IBM **Maintenance Information**

VOLUME 01	VOLUME 02	VOLUME 03	VOLUME 13/16	VOLUME 17	VOLUME 18
MAINTENANCE ANALYSIS PROCEDURE	MAINTENANCE ANALYSIS PROCEDURE	MAINTENANCE ANALYSIS PROCEDURE	SUPPLEMENT MAINTENANCE INFORMATION	GENERAL INFORMATION	GENERAL INFORMATION
START EXIT UU = 00 02	UU = 1X	UU = 4X 5X EX FX	LOCATIONS TOOLS REMOVAL/ REPLACEMENT ADJUSTMENTS SERVICE AIDS DISKETTE DRIVE PROCESSOR POWER	GENERAL DESCRIPTION FUNCTIONAL UNITS DIAGNOSTIC INFORMATION PROCESSOR LOGS SYSTEM TESTS FEATURES	CONSOLE FUNCTIONS INDEX INSTALLATION

4341 Processor Power

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PREFACE

This publication is the primary document needed by service personnel to service and maintain the 4341 processor power. It contains both guided maintenance information and general power information needed by service personnel to free-lance the isolation of a problem and fix.

Technical changes and additions to the text and illustrations are indicated by a line to the left of the change.

LEGIBILITY CONVENTION

This manual contains material that is not fully legible. The size of type and the nature of the material is such that legible reproduction is not possible. This material is provided for illustration, usually serving as a sample, and is *not* intended for reading. Illegible material is enclosed in wavy lines, and marked with a P, as follows:

IBM has prepared this maintenance documentation for the use of IBM customer engineers in the installation, maintenance, and repair of the specific machines indicated. IBM makes no representations that it is suitable for any other purpose.

Information contained in this documentation is subject to change from time to time. Changes will be reflected in subsequent revisions.

SAFETY

PERSONAL SAFETY

Personal safety cannot be overemphasized: it is a vital part of customer engineering. To ensure your safety and that of co-workers, always observe the safety precautions given during your safety training and adhere to the following:

Danger Notices

Observe all **DANGER** notices in this manual.

DANGER

The springs on the console file load arms are compressed. Either ensure that the springs are held safe by the safety rods before separating the items or, if renewing a spring or arm, release the compression of the spring carefully.

General Safety Practices

Observe the general safety practices and the procedure for performing artificial respiration outlined in the *CE Safety Practices* card shown on this page.

Grounding

Ground current may reach dangerous levels. Never operate the system with the grounding conductor removed.

Line-Powered Equipment

Ground all line-powered test equipment through the third-wire grounding conductor in the power cord of the machine being tested.

Machine Warning Labels

Heed the warning labels placed in hazardous areas of the machines.

CE Safety Practices

All Customer Engineers are expected to take every safety precaution possible, and to observe the following safety practices while maintaining IBM equipment:

