AIR FORCE T.O. 31M1-2FMQ13-3
ARMY TM 11-6660-282-30

TECHNICAL MANUAL

CIRCUIT DIAGRAM MANUAL

WIND MEASURING SET AN/FMQ-13(V)

The Sutron Corporation
F04606-85-C-0733

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i	0				
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iii - iv	0				
FP-1 - FP-74	0				

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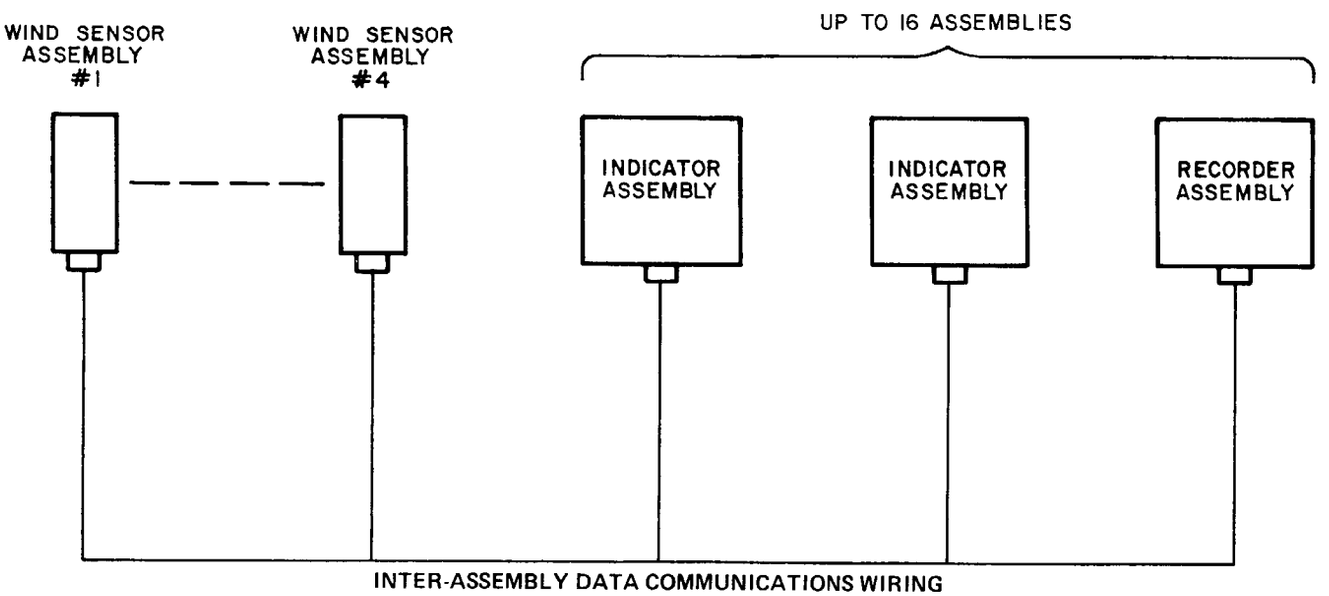
Forward. This manual provides the circuit diagrams for the AN/FMQ-13(V) Digital Wind Measuring Set. This manual contains block diagrams, signal flow diagrams, and schematic diagrams. Presentation of the diagrams starts with a block diagram of the AN/FMQ-13(V) Wind Measuring Set. This is followed by the diagrams for the ML-660 and ML-660A Wind Direction and Wind Speed Sensor. The sensor diagrams are followed by the diagrams for the ID-2408 Wind Direction and Wind Speed Indicator and the RO-588 Wind Direction and Wind Speed Recorder. The organization of the diagrams for each assembly starts with a block diagram. The block diagram is followed by signal flow diagrams. Schematic diagrams follow the signal flow diagrams.

TABLE OF ILLUSTRATIONS

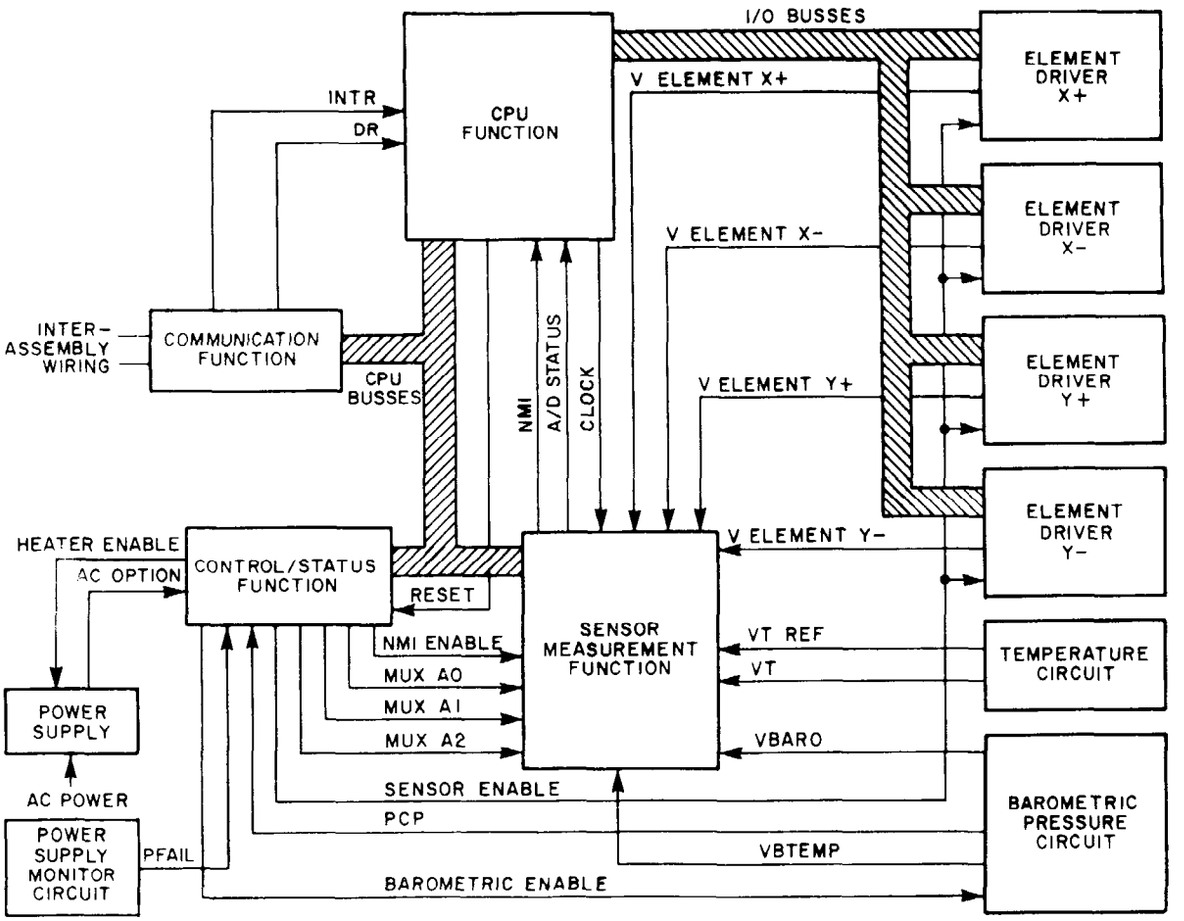
Figure No.	Title	Page
FO-1	Wind Measuring Set AN/FMQ-13(V) - Block Diagram	FP-1
FO-2	Sensor - Block Diagram	FP-3
FO-3	Sensor - Element Driver Function, Signal Flow Diagram	FP-5
FO-4	Sensor - Measurement Function, Signal Flow Diagram	FP-7
FO-5	Sensor - Power Failure, Temperature, and Barometric Pressure Circuits, Signal Flow Diagram	FP-9
FO-6	Sensor - Control/Status Function, Signal Flow Diagram	FP-11
FO-7	Sensor - CPU Function, Signal Flow Diagram	FP-13
FO-8	Sensor - Inter-Assembly Communications Function, Signal Flow Diagram	FP-15
FO-9	Sensor - Power Supply and Distribution, Power Distribution Diagram	FP-17
FO-10	Sensor - Interconnection Diagram	FP-19
FO-11	Sensor - Microprocessor A PCBA, Schematic Diagram (Sheet 1 of 2)	FP-21
FO-11	Sensor - Microprocessor A PCBA, Schematic Diagram (Sheet 2 of 2)	FP-23
FO-12	Sensor - Barometric Pressure Module, Schematic Diagram	FP-25
FO-13	Sensor - Microprocessor B PCBA, Schematic Diagram (Sheet 1 of 2)	FP-27
FO-13	Sensor - Microprocessor B PCBA, Schematic Diagram (Sheet 2 of 2)	FP-29
FO-14	Sensor - Power - Front PCBA, Schematic Diagram	FP-31
FO-15	Sensor - Power - Back PCBA, Schematic Diagram	FP-33
FO-16	Sensor - Terminal EMI Filter, Schematic Diagram	FP-35
FO-17	Indicator - Block Diagram	FP-37
FO-18	Recorder - Block Diagram	FP-39
FO-19	Indicator/Recorder - Microprocessor PCBA - CPU Function, Signal Flow Diagram	FP-41

TABLE OF ILLUSTRATIONS - CONT

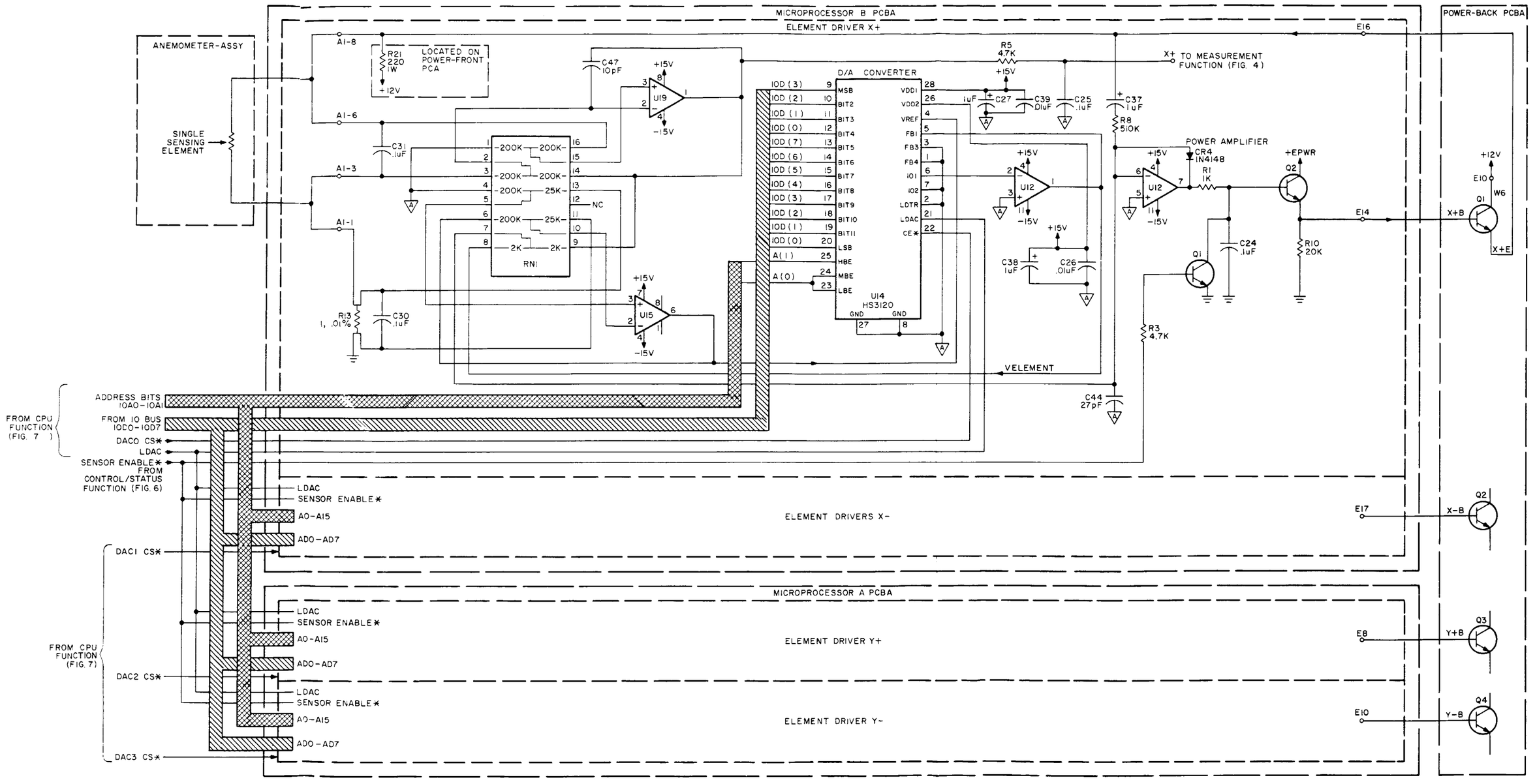
Figure No.	Title	Page
FO-20	Indicator/Recorder - Microprocessor PCBA - I/O Function, Signal Flow Diagram	FP-43
FO-21	Indicator/Recorder - Microprocessor PCBA - Inter-Assembly Communication Function, Signal Flow Diagram	FP-45
FO-22	Indicator/Recorder - Display PCBA, Signal Flow Diagram (Sheet 1 of 3)	FP-47
FO-22	Indicator/Recorder - Display PCBA, Signal Flow Diagram (Sheet 2 of 3)	FP-49
FO-22	Indicator/Recorder - Display PCBA, Signal Flow Diagram (Sheet 3 of 3)	FP-51
FO-23	Indicator/Recorder - Power Supply and Distribution, Power Distribution Diagram	FP-53
FO-24	Indicator/Recorder - Interconnection Diagram	FP-55
FO-25	Indicator/Recorder - Microprocessor PCBA, Schematic Diagram (Sheet 1 of 2)	FP-57
FO-25	Indicator/Recorder - Microprocessor PCBA, Schematic Diagram (Sheet 2 of 2)	FP-59
FO-26	Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 1 of 4)	FP-61
FO-26	Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 2 of 4)	FP-63
FO-26	Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 3 of 4)	FP-65
FO-26	Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 4 of 4)	FP-67
FO-27	Indicator/Recorder - Interconnect PCBA, Schematic Diagram	FP-69
FO-28	Indicator/Recorder - Communications EMI Filter, Schematic Diagram	FP-71
FO-29	Indicator - Power Output EMI Filter, Schematic Diagram	FP-73



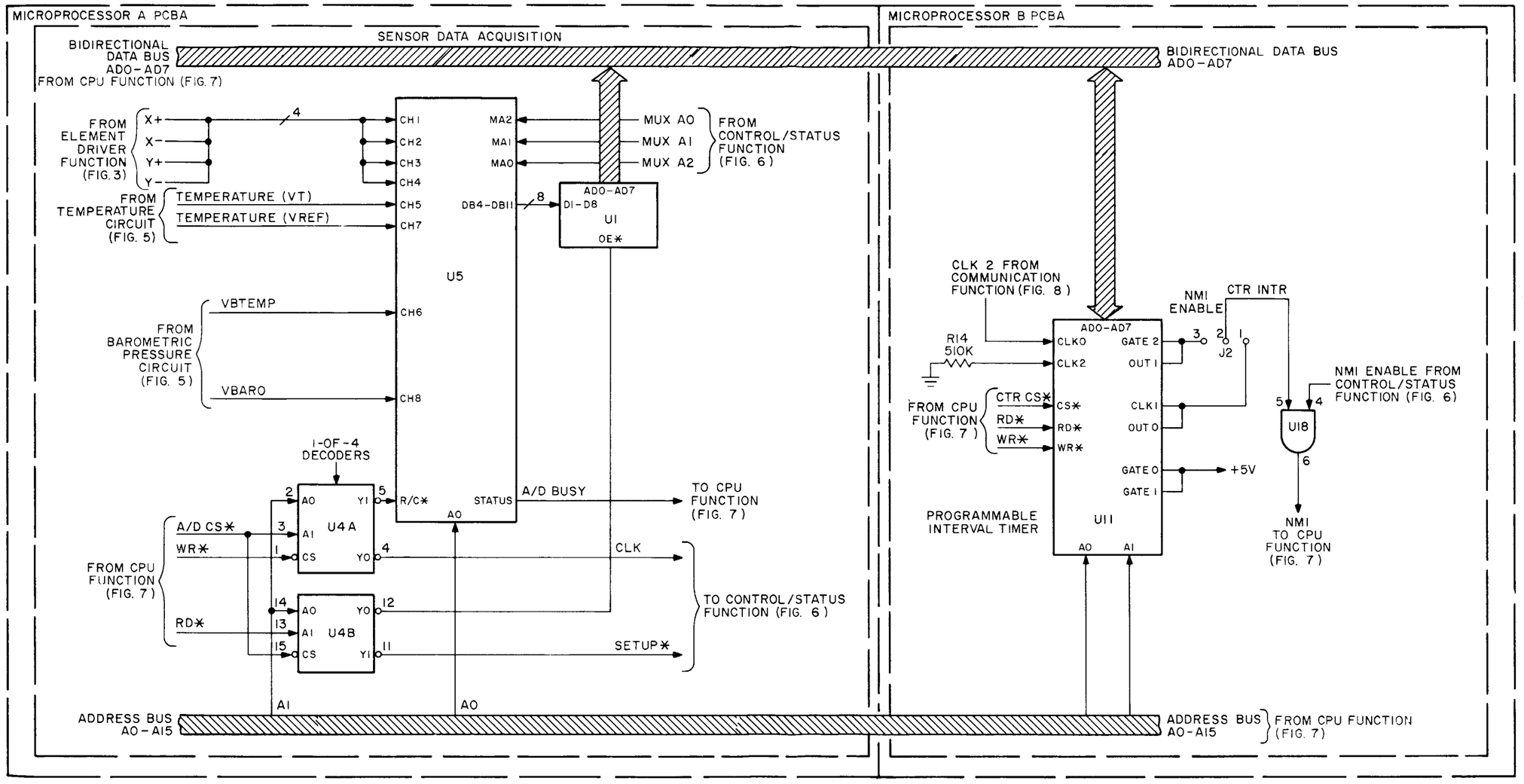
FO-1. Wind Measuring Set AN/FMQ-13(V) - Block Diagram



