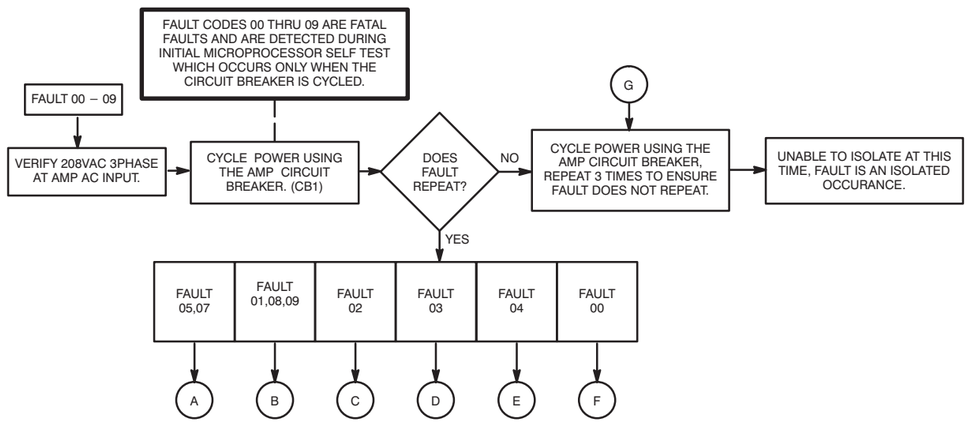
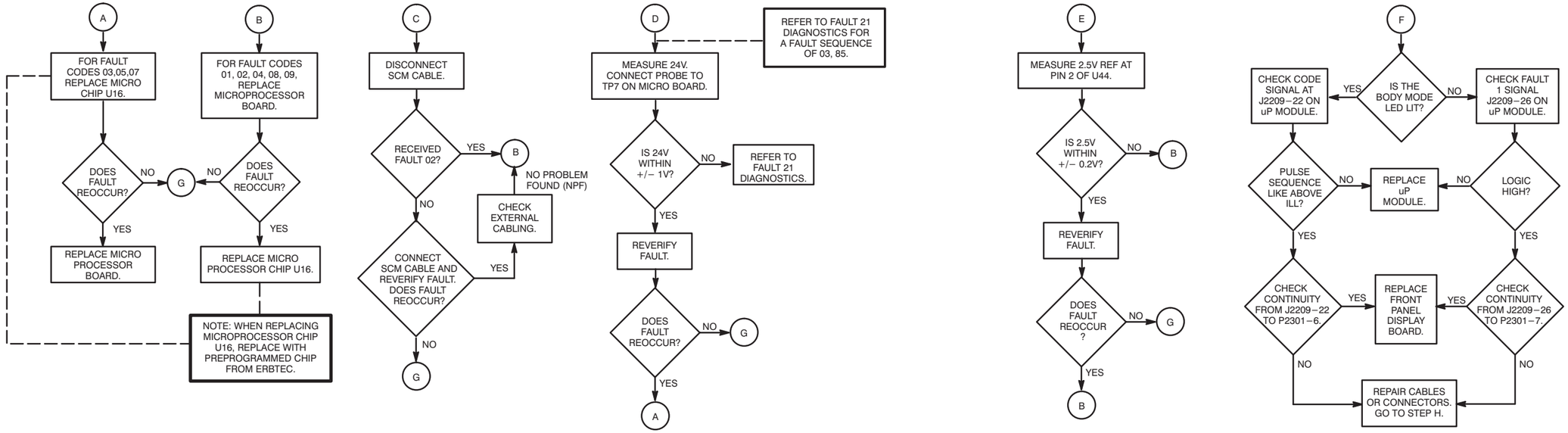
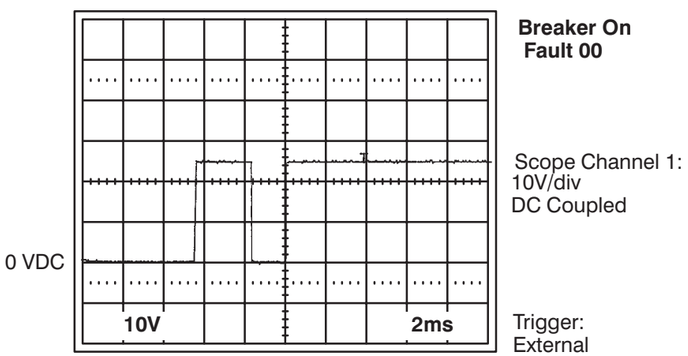
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS



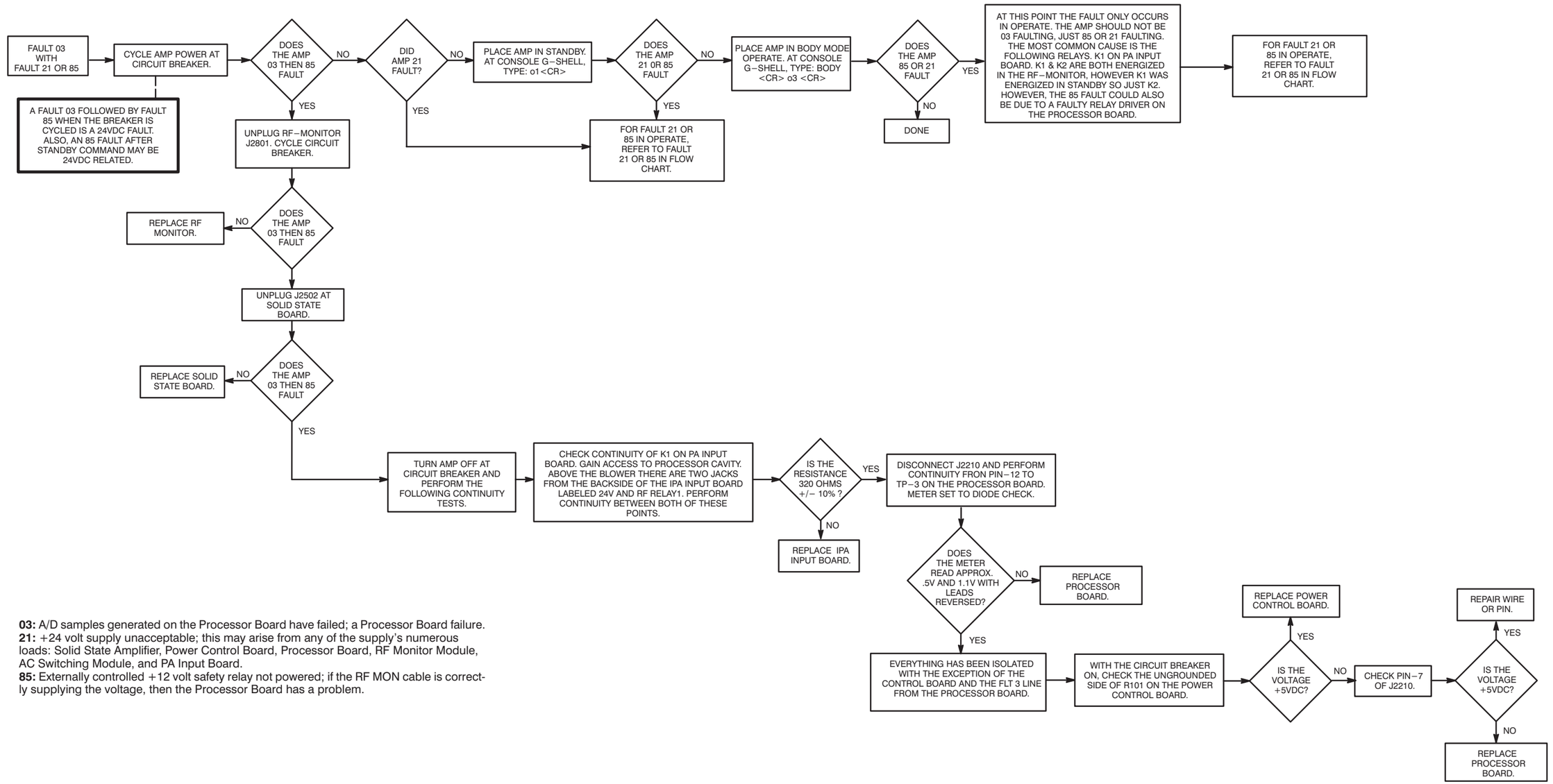


00: The fault interlock is being held high. The microprocessor is stuck in reset or the cable between the Processor Board and the Front Panel Display Board has an open.
01: The microprocessor detects a “checksum” error. This generally indicates that the address bus is faulted or the EPROM contains incorrect data; definitely a Processor Board problem.
02: Dual port RAM apparently has failed; a Processor Board failure.
03: A/D samples generated on the Processor Board have failed; a Processor Board failure.
04: A/D multiplexer apparently has failed. Either the Processor Board Board has a problem, or possibly one of the 32 analog convertible signals is unusually errant.
05:A/D on−board self−test has failed; a Processor Board failure.
07: Illegal opcode trap; a Processor Board failure.
08: External interrupt high does not cause interrupt; a Processor Board failure.
09: External interrupt low does not cause interrupt; a Processor Board failure.



RF AMPLIFIER FAULT CODE 00 − 05, 07−09 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−11

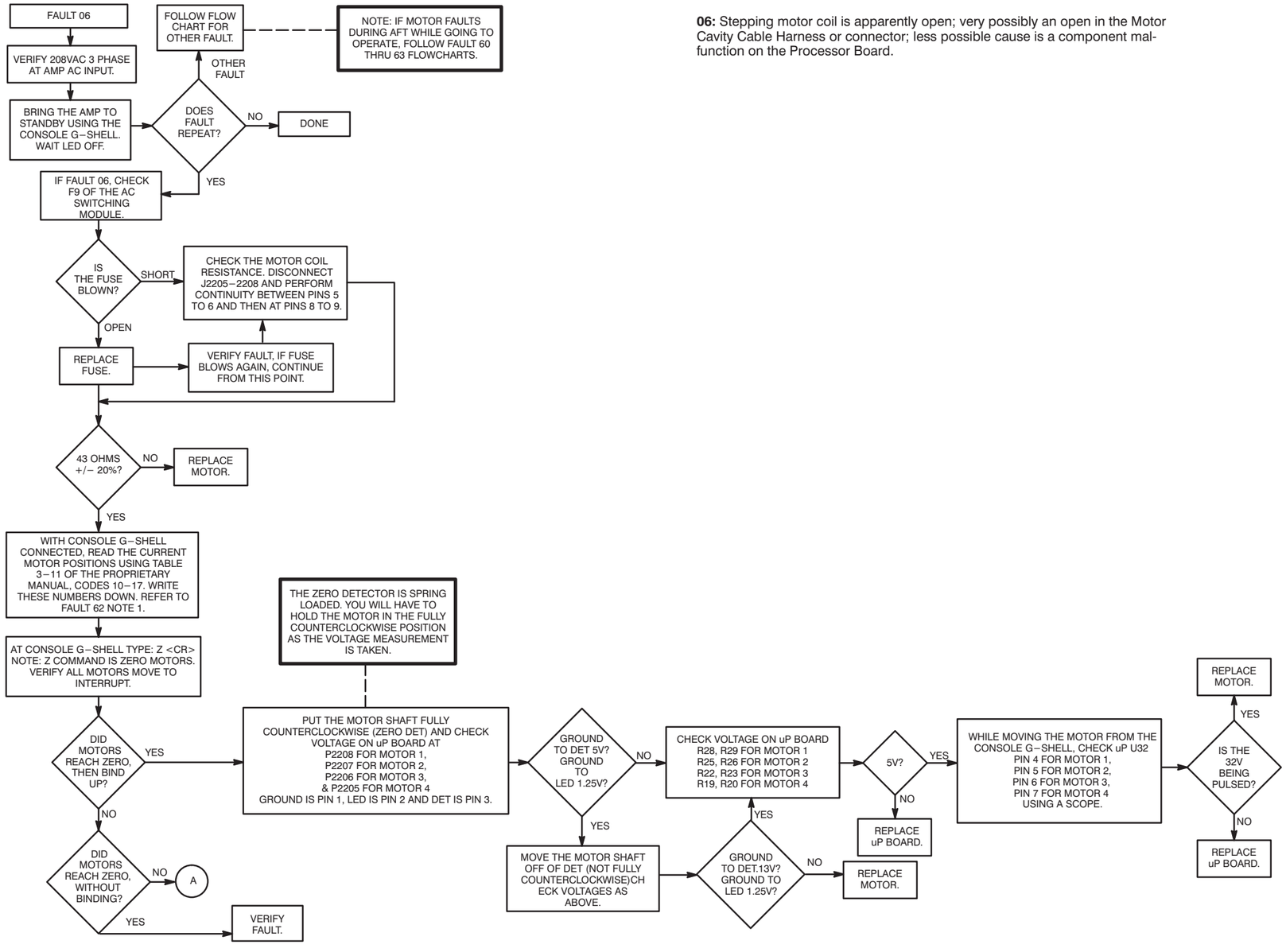
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



03: A/D samples generated on the Processor Board have failed; a Processor Board failure.
21: +24 volt supply unacceptable; this may arise from any of the supply's numerous loads: Solid State Amplifier, Power Control Board, Processor Board, RF Monitor Module, AC Switching Module, and PA Input Board.
85: Externally controlled +12 volt safety relay not powered; if the RF MON cable is correctly supplying the voltage, then the Processor Board has a problem.

RF AMPLIFIER FAULT CODE 03 WITH FAULT 21 OR 85 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−12

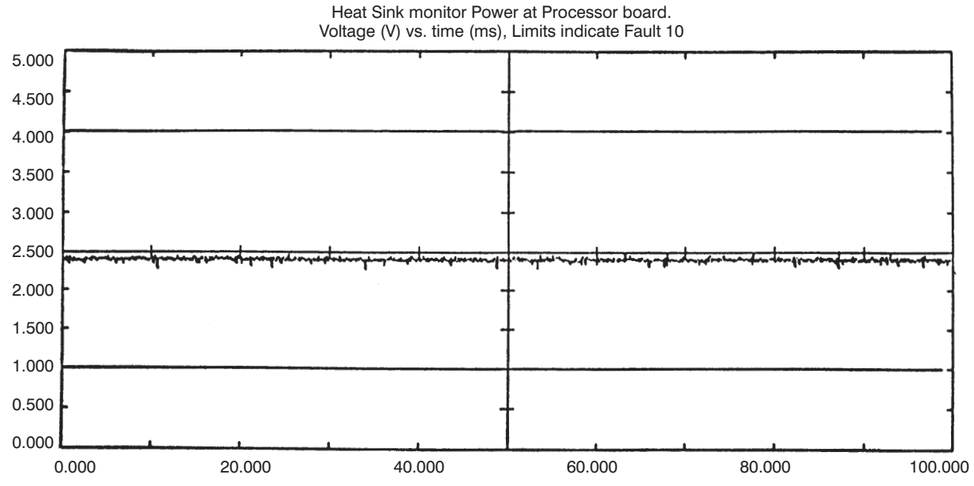
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

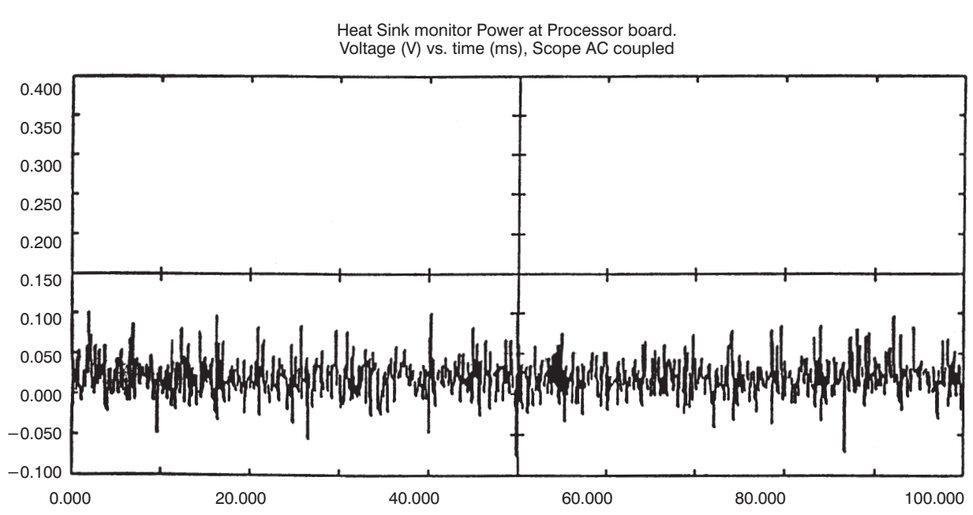


06: Stepping motor coil is apparently open; very possibly an open in the Motor Cavity Cable Harness or connector; less possible cause is a component malfunction on the Processor Board.

RF AMPLIFIER FAULT CODE 06 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−13

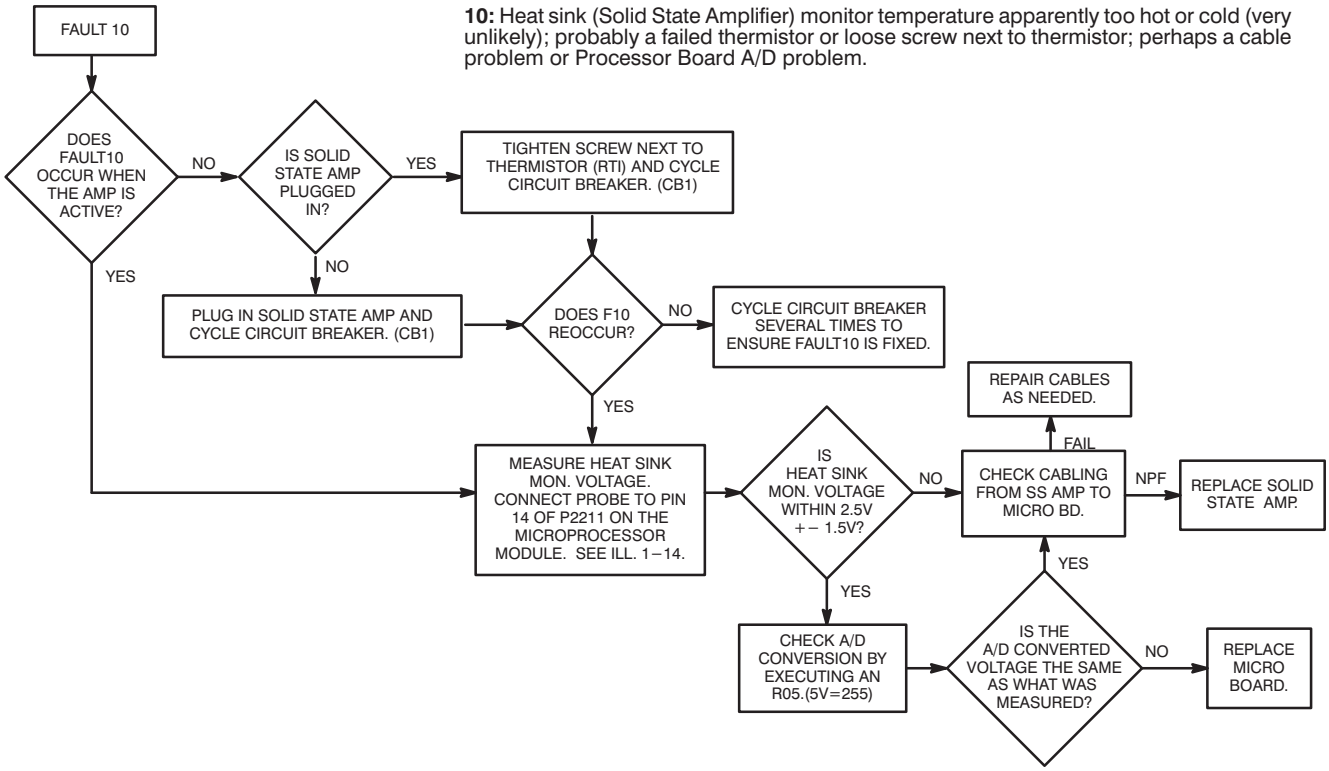
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)





RF AMPLIFIER FAULT CODE 10 SIGNALS
ILLUSTRATION 2−14

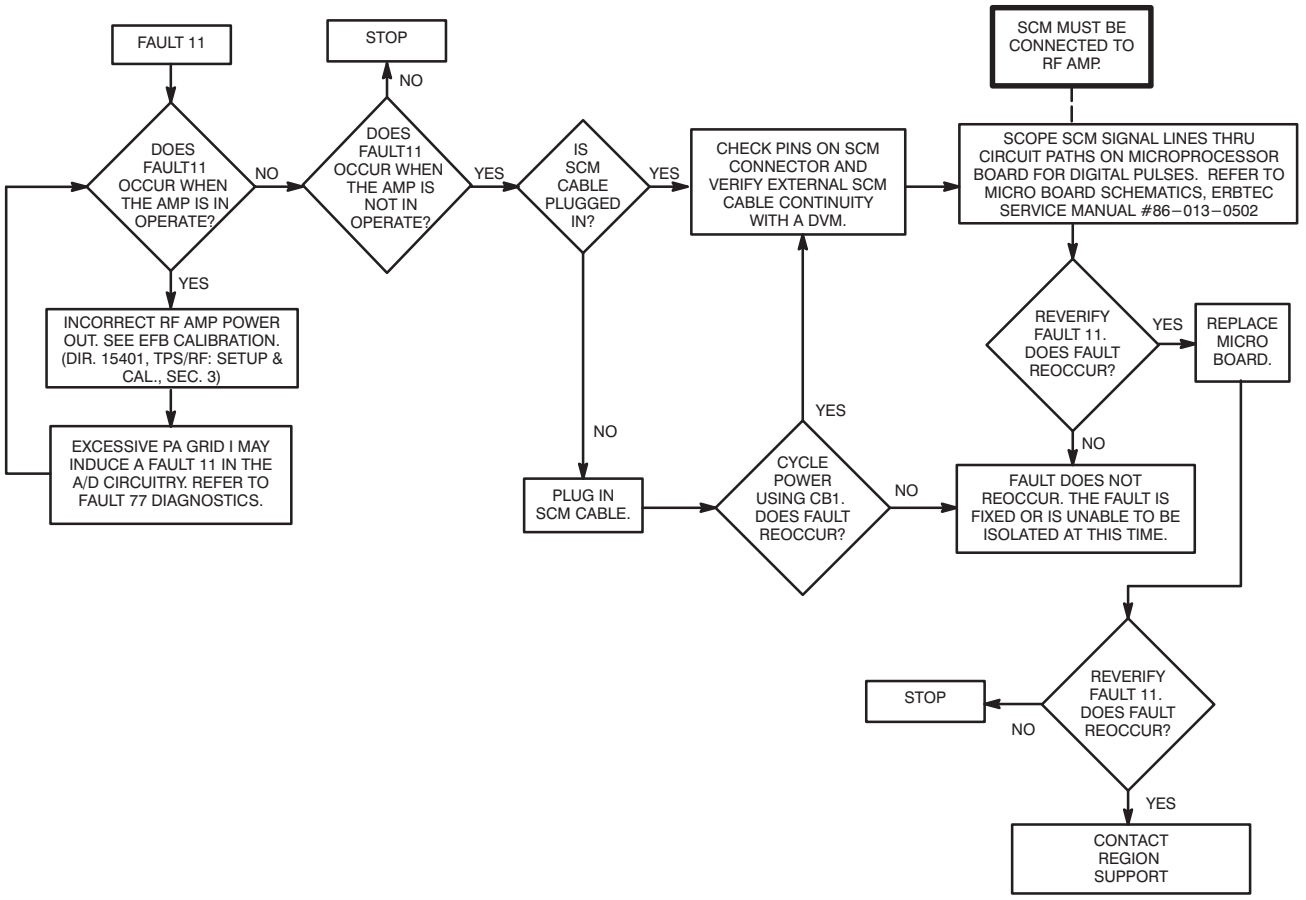
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 10 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−15

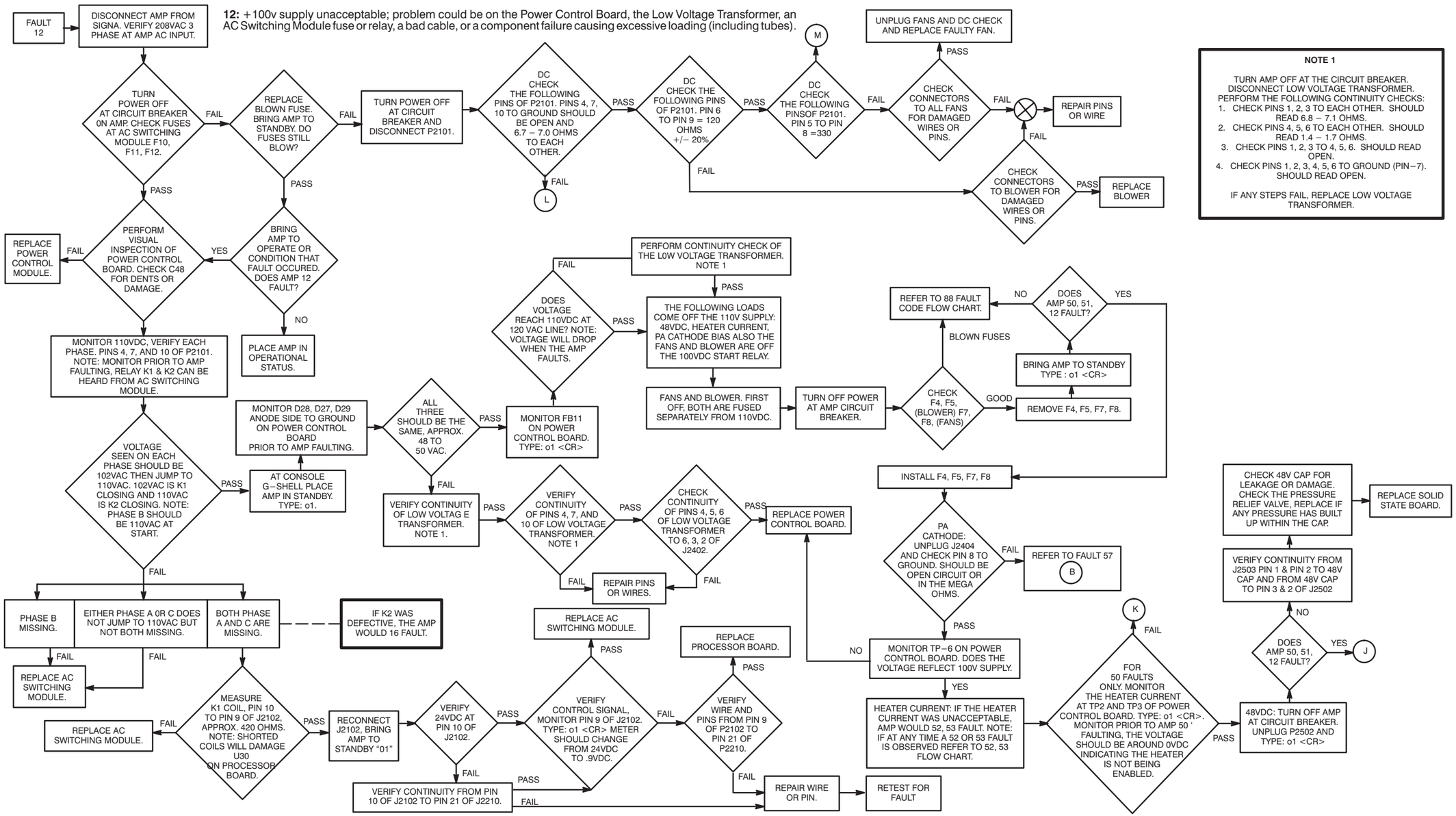
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

11:SCM (IPG) cable interlock invalid; either the strobe width is too wide, the cable is open, the strobe signal is high impedance, or most likely, the Processor Board has a problem.



RF AMPLIFIER FAULT CODE 11 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−16

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



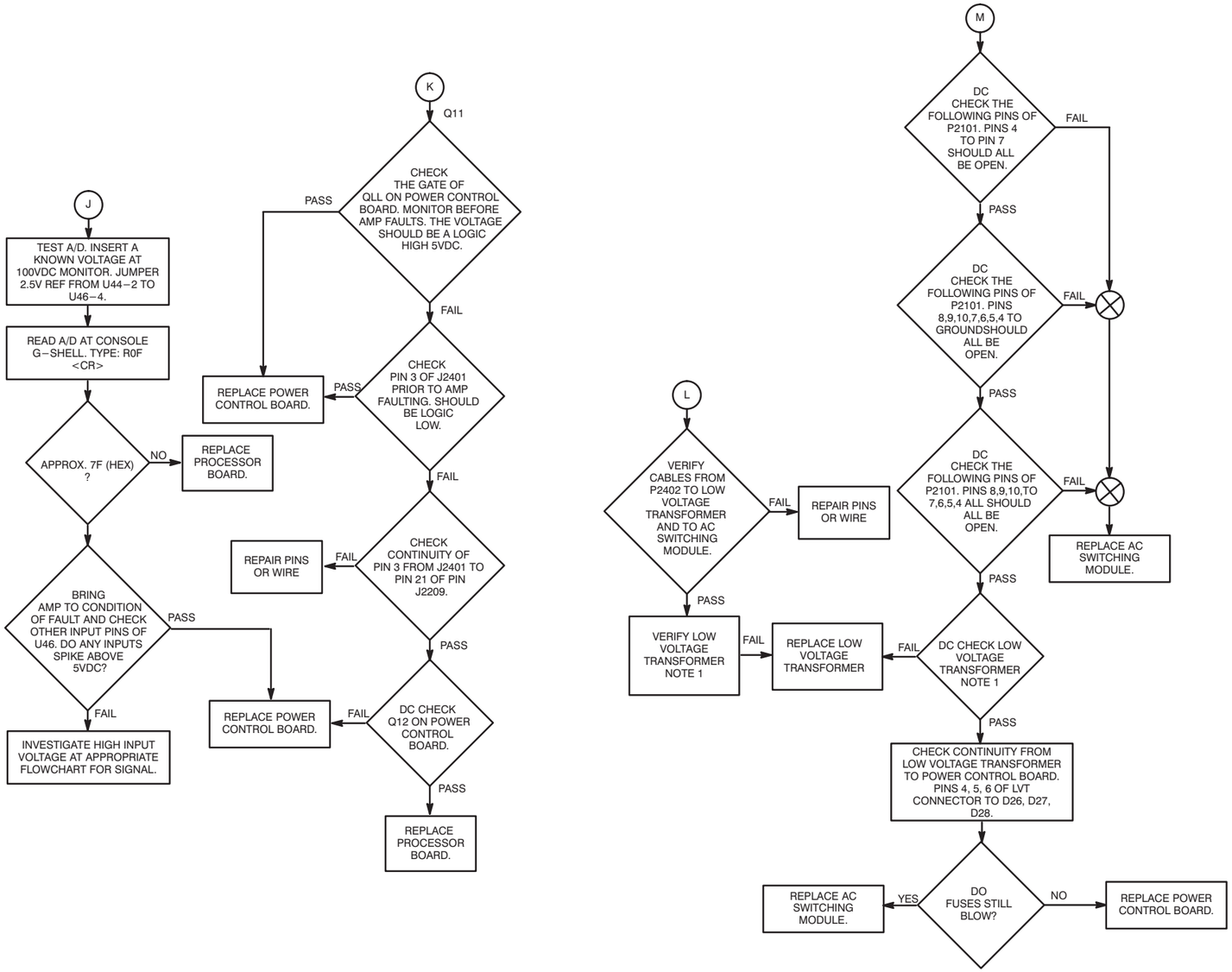
NOTE 1

TURN AMP OFF AT THE CIRCUIT BREAKER.
DISCONNECT LOW VOLTAGE TRANSFORMER.
PERFORM THE FOLLOWING CONTINUITY CHECKS:
1. CHECK PINS 1, 2, 3 TO EACH OTHER. SHOULD READ 6.8 − 7.1 OHMS.
2. CHECK PINS 4, 5, 6 TO EACH OTHER. SHOULD READ 1.4 − 1.7 OHMS.
3. CHECK PINS 1, 2, 3 TO 4, 5, 6. SHOULD READ OPEN.
4. CHECK PINS 1, 2, 3, 4, 5, 6 TO GROUND (PIN−7). SHOULD READ OPEN.