1. You should not work alone under hazardous conditions or around equipment with dangerous voltage. Always advise your manager if you MUST work alone.
2. Remove all power ac and dc when removing or assembling major components, working in the immediate area of power supplies, performing mechanical inspection of power supplies, and installing changes in machine circuitry.
3. Wall box power switch, when turned off, should be locked or tagged in off position. 'Do Not Operate' tags, order number S229-1266, should be affixed when applicable. Pull power supply cord whenever possible.
4. When it is absolutely necessary to work on equipment having exposed operating mechanical parts or exposed live electrical circuitry anywhere in the machine, the following precautions must be followed:
   a. Another person familiar with power off controls must be in the immediate vicinity.
   b. Rings, wrist watches, chains, bracelets, and metal cuff links shall not be worn.
   c. Only insulated pliers and screwdrivers shall be used.
   d. Keep one hand in pocket.
   e. When using test equipment, be certain that controls are set correctly and to the proper capacity, and that insulated probes are used.
   f. Avoid contacting ground potential (metal floor strips, machine frames, etc. - use suitable rubber mats, purchased locally if necessary).
5. Safety glasses must be worn when:
   a. Using a hammer to drive pins, riveting, staking, etc.
   b. Power hand drilling, reaming, grinding, etc.
   c. Using spring hooks, or attaching springs.
   d. Soldering, wire cutting, or removing steel bands.
   e. Parts cleaning using solvents, sprays, cleaners, chemicals, etc.
   f. Exposed to any other condition that may be hazardous to your eyes. REMEMBER, THEY ARE YOUR EYES.
6. Special safety instructions, such as for handling cathode ray tubes and extreme high voltages, must be followed as outlined in CEMs and in the Safety section of the Maintenance Manuals.
7. Do not use solvents, chemicals, greases, or oils that have not been approved by IBM.
8. Avoid using tools or test equipment that has not been approved by IBM.
9. Replace worn or broken tools and test equipment.
10. The maximum load to be lifted is that which, in the opinion of you and of management, does not jeopardize your own health or well-being, or that of other employees.
11. All safety devices, such as guards, shields, signs, ground wires, etc., shall be restored after maintenance.
12. Each Customer Engineer is responsible to be certain that no action on his part renders a product unsafe, or exposes hazards to customer personnel.
13. Place removed covers in an out-of-the-way place where no one can trip over them.
14. All machine covers must be in place before the machine is returned to the customer.
15. Always place CE tool kit away from walk areas (that is, under desk or table) where no one can trip over it.
16. Avoid touching moving mechanical parts (that is, when lubricating, checking for play, etc.).
17. When using stroboscope, do not touch ANYTHING; it may be moving.
18. Avoid wearing loose clothing that may become caught in machinery. Shirt sleeves must be left buttoned, or rolled to above the elbow.
19. Ties must be tucked in shirt or fastened with a tie clasp (preferably non-conductive), approximately 3 inches from the end. Tie chains are not recommended.
20. Before starting equipment, make certain that fellow CEs and customer personnel are not in a hazardous position.
21. Maintain good housekeeping in the area of machines while performing, and after completing, maintenance.

Artificial Respiration

General Considerations

1. Start Immediately. Seconds Count.
   Do not move victim unless absolutely necessary to remove from danger. Do not wait or look for help or stop to loosen clothing, warm the victim, or apply stimulants.
2. Check Mouth for Obstructions.
   Remove foreign objects; pull tongue forward.
3. Loosen Clothing; Keep Warm.
   Take care of these items after victim is breathing by himself, or when help becomes available.
4. Remain in Position.
   After victim revives, be ready to resume respiration if necessary.
5. Call a Doctor.
   Have someone summon medical aid.
6. Don't Give Up.
   Continue without interruption until victim is breathing without help, or until victim is certainly dead.

Rescue Breathing for Adults

Victim on His Back Immediately.

1. Clear throat of water, food, or foreign matter.
2. Tilt head back to open air passage.
3. Lift jaw up to keep tongue out of air passage.
4. Pinch nostrils to prevent air leakage when you blow.
5. Blow until you see the chest rise.
6. Remove your lips and allow the lungs to empty.
7. Listen for snoring and gurgling, signs of throat obstruction.
8. Repeat mouth-to-mouth breathing 10-20 times per minute.
   Continue rescue breathing until victim breathes for himself.

Thumb and finger position

Final mouth-to-mouth position

Reprint Courtesy Mine Safety Appliance Co.

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GENERAL INFORMATION

The major units of the power system are:

- Power supplies [A]
- Switching Regulators [B]
- Maintenance Support Subsystem (MSS) [C]
- Integrated Power System (IPS) [D]

The power supplies are ferroresonant transformer/rectifiers with outputs of unregulated dc voltages at ± 10% tolerance.

The switching regulator and IPS output voltages are regulated to ± 2%.

The maintenance support subsystem (MSS) monitors and controls the following:

- Sequencing
- Fault identification
- Sensor monitoring and display of sensor status
- Logout of faults
- Measurement and display of processor voltages
- Measurement and display of processor temperatures

The MSS and the remainder of the processor (CTCA, main storage and controls, and channels) have separate power supplies. The MSS can be powered on without powering on the complete processor. However, the complete processor can not be powered on if the MSS is not operational.

If the MSS becomes not operational, the complete processor powers down.

The MSS hardware units and their functions are:

Hardwired Sequence (HWS): Does the sequencing and fault isolation of MSS power.

Support Processor (SP): Controls sequencing, monitoring, and power diagnostics.

Diskette Drive Adapter and Diskette Drive: Contains power microcode and supplies logout area for power faults.

Operator Control Panel (OCP): Used by operator to power system on or off. Power indicators are POWER IN PROCESS, POWER COMPLETE, and BASIC CHECK.