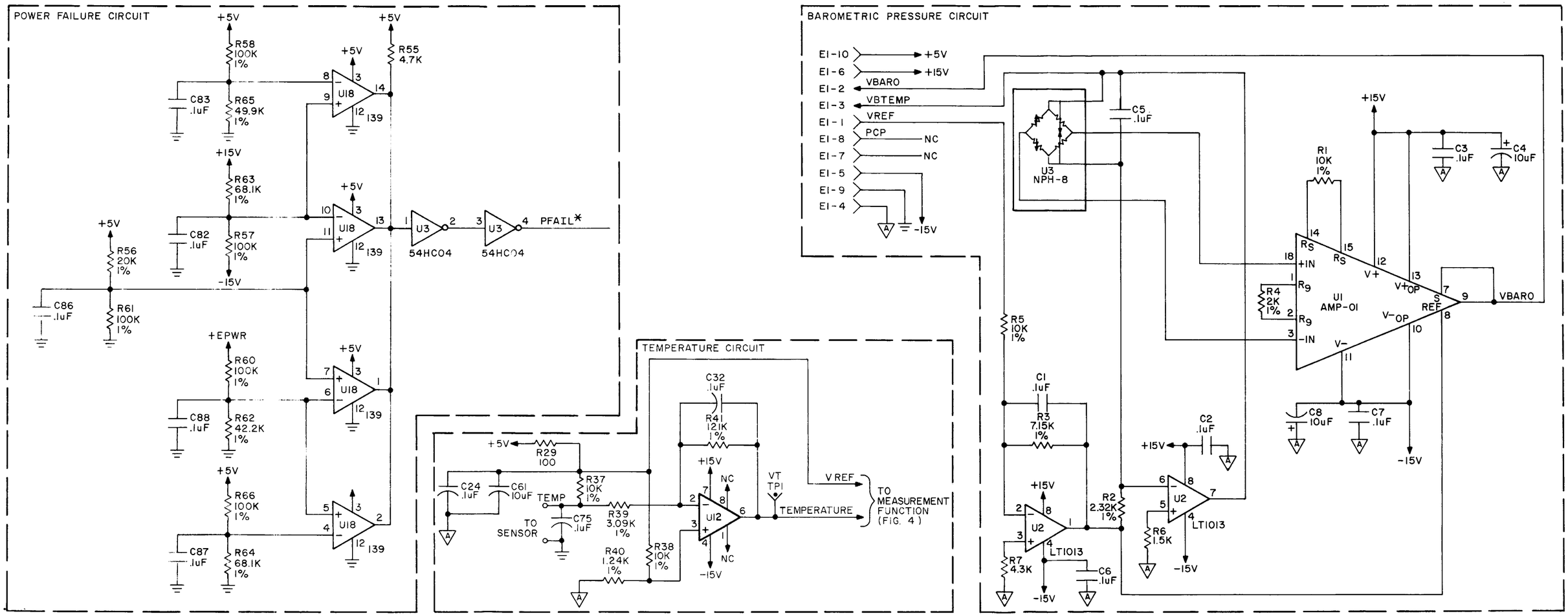
FO-2. Sensor - Block Diagram



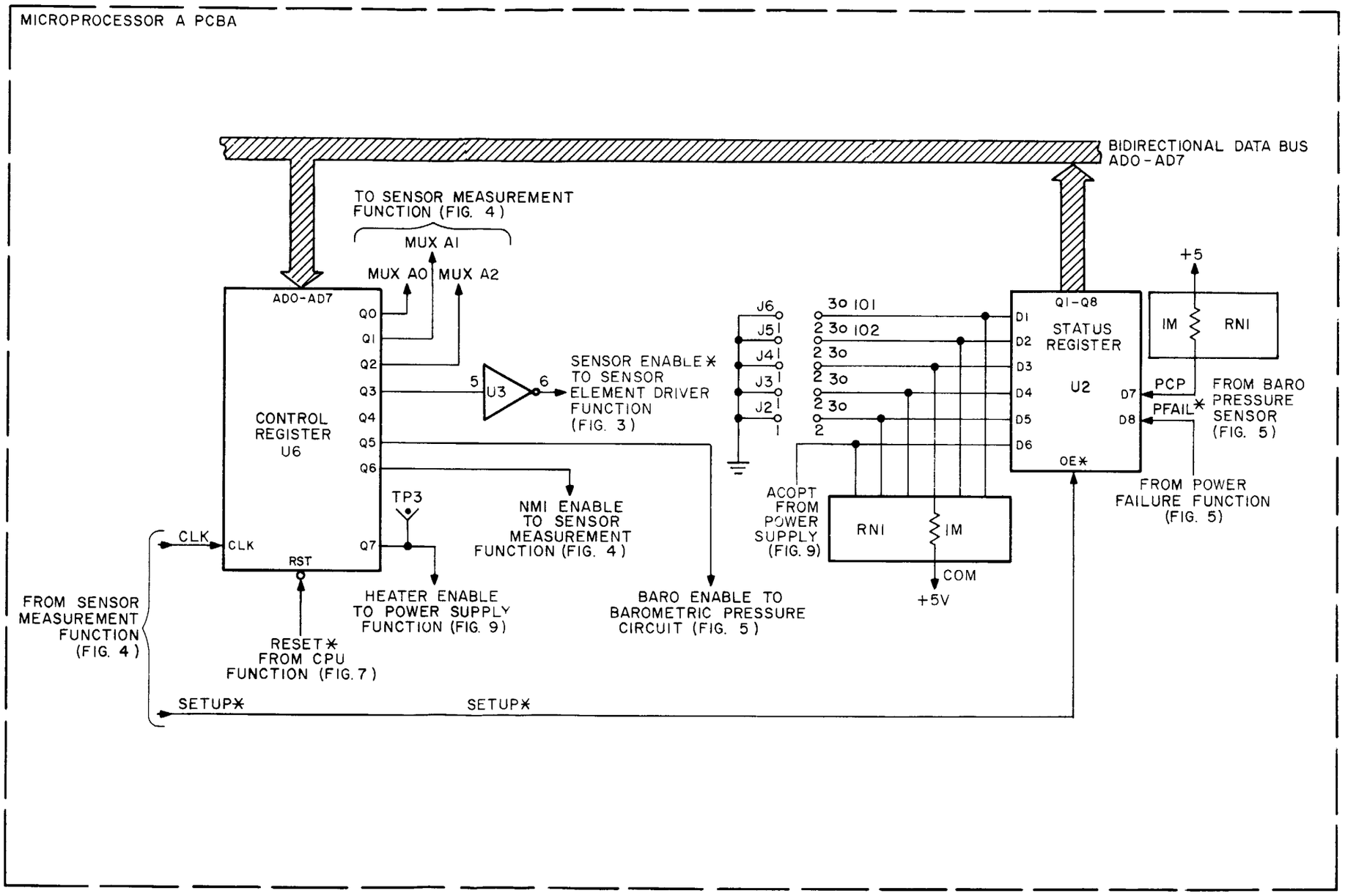
FO-3. Sensor - Element Driver Function, Signal Flow Diagram



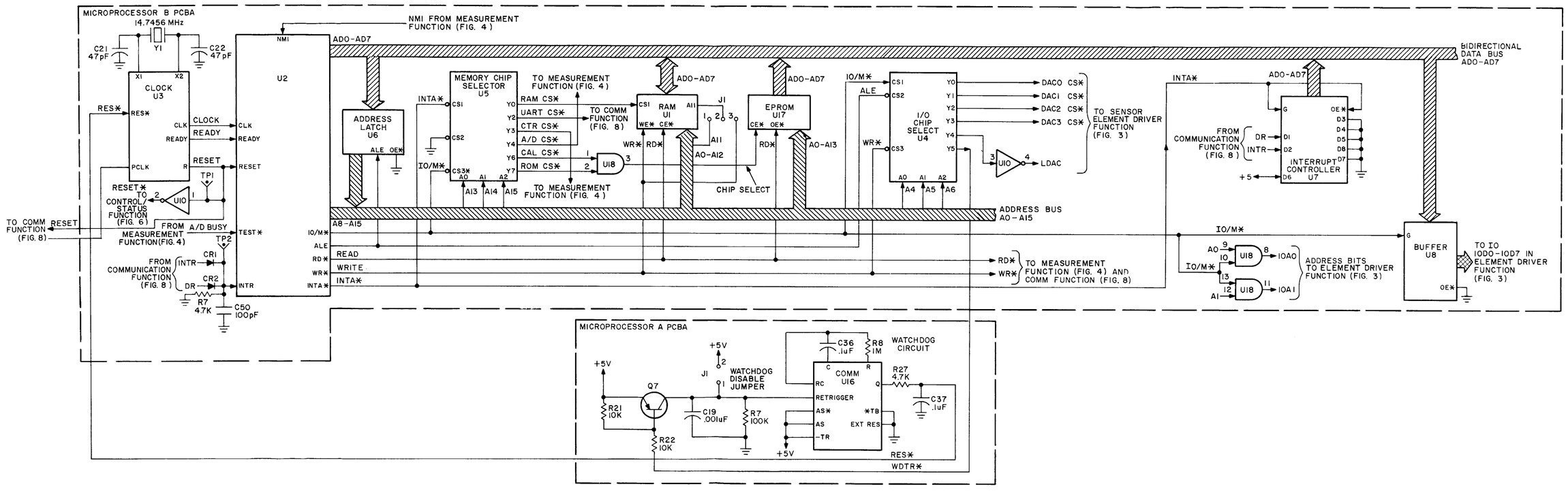
FO-4. Sensor - Measurement Function, Signal Flow Diagram



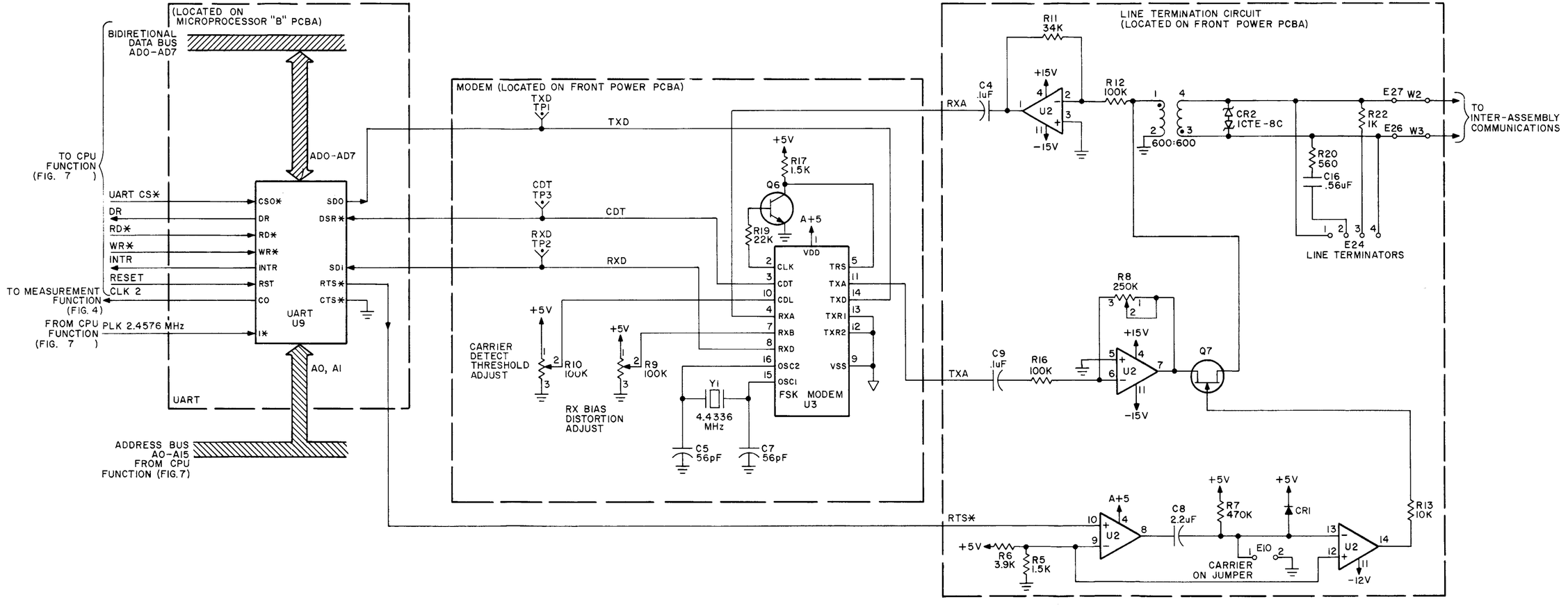
FO-5. Sensor - Power Failure, Temperature, and Barometric Pressure Circuits, Signal Flow Diagram



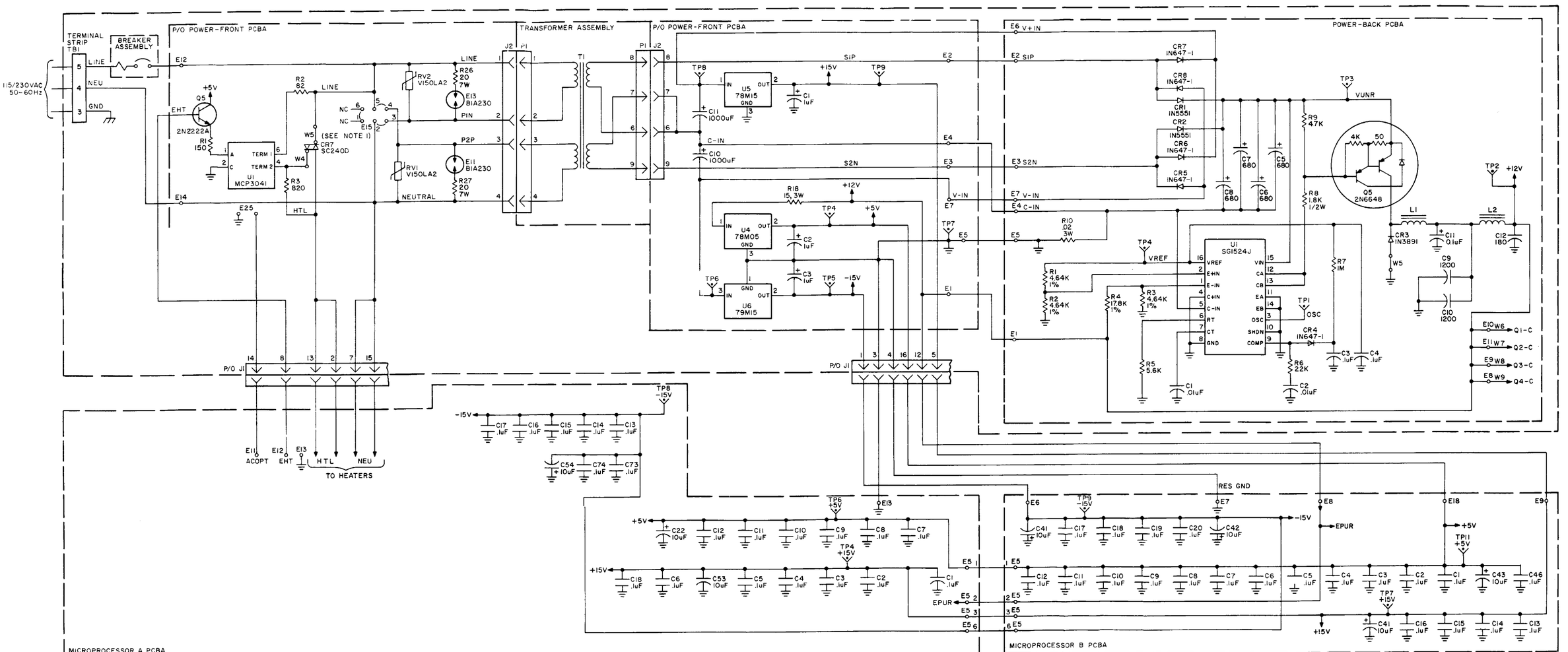
FO-6. Sensor - Control/Status Function, Signal Flow Diagram



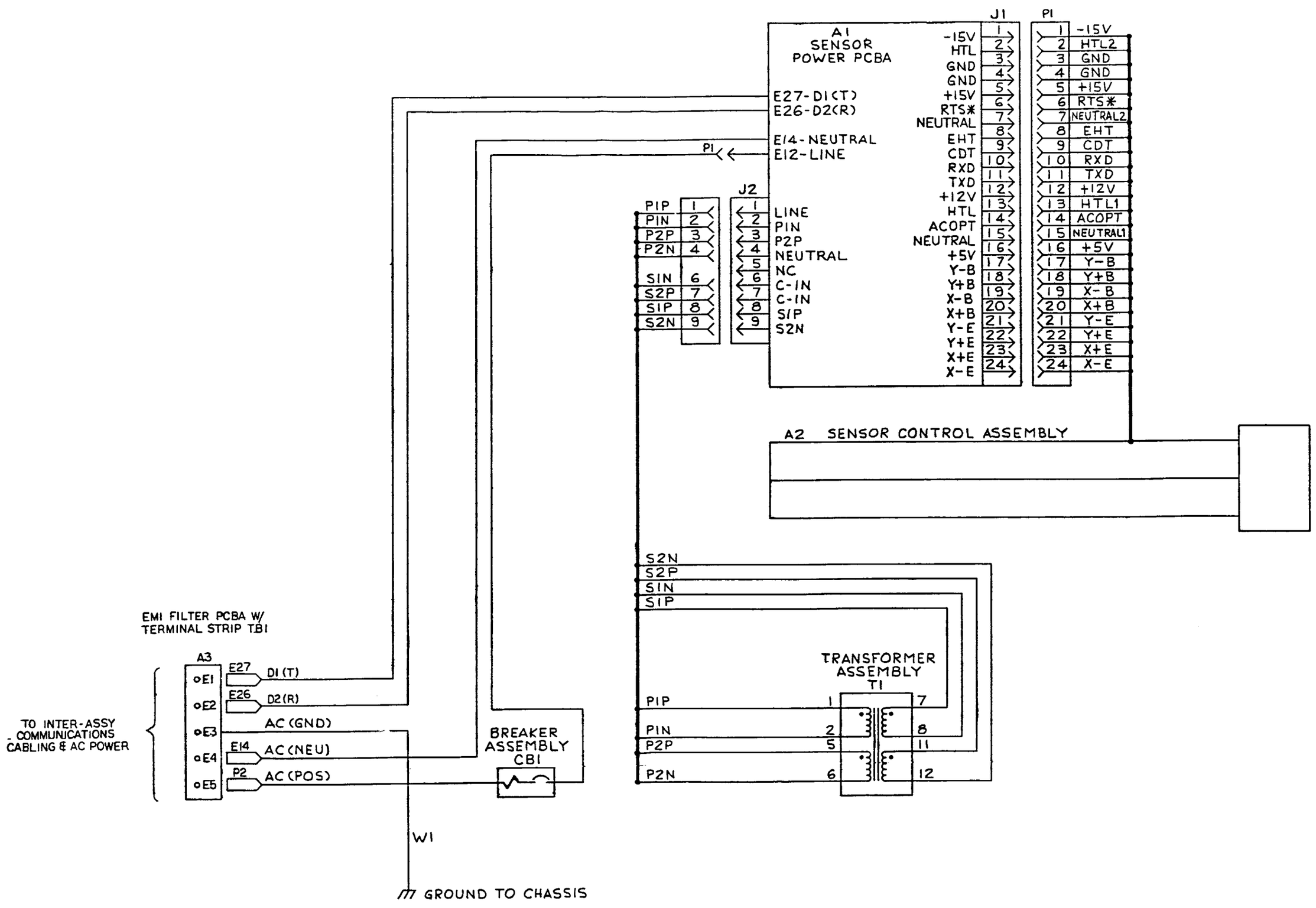
FO-7. Sensor - CPU Function, Signal Flow Diagram