IF ANY STEPS FAIL, REPLACE LOW VOLTAGE TRANSFORMER.

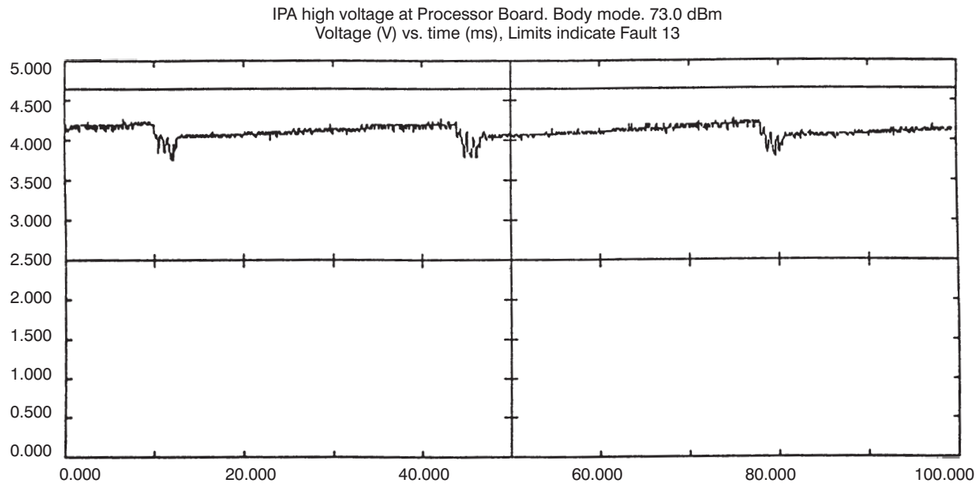
RF AMPLIFIER FAULT CODE 12 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−17

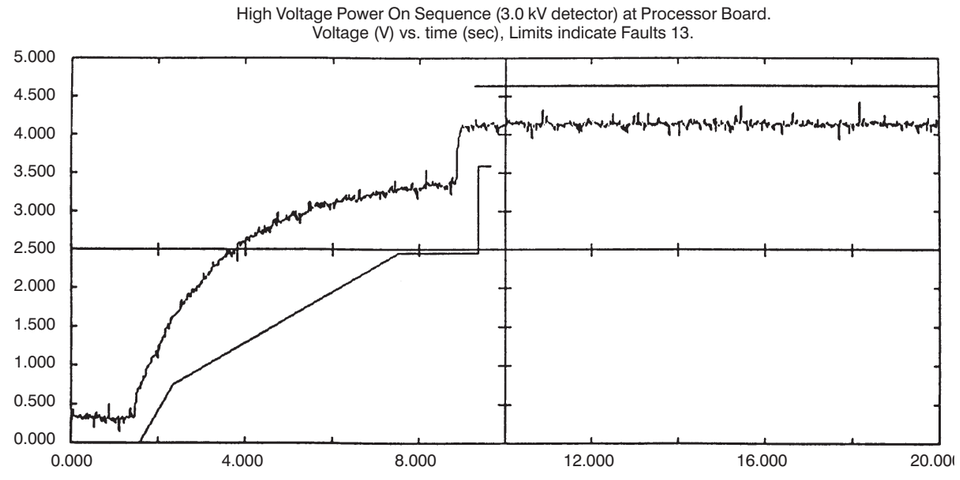
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

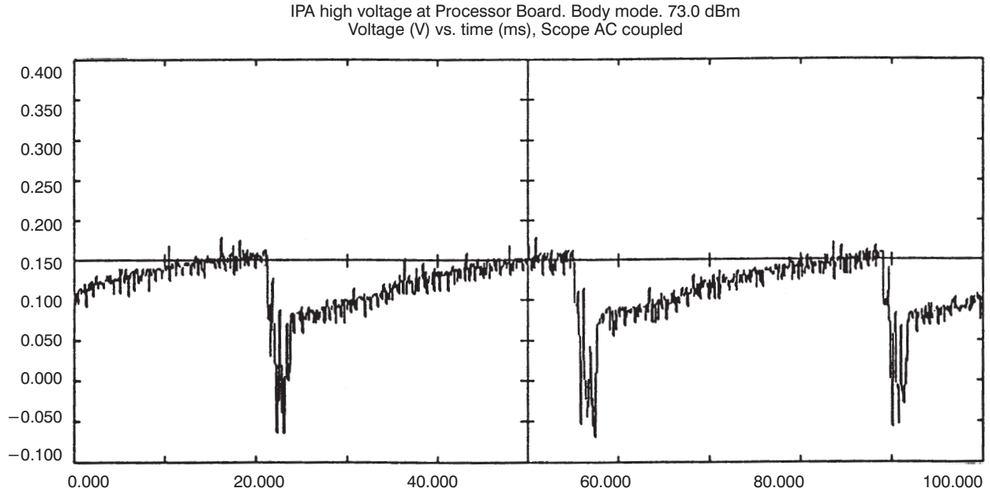


RF AMPLIFIER FAULT CODE 12 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−17 (continued)

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



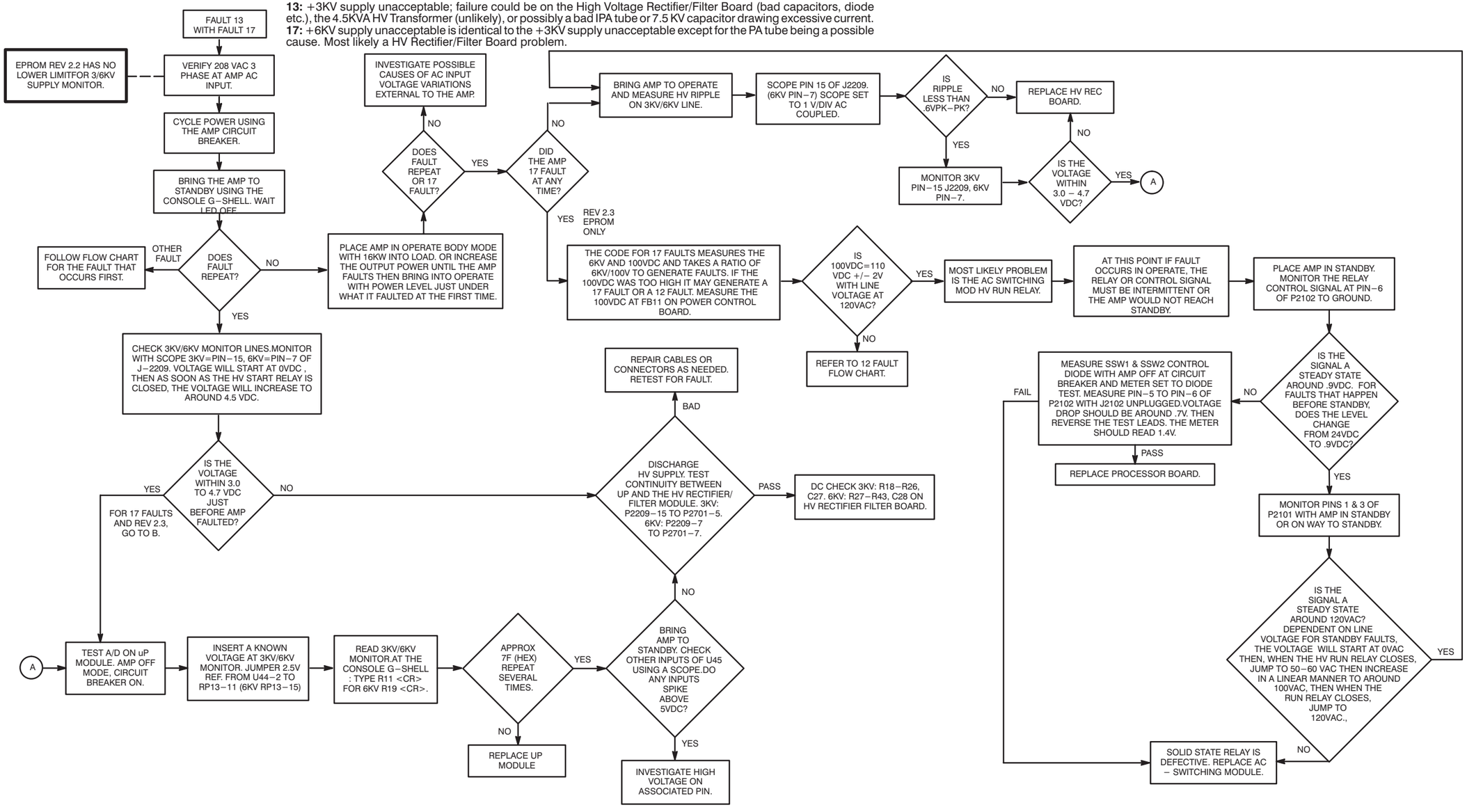




RF AMPLIFIER FAULT CODE 13 SIGNALS
ILLUSTRATION 2−18

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

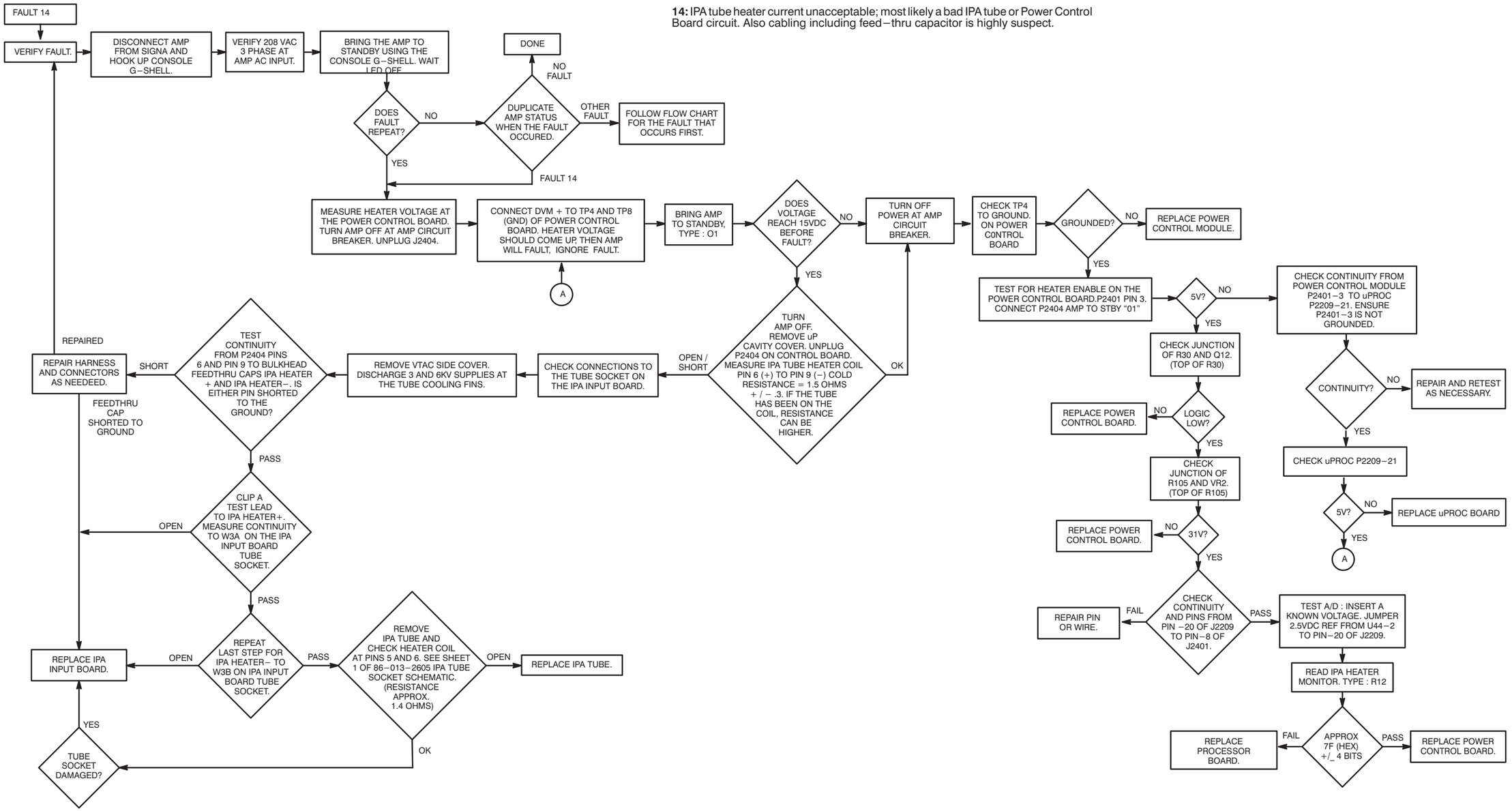
13: +3KV supply unacceptable; failure could be on the High Voltage Rectifier/Filter Board (bad capacitors, diode etc.), the 4.5KVA HV Transformer (unlikely), or possibly a bad IPA tube or 7.5 KV capacitor drawing excessive current.
17: +6KV supply unacceptable is identical to the +3KV supply unacceptable except for the PA tube being a possible cause. Most likely a HV Rectifier/Filter Board problem.



RF AMPLIFIER FAULT CODE 13 WITH FAULT 17 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−19

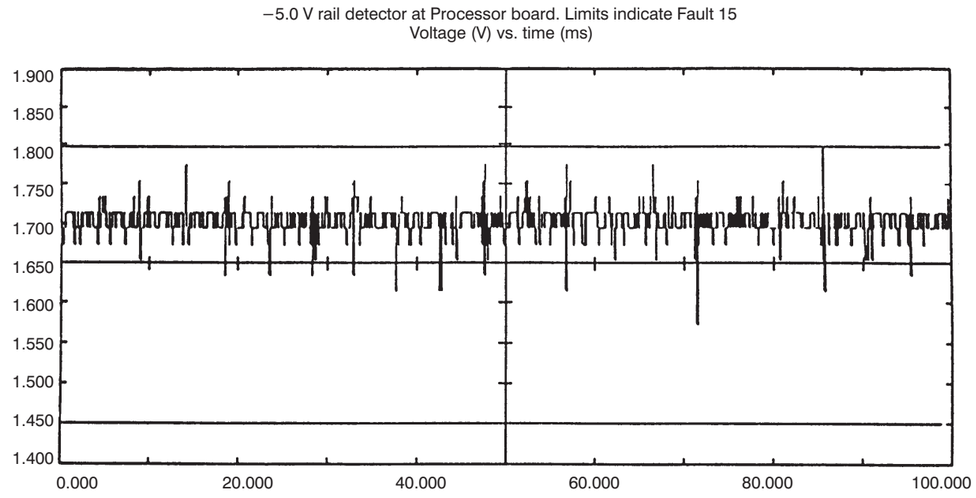
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

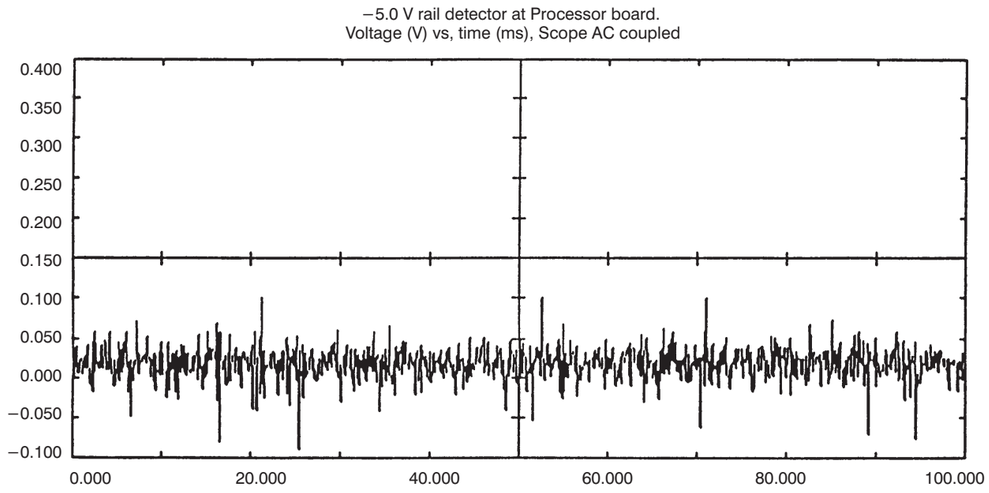
14: IPA tube heater current unacceptable; most likely a bad IPA tube or Power Control Board circuit. Also cabling including feed−thru capacitor is highly suspect.



RF AMPLIFIER FAULT CODE 14 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−20

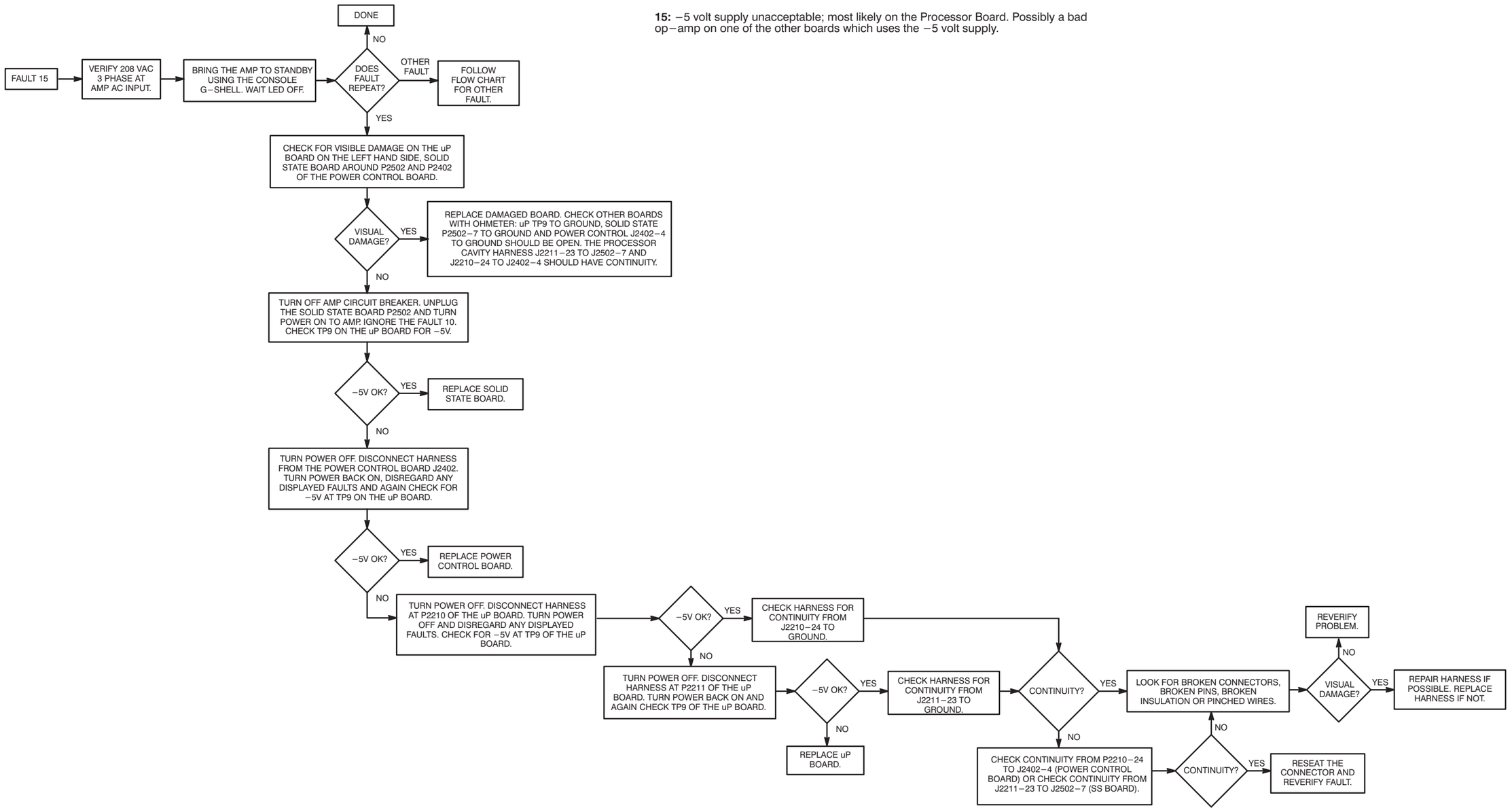
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)





RF AMPLIFIER FAULT CODE 15 SIGNALS
ILLUSTRATION 2−21

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

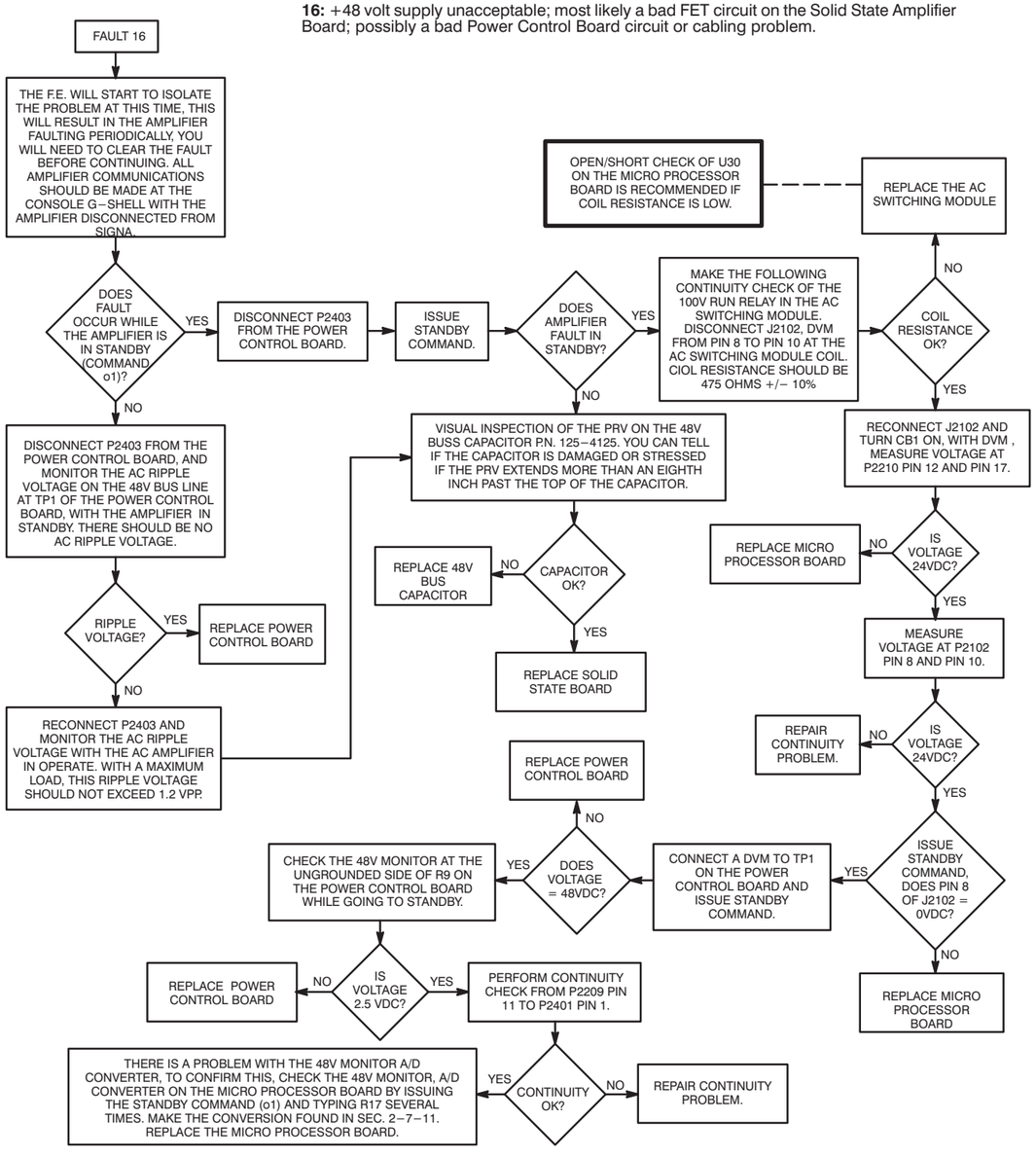


15: −5 volt supply unacceptable; most likely on the Processor Board. Possibly a bad op−amp on one of the other boards which uses the −5 volt supply.

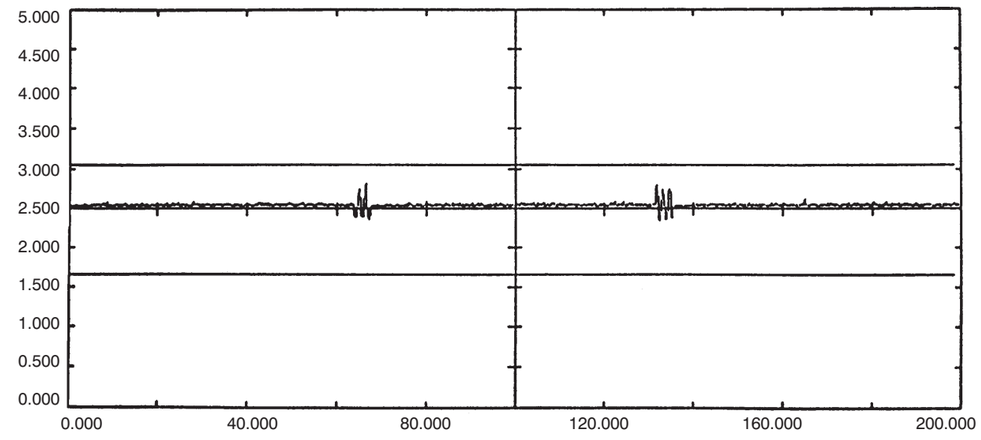
RF AMPLIFIER FAULT CODE 15 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−22

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

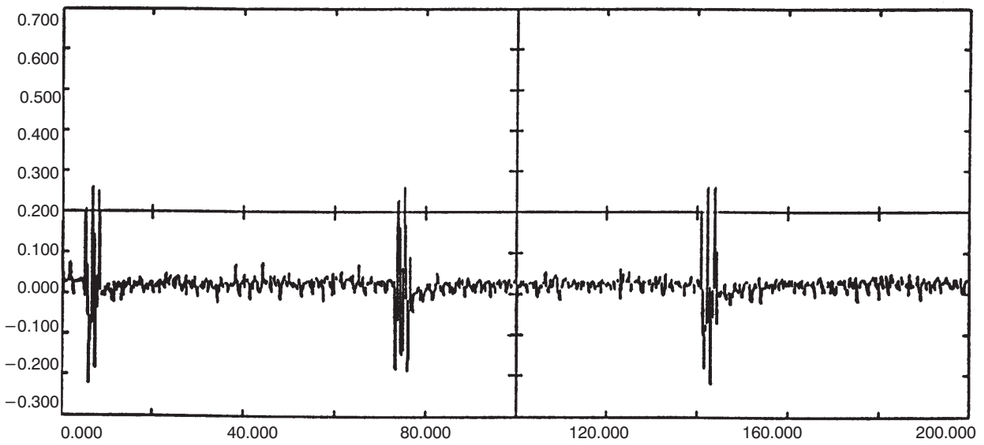
16: +48 volt supply unacceptable; most likely a bad FET circuit on the Solid State Amplifier Board; possibly a bad Power Control Board circuit or cabling problem.



