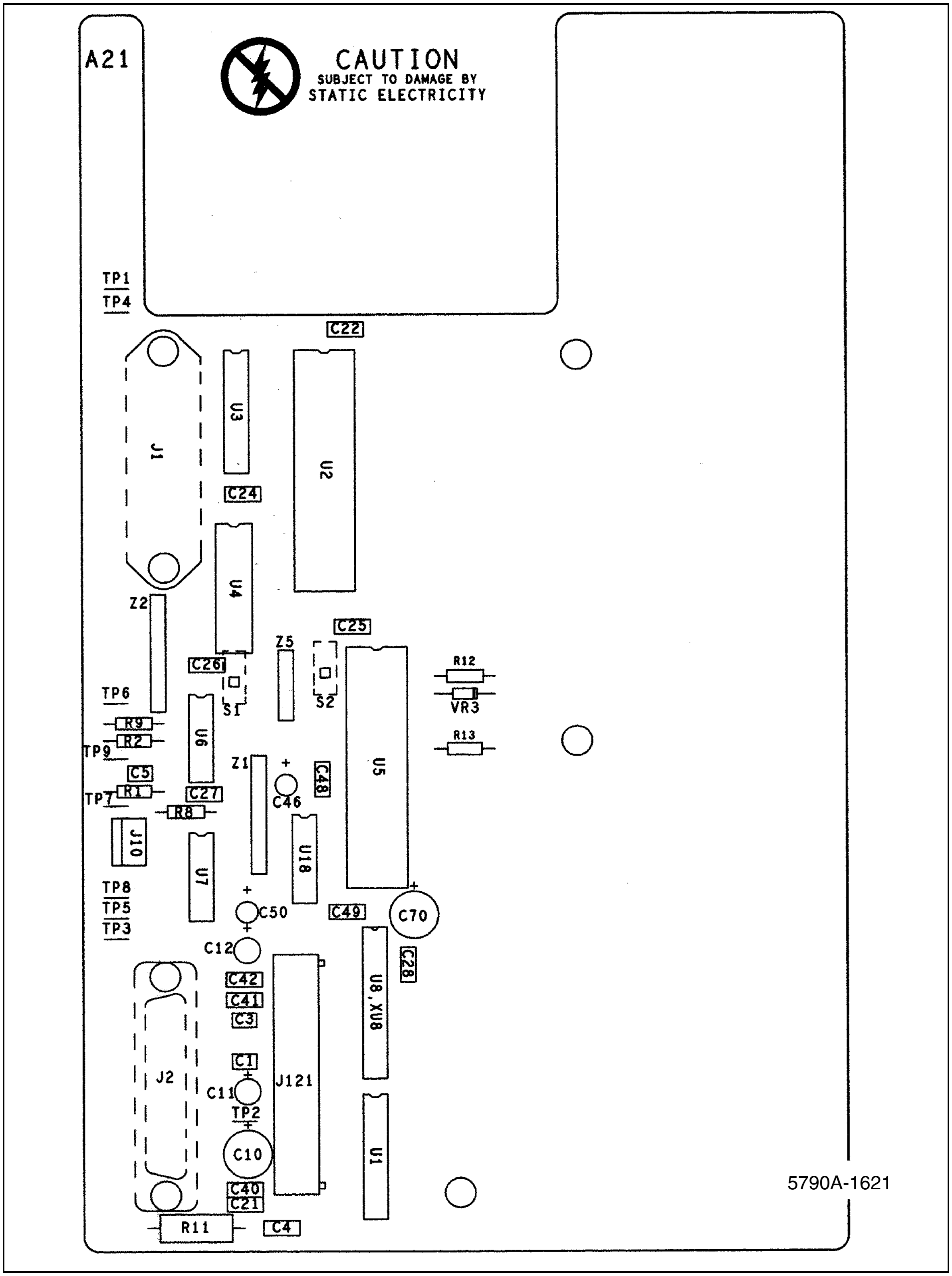


Figure 6-21. A21 Rear Panel I/O PCA

Chapter 7
Schematic Diagrams

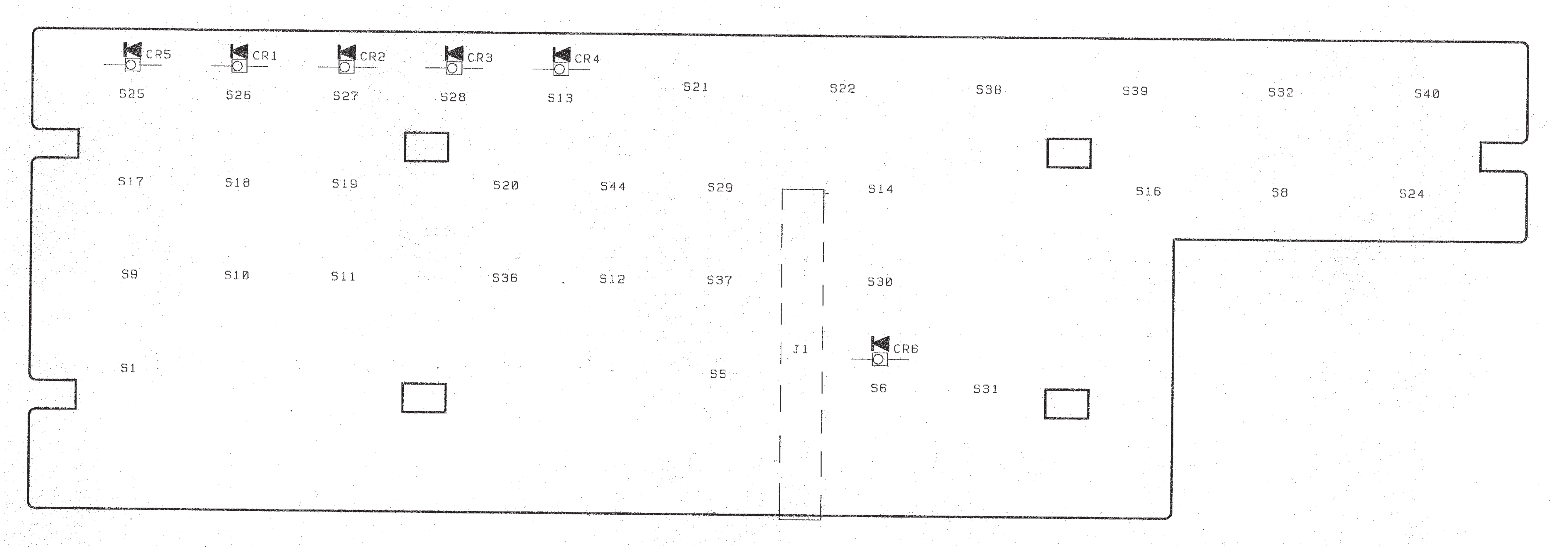


Figure 7-1. A1 Keyboard PCA

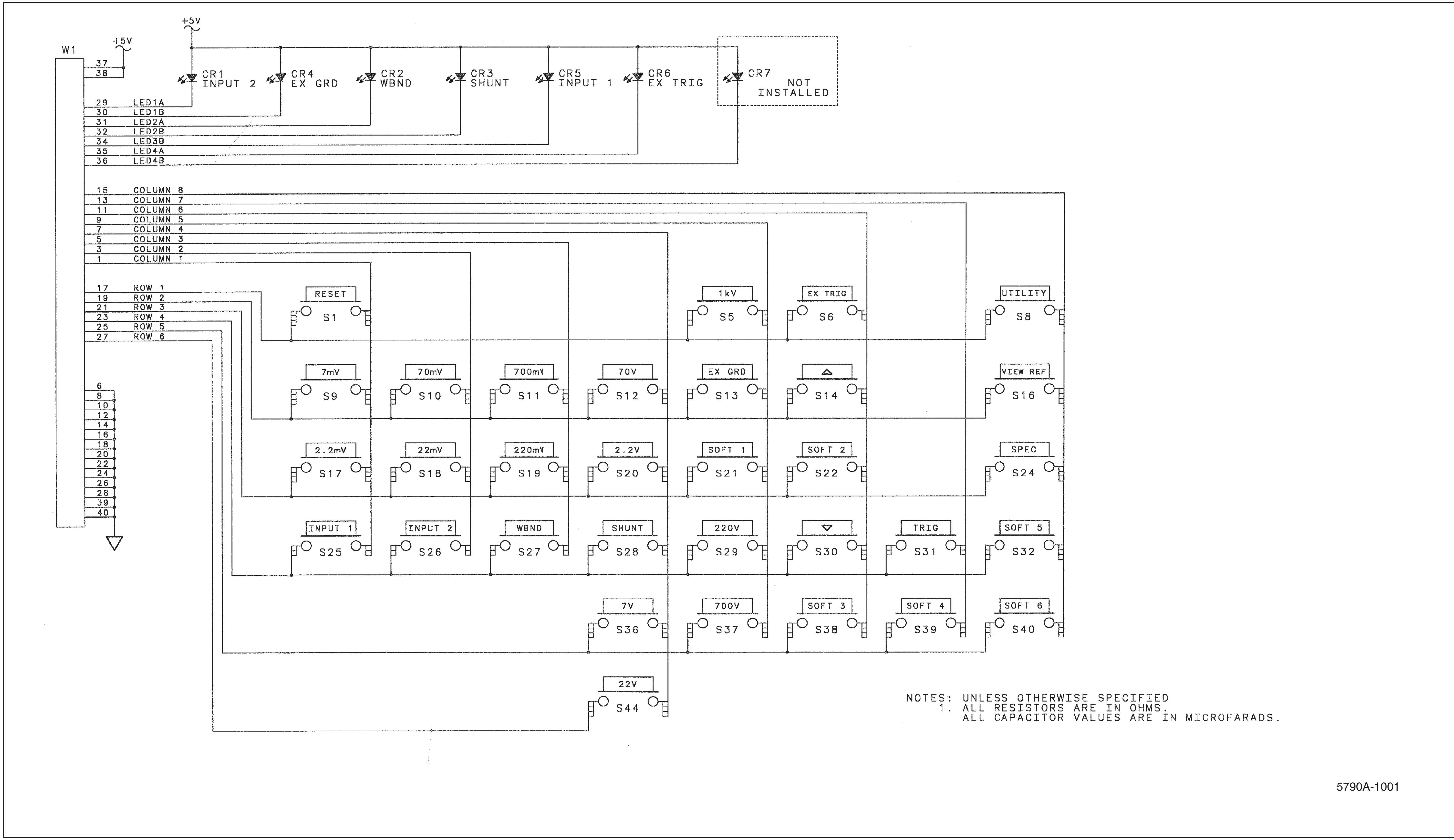
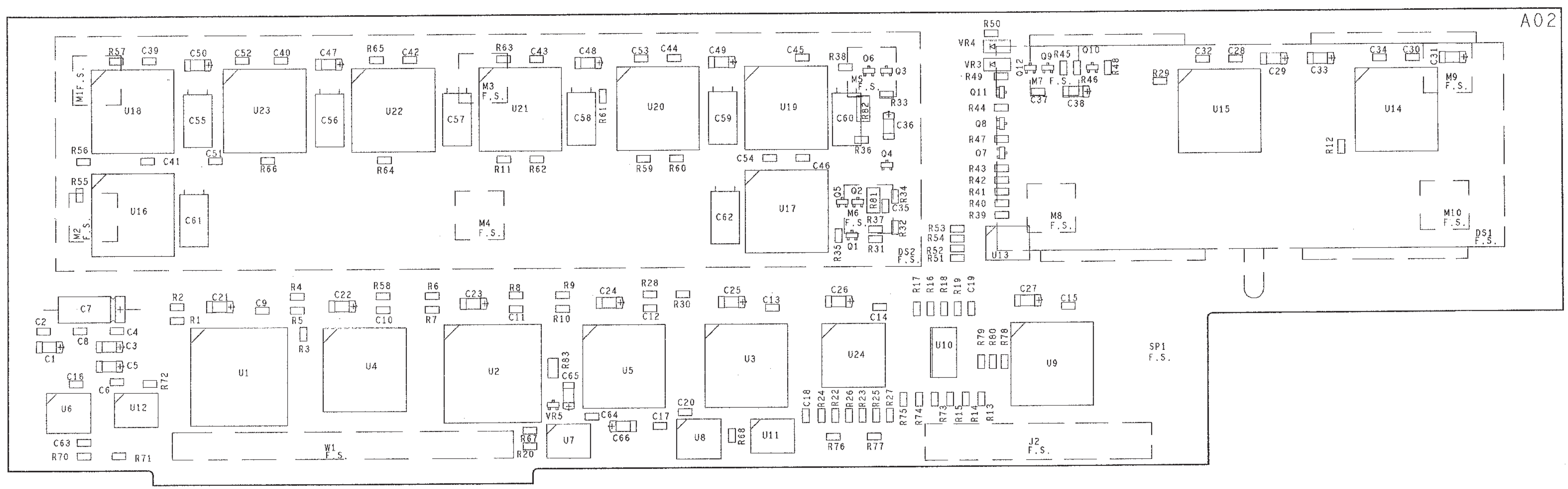
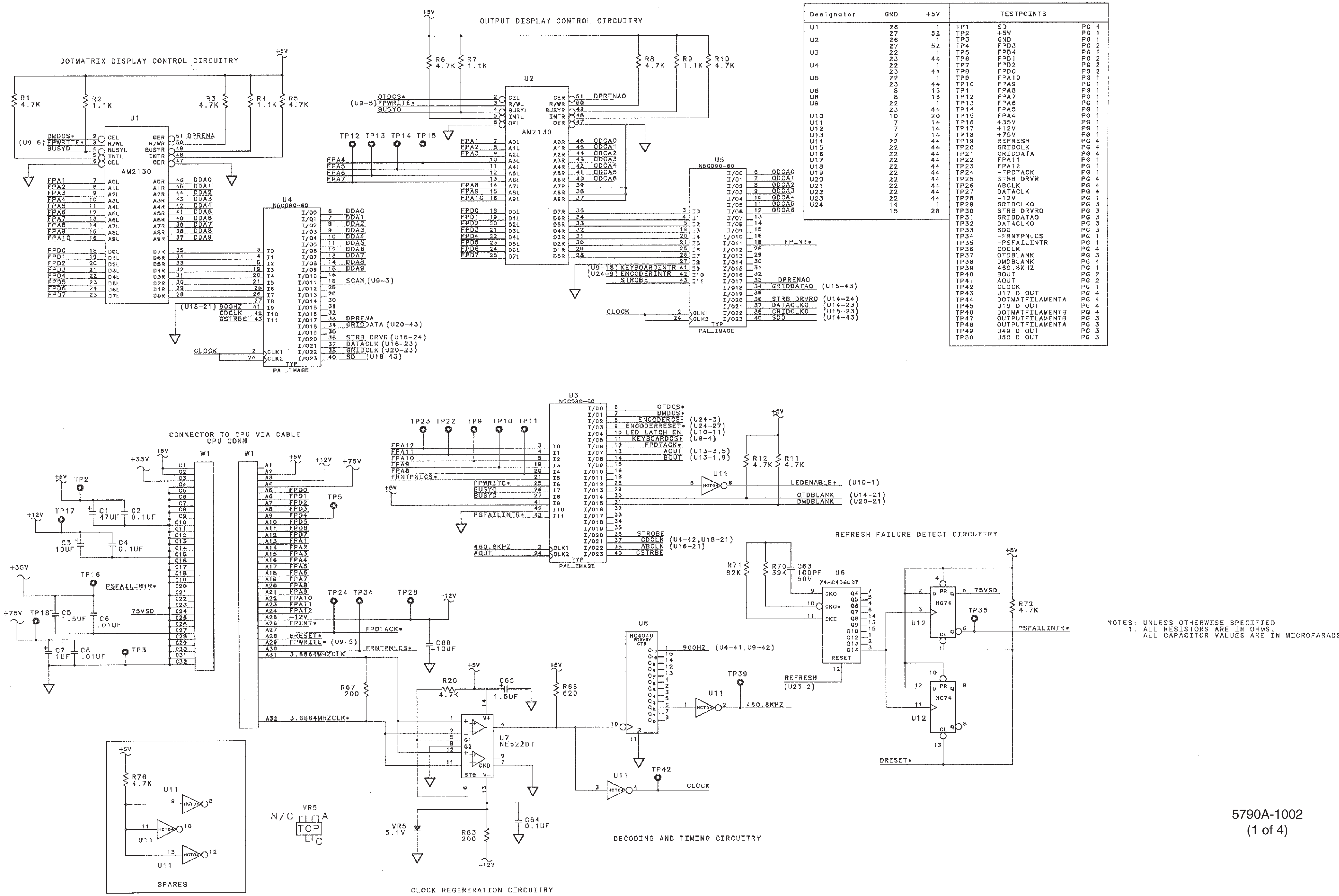


Figure 7-1. A1 Keyboard PCA (cont)



5790A-1602

Figure 7-2. A2 Front Panel PCA



Designator	GND	+5V
U1	26	1
	27	52
U2	26	1
	27	52
U3	22	1
	23	44
U4	22	1
	23	44
U5	22	1
	23	44
U6	8	16
U8	8	16
U9	22	1
	23	44
U10	10	20
U11	7	14
U12	7	14
U13	7	14
U14	22	44
U15	22	44
U16	22	44
U17	22	44
U18	22	44
U19	22	44
U20	22	44
U21	22	44
U22	22	44
U23	22	44
U24	14	1
	15	28

TESTPOINTS		
TP1	SD	PG 4
TP2	+5V	PG 1
TP3	GND	PG 1
TP4	FPD3	PG 2
TP5	FPD4	PG 1
TP6	FPD1	PG 2
TP7	FPD2	PG 2
TP8	FPD0	PG 2
TP9	FPA10	PG 1
TP10	FPA9	PG 1
TP11	FPA8	PG 1
TP12	FPA7	PG 1
TP13	FPA6	PG 1
TP14	FPA5	PG 1
TP15	FPA4	PG 1
TP16	+35V	PG 1
TP17	+12V	PG 1
TP18	+75V	PG 1
TP19	REFRESH	PG 4
TP20	GRIDCLK	PG 4
TP21	GRIDDATA	PG 4
TP22	FPA11	PG 1
TP23	FPA12	PG 1
TP24	-FPDTACK	PG 1
TP25	STRB DRVR	PG 4
TP26	ABCLK	PG 4
TP27	DATACLK	PG 4
TP28	-12V	PG 1
TP29	GRIDCLKO	PG 3
TP30	STRB DRVRO	PG 3
TP31	GRIDDATAO	PG 3
TP32	DATACLKO	PG 3
TP33	SDO	PG 3
TP34	-FRNTPNLCS	PG 1
TP35	-PSFAILINTR	PG 1
TP36	CDCLK	PG 4
TP37	OTDBLANK	PG 3
TP38	DMDBLANK	PG 4
TP39	460.8KHZ	PG 1
TP40	BOUT	PG 2
TP41	AOUT	PG 2
TP42	CLOCK	PG 1
TP43	U17 D OUT	PG 4
TP44	DOTMATFILAMENTA	PG 4
TP45	U19 D OUT	PG 4
TP46	DOTMATFILAMENTB	PG 4
TP47	OUTPUTFILAMENTB	PG 3
TP48	OUTPUTFILAMENTA	PG 3
TP49	U49 D OUT	PG 3
TP50	U50 D OUT	PG 3

Figure 7-2. A2 Front Panel PCA (cont)

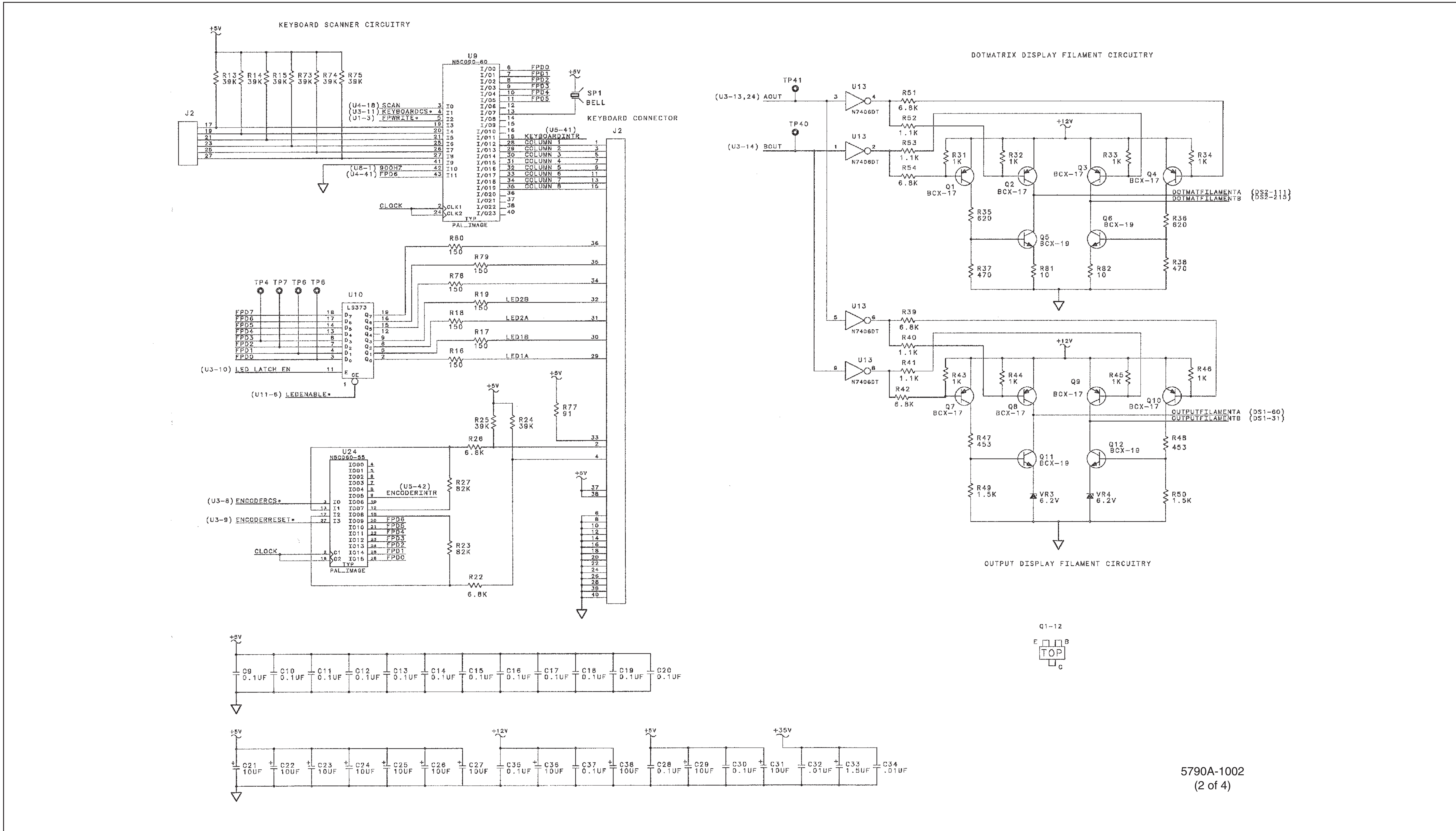


Figure 7-2. A2 Front Panel PCA (cont)

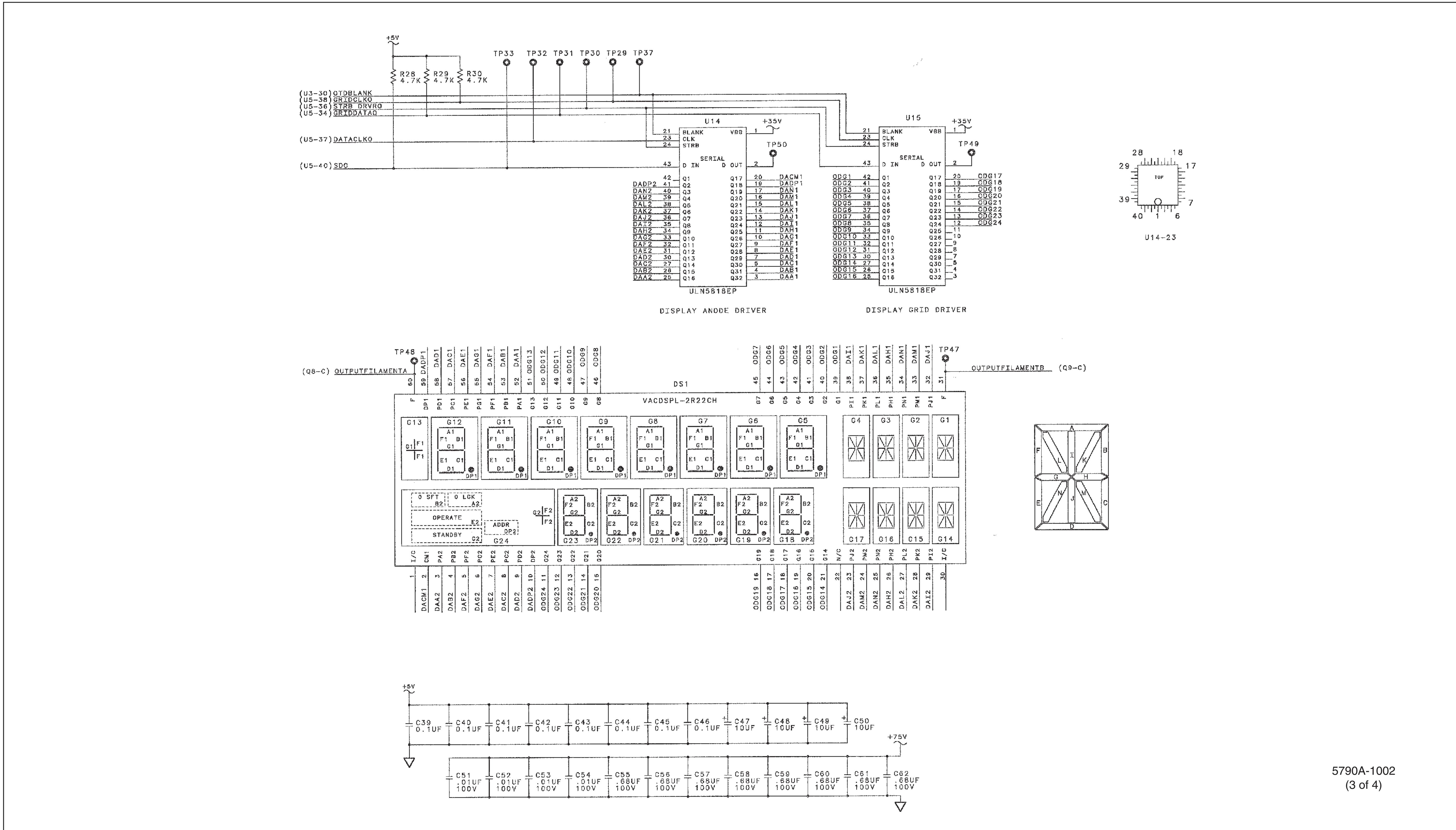


Figure 7-2. A2 Front Panel PCA (cont)

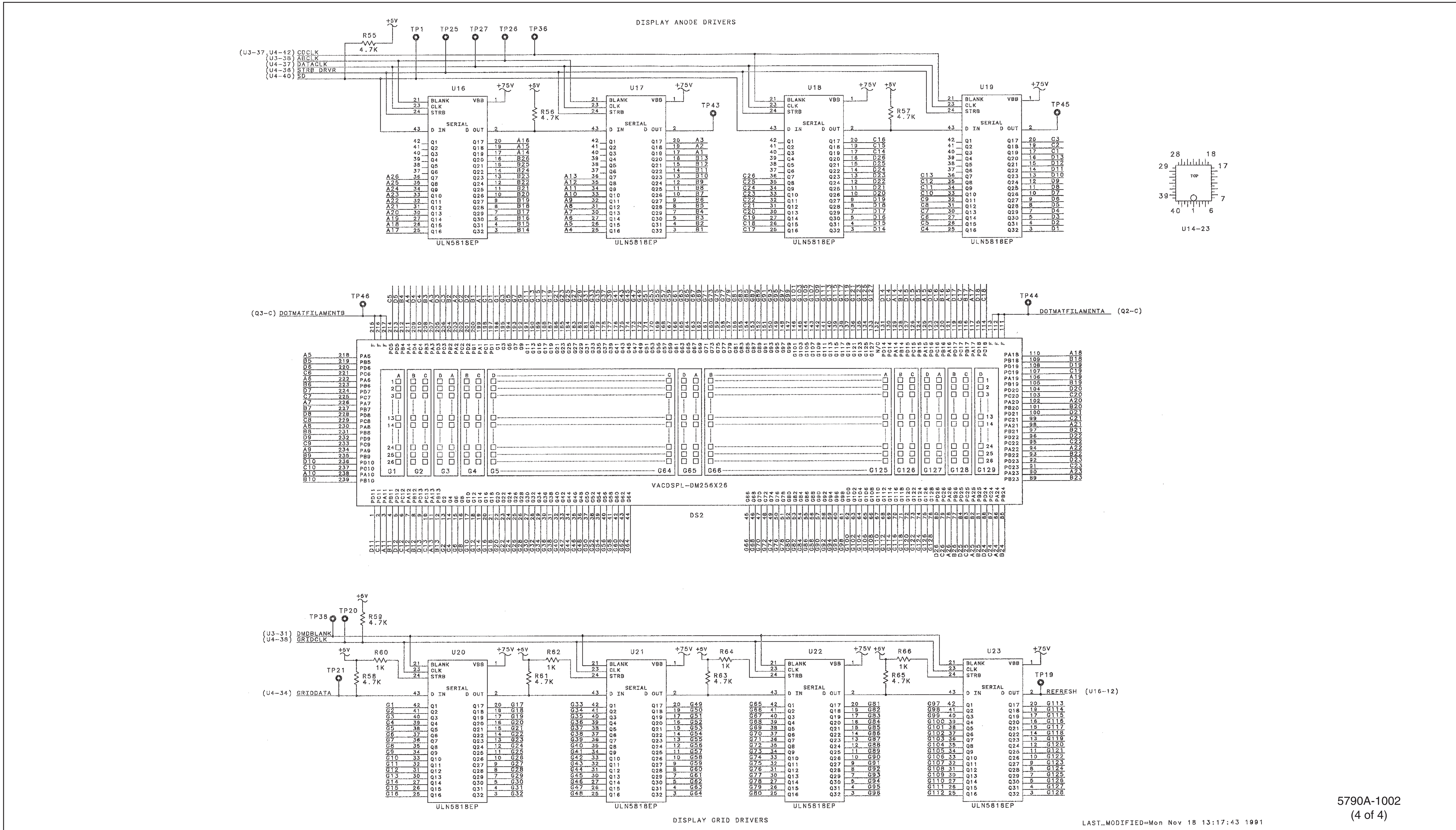


Figure 7-2. A2 Front Panel PCA (cont)

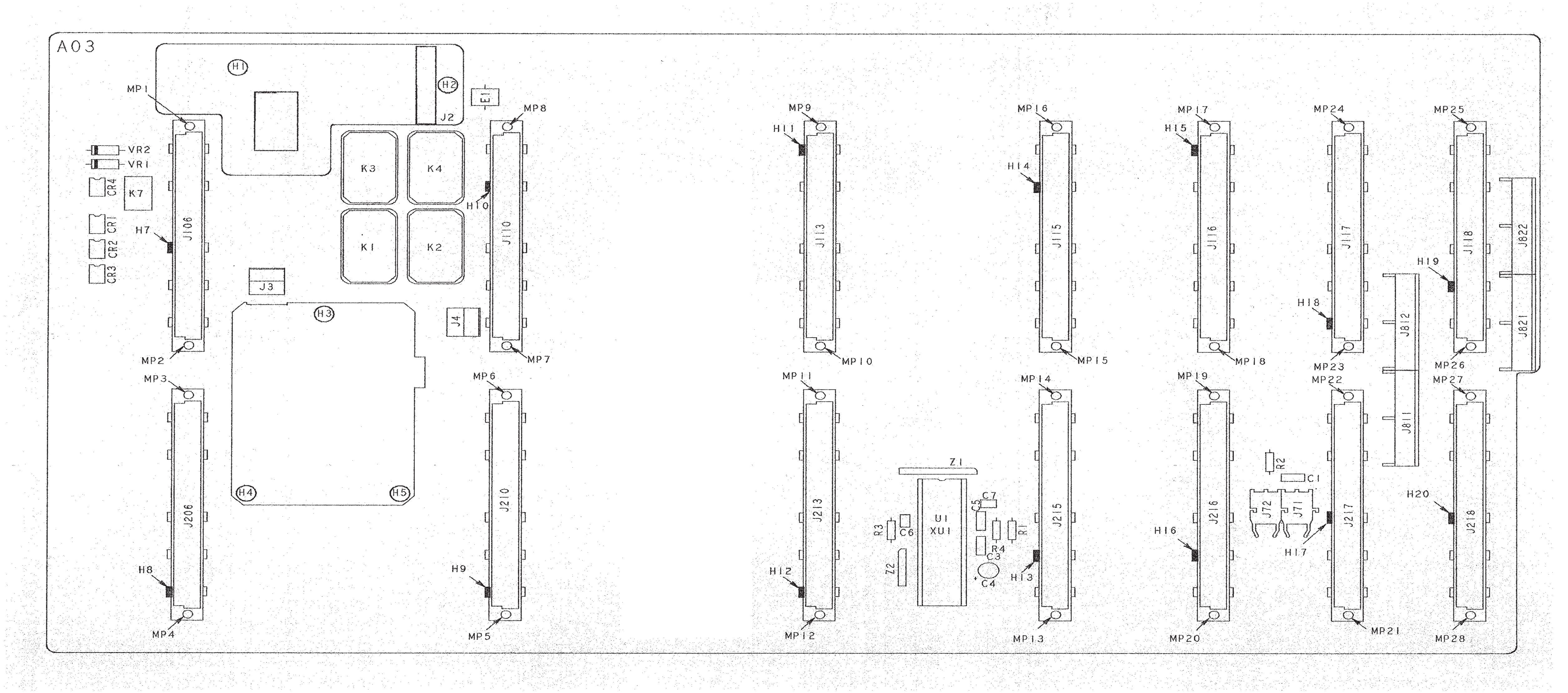


Figure 7-3. A3 Analog Motherboard PCA

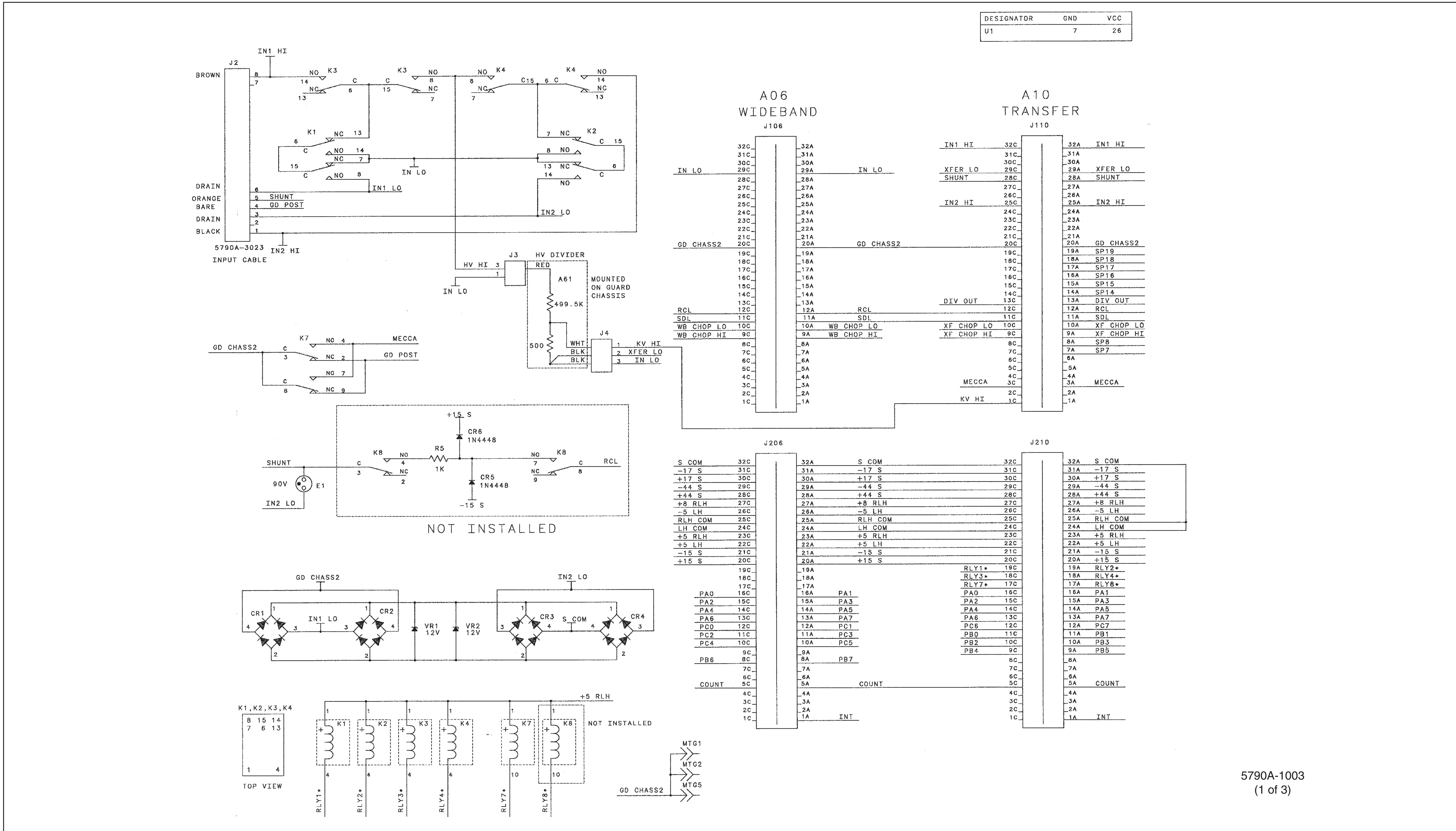


Figure 7-3. A3 Analog Motherboard PCA (cont)