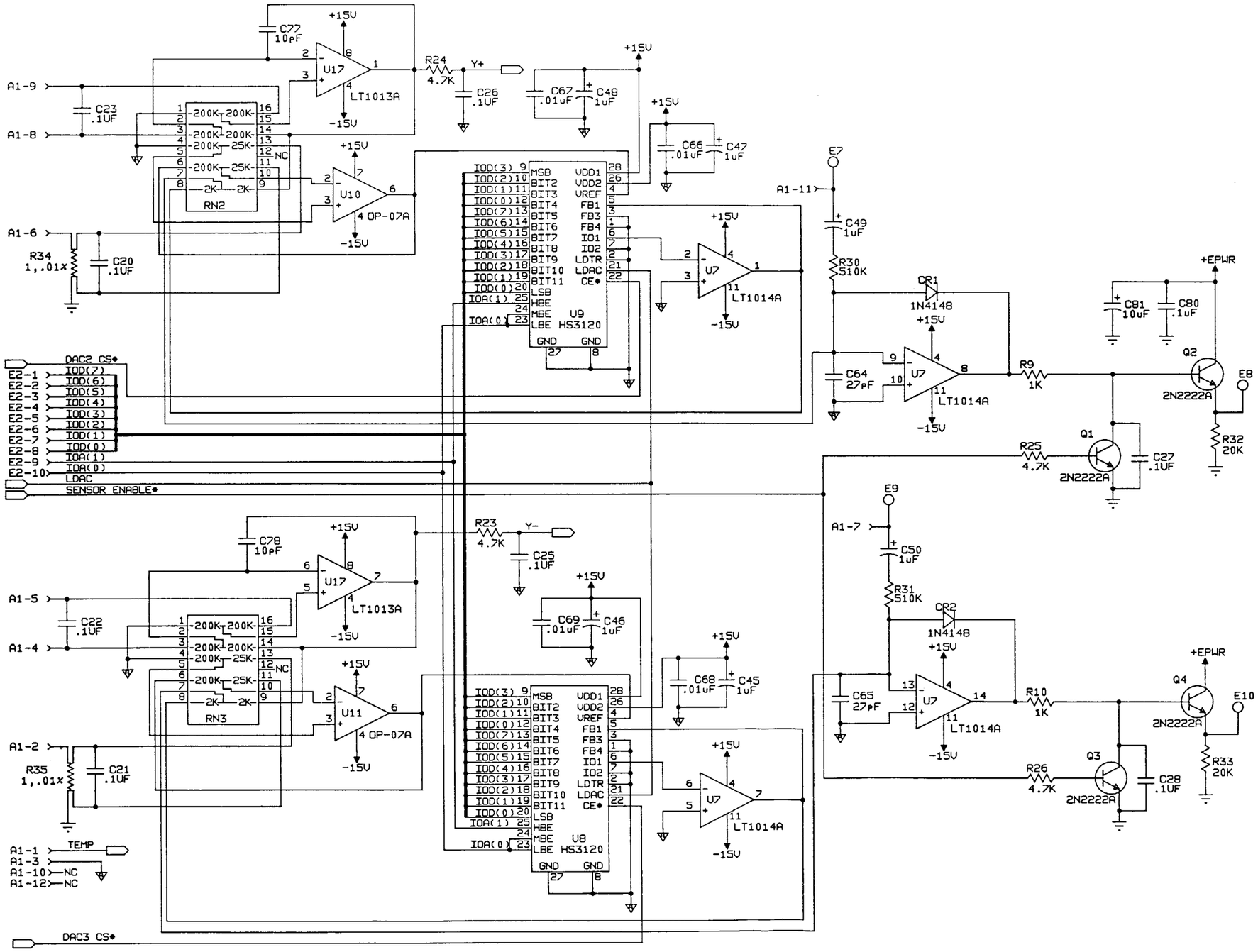
FO-8. Sensor - Inter-Assembly Communications Function, Signal Flow Diagram



FO-9. Sensor - Power Supply and Distribution, Power Distribution Diagram



FO-10. Sensor - Interconnection Diagram



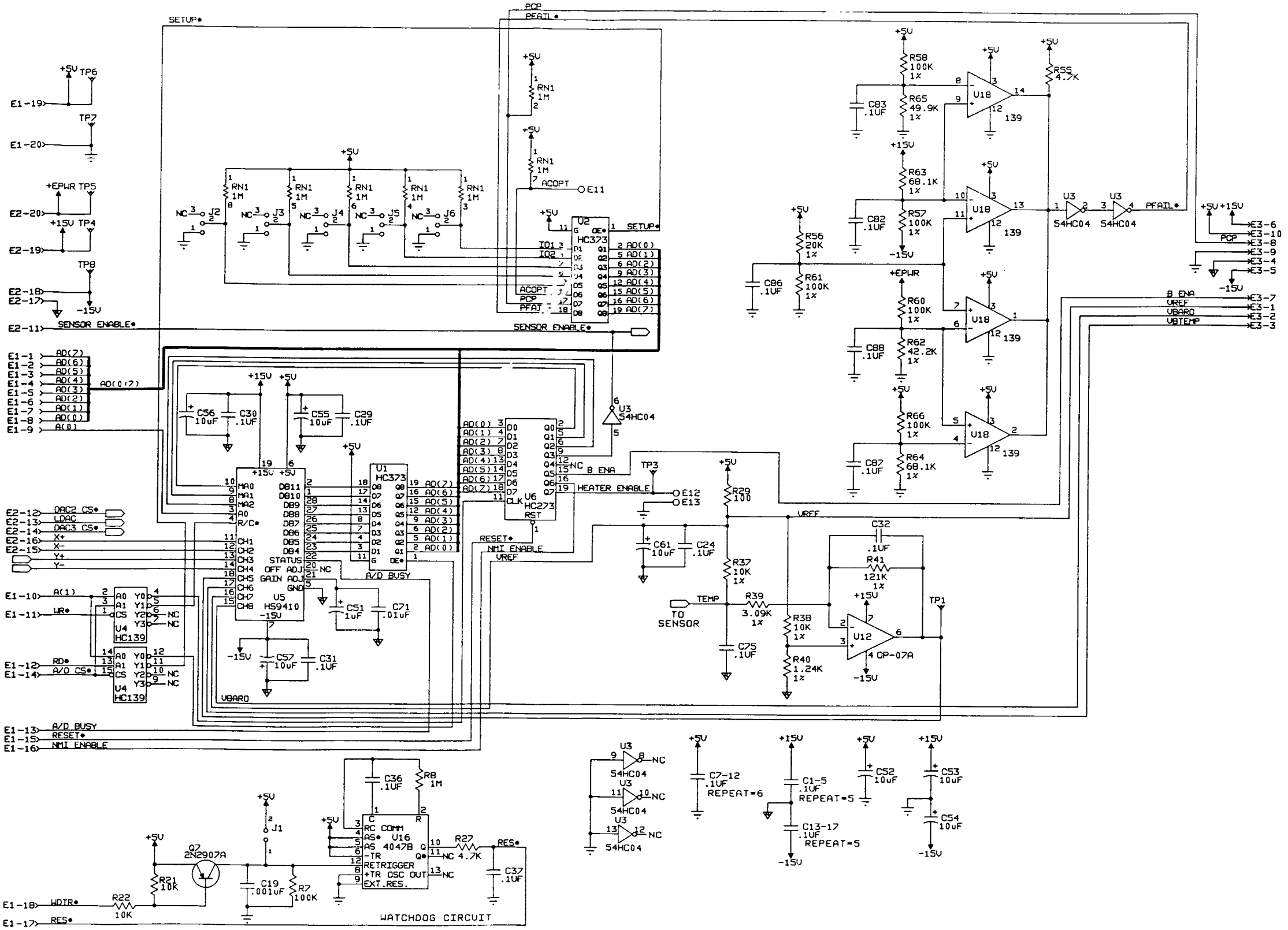
NOTES:
1. J1 IS THE WATCHDOG DISABLE JUMPER. IN OPERATIONAL MODES IT SHOULD BE DISCONNECTED.
2. J5 AND J6 ARE USED TO SET THE SENSOR ID.

ID	J5	J6
1	1-2	1-2
2	1-2	2-3
3	2-3	1-2
4	2-3	2-3

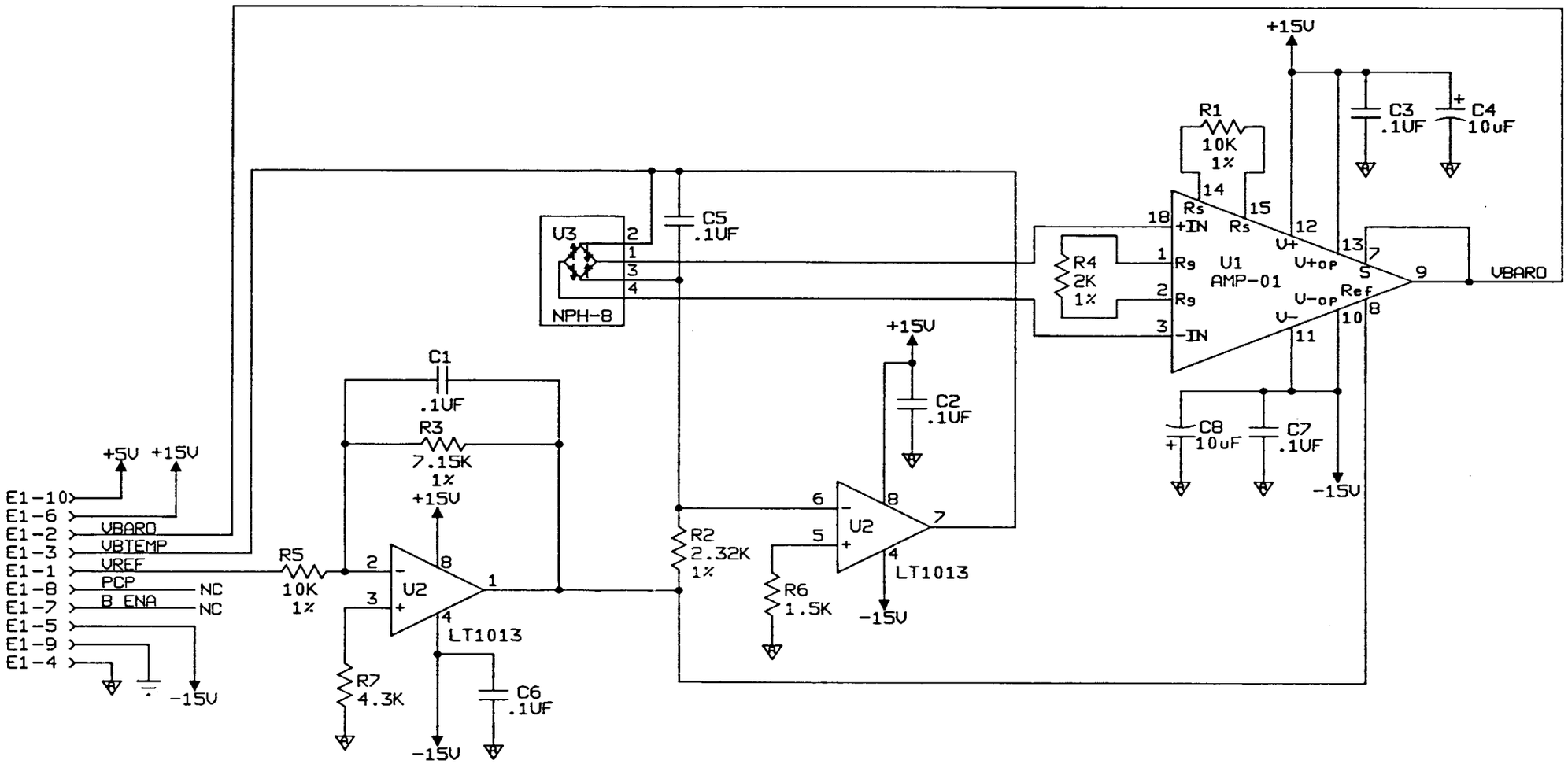
1-2 IMPLIES THAT PINS 1 AND 2 OF J5 ARE SHORTED AND PIN 3 IS OPEN

3. J2 AND J4 ARE LEFT UNCONNECTED.
4. J3 IS FACTORY CONFIGURED WITH A LINK BETWEEN PINS 1 AND 2.

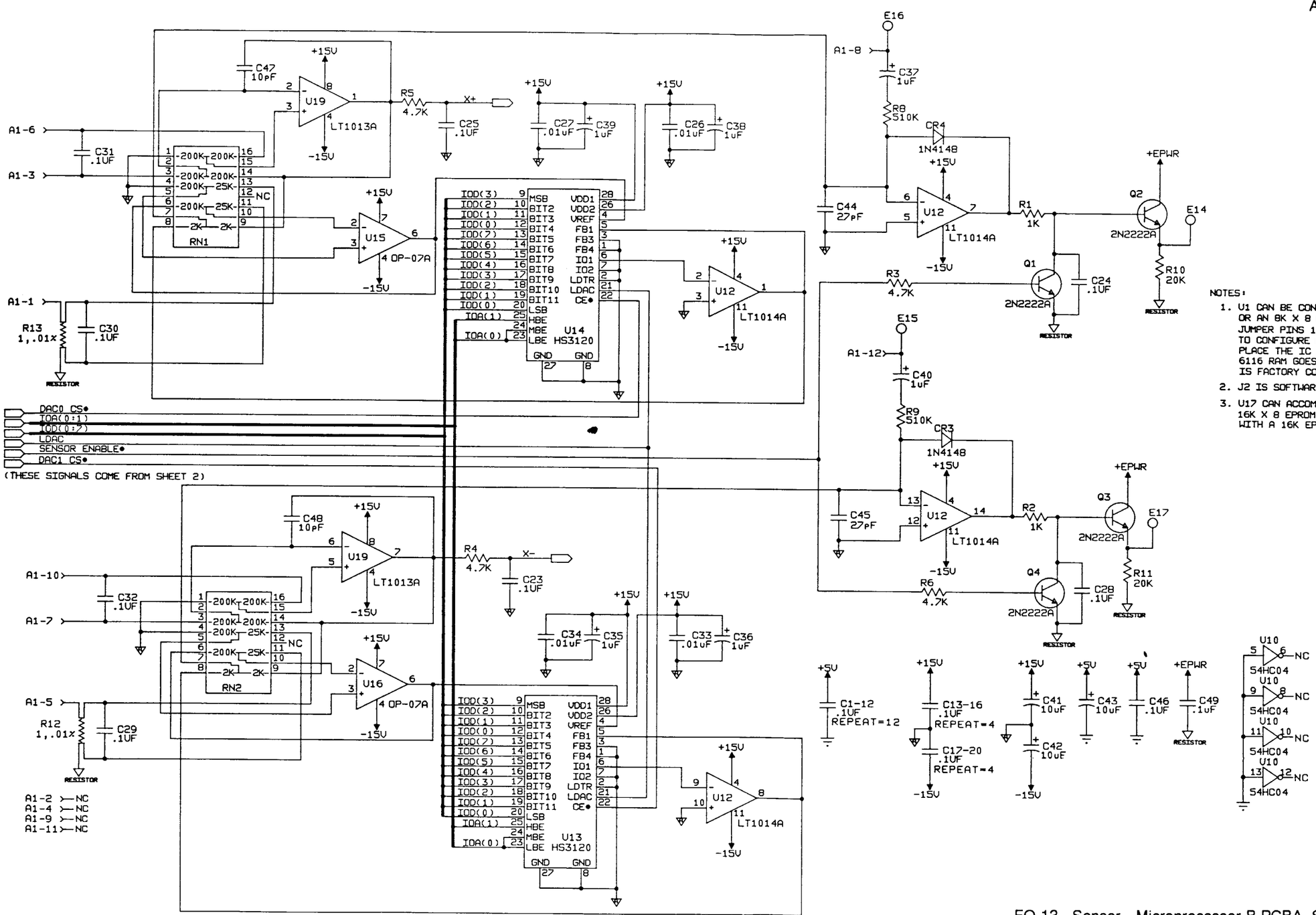
FO-11. Sensor - Microprocessor A PCBA, Schematic Diagram (Sheet 1 of 2)



FO-11. Sensor - Microprocessor A PCBA, Schematic Diagram (Sheet 2 of 2)