48 V rail monitor at Processor Board. Body mode. 73.0 dBm
Voltage (V) vs. time (ms), Limits indicate Fault 16

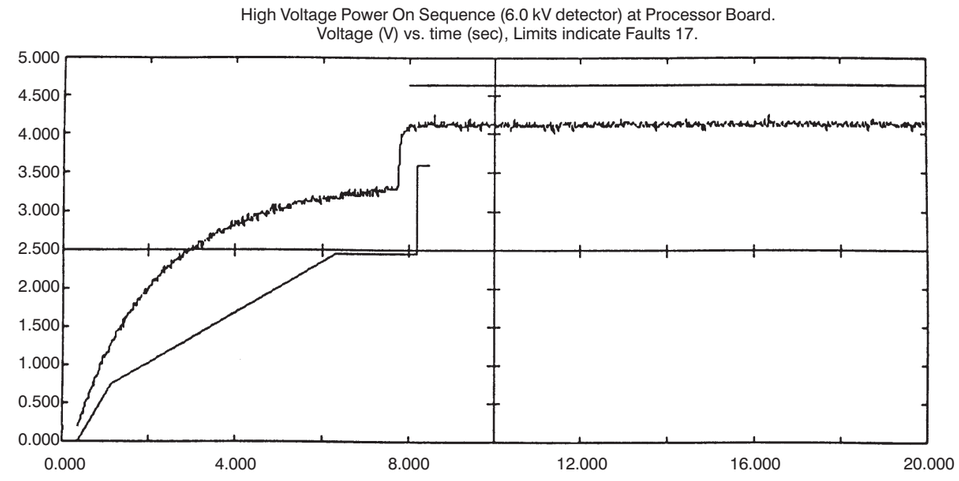


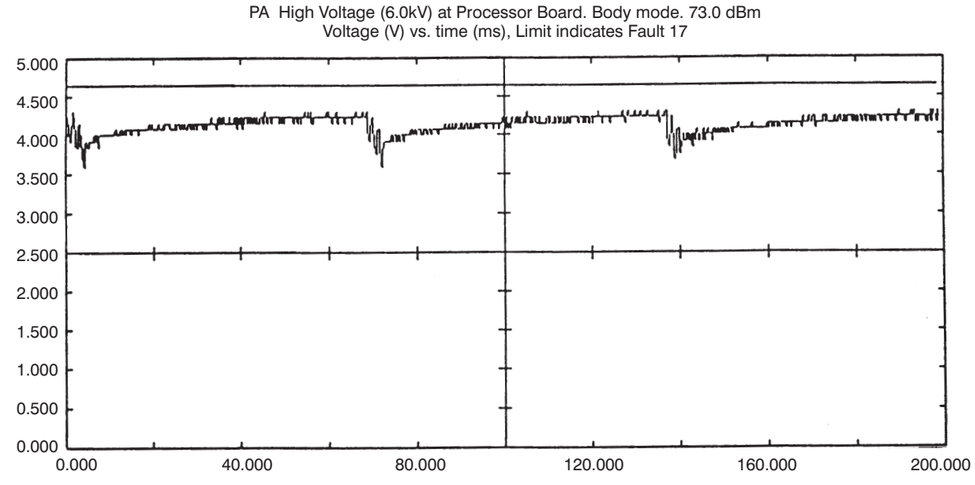
48 V rail monitor at Processor Board. Body mode. 73.0 dBm
Voltage (V) vs. time (ms), Scope AC coupled

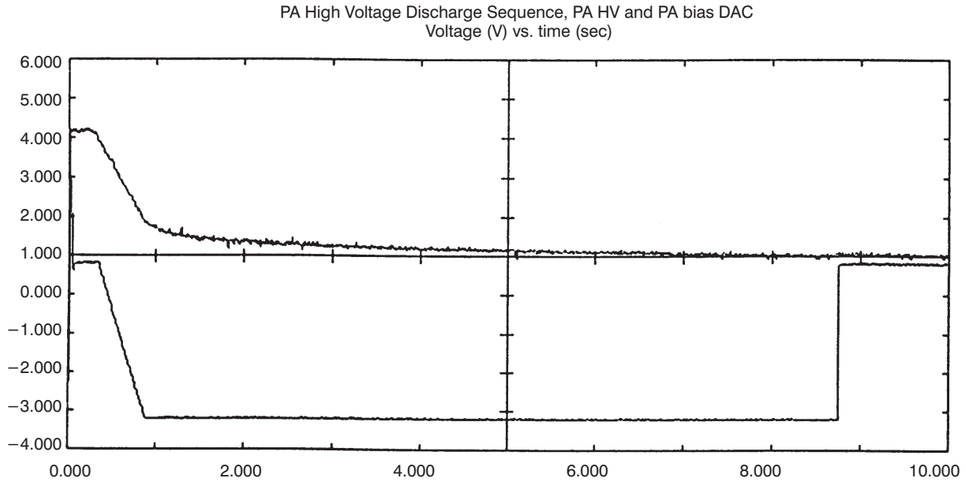


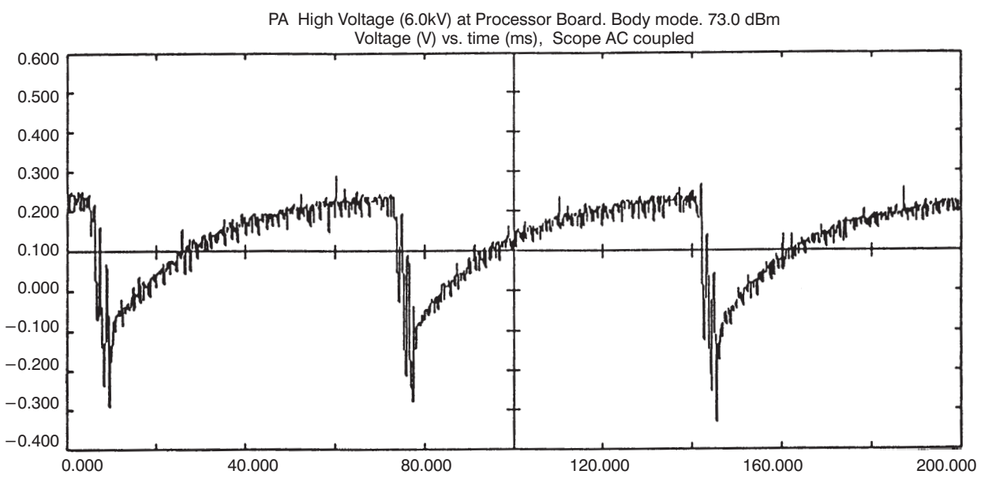
RF AMPLIFIER FAULT CODE 16 TROUBLESHOOTING FLOWCHART & SIGNALS
ILLUSTRATION 2−23

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)





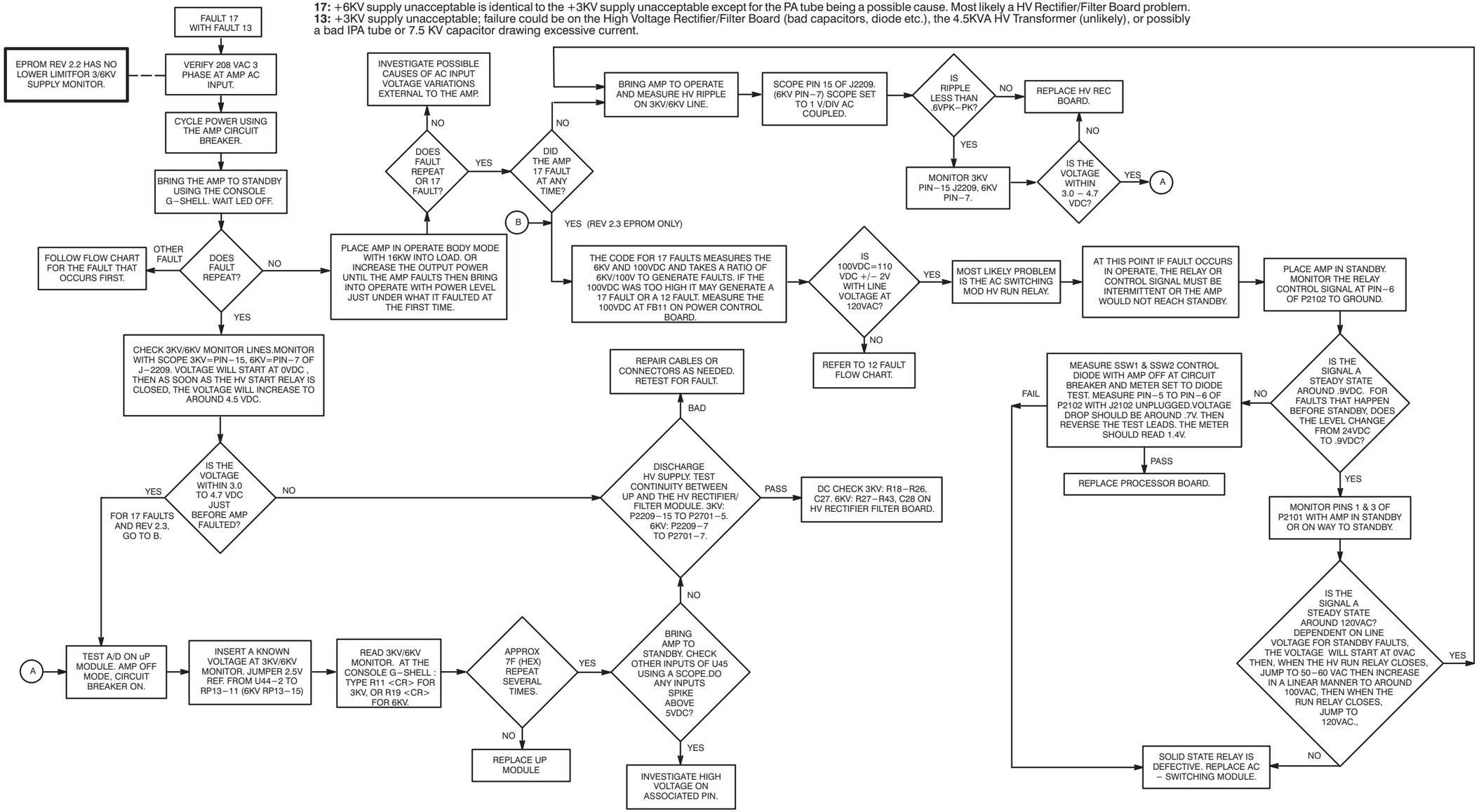




RF AMPLIFIER FAULT CODE 17 SIGNALS
ILLUSTRATION 2−24

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

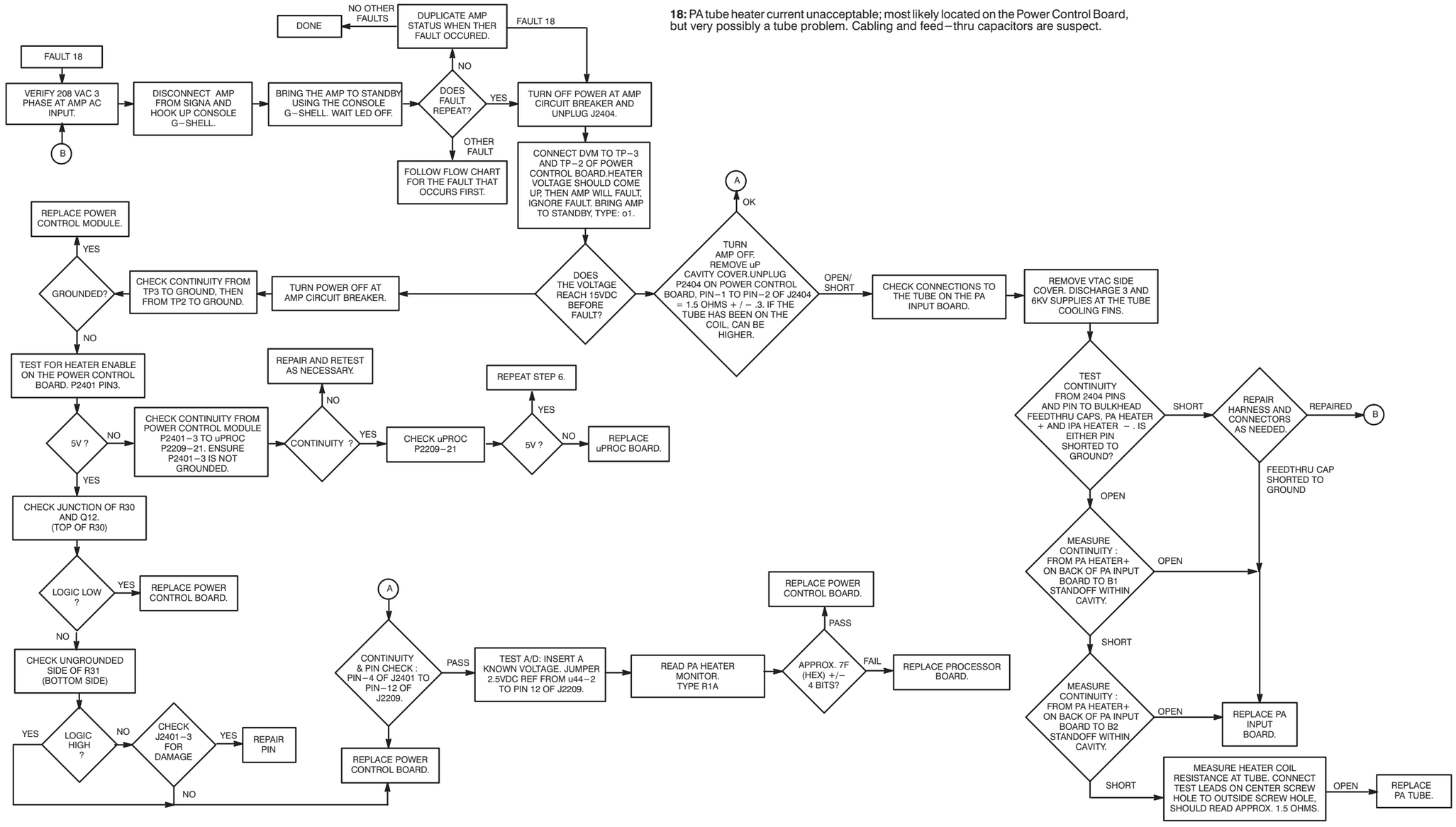
17: +6KV supply unacceptable is identical to the +3KV supply unacceptable except for the PA tube being a possible cause. Most likely a HV Rectifier/Filter Board problem.
13: +3KV supply unacceptable; failure could be on the High Voltage Rectifier/Filter Board (bad capacitors, diode etc.), the 4.5KVA HV Transformer (unlikely), or possibly a bad IPA tube or 7.5 KV capacitor drawing excessive current.



RF AMPLIFIER FAULT CODE 17 WITH FAULT 13 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−25

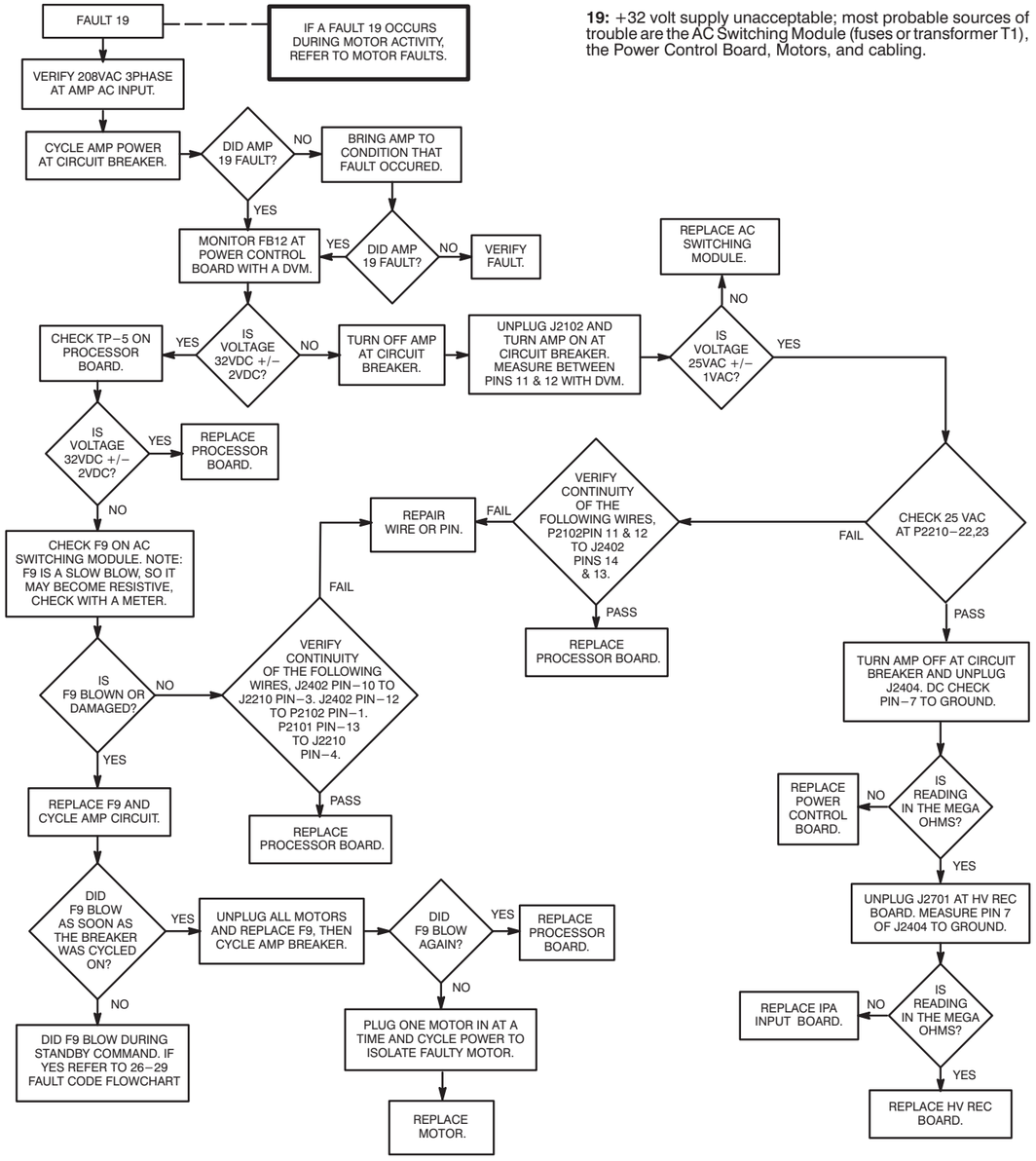
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

18: PA tube heater current unacceptable; most likely located on the Power Control Board, but very possibly a tube problem. Cabling and feed−thru capacitors are suspect.



RF AMPLIFIER FAULT CODE 18 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−26

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

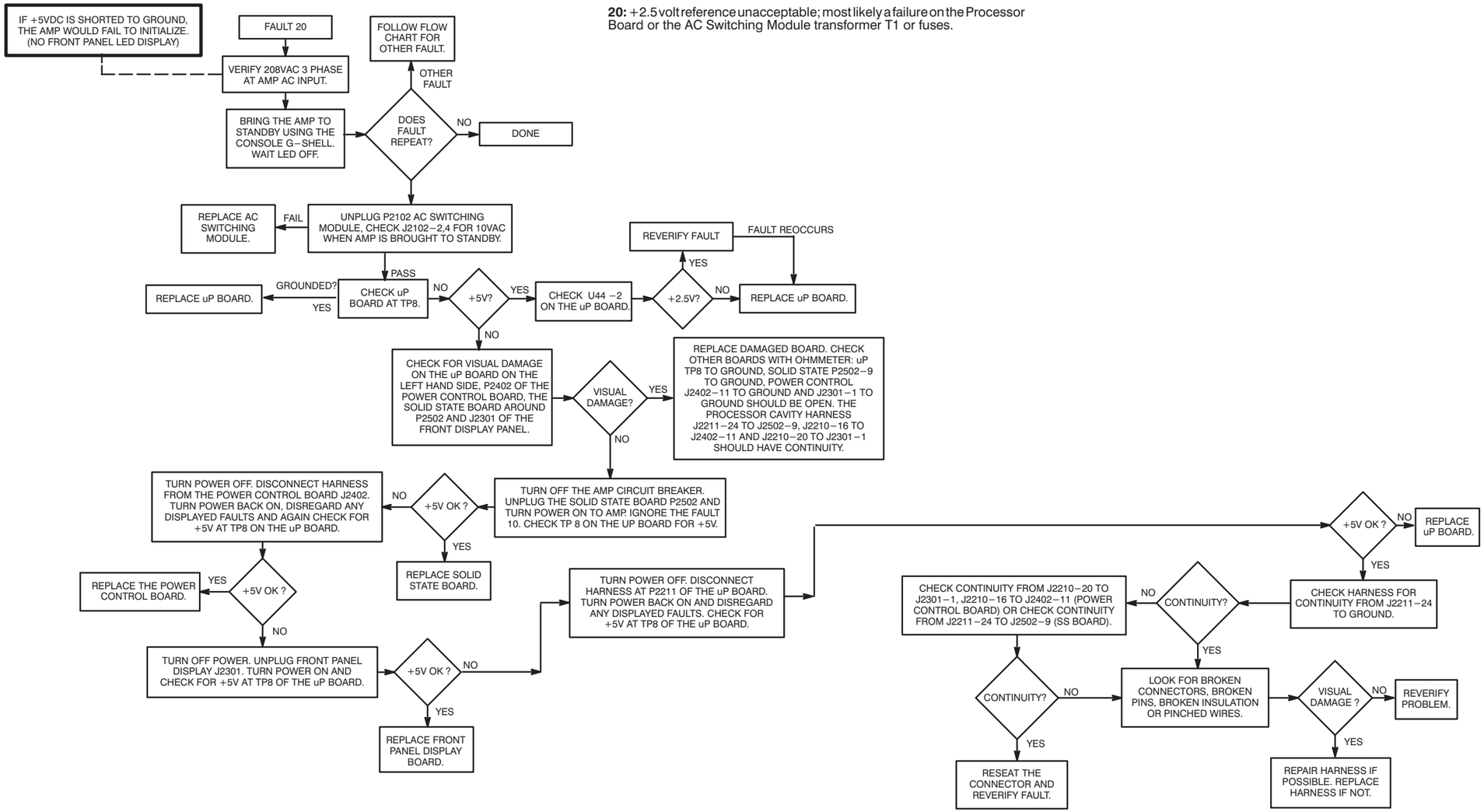


19: +32 volt supply unacceptable; most probable sources of trouble are the AC Switching Module (fuses or transformer T1), the Power Control Board, Motors, and cabling.

RF AMPLIFIER FAULT CODE 19 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−27

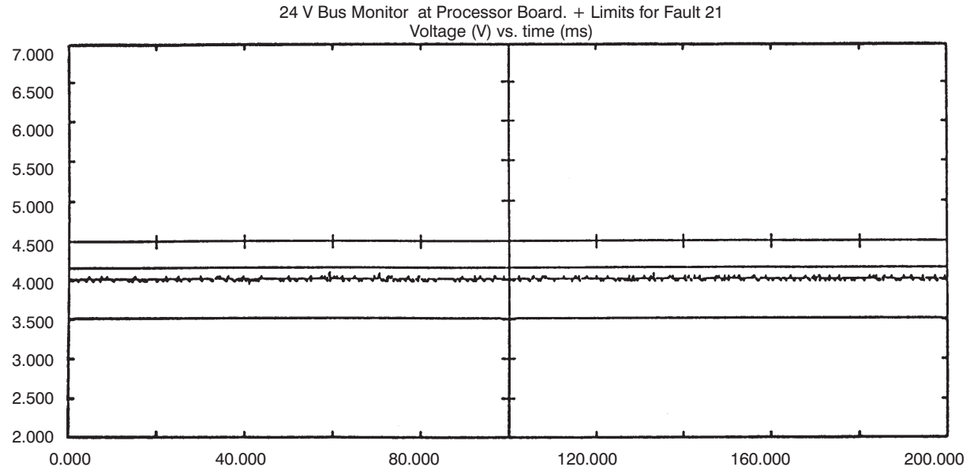
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

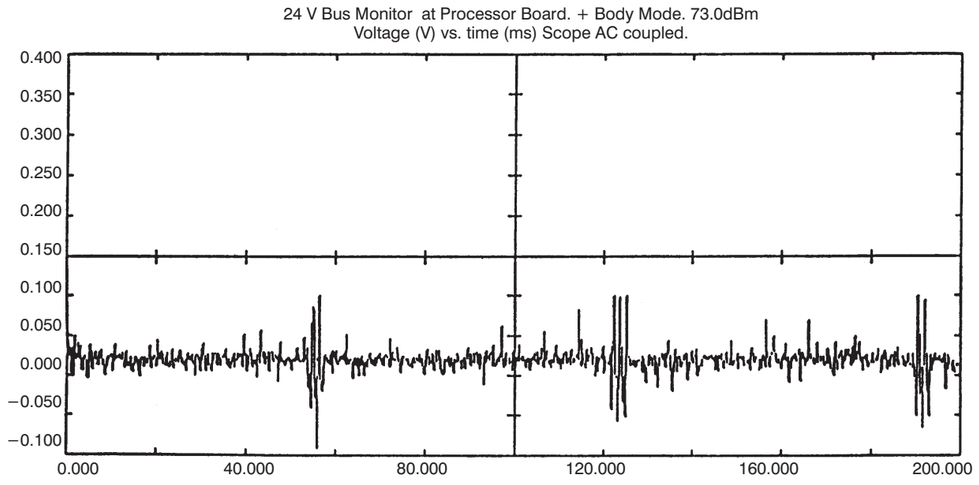
20: +2.5 volt reference unacceptable; most likely a failure on the Processor Board or the AC Switching Module transformer T1 or fuses.



RF AMPLIFIER FAULT CODE 20 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−28

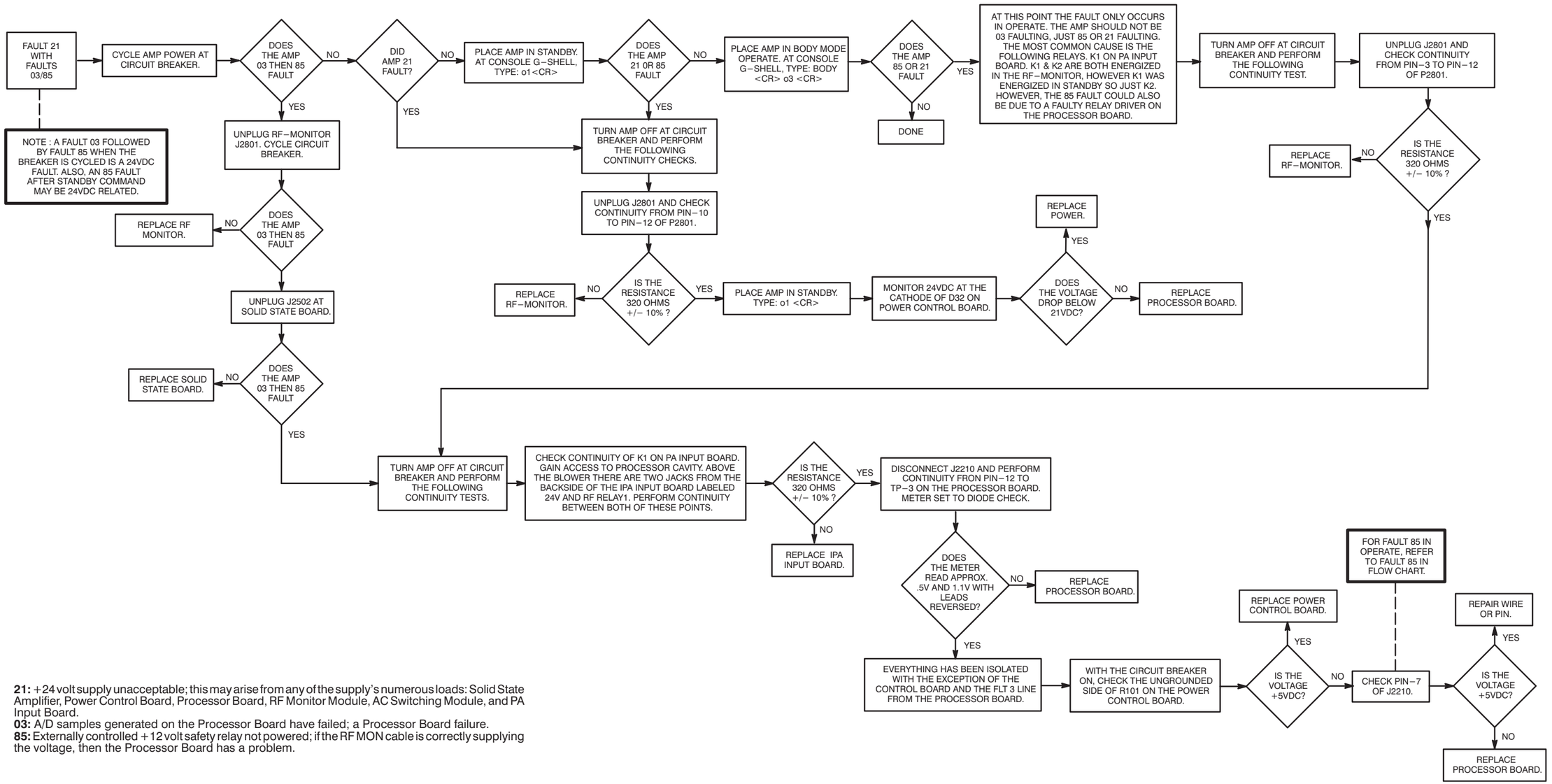
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)





RF AMPLIFIER FAULT CODE 21 SIGNALS
ILLUSTRATION 2−29

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

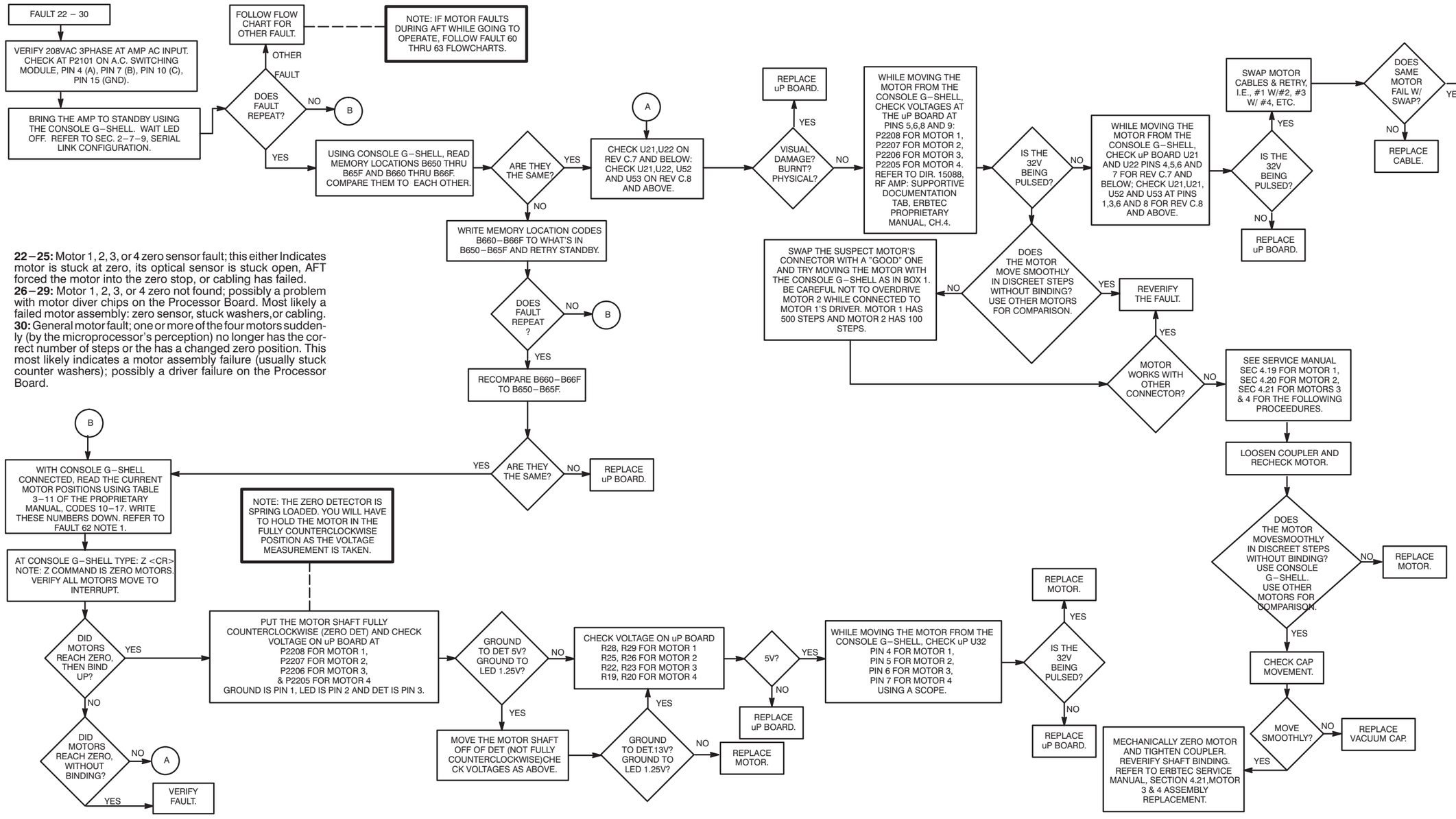


21: +24 volt supply unacceptable; this may arise from any of the supply's numerous loads: Solid State Amplifier, Power Control Board, Processor Board, RF Monitor Module, AC Switching Module, and PA Input Board.
03: A/D samples generated on the Processor Board have failed; a Processor Board failure.
85: Externally controlled +12 volt safety relay not powered; if the RF MON cable is correctly supplying the voltage, then the Processor Board has a problem.