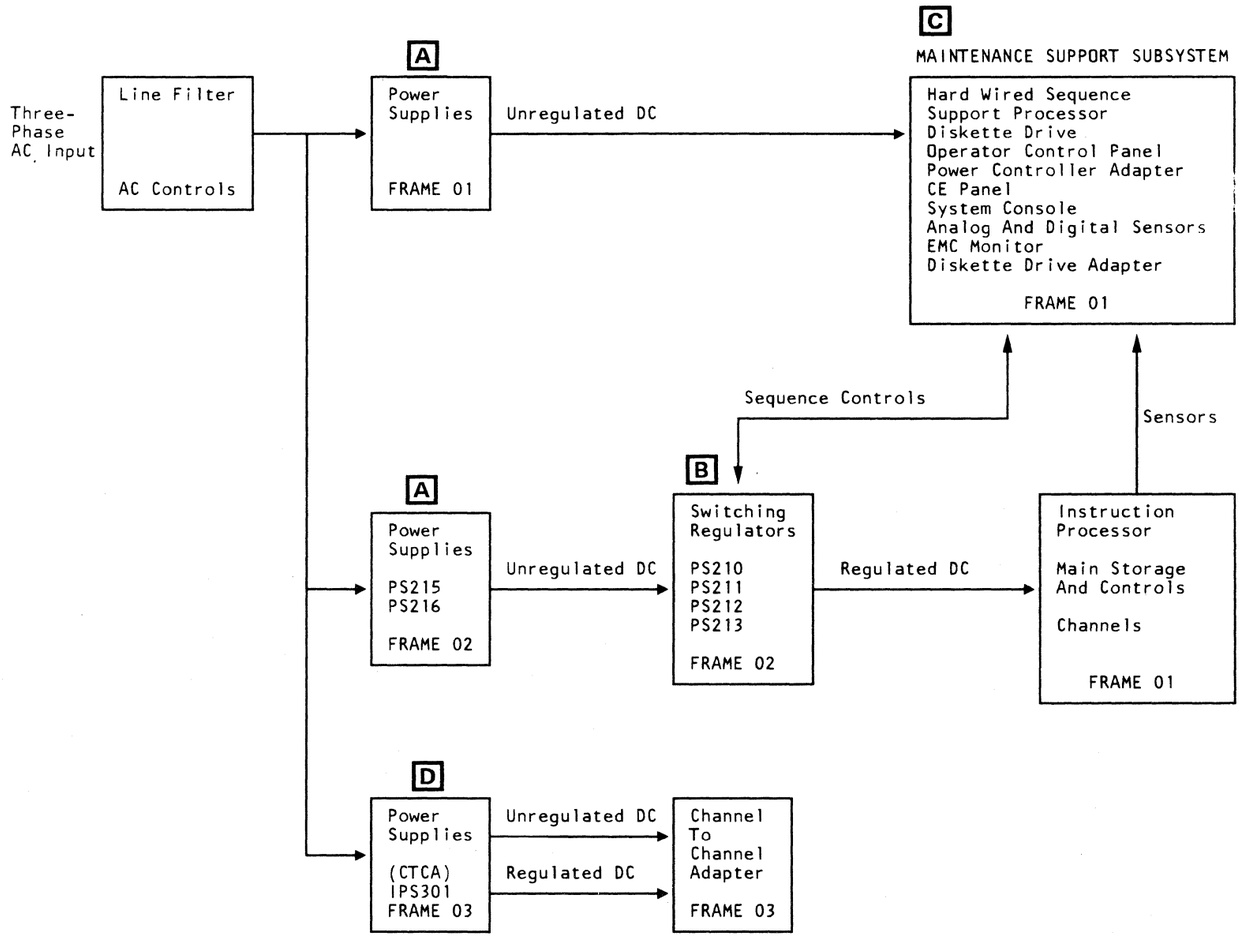
Power Controller Adapter (PCA): Used by the support processor as a link to power and environmental sensors.

CE Panel: Used with power MAPs to diagnose power faults in the HWS and MSS. Also contains switches that enable service personnel to control power.

System Console: Used by service personnel to invoke power diagnostics and to display power logs.

Analog and Digital Sensors: Monitors voltages, air flow, and temperatures (analog and digital sense points).

POWER SYSTEM BLOCK DIAGRAM



BASIC POWER-ON SEQUENCE

With CB1 on, +5V and +24V are generated from PS101 and distributed to board 01AD2 and the standard power interface (SPI).