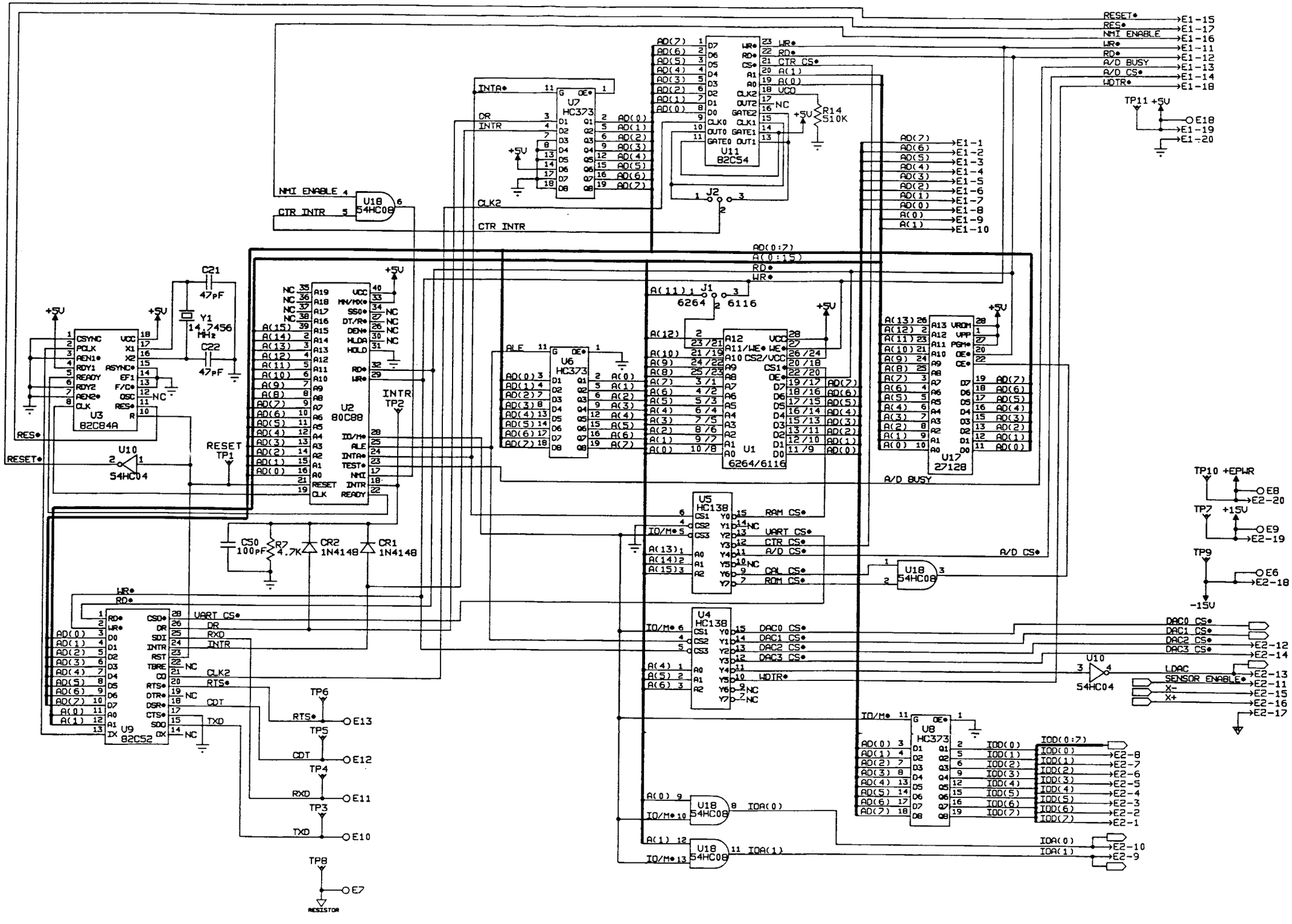
FO-12. Sensor - Barometric Pressure Module, Schematic Diagram



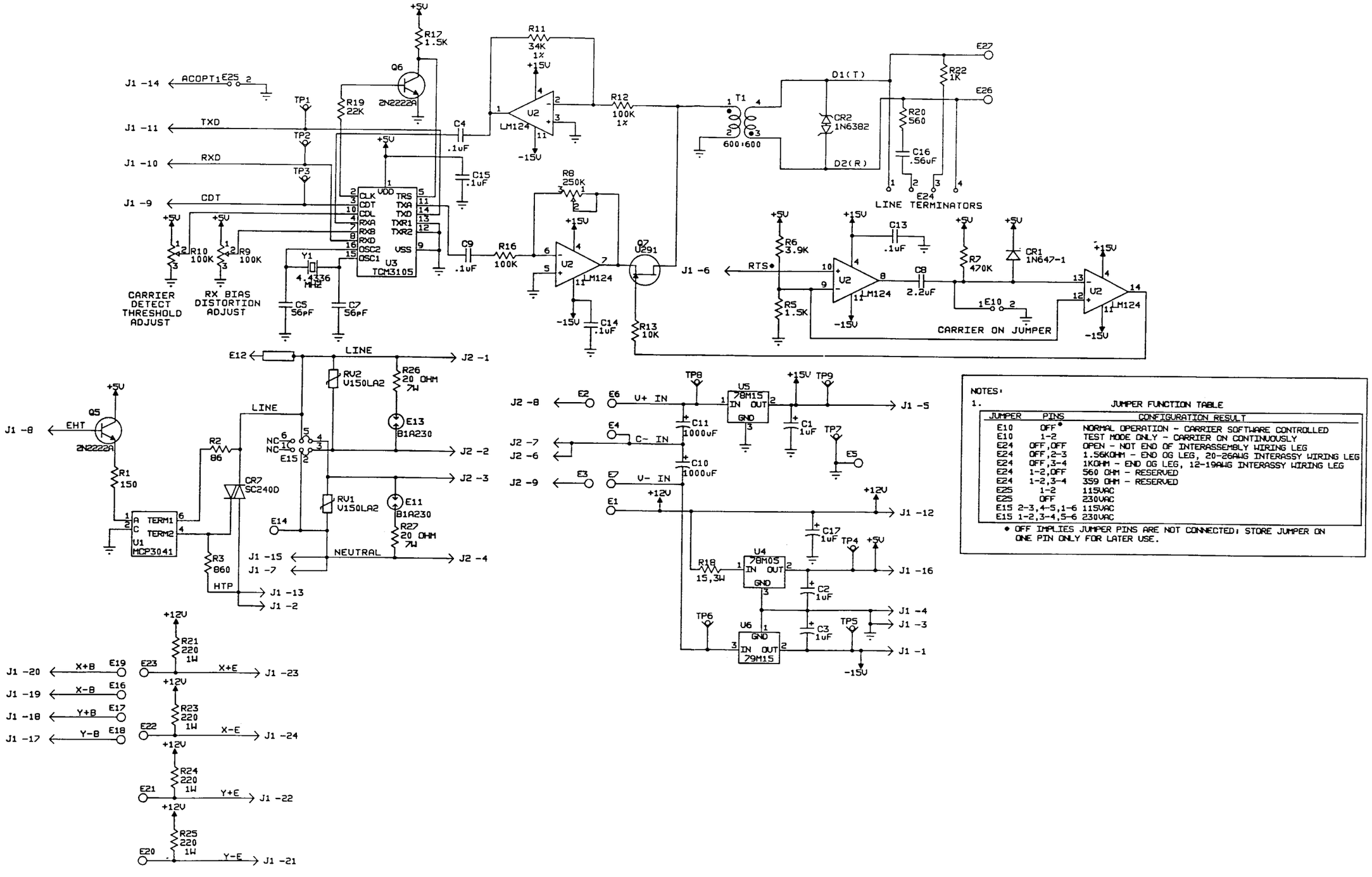
NOTES:

1. U1 CAN BE CONFIGURED FOR EITHER A 2K X 8 RAM (6116) OR AN 8K X 8 RAM (6264). TO CONFIGURE FOR AN 8K RAM JUMPER PINS 1 & 2 OF J1 (PIN 1 DENOTED BY SQUARE PAD). TO CONFIGURE FOR A 2K RAM JUMPER PINS 2 & 3 OF J1 AND PLACE THE IC IN PINS 3 - 26 OF THE SOCKET (PIN 1 OF 6116 RAM GOES IN PIN 3 OF THE SOCKET). THE PC BOARD IS FACTORY CONFIGURED WITH A 2K RAM.
2. J2 IS SOFTWARE DEPENDANT AND COMES FACTORY CONFIGURED.
3. U17 CAN ACCOMODATE EITHER AN 8K X 8 EPROM (2764) OR A 16K X 8 EPROM (27128). THE BOARD IS FACTORY CONFIGURED WITH A 16K EPROM.

FO-13. Sensor - Microprocessor B PCBA, Schematic Diagram (Sheet 1 of 2)



FO-13. Sensor - Microprocessor B PCBA, Schematic Diagram (Sheet 2 of 2)



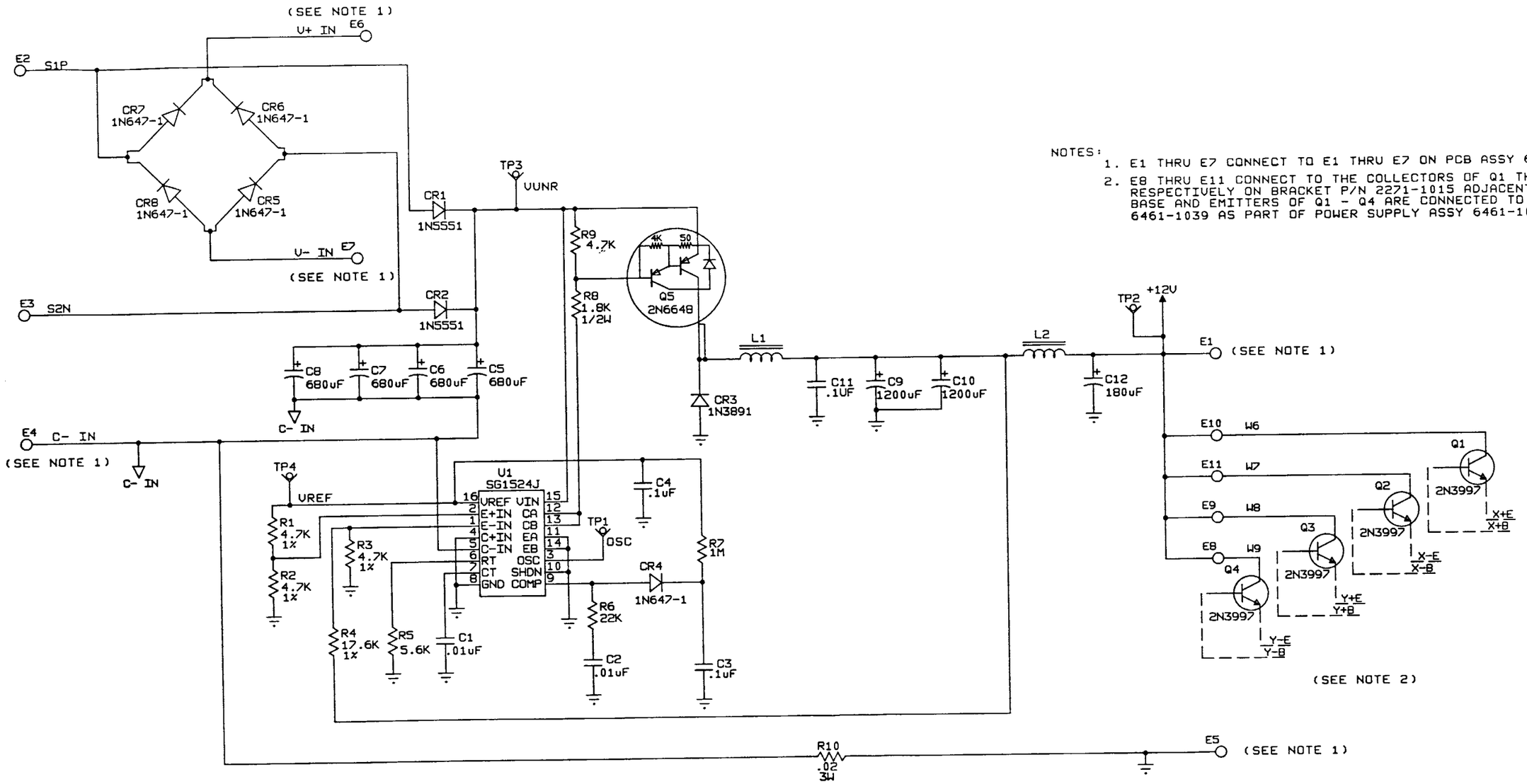
NOTES:

1. JUMPER FUNCTION TABLE

JUMPER	PINS	CONFIGURATION RESULT
E10	OFF*	NORMAL OPERATION - CARRIER SOFTWARE CONTROLLED
E10	1-2	TEST MODE ONLY - CARRIER ON CONTINUOUSLY
E24	OFF,OFF	OPEN - NOT END OF INTERASSEMBLY WIRING LEG
E24	OFF,2-3	1.56KOHM - END OG LEG, 20-26AWG INTERASSY WIRING LEG
E24	OFF,3-4	1KOHM - END OG LEG, 12-19AWG INTERASSY WIRING LEG
E24	1-2,OFF	560 OHM - RESERVED
E24	1-2,3-4	359 OHM - RESERVED
E25	1-2	115VAC
E25	OFF	230VAC
E15	2-3,4-5,1-6	115VAC
E15	1-2,3-4,5-6	230VAC

* OFF IMPLIES JUMPER PINS ARE NOT CONNECTED; STORE JUMPER ON ONE PIN ONLY FOR LATER USE.

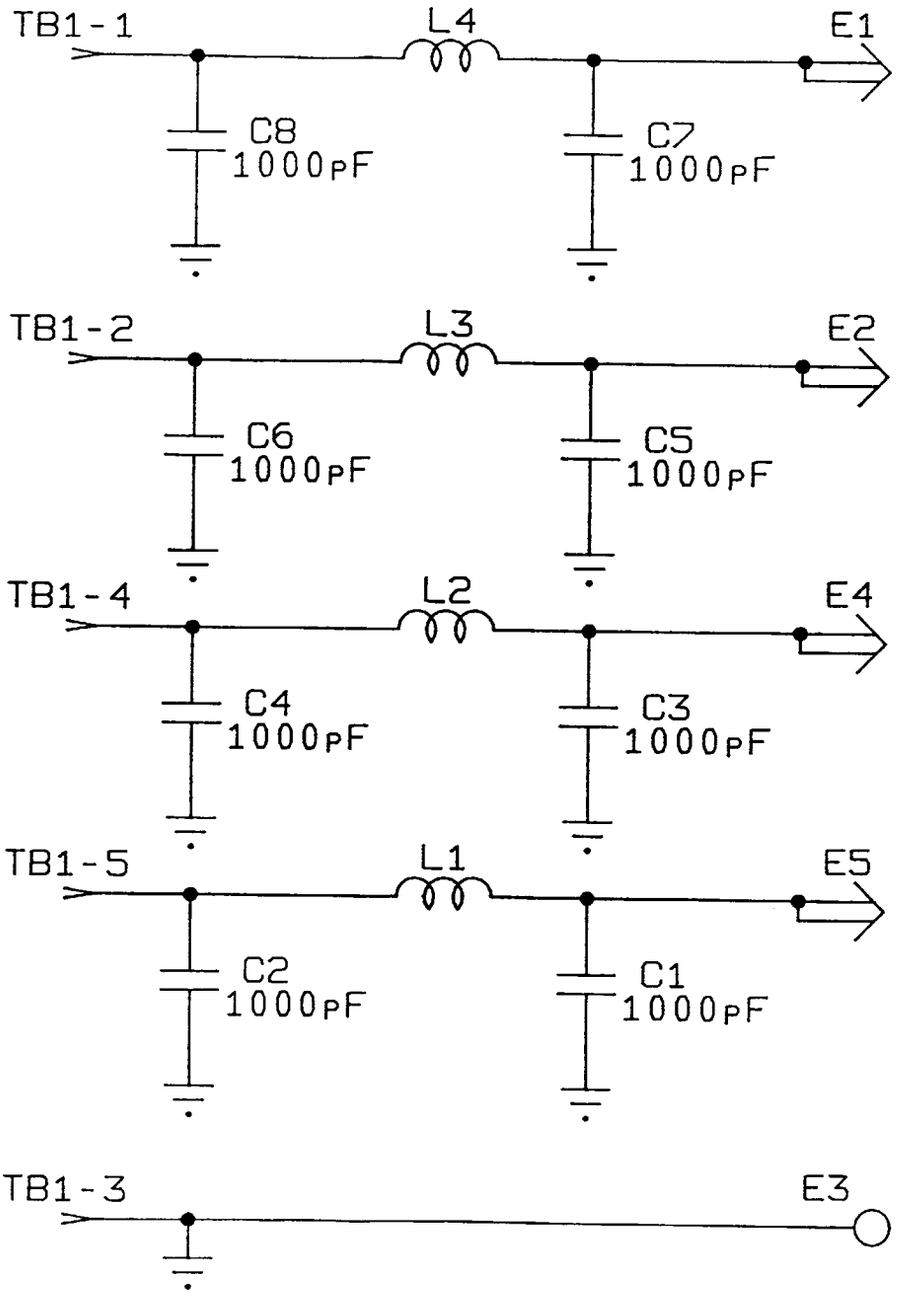
FO-14. Sensor - Power - Front PCBA, Schematic Diagram