RF AMPLIFIER FAULT CODE 21 WITH FAULTS 03 & 85 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−30

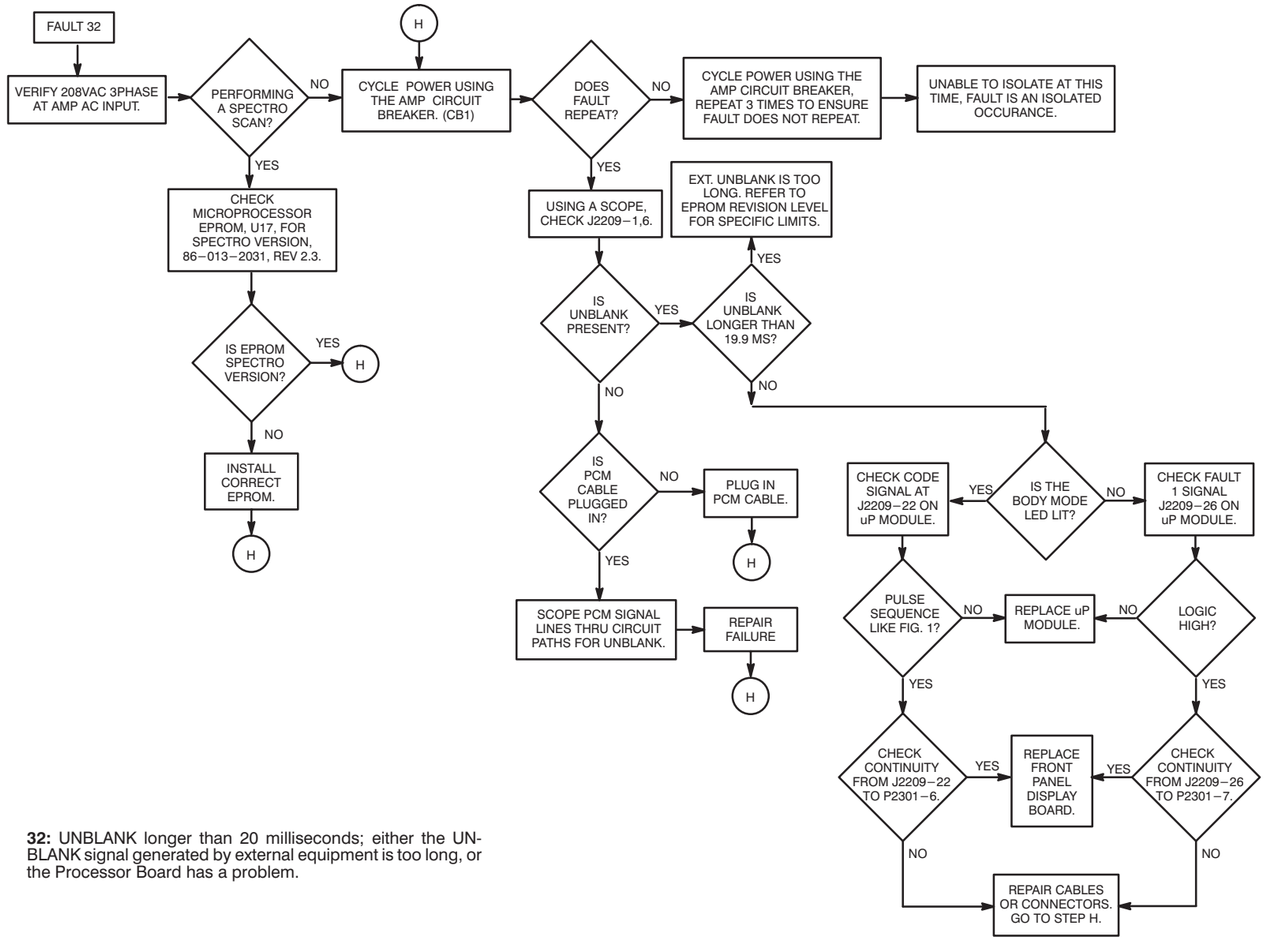
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

22−25: Motor 1, 2, 3, or 4 zero sensor fault; this either Indicates motor is stuck at zero, its optical sensor is stuck open, AFT forced the motor into the zero stop, or cabling has failed.
26−29: Motor 1, 2, 3, or 4 zero not found; possibly a problem with motor diver chips on the Processor Board. Most likely a failed motor assembly: zero sensor, stuck washers,or cabling.
30: General motor fault; one or more of the four motors suddenly (by the microprocessor's perception) no longer has the correct number of steps or the has a changed zero position. This most likely indicates a motor assembly failure (usually stuck counter washers); possibly a driver failure on the Processor Board.



RF AMPLIFIER FAULT CODE 22 − 30 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−31

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



32: UNBLANK longer than 20 milliseconds; either the UNBLANK signal generated by external equipment is too long, or the Processor Board has a problem.

RF AMPLIFIER FAULT CODE 32 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−32

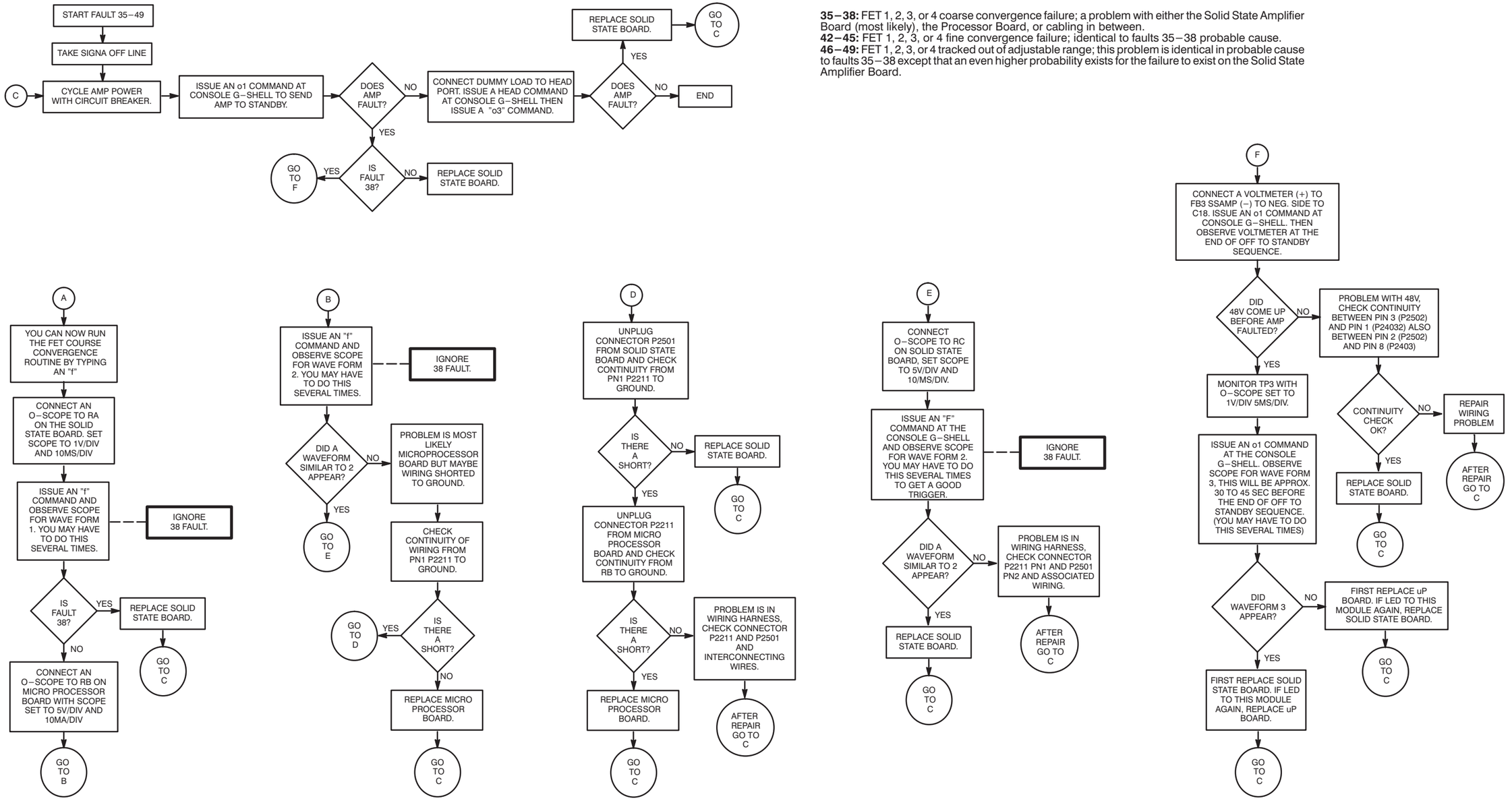
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

TABLE 2−2
TEST POINT LOCATIONS (FAULTS 35 − 38, 42 − 49)

CODE	RA (SSA)	RB (μP)	RC (SSA)	PIN 1 (2211)	PIN 2 (2501)	ADDR	VALUE
35	R133	R118	R15	PIN 17	PIN 1	00	1E
36	R128	R119	R5	PIN 18	PIN 4	00	1E
37	R141	R120	R10	PIN 21	PIN 5	01	8C
38	R136	R121	R20	PIN 22	PIN 2	01	8C
42	R133	R118	R15	PIN 17	PIN 1	00	1E
43	R128	R119	R5	PIN 18	PIN 4	00	1E
44	R141	R120	R10	PIN 21	PIN 5	01	8C
45	R136	R121	R20	PIN 22	PIN 2	01	8C
46	R133	R118	R15	PIN 17	PIN 1	00	1E
47	R128	R119	R5	PIN 18	PIN 4	00	1E
48	R141	R120	R10	PIN 21	PIN 5	01	8C
49	R136	R121	R20	PIN 22	PIN 2	01	8C

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

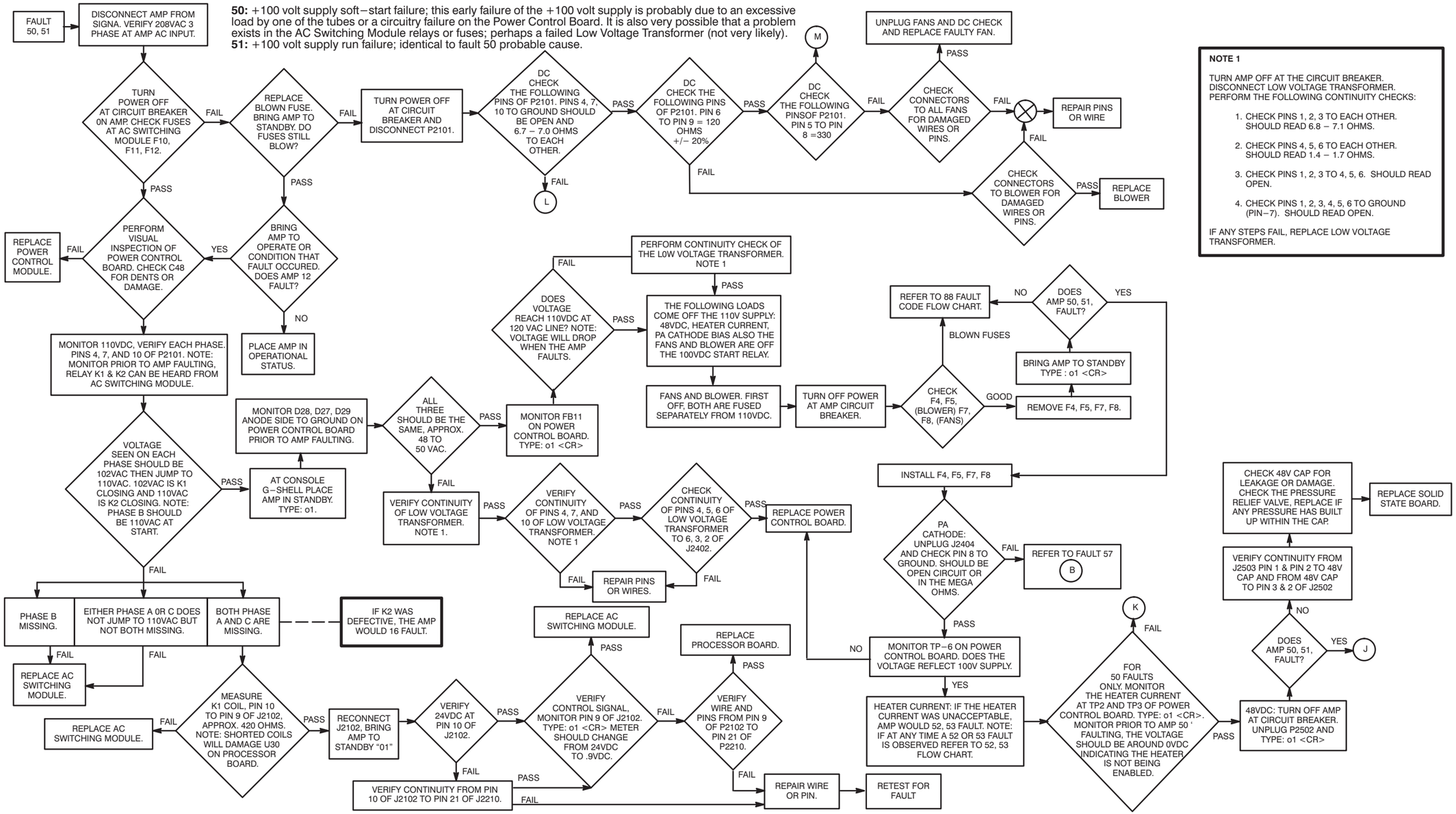
35−38: FET 1, 2, 3, or 4 coarse convergence failure; a problem with either the Solid State Amplifier Board (most likely), the Processor Board, or cabling in between.
42−45: FET 1, 2, 3, or 4 fine convergence failure; identical to faults 35−38 probable cause.
46−49: FET 1, 2, 3, or 4 tracked out of adjustable range; this problem is identical in probable cause to faults 35−38 except that an even higher probability exists for the failure to exist on the Solid State Amplifier Board.



RF AMPLIFIER FAULT CODE 35 − 38, 42 − 45, & 46 − 49 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−33

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

50: +100 volt supply soft−start failure; this early failure of the +100 volt supply is probably due to an excessive load by one of the tubes or a circuitry failure on the Power Control Board. It is also very possible that a problem exists in the AC Switching Module relays or fuses; perhaps a failed Low Voltage Transformer (not very likely).
51: +100 volt supply run failure; identical to fault 50 probable cause.



NOTE 1

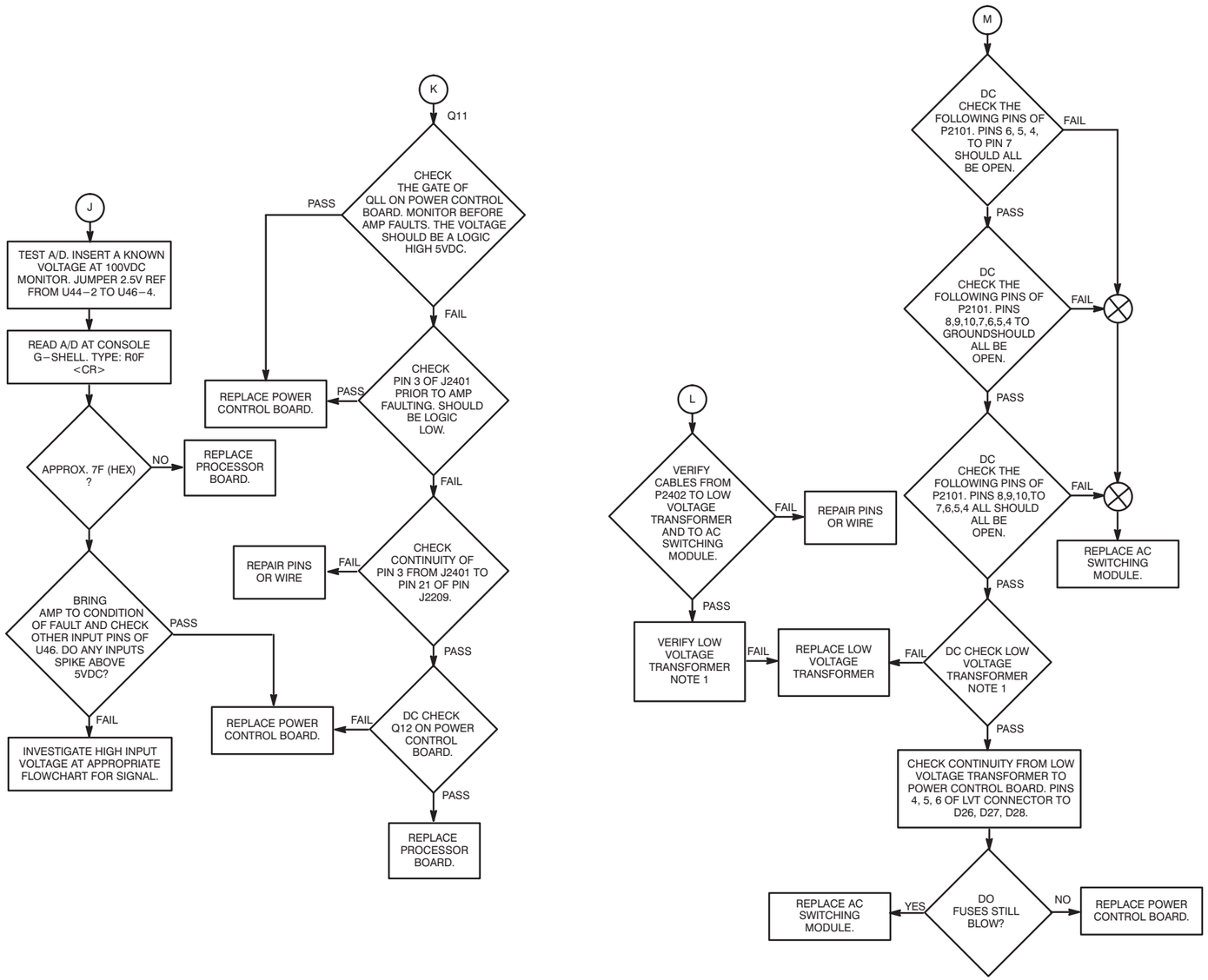
TURN AMP OFF AT THE CIRCUIT BREAKER.
DISCONNECT LOW VOLTAGE TRANSFORMER.
PERFORM THE FOLLOWING CONTINUITY CHECKS:

1. CHECK PINS 1, 2, 3 TO EACH OTHER. SHOULD READ 6.8 − 7.1 OHMS.
2. CHECK PINS 4, 5, 6 TO EACH OTHER. SHOULD READ 1.4 − 1.7 OHMS.
3. CHECK PINS 1, 2, 3 TO 4, 5, 6. SHOULD READ OPEN.
4. CHECK PINS 1, 2, 3, 4, 5, 6 TO GROUND (PIN−7). SHOULD READ OPEN.

IF ANY STEPS FAIL, REPLACE LOW VOLTAGE TRANSFORMER.

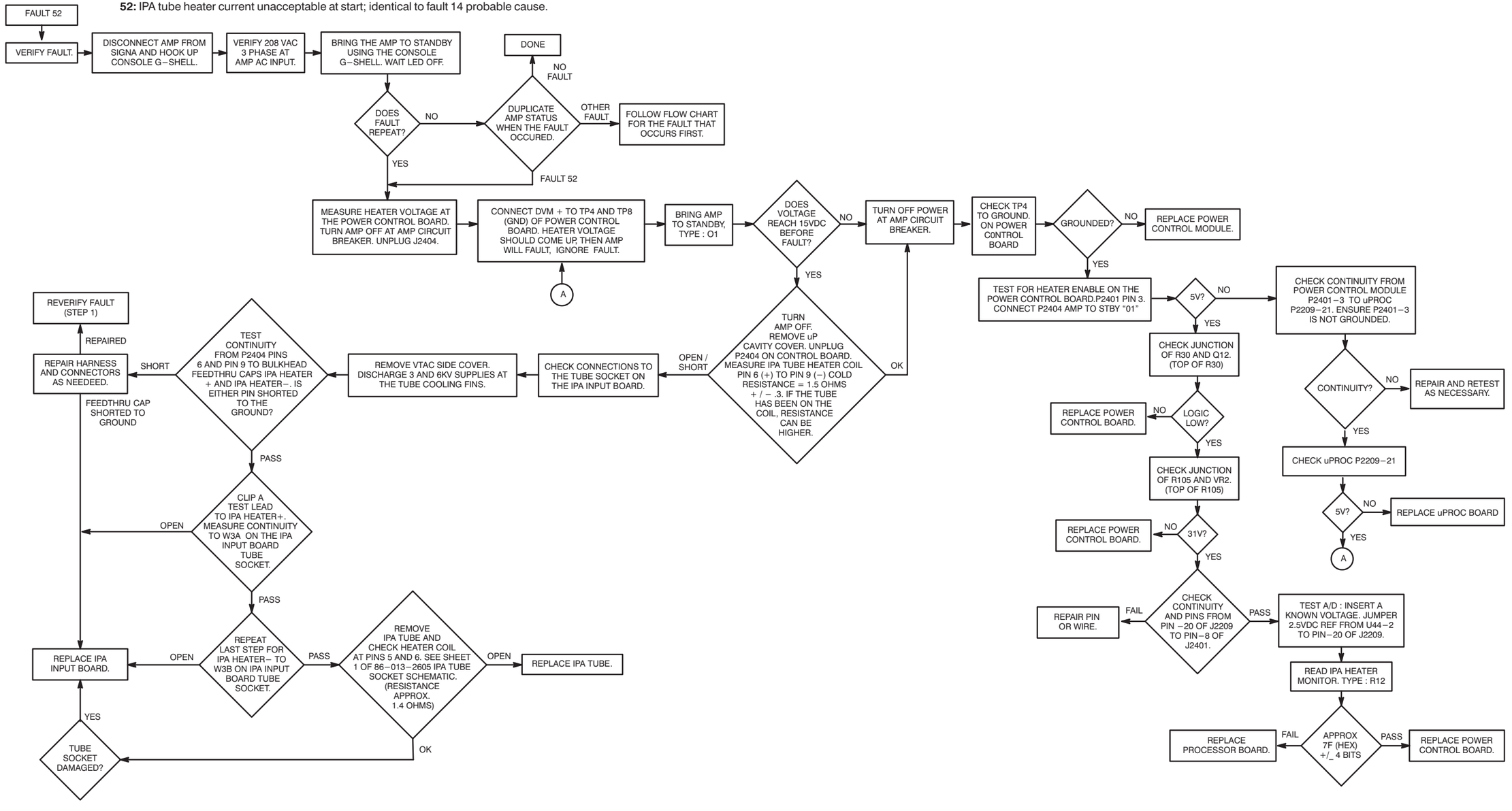
RF AMPLIFIER FAULT CODE 50 − 51 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−34

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 50 − 51 TROUBLESHOOTING FLOWCHART (continued)
ILLUSTRATION 2−34

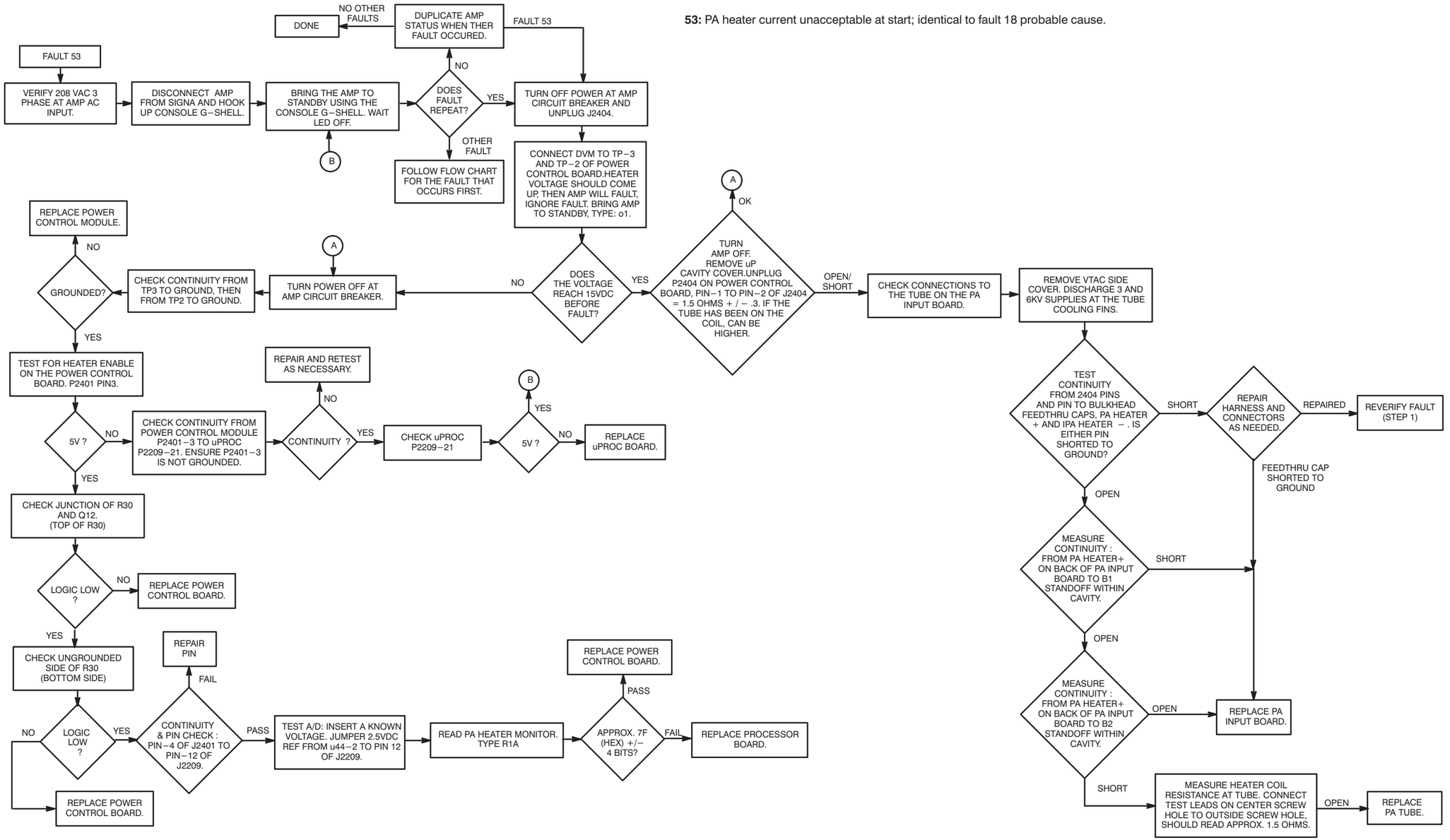
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 52 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−35

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

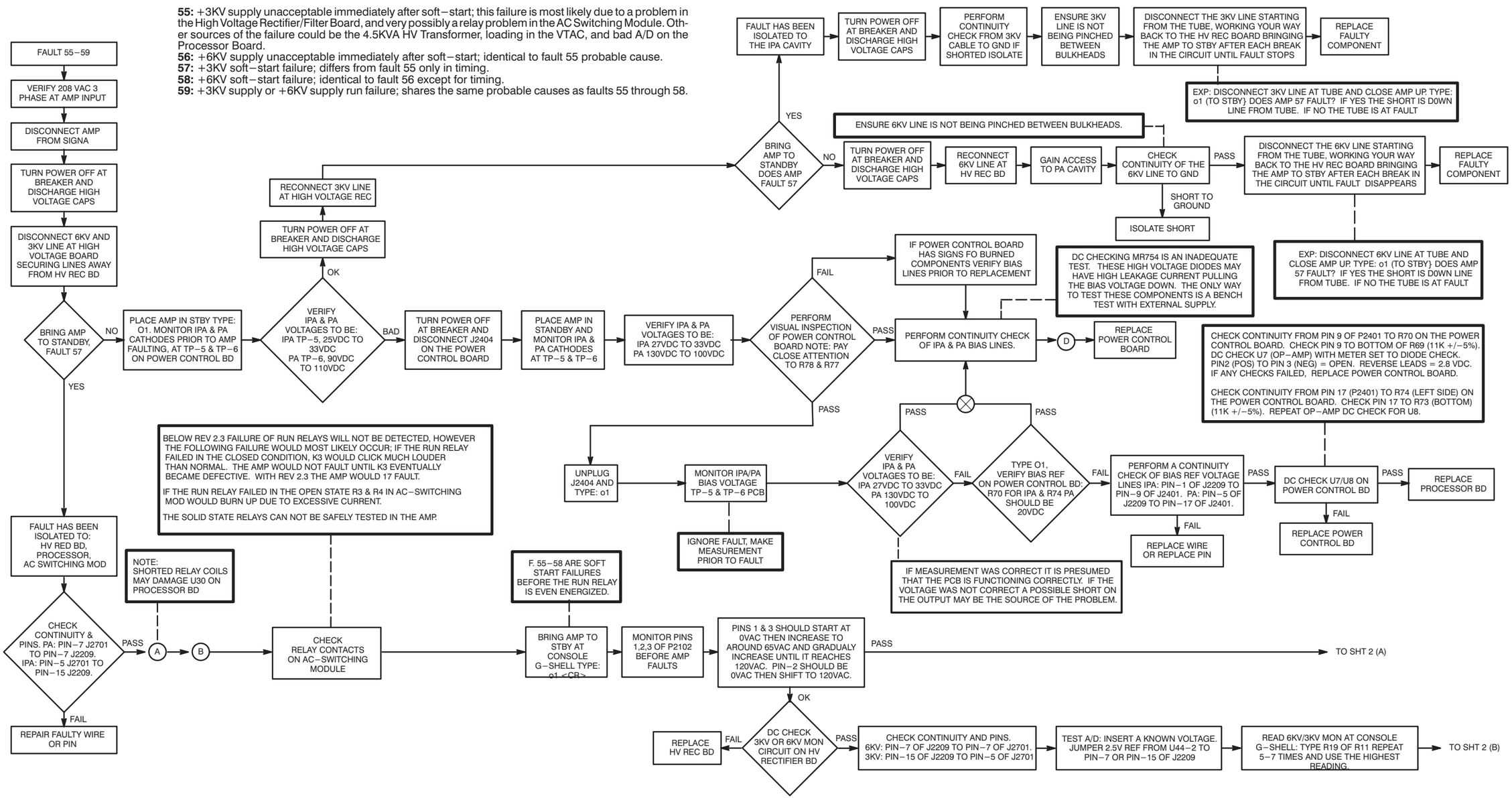
53: PA heater current unacceptable at start; identical to fault 18 probable cause.



RF AMPLIFIER FAULT CODE 53 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−36

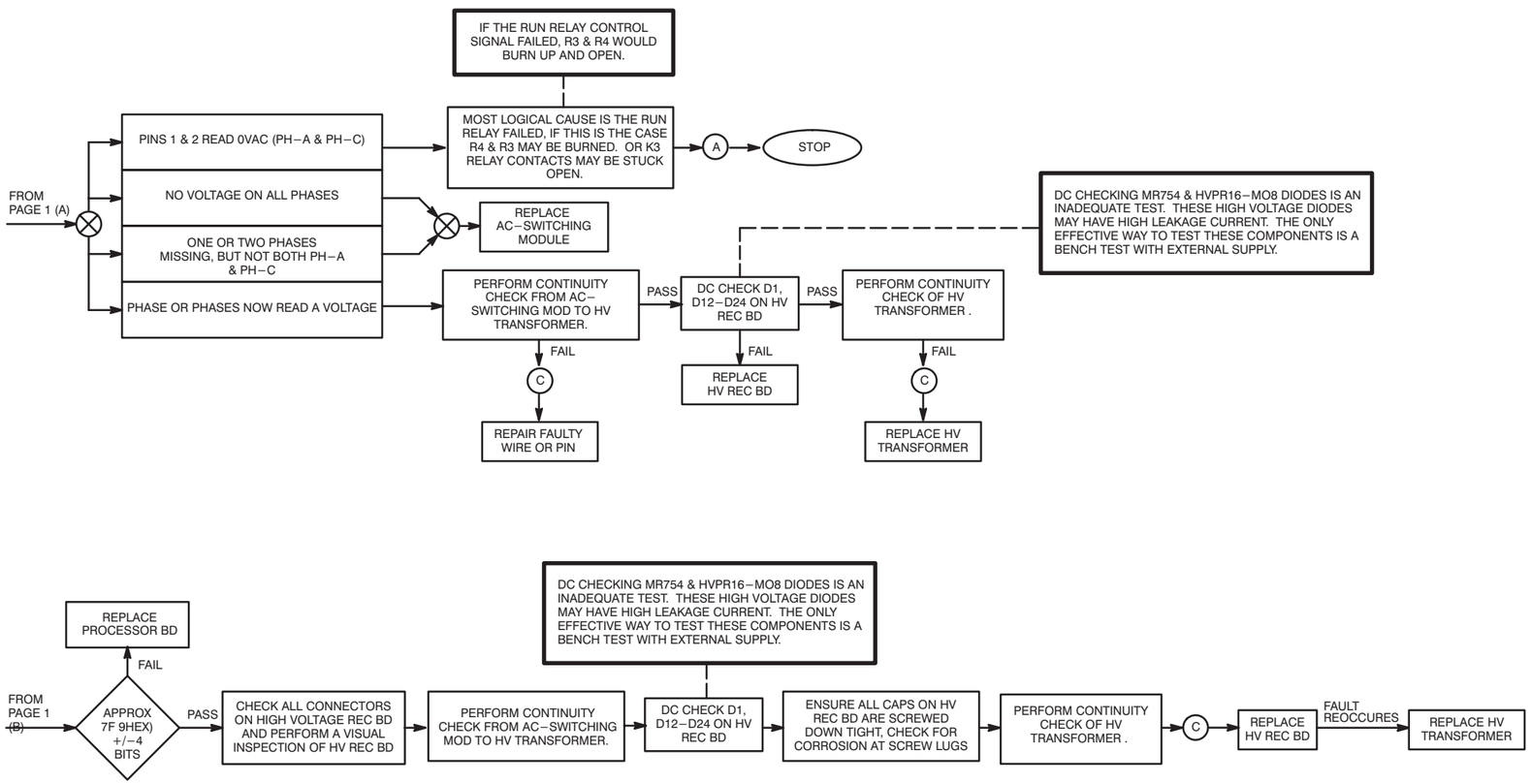
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

55: +3KV supply unacceptable immediately after soft−start; this failure is most likely due to a problem in the High Voltage Rectifier/Filter Board, and very possibly a relay problem in the AC Switching Module. Other sources of the failure could be the 4.5KVA HV Transformer, loading in the VTAC, and bad A/D on the Processor Board.
56: +6KV supply unacceptable immediately after soft−start; identical to fault 55 probable cause.
57: +3KV soft−start failure; differs from fault 55 only in timing.
58: +6KV soft−start failure; identical to fault 56 except for timing.
59: +3KV supply or +6KV supply run failure; shares the same probable causes as faults 55 through 58.