Note: *The air flow sensors (AFS) need 15 seconds to warm up after CB1 is turned on. The AFS must be warmed up before pressing the POWER ON key.*

Power-on is started by pressing the POWER ON key on the operator control panel (OCP) or the CE panel (CEP). The hardwired sequence (HWS) powers on the maintenance support subsystem (MSS) by picking relays to activate PS104 and the +24V controlled from PS101. The MSS is located on board 01AB2 and 01AA2.

Logic reset is generated by the HWS. Internal diagnostics are executed from the support processor (SP) read-only storage (ROS). After completion of the diagnostics, an SP IML is started.

The SP executes the initial microcode load (IML) that runs basic adapter tests and loads the resident microcode. The support bus adapter (SBA) and power controller adapter (PCA) are initialized, and the MSS starts power monitoring. The SP IML also starts the power sequencing microcode.

The SP executes the power sequencing microcode routines that, through the PCA, set control latches, activate relays and contactors, and set control lines to activate the switching regulators and integrated power system (IPS). The switching regulator and IPS voltages are distributed to the remainder of the processor logic. As sequencing routines are executed, the PCA using analog and digital sensors, monitors the power sequencing, to ensure the expected actions have occurred. The processor is powered on in steps called action strings. Each action string can power on/off a part of the processor. During normal power-on these action strings are chained together to result in a complete power-on. The last action string starts I/O device power-on.

I/O devices are powered on by relay circuits in the standard power interface (SPI). After all devices are powered on, the relay circuits generate a signal to the SP through the PCA. The SP completes the processor IML and sends the power complete control line to the HWS.

POWER-ON SEQUENCE IN CE MODE

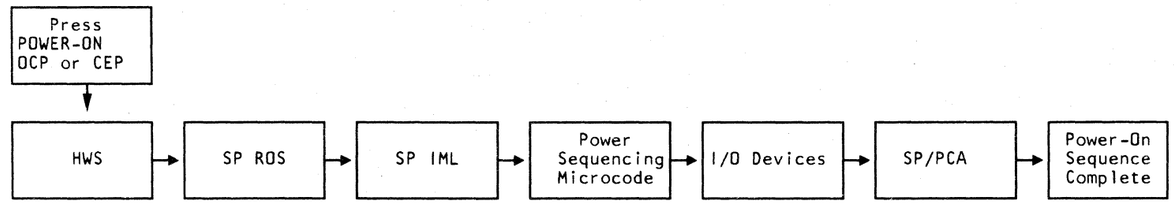
In CE Mode, power-on can be started only from the CE panel. The power-on sequence is the same as basic power on through SP IML, except that PCA diagnostics are not executed.

When SP IML is complete, the MW (partial power up/down) maintenance screen is displayed.

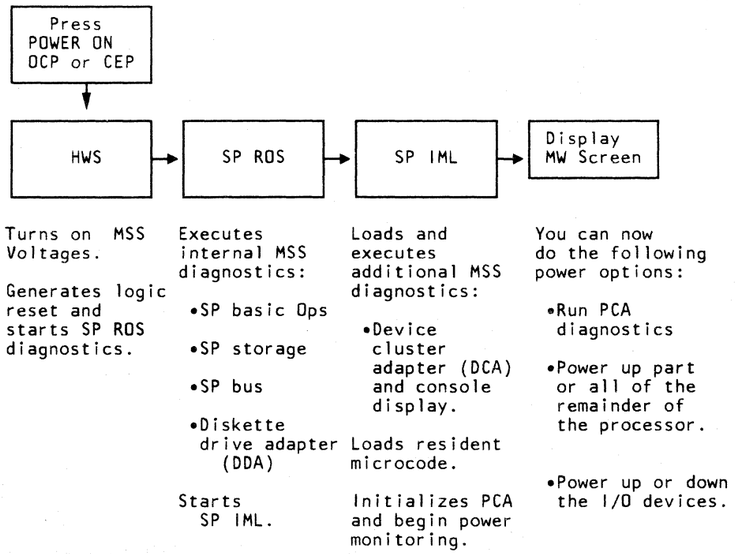
In CE mode, the I/O devices can be powered on/off by using the MW maintenance screen. This can be done with or without processor power on complete. However, the MSS must be powered on and operational.

For details of power-on sequence, see Detailed Power-On Sequence Flowchart on page 20 390.