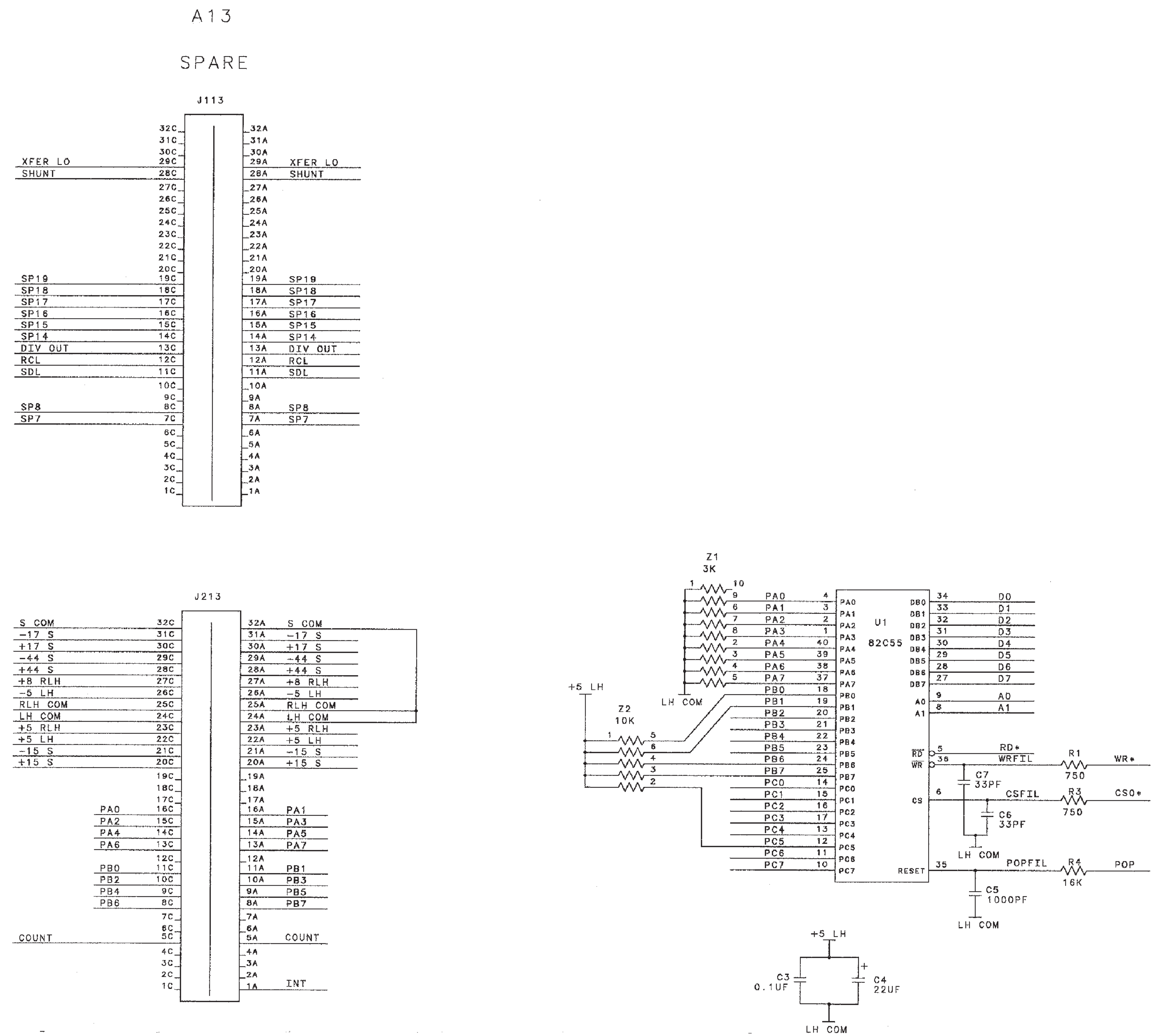


Figure 7-3. A3 Analog Motherboard PCA (cont)

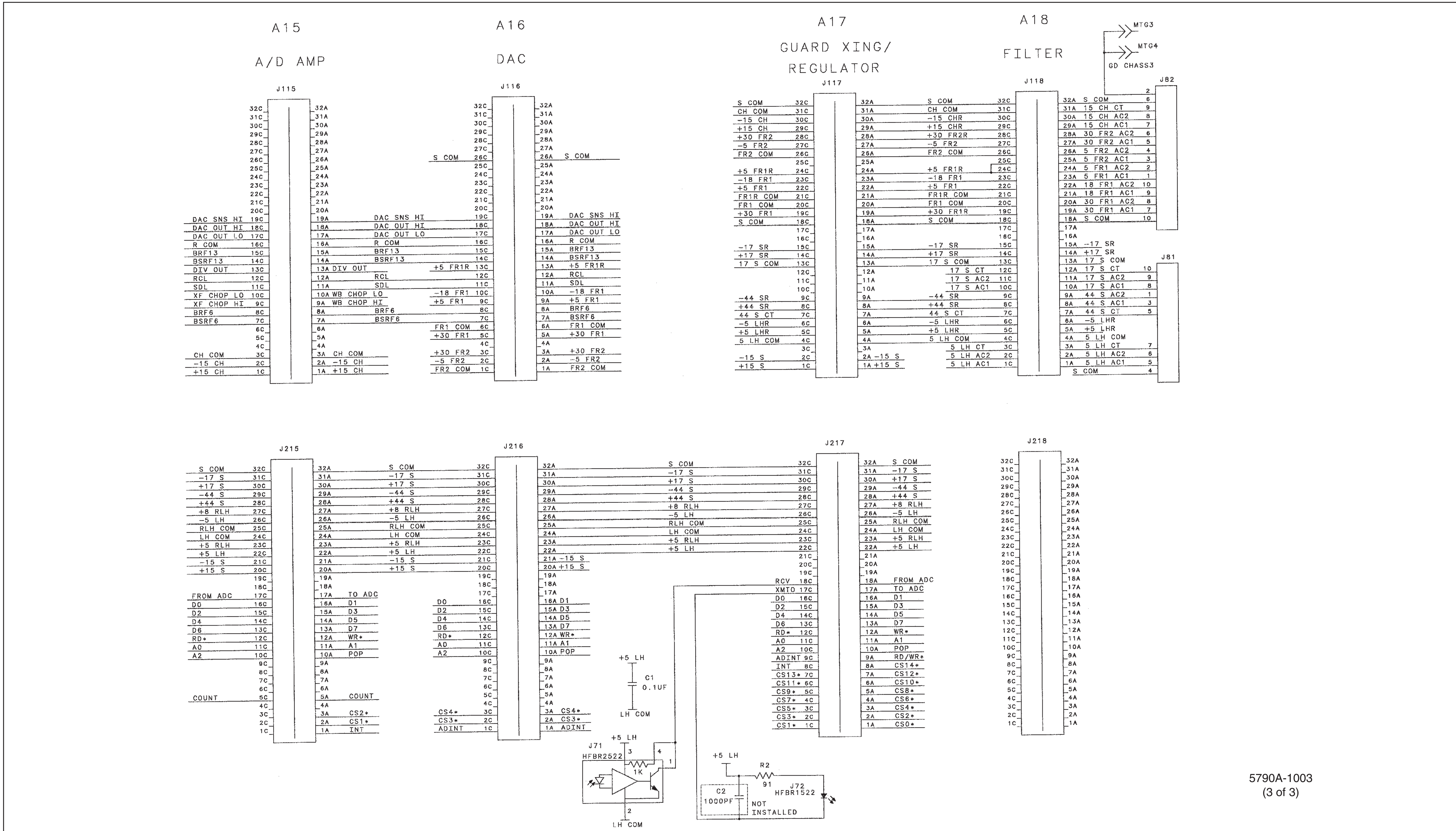


Figure 7-3. A3 Analog Motherboard PCA (cont)

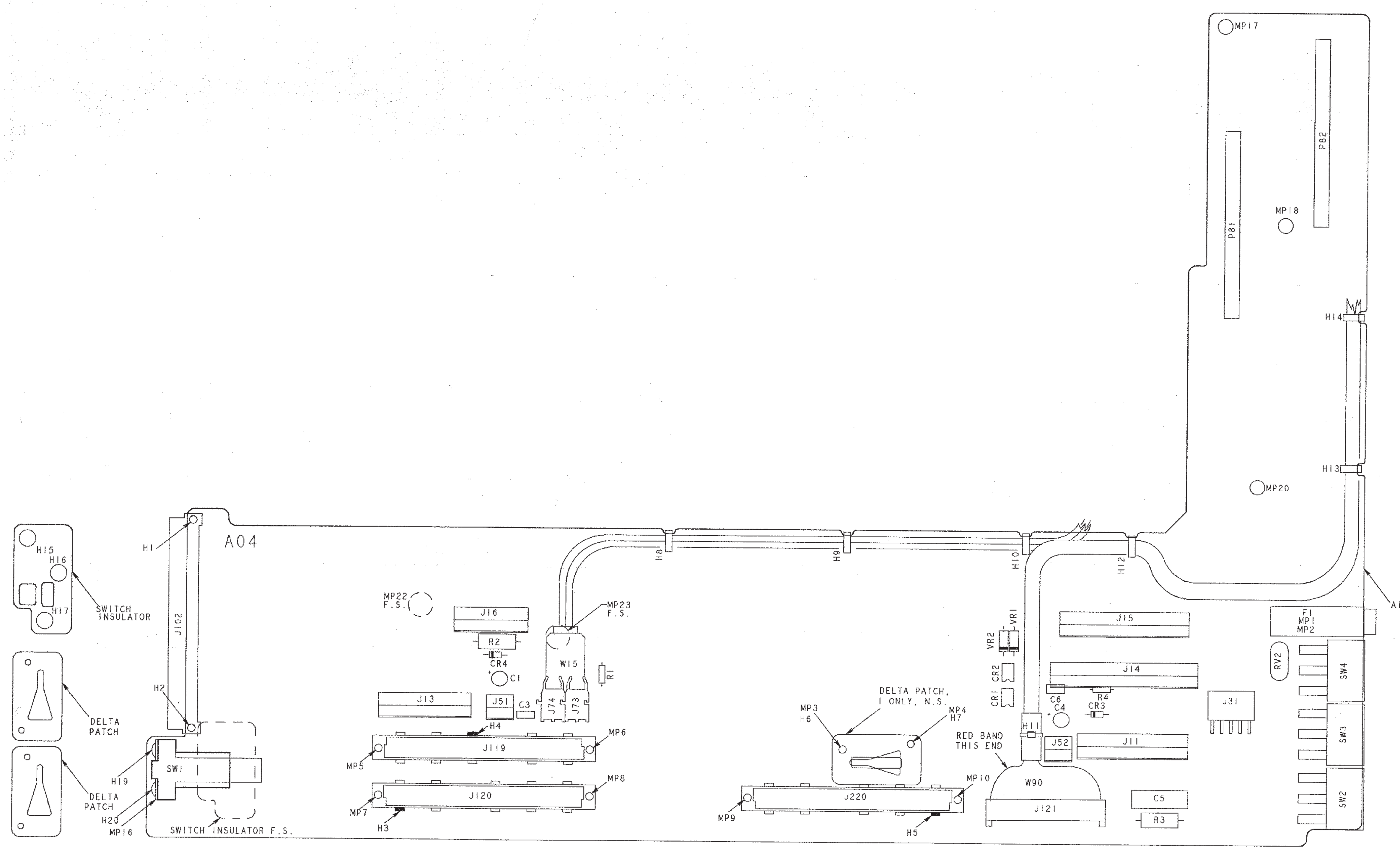
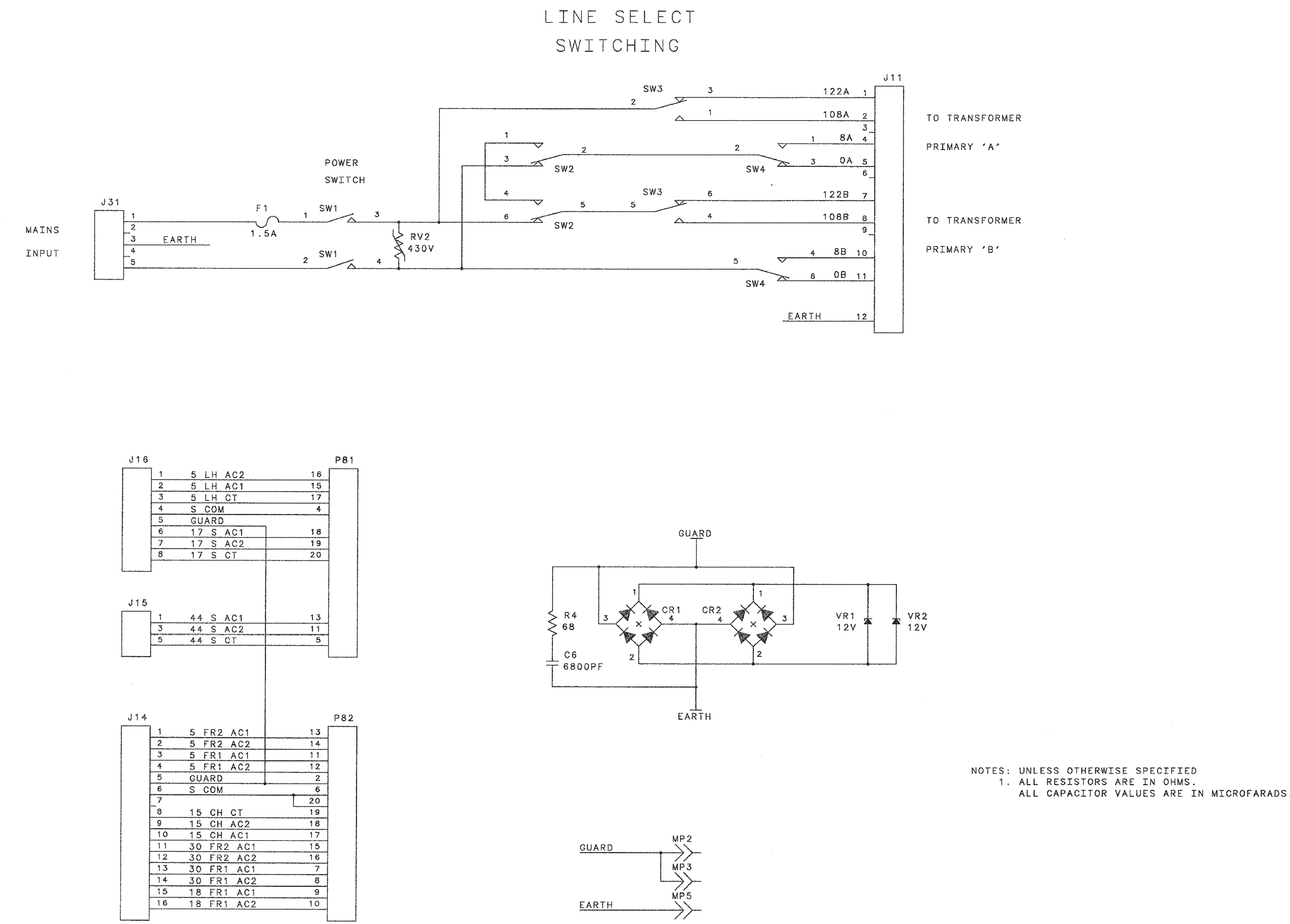


Figure 7-4. A4 Digital Motherboard PCA



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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Figure 7-4. A4 Digital Motherboard PCA (cont)

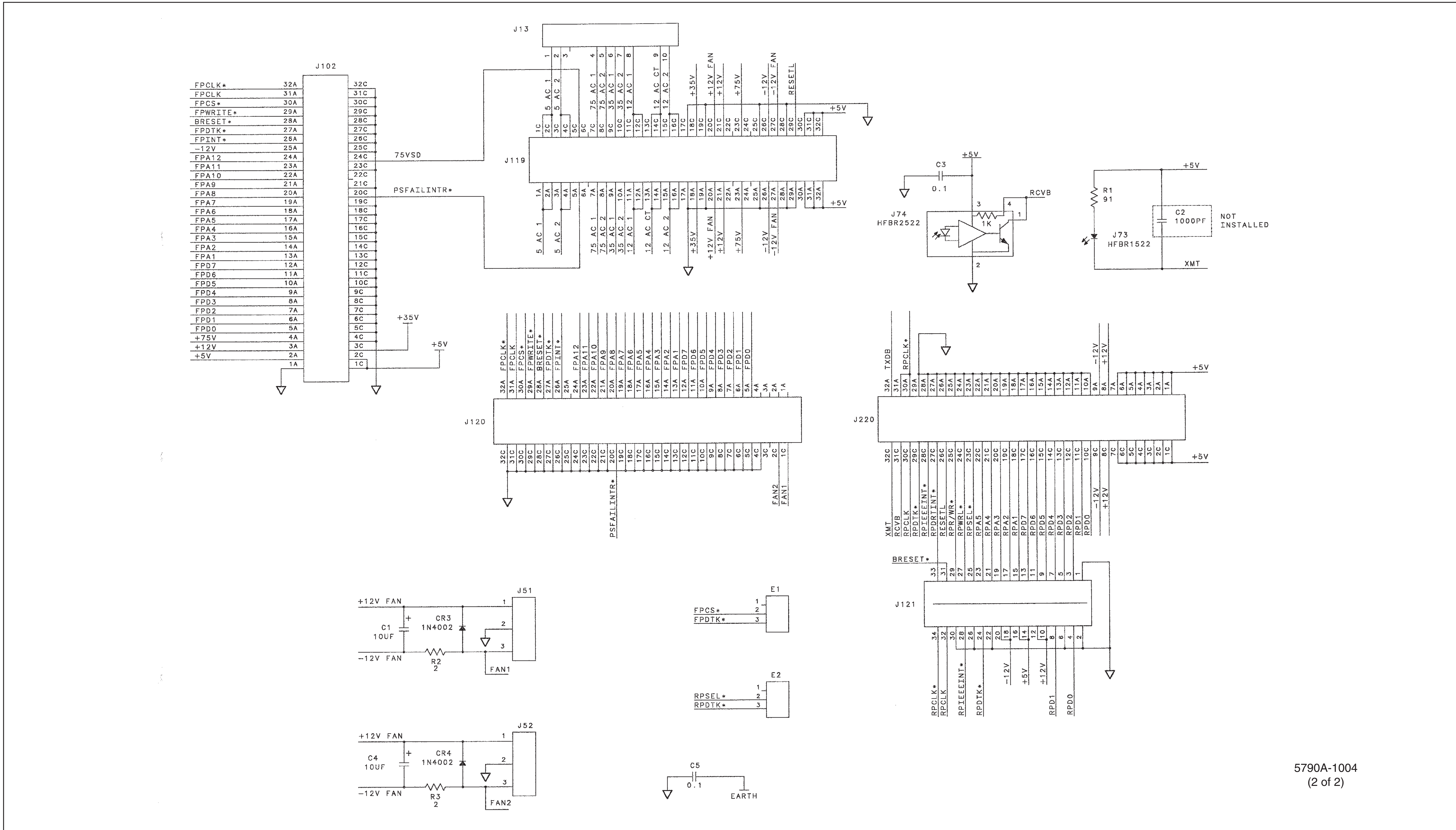

Figure 7-4. A4 Digital Motherboard PCA (cont)

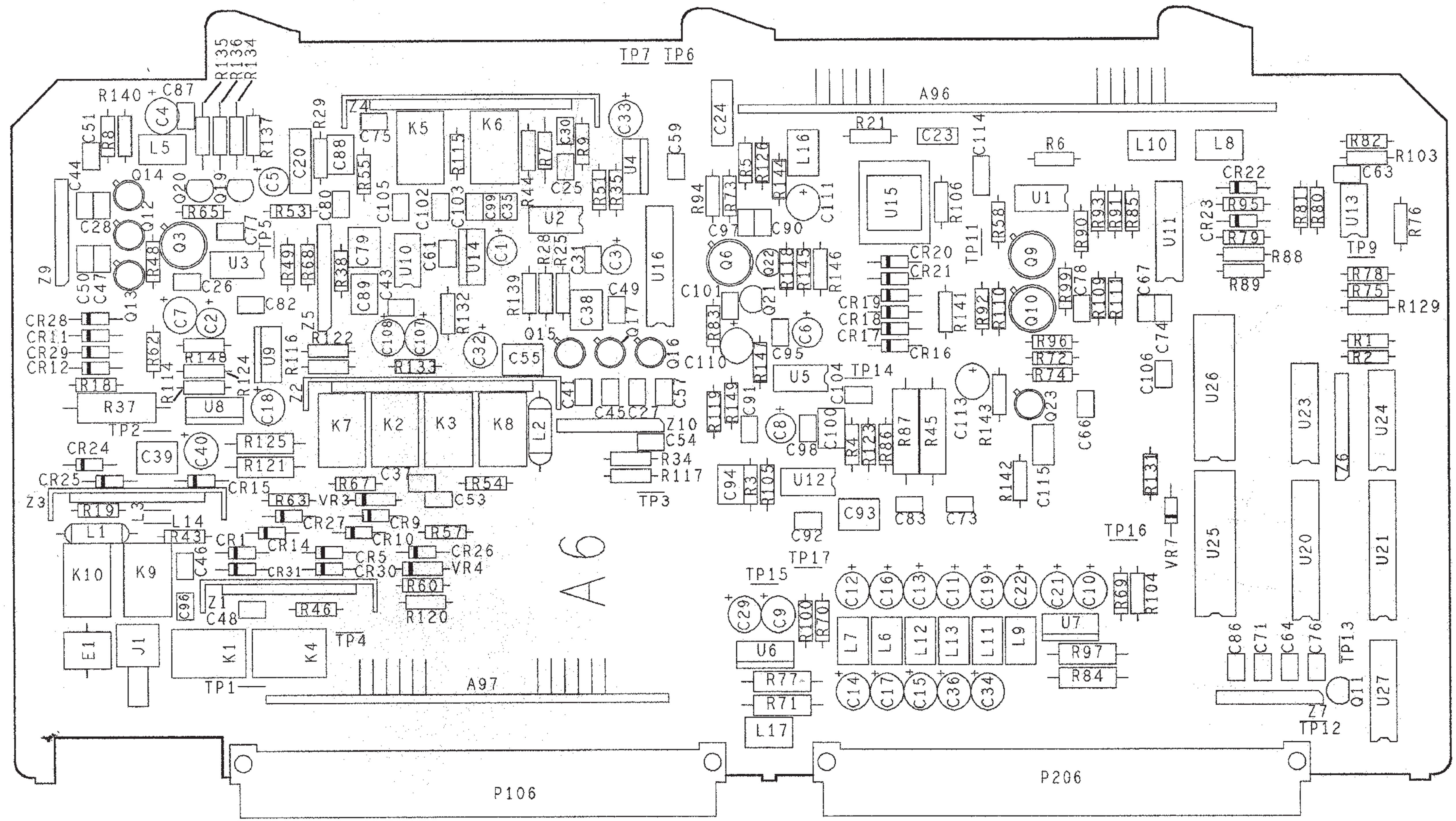

Figure 7-5. A6 Wideband PCA (Option -03)

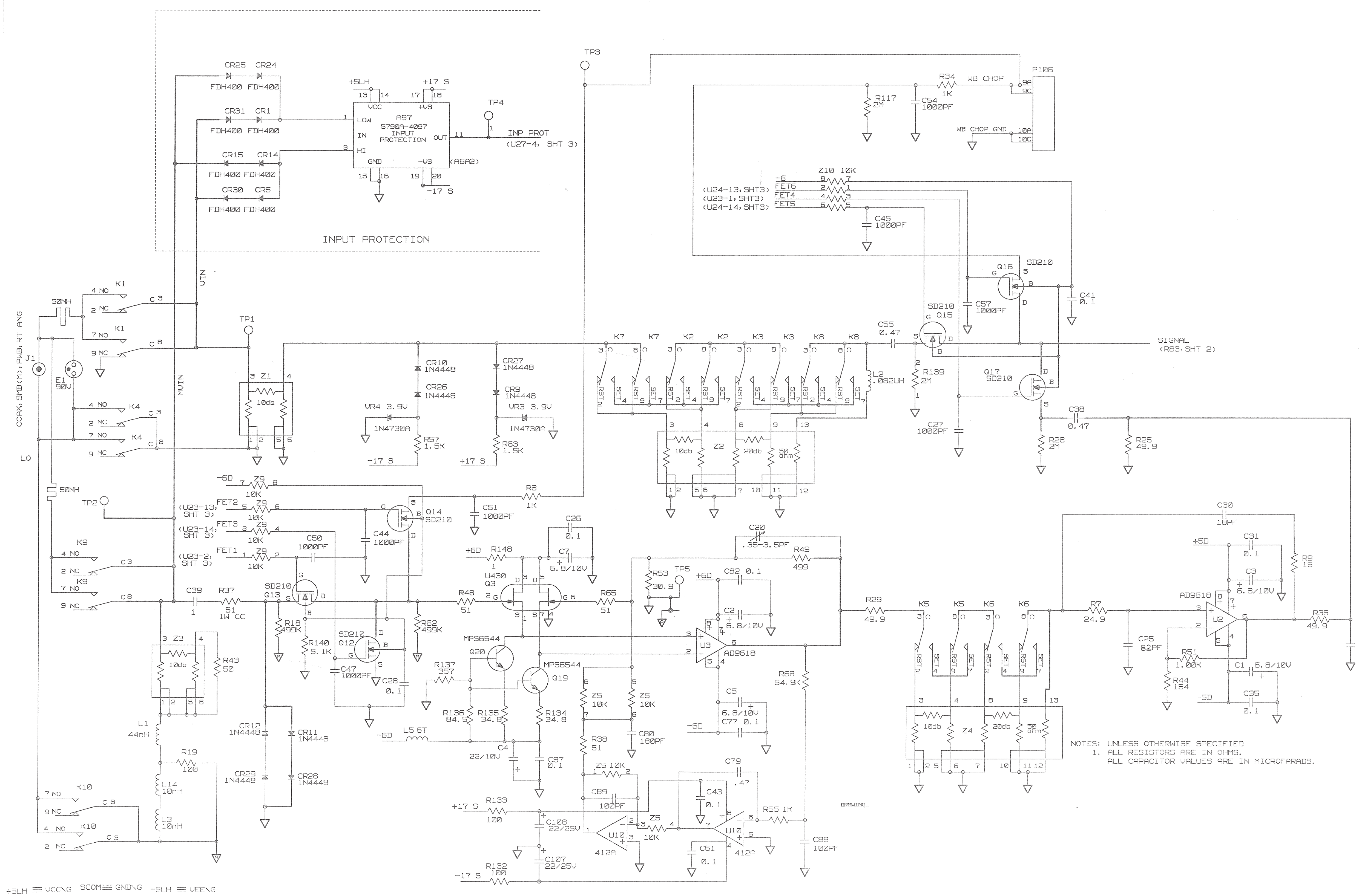

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Figure 7-5. A6 Wideband PCA (Option -03) (cont)

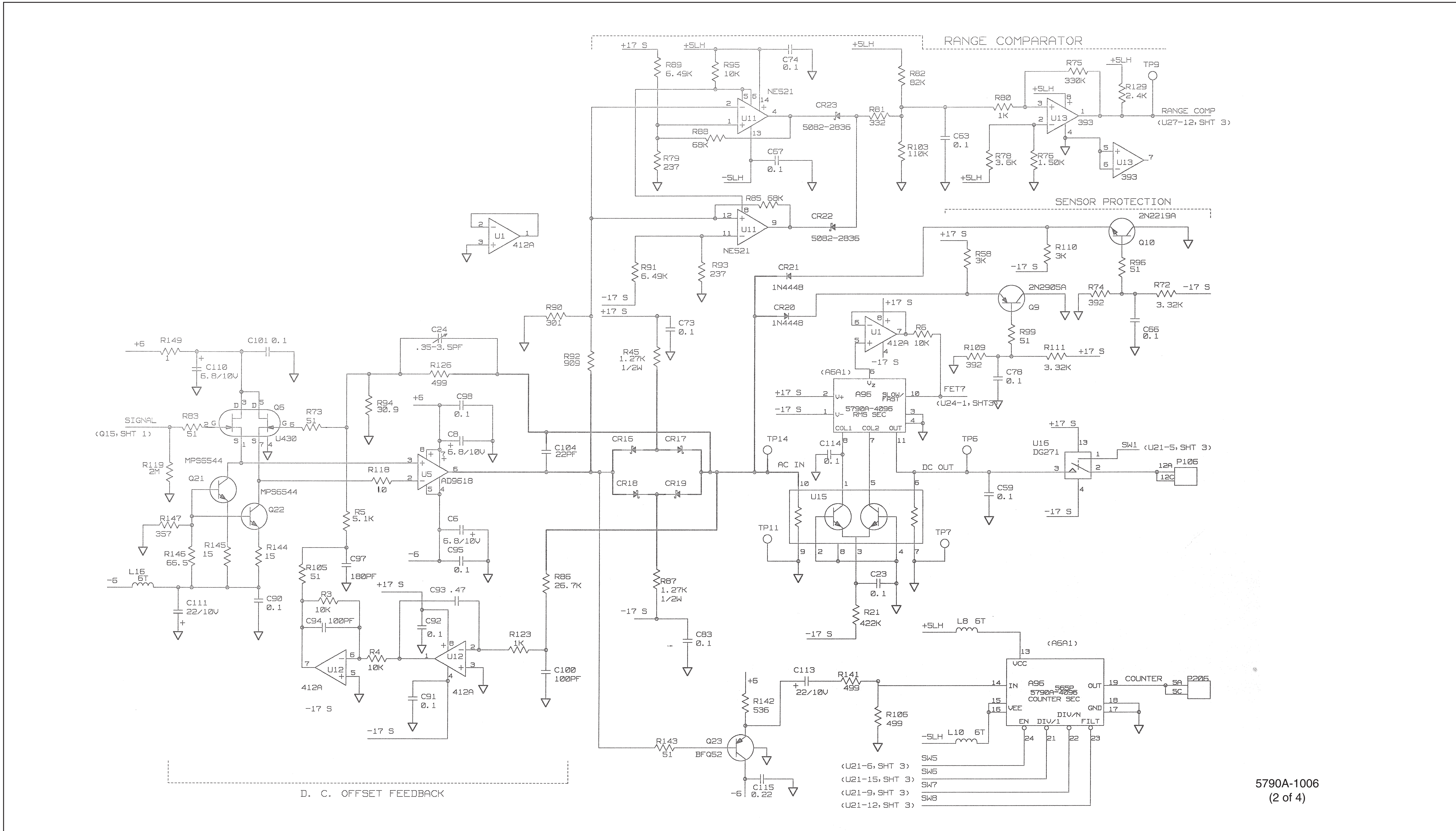


Figure 7-5. A6 Wideband PCA (Option -03) (cont)

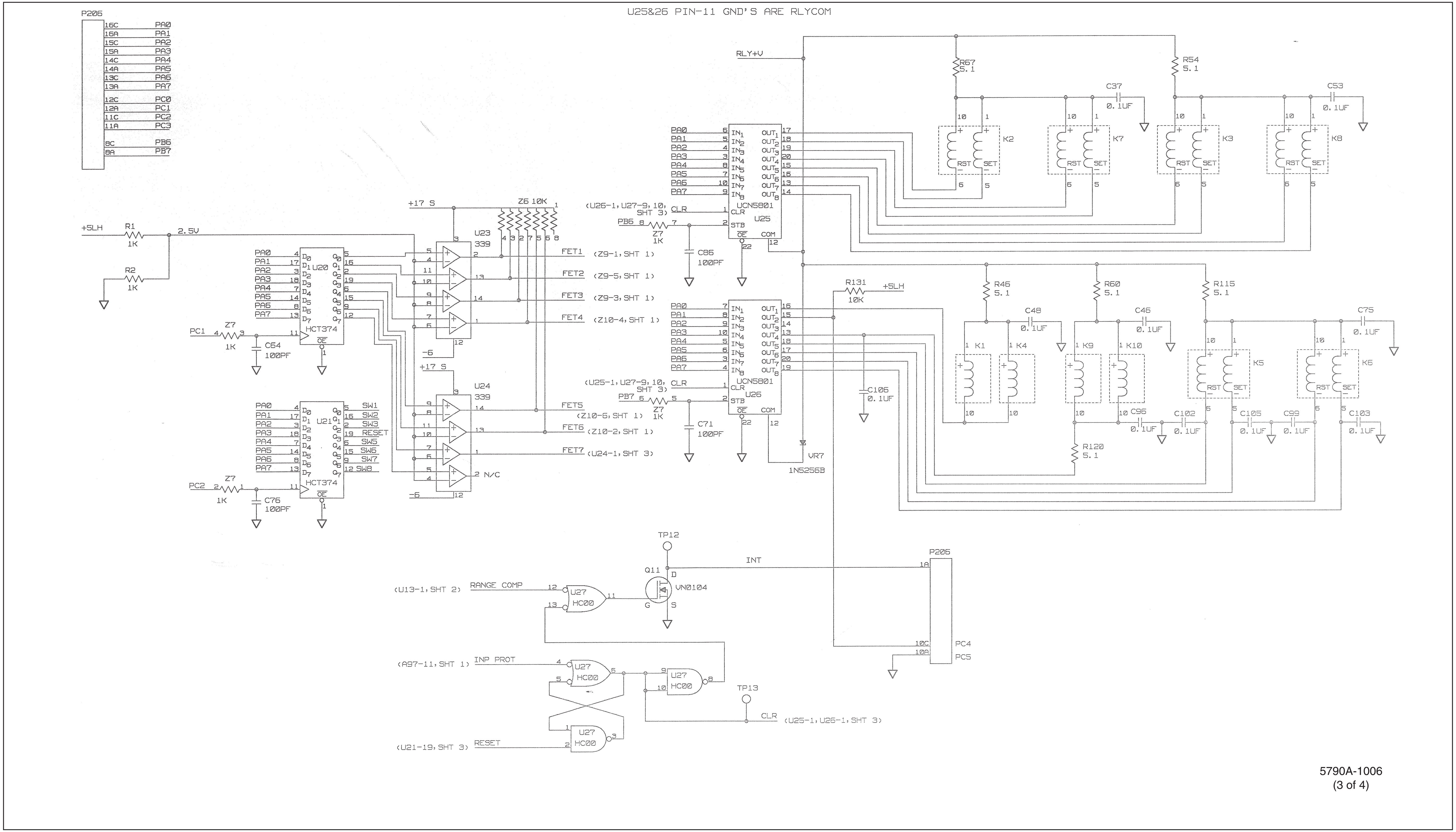
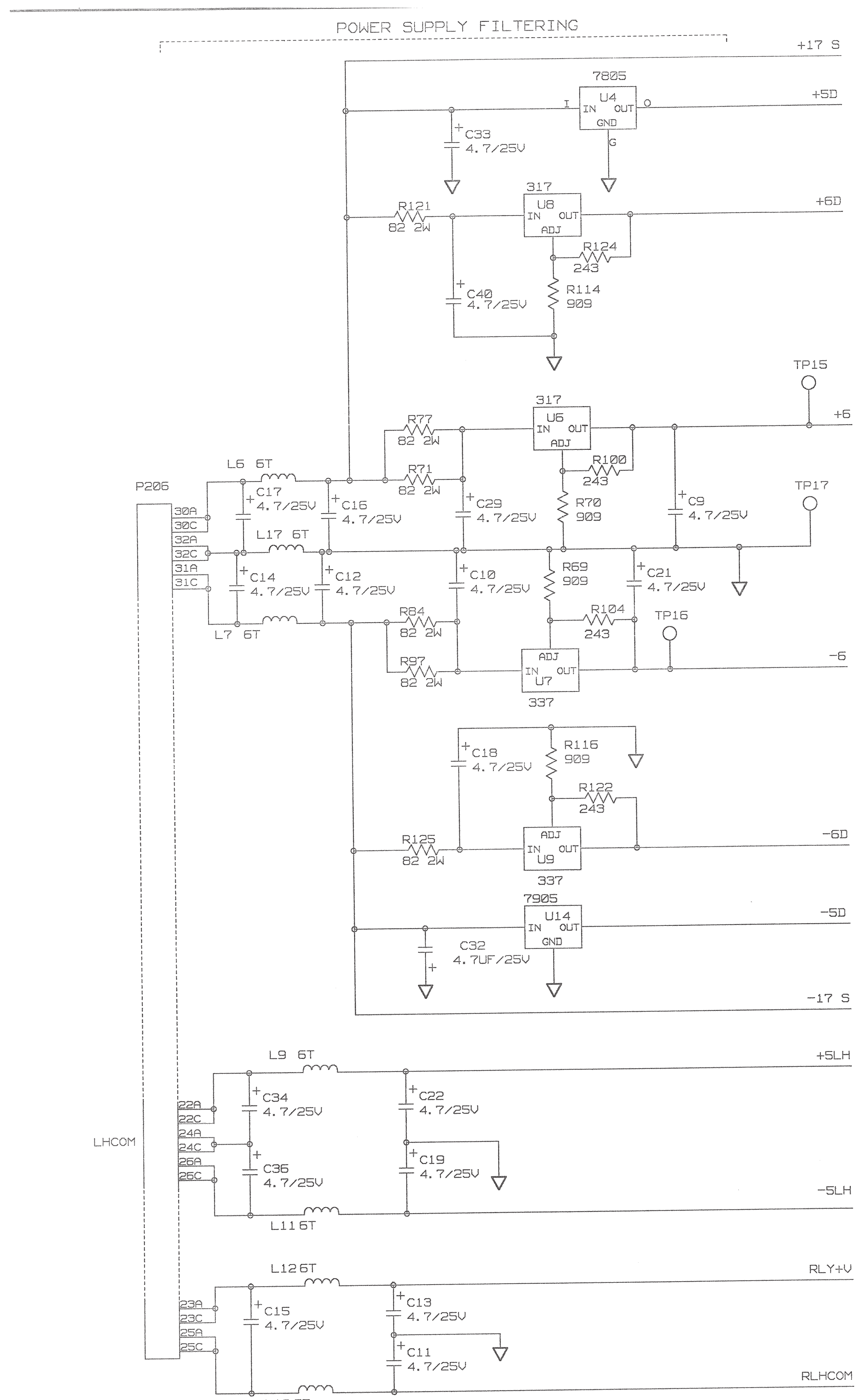