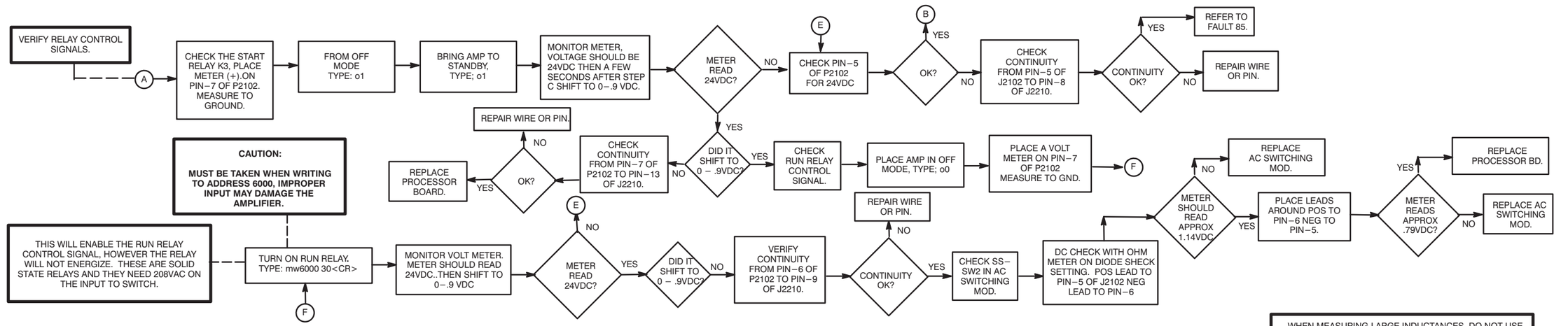
RF AMPLIFIER FAULT CODE 55 − 59 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−37

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 55 − 59 TROUBLESHOOTING FLOWCHART (continued)
ILLUSTRATION 2−37

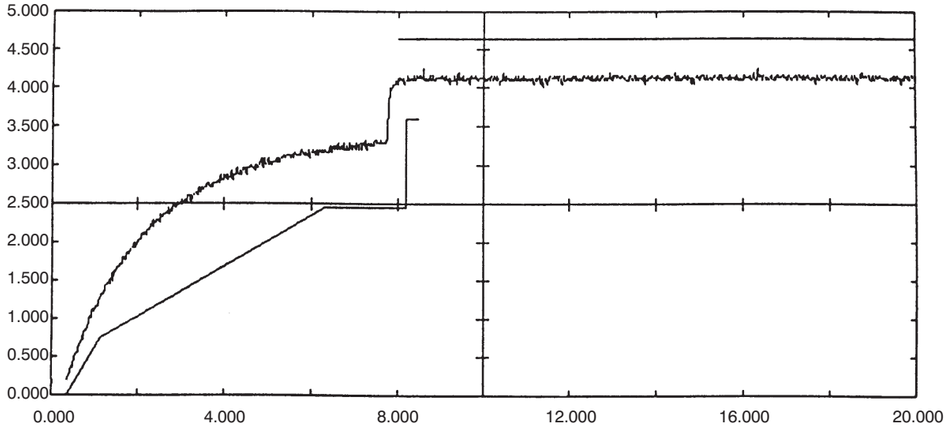
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



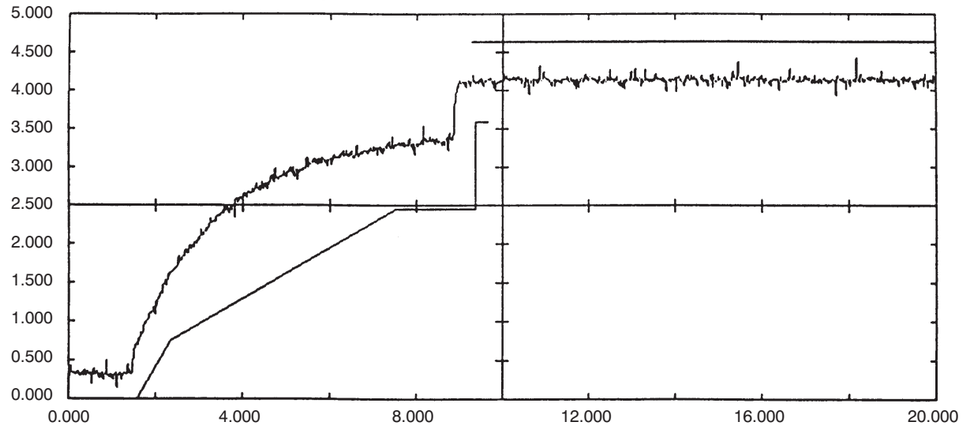
RF AMPLIFIER FAULT CODE 55 − 59 TROUBLESHOOTING FLOWCHART (continued)
ILLUSTRATION 2−37

2–6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

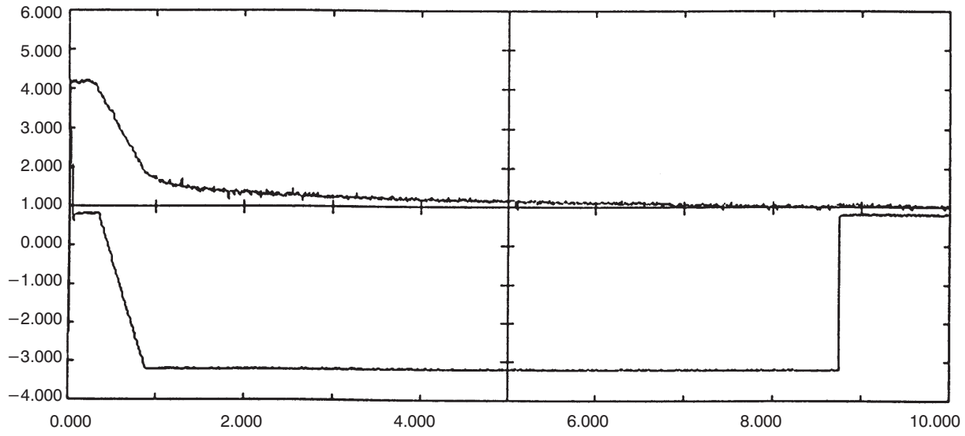
High Voltage Power On Sequence (6.0 kV detector) at Processor Board.
Voltage (V) vs. time (sec), Limits indicate Faults 57 and 17.



High Voltage Power On Sequence (3.0 kV detector) at Processor Board.
Voltage (V) vs. time (sec), Limits indicate Faults 57 and 13.



PA High Voltage Discharge Sequence, PA HV and PA bias DAC
Voltage (V) vs. time (sec)



RF AMPLIFIER FAULT CODE 57 SIGNALS
ILLUSTRATION 2–38

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

INITIAL SETUP CONDITIONS

VERIFY 208 3 PHASE AC AT THE AMP AC INPUT.
CONSOLE G−SHELL CONNECTED.
SIGNA TG SET TO MINIMUM.

NOTE 1: VERIFY MOTOR POSITIONS

REFER TO THE ERBTEC PROPRIETARY MANUAL, PAGE 3−26 AND 3−27.
THE PRIMARY ADDRESS FOR MOTOR LOCATIONS IS B6.
ADDRESSES 60 THRU 6F CONTAIN THE FACTORY MOTOR POSITIONS.
ADDRESSES 50 THRU 5F ARE THE ACTIVE MOTOR POSITIONS.
EACH MEMORY LOCATION CONTAINS TWO BITS OF HEX DATA, EITHER THE MSB OR THE LSB OF THE MOTOR POSITION.

PERFORM MEMORY READS AT THE CONSOLE G−SHELL AS FOLLOWS:
MRB660 THRU MRB66F
MRB650 THRU MRB5F
EXAMPLE: MRB650 [CR] RETURNS 01 (HEX) TYPICAL VALUE.
COMPARE THE MOTOR POSITION DATA FROM 60 THRU 6F TO THE DATA FROM 50 THRU 5F:

BODY MODE: MOTOR 1 FACTORY + OR − 30 STEPS
MOTOR 2 FACTORY + OR − 00 STEPS
MOTOR 3 FACTORY + OR − 800 STEPS
MOTOR 4 FACTORY + OR − 00 STEPS

HEAD MODE: MOTOR 1 FACTORY + OR − 30 STEPS
MOTOR 2 FACTORY + OR − 00 STEPS
MOTOR 3 SAME AS BODY MODE
MOTOR 4 SAME AS BODY MODE

IF THE ACTIVE MOTOR POSITIONS EXCEED THESE LIMITS THEN RESET TO THE FACTORY MOTOR POSITIONS.

EXAMPLE: MWB650 01 WILL WRITE 01 (HEX) TO ADDRESS 50.

READ THE FACTORY AFT CORRECTIONS AND RESET IF NEEDED:
AT THE CONSOLE G−SHELL TYPE: MRB62D [CR] PA PHASE DETECTOR MSB.
MRB62E [CR] PA PHASE DETECTOR LSB.

IF THE PA AFT CORRECTION EXCEEDS 200 STEPS (DECIMAL)
THEN RESET B62D AND B62E TO 00.

NOTE 6: CHECK SS AMP OUTPUT

DISCONNECT RF−IN, CONNECT OUTPUT OF SS BOARD THRU A 60DB ATTN. TO A SCOPE TERMINATION AT 50 OHMS.

AT THE CONSOLE G−SHELL:
TYPE BODY (CR) (AMP TO BODY MODE)
TYPE o3 (CR) (AMP TO OPERATE)
TYPE A90 (CR) (OUTPUT 100MV P−P)
TYPE o1 (CR) (AMP TO STANDBY)
TYPE HEAD (CR) (AMP TO HEAD MODE)
TYPE o3 (CR) (AMP TO OPERATE)
TYPE A95 (CR) (OUTPUT 48MV P−P)

NOTE 7: CHECK PA INPUT BOARD K−1

REMOVE RF INPUT FROM THE REAR OF THE AMPLIFIER J2503.
CHECK FOR 24VDC ON RELAY TERMINAL LABELED +24V. IF NOT CORRECT CHECK CONTINUITY TO POWER CONTROL BOARD AND 24V SUPPLY. THEN CHECK CONTINUITY FROM TERMINAL RF RELAY 1 TO PROCESSOR BOARD.

AT THE CONSOLE G−SHELL:
TYPE A− (CR) (AFT DISABLED)
TYPE BODY (CR) (AMP TO BODY MODE)
TYPE o3 (CR) (AMP TO OPERATE)

METER SHOULD READ 0VDC

AT THE CONSOLE G−SHELL:
TYPE o1 (CR) (AMP TO STANDBY)
TYPE HEAD (CR) (AMP TO HEAD MODE)
TYPE o3 (CR) (AMP TO OPERATE)

METER SHOULD READ +24VDC.

NOTE 2 CHECK PHASE DETECTOR PA / IPA.

IF SIDE COVERS ARE OFF REFER TO NOTE 6
FOR TEST POINTS AND SIGNAL DESCRIPTIONS. SEE ILL.1−29A.
GET THE CURRENT MOTOR POSITION DATA FROM NOTE 1.

PLACE AMP IN BODY MODE:
AT THE CONSOLE G−SHELL TYPE: BODY(CR)
TYPE: A− CR)(DISABLES AFT)
TYPE: o3 (CR) (AMP TO OPERATE)

MOVE MOTOR 3 TYPE: T3 XXXX (CR)
(XXXX = CURRENT MOTOR POSITION IN DECIMAL +100)

READ PHASE DETECTOR TYPE: MR4E (CR)
THE DATA RETURNED SHOULD BE 2X (HEX) (MAX PHASE LIMIT)

MOVE MOTOR 3 TYPE: T3 XXXX (CR)
(XXXX = CURRENT MOTOR POSITION IN DECIMAL −100)

READ PHASE DETECTOR TYPE: MR4E (CR)
THE DATA RETURNED SHOULD BE CX (HEX) (MIN PHASE LIMIT)

IPA PHASE DETECTOR TEST:
PLACE AMP IN HEAD MODE AND DISABLE AFT:
AT THE CONSOLE G−SHELL
TYPE HEAD (CR)
TYPE A− (CR) (DISABLES AFT)
TYPE 03 (CR) (AMP TO OPERATE)

MOVE MOTOR 1 TYPE: T1 XXX (CR)
(XXX = CURRENT MOTOR POSITION IN DECIMAL +20)

READ PHASE DETECTOR:
AT THE CONSOLE G−SHELL TYPE MR 4D (CR)
THE DATA RETURNED SHOULD BE 2X (HEX) (MAX PHASE LIMIT).

MOVE MOTOR 1 TYPE: T1 XXX
(XXX = CURRENT MOTOR POSITION −20)

READ PHASE DETECTOR:
AT THE CONSOLE G−SHELL TYPE MR4D (CR)
THE DATA RETURNED SHOULD BE CX (HEX) . (MIN PHASE LIMIT).

NOTE 8: CHECK PA CATHODE VOLTAGE AND 6KV

PA CATHODE:

AT THE CONSOLE G−SHELL: TYPE A− (CR) (AFT DISABLED)
TYPE BODY (CR) (AMP TO BODY MODE)
TYPE o3 (CR) (AMP TO OPERATE)
MONITOR PA CATHODE AT POWER CONTROL BOARD.

SCOPE SETUP: BW LIMIT IN
10V/DIV
10MSEC/DIV
EXT TRIG
EXT TRIG AT BOTTOM SIDE OF R31 (PCB)
VOLTAGE BIAS SHOULD PULL DOWN FROM 100V TO 24 − 32VDC.

6KV MEASUREMENT

AT THE CONSOLE G−SHELL: TYPE A− (CR) (AFT DISABLED)
TYPE BODY (CR) (AMP TO BODY MODE)
TYPE o3 (CR) (AMP TO OPERATE)
MONITOR 6KV WITH SCOPE AT RP13−PIN 15 ON PROCESSOR BOARD.
SEE ILLUSTRATION 1−29A.

NOTE 3: VERIFY RF MONITOR FUNCTION

SETUP: DISCONNECT RF INPUT FROM THE REAR OF THE AMP (J2503). DISCONNECT COAXIAL CABLES J2601, J2602 AND J2603 FROM THE VTAC BULKHEAD. REMOVE THE TWELVE SCREWS MOUNTING THE RF MONITOR TO THE BACK PANEL OF THE AMP, MOVE THE MONITOR MODULE TO A POSITION WERE P32801 ON TOP OF THE MODULE IS AVAILABLE FOR TESTING. PULL OUT THE AC INTERLOCK SWITCH.

AT THE CONSOLE G−SHELL
TYPE o1 (CR) (AMP TO STANDBY)
TYPE HEAD (CR) (AMP TO HEAD MODE)
TYPE o3 (CR) (AMP TO OPERATE)

24V − MONITOR PIN 12 OF P2801. SHOULD BE 24VDC TO GND. (I)
K1 − MONITOR PIN 10 (RF RLY 2) OF P2801 = 24VDC TO GND. (II)
K2 − MONITOR PIN 3 (RF RLY 3) OF P2801 = 24VDC TO GND. (II)
J2602 CENTER PIN TO SHIELD OPEN.
J2603 CENTER PIN TO SHIELD 50 OHMS + OR = 5%.

FAIL 50 OHM LOAD TEST REPLACE RF MONITOR.

AT THE CONSOLE G−SHELL
TYPE o1 (CR) (AMP TO STANDBY)
TYPE BODY (CR) (AMP TO BODY MODE)
TYPE o3 (CR) (AMP TO OPERATE)

K1 − MONITOR PIN 10 OF J2801 SHOULD BE OVDC TO GNS. (II)
K2 − MONITOR PIN 3 OF J2802 SHOULD BE OVDC TO GND. (II)
J2602 CENTER PIN TO SHIELD 50 OHMS + OR − 5%.
J2603 CENTER PIN TO SHIELD OPEN.
FAIL 50 OHM LOAD TEST REPLACE RF MONITOR.

(I) FAILS 24V AT PIN 12 − VERIFY CONTINUITY TO POWER CONTROL BOARD, AND TEST 24V SUPPLY AT THE POWER CONTROL BOARD.

(II) IF DURING K1 OR K2 TEST PINS 10 AND 3 FAIL 24V OR FAIL TO REACH .2V MIN.

AT THE CONSOLE G−SHELL
TYPE o0 (CR) (AMP OFF)

AFTER SHUTDOWN UNPLUG J2801 AND MEASURE THE RELAY COIL RESISTANCE AT THE RF MONITOR PLUG P2801.
PIN 12 TO PIN 10 APPROX. 300 OHMS. FAIL REPLACE RF MONITOR.
PIN 12 TO PIN 3 APPROX. 300 OHMS. FAIL REPLACE RF MONITOR.
VERIFY CONTINUITY FROM J2801 PINS 3, 10 TO J2211 PINS 7, 3.
CONTINUITY FAILS REPAIR AS NEEDED IF OK REPLACE UP MODULE.

NOTE 9: CHECK IPA CATHODE VOLTAGE AND 3KV

IPA CATHODE:

AT THE CONSOLE G−SHELL: TYPE A− (CR) (AFT DISABLED)
TYPE HEAD (CR) (AMP TO HEAD MODE)
TYPE o3 (CR) (AMP TO OPERATE)
MONITOR CATHODE BIAS WITH A SCOPE AT TP5 ON THE POWER CONTROL BOARD.

SCOPE SETUP: BW LIMIT IN
2V/DIV X10 PROBE
10MSEC/DIV
EXT TRIG
EXT TRIG AT BOTTOM SIDE OF R31 (PCB)

VOLTAGE SHOULD PULL DOWN FROM 32V TO WITHIN 3 − 7VDC.
SEE FLOWCHART SIGNAL NOTE ON NEXT PAGE.

3KV MEASUREMENT

AT THE CONSOLE G−SHELL: TYPE A− (CR) (AFT DISABLED)
TYPE HEAD (CR) (AMP TO HEAD MODE)
TYPE o3 (CR) (AMP TO OPERATE)

MONITOR 3KV WITH SCOPE AT RP13−PIN 11 ON PROCESSOR BOARD.
SEE ILLUSTRATION 1−29A.

NOTE 4: VERIFY MOTOR DRIVERS

AT THE CONSOLE G−SHELL TYPE o1 (CR) (AMP TO STANDBY)

VERIFY MOTORS DRIVE TO ZERO THEN TO BODY POSITIONS

AT THE CONSOLE G−SHELL TYPE Z (CR) (MOTOR ZERO)
WATCH TO SEE THAT THE MOTORS MOVE FREELY.
DO THE MOTORS REACH ZERO WITHOUT A FAULT?
TYPE BODY (CR) (AMP TO BODY MODE)
TYPE Z (CR) (RECORD MOTOR DATA)

REPEAT Z & BODY COMMAND SEQUENCE TWO TIMES TO HEAT UP MOTOR DRIVERS AND VERIFY MOTOR POSITIONS STAY THE SAME WITHIN A FEW BITS.
TYPE BODY (CR) (AMP TO BODY MODE)

NOTE 5: VERIFY MICRO A/D CONVERSION FOR PHASE DETECTOR

PA/IPA PHASE DETECTOR:
PA − SCOPE : PIN−1 OF THE OUTPUT CONNECTOR RED/BLU WIRE
IPA − SCOPE : PIN−1 OF RPL4 PROCESSOR BD.
SCOPE SETUP: BW LIMIT OUT
DC COUPLING
2V/DIV
50MSEC/DIV
MAKE NOTE OF VOLTAGE LEVEL.

READ A/D OUTPUT:
AT THE CONSOLE G−SHELL
TYPE R07 (CR) (READ PA PHASE VALUE)
TYPE R0E (CR) (READ IPA PHASE VALUE)
REPEAT READ SEVERAL TIMES AND RECORD THE HIGHEST VALUE.
CONVERT TO DECIMAL AND MULTIPLY BY .0196
COMPARE TO RECORDED VALUE.

IF THEY DIFFER BY MORE THAN .O6V, VERIFY WIRING THEN REPLACE MICROPROCESSOR.

NOTE 10: CHECK OSCILLATOR OUTPUT AS FOLLOWS:

PLACE AMP IN OFF MODE AND SELECT OSC OUT TO TEST JACK.

AT THE CONSOLE G−SHELL: TYPE o0 (CR)
TYPE AD0 (CR)

THEN INHIBIT UNBLANK:

AT THE CONSOLE G−SHELL: TYPE MW1000 FB (CR)

CONNECT OSCILLOSCOPE TO THE TEST RF OUTPUT JACK ON THE SSA AT THE REAR OF THE AMPLIFIER.

SCOPE SETUP: ENSURE 50 OHM TERMINATION AT SCOPE
BW LIMIT OUT
1V/DIV
1MSEC/DIV
VOLTAGE SHOULD BE AROUND 3.5V P−P OF RF.

NOTE 11: IPA INPUT BOARD TEST

ENSURE TUNE AND LOAD ADJUSTMENT CAPACITORS HAVE NOT BEEN TAMPERED WITH. IF ANY ADJUSTMENT HAS BEEN MADE, REPLACE THE IPA INPUT BOARD.

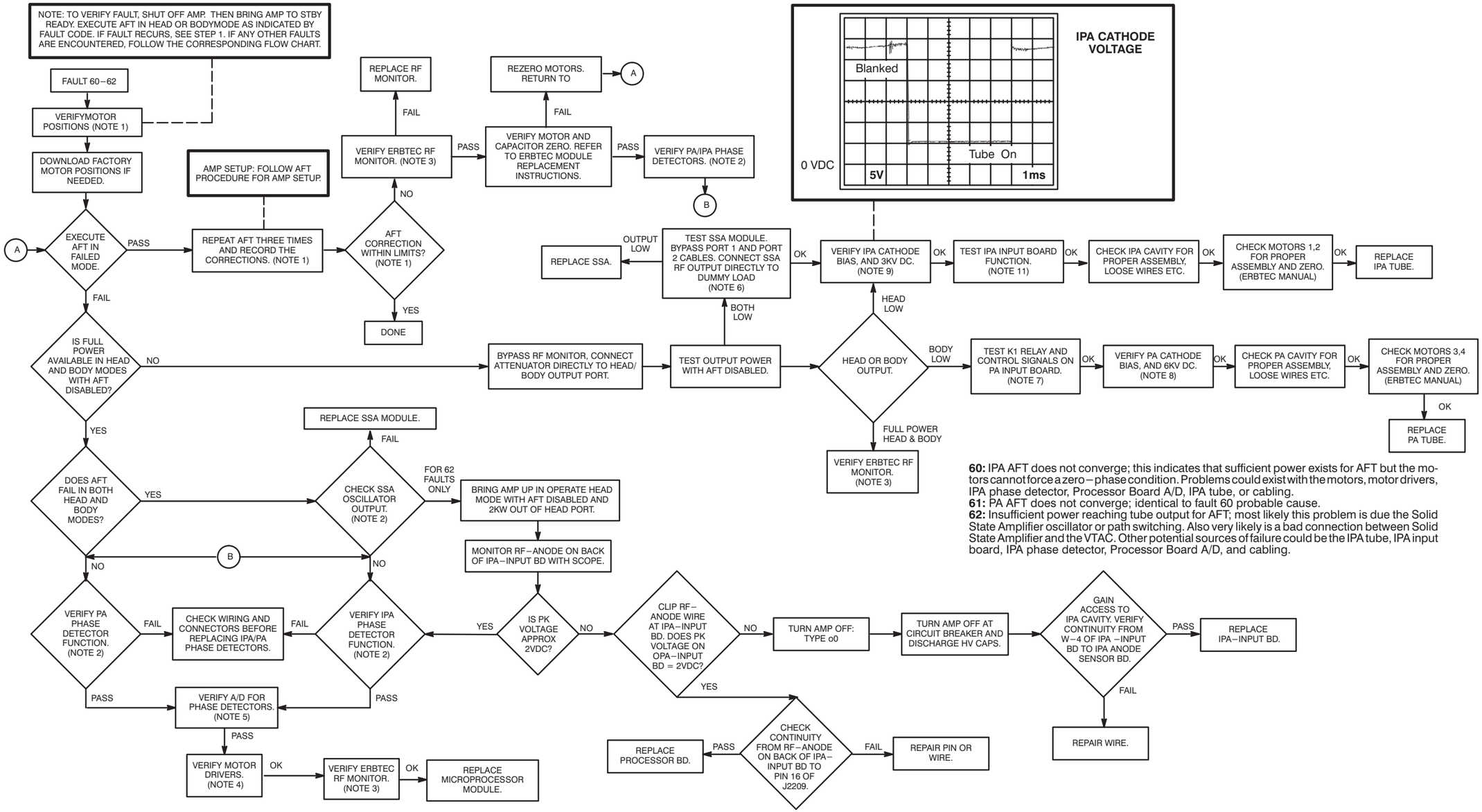
GAIN ACCESS TO THE IPA CAVITY.
CHECK CONTINUITY OF THE FOLLOWING:

J2503, CENTER CONDUCTOR TO L5 ON THE IPA INPUT BOARD.
CHECK L3 TO W1 ON IPA TUBE SOCKET.

IF CONTINUITY FAILS, REPLACE THE IPA INPUT BOARD.

RF AMPLIFIER FAULT CODE 60 − 62 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−39

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

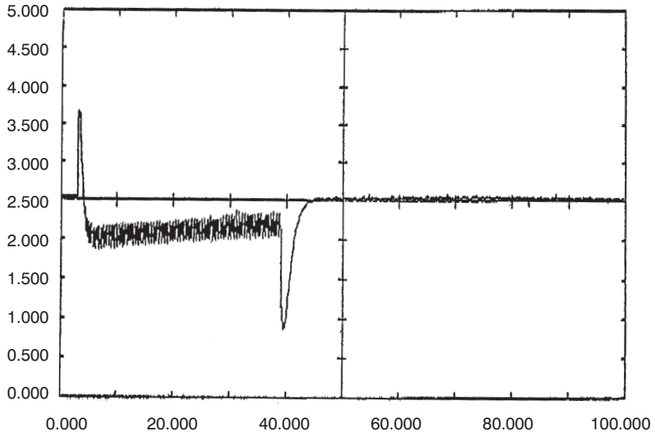


60: IPA AFT does not converge; this indicates that sufficient power exists for AFT but the motors cannot force a zero−phase condition. Problems could exist with the motors, motor drivers, IPA phase detector, Processor Board A/D, IPA tube, or cabling.
61: PA AFT does not converge; identical to fault 60 probable cause.
62: Insufficient power reaching tube output for AFT; most likely this problem is due the Solid State Amplifier oscillator or path switching. Also very likely is a bad connection between Solid State Amplifier and the VTAC. Other potential sources of failure could be the IPA tube, IPA input board, IPA phase detector, Processor Board A/D, and cabling.