POWER ON SEQUENCE (NORMAL)



POWER ON SEQUENCE (CE MODE)



BASIC POWER OFF SEQUENCES

Normal Power-Off Sequence

The OCP and CE panel POWER OFF keys cause the hardwired sequence to generate a "power-off" signal to the PCA. The monitor microcode senses the power-off request and requests control microcode to schedule the power analysis microcode.

The power analysis microcode logs the current temperatures on the diskette and invokes the power-off microcode which powers off the I/O devices and the processing unit voltages. The power controller generates a "MSS off" signal to the hardwired sequence that powers off the MSS.

Power-Off Because Of A Power Fault

A power or thermal fault causes the power error action microcode to power off the part of the system in which the fault occurred. Usually the MSS remains functional. In case of a power fault in the MSS, the hardwired sequence drops all power immediately.

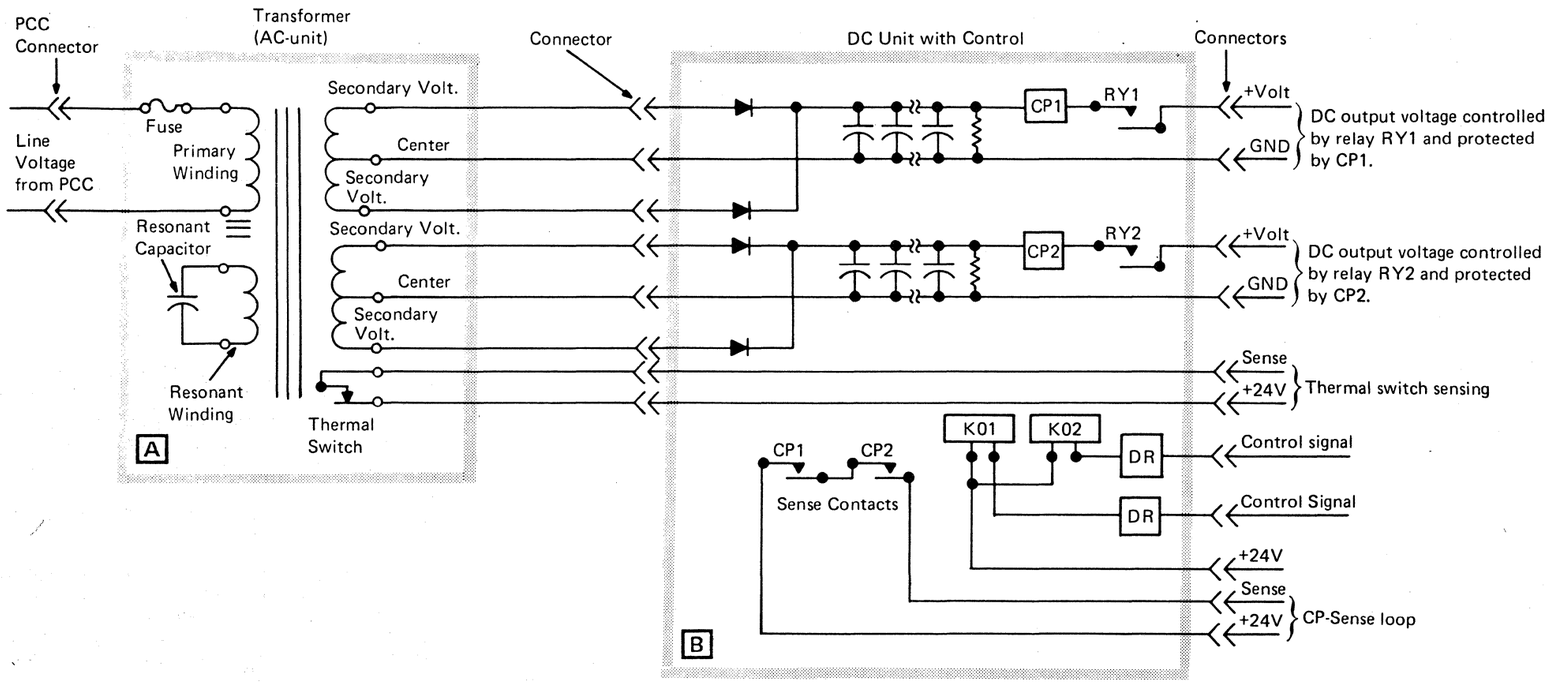
Support Processor Machine Check

A SP machine check or clock check causes the maintenance support subsystem to become not operational. Therefore, the power microcode cannot be executed. The 30-second timer times out, and the hardwired sequence powers the system down. The 30-second timer is not active in CE mode.