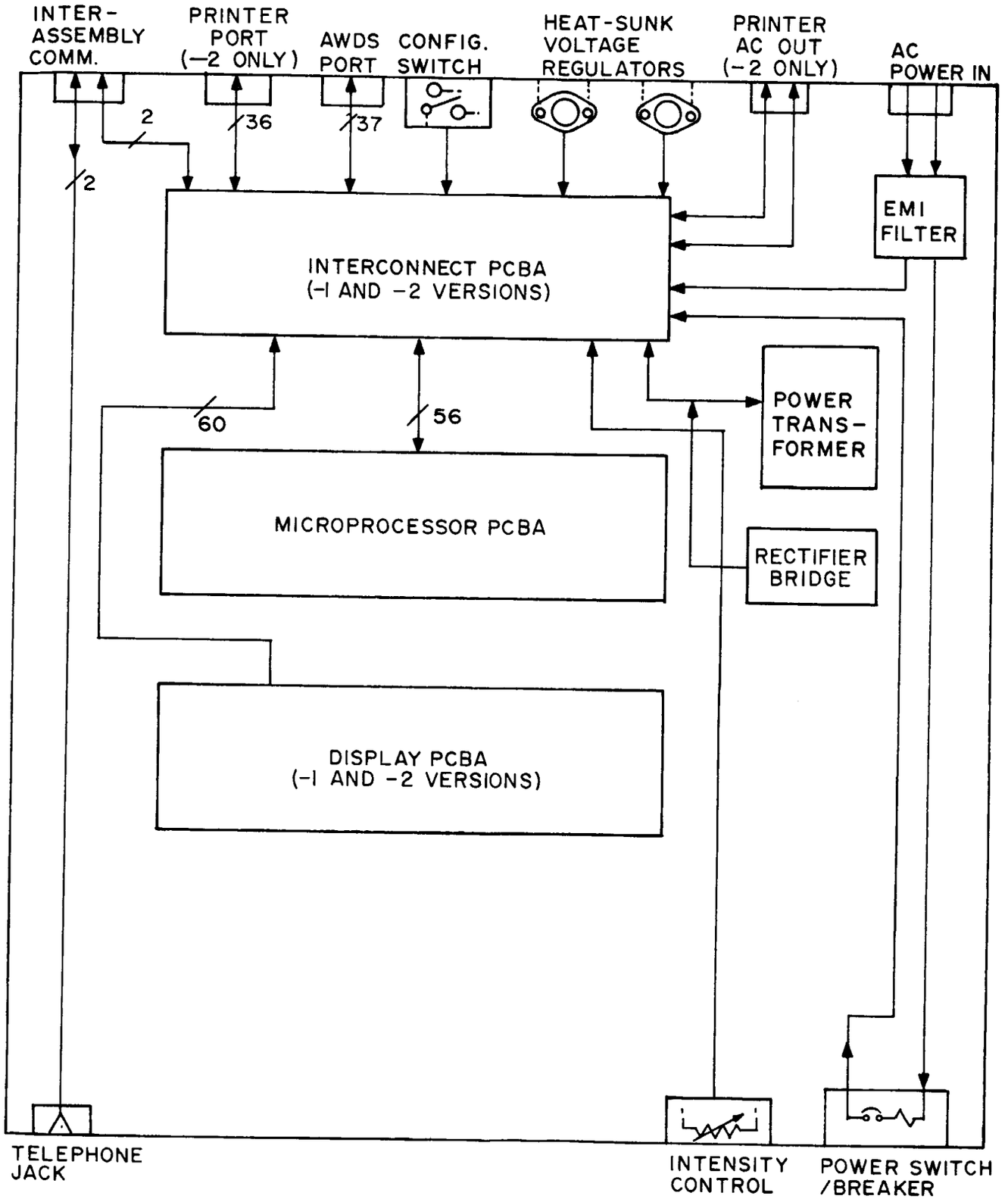
NOTES:

1. E1 THRU E7 CONNECT TO E1 THRU E7 ON PCB ASSY 6461-1039.
2. E8 THRU E11 CONNECT TO THE COLLECTORS OF Q1 THRU Q4 RESPECTIVELY ON BRACKET P/N 2271-1015 ADJACENT TO PCB. BASE AND EMITTERS OF Q1 - Q4 ARE CONNECTED TO PCB ASSY 6461-1039 AS PART OF POWER SUPPLY ASSY 6461-1038.

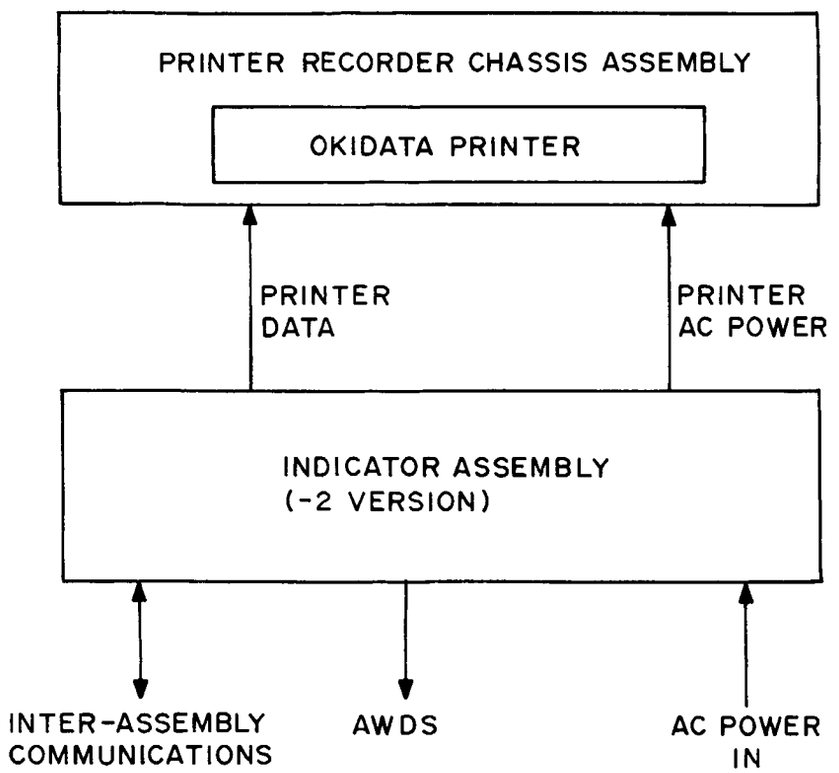
FO-15. Sensor - Power - Back PCBA, Schematic Diagram



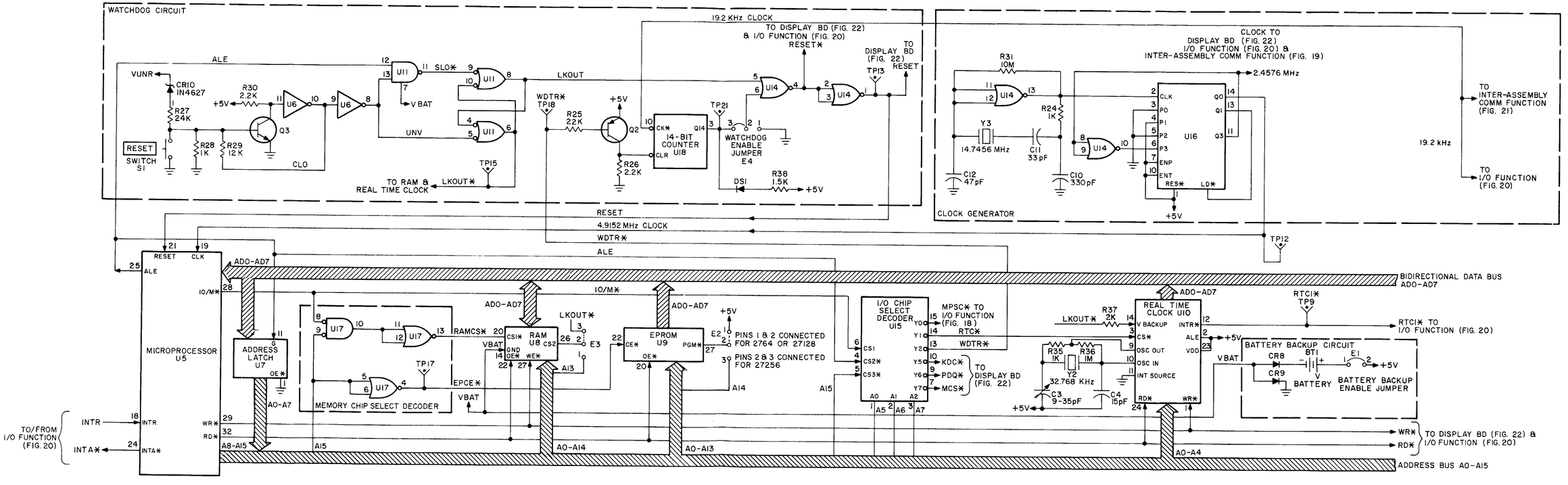
FO-16. Sensor - Terminal EMI Filter, Schematic Diagram



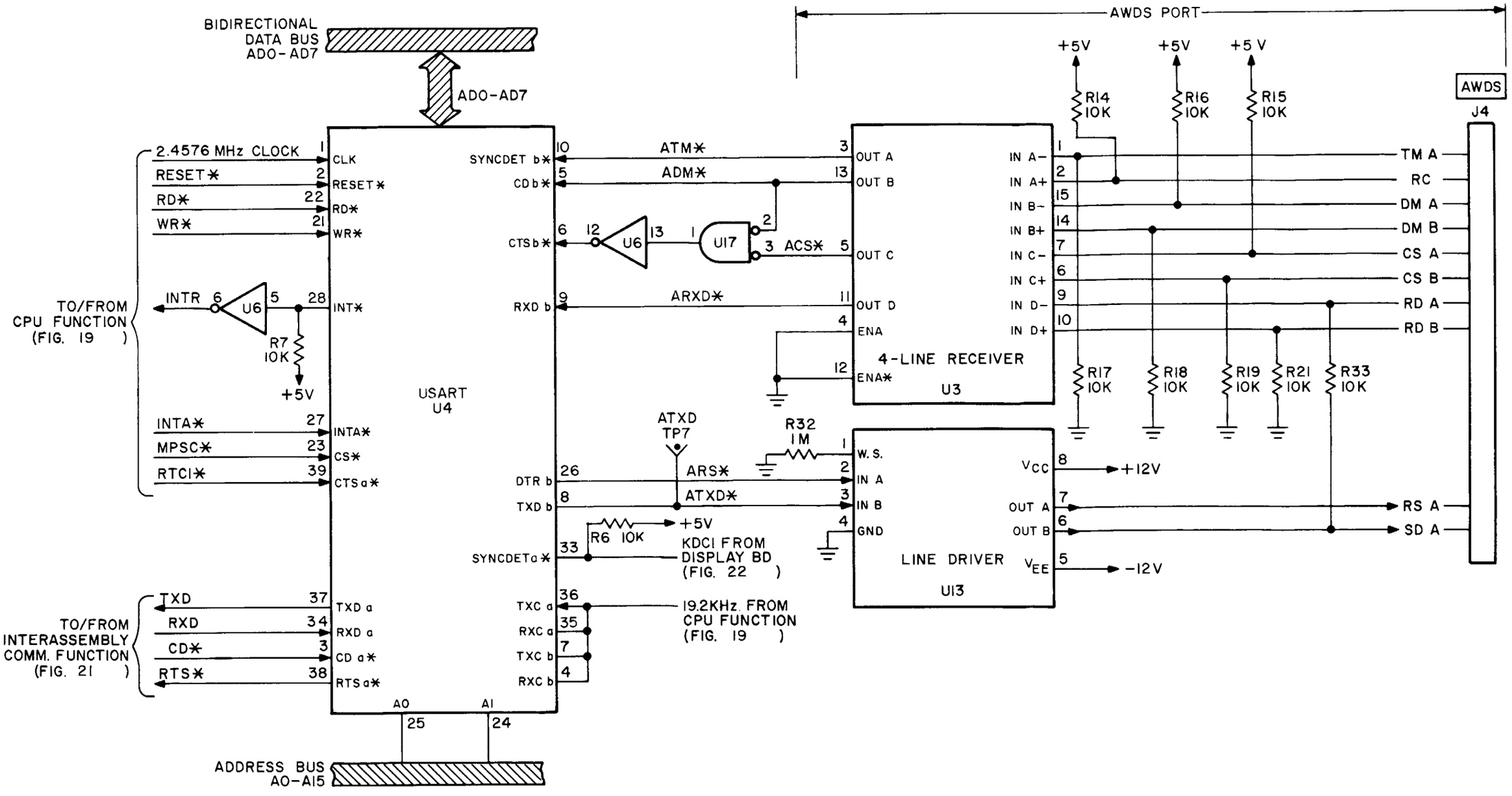
FO-17. Indicator - Block Diagram



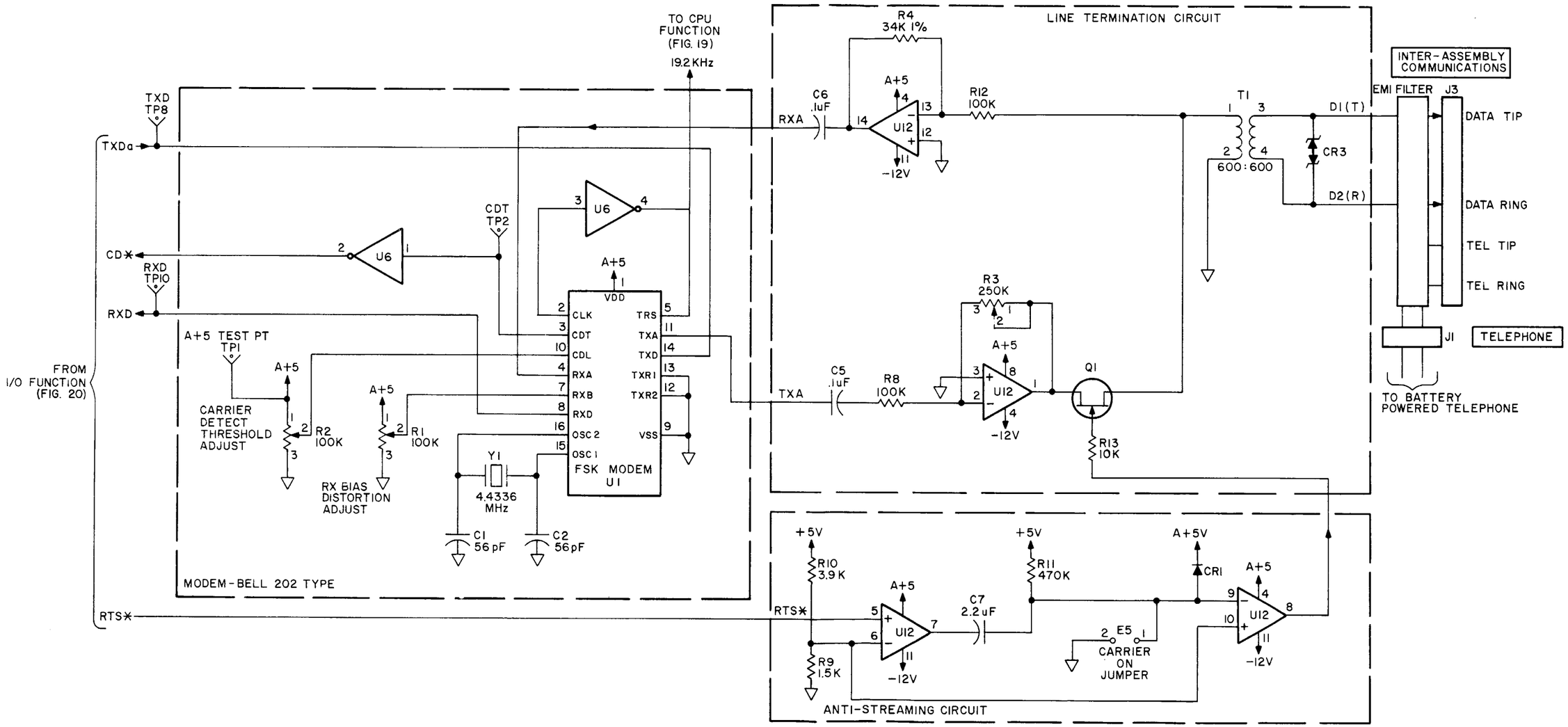
FO-18. Recorder - Block Diagram



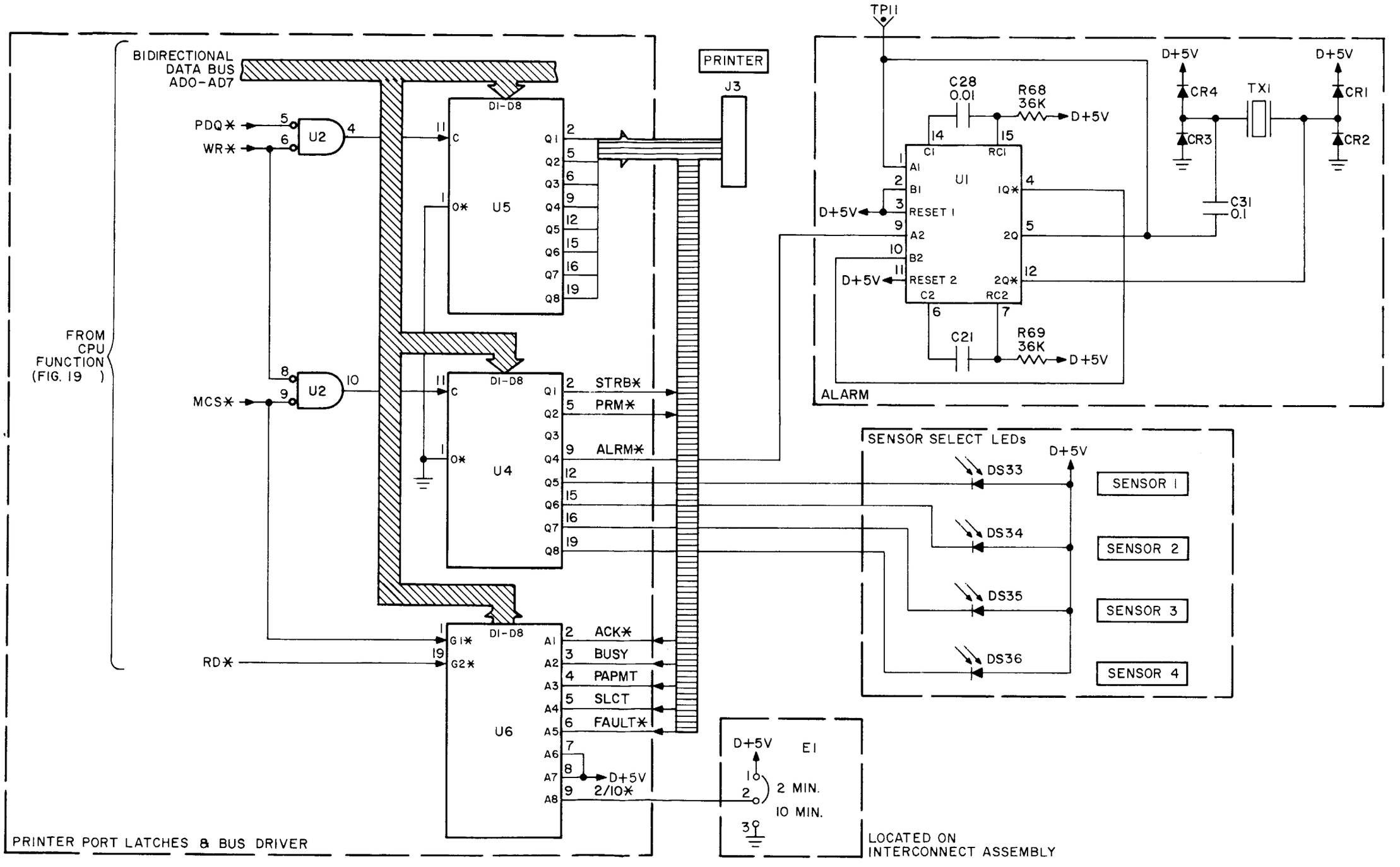
FO-19. Indicator/Recorder - Microprocessor PCBA - CPU Function, Signal Flow Diagram