Figure 7-5. A6 Wideband PCA (Option -03) (cont)



TESTPOINTS		
TP1	VIN	PG 1
TP2	MVIN	PG 1
TP3	WB CHOP	PG 1
TP4	INP PROT	PG 1
TP5	GND	PG 1
TP6	DC OUT	PG 2
TP7	GND	PG 2
TP9	RANGE COMP	PG 2
TP11	GND	PG 2
TP12	INT	PG 3
TP13	CLR	PG 3
TP14	AC IN	PG 2
TP15	+6	PG 4
TP16	-6	PG 4
TP17	GND	PG 4

POWER PINS TABLE

REF DES	+5LH	-5LH	SCOM	RLHCOM
U11	14	13	7	
U13	8	——	4	
U16	——	——	5	
U20	20	——	1, 10	
U21	20	——	1, 10	
U25	21	——	22	11
U26	21	——	22	11
U27	14	——	7	

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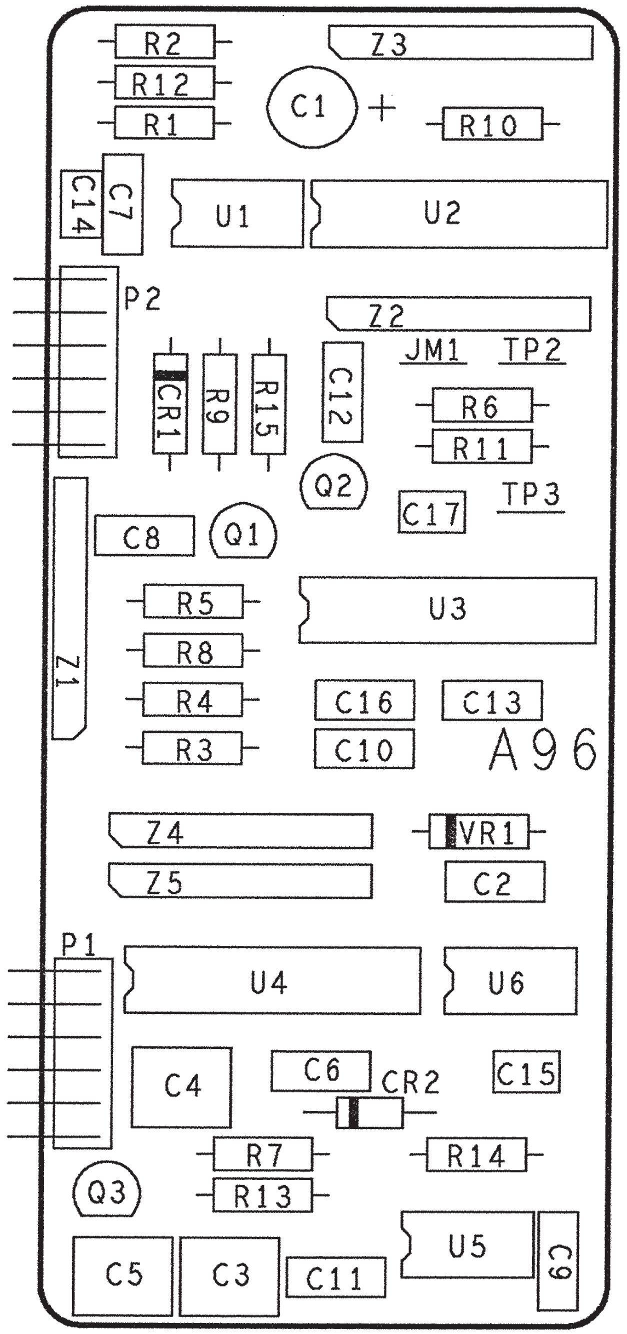
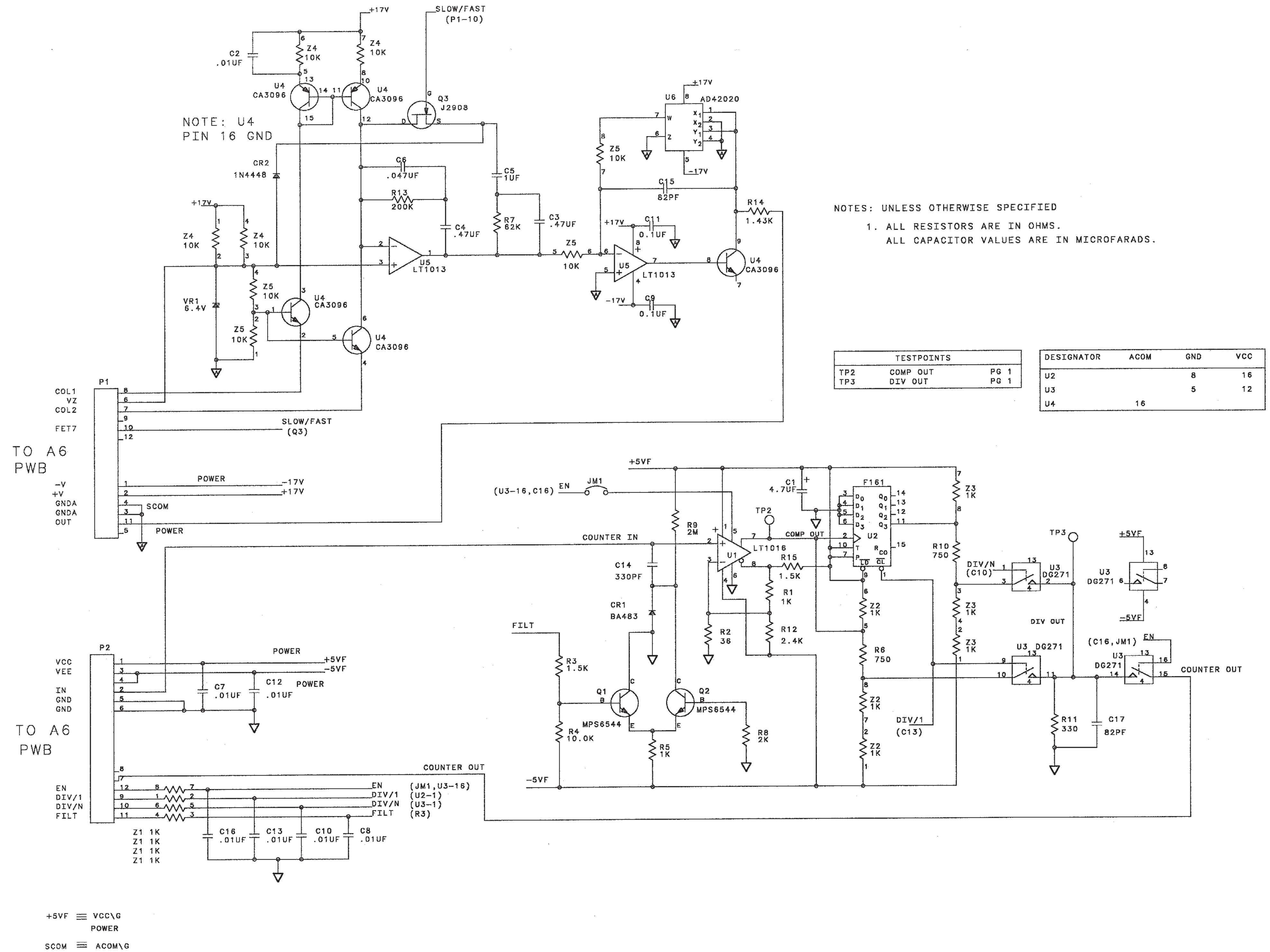
Figure 7-5. A6 Wideband PCA (Option -03) (cont)



5790A-1696

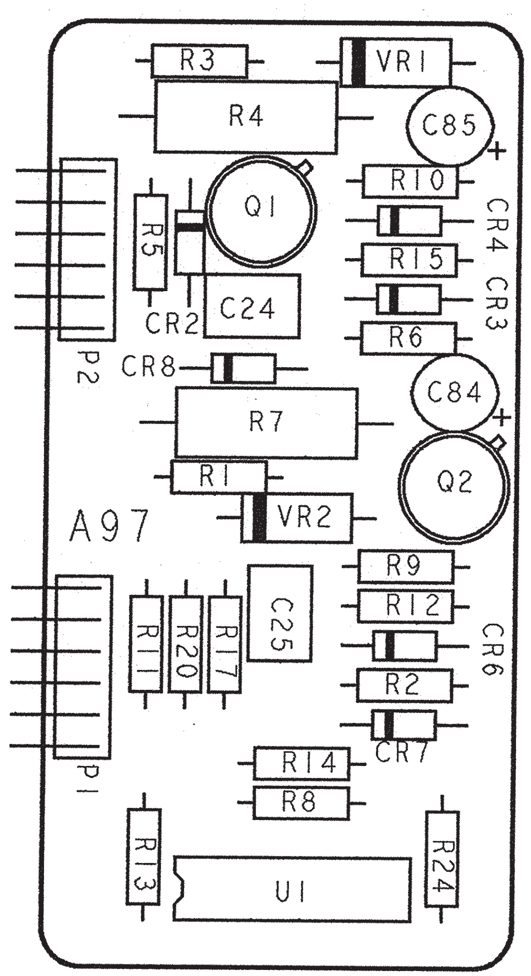


TESTPOINTS		
TP2	COMP OUT	PG 1
TP3	DIV OUT	PG 1

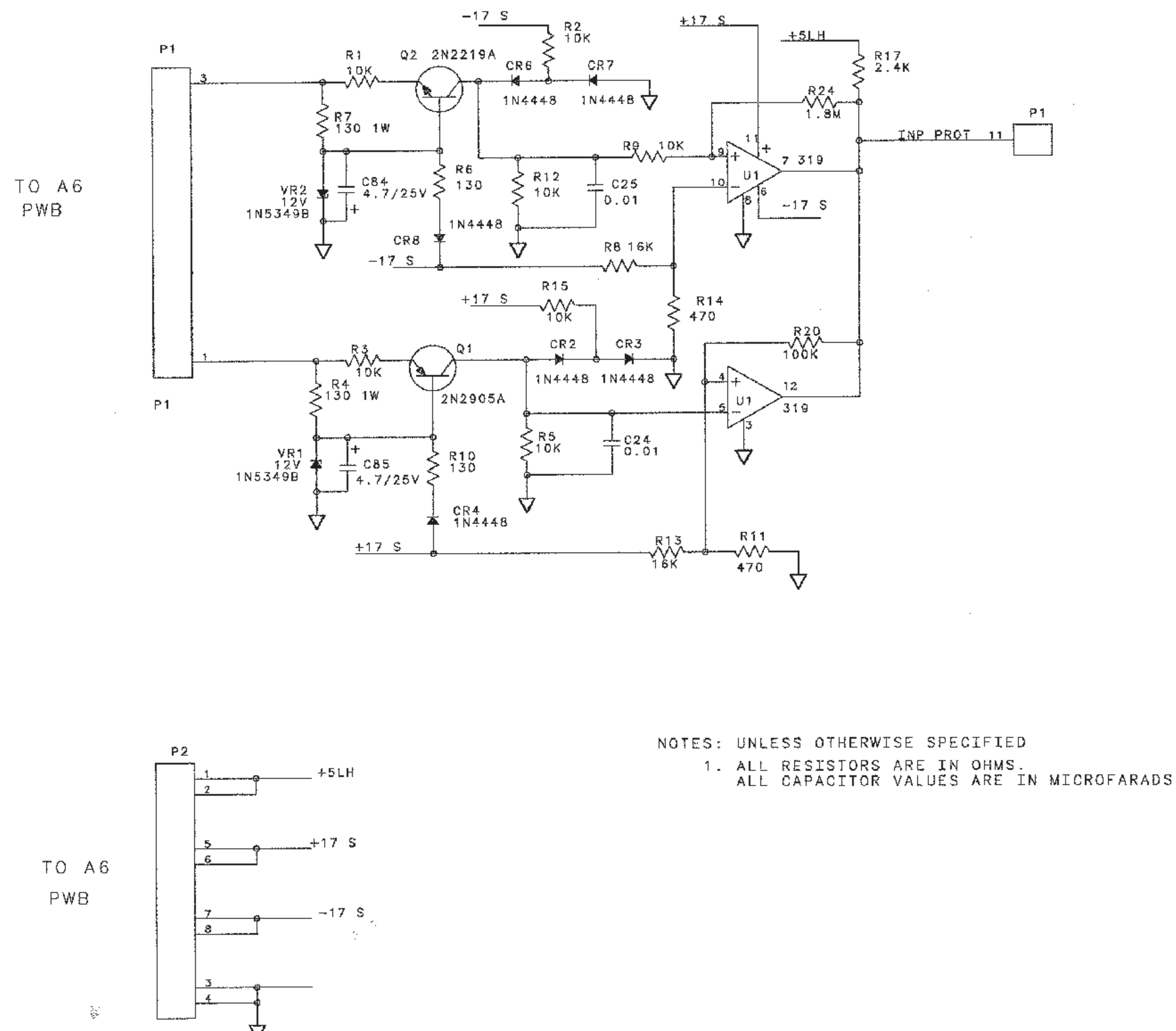
DESIGNATOR	ACOM	GND	VCC
U2		8	16
U3		5	12
U4	16		

5790A-1096

Figure 7-6. A6A1 RMS Support PCA

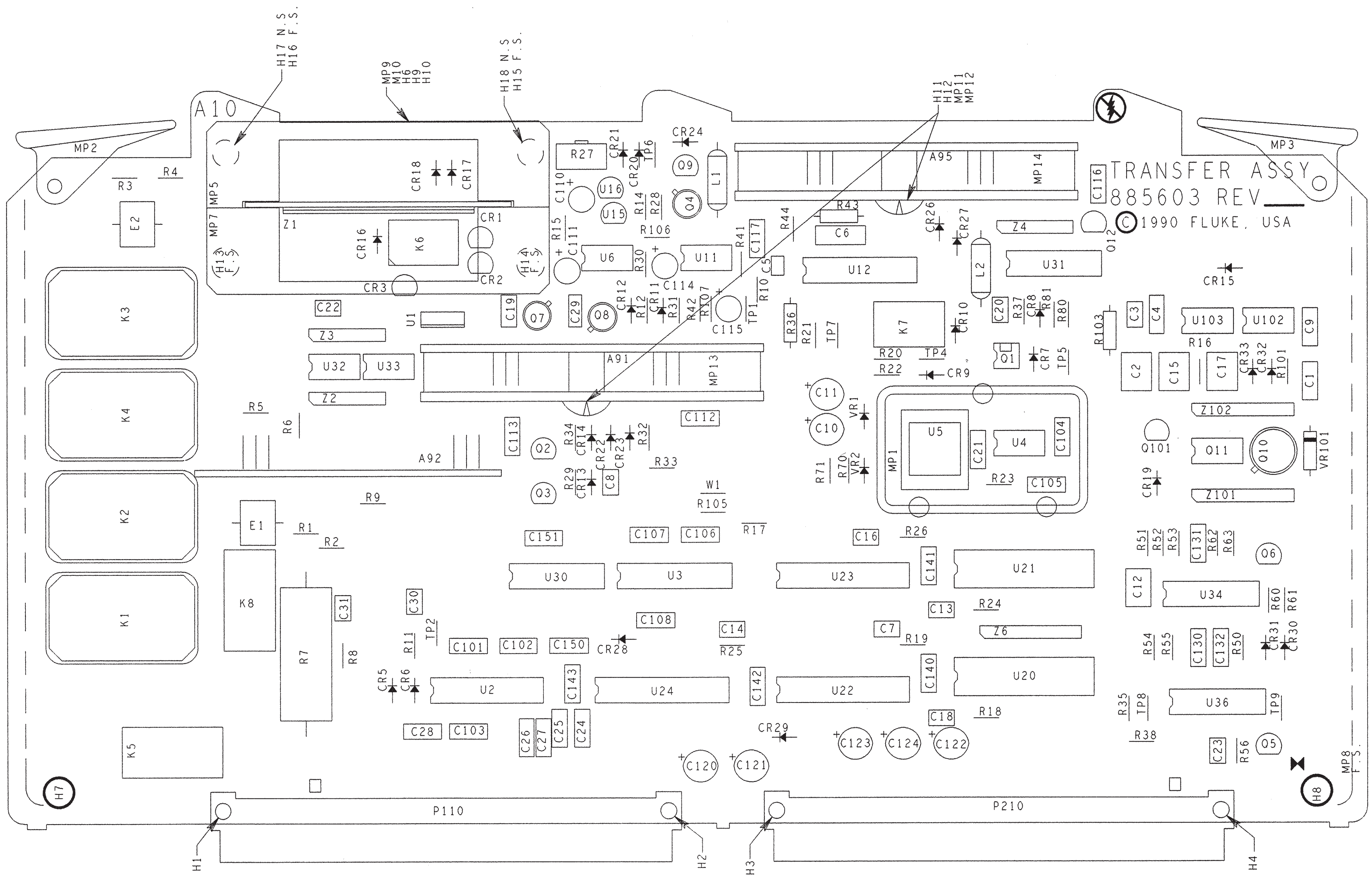


5790A-1697



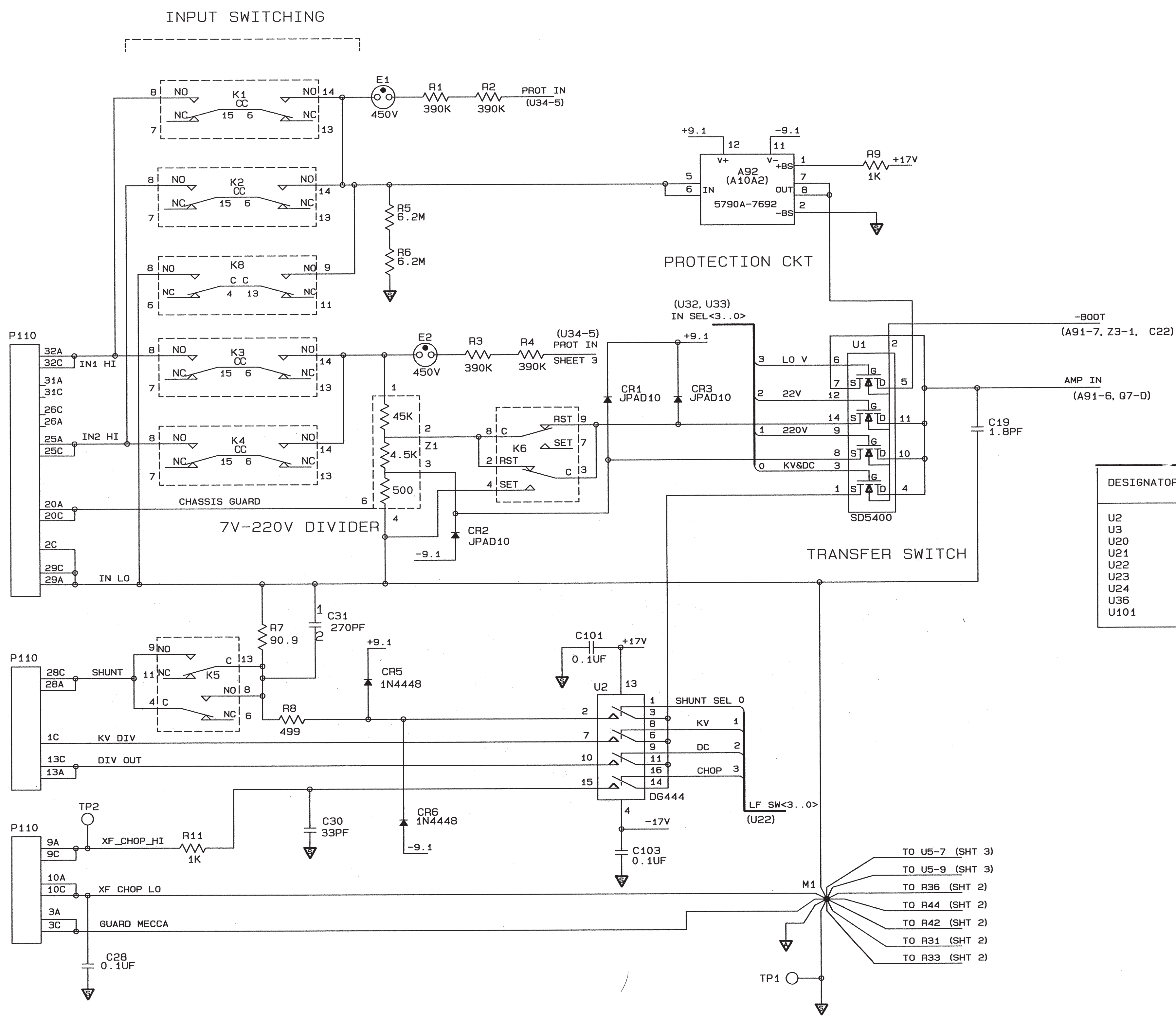
5790A-1097

Figure 7-7. A6A2 WB Input Protection PCA



5790A-1610

Figure 7-8. A10 Transfer PCA



DESIGNATOR	GND	RLHCOM	VCC
U2	5		12
U3	5		12
U20		11	21
U21		11	21
U22	10		20
U23	10		20
U24	10		20
U36	7		14
U101	16		

TESTPOINTS		
TP1	SCOM	PG 1
TP2	XF CHOP HI	PG 1
TP4	AMP OUT	PG 3
TP5	OUT	PG 3
TP6	A3 OUT	PG 2
TP7	A4 IN	PG 2
TP8	PC6	PG 4
TP9	INT	PG 4

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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Figure 7-8. A10 Transfer PCA (cont)

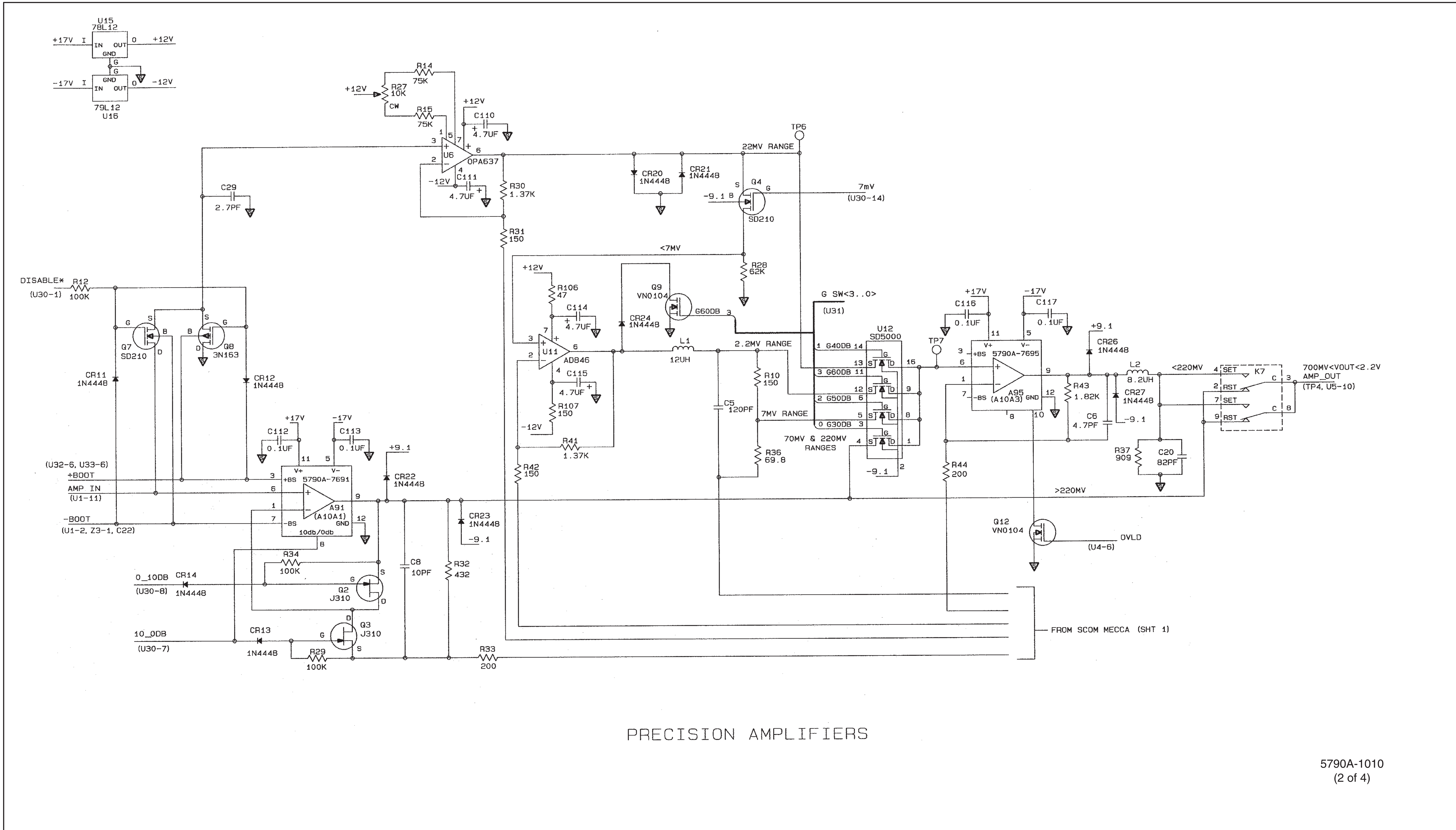

Figure 7-8. A10 Transfer PCA (cont)

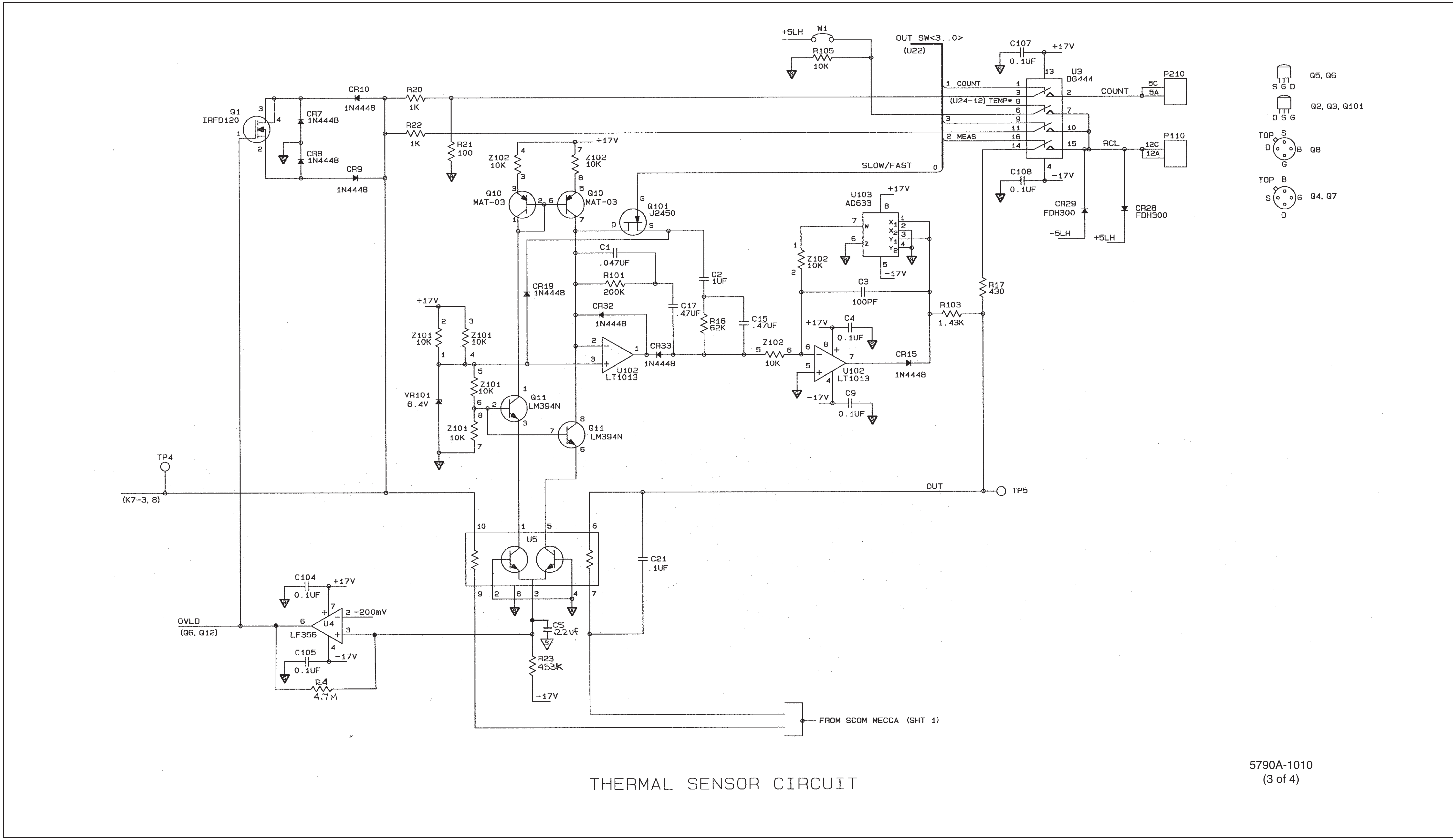

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Figure 7-8. A10 Transfer PCA (cont)

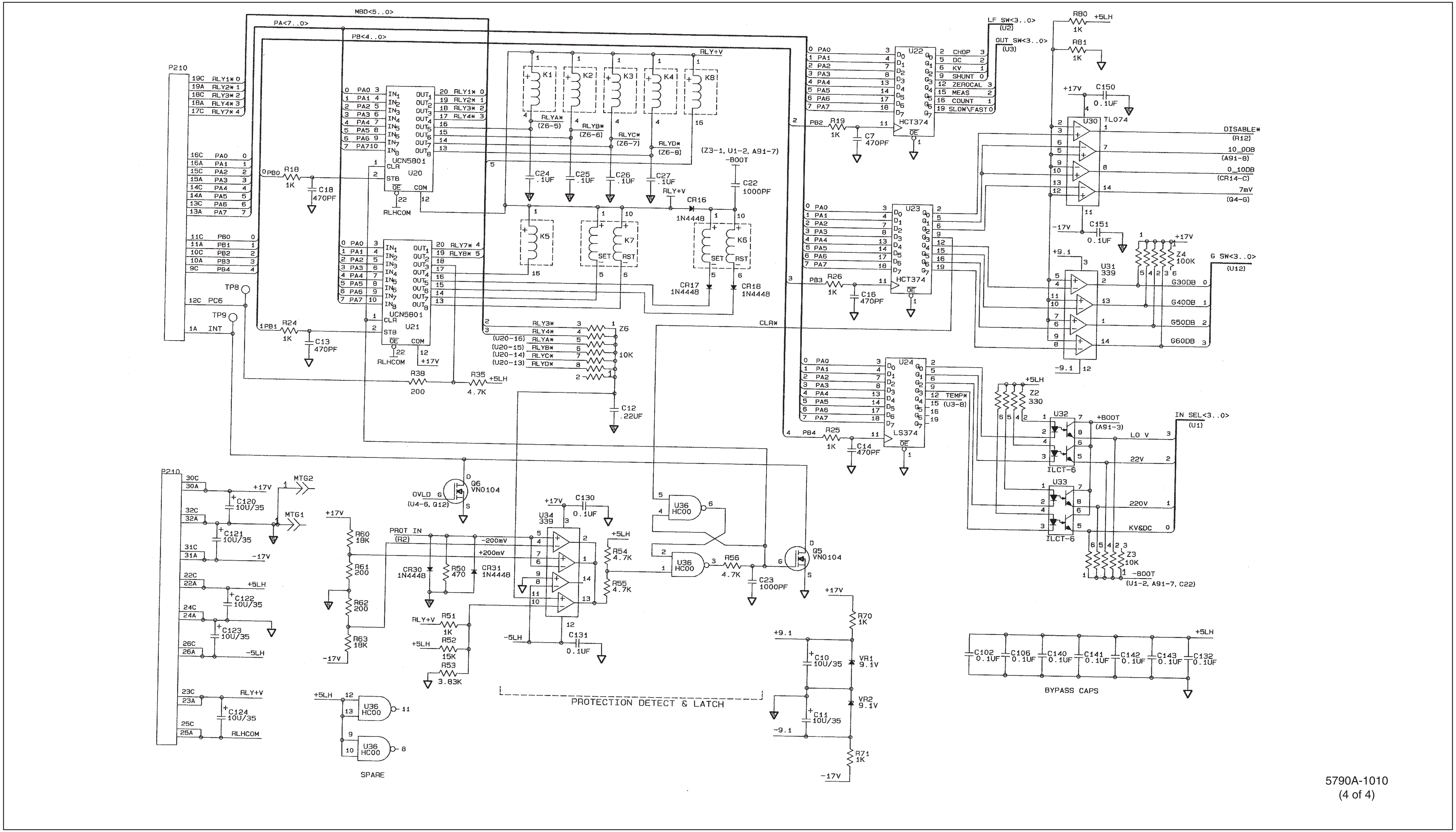
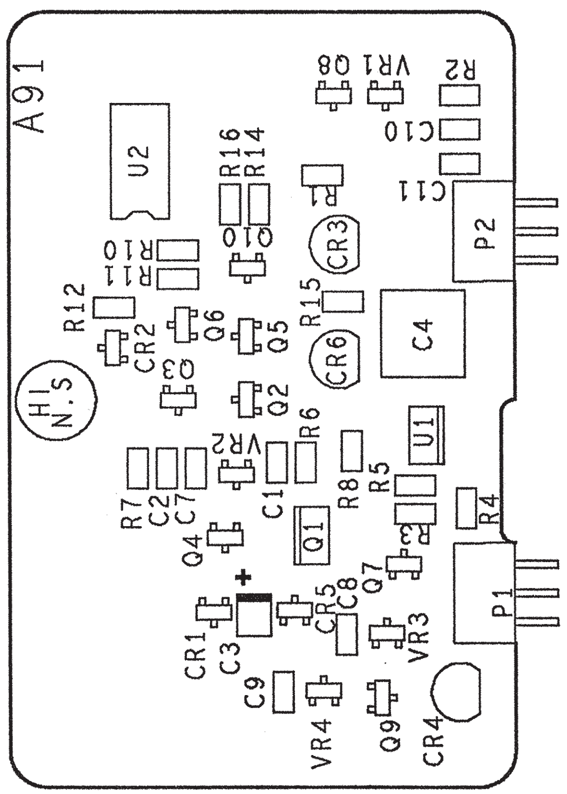
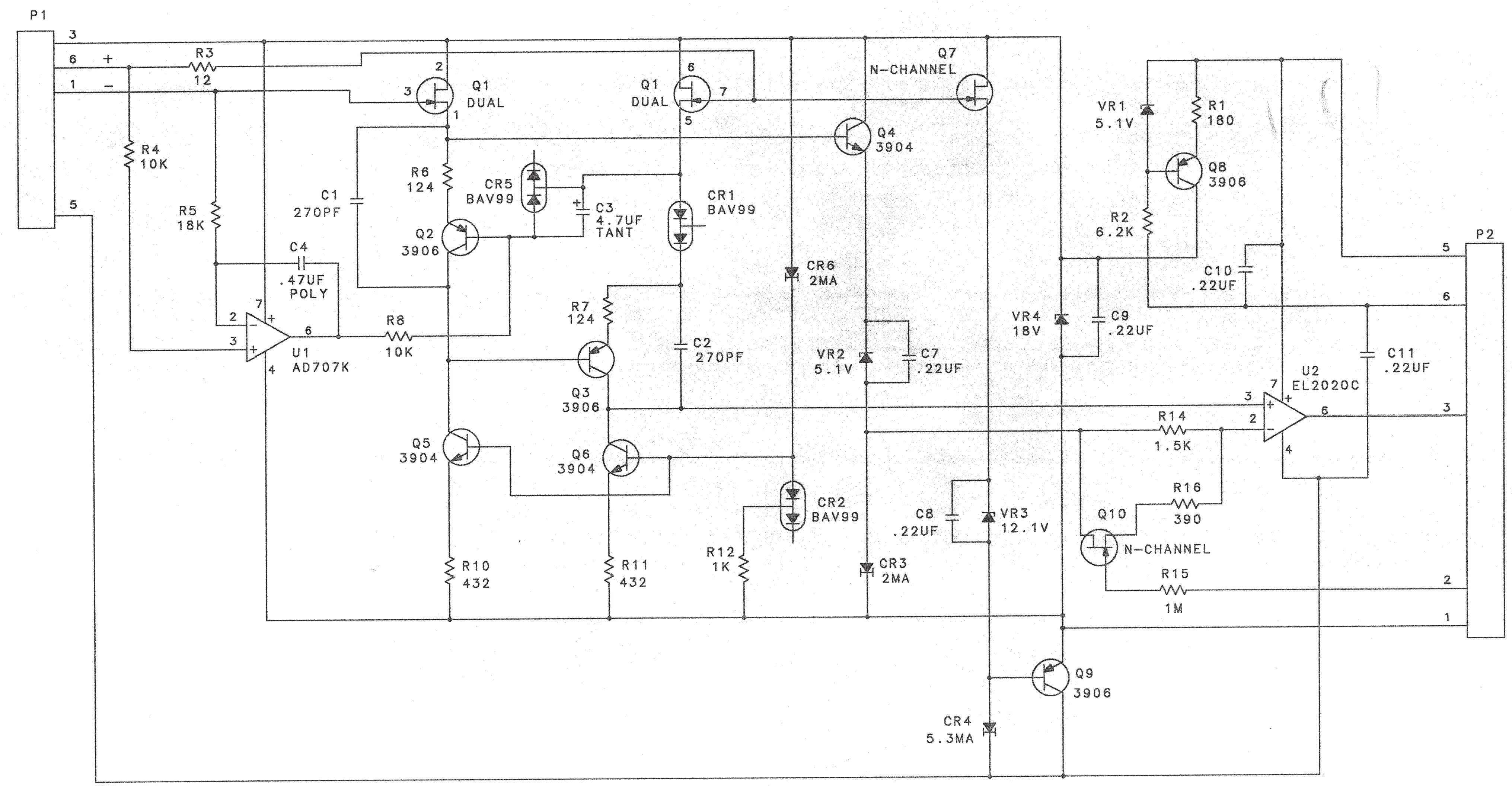