Unit Emergency Power-Off

A unit emergency power-off removes the 24V control voltage. This drops all relays and contactors and removes power from I/O devices and the processor.

For details of power-off sequence, see "Detailed Power-Off Sequence Flowchart."



FERRORESONANT POWER SUPPLY

All power supplies in the system, except the IPS and switching regulators are ferroresonant power supplies. Each power supply has an ac unit (ferroresonant transformer) and a dc unit with a control section.

A The transformer changes the input voltage (line or primary voltage) to one or more output (secondary) voltage(s). To keep the output voltage in range, the transformer has a resonant winding with a capacitor. To prevent overheating, a thermal switch is inside the transformer. TR101 has no thermal switch. An open thermal switch is sensed by the HWS or the PCA. The operation control microcode drops the line voltage input to the transformer. A short circuit or overload opens the primary fuse.

B The dc unit is plugged by a connector to the transformer. The ac voltages from the transformer are rectified by diodes and filtered by capacitors. The dc output voltages are controlled by contactors and protected by circuit protectors (CPs). The status of the CPs is sensed by the HWS or PCA with the aid of auxiliary CP sense contacts. All cables to the load and control lines, as well as to the sense lines, are pluggable (for quick removal). The only exceptions are FDS cables that are connected to terminal blocks by screws.

POWER MAINTENANCE

FAULT ISOLATION/IDENTIFICATION

Fault isolation/identification is done by monitoring many points throughout the power system with analog and digital sensors. When power faults occur, the status of these sensors is compared with known fault conditions. If the sensor information matches the known fault condition, the fault is identified to a field replaceable unit (FRU).

Points monitored in the power system are:

- Circuit breakers
- Contactor auxiliary points
- Air moving devices
- Ferro regulators
- Power supplies
- Circuit boards

When power faults occur, the SP keeps the sensor data in SP storage for log analysis.

Log analysis is done by the MSS using sensor data stored in SP storage. The failure analysis microcode generates a reference code for processor faults that directs you to a entry point in the MAPs.

Some power faults cause the MSS to power down immediately. These faults are analyzed by using the hardwired sequence indicators and power MAPs. Usually, fault data can be obtained before MSS power is dropped. If fault data is not obtained or the validity is questionable, service personnel must power up in a diagnostic mode (as directed by the MAPs) to generate a fault pattern. Faults in the switching regulators/IPS result in the power-down of only the part of the processor fed by the switching regulator/IPS voltages; the MSS remains powered on.

Analog and digital sensors are used by power microcode to log system temperature.

- temperature logs might indicate a change in operating environment.
- All voltages are monitored for a microcode-set, high and low limit, called the *CE Call* limit. When this limit is passed, a reference code is displayed on the system console.

Power MAPs and power automated logic diagrams (ALDs) are used to aid in power system maintenance.

Power controller adapter diagnostics run as part of the system IML to ensure the MSS is functional.

ADDITIONAL PROTECTION

The power system has additional protection to the overvoltage turn-off in the series regulators.

Timeout Circuit

The timeout circuit is in the power controller adapter hardware.

Digital sense signals (interrupts) start the timer. If the SP fails to address the power adapter before approximately 35 milliseconds (to handle the interrupt), the circuit times out.

All control latches in the power adapter are reset at the same time. Contactors, relays, and remote start circuits are de-activated and system power drops.

30-Second Timer

The 30-second timer is started by the power monitor. If not reset by the power controller adapter in 30 seconds, the hardwired sequence starts the power-off sequence. The 30-second timer is not active in CE mode.

POWER ERROR LOGGING

The power error analysis and logging microcode logs the sensor bit patterns at the time of a fault.

The logout information is available to service personnel through the system console as directed by the power MAPs. This information aids in:

- Locating the failing FRU
- Indicating an entry point to the MAPs
- Indicating possible fault areas by early warning indications (temperature log)

For details of logs available, see Error Logouts Screen on page 20 125.

POWER LOGS

System Logs

Changes of power sensor values outside a known tolerance result in an error action by the power microcode. Changes are logged in the common system log area. The only exceptions are ESD, PLT, and changes in the service switches (CE MODE switch, POWER ON/OFF, and so forth).