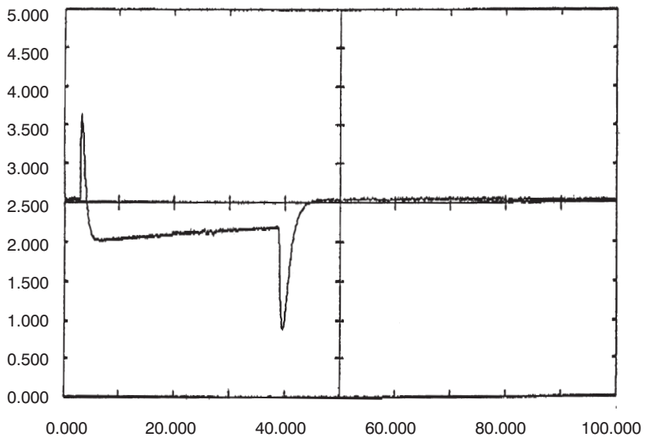
RF AMPLIFIER FAULT CODE 60 − 62 TROUBLESHOOTING FLOWCHART (continued)
ILLUSTRATION 2−39

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

PA Tune sensor on Processor Board. Body mode. 70.0 dBm.
Voltage (V) vs. time (ms)

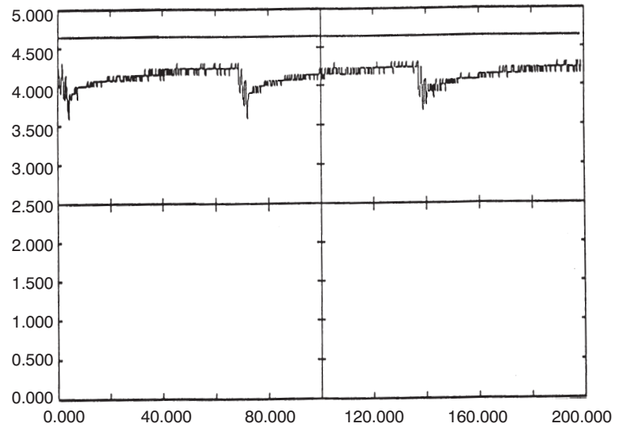


IPA Tune sensor on Processor Board. Head mode. 60.0 dBm.
Voltage (V) vs. time (ms)

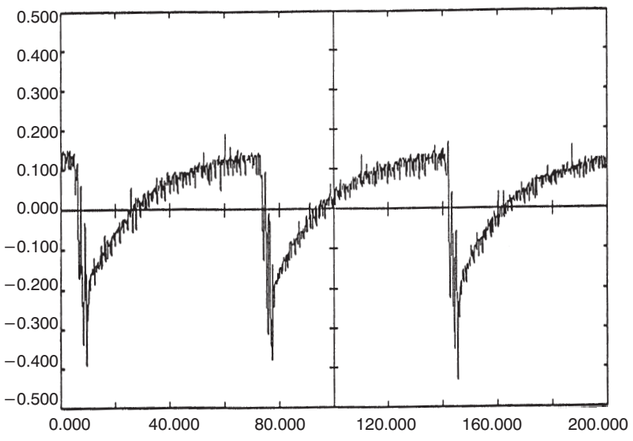


PHASE DETECTOR (PA/IPA)

PA High Voltage (6.0kV) at Processor Board. Body mode. 73.0 dBm
Voltage (V) vs. time (ms)

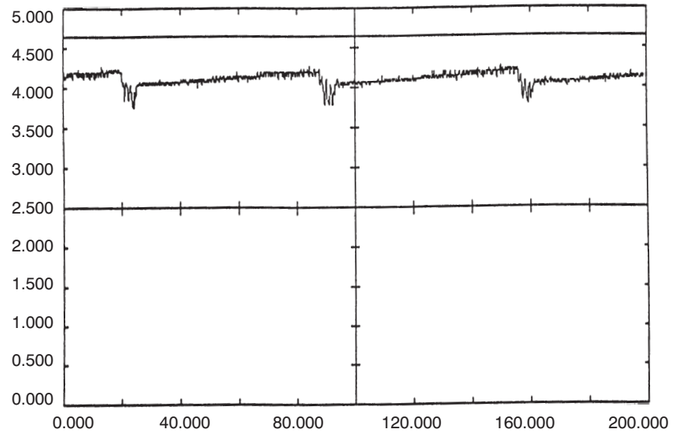


PA High Voltage (6.0kV) at Processor Board. Body mode. 73.0 dBm
Voltage (V) vs. time (ms), Scope AC coupled

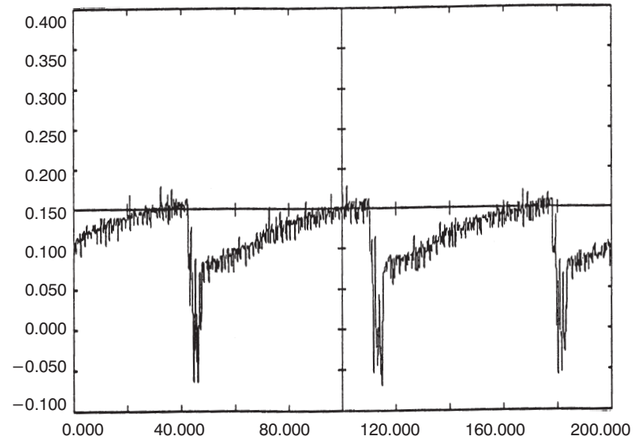


6KV MEASUREMENT

IPA high voltage (3.0KV) at Processor Board. Body mode. 73.0 dBm
Voltage (V) vs. time (ms)



IPA high voltage (3.0KV) at Processor Board. Body mode. 73.0 dBm
Voltage (V) vs. time (ms), Scope AC coupled

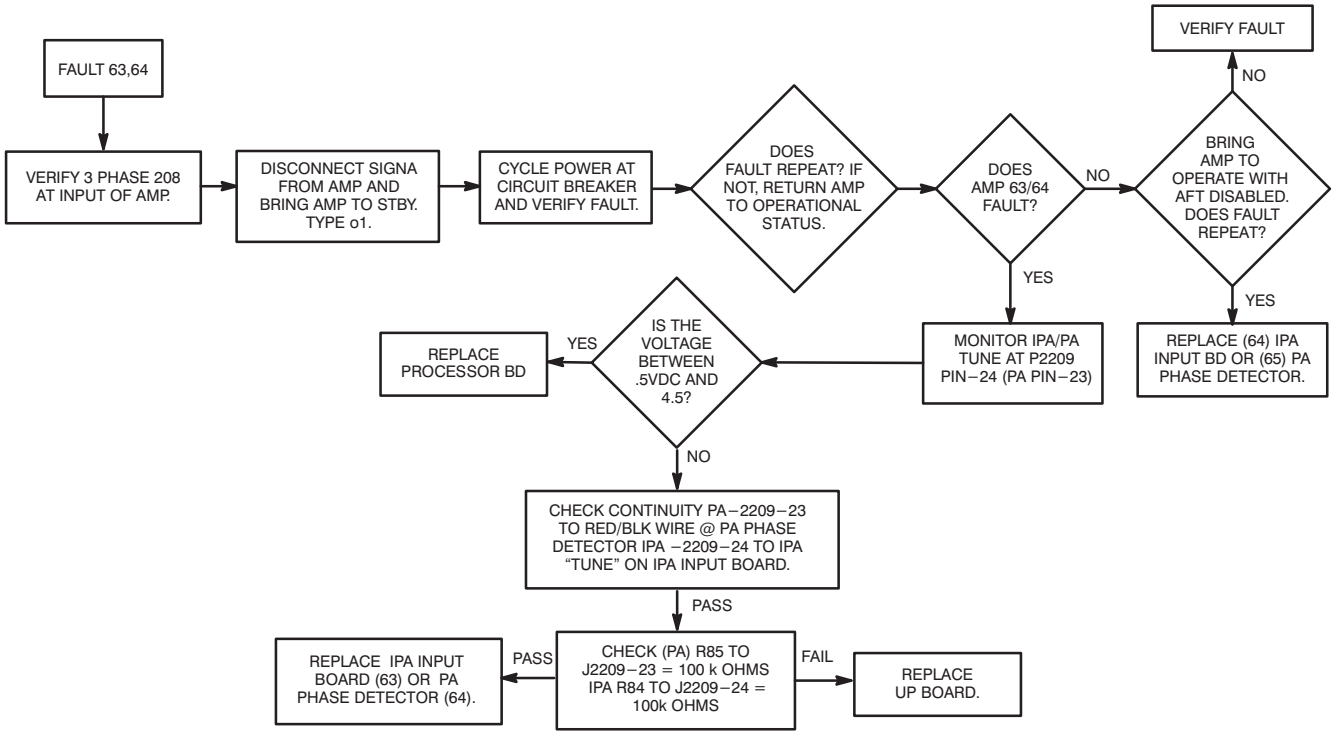


3KV MEASUREMENT

RF AMPLIFIER FAULT CODE 60 − 62 SIGNALS
ILLUSTRATION 2−40

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

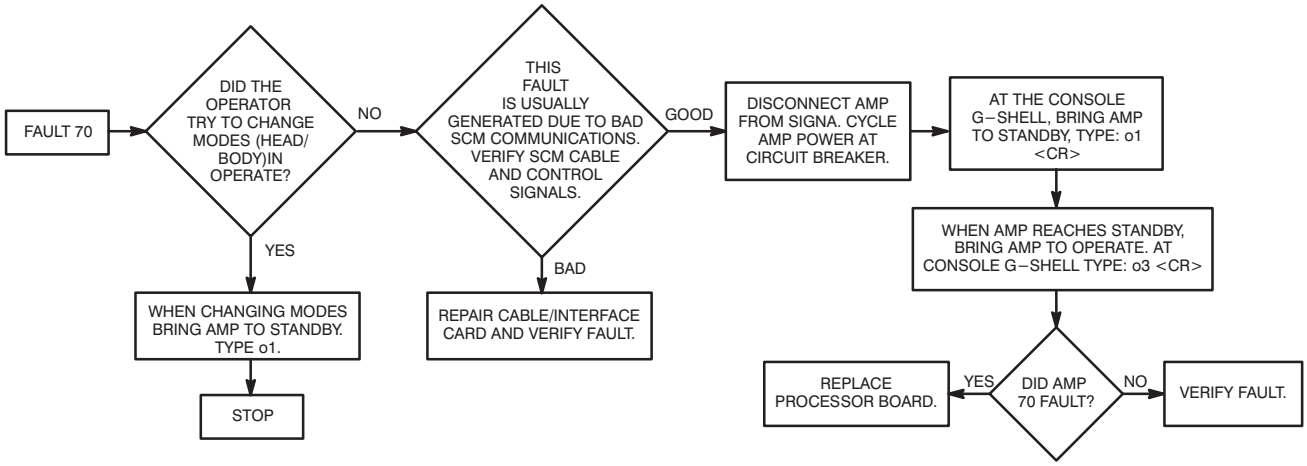
63: IPA phase detector signal error; this indicates that IPA Tune signal is out of spec. and is probably a hardware failure.
64: PA phase detector signal error; this indicates that PA Tune signal is out of spec. and is probably a hardware failure.



RF AMPLIFIER FAULT CODE 63 − 64 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−41

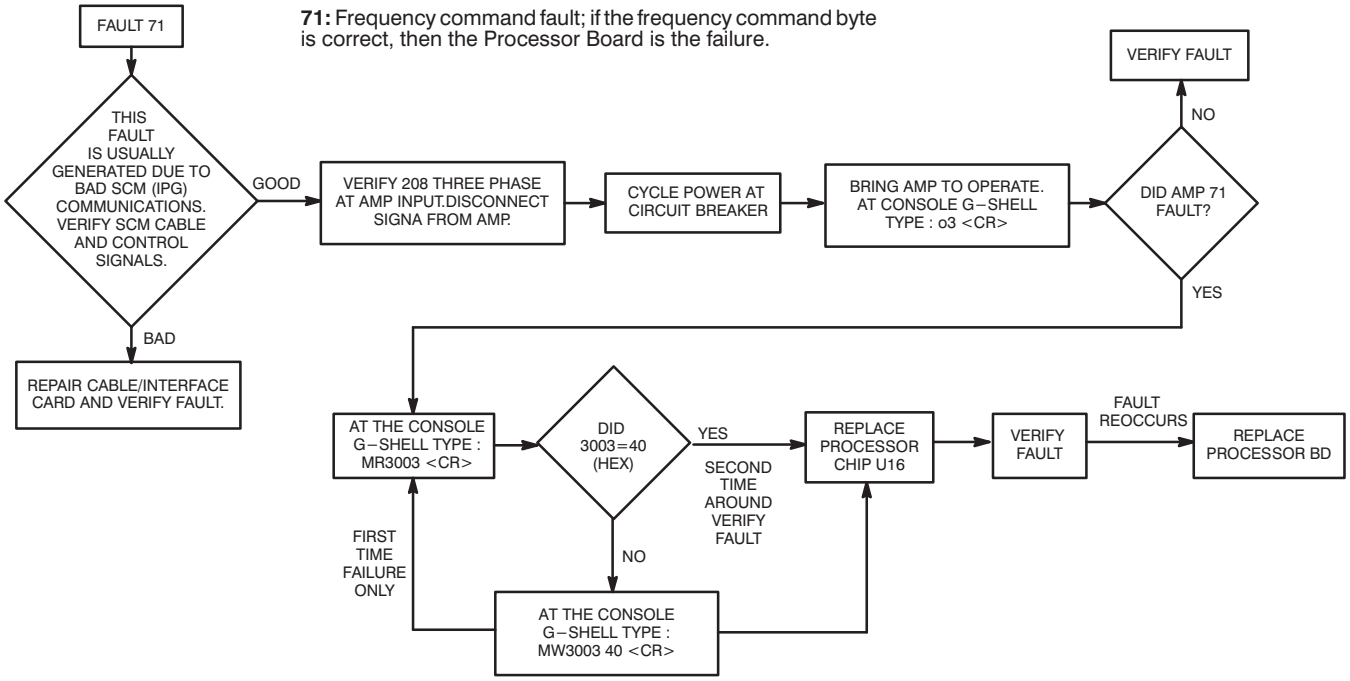
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

70: Change mode command while in operate; if no such command is being issued by the external controllIng computer, then the Processor Board is definitely at fault.



RF AMPLIFIER FAULT CODE 70 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−42

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

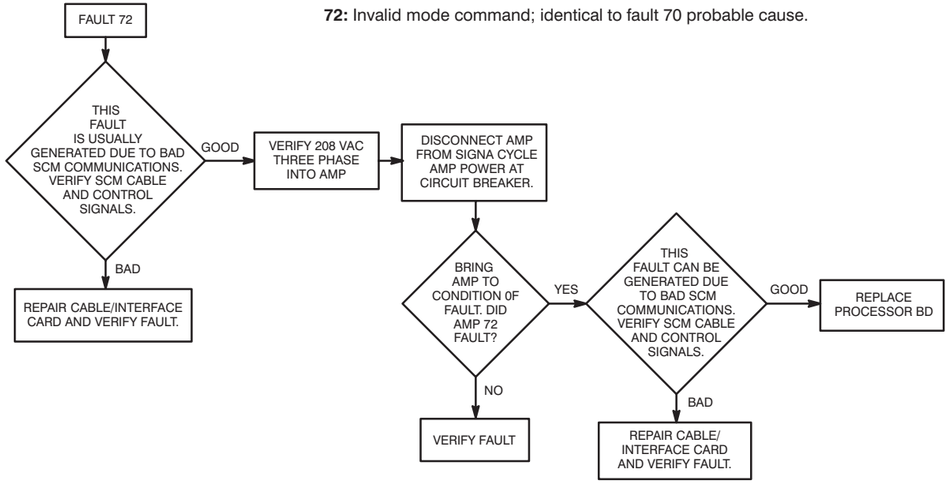


RF AMPLIFIER FAULT CODE 71 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−43

Blank

DIRECTION 15492

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

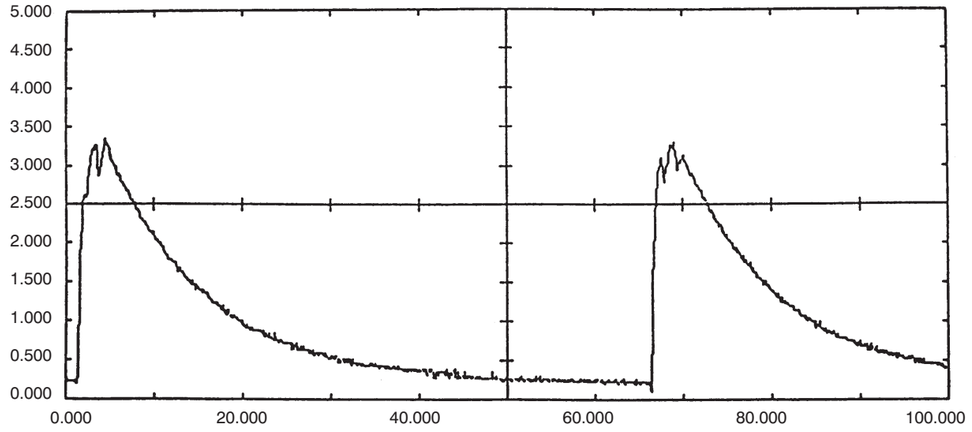


72: Invalid mode command; identical to fault 70 probable cause.

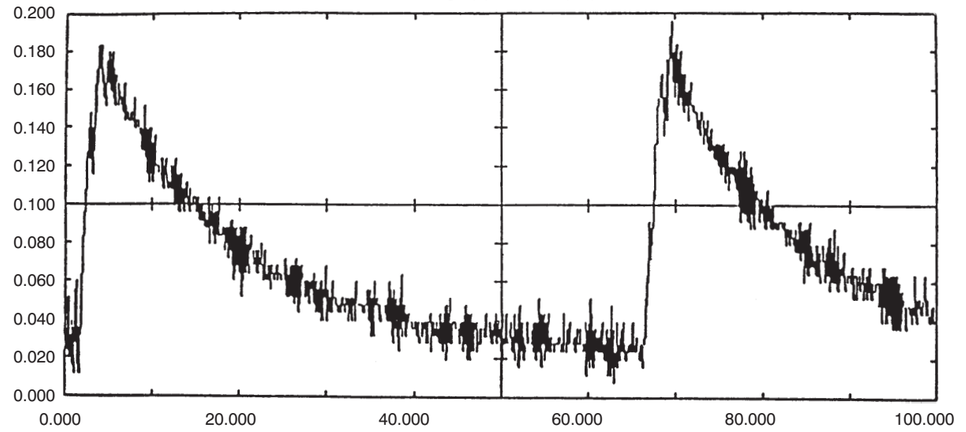
RF AMPLIFIER FAULT CODE 72 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−44

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

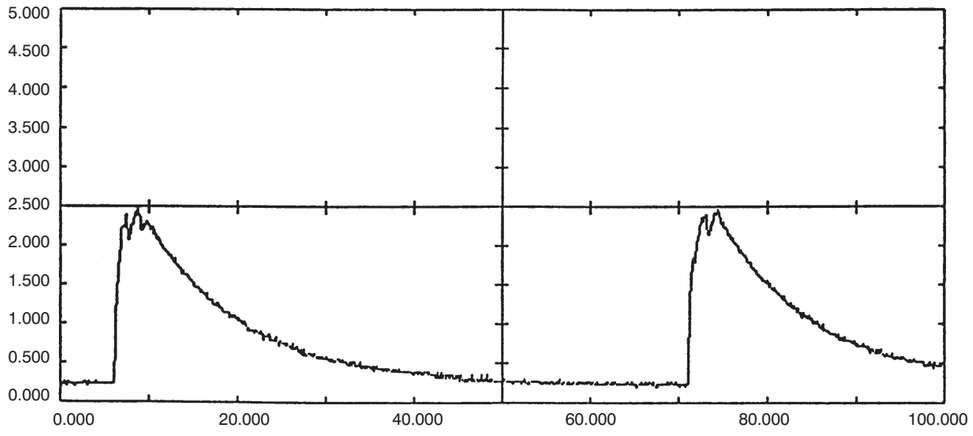
PA forward power @ Processor Board. Body mode output at 70.0 dBm
Voltage (V) vs. time (ms)



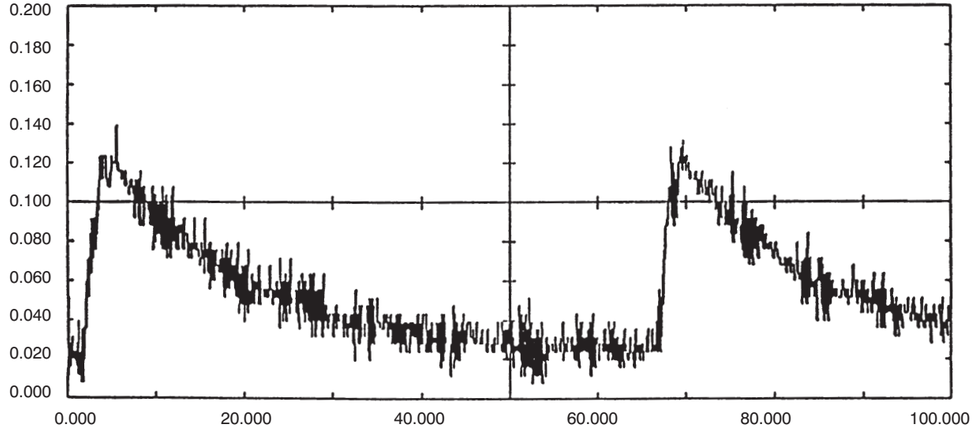
PA Reflected power at Processor Board. Body mode, 70.0 dBm
Voltage (V), vs. time (ms)



PA forward power @ Processor Board. Body mode output at 67.0 dBm
Voltage (V) vs. time (ms)

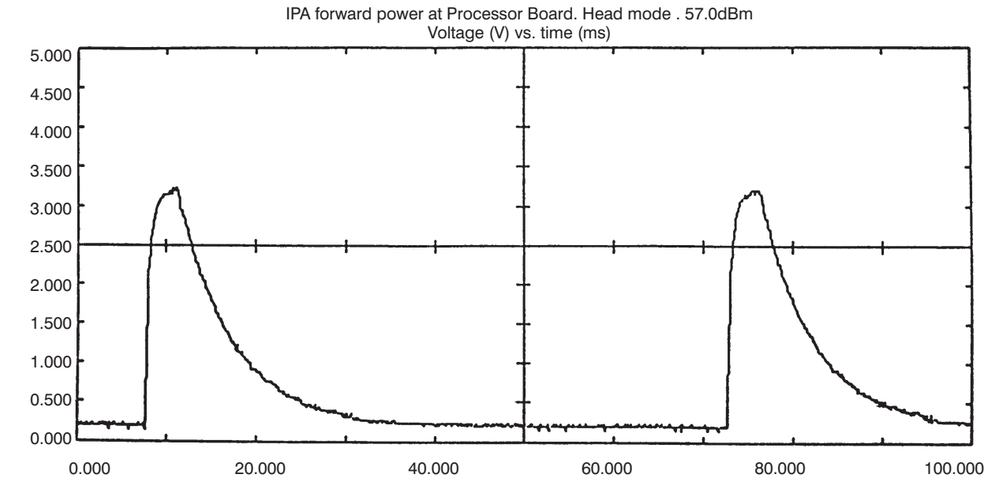


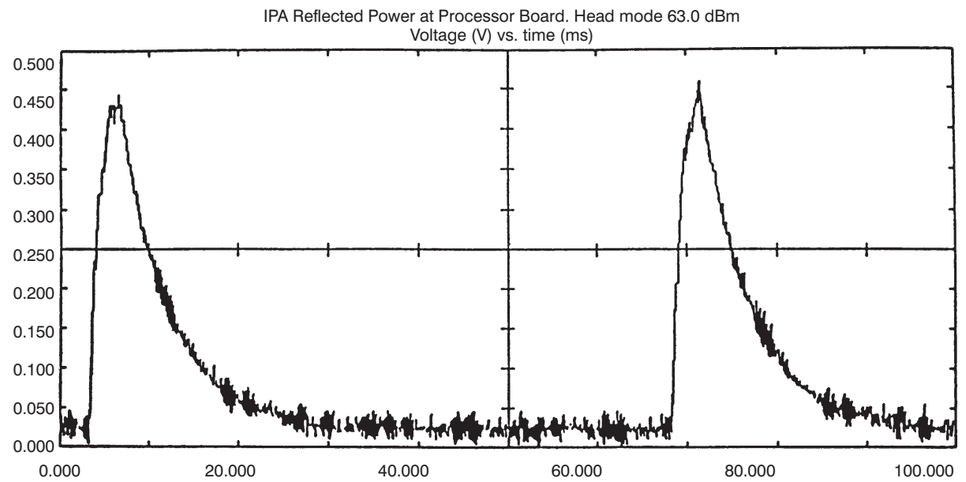
PA Reflected power at Processor Board. Body mode, 67.0 dBm
Voltage (V), vs. time (ms)

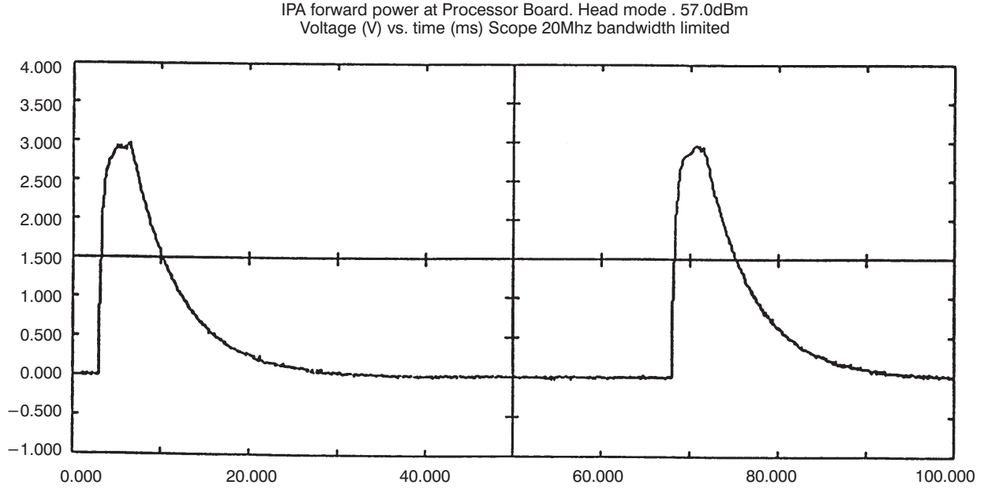


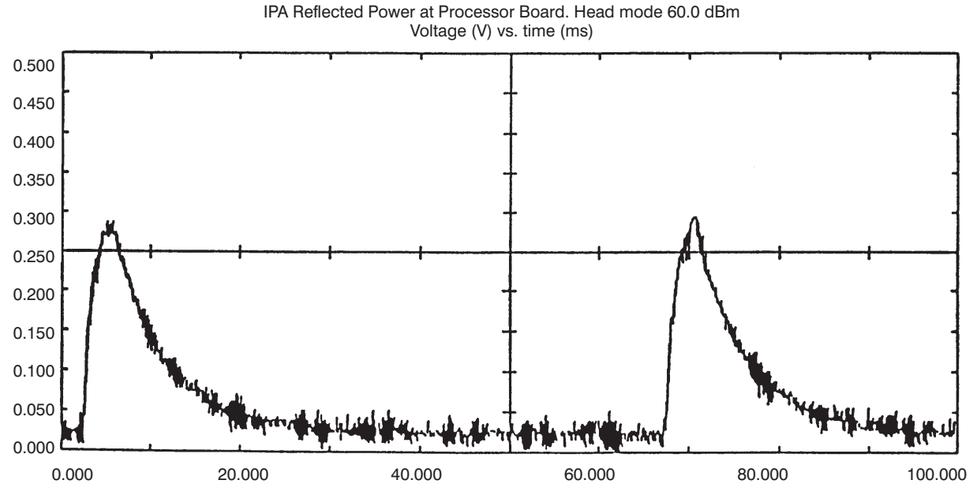
RF AMPLIFIER FAULT CODE 73 − 76 SIGNALS
ILLUSTRATION 2−45

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



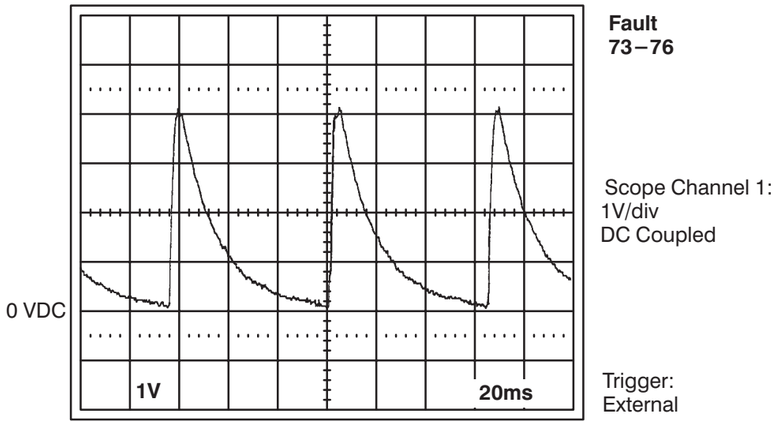






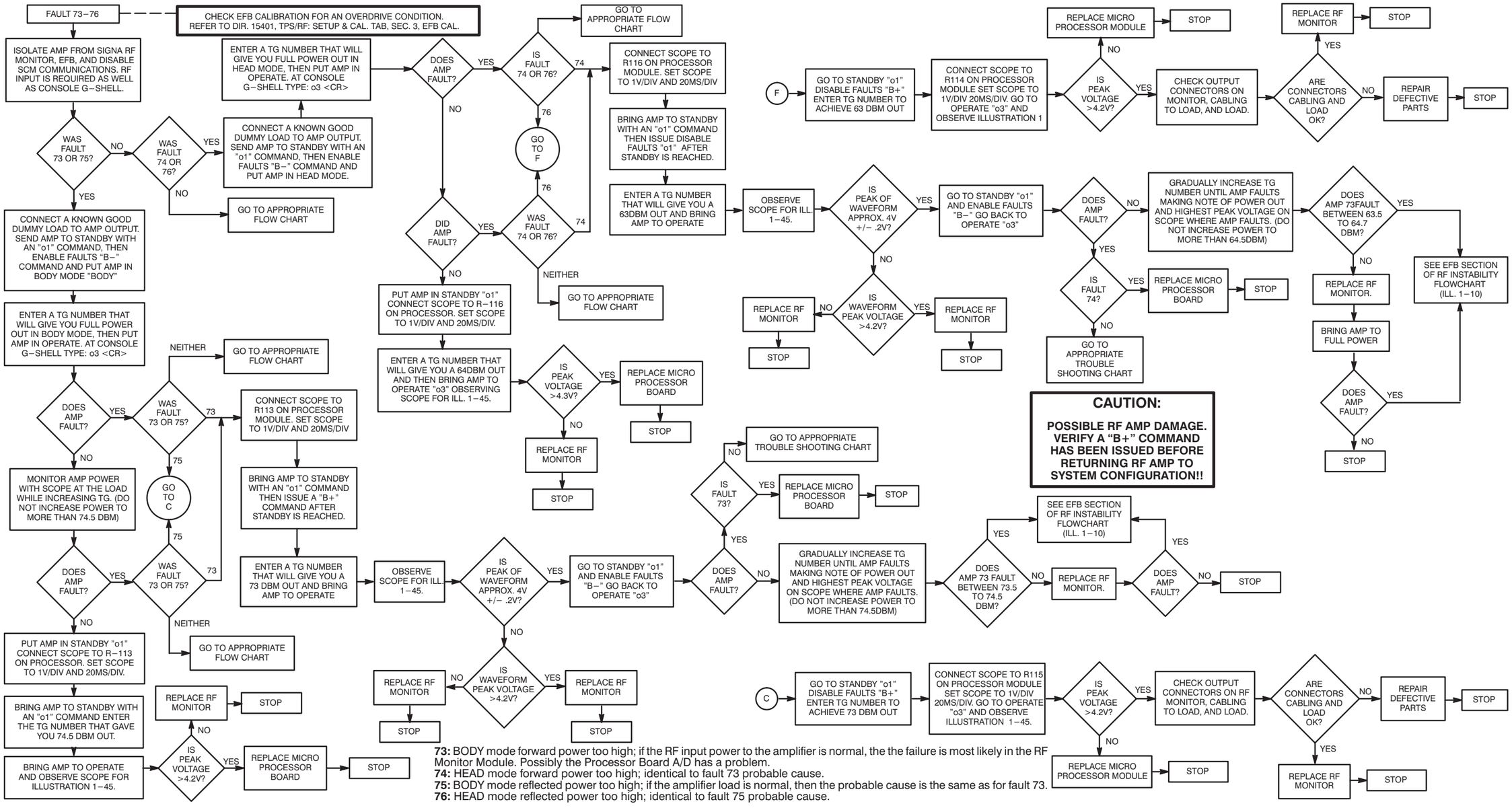
RF AMPLIFIER FAULT CODE 73 − 76 SIGNALS
ILLUSTRATION 2−45 (continued)

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



MICROPROCESSOR BD. AT R113 (PA FOR), R115 (PA REF), R116 (IPA FOR), & R114 (IPA REF)
ILLUSTRATION 2−46

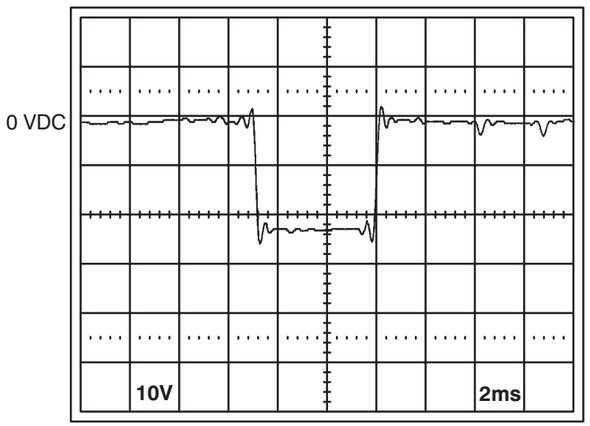
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



73: BODY mode forward power too high; if the RF input power to the amplifier is normal, the the failure is most likely in the RF Monitor Module. Possibly the Processor Board A/D has a problem.
74: HEAD mode forward power too high; identical to fault 73 probable cause.
75: BODY mode reflected power too high; if the amplifier load is normal, then the probable cause is the same as for fault 73.
76: HEAD mode reflected power too high; identical to fault 75 probable cause.