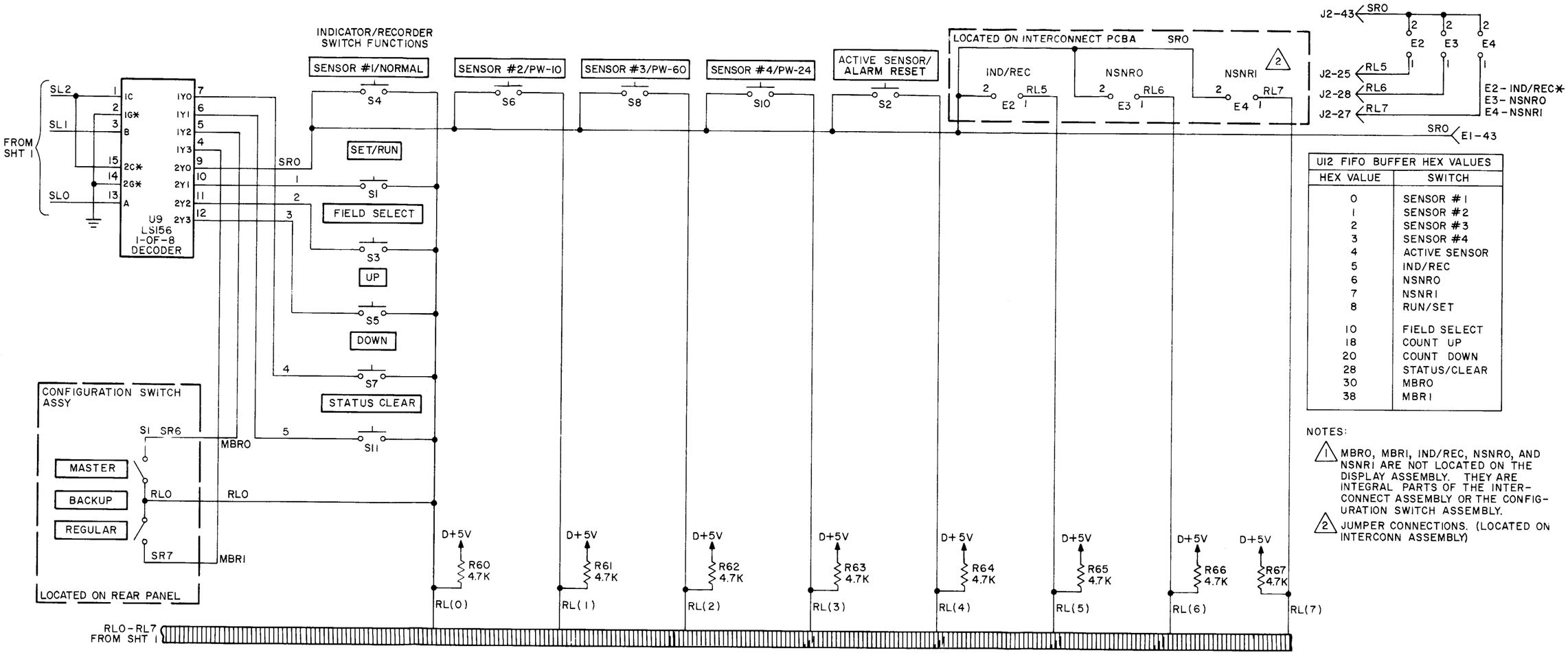
FO-20. Indicator/Recorder - Microprocessor PCBA - I/O Function, Signal Flow Diagram



FO-21. Indicator/Recorder - Microprocessor PCBA - Inter-Assembly Communication Function, Signal Flow Diagram



FO-22. Indicator/Recorder - Display PCBA, Signal Flow Diagram (Sheet 1 of 3)

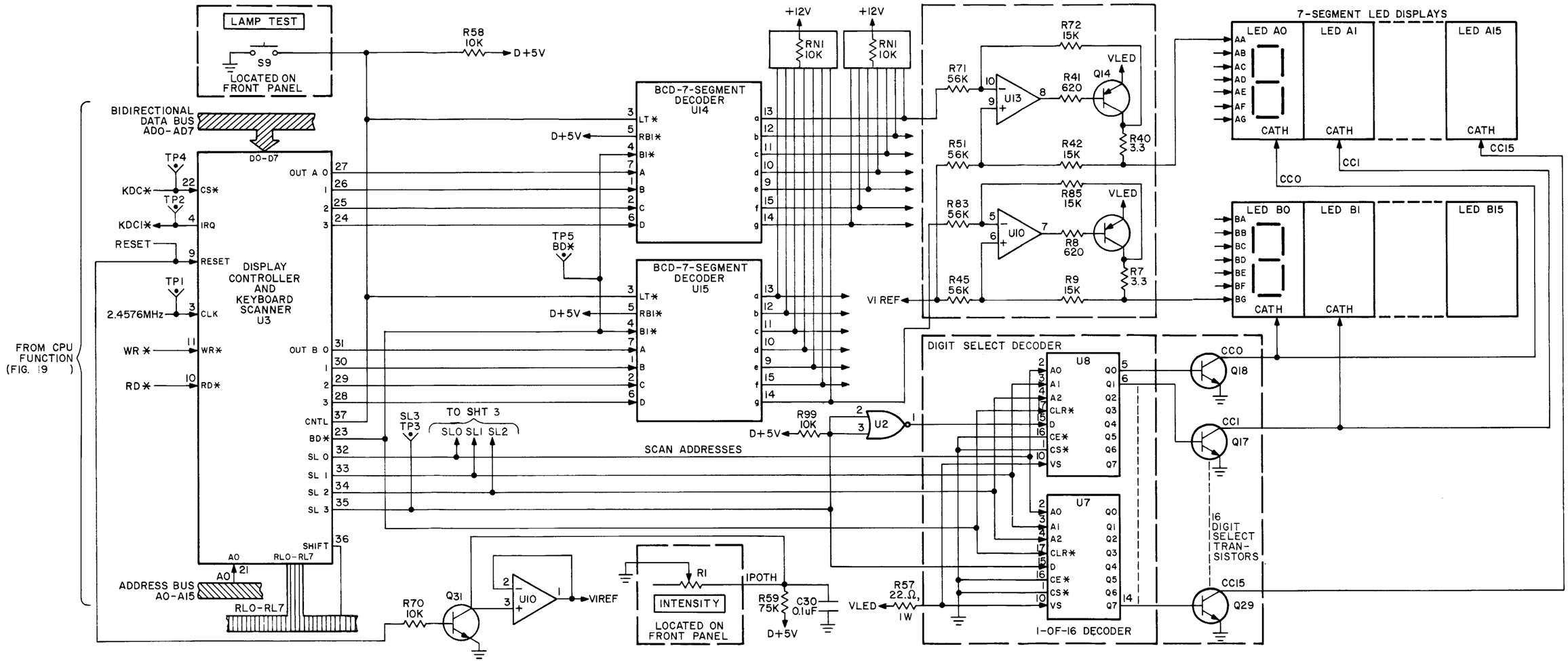


UI2 FIFO BUFFER HEX VALUES	
HEX VALUE	SWITCH
0	SENSOR #1
1	SENSOR #2
2	SENSOR #3
3	SENSOR #4
4	ACTIVE SENSOR
5	IND/REC
6	NSNRO
7	NSNRI
8	RUN/SET
10	FIELD SELECT
18	COUNT UP
20	COUNT DOWN
28	STATUS/CLEAR
30	MBRO
38	MBRI

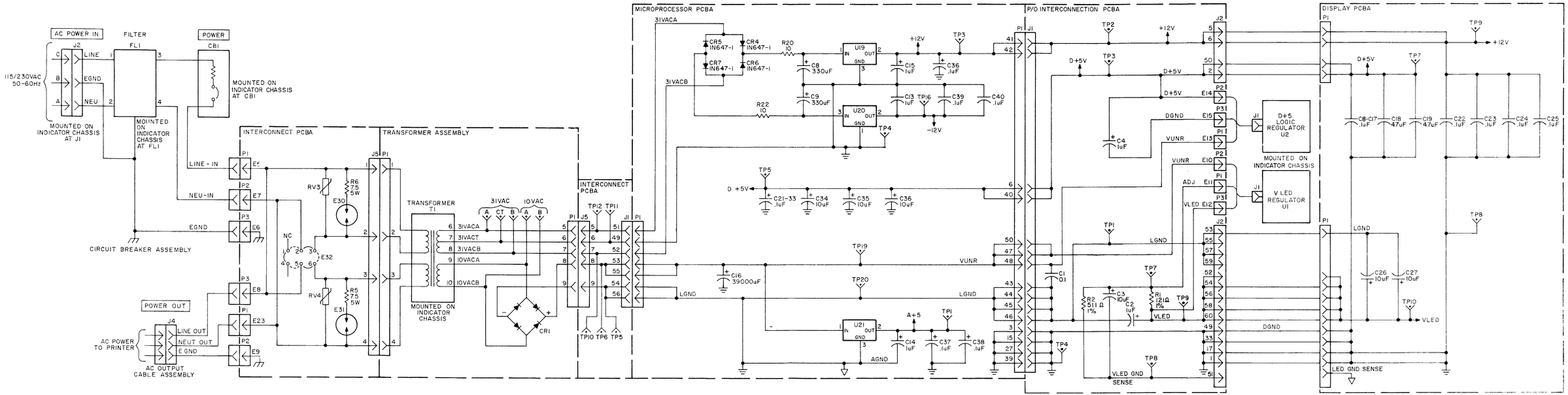
NOTES:

1. MBRO, MBRI, IND/REC, NSNRO, AND NSNRI ARE NOT LOCATED ON THE DISPLAY ASSEMBLY. THEY ARE INTEGRAL PARTS OF THE INTERCONNECT ASSEMBLY OR THE CONFIGURATION SWITCH ASSEMBLY.
2. JUMPER CONNECTIONS. (LOCATED ON INTERCONN ASSEMBLY)

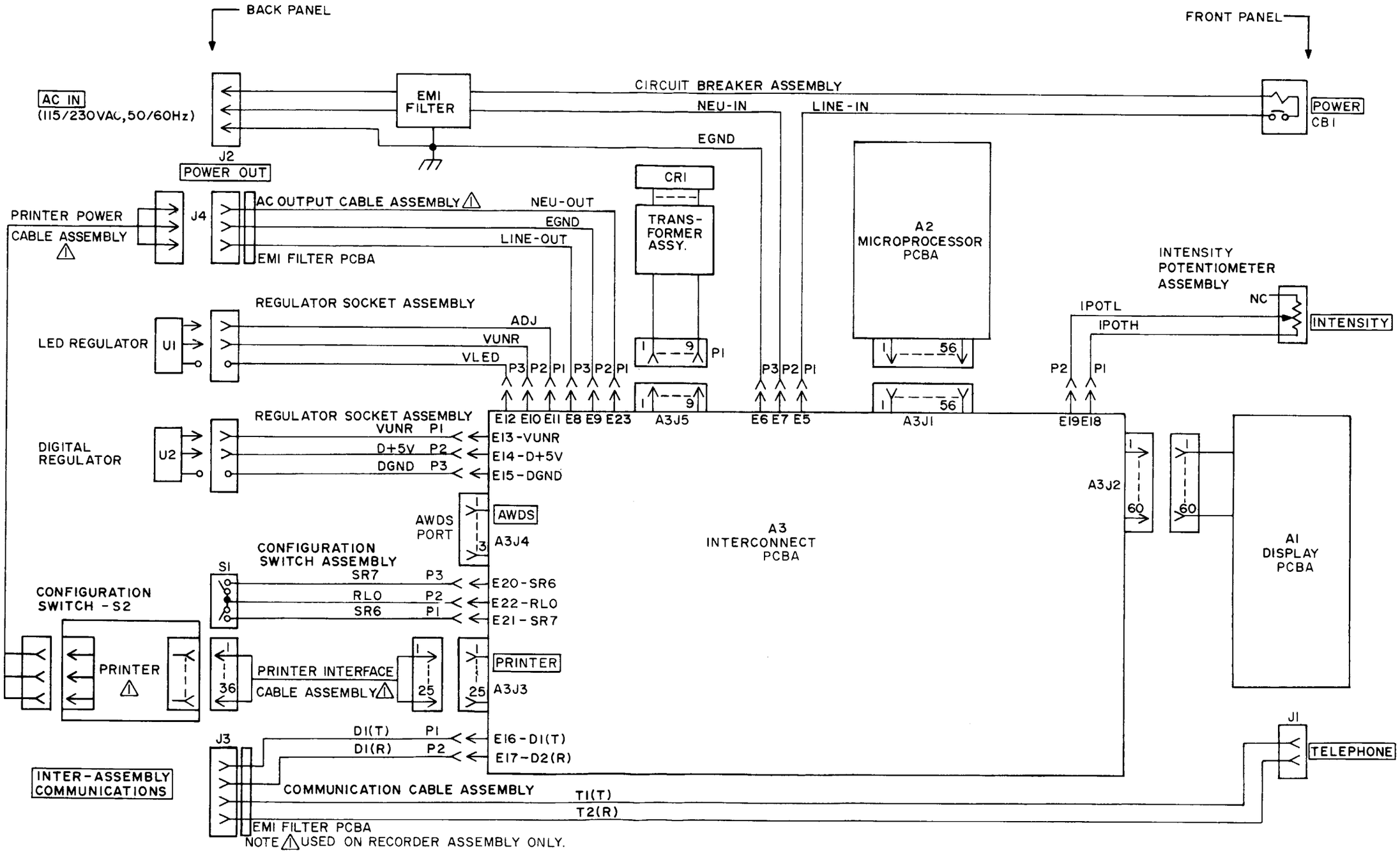
FO-22. Indicator/Recorder - Display PCBA, Signal Flow Diagram (Sheet 2 of 3)



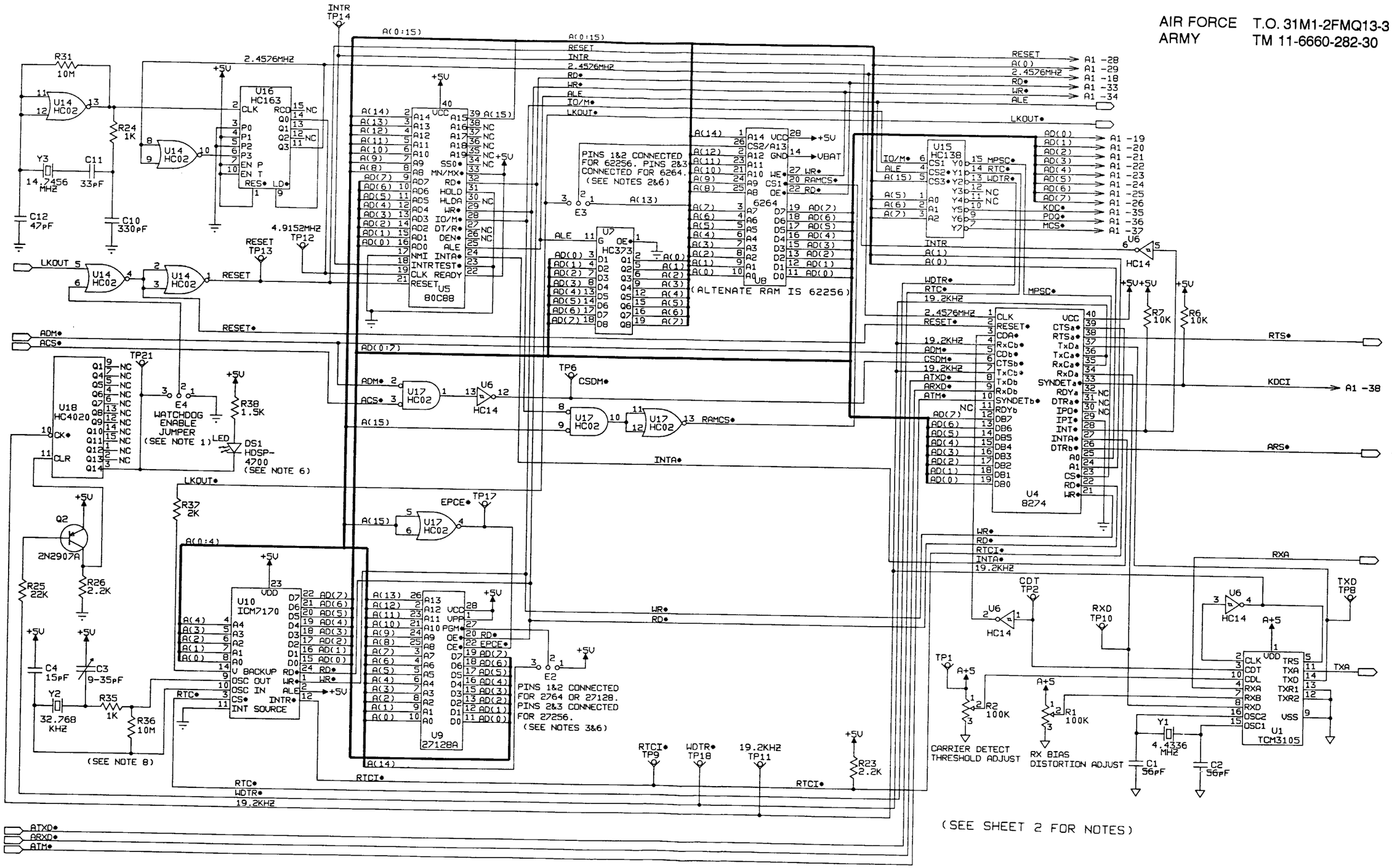
FO-22. Indicator/Recorder - Display PCBA, Signal Flow Diagram (Sheet 3 of 3)