Power Error Log (Expanded Error Information)

Power faults (except EMC, service switches, and reaching the CE call limit) generate a special power error log. This log contains the following power status information at the time of the fault:

Sensor status, Expected sensor status, and Control latch status	For the last four errors
Reference code	Last eight

This log is used for extended error analysis if the reference code does not contain enough data. The log is written on the diskette after error analysis microcode generates a reference code.

For details of the Power Error Log, see "Expanded Power Error Information," page 20 130.

Temperature Trace

A temperature trace log is kept on the diskette. The highest and lowest temperature (from power-on to power-off) at the gate 01A air inlet is logged on the diskette during power-off sequence.

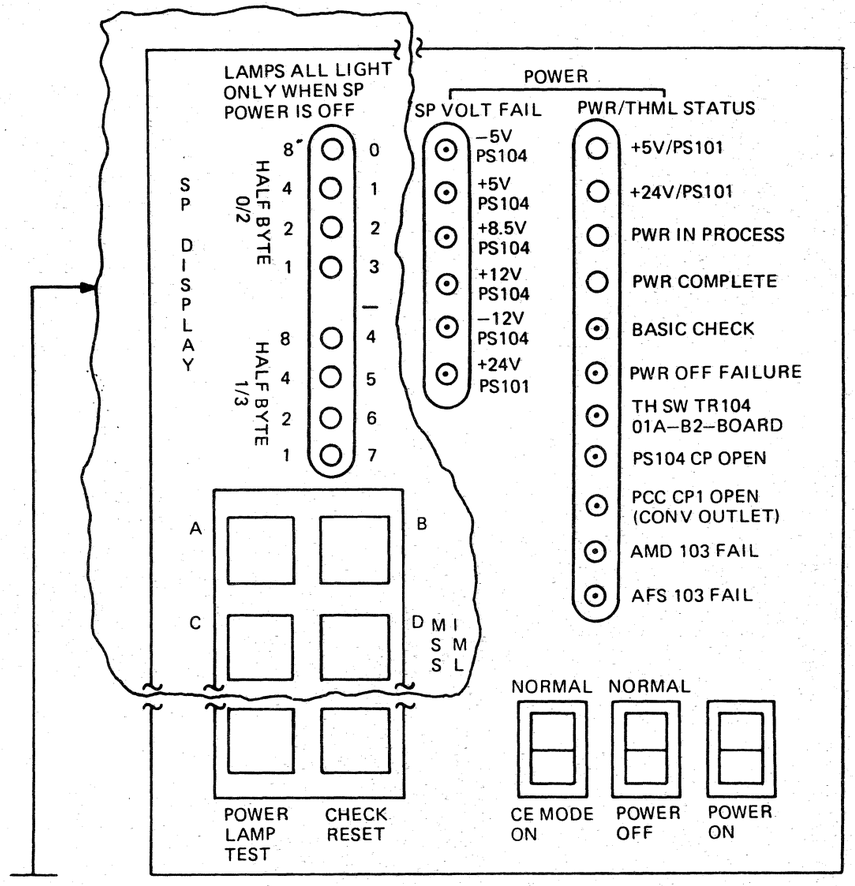
For details of the Temperature Trace Log, see Temperature Trace on page 20 135.

CE PANEL

⊙ = red LED (used for error indication)

For second-level diagrams of indicators, see CE Panel (CEP) Indicators on page 20 255.

For second-level diagrams of switches, see HWS Second Level, Sheet 1 of 7 on page 20 305.



SP DISPLAY

The Support Processor (SP) display indicators are used to display support processor information. SP display is not used for the power system.

The SP switches give service personnel access to the support processor. The SP switches are not used for the power system. **Note:** *For details of SP Display, see Volume 17, General Information.*

POWER INDICATORS AND SWITCHES

SP VOLT FAIL If any voltage generated by PS104 or +24V from PS101 is less than 85% at TD2 end time (1.6 sec after POWER ON key pressed) the comparable VOLT FAIL indicator is switched on. The SP VOLT FAIL indicator -5V PS104 is turned on if the -5V is more than 50% at TD1 end time.

PWR/THML STATUS

+5V/PS101 and +24V/PS101 Indicates that +5V and +24V generated by PS101 are present.

PWR IN PROCESS Indicates power-on or power-off sequence is in process. This indicator is also turned on if a channel attached control unit does not have power complete.

PWR COMPLETE Indicates that the power-on sequence (including I/O devices) was correctly executed. Indicator is on continuously if no power failure occurs.