RF AMPLIFIER FAULT CODE 73 − 76 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−47

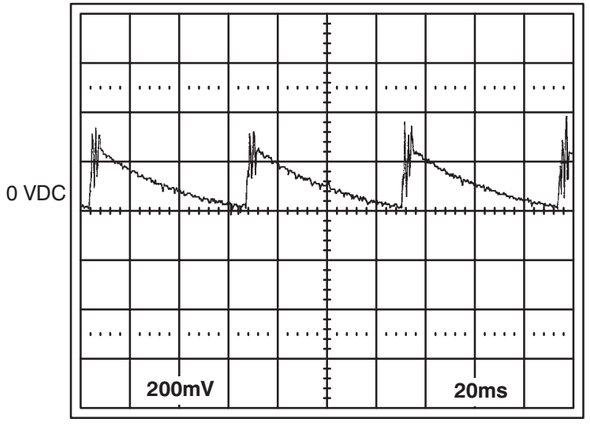
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



IPA Bias
Fault 77

Scope Channel 1:
10V/div
DC Coupled

Trigger:
External



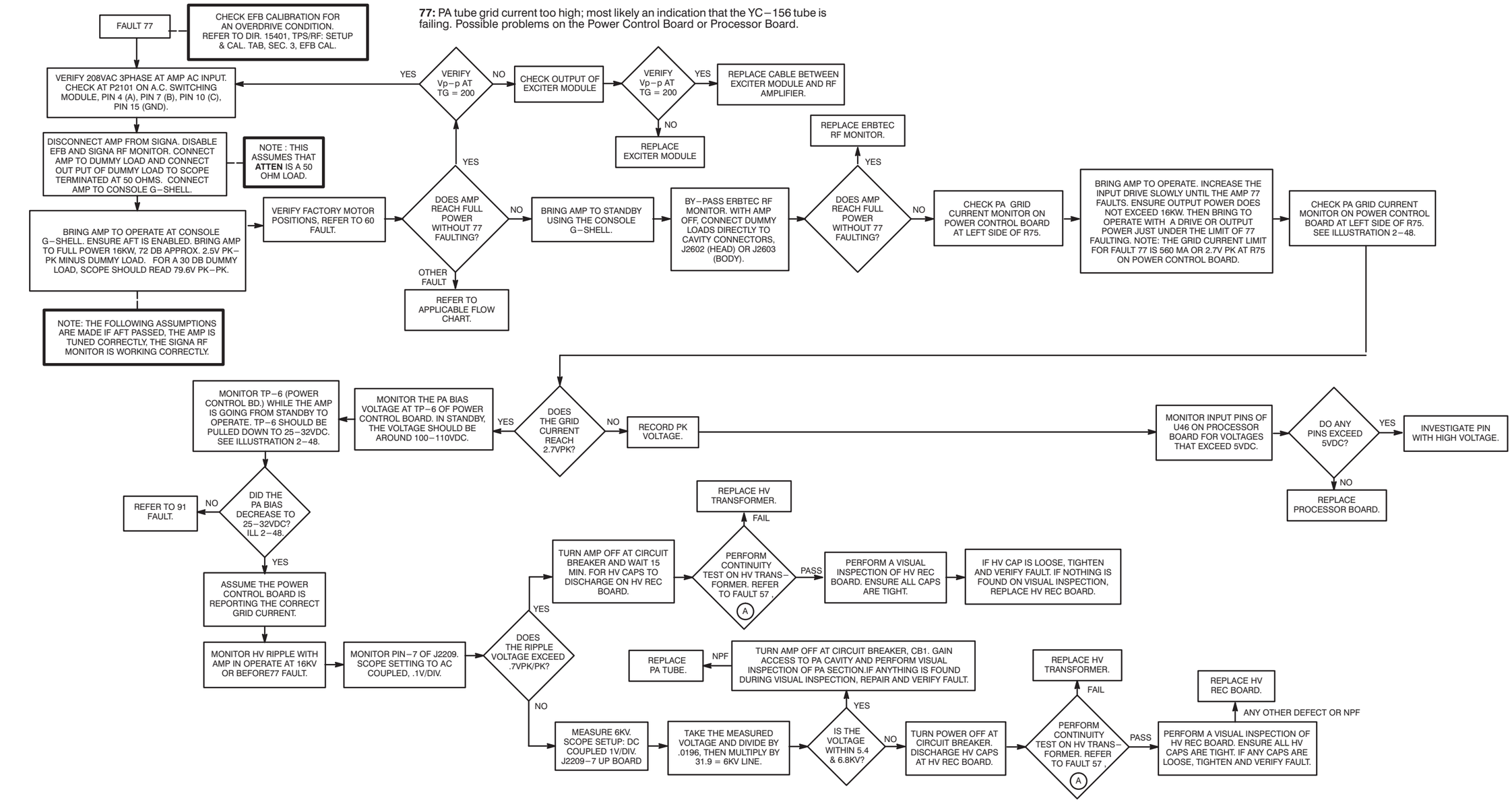
Grid Current
Fault 77

Scope Channel 1:
200mV/div
AC Coupled

Trigger:
External

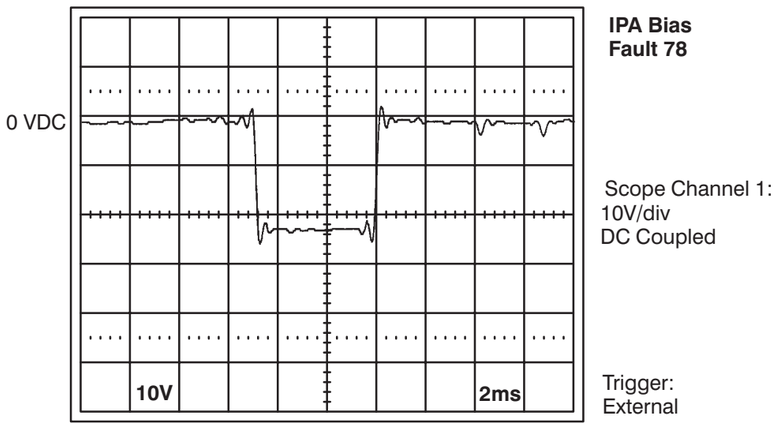
RF AMPLIFIER FAULT CODE 77 SIGNALS
ILLUSTRATION 2−48

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 77 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−49

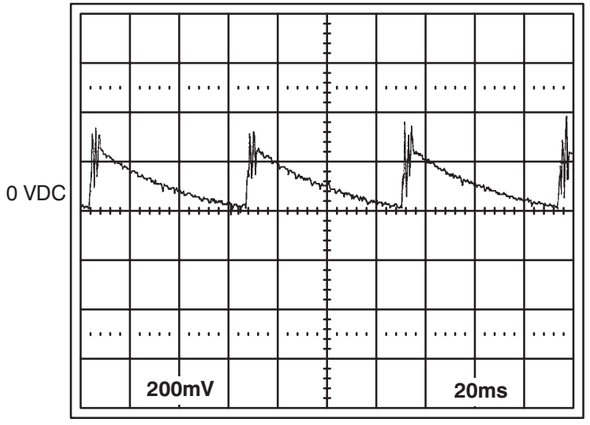
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



IPA Bias
Fault 78

Scope Channel 1:
10V/div
DC Coupled

Trigger:
External



Grid Current
Fault 78

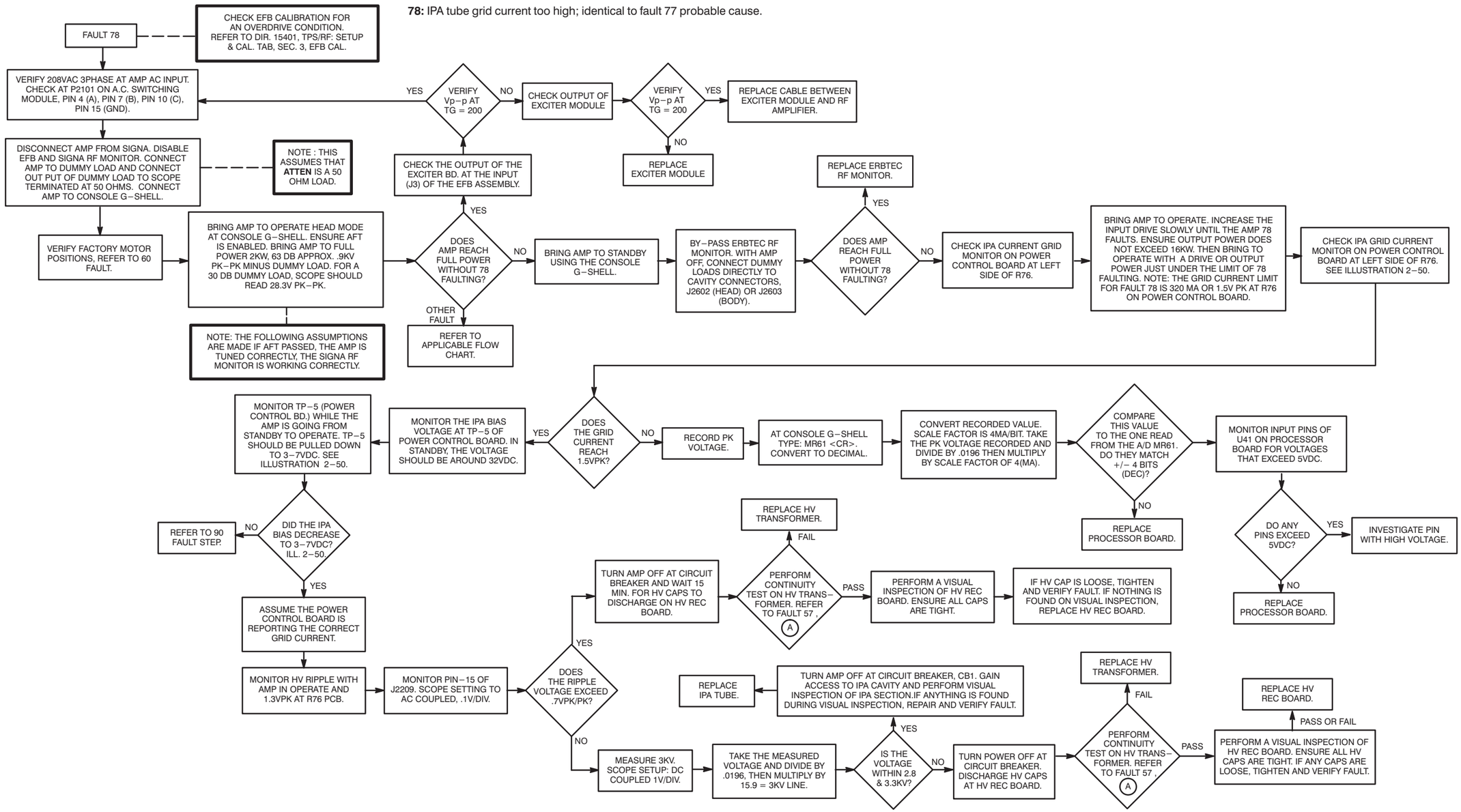
Scope Channel 1:
200mV/div
AC Coupled

Trigger:
External

RF AMPLIFIER FAULT CODE 78 SIGNALS
ILLUSTRATION 2−50

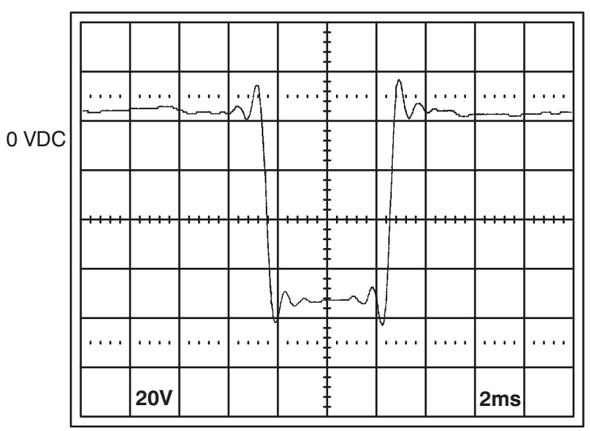
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

78: IPA tube grid current too high; identical to fault 77 probable cause.



RF AMPLIFIER FAULT CODE 78 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−51

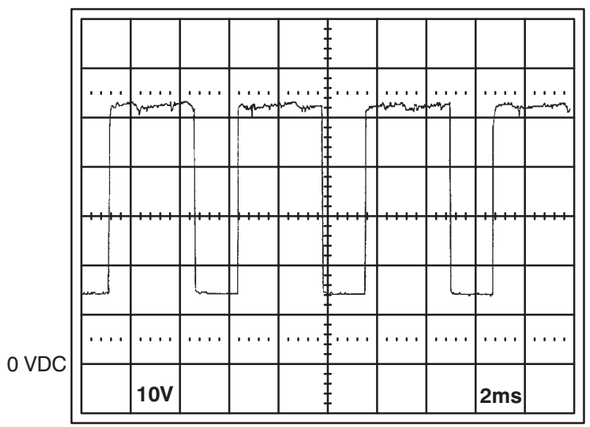
2–6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



PA Bias
Fault 79

Scope Channel 1:
20V/div
AC Coupled

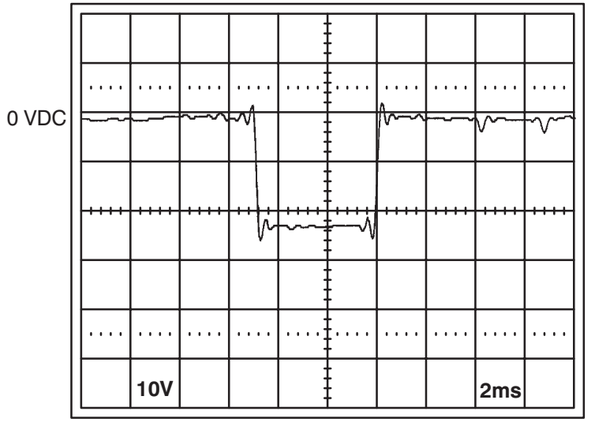
Trigger:
External



Fault 79

Scope Channel 1:
10V/div
DC Coupled

Trigger:
External



IPA Bias
Fault 79

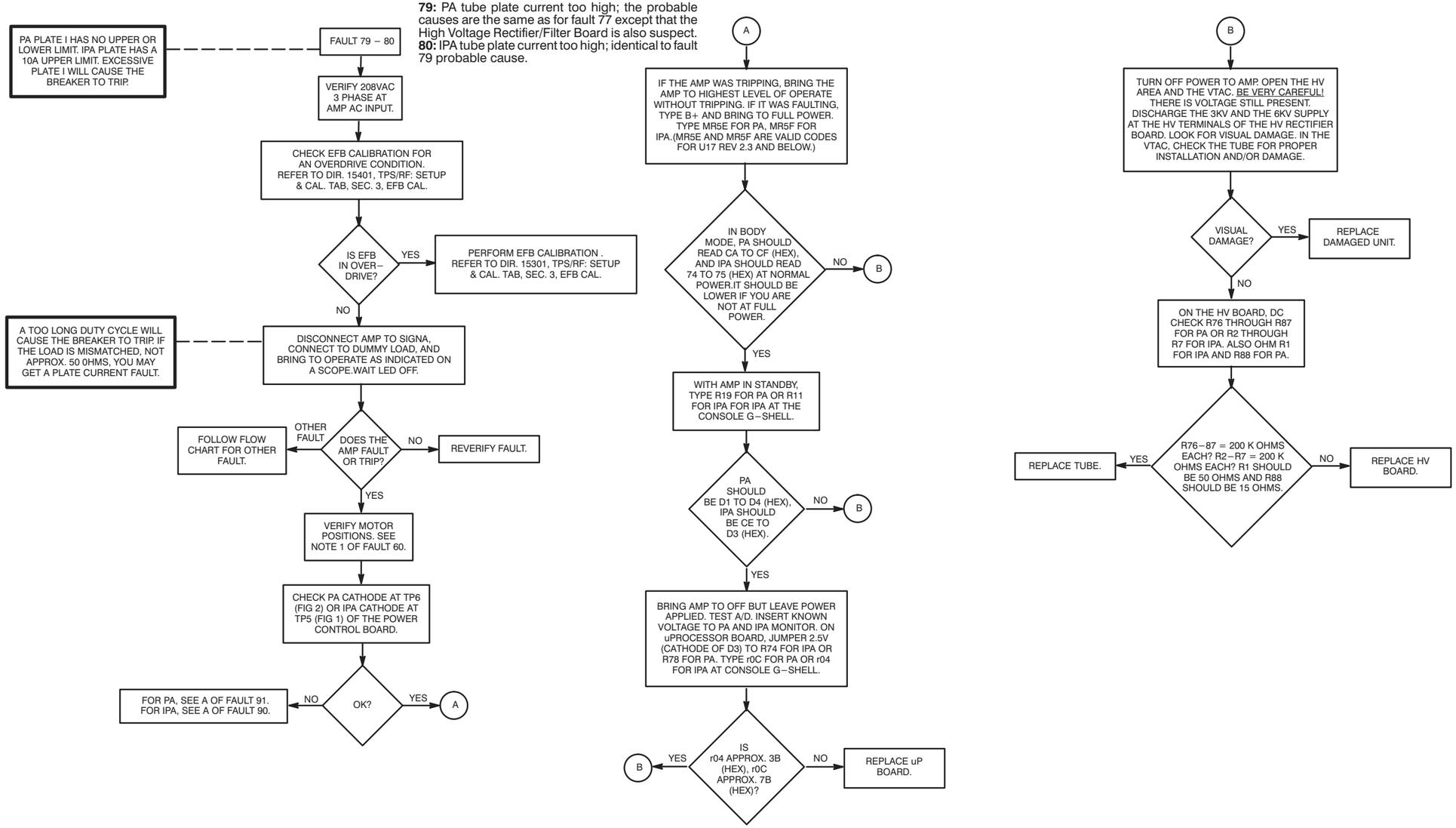
Scope Channel 1:
10V/div
AC or DC
Coupled

Trigger:
External

RF AMPLIFIER FAULT CODE 79 SIGNALS
ILLUSTRATION 2–52

2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

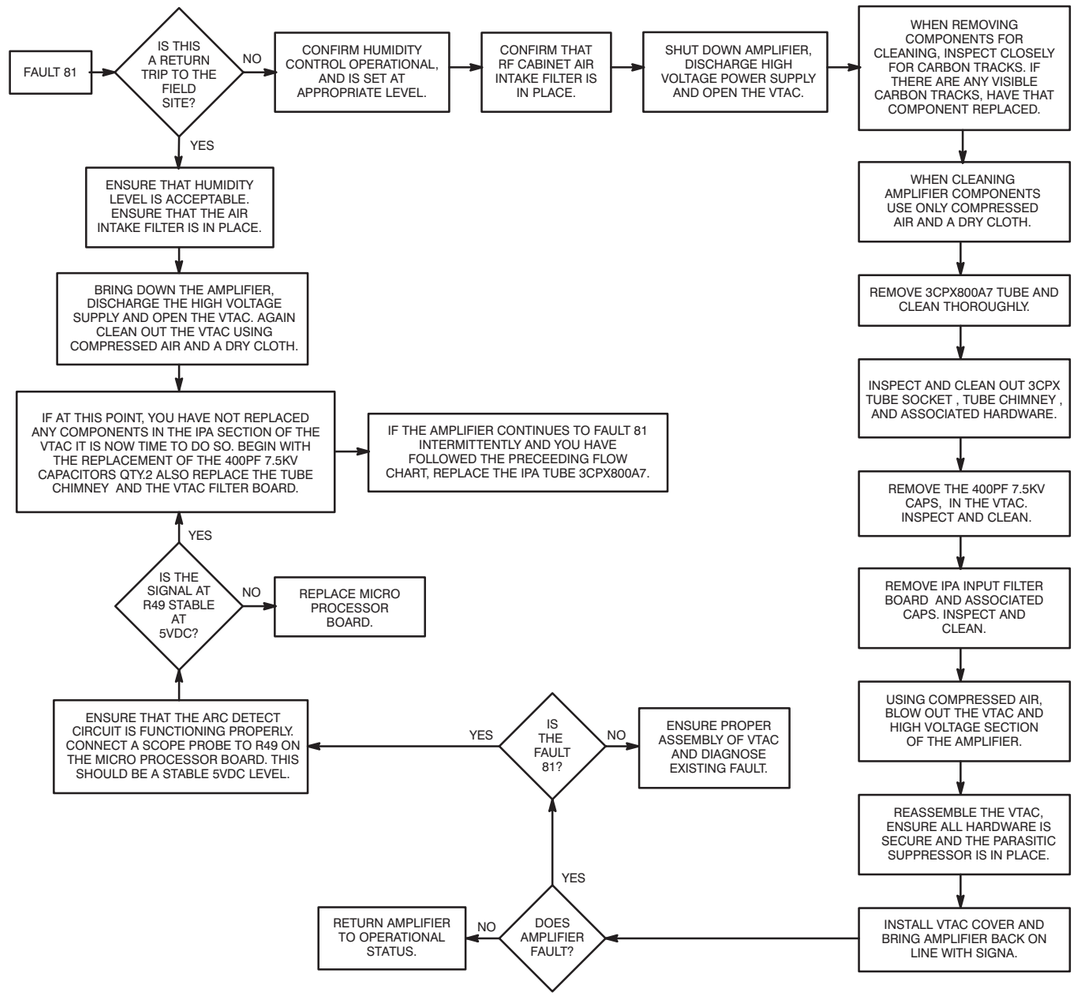
79: PA tube plate current too high; the probable causes are the same as for fault 77 except that the High Voltage Rectifier/Filter Board is also suspect.
80: IPA tube plate current too high; identical to fault 79 probable cause.



RF AMPLIFIER FAULT CODE 79 − 80 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−53

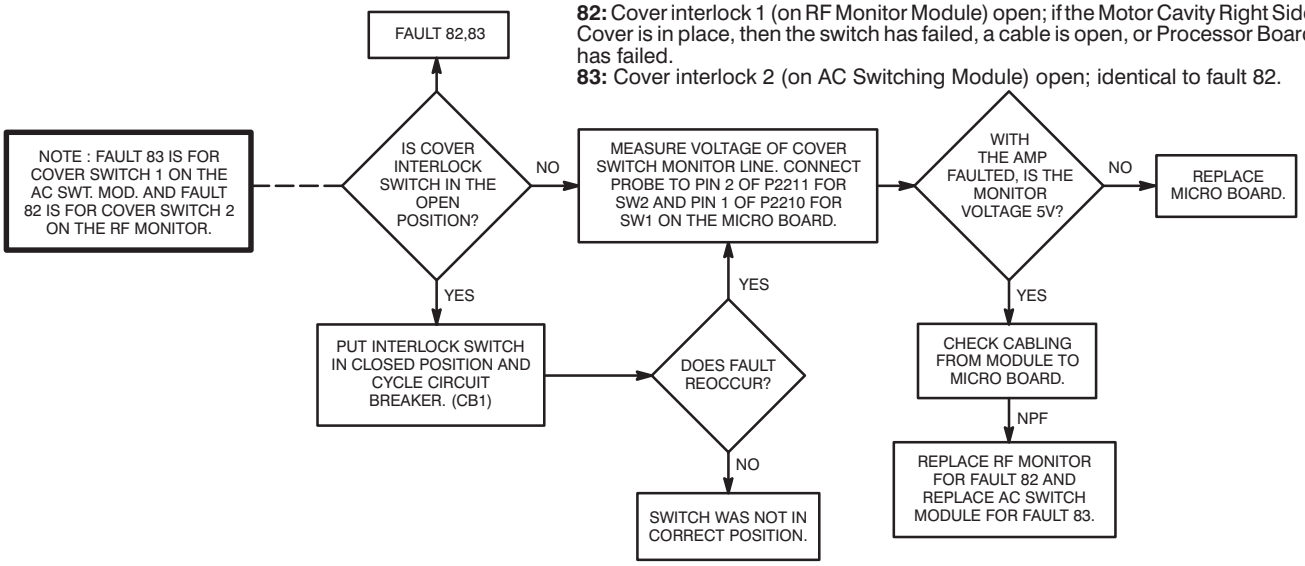
2–6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

81: IPA tube or +3KV arc; a genuine arc will usually leave a visible mark, and will most probably eventually occur again. Tube arcs may occur internally and will not be visible; if these persist, the tube must be replaced. it is also possible that the arc detect circuitry on the Processor Board is giving false indications.



RF AMPLIFIER FAULT CODE 81 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2–54

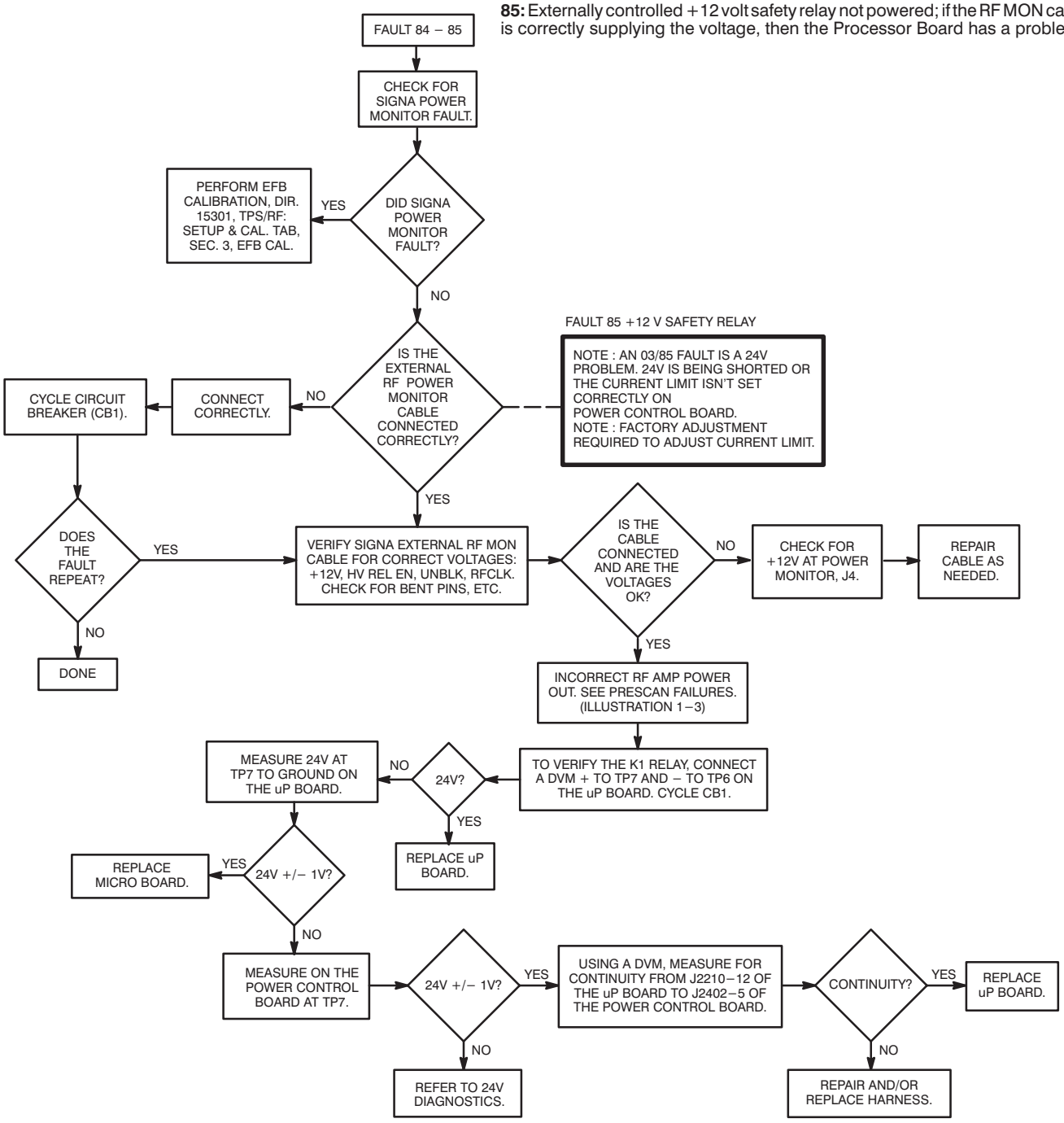
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 82 − 83 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−55

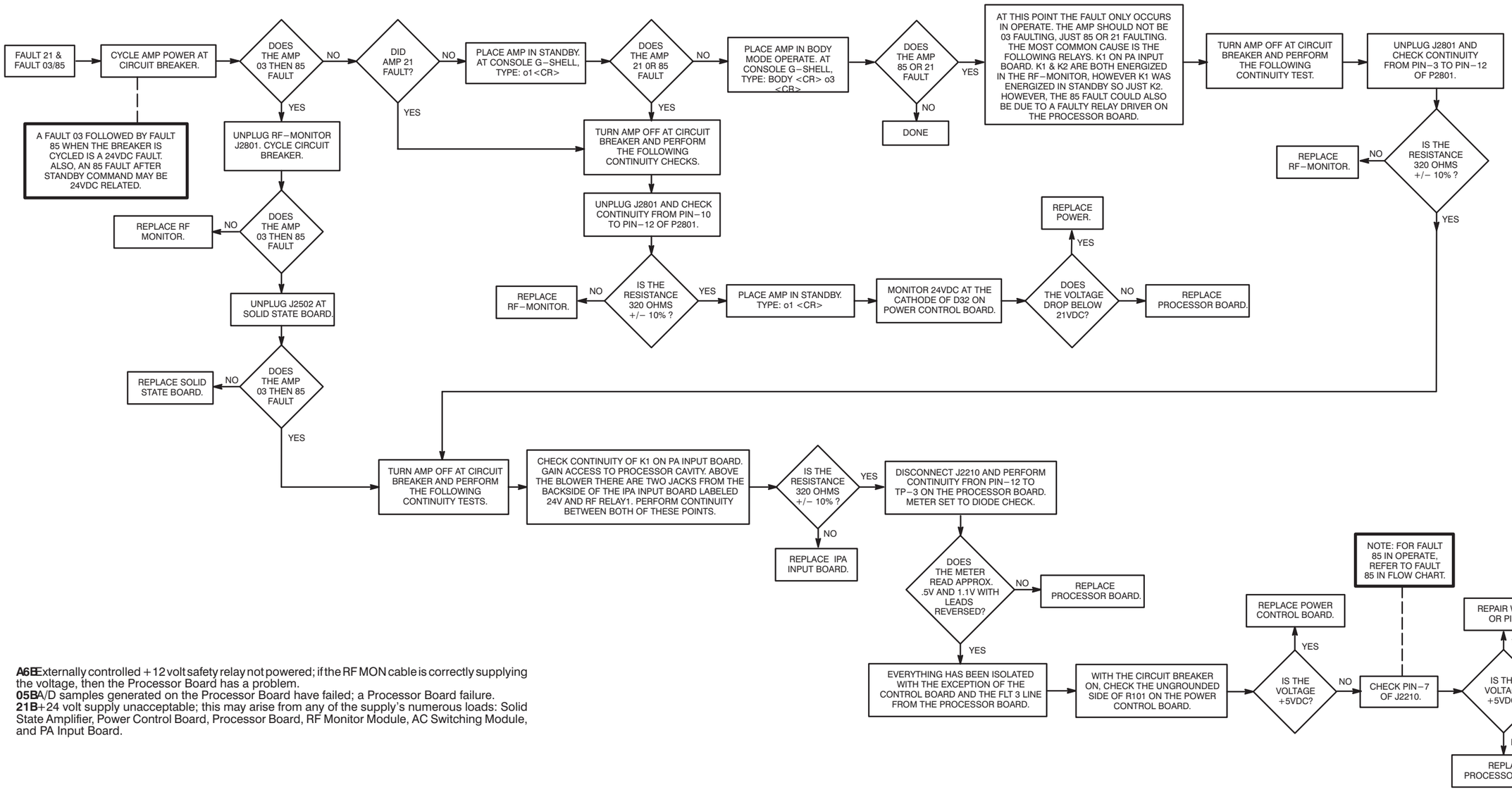
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

84: RF MON cable disconnected; if RF MON cable is correct, then failure is on the Processor Board.
85: Externally controlled +12 volt safety relay not powered; if the RF MON cable is correctly supplying the voltage, then the Processor Board has a problem.