Figure 7-8. A10 Transfer PCA (cont)

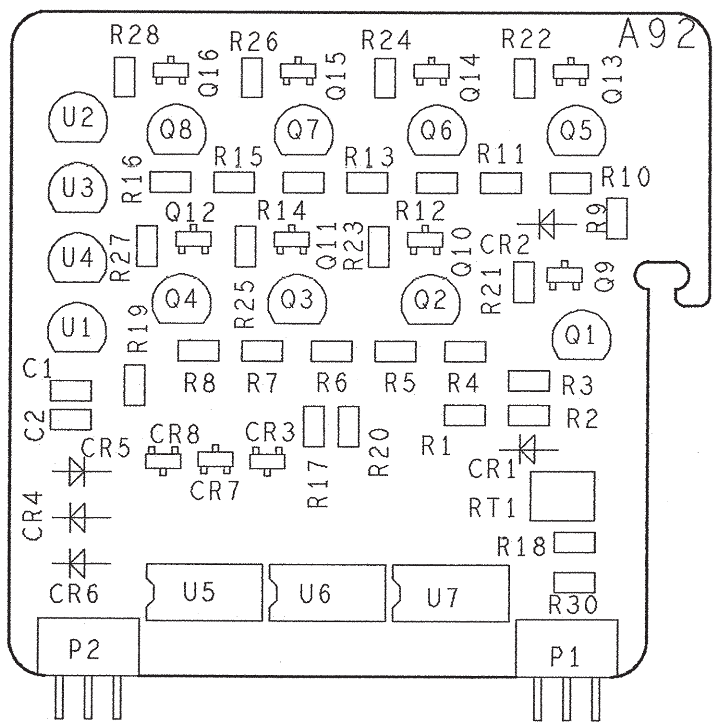


5790A-1691

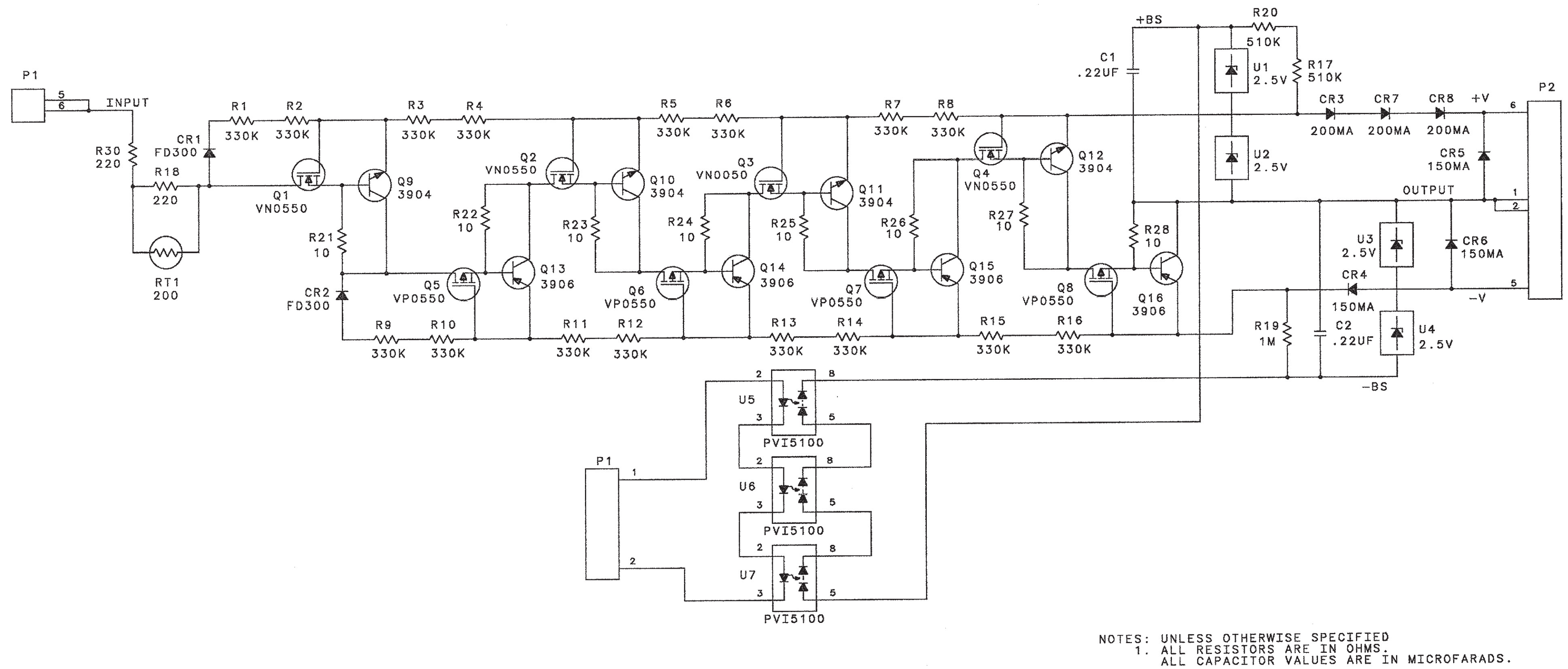


5790A-1091

Figure 7-9. A10A1 Precision Amplifier PCA

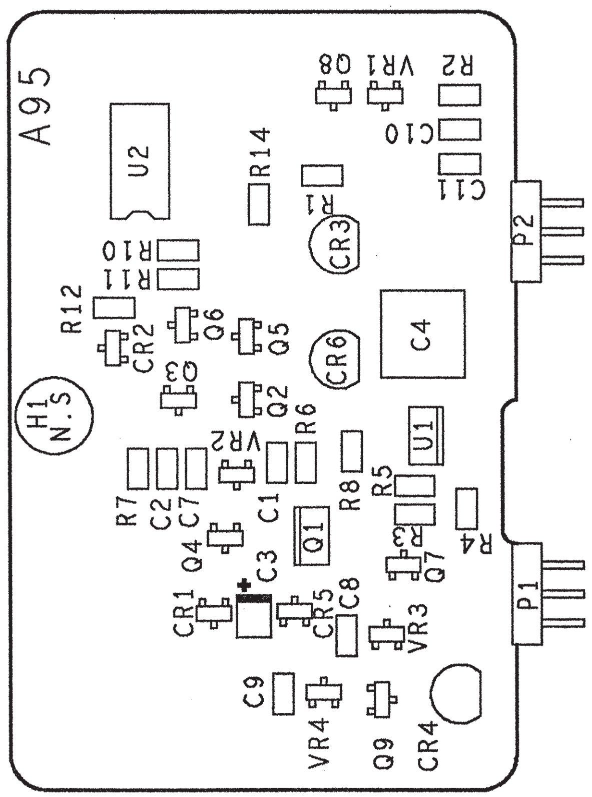


5790A-1692

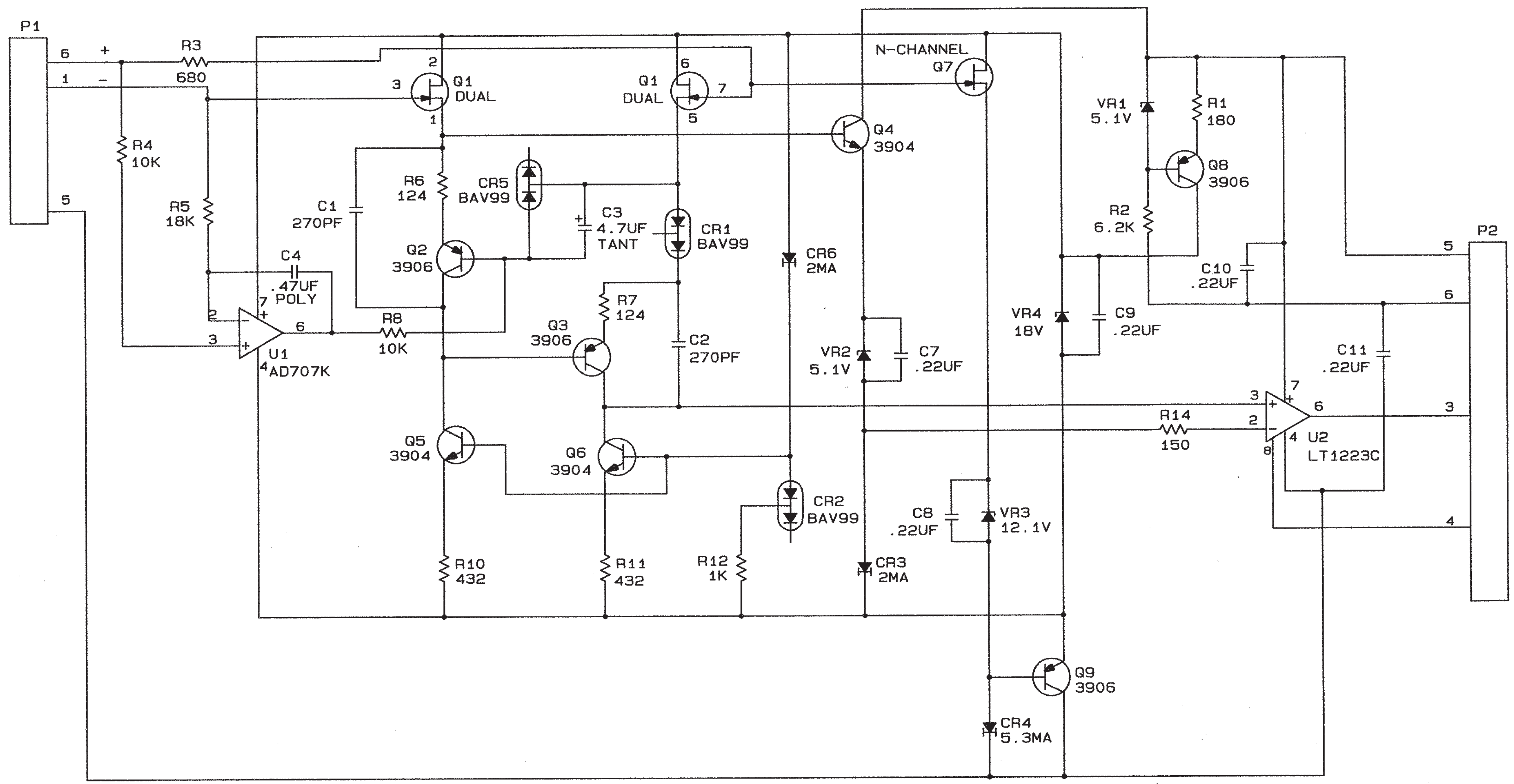


5790A-1092

Figure 7-10. A10A2 High Voltage Protection PCA



5790A-1695



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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Figure 7-11. A10A3 High Gain Precision Amplifier PCA

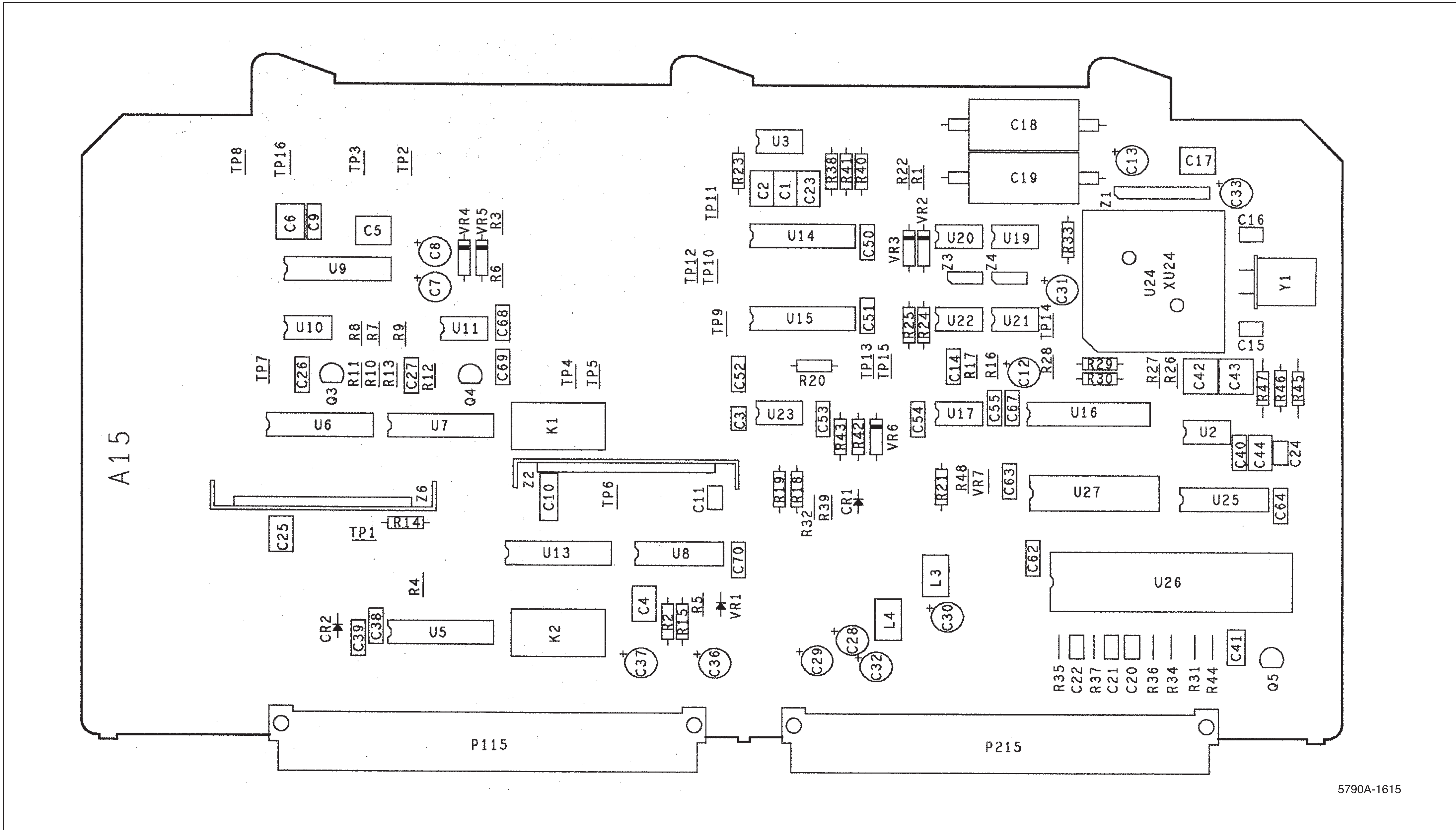
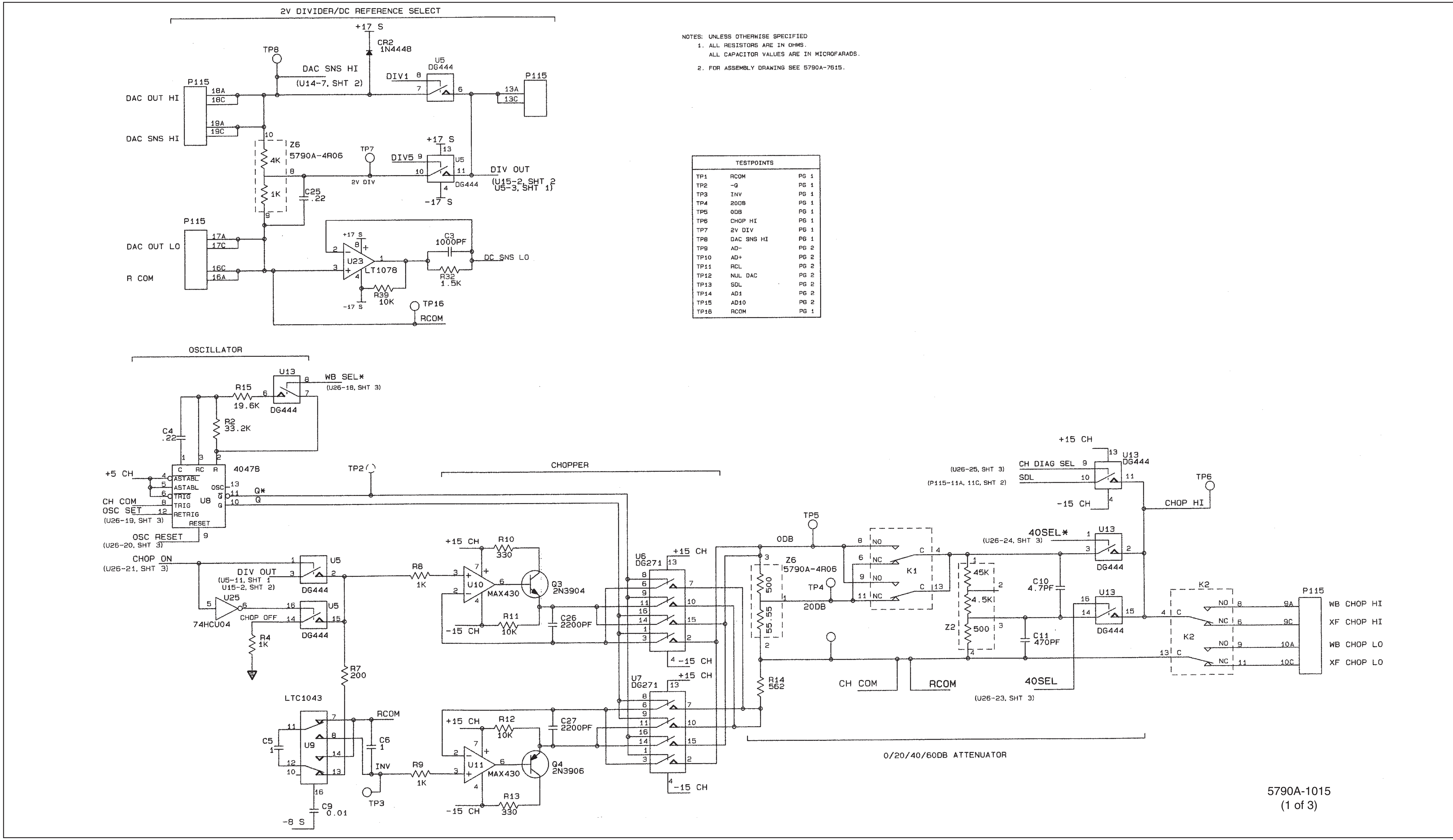


Figure 7-12. A10 A/D Amplifier PCA



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. FOR ASSEMBLY DRAWING SEE 5790A-7615.

TESTPOINTS		
TP1	RCOM	PG 1
TP2	-Q	PG 1
TP3	INV	PG 1
TP4	20DB	PG 1
TP5	0DB	PG 1
TP6	CHOP HI	PG 1
TP7	2V DIV	PG 1
TP8	DAC SNS HI	PG 1
TP9	AD-	PG 2
TP10	AD+	PG 2
TP11	RCL	PG 2
TP12	NUL DAC	PG 2
TP13	SDL	PG 2
TP14	AD1	PG 2
TP15	AD10	PG 2
TP16	RCOM	PG 1

Figure 7-12. A10 A/D Amplifier PCA (cont)

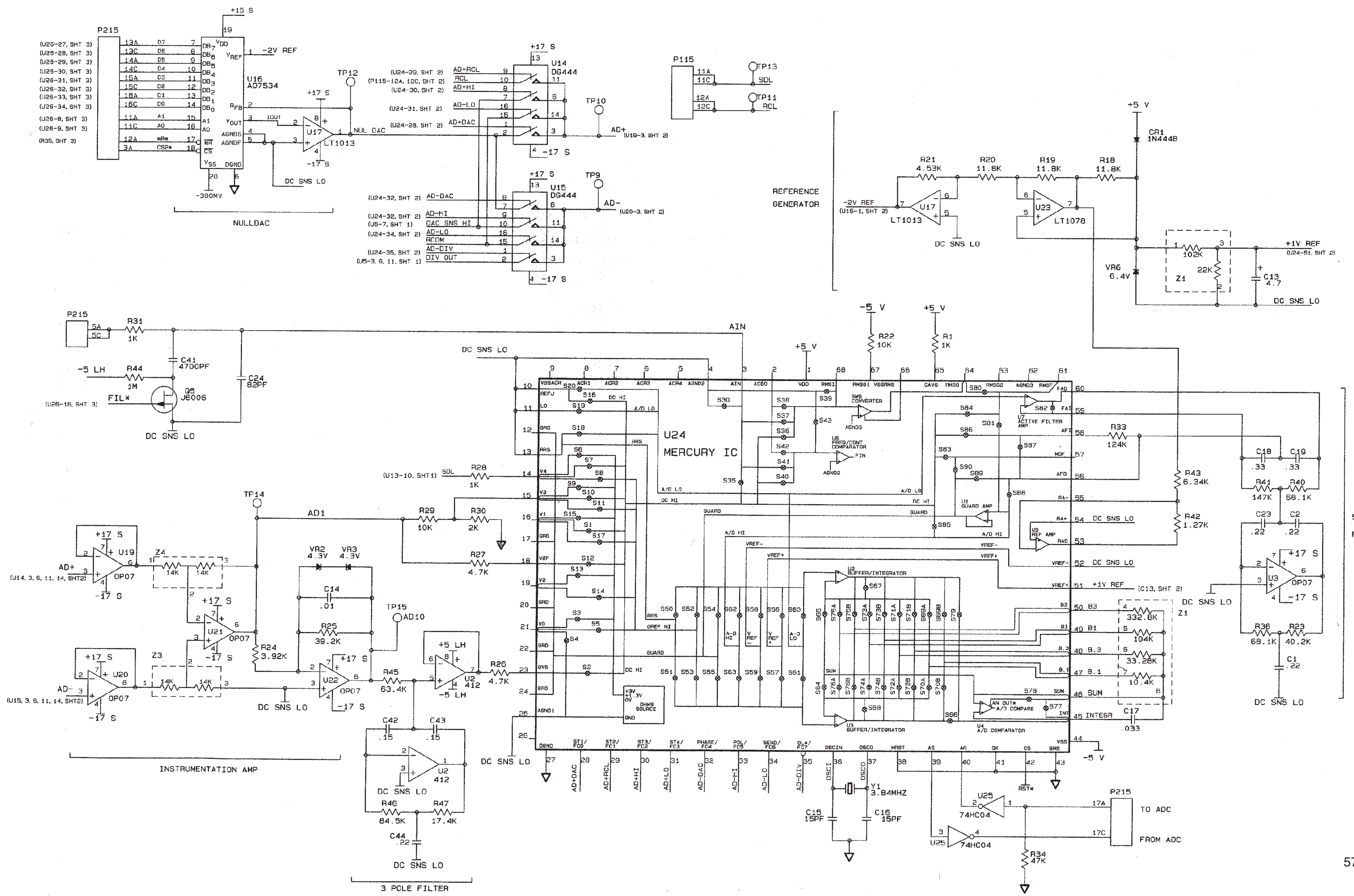


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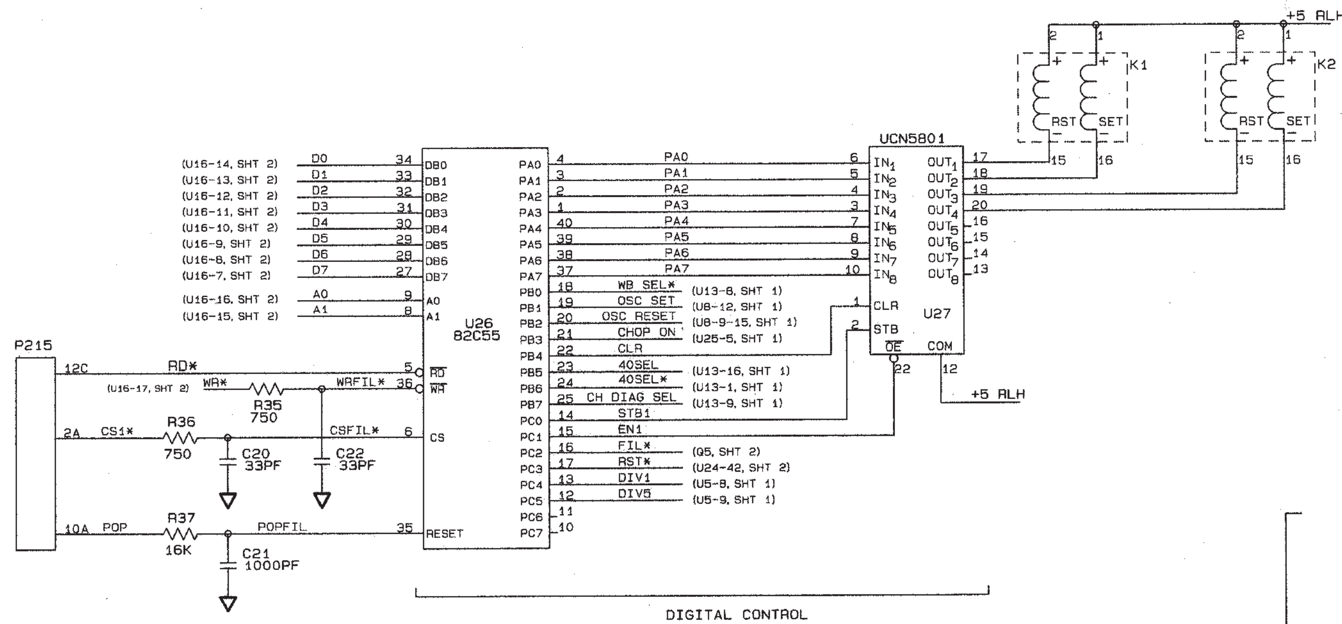
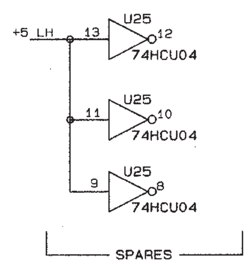
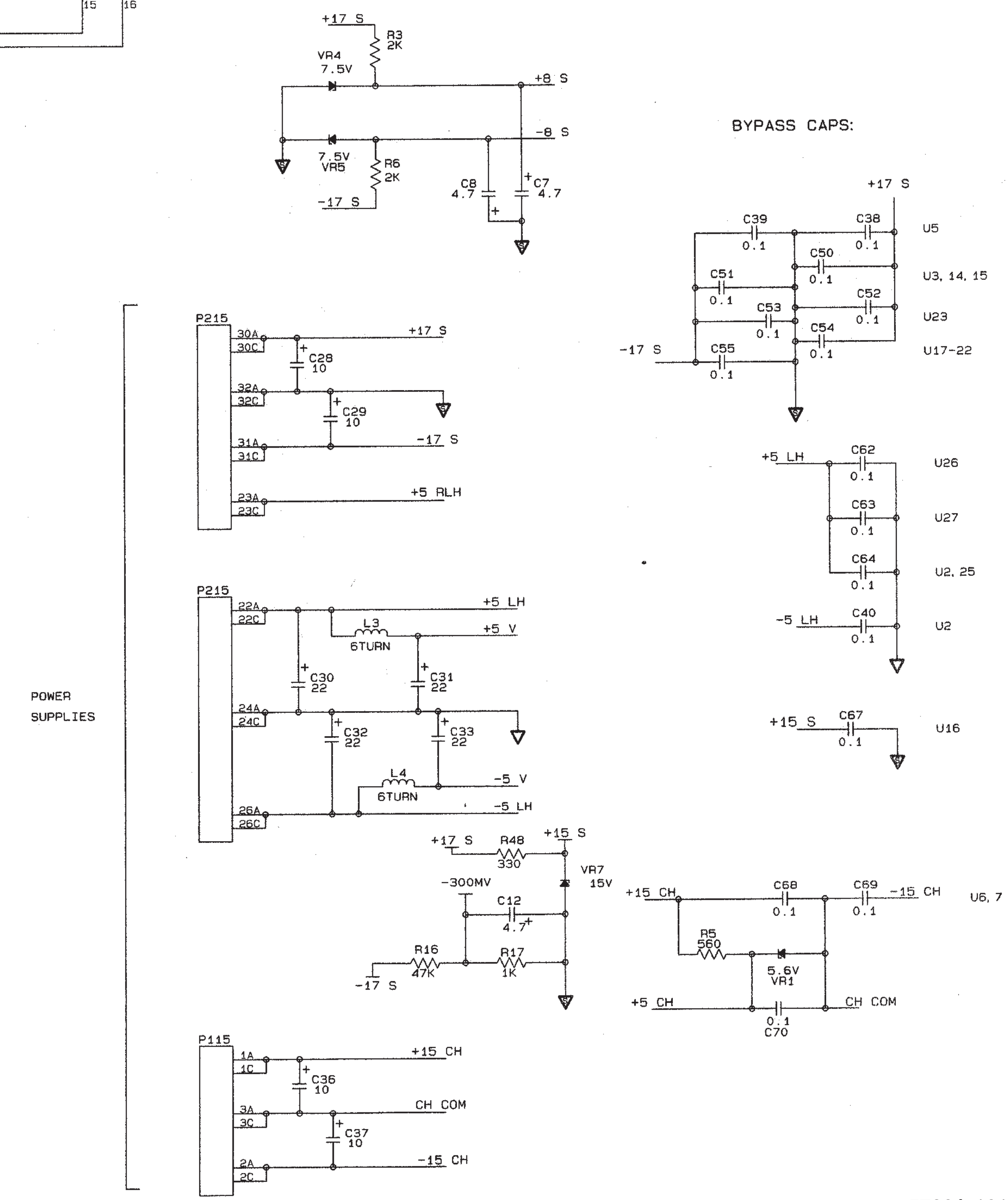
Figure 7-12. A10 A/D Amplifier PCA (cont)







REF DES	+5 LH		+17 S	−17 S		+8 S	−8 S
U5	12		13	4	5		
U9						4	17
U14	12		13	4	5		
U15	12		13	4	5		
U25	14	7					
U26	26	7					
U27	21	11					

REF DES	+15 CH	−15 CH	CH COM	+5 CH
U6	13	4	5	
U7	13	4	5	
U8			7	14
U13	13	4	5	12

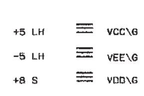


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Figure 7-12. A10 A/D Amplifier PCA (cont)