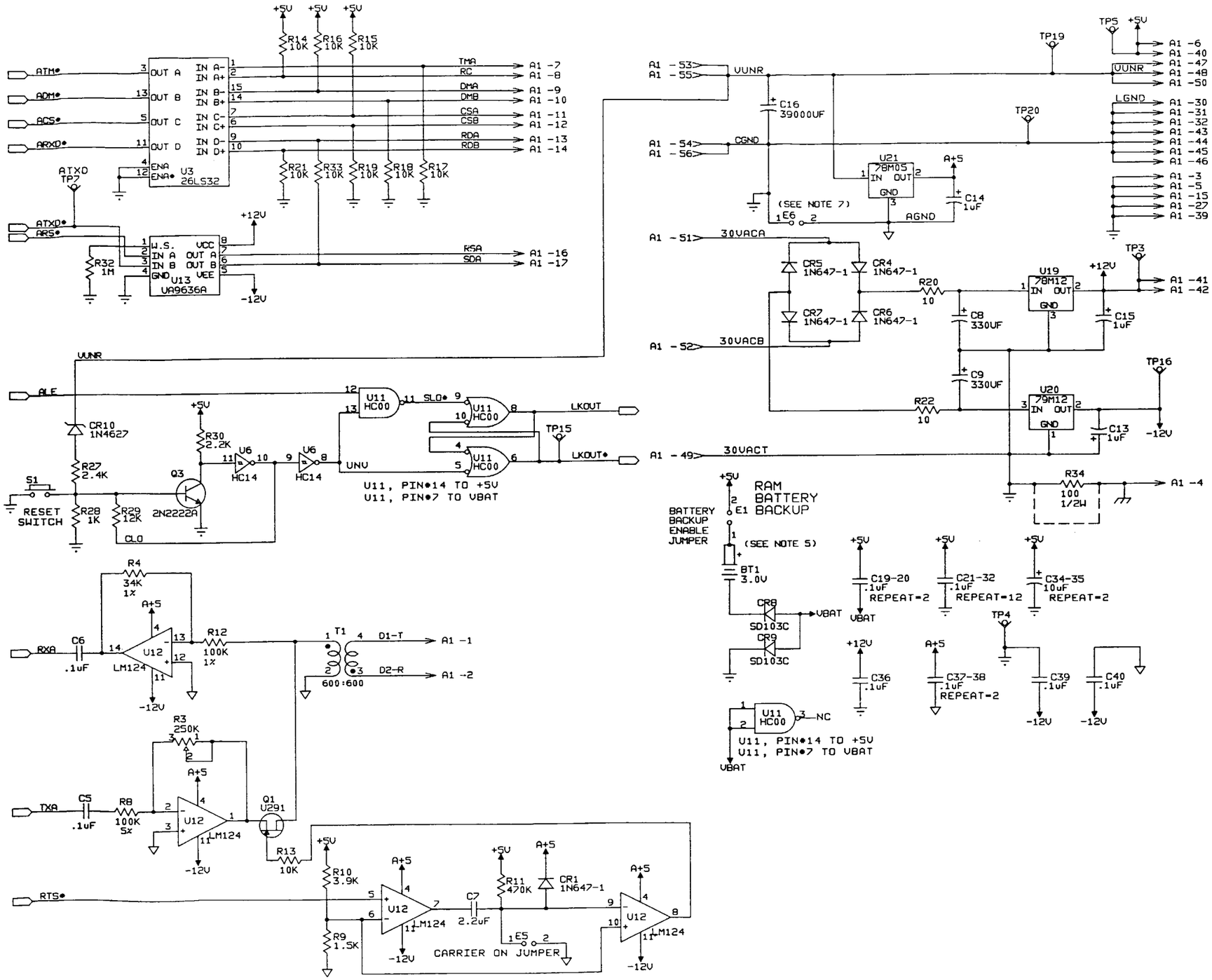
FO-23. Indicator/Recorder - Power Supply and Distribution, Power Distribution Diagram



FO-24. Indicator/Recorder - Interconnection Diagram



FO-25. Indicator/Recorder - Microprocessor PCBA, Schematic Diagram (Sheet 1 of 2)



NOTES:

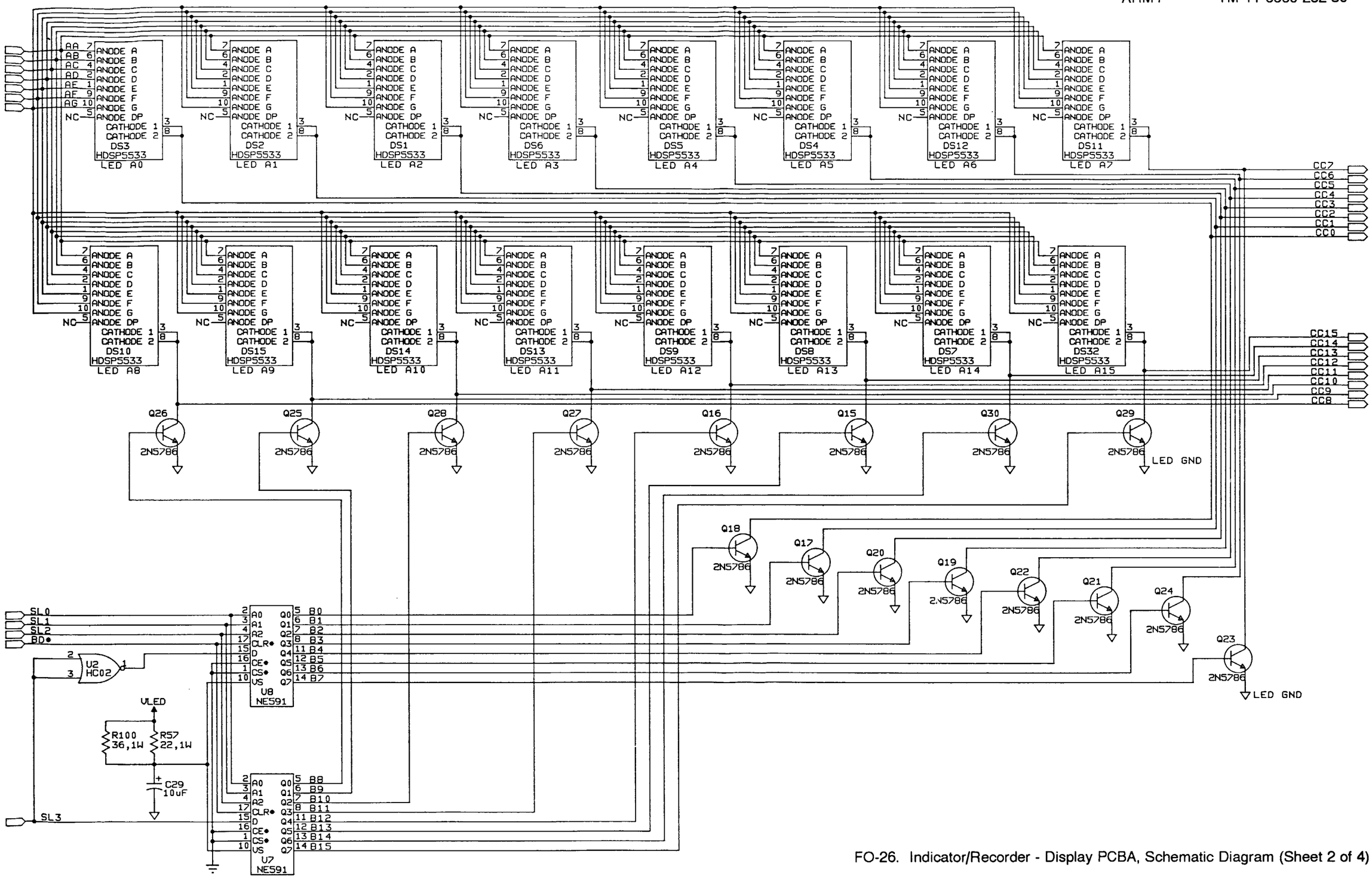
1. WATCHDOG ENABLE JUMPER SHOULD BE IN THE ENABLE POSITION (E4 PIN 2 JUMPERED TO PIN 3) DURING NORMAL OPERATION. THE WATCHDOG MAY BE DISABLED FOR TESTING BY JUMPERING E4 PIN 2 TO PIN 1.
2. PINS 2 & 3 OF F3 ARE CONNECTED ON PCB TRACES, WHICH SETS U8 TO BE AN DW6264 (8K X 8 RAM); THEREFORE E3 IS NOT NORMALLY INSTALLED. FOR SPECIAL LABORATORY APPLICATIONS A 32K X 8 RAM (DW62256 OR HM62256) MAY BE USED BY CUTTING TRACE CONNECTING PINS 2 & 3 OF E3 AND JUMPERING PINS 1 & 2 OF E3. PIN 1 IS DENOTED BY A SQUARE PAD.
3. PINS 1 & 2 OF E2 ARE CONNECTED BY TRACES ON PCB WHICH SETS U9 TO BE A 27128A (16K X 8 EPROM). FOR SPECIAL LABORATORY APPLICATIONS A 27256 (32K X 8 EPROM) MAY BE USED BY CUTTING TRACE CONNECTING PINS 1 & 2 OF E2 AND JUMPERING PINS 2 & 3 OF E2. PIN 1 IS DENOTED BY A SQUARE PAD.
4. DURING NORMAL OPERATION THE CARRIER-ON JUMPER (E5) MUST BE DISCONNECTED, ALLOWING THE MICROPROCESSOR TO ENABLE AND DISABLE CARRIER AS NEEDED. THE JUMPER SHOULD BE PLACED ON ONLY ONE OF E5'S PINS, JUMPER PINS 1 2 PROVIDING A CONVENIENT STORAGE POSITION FOR THE JUMPER. FOR TESTING THE JUMPER MAY BE INSTALLED ACROSS PINS 1 & 2 OF E5, WHICH TURNS ON MODEM CARRIER CONTINUOUSLY FOR EASY OSCILLISCOPE VIEWING.
5. DURING SHIPPING AND STORAGE E1 SHOULD BE DISCONNECTED TO CONSERVE BATTERY LIFE. WHEN THE ASSEMBLY IS ON LINE E1 SHOULD BE INSTALLED TO PRESERVE TIME, DATE AND WIND DATA DURING POWER OUTAGES.
6. THE RESET SWITCH (S1), RAM AND ROM JUMPERS (E3 AND E2), THE LED (DS1), AND RESISTOR (R35) ARE NOT INSTALLED FOR FINAL ASSEMBLY. THEY ARE FOR LABORATORY USE ONLY AND WILL NOT BE FOUND ON PC BOARD SILKSCREEN.
7. E6 IS A LINK WHICH TIES DIGITAL GROUND TO ANALOG GROUND AT ONLY ONE POINT. A TRACE HAS BEEN PLACED ACROSS PINS 1 AND 2 OF E6 ON THE PRINTED CIRCUIT BOARD TO FULFILL E6'S PURPOSE.
8. THE VALUES OF R35 AND R36 ARE DETERMINED BY THE PART NUMBER OF Y2 AS INDICATED BELOW:

Y2	R35	R36
NTF3238F	1K	NOT USED
CX-1V-32.768KHZ	220K	10M

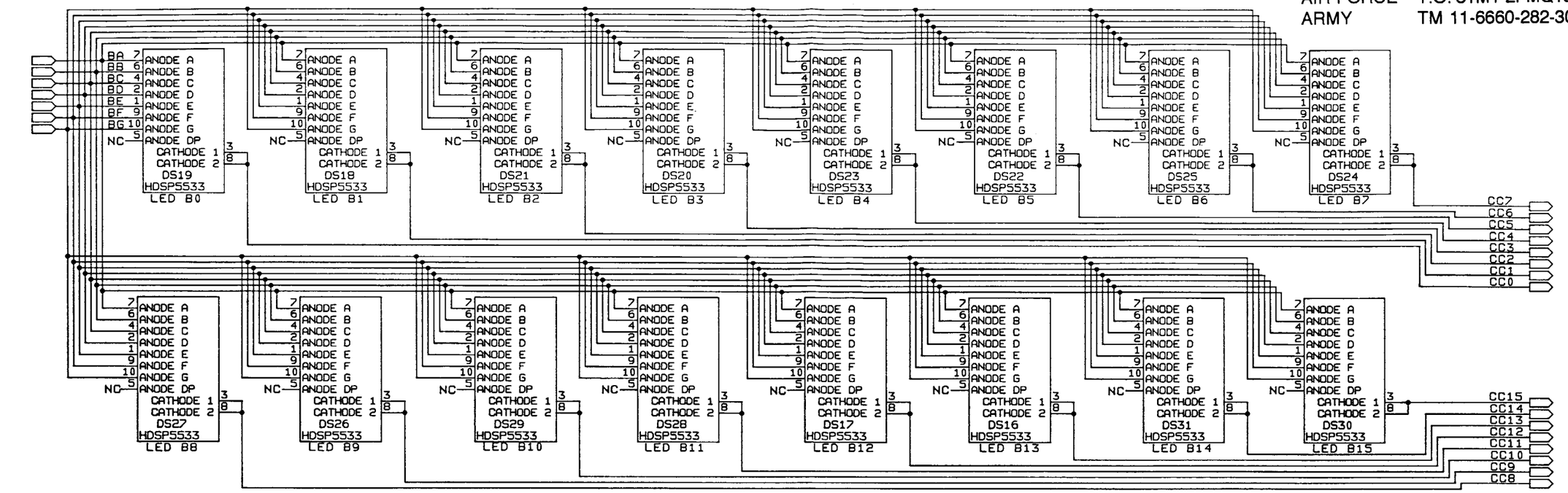
FO-25. Indicator/Recorder - Microprocessor PCBA, Schematic Diagram (Sheet 2 of 2)

U10,U11,U12,U13 PIN#4 : +12V
PIN#11: GND

FO-26. Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 1 of 4)

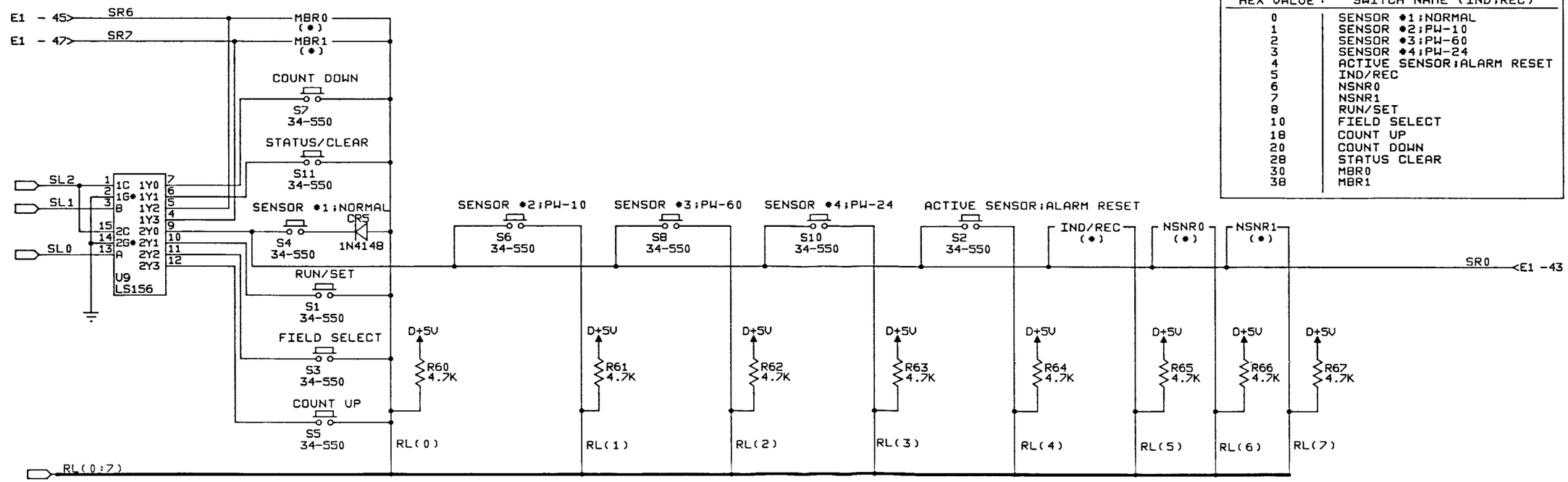


FO-26. Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 2 of 4)