RF AMPLIFIER FAULT CODE 84 − 85 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−56

2−6 GTDVGE THCOSNWMGT HCWNV ERFGVTRWDNGULRRVMPI HNRc ELCTVU (eut d ni)

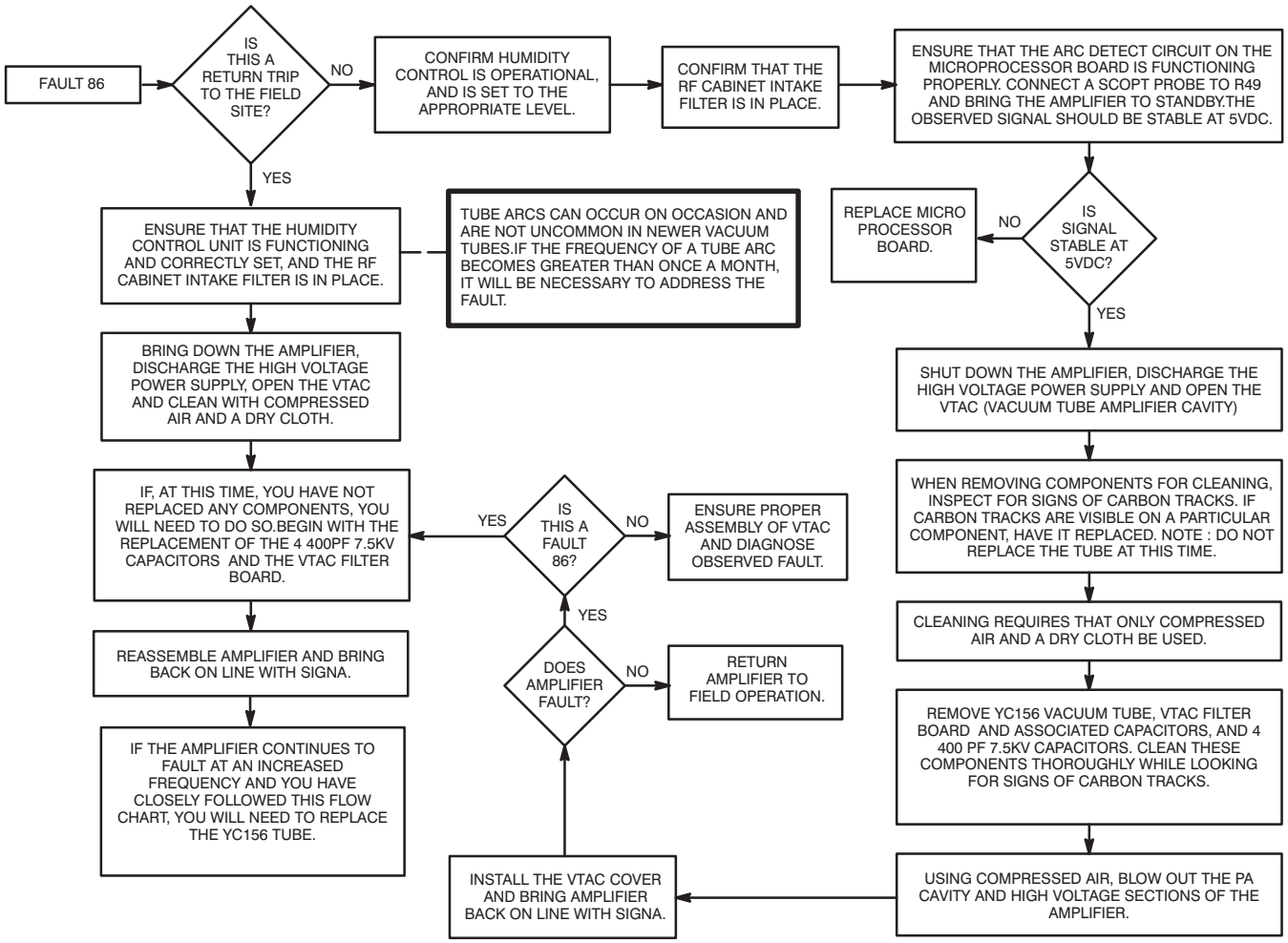


A6E Externally controlled +12 volt safety relay not powered; if the RF MON cable is correctly supplying the voltage, then the Processor Board has a problem.
05BA/D samples generated on the Processor Board have failed; a Processor Board failure.
21B+24 volt supply unacceptable; this may arise from any of the supply's numerous loads: Solid State Amplifier, Power Control Board, Processor Board, RF Monitor Module, AC Switching Module, and PA Input Board.

THCOSNWMGT HCWNV ERFGA6c NVL HCWNV 05 & 21 VTRWDNGULRRVMPI HNRc ELCTV
ILLUSTRATION 2−57

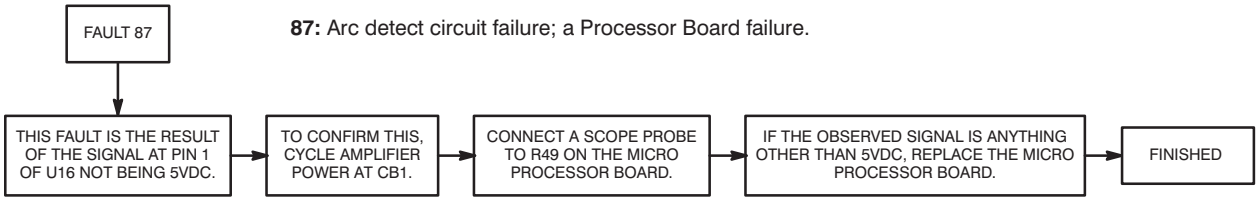
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

86: PA tube or +6KV arc; identical to fault 81, but with more punch.



RF AMPLIFIER FAULT CODE 86 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−58

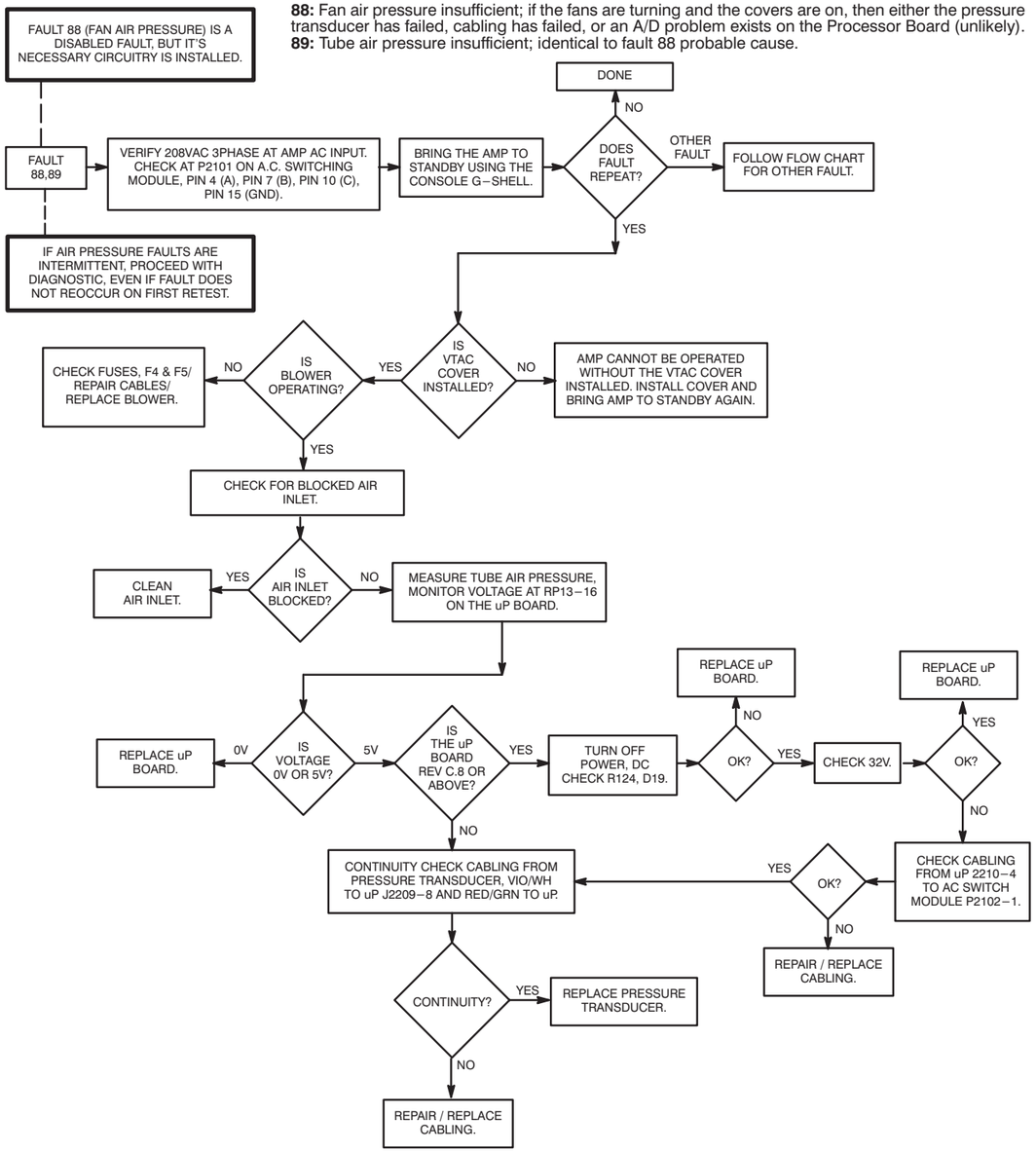
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 87 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−59

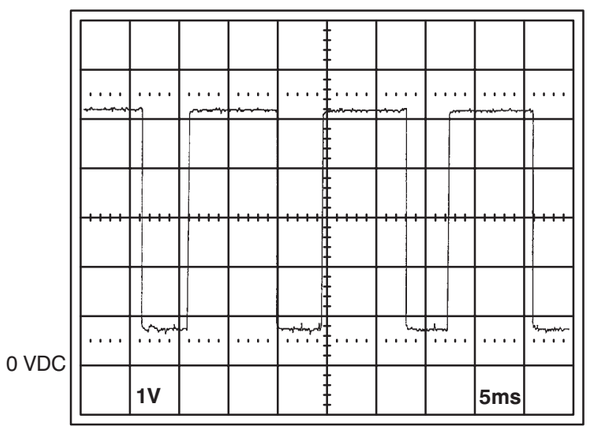
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

88: Fan air pressure insufficient; if the fans are turning and the covers are on, then either the pressure transducer has failed, cabling has failed, or an A/D problem exists on the Processor Board (unlikely).
89: Tube air pressure insufficient; identical to fault 88 probable cause.



RF AMPLIFIER FAULT CODE 88 − 89 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−60

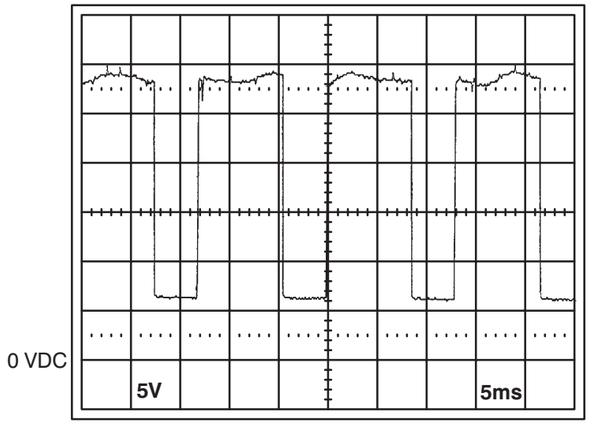
2–6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



IPA Gate
Fault 90

Scope Channel 1:
1V/div
AC or DC
Coupled

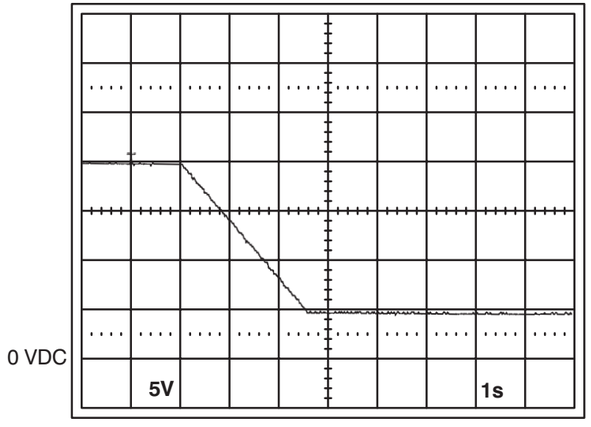
Trigger:
External



TPS
Fault 90

Scope Channel 1:
5V/div
AC or DC
Coupled

Trigger:
External



IPA Bias
Fault 90

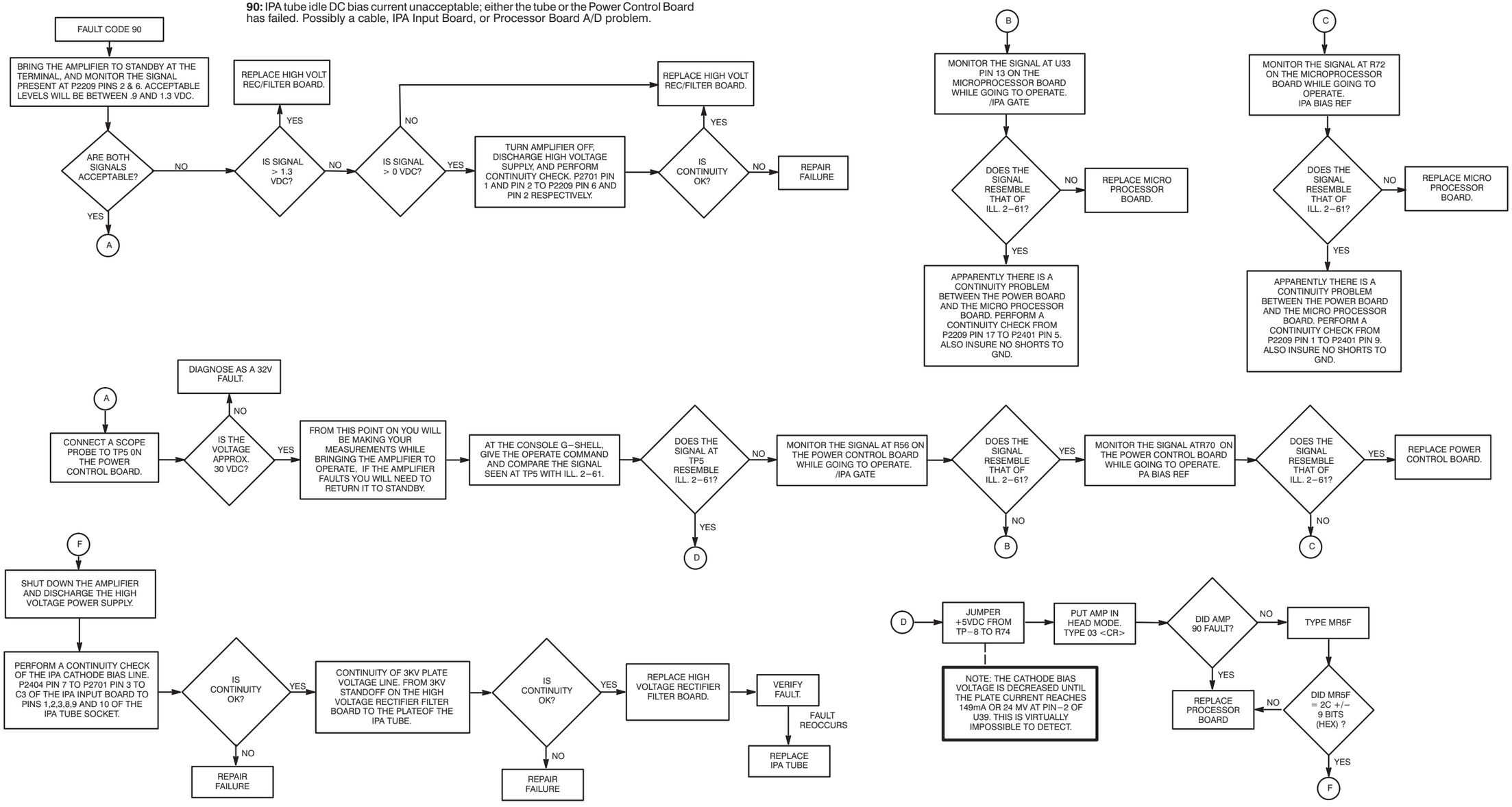
Scope Channel 1:
5V/div
AC or DC
Coupled

Trigger:
External

RF AMPLIFIER FAULT CODE 90 SIGNALS
ILLUSTRATION 2–61

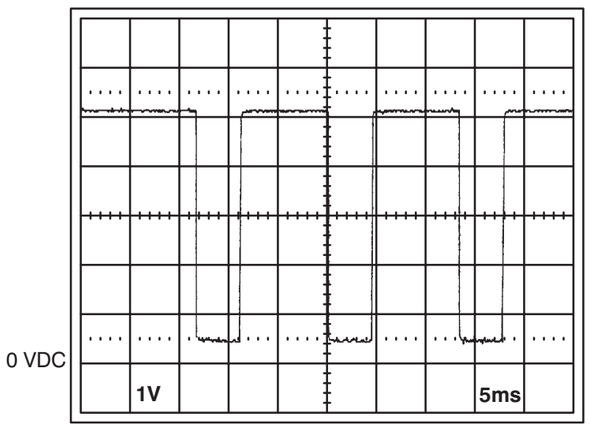
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

90: IPA tube idle DC bias current unacceptable; either the tube or the Power Control Board has failed. Possibly a cable, IPA Input Board, or Processor Board A/D problem.



RF AMPLIFIER FAULT CODE 90 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−62

2–6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

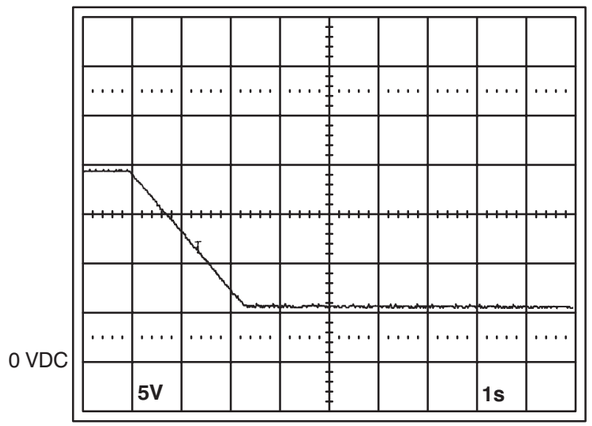


IPA Gate
Fault 91

Power Control Board @ R63

Scope Channel 1:
1V/div
DC Coupled

Trigger:
External

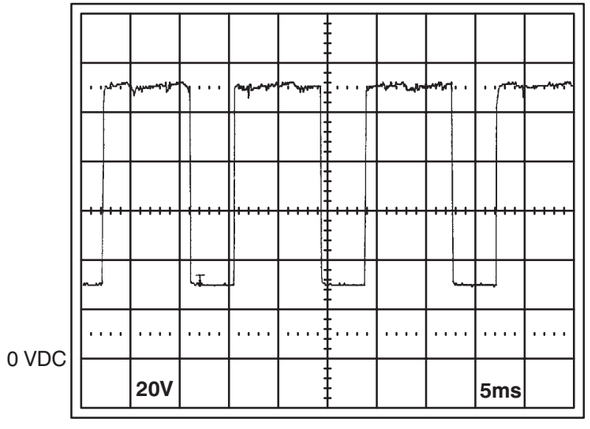


PA Bias
Fault 91

Power Control Board @ R74

Scope Channel 1:
5V/div
DC Coupled

Trigger:
External



PA Cath-
ode
Fault 91

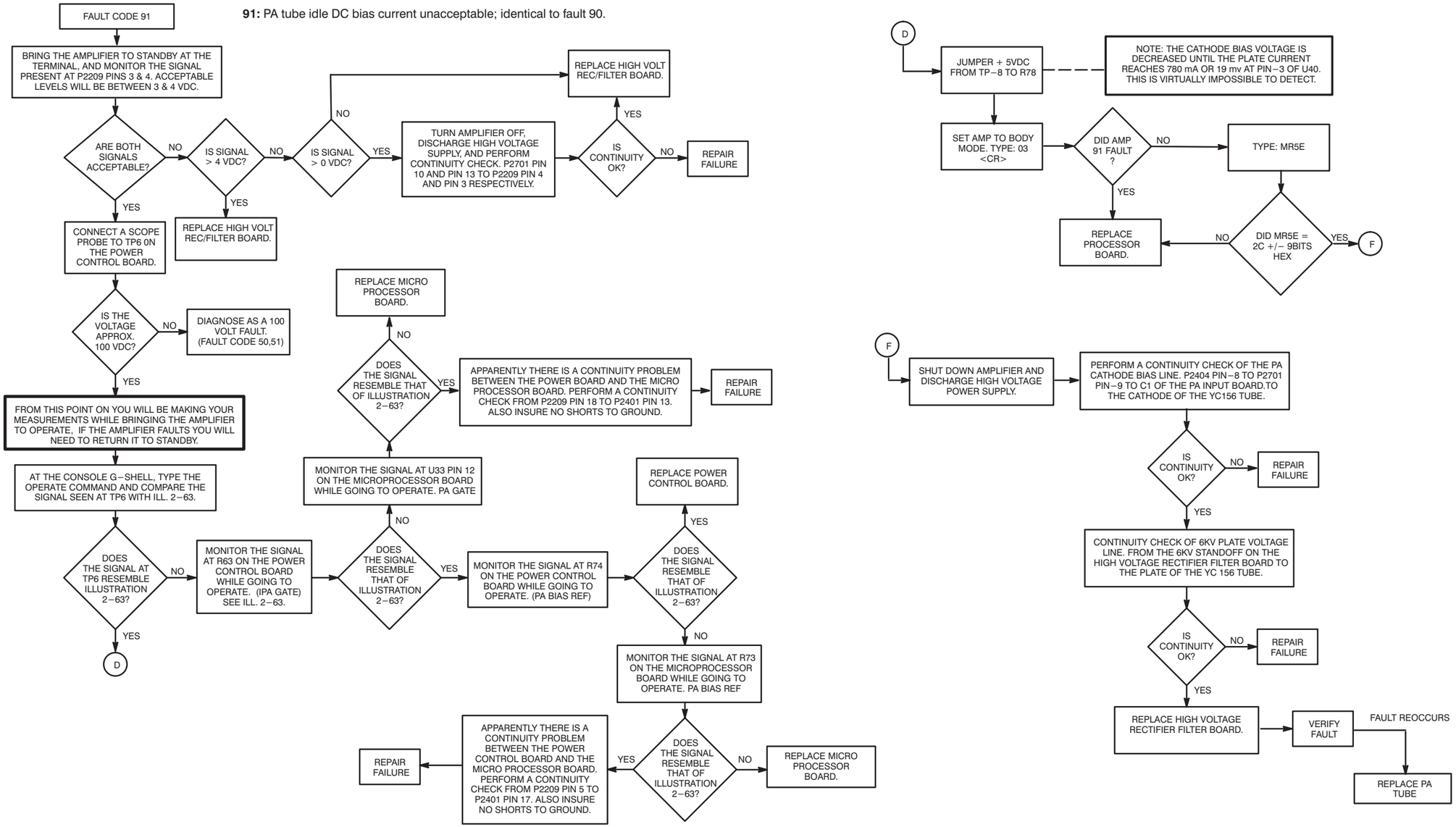
Power Control Board TP6

Scope Channel 1:
20V/div
DC Coupled

Trigger:
External

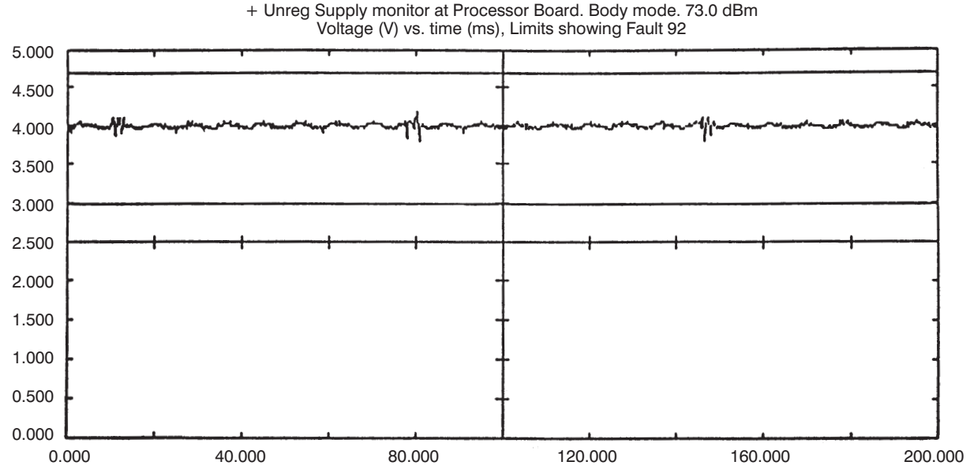
RF AMPLIFIER FAULT CODE 91 SIGNALS
ILLUSTRATION 2–63

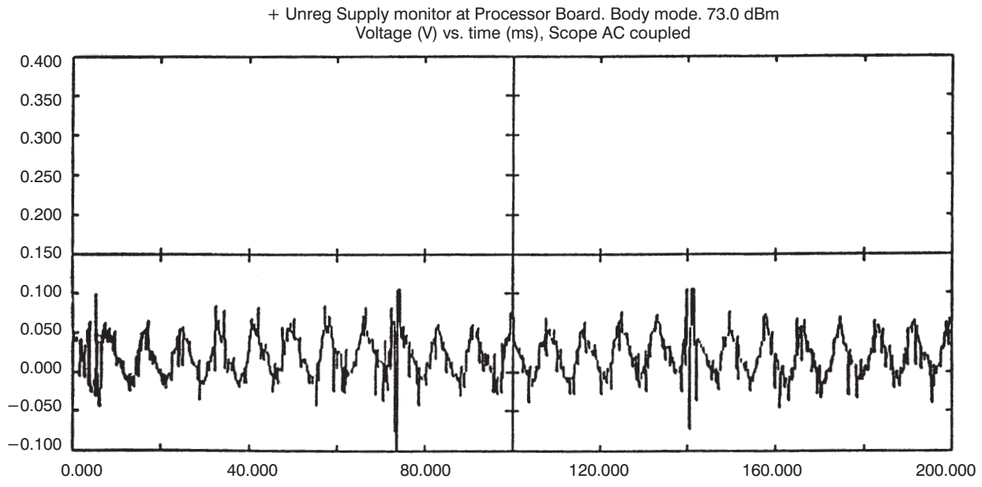
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 91 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−64

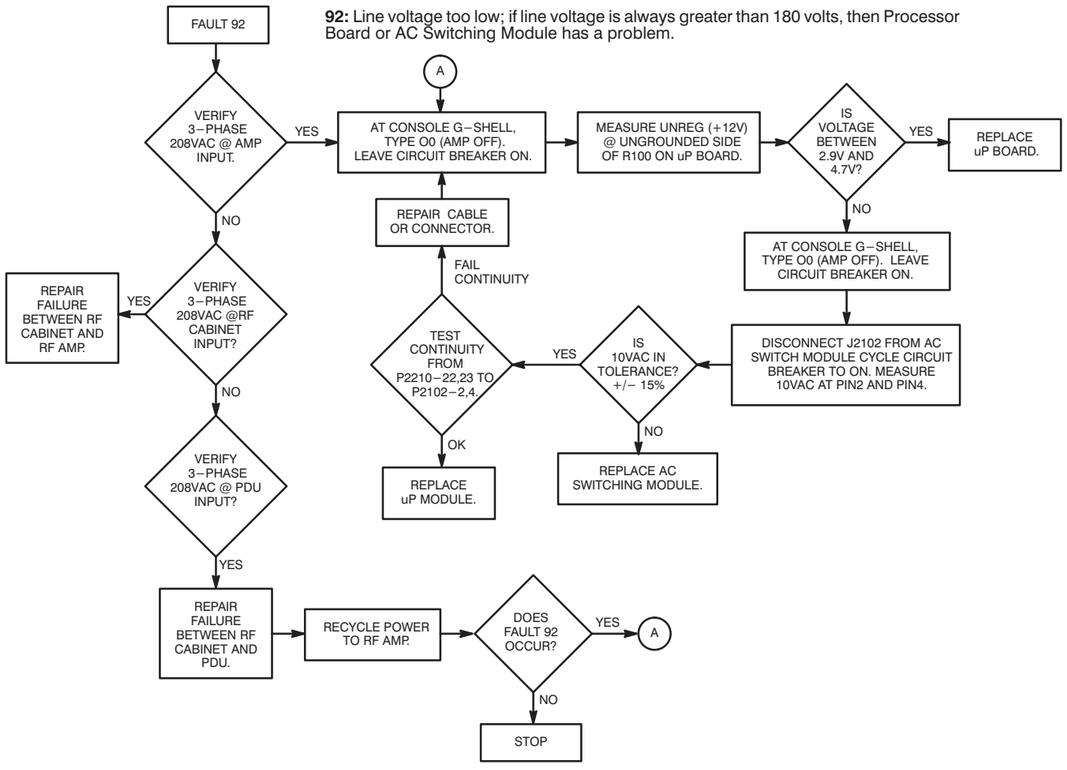
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)





RF AMPLIFIER FAULT CODE 92 SIGNALS
ILLUSTRATION 2−65

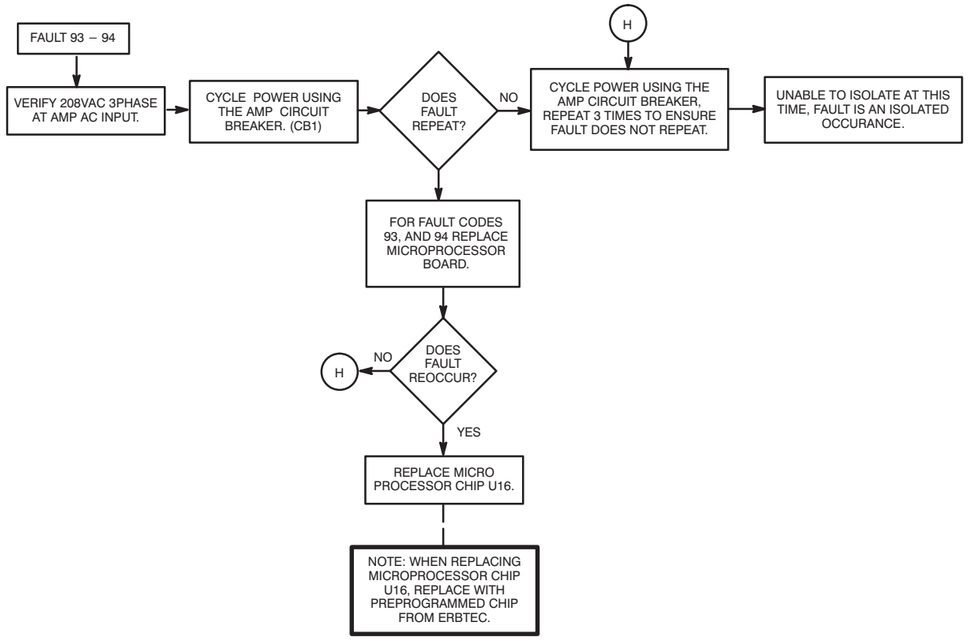
2−6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)



RF AMPLIFIER FAULT CODE 92 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2−66

2–6 ERBTEC RF AMPLIFIER FAULT CODE TROUBLESHOOTING FLOWCHARTS (continued)

93: Microprocessor “Watchdog” failed to fire in time; a Processor Board failure.
94: Microprocessor “Watchdog” intercepted program; a Processor Board failure.



RF AMPLIFIER FAULT CODE 93 – 94 TROUBLESHOOTING FLOWCHART
ILLUSTRATION 2–67