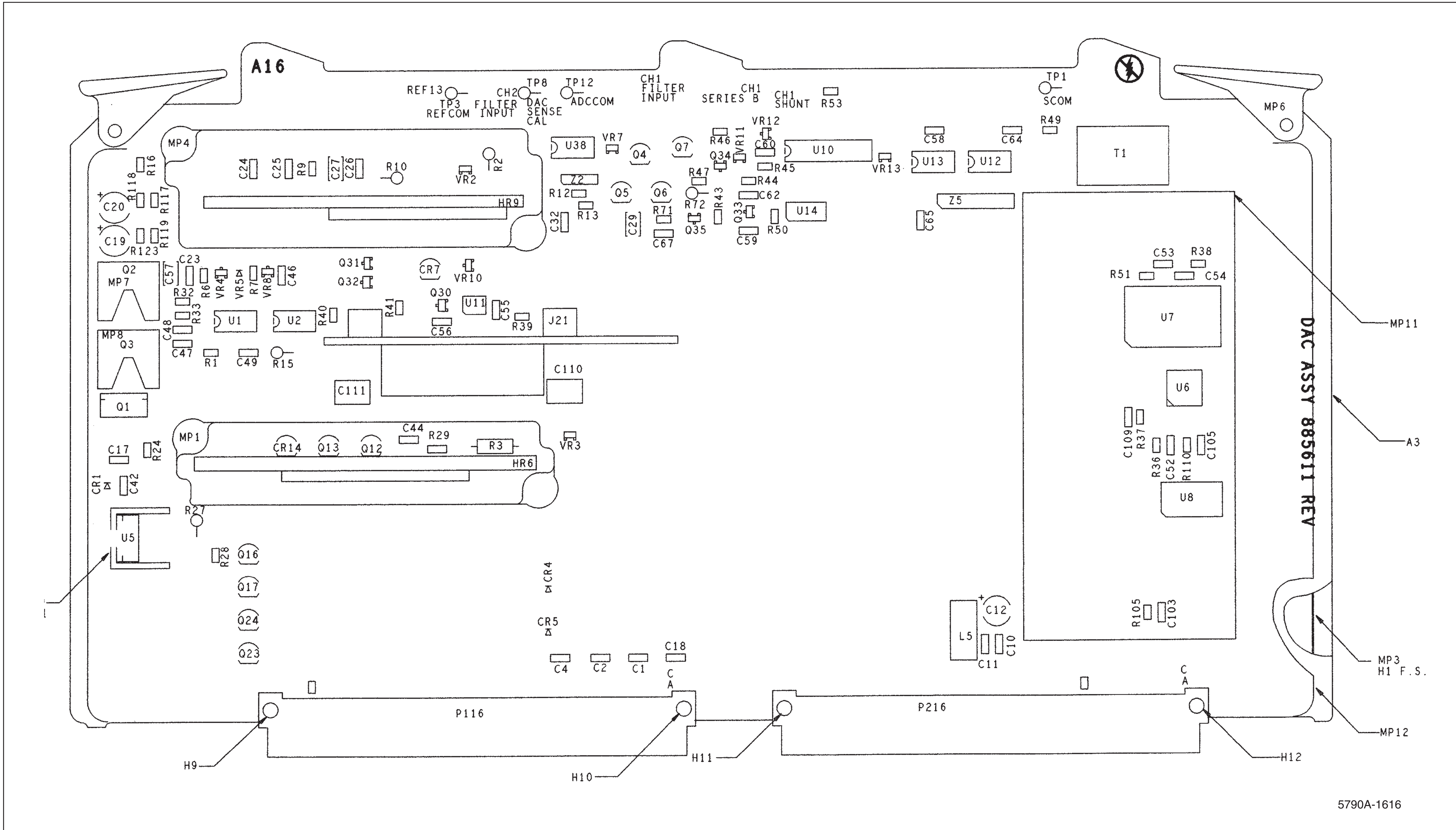
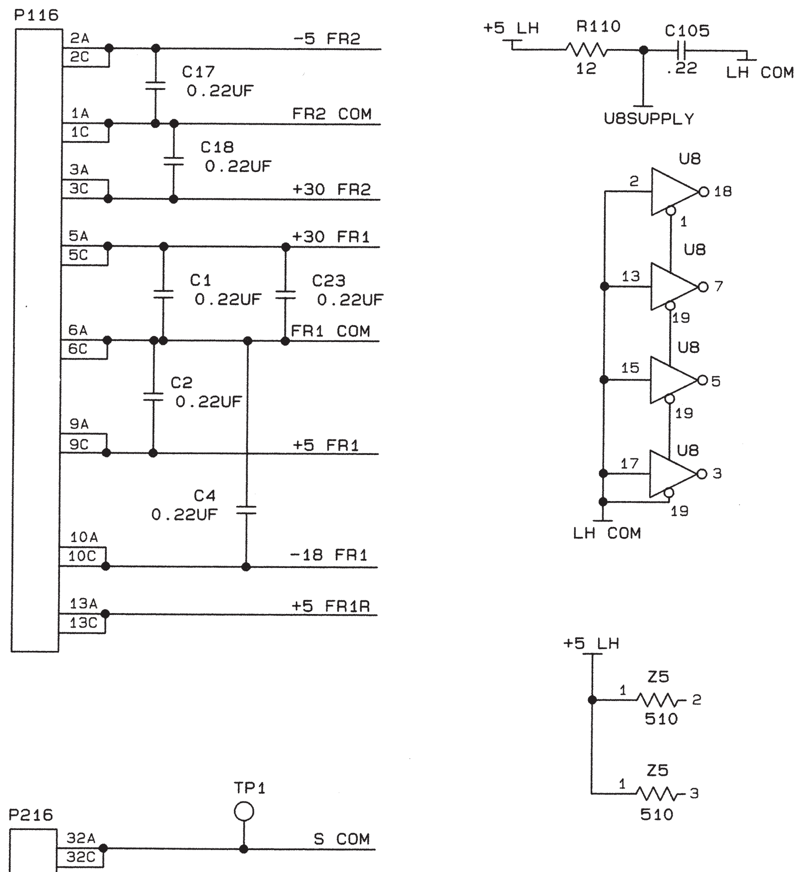
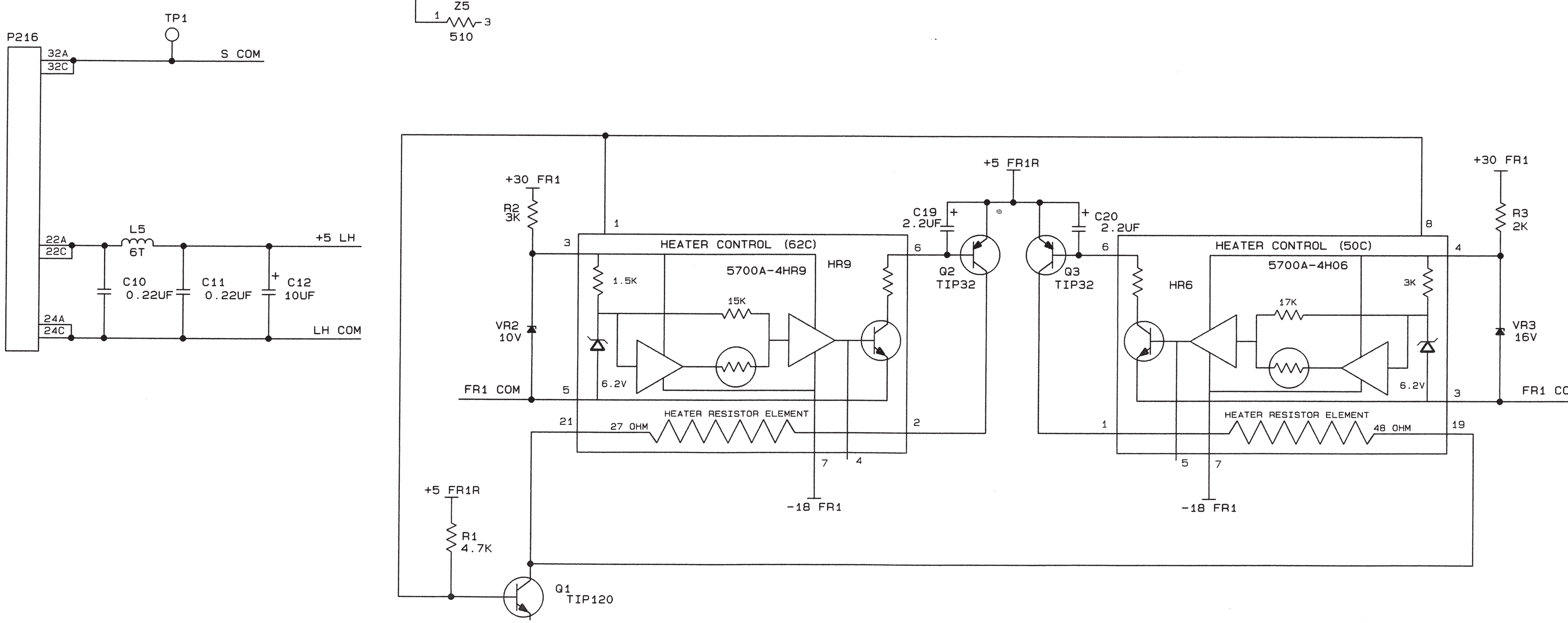


Figure 7-13. A16 DAC PCA



Designator	LHCOM	FR1COM	U6SUPPLY	U8SUPPLY	+5FR1
U6	14		28		
U8	10			20	
U10		7			
U14		7			14

TESTPOINTS		
TP1	SCOM	PG 1
TP2	REF13	PG 2
TP3	REFCOM	PG 2
TP4	CH1-SERIES-B	PG 3
TP5	TN-91	PG 2
TP6	CH1-SHUNT	PG 3
TP7	CH2	PG 3
TP8	DAC-SENSE-CA	PG 2
TP12	ADCCOM	PG 2



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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Figure 7-13. A16 DAC PCA (cont)

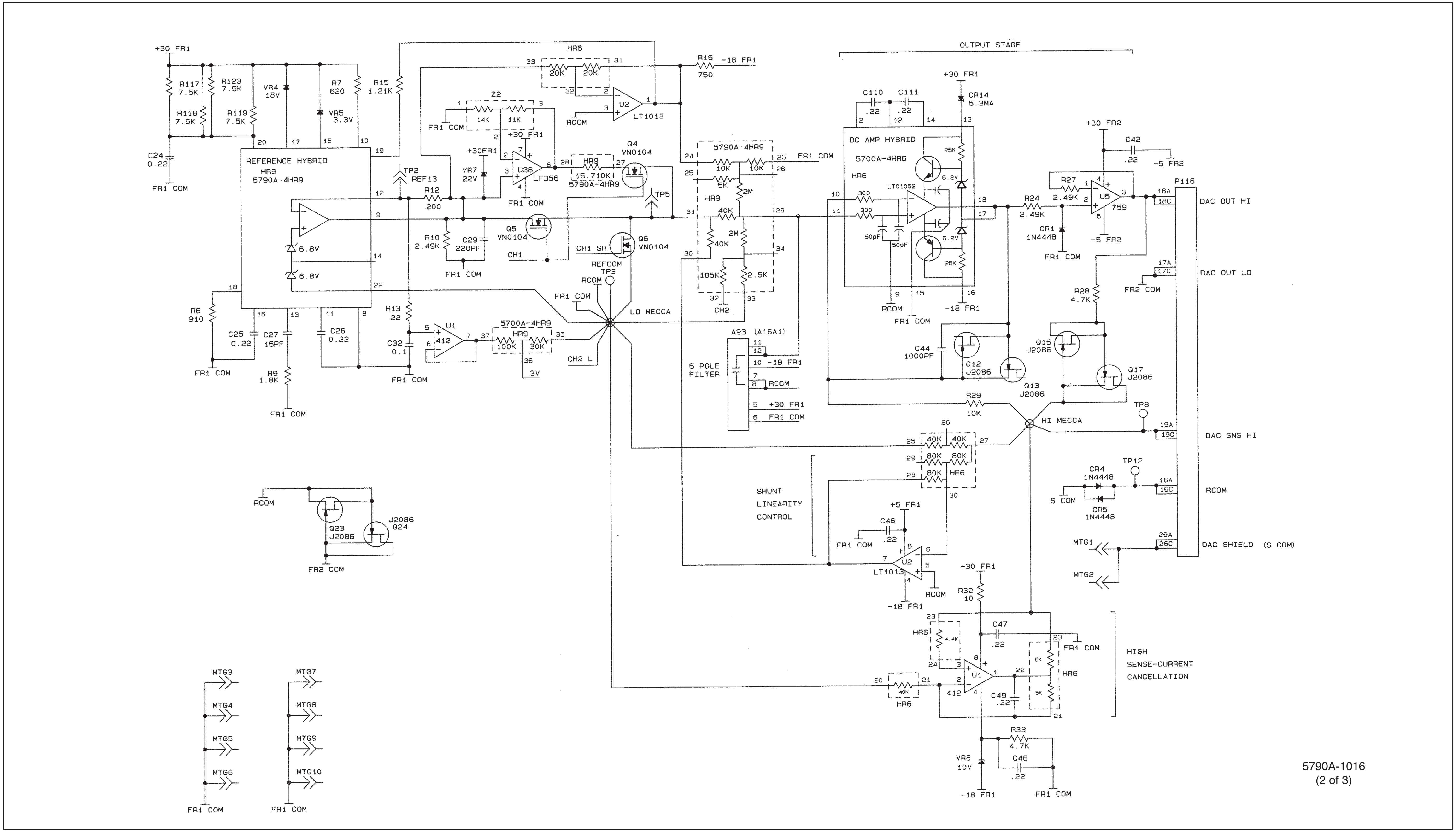
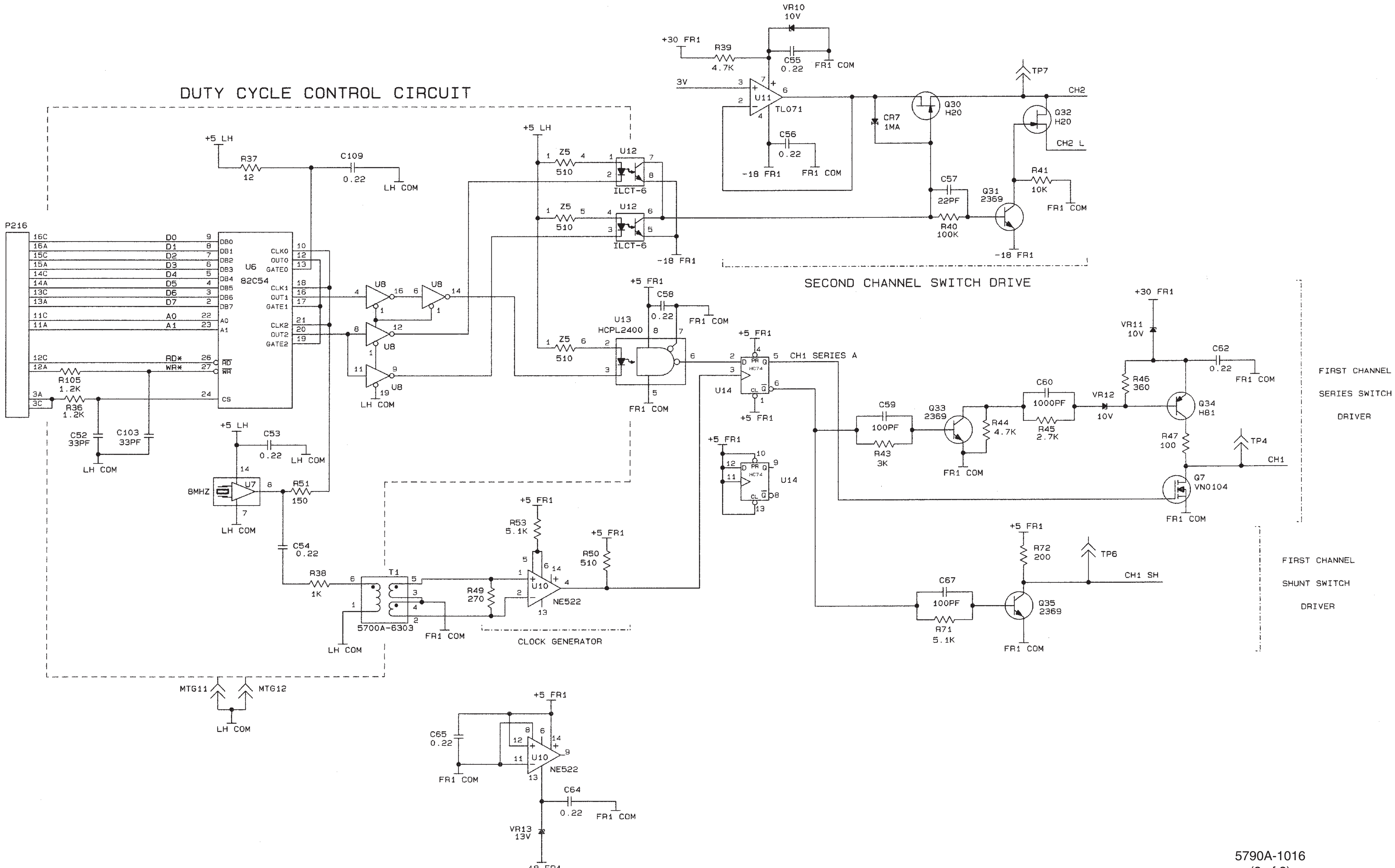


Figure 7-13. A16 DAC PCA (cont)



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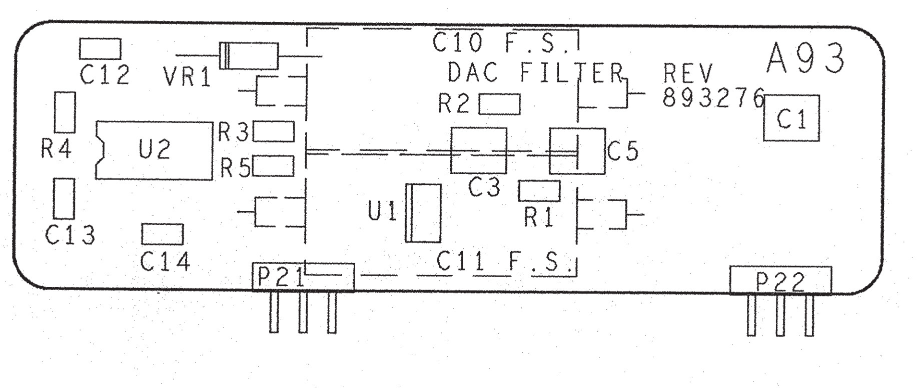
(3 of 3)

Figure 7-13. A16 DAC PCA (cont)



5790A-1693

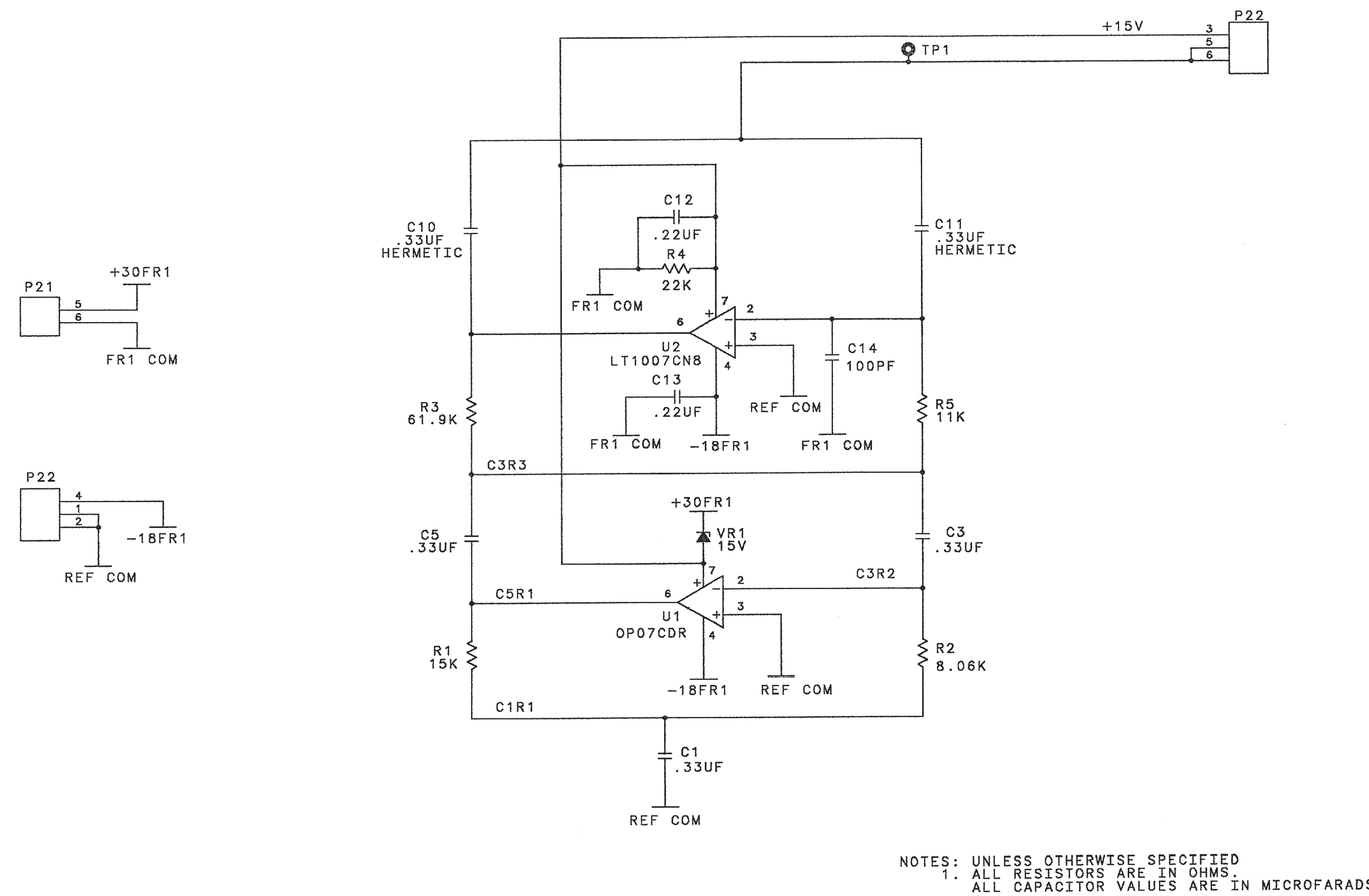


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Figure 7-14. A16A1 DAC Filter PCA

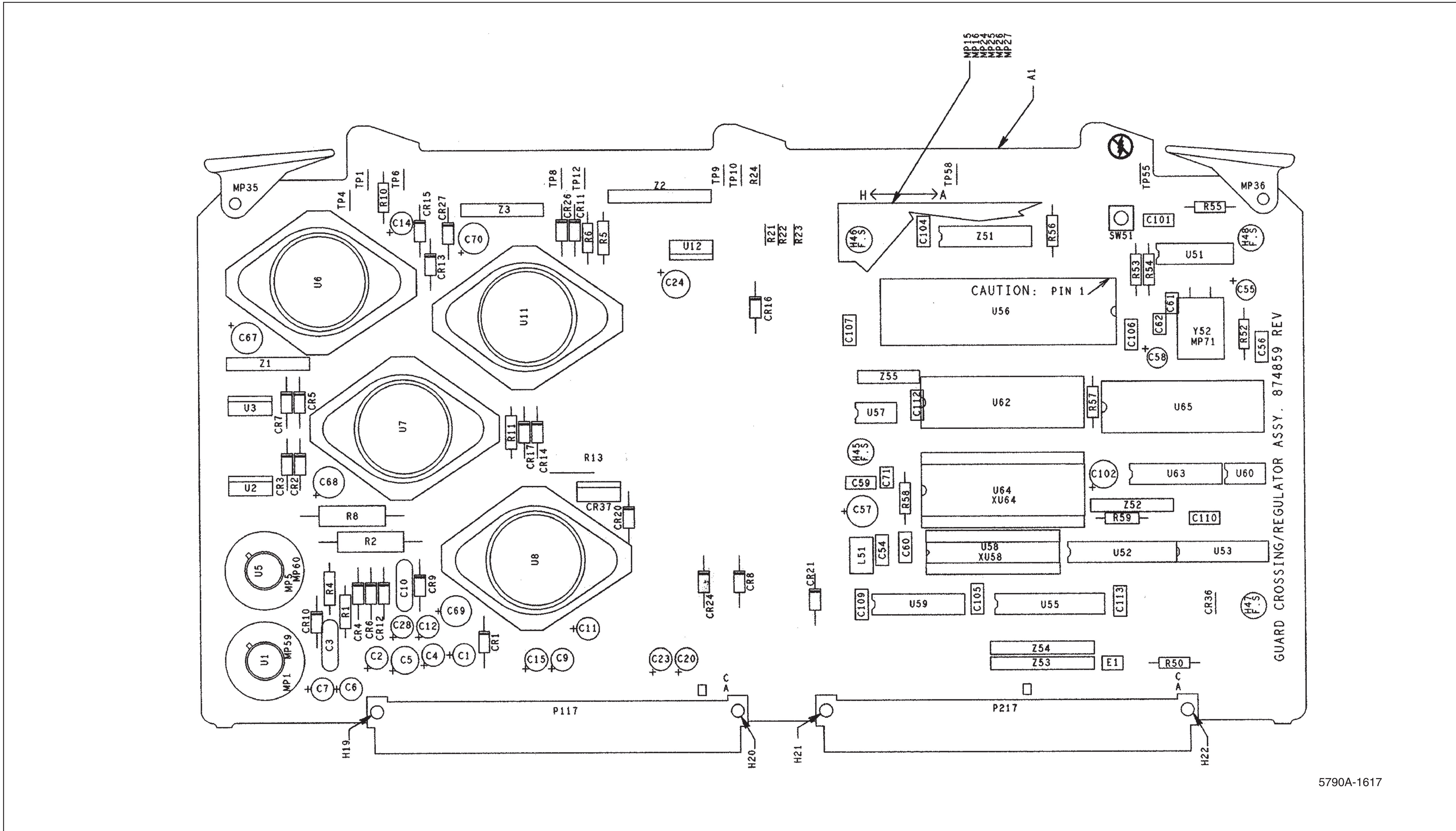
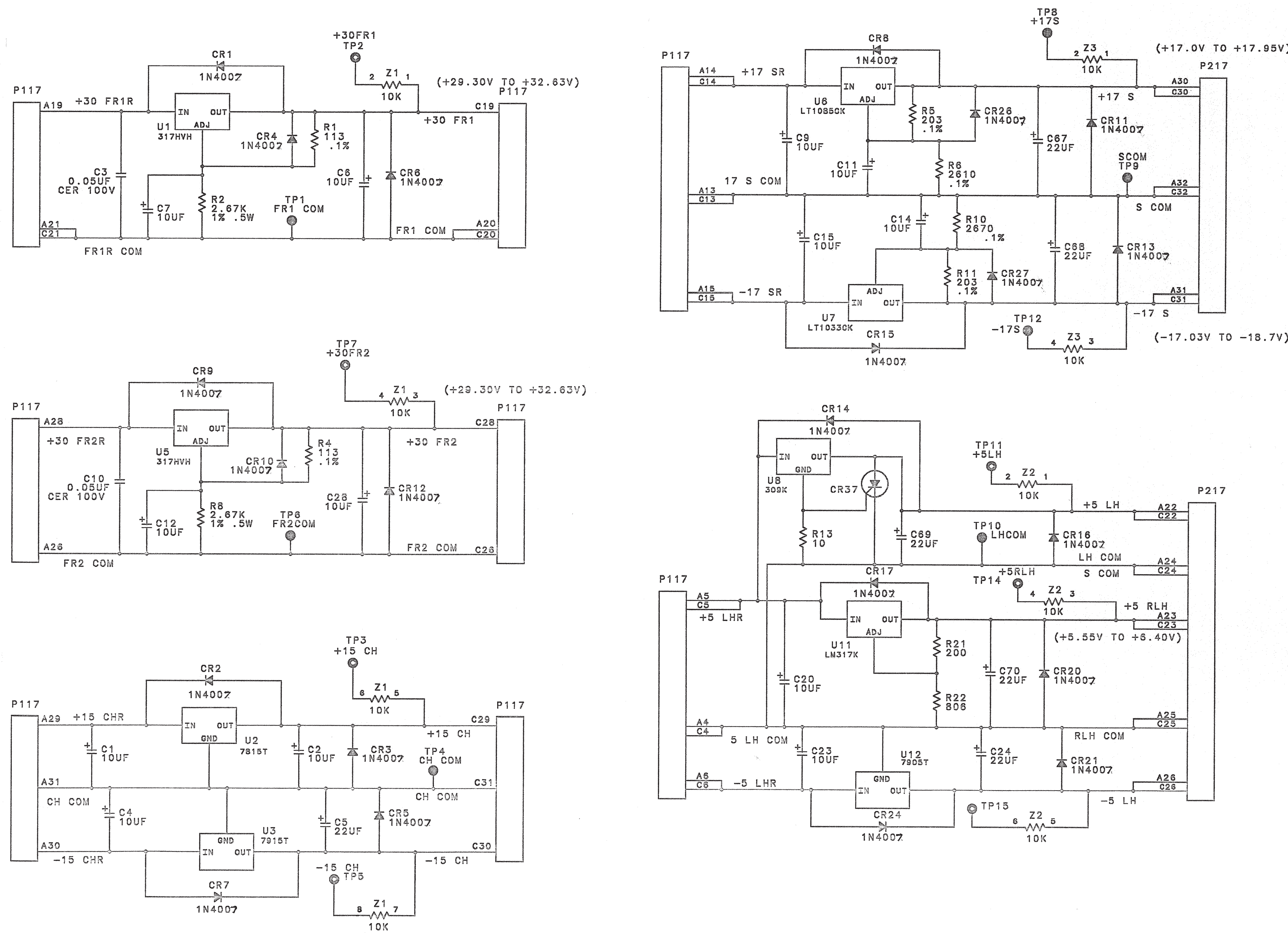


Figure 7-15. A17 Regulator/Guard Crossing PCA



Designator	GND	+5V
U51	7	14
U52	10	20
U53	8	16
U55	10	20
U56	1	33
	42	
U57	4	8
U58	12	24
U59	8	16
U60	4	8
U62	14	28
U63	8	16
U64	14	28
U65	14	28

TESTPOINTS		
TP1	FR1 COM	PG 1
TP2	+30 FR1	PG 1
TP3	+15 CH	PG 1
TP4	CH COM	PG 1
TP5	-15 CH	PG 1
TP6	FR2 COM	PG 1
TP7	+30 FR2	PG 1
TP8	+17 S	PG 1
TP9	GND	PG 1
TP10	GND	PG 1
TP11	+5 LH	PG 1
TP12	-17 S	PG 1
TP14	+5 RLH	PG 1
TP15	-5 LH	PG 1
TP52	+5V	PG 2
TP55	GND	PG 2
TP58	GND	PG 2

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. FOR ASSEMBLY DRAWING SEE 5790A-7817.

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Figure 7-15. A17 Regulator/Guard Crossing PCA (cont)

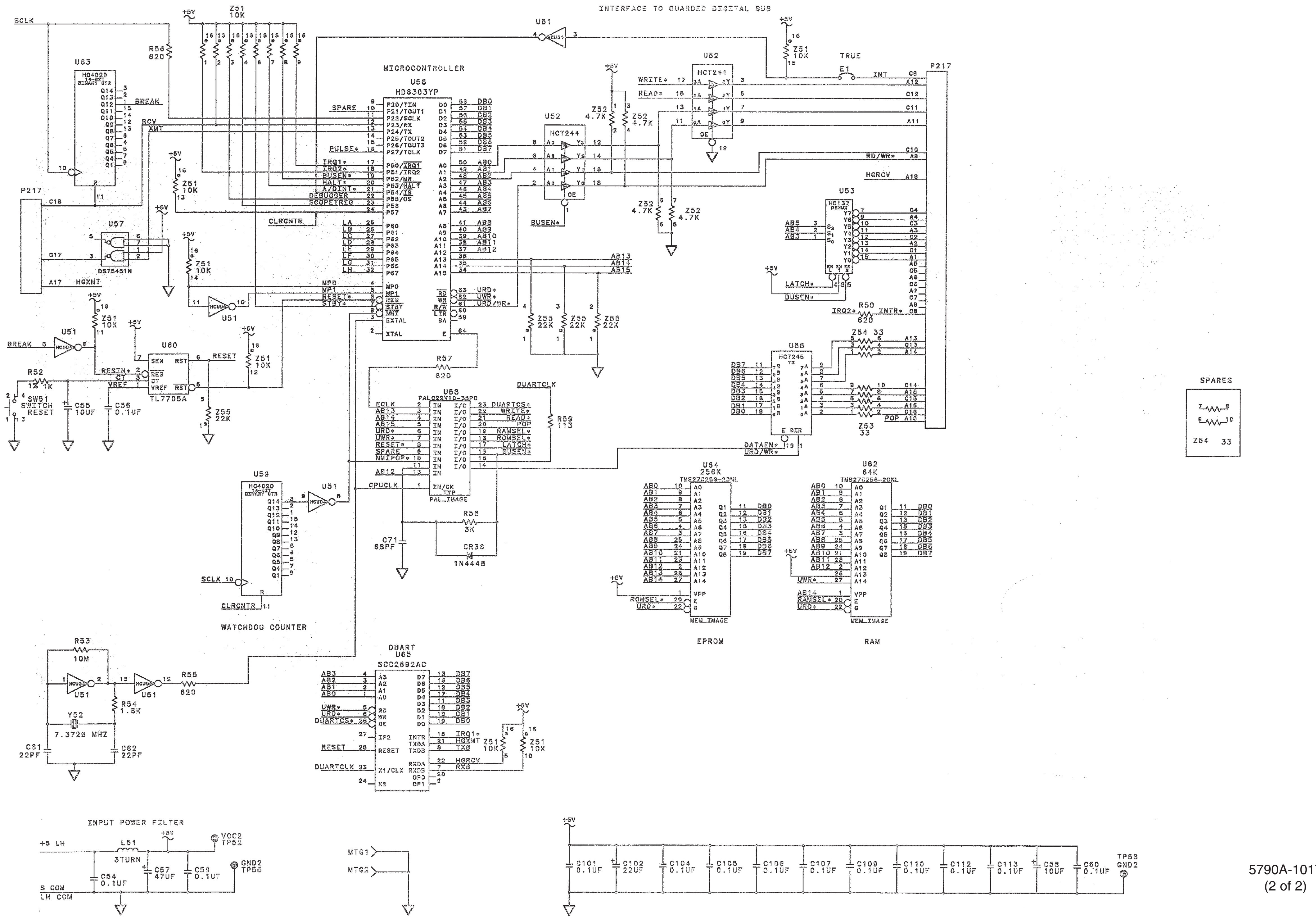


Figure 7-15. A17 Regulator/Guard Crossing PCA (cont)

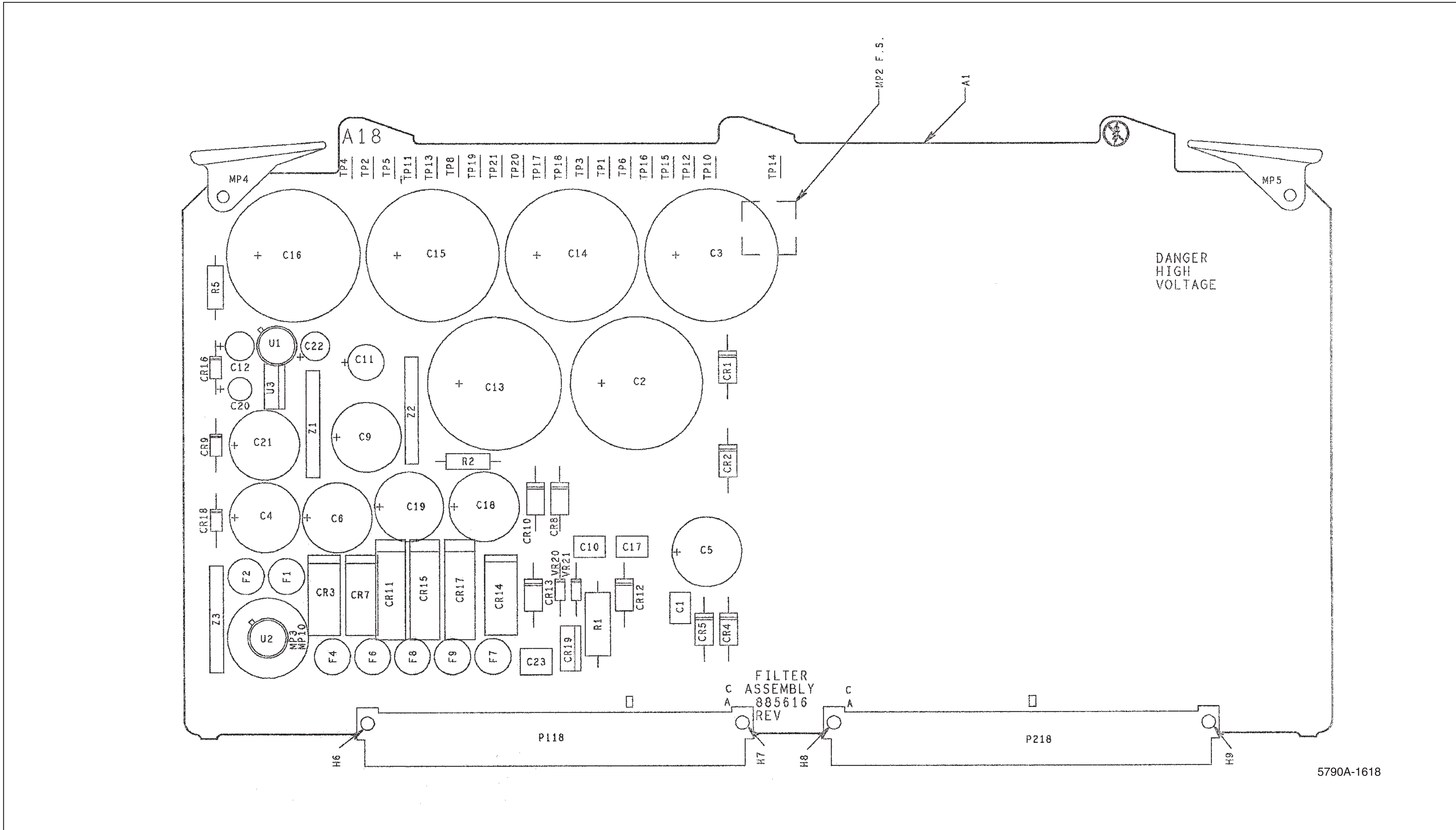
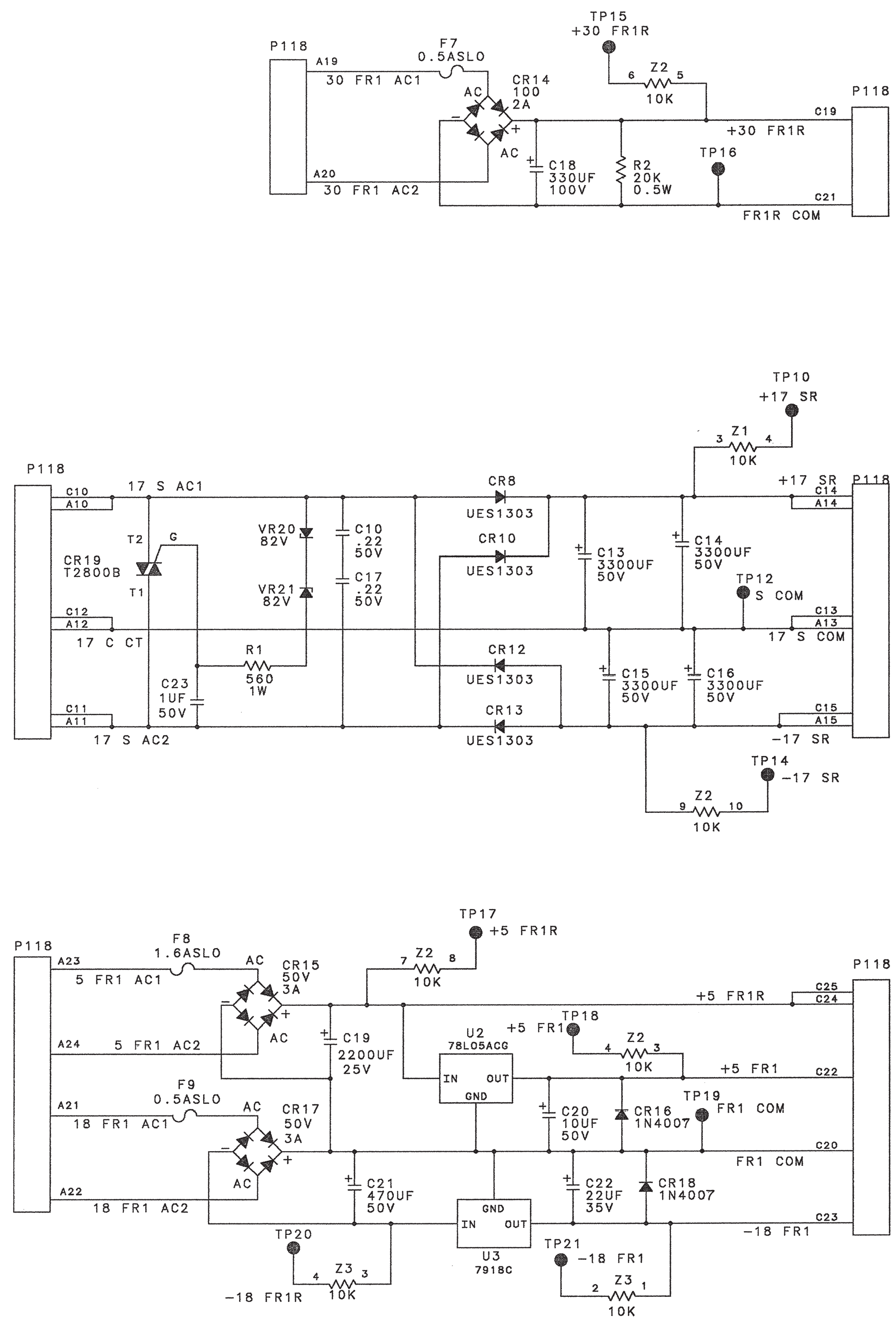


Figure 7-16. A18 Filter PCA



TESTPOINTS		
TP1	+5LHR	PG 2
TP2	+15CHR	PG 2
TP3	5 LH COM	PG 2
TP4	CH COM	PG 2
TP5	−15CHR	PG 2
TP6	−5LHR	PG 2
TP7	+44SR	PG 3
TP8	+30FR2	PG 2
TP9	−44SR	PG 3
TP10	+17SR	PG 1
TP11	FR2 COM	PG 2
TP12	17 S COM	PG 1
TP13	−5FR2	PG 2
TP14	−17SR	PG 1
TP15	+30FR1R	PG 1
TP16	FR1R COM	PG 1
TP17	+5FR1R	PG 1
TP18	+5FR1	PG 1
TP19	FR1 COM	PG 1
TP20	−18 FR1R	PG 1
TP21	−18FR1	PG 1
TP22	44 S CT	PG 3

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. FOR ASSEMBLY DRAWING SEE 5790A-7618.