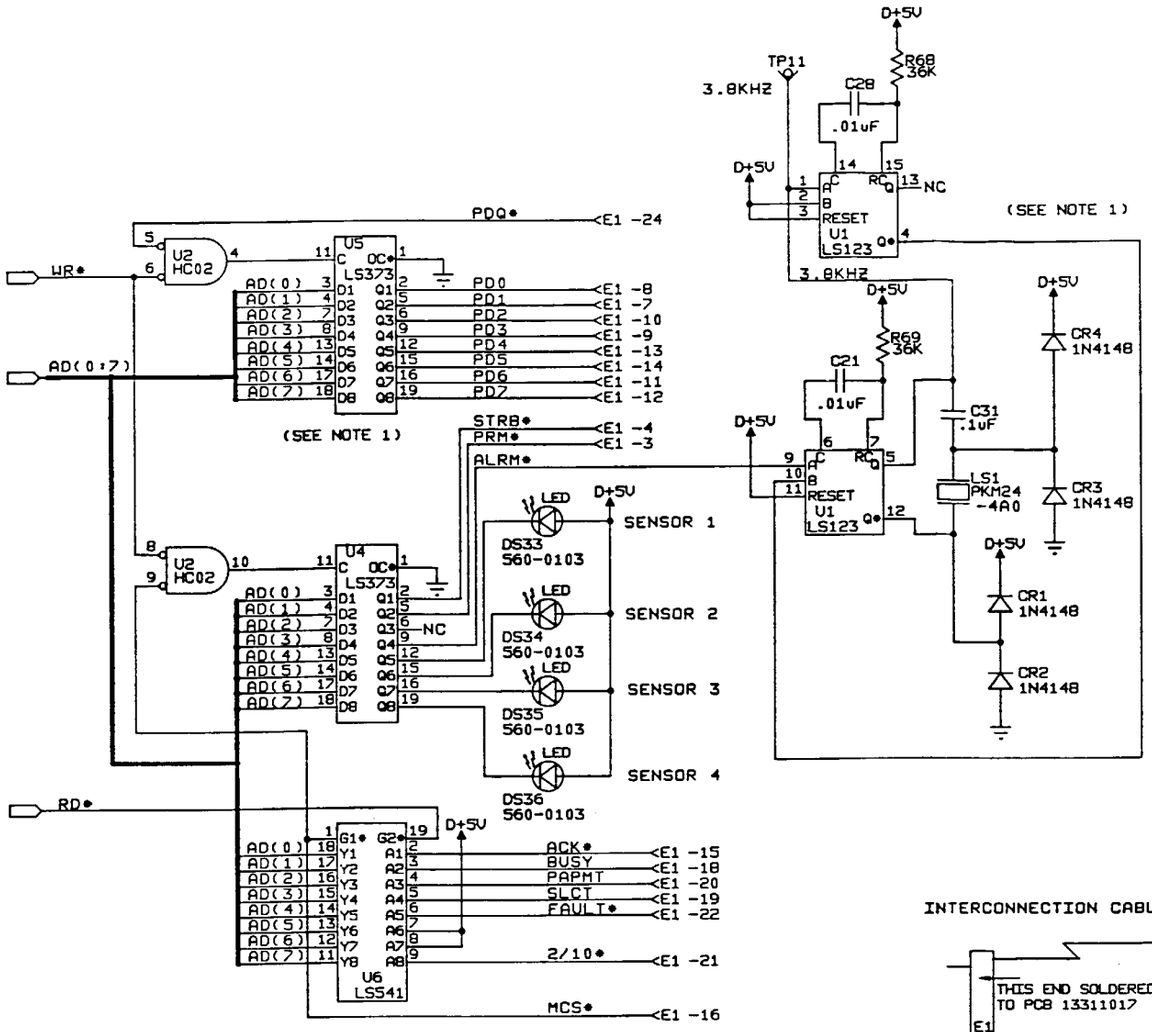


(*) SWITCHES MBR0 AND MBR1 AND STRAPS IND/REC, NSNR0, AND NSNR1 ARE NOT LOCATED ON THE DISPLAY ASSEMBLY.
THEY ARE LOCATED ON THE INTERCONNECT ASSEMBLY OR THE CONFIGURATION SWITCH ASSEMBLY.

8279-5 FIFO BUFFER HEX VALUES	
HEX VALUE	SWITCH NAME (IND;REC)
0	SENSOR *1;NORMAL
1	SENSOR *2;PW-10
2	SENSOR *3;PW-60
3	SENSOR *4;PW-24
4	ACTIVE SENSOR;ALARM RESET
5	IND/REC
6	NSNR0
7	NSNR1
8	RUN/SET
10	FIELD SELECT
18	COUNT UP
20	COUNT DOWN
28	STATUS CLEAR
30	MBR0
38	MBR1



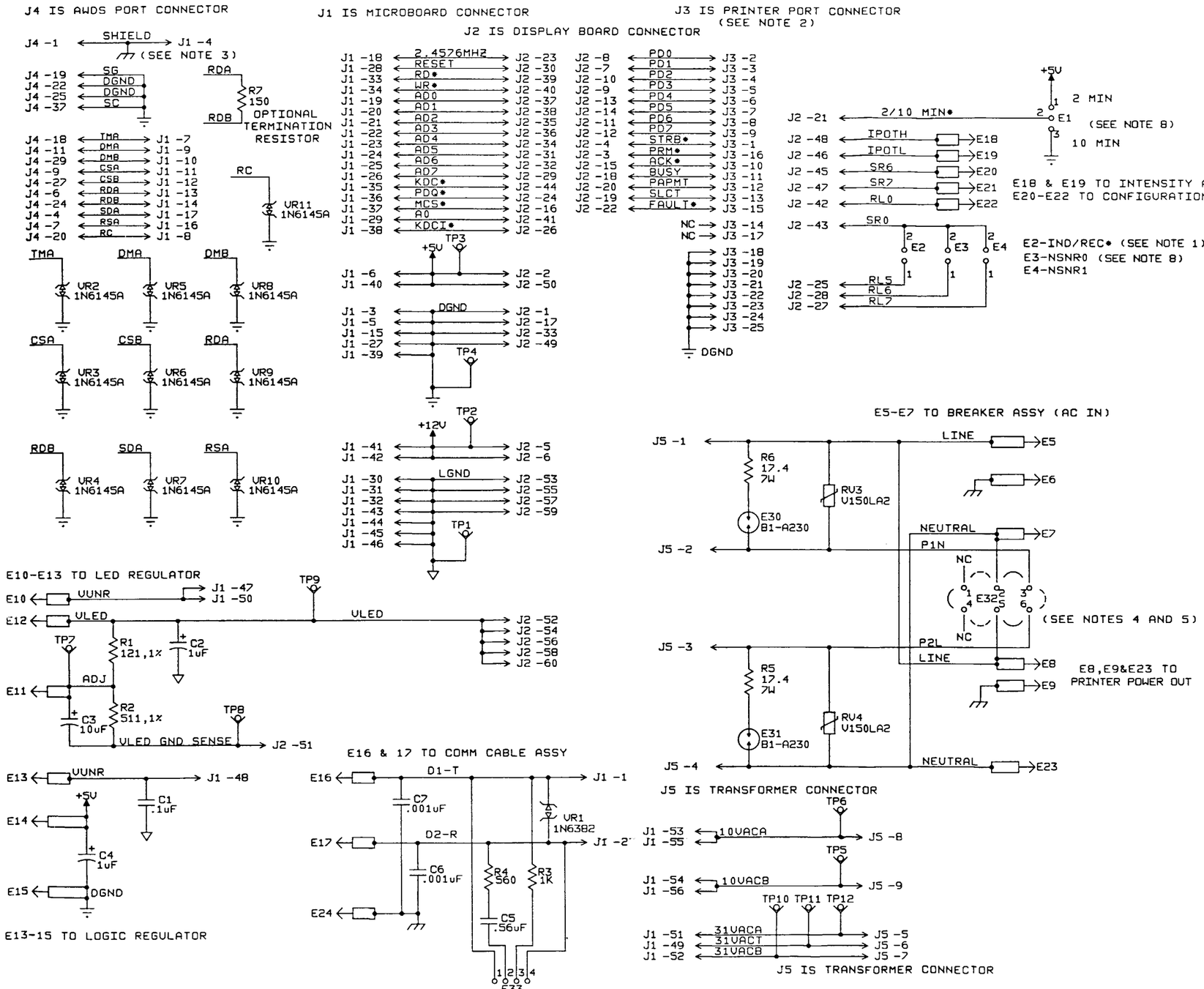
FO-26. Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 3 of 4)



NOTES:

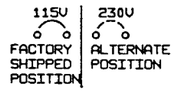
1. 6461-1017-2 PRINTED CIRCUIT BOARD ASSEMBLY AS SHOWN. 6461-1017-1 PRINTED CIRCUIT BOARD ASSEMBLY SCHEMATIC SAME AS SHOWN EXCEPT CR1-CR4, LS1, C31, C21, C28, R68, R69, U1 AND U5 ARE NOT USED.
2. ALL RESISTORS ARE 1/4W +/-5% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS ARE +/-10% UNLESS OTHERWISE SPECIFIED.

FO-26. Indicator/Recorder - Display PCBA, Schematic Diagram (Sheet 4 of 4)

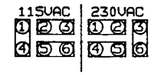


NOTES:

1. E2 STRAP IS NOT FIELD CHANGEABLE. A WIRE STRAP IS SOLDERED IN PLACE ON THE -1 VERSION ASSEMBLIES AND DELETED ON THE -2 VERSION ASSEMBLIES.
2. J3 AND E8, E23 AND E9 ARE INSTALLED ON THE -2 VERSION ASSEMBLIES AND DELETED ON THE -1 VERSION ASSEMBLIES.
3. J1-4, J3-17, AND J4-1 ARE CONNECTED TO EARTH GROUND AND THE ASSEMBLY SHELL.
4. THE DIAGRAM BELOW SHOWS THE STRAPPING OPTIONS FOR E32 FOR BOTH 115VAC AND 230VAC.



5. AC POWER VOLTAGE STRAPPING:



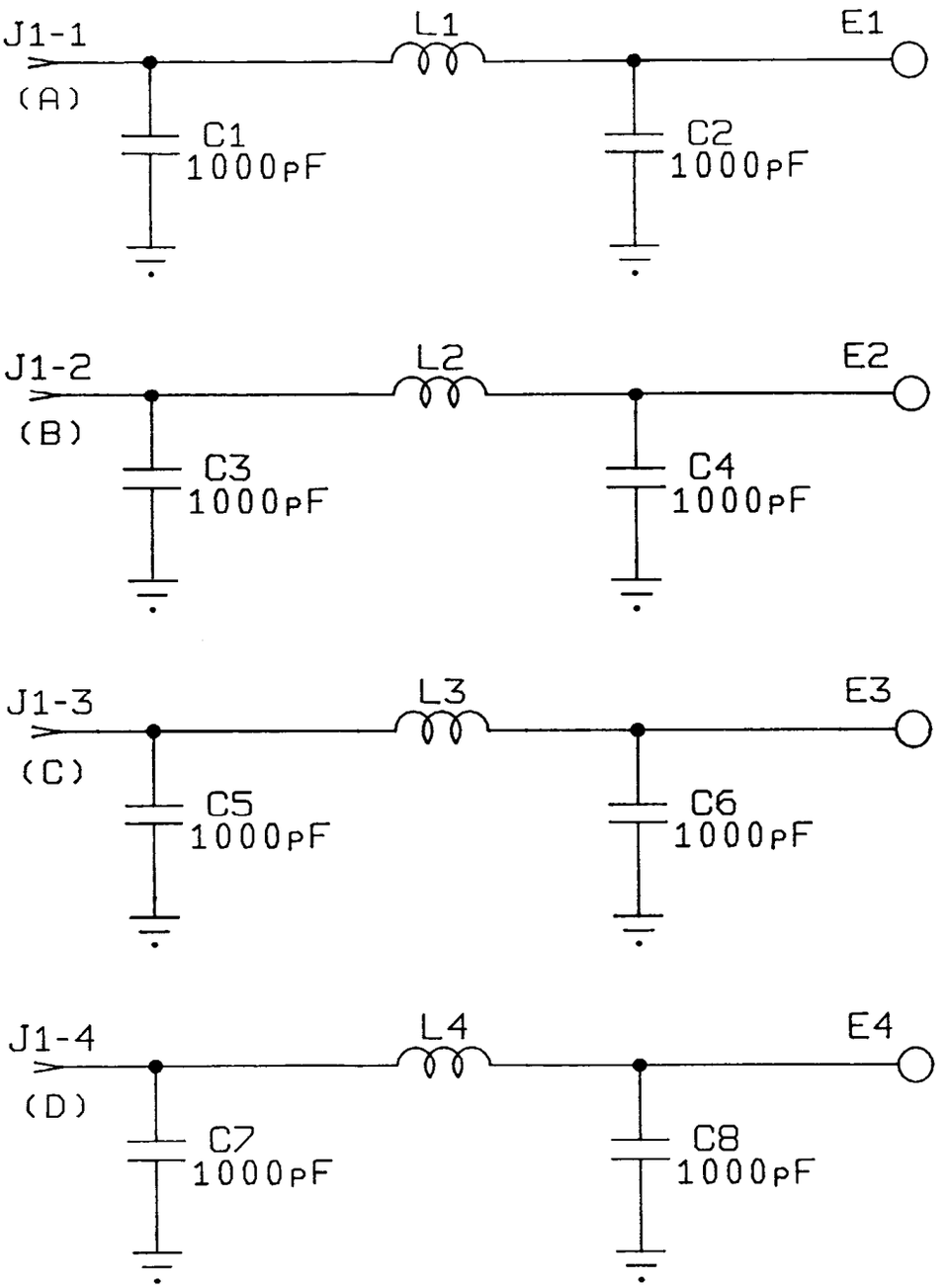
6. ALL RESISTORS ARE IN OHMS 1/4W 5% UNLESS OTHERWISE STATED.
7. ALL CAPACITORS ARE 10% UNLESS OTHERWISE STATED.
8. STRAPPING FUNCTION TABLE:

STRAP(S)	POSITION	FUNCTION
E1	1-2	2-MINUTE AVERAGING
E1	2-3	10-MINUTE AVERAGING
E3,E4	OFF,OFF	1 SENSOR
E3,E4	ON,OFF	2 SENSORS
E3,E4	OFF,ON	3 SENSORS
E3,E4	ON,ON	4 SENSORS
E33	OFF,OFF	OPEN - NOT AT END OF LEG
E33	OFF,2-3	1.56K - END OF LEG, 20-26 AWG INTERASSEMBLY WIRING
E33	OFF,3-4	1K - END OF LEG, 12-19 AWG INTERASSEMBLY WIRING
E33	1-2,OFF	560 OHM - RESERVED
E33	1-2,3-4	359 OHM - RESERVED

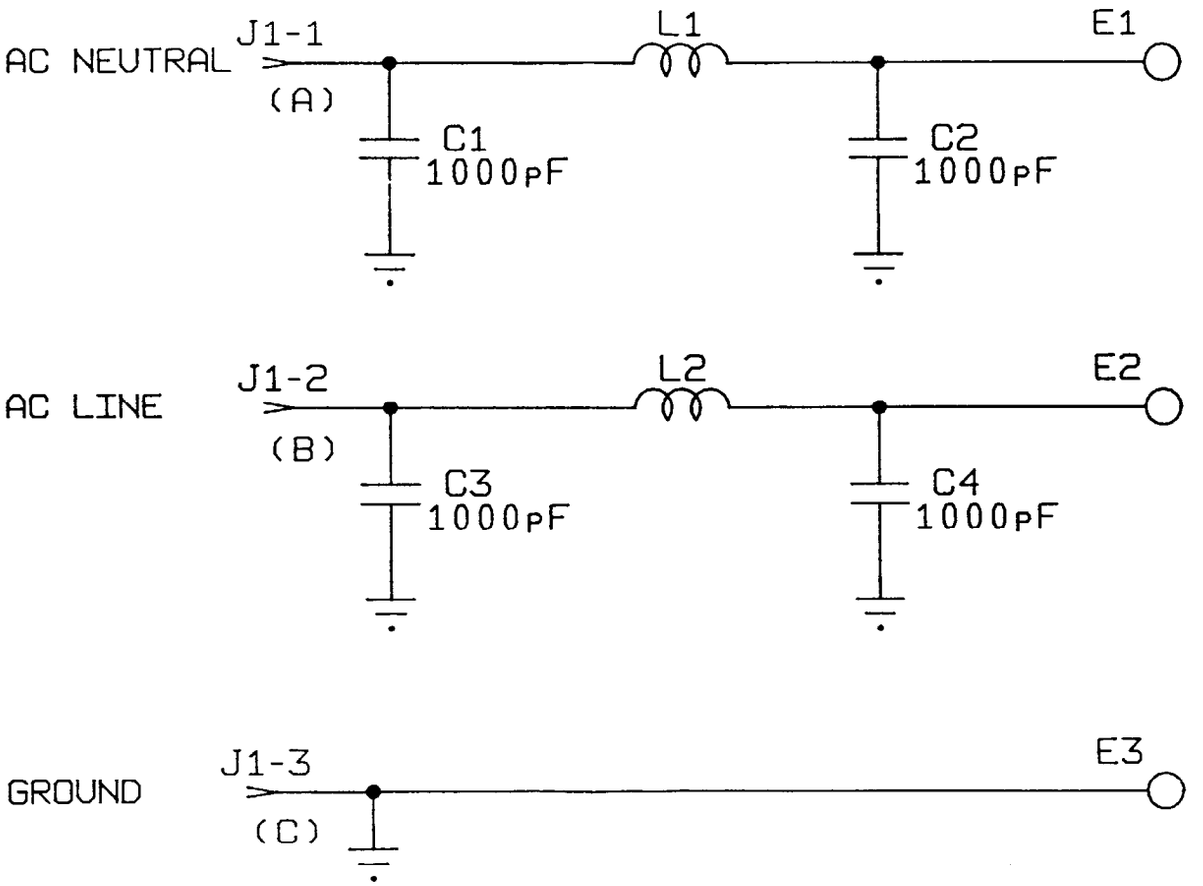
KEY: "2-3" = STRAP PINS 2 AND 3 TOGETHER
"ON" = STRAP THE TWO PINS OF EXX TOGETHER
"OFF" = LEAVE THE TWO PINS OF EXX OPEN. STORE JUMPER ON ONLY ONE PIN FOR LATER USE.

9. SURGE SUPPRESSORS, VR2 - VR11, ARE OPTIONAL.

FO-27. Indicator/Recorder - Interconnect PCBA, Schematic Diagram



FO-28. Indicator/Recorder - Communications EMI Filter, Schematic Diagram



FO-29. Indicator - Power Output EMI Filter, Schematic Diagram