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Figure 7-16. A18 Filter PCA (cont)

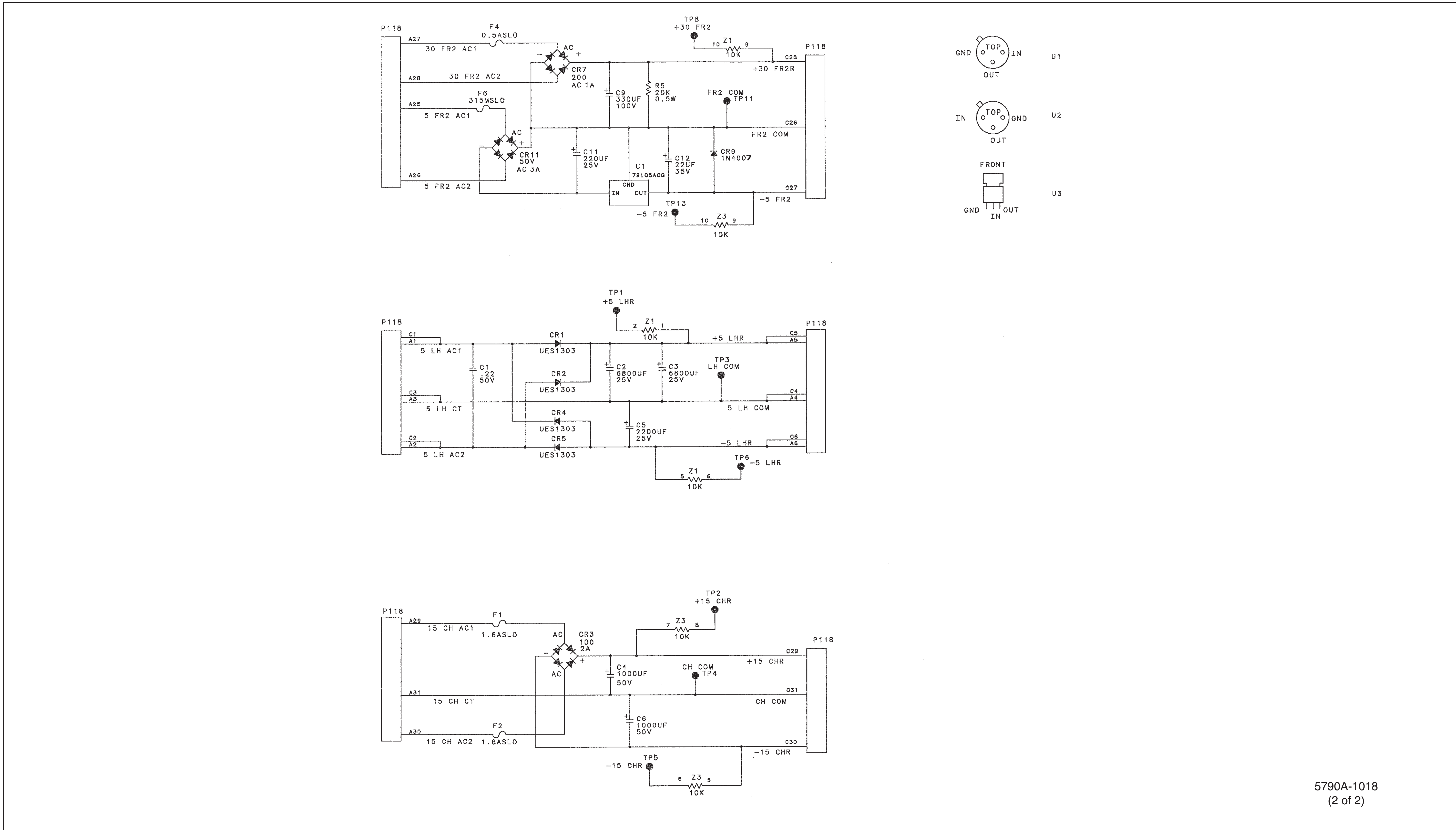


Figure 7-16. A18 Filter PCA (cont)

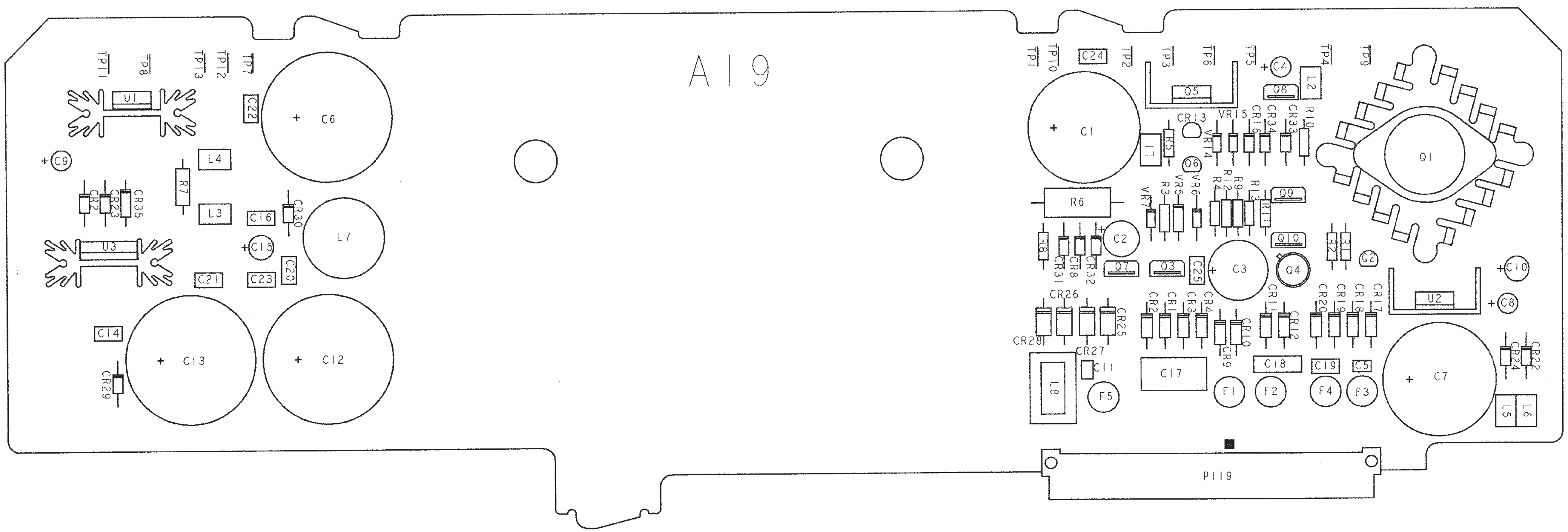


Figure 7-17. A19 Digital Power Supply PCA

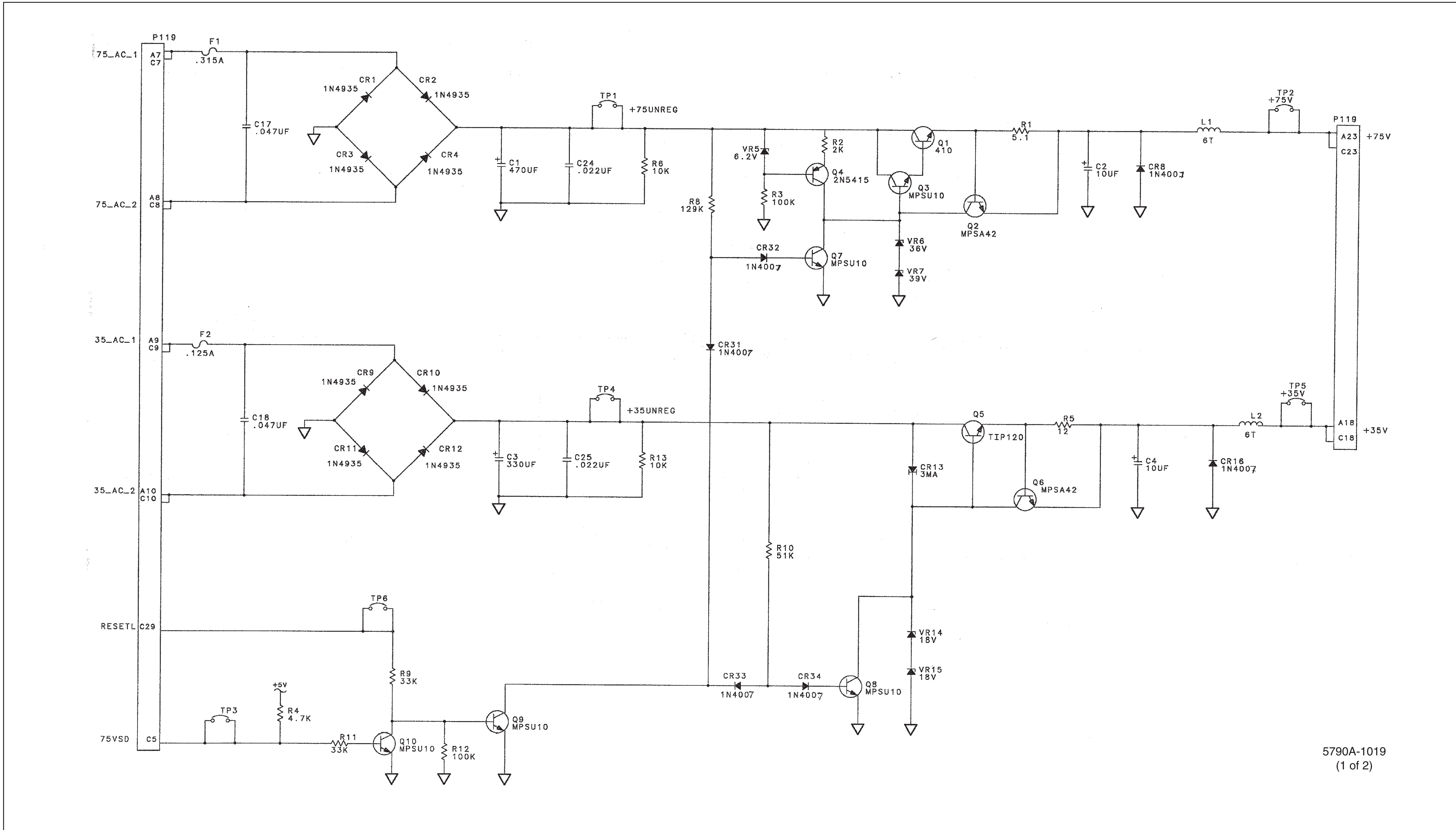


Figure 7-17. A19 Digital Power Supply PCA (cont)

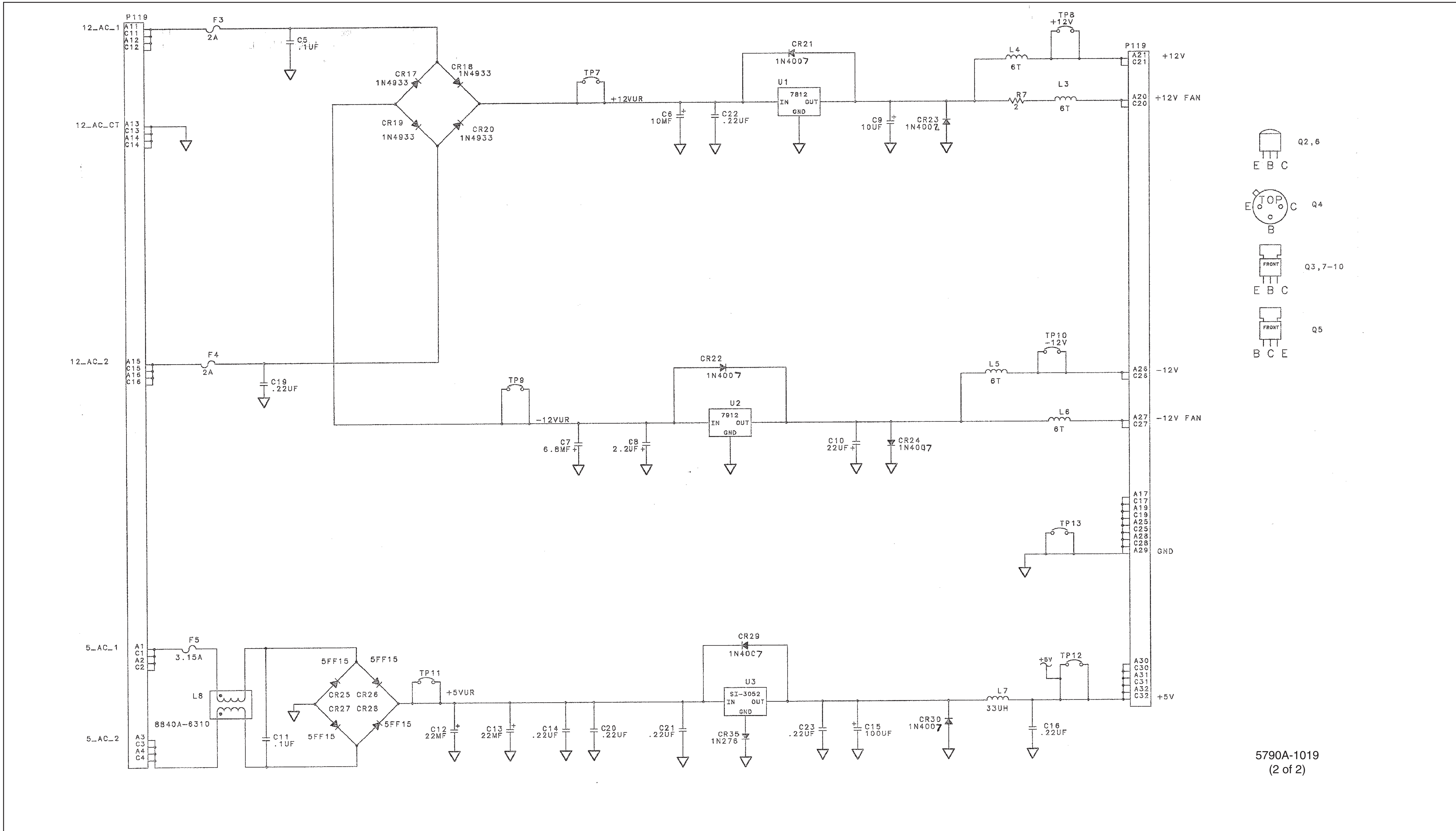
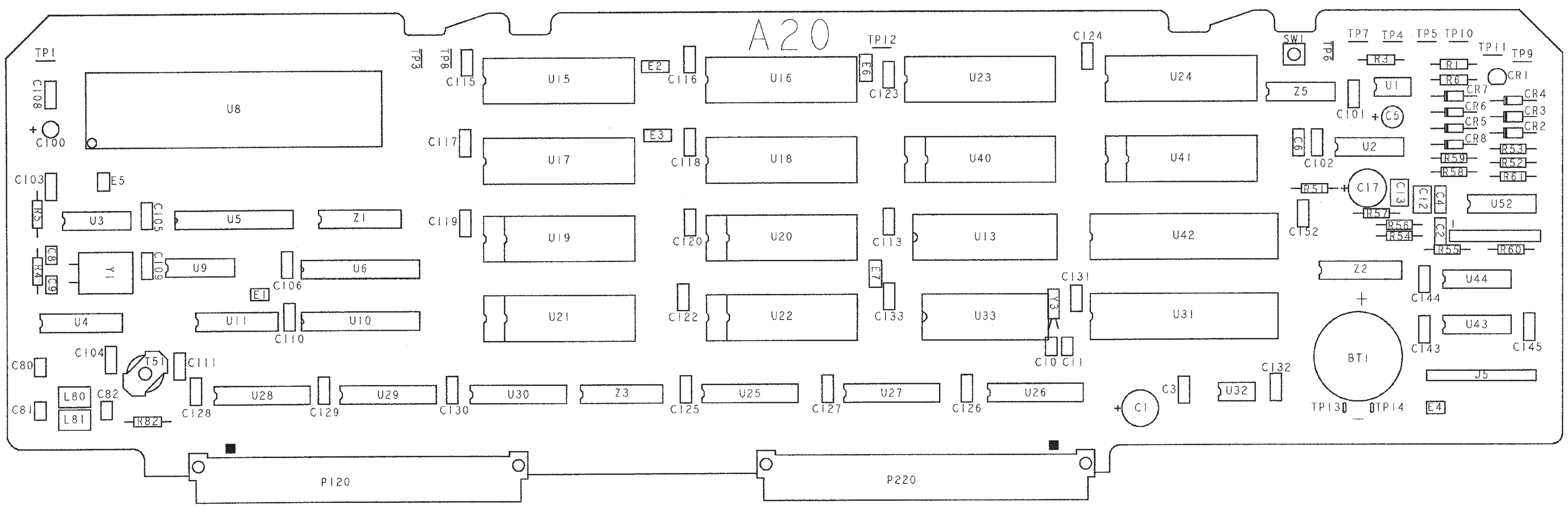


Figure 7-17. A19 Digital Power Supply PCA (cont)



5790A-1620

Figure 7-18. A20 CPU PCA

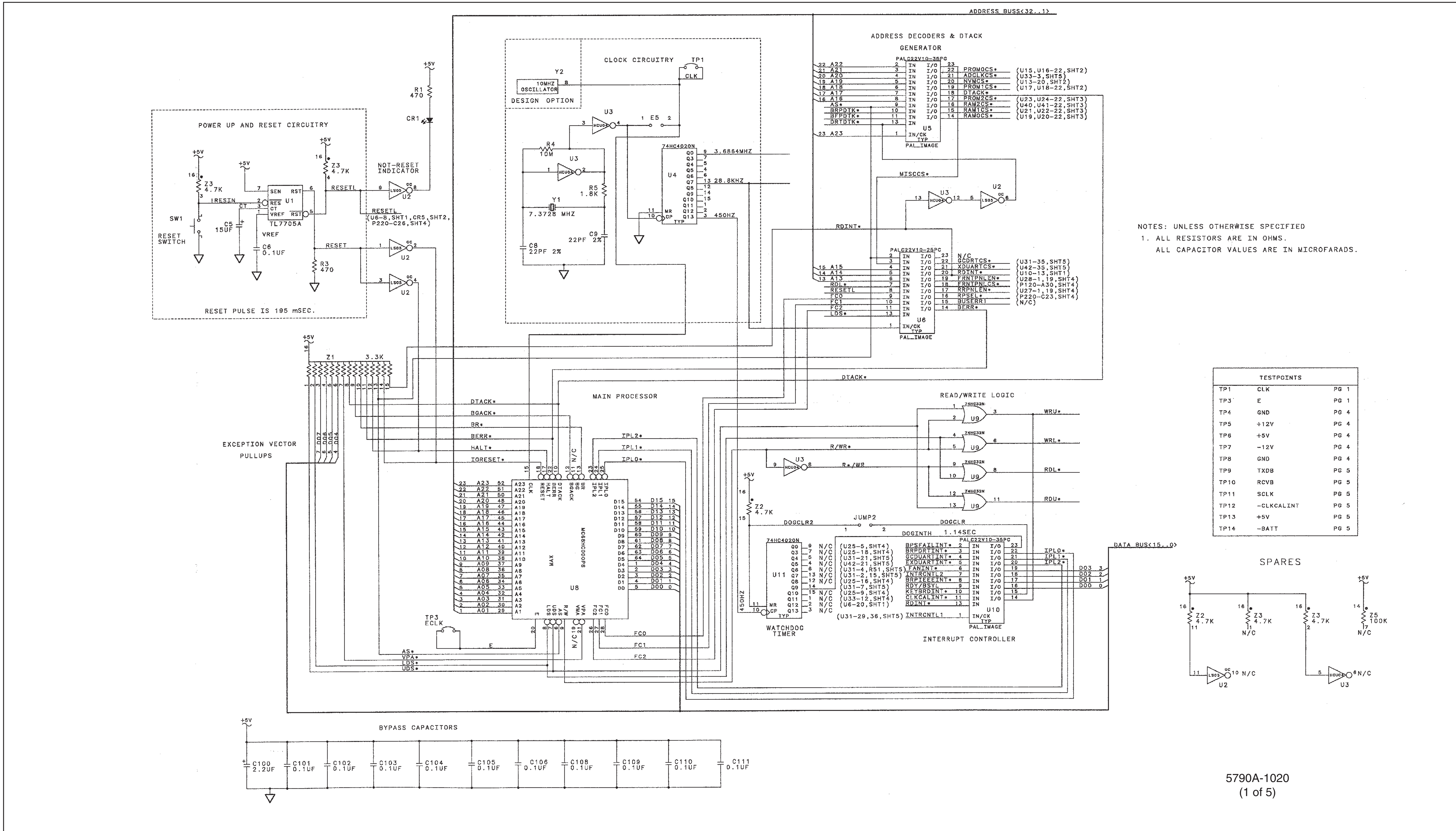


Figure 7-18. A20 CPU PCA (cont)

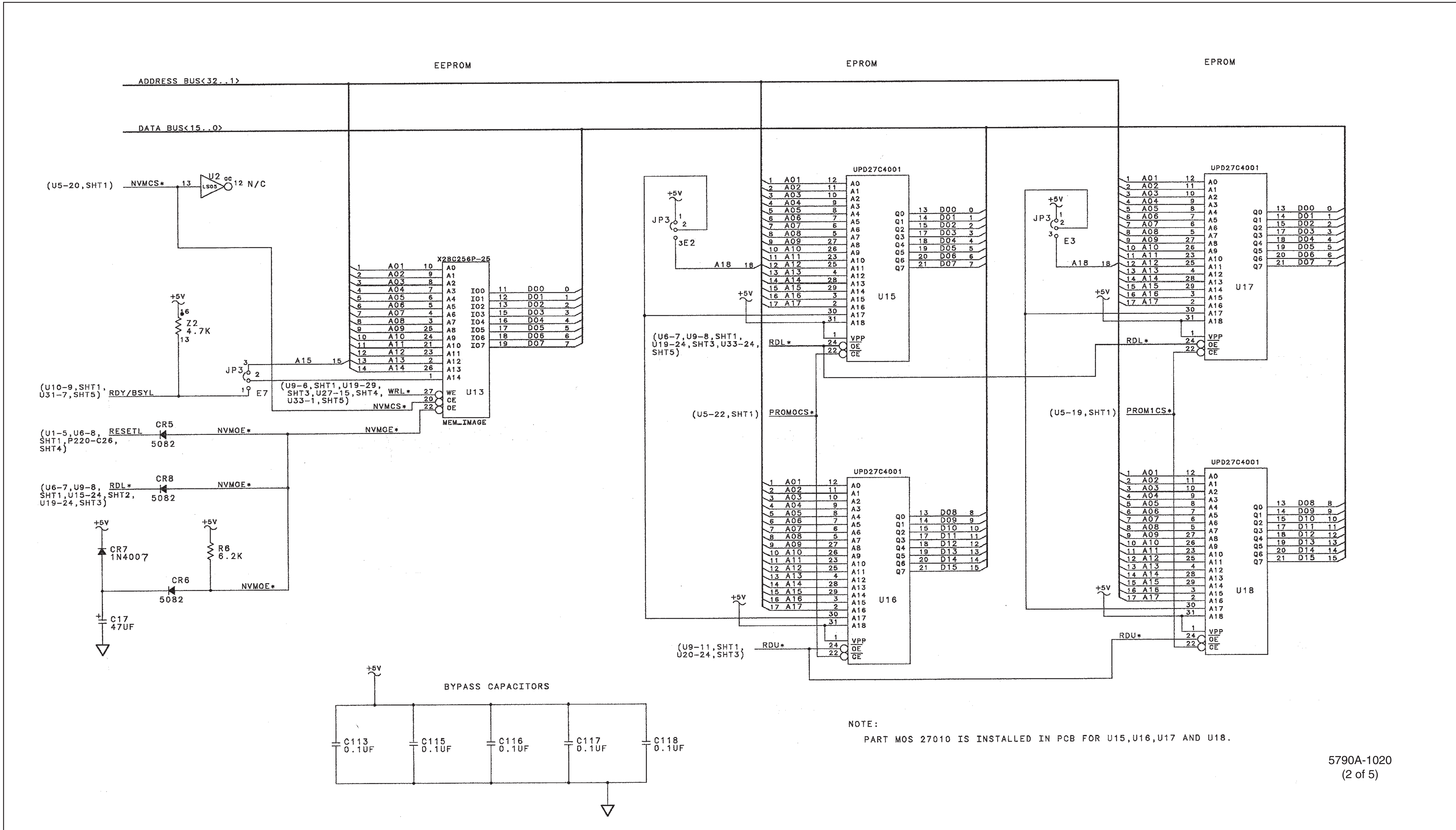


Figure 7-18. A20 CPU PCA (cont)

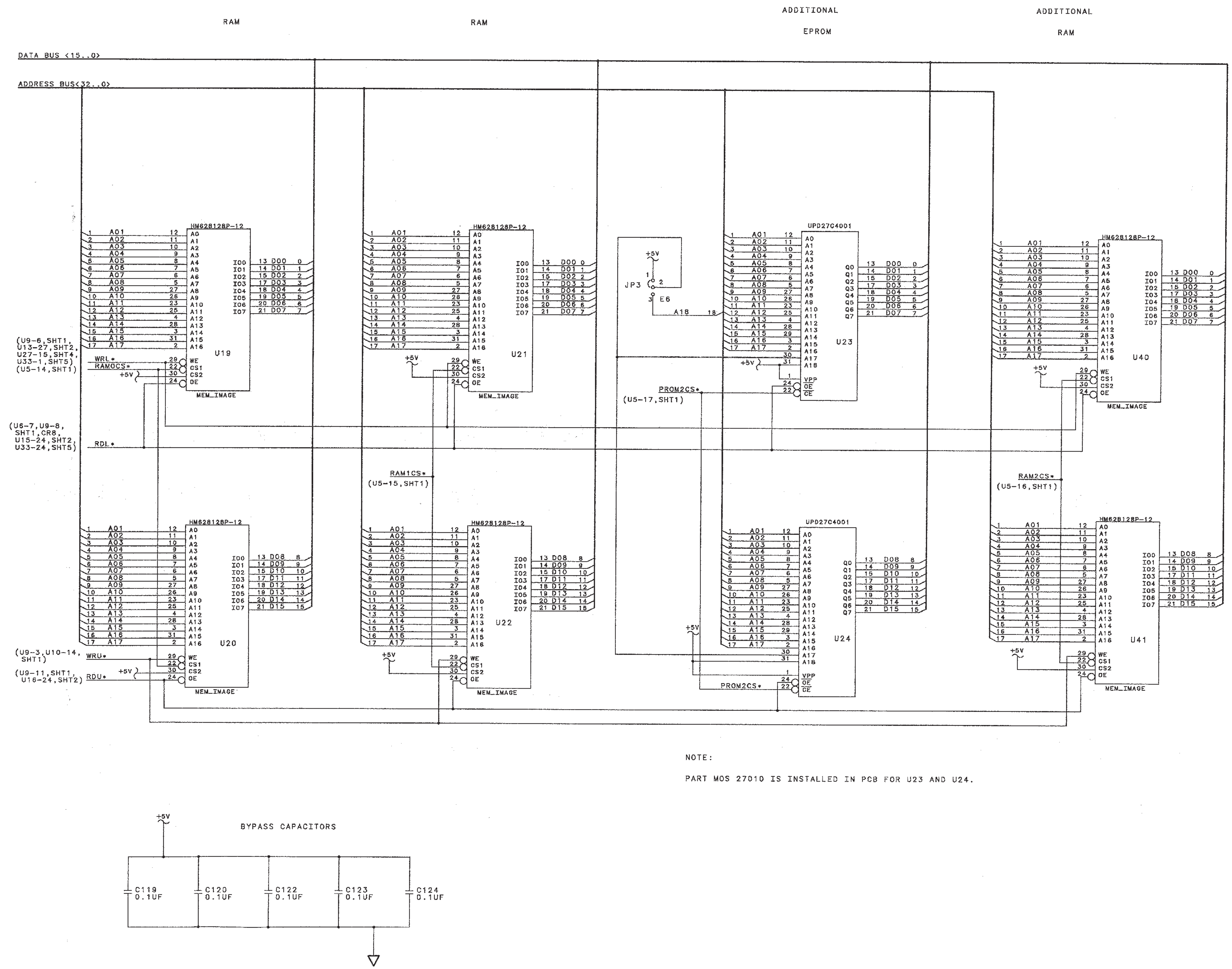


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Figure 7-18. A20 CPU PCA (cont)

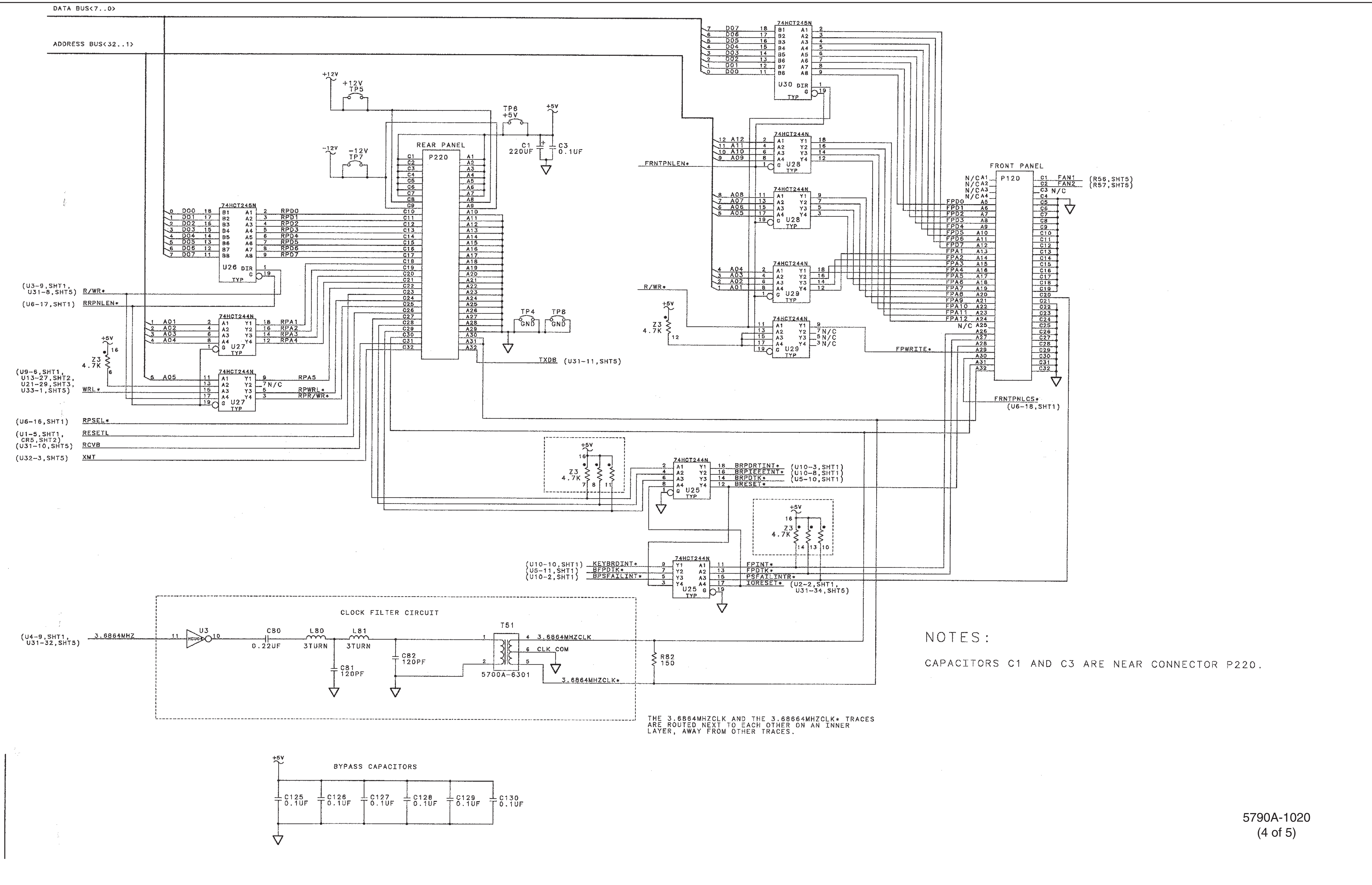
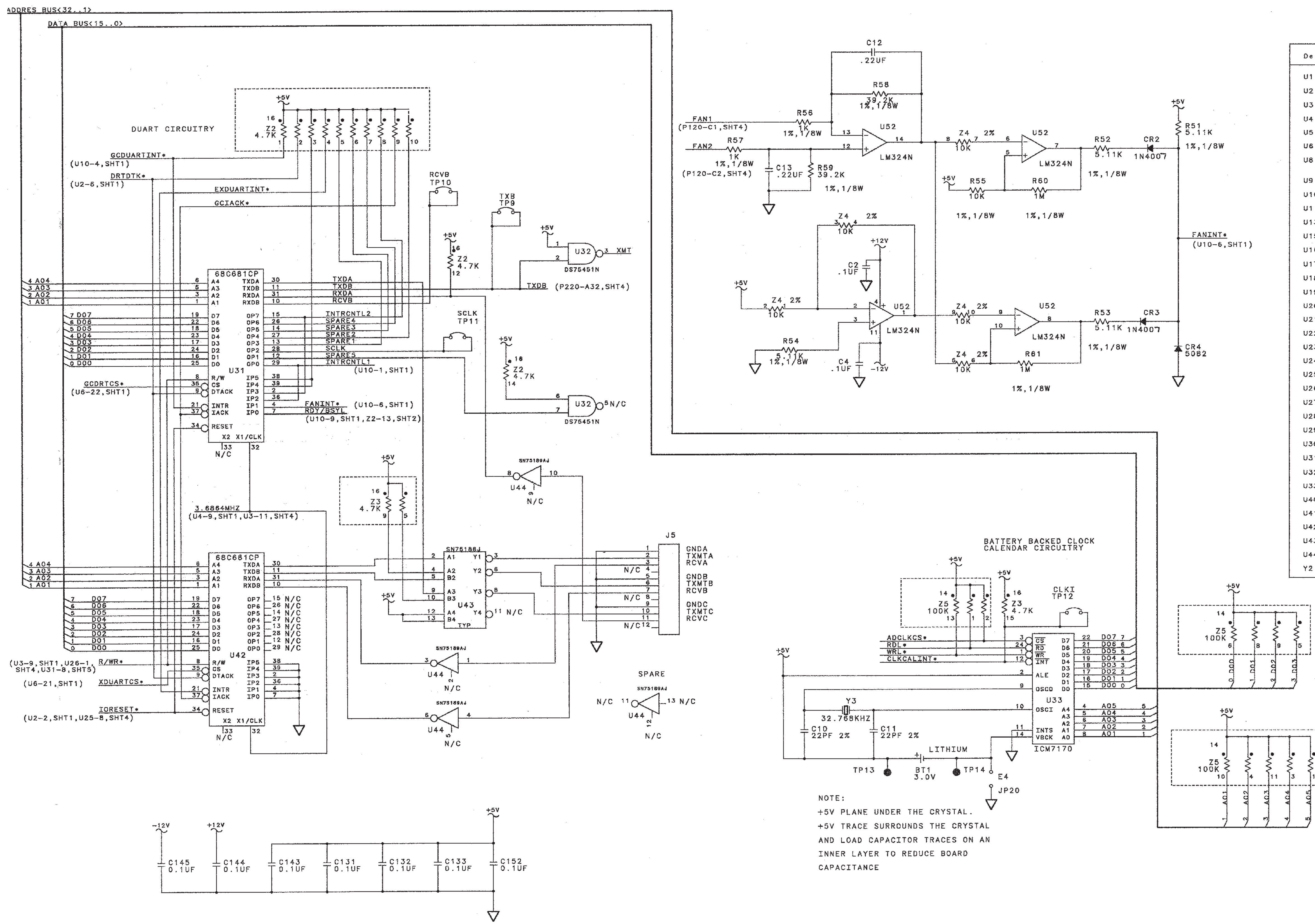


Figure 7-18. A20 CPU PCA (cont)



Designator	GND	-12V	+12V	+5V
U1	4			8
U2	7			14
U3	7			14
U4	8			16
U5	12			24
U6	12			24
U8	16 53			14 49
U9	7			14
U10	12			24
U11	8			16
U13	14			28
U15	16			32
U16	16			32
U17	16			32
U18	16			32
U19	16			32
U20	16			32
U21	16			32
U22	16			32
U23	16			32
U24	16			32
U25	10			20
U26	10			20
U27	10			20
U28	10			20
U29	10			20
U30	10			20
U31	20			40
U32	4			8
U33	13			23
U40	16			32
U41	16			32
U42	20			40
U43	7	1	14	
U44	7			14
Y2	7			14

Figure 7-18. A20 CPU PCA (cont)

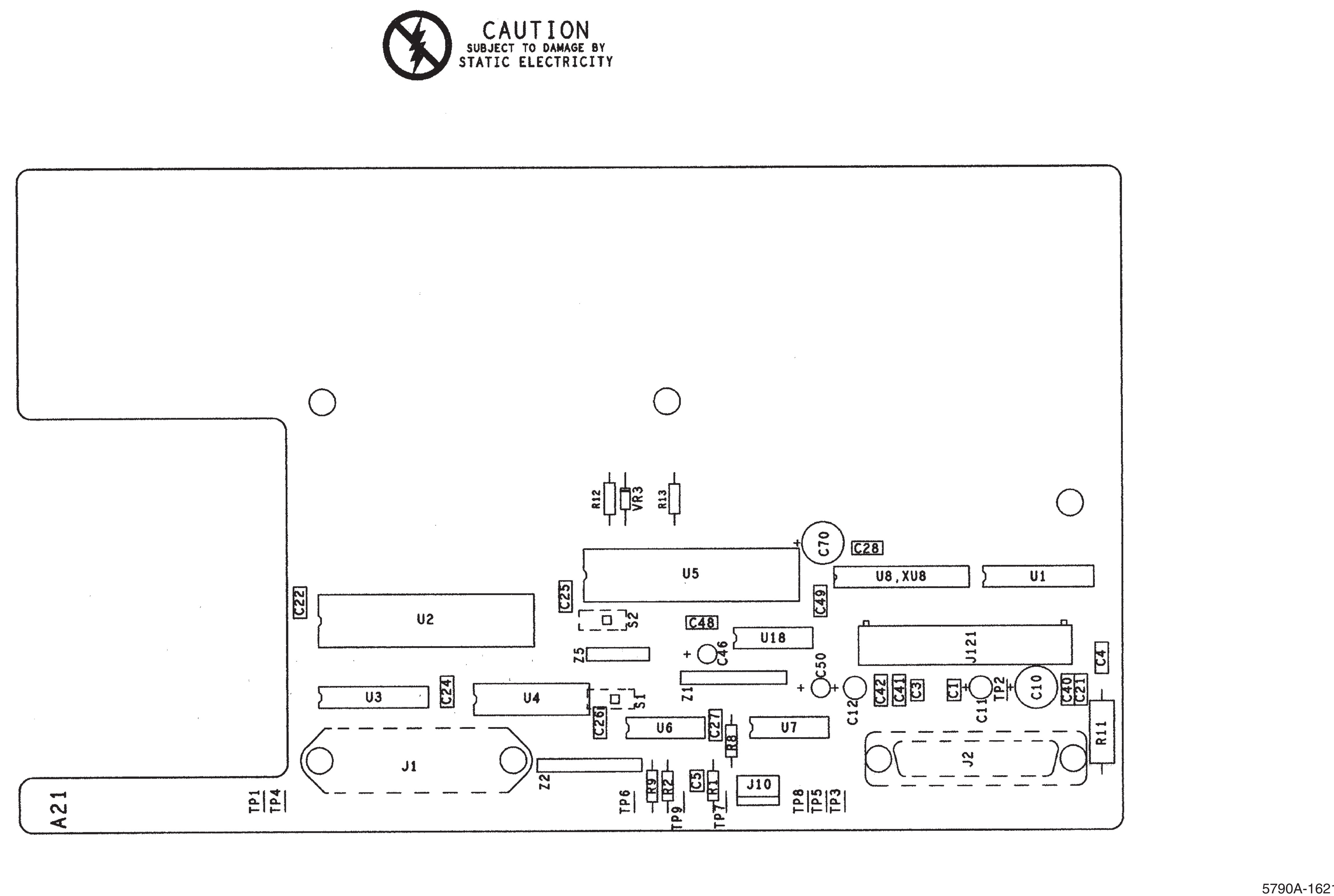


Figure 7-19. A21 Rear Panel I/O PCA

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

TESTPOINTS		
TP1	+5V	PG 1
TP2	+12V	PG 1
TP3	−12V	PG 1
TP4	GND	PG 1
TP5	−RXDA	PG 2
TP6	−TXDA	PG 2
TP7	SERIAL CLOCK	PG 2
TP8	−RXDB	PG 2
TP9	−TXDB	PG 2

Designator	GND	−12V	+12V	+5V
U1	10			20
U2	20			40
U3	10			20
U4	11			22
U5	20			40
U6	7	1	14	
U7	7			14
U8	12			24

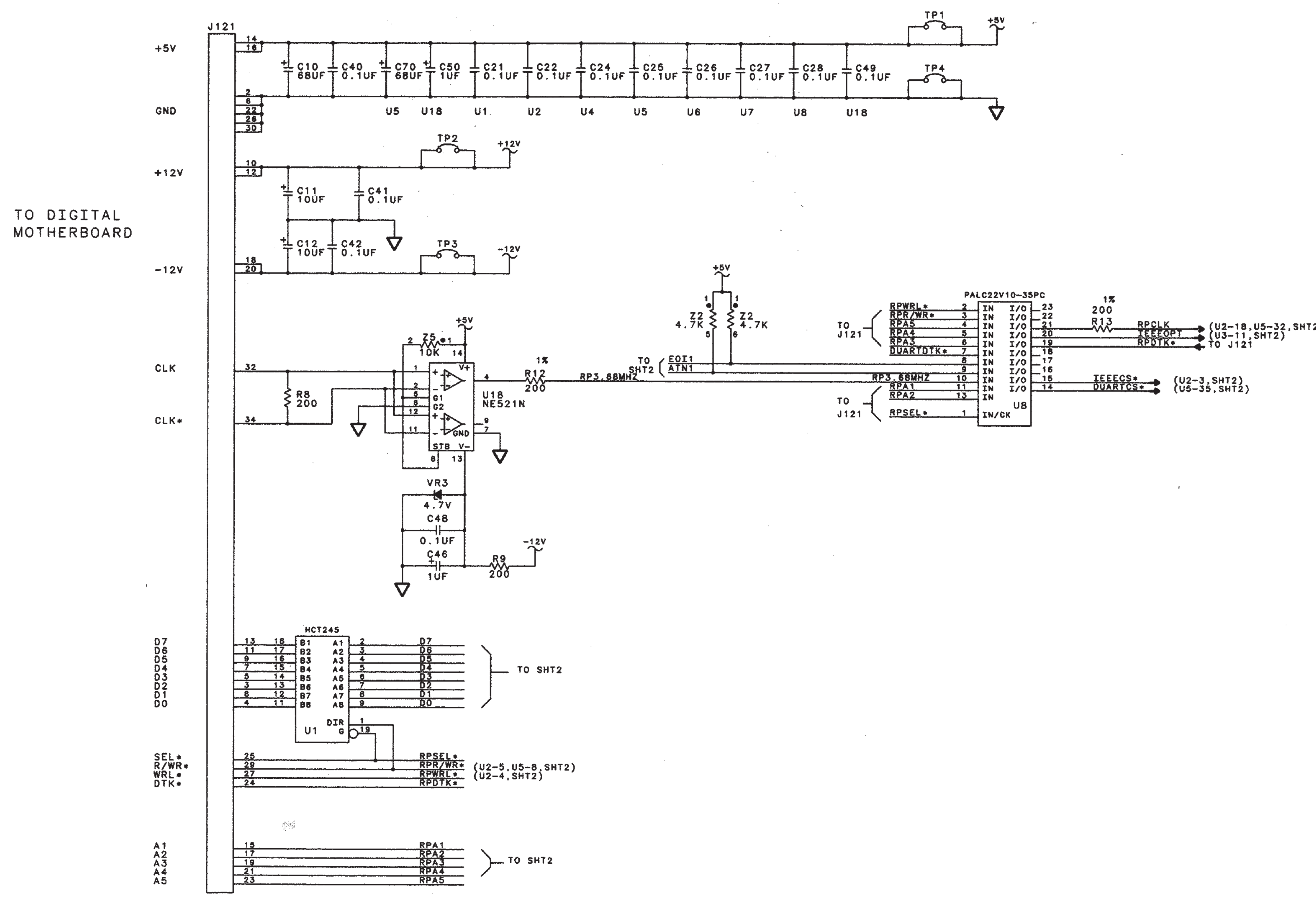


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Figure 7-19. A21 Rear Panel I/O PCA (cont)

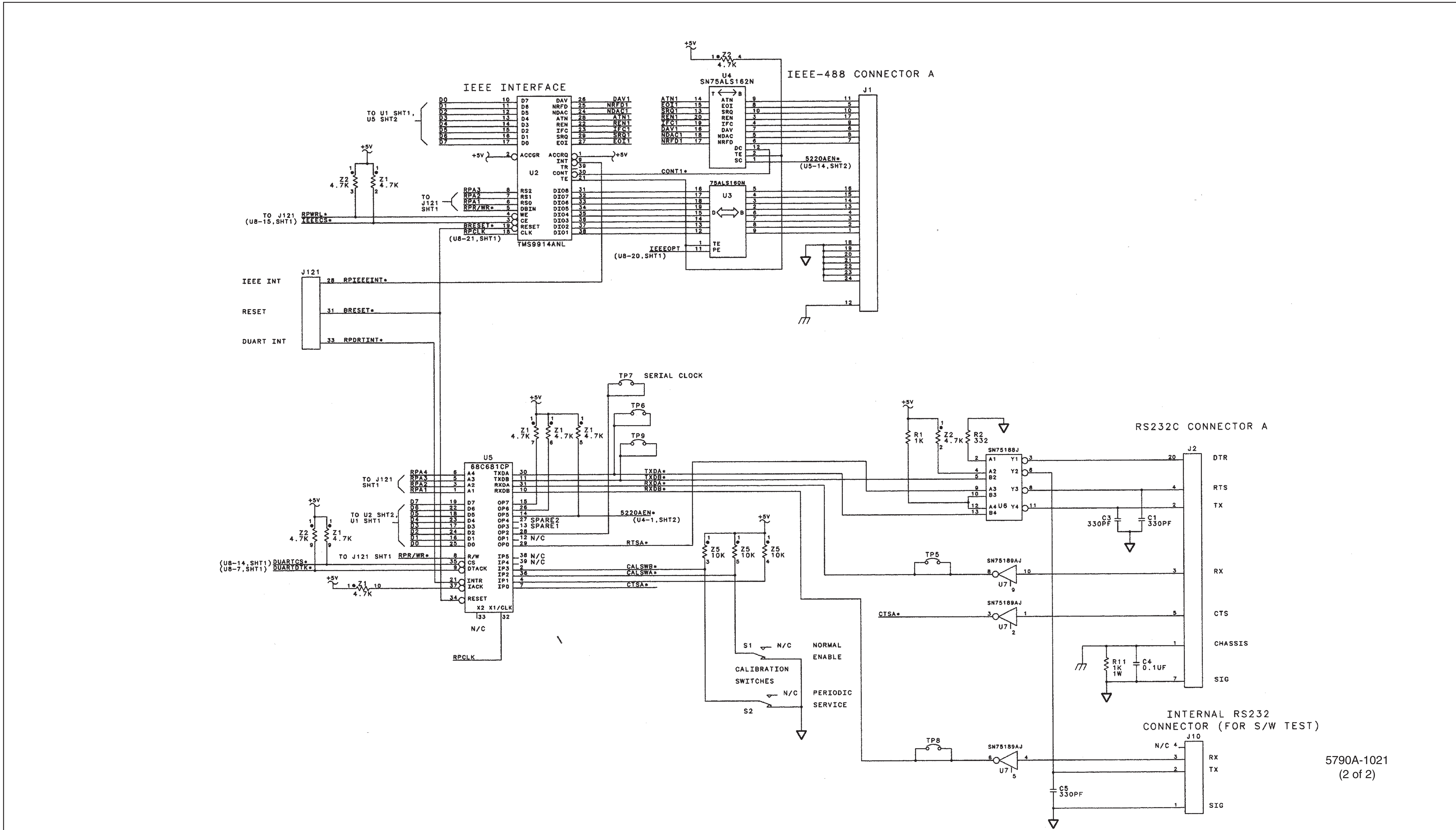
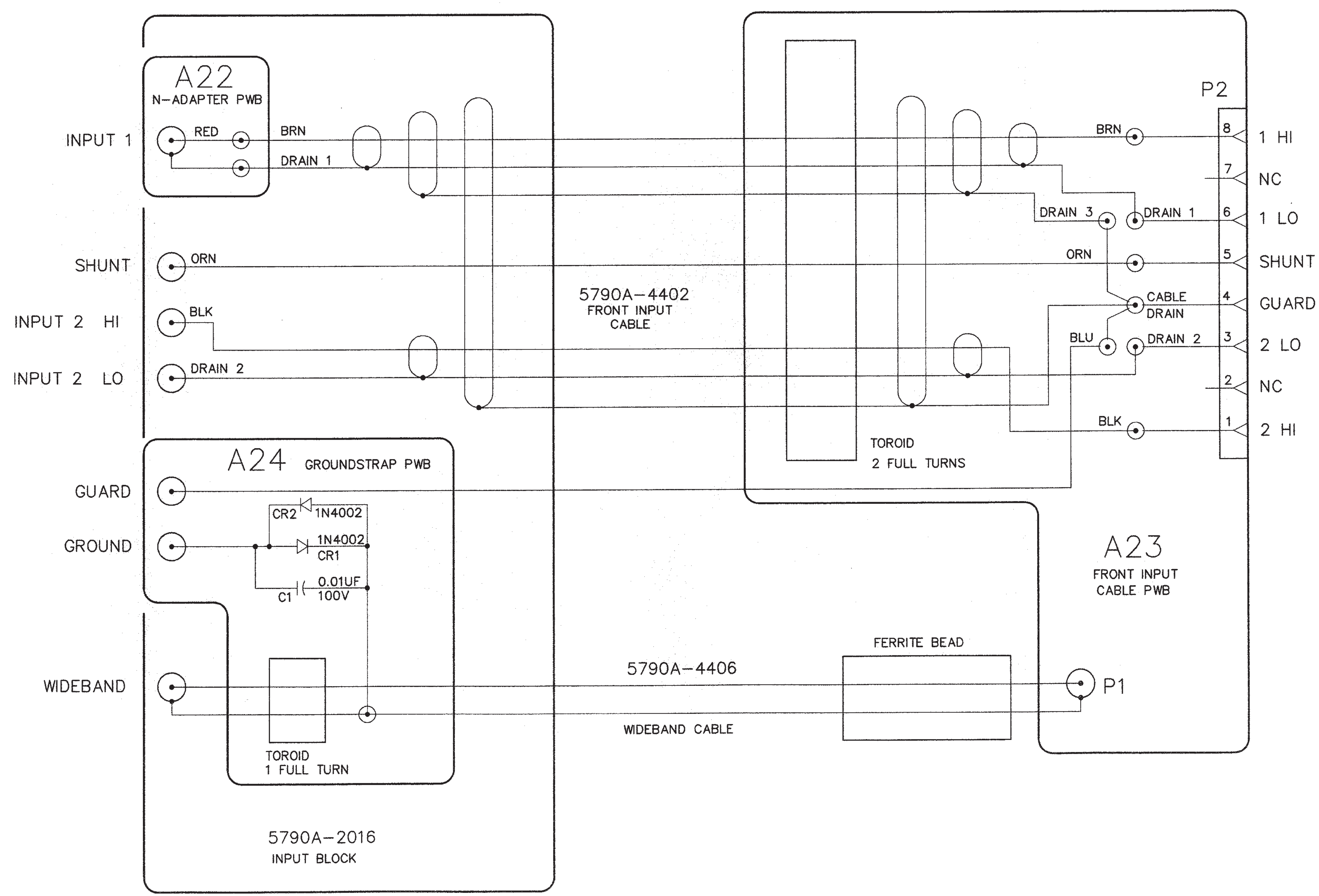


Figure 7-19. A21 Rear Panel I/O PCA (cont)

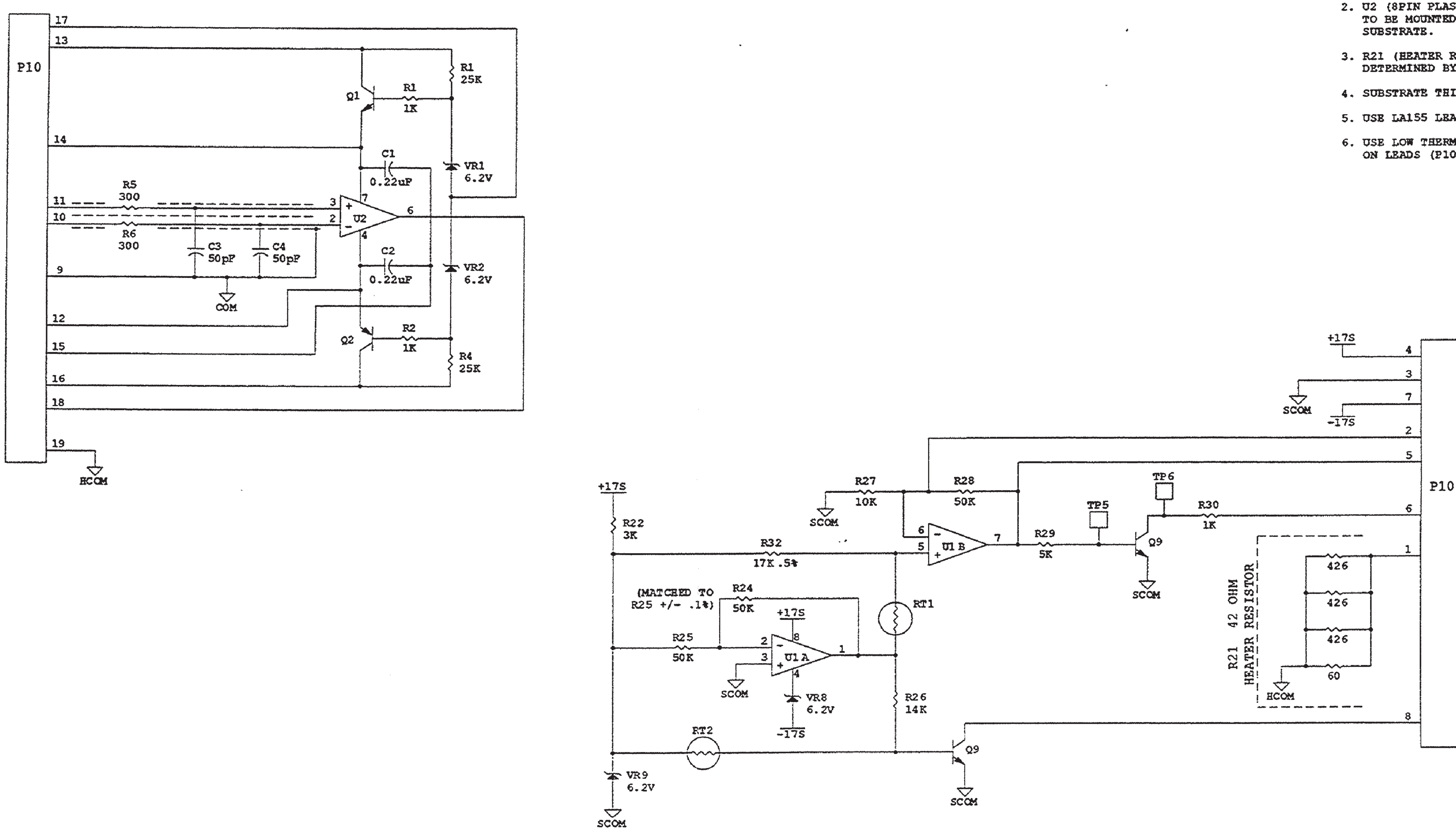


NOTES: (UNLESS OTHERWISE SPECIFIED)

2. ALL RESISTORS ARE IN OHMS
ALL CAPACITOR VALUES ARE IN MICROFARADS

5790A-1022

Figure 7-20. A62 Input Block Assembly

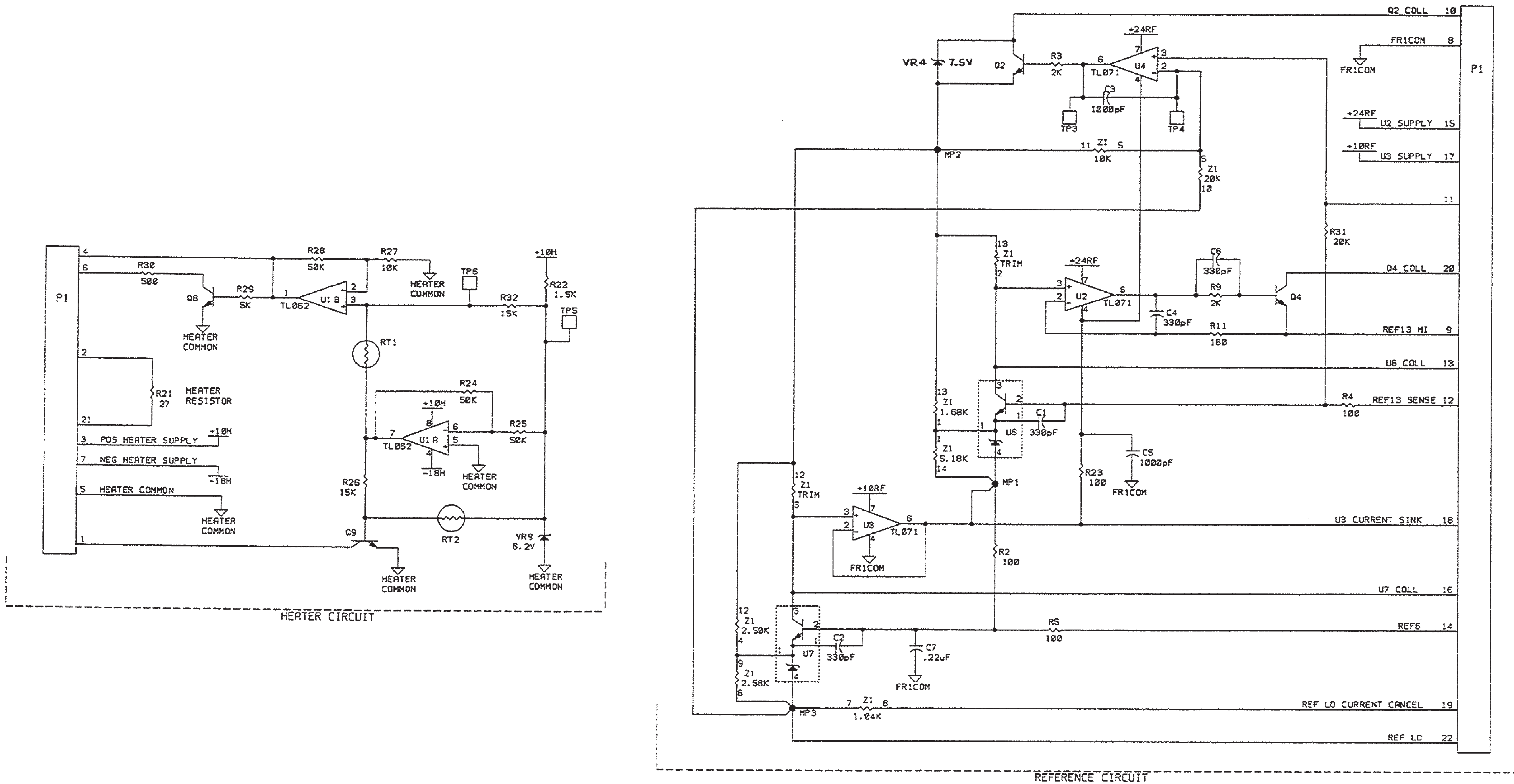


NOTES (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS, 5%.
2. U2 (8PIN PLASTIC DIP PACKAGE) TO BE MOUNTED FLUSH TO SUBSTRATE.
3. R21 (HEATER RESISTOR) IS DETERMINED BY EXTERNAL JUMPERS.
4. SUBSTRATE THICKNESS = 25 MIL.
5. USE LA155 LEADS (513622)
6. USE LOW THERMAL MATERIAL ON LEADS (P10 - PINS 10 & 11).

5790A-1H01

Figure 7-21. A16HR6 DC Amp Hybrid (on the A16 DAC PCA)



5790A-1H42

Figure 7-22. A16HR9 Reference Hybrid (on the A16 DAC PCA)

Appendices

Appendix	Title	Page

Appendix A
Glossary of AC-DC Transfer Related Terms

Absolute Uncertainty

Uncertainty that includes contributions from all sources, i.e., treability to national standards of the standards used, plus the uncertainty of the measurement process. Absolute uncertainty should be used to compute test uncertainty ratio. Also see “relative uncertainty”.

Accury

The degree to which the measured value of a quantity agrees with the cepted, consensus, or true value of that quantity. Accury is the same as 1 - % uncertainty. For example, an instrument specified to ±1 % uncertainty is 99 % curate. Also see “uncertainty”.

Artift Calibration

An instrument calibration technique that uses a calibration system within the instrument to reduce the number of required external standards to a small number of artift standards. The Fluke 5700A Calibrator uses Artift Calibration.

Artift Standard

A stable object that produces or embodies a physical quantity for use as a reference standard. An artift standard may have an assigned treable value when used for calibration purposes. Fluke 732A DC Voltage Reference Standard and the Fluke 742A Series Standard Resistors are examples. Also see “transfer standard”.

AC-DC Absolute Uncertainty

Includes all known error sources contributing to the uncertainty of an AC-DC difference correction. This includes NIST (National Institute of Standards and Technology) uncertainties, transfer uncertainty from a primary standard to working standard, and internal error contributions (both random and temperature related).

AC-DC Transfer

The process of comparing an AC voltage to a known DC voltage, thereby transferring the low uncertainty of the DC voltage to the AC voltage. The 792A can be used to perform two different types of AC-DC transfers:

1. An AC measurement
2. An AC-DC difference measurement

In an measurement, the transfer standard is used to determine absolute RMS voltage level. In an AC-DC difference measurement, the transfer standard is a reference that tests the and DC response of another transfer standard. The goal of an measurement is to determine the error of the source or voltmeter under test. The goal of an AC-DC difference measurement is a value called the “AC-DC difference”, which is positive when more voltage than DC voltage is required to produce the same output in the transfer standard under test.

AC-DC Difference

A measurement of an AC-DC transfer device's cury. The AC-DC difference is a transfer device's error when it compares a DC voltage to the same RMS voltage. A positive AC-DC difference indicates that more alternating than direct voltage is required to produce the same reading.

Base Units

Units in the SI system that are dimensionally independent. All other units are derived from base units. The only base unit in electricity is the ampere.

Buffer

1. An area of digital memory for temporary storage of data.
2. An additional amplifier stage to reduce output impedance levels.

Burden Voltage

The maximum sustainable voltage ross the terminals of a load.

Calibration

The comparison of a measurement system or device of unknown cury to a measurement system or device of known and greater cury to detect or correct any variation from required performance of the unverified measurement system or device. Also see “verification” and “treability”.

Calibration Constant

A coefficient that is applied manually or automatically to adjust the output or reading of an instrument.

Calibration Curve

A smooth curve drawn through a graph of calibration points.

Calibration Interval

The interval after which calibration must occur to maintain the performance of an instrument as stated in its specifications.

Calibration Report
A record of shifts or calibration constant changes that have occurred during calibration.

Calibrator
A device that supplies outputs with a known uncertainty for use in testing the cury of measurement devices or other sources.

Charterization
A calibration process that produces a calibration constant or known error for use in correcting the output or reading of an instrument or standard.

Common Mode Noise
An undesired signal that exists between a device's terminals and ground. Common mode noise is at the same potential on both terminals of a device. Also see “normal mode noise”.

Compliance Voltage
The maximum voltage that a constant-current source can supply.

Confidence Level
A percentage indicating certainty or assurance that an associated condition is true.

Control Chart
A chart devised to monitor one or more processes in order to detect the excessive deviation from a desired value of a component or process.

Crest Ftor
The ratio of the peak voltage to the RMS voltage of a waveform (with the DC component removed). Also see RMS.

DAC (Digital-to-Analog Converter)
A device or circuit that converts a digital waveform to an analog voltage.

Derived Units
Units in the SI system that are derived from base units. Volts, ohms, and watts are derived from amperes and other base and derived units.

Distribution Function
The expression of a relationship between the values and the corresponding frequencies of a variable.

Drift
Gradual change in a value over time.

Error
Deviation from correct value. The different types of error defined in this glossary are floor, gain, offset, linearity, random, scale, systematic, transfer, and zero.

Flatness

A measure of output level variation for an voltage source as frequency is varied. Flatness limits are normally specified as a ratio (%) to nominal output level at a reference frequency.

Floor Error

A contribution to measurement or source uncertainty that is independent of reading or output setting. In uncertainty specifications, floor error is often combined with fixed range errors and expressed in units such as microvolts or counts of the least significant digit. Also see “error”.

Full Scale

The upper limit of measurement or source value for which a given uncertainty specification applies, including any “overrange”. Also see “overrange” and “range”.

Gain Error

Same as scale error. An example of scale or gain error is, when the slope of a calibrator's displayed output vs. its true output is not extly 1. A calibrator with only gain error (no offset or linearity error), will read 0 V with 0 V on the display, but something other than 10 V with 10 V on the display.

Ground

The voltage reference point in a circuit. Earth ground is a connection through a ground rod or other conductor to the earth, usually cessible through the ground conductor in an power recepte.

Ground Loop

Undesirable current induced when there is more than one chassis ground potential in a system of instruments. Ground Loops can be minimized by connecting all instruments in a system to ground at one point.

Guard

A floating shield around sensitive circuitry inside an instrument. The guard provides a low-impedance path to ground for common-mode noise and ground currents, thereby eliminating errors introduced by such interference.

International System of Units

Same as “SI System of Units”; the cepted system of units. See also “units”, “base units”, and “derived units”.

Legal Units

The highest echelon in a system of units, for example the 1990 SI volt.

Life-Cycle Cost

The consideration of all elements contributing to the cost of an instrument throughout its useful life. This includes initial purchase cost, service and maintenance cost, and the cost of support equipment.

Linearity

The relationship between two quantities when a change in the first quantity is directly proportional to a change in the second quantity.

Linearity Error

Linearity Error occurs when the true output vs. selected output response curve of a calibrator is not extly a straight line. You can measure this type of error by plotting the response curve, then measuring how far the curve deviates from the straight line at various points.

MAP (Measurement Assurance Program)

A program for a measurement process. A MAP provides information to demonstrate that the total uncertainty of the measurements (data), including both random error and systematic components of error relative to national or other designated standards is quantified, and sufficiently small to meet requirements.

Maximum Transfer Time

Maximum time that an AC-DC transfer can be made to stay within the stated AC-DC absolute uncertainty.

Metrology

The science of, and the field of knowledge concerned with measurement.

Minimum V(Sub)in

For eh range of an / transfer standard, the minimum input RMS voltage for which uncertainty specifications apply. Also see RMS.

Minimum Use Specifications

Specifications computed to satisfy the calibration requirements of measurement or source device (UUT). Usually determined by a specified test uncertainty ratio between the absolute uncertainties of the UUT and its required calibration equipment. Also see Test Uncertainty Ratio.

Noise

An undesirable signal that is superimposed on a desired or expected signal. See “normal mode noise” and “common mode noise”.

Noise Floor

For an AC-DC transfer standard, the transfer uncertainty due to noise ftors.

Nonvolatile Memory

An electronic memory that retains its contents when the power is turned off.

Normal Mode Noise

An undesired signal that appears between the terminals of a device.

Offset Error

Same as zero error. The reading shown on a meter when an input value of zero is applied is its offset or zero error.

Parameters

Independent variables in a measurement process such as temperature, humidity, test lead resistance, etc.

Precision

The degree of agreement among independent measurements of a quantity under specified conditions. The precision of a measurement process is its coherence or repeatability. Note that while precision is necessary for cury, it does not imply it.

Predictability

A measure of what is known of the time-behavior of a device. A documented drift rate with understood charteristics (e.g., linear, exponential) can be highly predictable.

Primary Standard

A standard defined and maintained by some authority and used to calibrate all other secondary standards.

Process Metrology

Trking the cury drift of calibration and other equipment by applying statistical analysis to correction ftors obtained during calibration.

Random Error

Any error which varies in an unpredictable manner in absolute value and in sign when measurements of the same value of a quantity are made under effectively identical conditions.

Range

Stated upper limits of measurement or source values for which given uncertainty specifications apply. Also see “overrange” and “scale”.

Reference Standard

The highest-echelon standard in a laboratory; the standard that is used to maintain working standards that are used in routine calibration and comparison procedures.

Relative Uncertainty

Uncertainty specifications that are relative to a reference value, and not treable to national standards. Also see “absolute uncertainty”.

Reliability

A measure of the probability of failure of an instrument.

Repeatability

See “precision”.

Resistance

A property of a conductor that determines the amount of current that will flow when a given amount of voltage exists ross the conductor. Resistance is measured in ohms. One ohm is the resistance through which one volt of the potential will cause one ampere of current to flow.

Resolution

The smallest change in quantity that can be detected by a measurement system or device. For a given parameter, resolution is the smallest increment that can be measured, generated or displayed.

Reversal Error

Also called turnover error, the difference in output of an AC-DC transfer standard for the same DC input but with polarity reversed. The output logged for the DC reference should be the average of the two readings.

Retre Error

For an AC-DC transfer standard, the degree of agreement of output value readings when input is applied, removed, and reapplied over a specified time period.

RF (Radio Frequency)

The frequency range of radio waves; from 150 kHz up to the infrared range.

RMS (Root-Mean-Square)

The value assigned to an voltage or current that results in the same power dissipation in a resistance as a DC current or voltage of the same value.

RMS Sensor

A device that generates a DC output signal proportional to the RMS value of the input signal. RMS sensors operate by measuring the heat generated by a voltage through a known resistance (i.e., power); therefore, they sense true RMS voltage. RMS sensors are used to make AC-DC difference measurements.

Scale

The absolute span of the reading range of a measurement device including overrange capability.

Scale Error

See “gain error”.

Secondary Standard

A standard maintained by comparison against a primary standard.

Sensitivity

The degree of response of a measuring device to the change in input quantity, or a figure of merit that expresses the ability of a measurement system or device to respond to an input quantity.

Settling Time

The time taken for a measurement device's reading to stabilize after a voltage is applied to the input.

Shield

A grounded covering device designed to protect a circuit or cable from electromagnetic interference. Also see “guard”.

SI System of Units

The cepted International System of Units. See also “units”, “base units”, and “derived units”.

Specifications

A precise statement of the performance of a measurement or stimulus device.

Square Law

Defines the response of a device whose output is proportional to the square of the applied stimulus. Thermocouple-type transfer devices have a square-law response.

Stability

A measure of the freedom from drift relative to a reference value, over time and over changes in other variables such as temperature. Note that stability is not the same as uncertainty.

Standard

A device that is used as an ext value for reference and comparison.

Standard Cell

A primary cell that serves as a standard of voltage. The term “standard cell” often refers to a “Weston normal cell”, which is a wet cell with a mercury anode, a cadmium mercury amalgam cathode, and a cadmium sulfate solution as the electrolyte.

Systematic Error

Any error that remains constant or varies in a predictable manner as successive measurements of the same quantity are made under effectively identical conditions. Note that a known systematic error can be compensated for with a correction, whereas, a random error cannot. Also see “random error”.

Temperature Coefficient

A ftor used to calculate the change in indication or output of an instrument as a result of changes in temperature. Changes in temperature contribute to instrument uncertainty by an amount determined by the temperature coefficient.

Test Uncertainty Ratio

The numerical ratio of the uncertainty of the measurement system or device being calibrated or verified, and the uncertainty of the measurement system or reference device.

Thermal EMF

The voltage generated when two dissimilar metals joined together are heated.

Treability

The ability to relate individual measurement results to legally defined national standards through an unbroken chain of comparisons. Treability requires evidence produced on a continuing basis, such as calibration records, that the measurement process is producing results for which the total measurement uncertainty relative to national standards is quantified.

Transfer

See “AC-DC transfer”.

Transfer Error

Error induced by the process of comparing one standard or instrument with another. This does not include the uncertainty of the transfer standard.

Transfer Stability

Change in the AC-DC Difference correction over time, with stated conditions.

Transfer Standard

Any standard used to intercompare one measurement or source device with another. Note that a transfer standard needs only to be stable for the duration of the transfer. It does not need an assigned value.

Transport Standard

A transfer standard that is rugged enough to allow the shipment by common carrier to another location.

True Value

Also called as legal value, the cepted consensus, i.e., the correct value of the quantity being measured.

Uncertainty

The range of values, usually centered on the indicated or requested value, within which the true, cepted, or consensus value is expected to lie with stated probability or confidence. Fluke uses 99.7 % (3σ) confidence limits. Uncertainty is a quantification of incury.

Units

Symbols or names that define the measured quantities. Examples of units are: V, mV, A, kW, and dBm. See also “SI System of Units”.

UUT (Unit Under Test)

An abbreviated name for an instrument that is being tested or calibrated.

Volt

The unit of emf (electromotive force) or electrical potential in the SI system of units. One volt is the difference of electrical potential between two points on a conductor carrying one ampere of current, when the power being dissipated between these two points is equal to one watt.

The unit of power in the SI system of units. One watt is the power required to do work at the rate of one joule/second. In terms of volts and ohms, one watt is the power dissipated by one ampere flowing through a one-ohm load.

In instrumentation, wideband refers to the ability to measure or generate signals in the radio frequency spectrum.

Verification

The comparison of a measurement or source device (UUT) with a measurement or source device of known and lesser uncertainty, to report variation from required performance. Verification does not include adjustment or reassignment of values to UUT, and is often done to determine whether the adjustment is necessary. Also see “calibration”.

Working Standard

A standard that is used in routine calibration and comparison procedures in the laboratory, and is maintained by comparison to reference standards.

Zero Error

Same as offset error. The reading shown on a meter when an input value of zero is applied is its zero or offset error.

Appendix B
ASCII and IEEE – 488 Bus Codes

ASCII Char.	Decimal	Octal	Hex	Binary 7654 3210	Dev. No.	Message ATN = True	
NUL	0	000	00	0000 0000			ADDRESSED COMMANDS
SOH	1	001	01	0000 0001		GTL	
STX	2	002	02	0000 0010			
ETX	3	003	03	0000 0011			
EOT	4	004	04	0000 0100		SDC	
ENQ	5	005	05	0000 0101		PPC	
ACK	6	006	06	0000 0110			
BELL	7	007	07	0000 0111			
BS	8	010	08	0000 1000		GET	
HT	9	011	09	0000 1001		TCT	
LF	10	012	0A	0000 1010			
VT	11	013	0B	0000 1011			
FF	12	014	0C	0000 1100			
CR	13	015	0D	0000 1101			
SO	14	016	0E	0000 1110			
SI	15	017	0F	0000 1111			

ASCII Char.	Decimal	Octal	Hex	Binary 7654 3210	Dev. No.	Message ATN = True	
DLE	16	020	10	0001 0000			UNIVARSAL COMMANDS
DC1	17	021	11	0001 0001		LLO	
DC2	18	022	12	0001 0010			
DC3	19	023	13	0001 0011			
DC4	20	024	14	0001 0100		DCL	
NAK	21	025	15	0001 0101		PPU	
SYN	22	026	16	0001 0110			
ETB	23	027	17	0001 0111			
CAN	24	030	18	0001 1000		SPE	
EM	25	031	19	0001 1001		SPD	
SUB	26	032	1A	0001 1010			
ESC	27	033	1B	0001 1011			
FS	28	034	1C	0001 1100			
GS	29	035	1D	0001 1101			
RS	30	036	1E	0001 1110			
US	31	037	1F	0001 1111			
SPACE	32	040	20	0010 0000	0	MLA	LISTEN ADDRESSES
!	33	041	21	0010 0001	1	MLA	
”	34	042	22	0010 0010	2	MLA	
#	35	043	23	0010 0011	3	MLA	
S	36	044	24	0010 0100	4	MLA	
%	37	045	25	0010 0101	5	MLA	
&	38	046	26	0010 0110	6	MLA	
‘	39	047	27	0010 0111	7	MLA	
(	40	050	28	0010 1000	8	MLA	
)	41	051	29	0010 1001	9	MLA	
“	42	052	2A	0010 1010	10	MLA	
:-	43	053	2B	0010 1011	11	MLA	
`	44	054	2C	0010 1100	12	MLA	
-	45	055	2D	0010 1101	13	MLA	
.	46	056	2E	0010 1110	14	MLA	
/	47	057	2F	0010 1111	15	MLA	

ASCII Char.	Decimal	Octal	Hex	Binary 7654 3210	Dev. No.	Message ATN = True	
0	48	060	30	0011 0000	16	MLA	
1	49	061	31	0011 0001	17	MLA	
2	50	062	32	0011 0010	18	MLA	
3	51	063	33	0011 0011	19	MLA	
4	52	064	34	0011 0100	20	MLA	
5	53	065	35	0011 0101	21	MLA	
6	54	066	36	0011 0110	22	MLA	
7	55	067	37	0011 0111	23	MLA	
8	56	070	38	0011 1000	24	MLA	
9	57	071	39	0011 1001	25	MLA	
:	58	072	3A	0011 1010	26	MLA	
:	59	073	3B	0011 1011	27	MLA	
<	60	074	3C	0011 1100	28	MLA	
=	61	075	3D	0011 1101	29	MLA	
>	62	076	3E	0011 1110	30	MLA	
?	63	077	3F	0011 1111		UNL	
@	64	100	40	0100 0000	0	MTA	TALK ADDRESSES
A	65	101	41	0100 0001	1	MTA	
B	66	102	42	0100 0010	2	MTA	
C	67	103	43	0100 0011	3	MTA	
D	68	104	44	0100 0100	4	MTA	
E	69	105	45	0100 0101	5	MTA	
F	70	106	46	0100 0110	6	MTA	
G	71	107	47	0100 0111	7	MTA	
H	72	110	48	0100 1000	8	MTA	
I	73	111	49	0100 1001	9	MTA	
J	74	112	4A	0100 1010	10	MTA	
K	75	113	4B	0100 1011	11	MTA	
L	76	114	4C	0100 1100	12	MTA	
M	77	115	4D	0100 1101	13	MTA	
N	78	116	4E	0100 1110	14	MTA	
O	79	117	4F	0100 1111	15	MTA	

ASCII Char.	Decimal	Octal	Hex	Binary 7654 3210	Dev. No.	Message ATN = True	
P	80	120	50	0101 0000	16	MTA	
Q	81	121	51	0101 0001	17	MTA	
R	82	122	52	0101 0010	18	MTA	
S	83	123	53	0101 0011	19	MTA	
T	84	124	54	0101 0100	20	MTA	
U	85	125	55	0101 0101	21	MTA	
V	86	126	56	0101 0110	22	MTA	
W	87	127	57	0101 0111	23	MTA	
X	88	130	58	0101 1000	24	MTA	
Y	89	131	59	0101 1001	25	MTA	
Z	90	132	5A	0101 1010	26	MTA	
[	91	133	5B	0101 1011	27	MTA	
\	92	134	5C	0101 1100	28	MTA	
]	93	135	5D	0101 1101	29	MTA	
^	94	136	5E	0101 1110	30	MTA	
_	95	137	5F	0101 1111		UNT	
‘	96	140	60	0110 0000	0	MSA	SECONDARY ADDRESSES
a	97	141	61	0110 0001	1	MSA	
b	98	142	62	0110 0010	2	MSA	
c	99	143	63	0110 0011	3	MSA	
d	100	144	64	0110 0100	4	MSA	
e	101	145	65	0110 0101	5	MSA	
f	102	146	66	0110 0110	6	MSA	
g	103	147	67	0110 0111	7	MSA	
h	104	150	68	0110 1000	8	MSA	
i	105	151	69	0110 1001	9	MSA	
j	106	152	6A	0110 1010	10	MSA	
k	107	153	6B	0110 1011	11	MSA	
l	108	154	6C	0110 1100	12	MSA	
m	109	155	6D	0110 1101	13	MSA	
n	110	156	6E	0110 1110	14	MSA	
o	111	157	6F	0110 1111	15	MSA	

ASCII Char.	Decimal	Octal	Hex	Binary 7654 3210	Dev. No.	Message ATN = True	
p	112	160	70	0111 0000	16	MSA	
q	113	161	71	0111 0001	17	MSA	
r	114	162	72	0111 0010	18	MSA	
s	115	163	73	0111 0011	19	MSA	
t	116	164	74	0111 0100	20	MSA	
u	117	165	75	0111 0101	21	MSA	
v	118	166	76	0111 0110	22	MSA	
w	119	167	77	0111 0111	23	MSA	
x	120	170	78	0111 1000	24	MSA	
y	121	171	79	0111 1001	25	MSA	
z	122	172	7A	0111 1010	26	MSA	
{	123	173	7B	0111 1011	27	MSA	
|	124	174	7C	0111 1100	28	MSA	
}	125	175	7D	0111 1101	29	MSA	
~	126	176	7E	0111 1110	30	MSA	
	127	177	7F	0111 1111			

Appendix C
Calibration Constant Information

The constants in these tables are arranged by group. Eh group is stored as a block in nonvolatile memory. The value given for eh constant in this list is the default assigned value before the instrument is first calibrated. Defaults are reinstated if you perform a format of the EEPROM ALL or CAL areas.

Note

Refer to Chapter 2 of the 5790A Service Manual for calibration constant theory of operation.

Table C-1. Group ZC_BASIC: Internally Calibrated DAC, Sensor, and A/D Parameters

Name	Default	Function
DAC_Z1	398.0	Reference DAC zero, coarse channel
DAC_Z2	17500.0	Reference DAC zero, fine channel
DAC_RATIO	16500.0	Reference DAC coarse/fine gain ratio
AD_X1_Z	0.0	A/D x1 range zero
AD_X1_G	–7.23E-6	A/D x1 range gain
AD_X10_Z	0.0	A/D x100 range zero
AD_X10_G	7.23E-8	A/D x100 range gain
NULLDAC_Z	0.0	Null DAC zero
NULLDAC_G	6560.0	Null DAC gain
SENSOR_C1	1.0	Main thermal sensor linearization
SENSOR_C2	0.0	Main thermal sensor linearization
OF_VSQ	0.0	Main thermal sensor turnover connection

Table C-2. Group FREQ: Frequency Counter Gain

Name	Default	Function
FREQ_G	1.0	(see title)

Table C-3. Group DC_DAC: Reference DAC Coarse Channel Gain

Name	Default	Function
DAC_G	3017.0	(see title)

Table C-4. Group WDC_SENSOR: Wideband Sensor Linearization

Name	Default	Function
SENSOR_C1_WB	3.162277660e-03	Wideband thermal sensor linearization
Sensor_c2_wb	0.0	Wideband thermal sensor linearization

Table C-5. Group AC_LINEARITY:Low Frequency Linearization

Name	Default	Function
LN_C	.02	(see title)

Table C-6. Group FACTORY: Ftory/Service Calibrated Corrections

Name	Default	Function
INPUT2_LO	150.0E-6	(INPUT2 vs. INPUT1 flatness, <2.2 V)
INPUT2_MID	350.0E-6	(INPUT2 vs. INPUT1 flatness, <2.2 - 220 V)
INPUT2_HI	–17.0E-6	(INPUT2 vs. INPUT1 flatness, >220 V)

Table C-7. Group DC_2_2MV: DC Constants, 2.2 mV Range

Name	Default	Function
DI_2_2MV	5000.0	Basic gain (Ref. DAC to input ratio)
OF_2_2MV	0.0	Full scale calibrated DC offset

Table C-8. Group ZC_2_2MV: More DC Constants, 2.2 mV Range

Name	Default	Function
Z_2_2MV	0.0	Zero calibrated DC offset
SHO_2_2MV	0.0	Shunt input DC offset
IA_2_2MV	0.001	Rough gain (input to A/D ratio)

Table C-9. Group AC_2_2MV: Flatness Constants, 2.2 mV Range

Name	Default	Function
F1_2_2MV	1.0	(10 Hz)
F2_2_2MV	1.0	(1 kHz)
F3_2_2MV	1.0	(20 kHz)
F4_2_2MV	1.0	(300 kHz)
F5_2_2MV	1.0	(500 kHz)
F6_2_2MV	1.0	(800 kHz)
F7_2_2MV	1.0	(1 MHz)

Table C-10. Group DC_7MV: DC Constants, 7 mV Range

Name	Default	Function
DI_7MV	1000.0	Basic gain (Ref. DAC to input ratio)
OF_7MV	0.0	Full scale calibrated DC offset

Table C-11. Group ZC_7MV: More DC Constants, 7 mV Range

Name	Default	Function
Z_7MV	0.0	Zero calibrated DC offset
SHO_7MV	0.0	Shunt input DC offset
IA_7MV	0.00316228	Rough gain (input to A/D ratio)

Table C-12. Group AC_7MV: Flatness Constants, 7 mV Range

Name	Default	Function
F1_7MV	1.0	(10 Hz)
F2_7MV	1.0	(1 kHz)
F3_7MV	1.0	(20 kHz)
F4_7MV	1.0	(300 kHz)
F5_7MV	1.0	(500 kHz)
F6_7MV	1.0	(800 kHz)
F7_7MV	1.0	(1 MHz)

Table C-13. Group DC_22MV: DC Constants, 22 mV Range

Name	Default	Function
DI_22MV	500.0	Basic gain (Ref. DAC to input ratio)
OF_22MV	0.0	Full scale calibrated DC offset

Table C-14. Group ZC_22MV: More DC Constants, 22 mV Range

Name	Default	Function
Z_22MV	0.0	Zero calibrated DC offset
SHO_22MV	0.0	Shunt input DC offset
IA_22MV	0.001	Rough gain (input to A/D ratio)

Table C-15. Group AC_22MV Flatness Constants, 22 mV Range

Name	Default	Function
F1_22MV	1.0	(10 Hz)
F2_22MV	1.0	(1 kHz)
F3_22MV	1.0	(20 kHz)
F4_22MV	1.0	(300 kHz)
F5_22MV	1.0	(500 kHz)
F6_22MV	1.0	(1 MHz)

Table C-16. Group DC_70MV: DC Constants, 70 mV Range

Name	Default	Function
DI_70MV	100.0	Basic gain (Ref. DAC to input ratio)
OF_70MV	0.0	Full scale calibrated DC offset

Table C-17. Group ZC_70MV: More DC Constants, 70 mV Range

Name	Default	Function
Z_70MV	0.0	Zero calibrated DC offset
SHO_70MV	0.0	Shunt input DC offset
IA_70MV	0.0316228	Rough gain (input to A/D ratio)

Table C-18. Group AC_70MV: Flatness Constants, 70 mV Range

Name	Default	Function
F1_70MV	1.0	(10 Hz)
F2_70MV	1.0	(1 kHz)
F3_70MV	1.0	(20 kHz)
F4_70MV	1.0	(300 kHz)
F5_70MV	1.0	(1 MHz)

Table C-19. Group DC_220MV: DC Constants, 220 mV Range

Name	Default	Function
DI_220MV	50.0	Basic gain (Ref. DAC to input ratio)
OF_220MV	0.0	Full scale calibrated DC offset

Table C-20. Group ZC_220MV: More DC Constants, 220 mV Range

Name	Default	Function
Z_220MV	0.0	Zero calibrated DC offset
SHO_220MV	0.0	Shunt input DC offset
IA_220MV	0.1	Rough gain (input to A/D ratio)

Table C-21. Group AC_220MV: Flatness Constants, 220 mV Range

Name	Default	Function
F1_220MV	1.0	(10 Hz)
F2_220MV	1.0	(1 kHz)
F3_220MV	1.0	(20 kHz)
F4_220MV	1.0	(300 kHz)
F5_220MV	1.0	(1 MHz)

Table C-22. Group DC_700MV: DC Constants, 700 mV Range

Name	Default	Function
DI_700MV	10.0	Basic gain (Ref. DAC to input ratio)
OF_700MV	0.0	Full scale calibrated DC offset

Table C-23. Group ZC_700MV: More DC Constants, 700 mV Range

Name	Default	Function
Z_700MV	0.0	Zero calibrated DC offset
SHO_700MV	0.0	Shunt input DC offset
IA_700MV	0.316228	Rough gain (input to A/D ratio)

Table C-24. Group AC_700MV: Flatness Constants, 700 mV Range

Name	Default	Function
F1_700MV	1.0	(10 Hz)
F2_700MV	1.0	(1 kHz)
F3_700MV	1.0	(20 kHz)
F4_700MV	1.0	(300 kHz)
F5_700MV	1.0	(1 MHz)

Table C-25. Group DC_2_2V: DC constants, mV Range

Name	Default	Function
DI_2_2V	5.0	Basic gain (Ref. DAC to input ratio)
OF_2_2V	0.0	Full scale calibrated DC offset

Table C-26. Group ZC_2_2V: More DC Constants, mV Range

Name	Default	Function
Z_2_2V	0.0	Zero calibrated DC offset
IA_2_2V	1.0	Rough gain (input to A/D ratio)

Table C-27. Group AC_2_2V: Flatness Constants, mV Range

Name	Default	Function
F1_2_2V	1.0	(10 Hz)
F2_2_2V	1.0	(1 kHz)
F3_2_2V	1.0	(20 kHz)
F4_2_2V	1.0	(300 kHz)
F5_2_2V	1.0	(1 MHz)

Table C-28. Group DC_7V: DC Constants, 7 V Range

Name	Default	Function
DI_7V	1.0	Basic gain (Ref. DAC to input ratio)
OF_7V	0.0	Full scale calibrated DC offset

Table C-29. Group ZC_7V: More DC Constants, 7 V Range

Name	Default	Function
Z_7V	0.0	Zero calibrated DC offset
IA_7V	3.16228	Rough gain (input to A/D ratio)

Table C-30. Group AC_7V: Flatness Constants, 7 V Range

Name	Default	Function
F1_7V	1.0	(10 Hz)
F2_7V	1.0	(1 kHz)
F3_7V	1.0	(20 kHz)
F4_7V	1.0	(100 kHz)

Table C-31. Group DC_7VHF: DC Constants, High Frequency 7 V Range

Name	Default	Function
DI_7VHF	1.0	Basic gain (Ref. DAC to input ratio)

Table C-32. Group ZC_7VHF: More DC Constants, High Frequency 7 V Range

Name	Default	Function
IA_7VHF	3.16228	Rough gain (input to A/D ratio)

Table C-33. Group AC_7VHF: Flatness Constants, High Frequency 7 V Range

Name	Default	Function
F1_7VHF	1.0	(100 kHz)
F2_7VHF	1.0	(300 kHz)
F3_7VHF	1.0	(500 kHz)
F4_7VHF	1.0	(800 kHz)
F5_7VHF	1.0	(1 MHz)

Table C-34. Group DC_22V: DC Constants, 22 V Range

Name	Default	Function
DI_22V	0.5	Basic gain (Ref. DAC to input ratio)
OF_22V	0.0	Full scale calibrated DC offset

Table C-35. Group ZC_22V: More DC Constants, 22 V Range

Name	Default	Function
Z_22V	0.0	Zero calibrated DC offset
IA_22V	10.0	Rough gain (input to A/D ratio)

Table C-36. Group AC_22V: Flatness Constants, 22 V Range

Name	Default	Function
F1_22V	1.0	(10 Hz)
F2_22V	1.0	(1 kHz)
F3_22V	1.0	(20 kHz)
F4_22V	1.0	(100 kHz)

Table C-37. Group DC_22VHF: DC Constants, High Frequency 22 V Range

Name	Default	Function
DI_22VHF	0.5	Basic gain (Ref. DAC to input ratio)

Table C-38. Group ZC_22VHF: More DC Constants, High Frequency 22 V Range

Name	Default	Function
IA_22VHF	10.0	Rough gain (input to A/D ratio)

Table C-39. Group AC_22VHF: Flatness Constants, High Frequency 22 V Range

Name	Default	Function
F1_22VHF	1.0	(100 kHz)
F2_22VHF	1.0	(300 kHz)
F3_22VHF	1.0	(500 kHz)
F4_22VHF	1.0	(1 MHz)

Table C-40. Group DC_70V: DC Constants, 70 V Range

Name	Default	Function
DI_70V	0.1	Basic gain (Ref. DAC to input ratio)
OF_70V	0.0	Full scale calibrated DC offset

Table C-41. Group ZC_70V: More DC Constants, 70 V Range

Name	Default	Function
Z_70V	0.0	Zero calibrated DC offset
IA_70V	31.6228	Rough gain (input to A/D ratio)

Table C-42. Group AC_70V: Flatness Constants, 70 V Range

Name	Default	Function
F1_70V	1.0	(10 Hz)
F2_70V	1.0	(1 kHz)
F3_70V	1.0	(20 kHz)
F4_70V	1.0	(500 kHz)
F5_70V	1.0	(1 MHz)

Table C-43. Group DC_220V: DC Constants, 220 V Range

Name	Default	Function
DI_220V	0.05	Basic gain (Ref. DAC to input ratio)
OF_220V	0.0	Full scale calibrated DC offset

Table C-44. Group ZC_220V: More DC Constants, 220 V Range

Name	Default	Function
Z_220V	0.0	Zero calibrated DC offset
IA_220V	100.0	Rough gain (input to A/D ratio)

Table C-45. Group AC_220V: Flatness Constants, 220 V Range

Name	Default	Function
F1_220V	1.0	(10 Hz)
F2_220V	1.0	(1 kHz)
F3_220V	1.0	(20 kHz)
F4_220V	1.0	(100 kHz)

Table C-46. Group DC_700V: DC Constants, 700 V Range

Name	Default	Function
DI_700V	0.01	Basic gain (Ref. DAC to input ratio)
OF_700V	0.0	Full scale calibrated DC offset

Table C-47. Group ZC_700V: More DC Constants, 700 V Range

Name	Default	Function
Z_700V	0.0	Zero calibrated DC offset
IA_700V	316.228	Rough gain (input to A/D ratio)

Table C-48. Group AC_700V: Flatness Constants, 700 V Range

Name	Default	Function
F1_700V	1.0	(10 Hz)
F2_700V	1.0	(1 kHz)
F3_700V	1.0	(20 kHz)
F4_700V	1.0	(100 kHz)

Table C-49. Group DC_1000V: DC Constants, 1000 V Range

Name	Default	Function
DI_1000V	0.005	Basic gain (Ref. DAC to input ratio)
OF_1000V	0.0	Full scale calibrated DC offset

Table C-50. Group ZC_1000V: More DC Constants, 1000 V Range

Name	Default	Function
Z_1000V	0.0	Zero calibrated DC offset
IA_1000V	1000.0	Rough gain (input to A/D ratio)

Table C-51. Group AC_1000V: Flatness Constants, 1000 V Range

Name	Default	Function
F1_1000V	1.0	(10 Hz)
F2_1000V	1.0	(1 kHz)
F3_1000V	1.0	(20 kHz)
F4_1000V	1.0	(100 kHz)

Table C-52. Group WDC_2_2MV: Gain Constants, Wideband 2.2 mV Range

Name	Default	Function
DI_2_2MV_WB	5000.0	Basic gain (Ref. DAC to input ratio)
IA_2_2MV_WB	0.0316228	Rough gain (input to A/D ratio)

Table C-53. Group WAC_2_2MV: Flatness Constants, Wideband 2.2 mV Range

Name	Default	Function
F1_2_2MV_WB	1.0	(10 Hz)
F2_2_2MV_WB	1.0	(100 Hz)
F3_2_2MV_WB	1.0	(1 kHz)
F4_2_2MV_WB	1.0	(10 kHz)
F5_2_2MV_WB	1.0	(50 kHz)
F6_2_2MV_WB	1.0	(200 kHz)
F7_2_2MV_WB	1.0	(500 kHz)
F8_2_2MV_WB	1.0	(1 MHz)
F9_2_2MV_WB	1.0	(2 MHz)
F10_2_2MV_WB	B 1.0	(4 MHz)
F11_2_2MV_WB	B 1.0	(8 MHz)
F12_2_2MV_WB	B 1.0	(10 MHz)
F13_2_2MV_WB	B 1.0	(15 MHz)
F14_2_2MV_WB	B 1.0	(20 MHz)
F15_2_2MV_WB	B 1.0	(26 MHz)
F16_2_2MV_WB	B 1.0	(30 MHz)

Table C-54. Group WDC_7MV: Gain Constants, Wideband 7 mV Range

Name	Default	Function
DI_7MV_WB	1000.0	Basic gain (Ref. DAC to input ratio)
IA _7MV_WB	0.1	Rough gain (input to A/D ratio)

Table C-55. Group WAC_7MV: Flatness Constants, Wideband 7 mV Range

Name	Default	Function
F1_7MV_WB	1.0	(10 Hz)
F2_7MV_WB	1.0	(100 Hz)
F3_7MV_WB	1.0	(1 kHz)
F4_7MV_WB	1.0	(10 kHz)
F5_7MV_WB	1.0	(50 kHz)
F6_7MV_WB	1.0	(200 kHz)
F7_7MV_WB	1.0	(500 kHz)
F8_7MV_WB	1.0	(1 MHz)
F9_7MV_WB	1.0	(2 MHz)
F10_7MV_WB	1.0	(4 MHz)
F11_7MV_WB	1.0	(8 MHz)
F12_7MV_WB	1.0	(10 MHz)
F13_7MV_WB	1.0	(15 MHz)
F14_7MV_WB	1.0	(20 MHz)
F15_7MV_WB	1.0	(26 MHz)
F16_7MV_WB	1.0	(30 MHz)

Table C-56. Group WDC_22MV: Gain Constants, Wideband 22 mV Range

Name	Default	Function
DI_22MV_WB	500.0	Basic gain (Ref. DAC to input ratio)
IA_22MV_WB	0.316228	Rough gain (input to A/D ratio)

Table C-57. Group WAC_22MV: Flatness Constants, Wideband 22 mV Range

Name	Default	Function
F1_22MV_WB	1.0	(10 Hz)
F2_22MV_WB	1.0	(100 Hz)
F3_22MV_WB	1.0	(1 kHz)
F4_22MV_WB	1.0	(10 kHz)
F5_22MV_WB	1.0	(50 kHz)

Name	Default	Function
F6_22MV_WB	1.0	(200 kHz)
F7_22MV_WB	1.0	(500 kHz)
F8_22MV_WB	1.0	(1 MHz)
F9_22MV_WB	1.0	(2 MHz)
F10_22MV_WB	1.0	(4 MHz)
F11_22MV_WB	1.0	(8 MHz)
F12_22MV_WB	1.0	(10 MHz)
F13_22MV_WB	1.0	(15 MHz)
F14_22MV_WB	1.0	(20 MHz)
F15_22MV_WB	1.0	(26 MHz)
F16_22MV_WB	1.0	(30 MHz)

Table C-58. Group WDC_70MV: Gain Constants, Wideband 70 mV Range

Name	Default	Function
DI_70MV_WB	100.0	Basic gain (Ref. DAC to input ratio)
IA_70MV_WB	1.0	Rough gain (input to A/D ratio)

Table C-59. Group WAC_70MV: Flatness Constants, Wideband 70 mV Range

Name	Default	Function
F1_70MV_WB	1.0	(10 Hz)
F2_70MV_WB	1.0	(100 Hz)
F3_70MV_WB	1.0	(1 kHz)
F4_70MV_WB	1.0	(10 kHz)
F5_70MV_WB	1.0	(50 kHz)
F6_70MV_WB	1.0	(200 kHz)
F7_70MV_WB	1.0	(500 kHz)
F8_70MV_WB	1.0	(1 MHz)
F9_70MV_WB	1.0	(2 MHz)
F10_70MV_WB	1.0	(4 MHz)
F11_70MV_WB	1.0	(8 MHz)
F12_70MV_WB	1.0	(10 MHz)
F13_70MV_WB	1.0	(15 MHz)
F14_70MV_WB	1.0	(20 MHz)
F15_70MV_WB	1.0	(26 MHz)
F16_70MV_WB	1.0	(30 MHz)

Table C-60. Group WDC_220MV: Gain Constants, Wideband 220 mV Range

Name	Default	Function
DI_220MV_WB	31.6228	Basic gain (Ref. DAC to input ratio)
IA_220MV_WB	3.16228	Rough gain (input to A/D ratio)

Table C-61. Group WAC_220MV: Flatness Constants, Wideband 220 mV Range

Name	Default	Function
F1_220MV_WB	1.0	(10 Hz)
F2_220MV_WB	1.0	(100 Hz)
F3_220MV_WB	1.0	(1 kHz)
F4_220MV_WB	1.0	(10 kHz)
F5_220MV_WB	1.0	(50 kHz)
F6_220MV_WB	1.0	(200 kHz)
F7_220MV_WB	1.0	(500 kHz)
F8_220MV_WB	1.0	(1 MHz)
F9_220MV_WB	1.0	(2 MHz)
F10_220MV_WB	B 1.0	(4 MHz)
F11_220MV_WB	B 1.0	(8 MHz)
F12_220MV_WB	B 1.0	(10 MHz)
F13_220MV_WB	B 1.0	(15 MHz)
F14_220MV_WB	B 1.0	(20 MHz)
F15_220MV_WB	B 1.0	(26 MHz)
F16_220MV_WB	B 1.0	(30 MHz)

Table C-62. Group WDC_700MV: Gain Constants, Wideband 700 mV Range

Name	Default	Function
DI_700MV_WB	10.0	Basic gain (Ref. DAC to input ratio)
IA_700MV_WB	10.0	Rough gain (input to A/D ratio)

Table C-63. Group WAC_700MV: Flatness Constants, Wideband 700 mV Range

Name	Default	Function
F1_700MV_WB	1.0	(10 Hz)
F2_700MV_WB	1.0	(100 Hz)
F3_700MV_WB	1.0	(1 kHz)
F4_700MV_WB	1.0	(10 kHz)
F5_700MV_WB	1.0	(50 kHz)

Name	Default	Function
F6_700MV_WB	1.0	(200 kHz)
F7_700MV_WB	1.0	(500 kHz)
F8_700MV_WB	1.0	(1 MHz)
F9_700MV_WB	1.0	(2 MHz)
F10_700MV_WB	B 1.0	(4 MHz)
F11_700MV_WB	B 1.0	(8 MHz)
F12_700MV_WB	B 1.0	(10 MHz)
F13_700MV_WB	B 1.0	(15 MHz)
F14_700MV_WB	B 1.0	(20 MHz)
F15_700MV_WB	B 1.0	(26 MHz)
F16_700MV_WB	B 1.0	(30 MHz)

Table C-64. Group WDC_2_2V: Gain Constants, Wideband 2.2 V Range

Name	Default	Function
DI_2_2V_WB	3.16228	Basic gain (Ref. DAC to input ratio)
IA_2_2V _WB	31.6228	Rough gain (input to A/D ratio)

Table C-65. Group WAC_2_2V: Flatness Constants, Wideband 2.2 V Range

Name	Default	Function
F1_2_2V _WB	1.0	(10 Hz)
F2_2_2V _WB	1.0	(100 Hz)
F3_2_2V _WB	1.0	(1 kHz)
F4_2_2V _WB	1.0	(10 kHz)
F5_2_2V _WB	1.0	(50 kHz)
F6_2_2V _WB	1.0	(200 kHz)
F7_2_2V _WB	1.0	(500 kHz)
F8_2_2V _WB	1.0	(1 MHz)
F9_2_2V _WB	1.0	(2 MHz)
F10_2_2V _WB	1.0	(4 MHz)
F11_2_2V _WB	1.0	(8 MHz)
F12_2_2V _WB	1.0	(10 MHz)
F13_2_2V _WB	1.0	(15 MHz)
F14_2_2V _WB	1.0	(20 MHz)
F15_2_2V _WB	1.0	(26 MHz)
F16_2_2V _WB	1.0	(30 MHz)

Table C-66. Group WDC_7V: Gain Constants, Wideband 7 V Range

Name	Default	Function
DI_7V_WB	1.0	Basic gain (Ref. DAC to input ratio)
IA_7V _WB	100.0	Rough gain (input to A/D ratio)

Table C-67. Group WAC_7V: Flatness Constants, Wideband 7 V Range

Name	Default	Function
F1_7V _WB	1.0	(10 Hz)
F2_7V _WB	1.0	(100 Hz)
F3_7V _WB	1.0	(1 kHz)
F4_7V _WB	1.0	(10 kHz)
F5_7V _WB	1.0	(50 kHz)
F6_7V _WB	1.0	(200 kHz)
F7_7V _WB	1.0	(500 kHz)
F8_7V _WB	1.0	(1 MHz)
F9_7V _WB	1.0	(2 MHz)
F10_7V _WB	1.0	(4 MHz)
F11_7V _WB	1.0	(8 MHz)
F12_7V _WB	1.0	(10 MHz)
F13_7V _WB	1.0	(15 MHz)
F14_7V _WB	1.0	(20 MHz)
F15_7V _WB	1.0	(26 MHz)
F16_7V _WB	1.0	(30 MHz)