BASIC CHECK Indicator is turned on by the CE MODE switch, HWS, or by power controller adapter microcode. If no reference code is displayed, the error was sensed by the HWS, and one or more error indicators on the CE Panel are lit. The CE MODE switch lights the BASIC CHECK indicator with no other error indicators.

POWER OFF FAILURE Indicator is turned on if power-off sequence was started by a T4 (30-second timer) timeout. A T4 timeout occurs if power monitoring was not performed in 30 seconds. Timer T4 is disabled in CE Mode.

TH SW TR104 01A-B2-BOARD Indicator is turned on if the thermal switch inside TR104 or thermal switch below board 01AB2 opens.

PS104 CP OPEN Indicator is on if any PS104 CP is tripped.

PCC CP1 OPEN (CONV OUTLET) Indicator is on when CP1 in the primary control compartment (PCC) is tripped.

AMD 103 FAIL Indicator is on when AMD103 (air moving device) is not running or is running too slow.

AFS 103 FAIL Indicator is on if AFS103 failed to generate an error signal during HWS power-on.

POWER LAMP TEST When the POWER LAMP TEST key is pressed, all indicators on the OCP and all indicators on the CE Panel (except SP DISPLAY) must be on.

CHECK RESET The CHECK RESET key generates a reset signal for the failure latches in the HWS. The check reset signal from the CE panel is ORed with the check reset signal generated by the POWER OFF key on the OCP.

CE MODE The CE MODE switch activates digital sense line 11. The control microcode permits higher and lower voltage deviations when the CE MODE switch is on. The BASIC CHECK indicator is turned on in CE Mode. Timeout of T4 (30-second timer) is inhibited.

POWER OFF This switch starts the power-off sequence (if power is on). If system power is off, check reset is generated. When the switch is in the POWER OFF position, power-on cannot be started from the OCP.

POWER ON The POWER ON switch is a momentary switch used to start the power-on sequence. This switch is not active when the POWER OFF switch is in the POWER OFF position.

POWER MAINTENANCE SCREENS

The M (Power/Temperature) screen lists available power maintenance screens and lets you execute any one of them by entering a one-letter code B.

Exceptions to this are the momentary status display and error status display that are displayed from the partial power up/down (MW) screen.

You must be in CE mode to have access to the power maintenance screens.

M SCREEN

- The M screen is displayed by entering the M option from the Q (general selection) screen.

Power maintenance screens are displayed from the Q screen by entering Mx, with x being the one-letter code of desired screen. For example, when you enter MP, the power diagnostics run.

M SCREEN EXAMPLE

```
                    A    POWER/TEMPERATURE:

                         W PARTIAL POWER UP/DOWN

                         U FULL POWER UP

                         A ANALOG SENSOR DISPLAY

                         D DIGITAL SENSOR DISPLAY

                         T TEMPERATURE SENSOR DISPLAY

                    WITH POWER OFF ONLY
                         V VOLTAGE TRACKING

                         P POWER DIAGNOSTICS

               B         Q GENERAL SELECTION
                         Z RETURN TO PROG SYS
SELECTION:                                    ==>

C                                                    4341
9207  9207
```

A List of maintenance screens.

B Enter one-letter code.
Example: Entering A displays the analog sensor display.

C ID of last microcode module loaded.

EC 379583 16Apr79
EC 376694 16Jul79
PN 5666166
1 of 2
20 065

PARTIAL POWER UP/DOWN SCREEN (MW)

The MW screen displays the power status of the complete system.

The MW screen permits you to power up or down a part of the processor, I/O devices, or to power down the complete system.

- The Partial Power Up/Down screen is displayed by entering MW from the Q screen or W from the M screen.

Example: 1

To power down, 01 is entered after POWER UP/DOWN: **C**. After FUNCTION: **C**, enter the number of the part of the system you want to power down. For example, by entering 04, the channel-to-channel adapter (CTCA) feature is powered down.

After the 04 is entered the screen in example 2 is displayed, to indicate that the status of CTCA is OFF.

To power up or down another part of the system, enter 44 to rerun the MW screen. To go back to the M screen, press MODE SELECT.

The momentary status display and error status display are displayed from the MW screen. See "Momentary Status Display" and "Error Status Display" in the "Maintenance Screens" section of Volume 16.

MW SCREEN EXAMPLE 1

```
          PARTIAL POWER UP AND DOWN
          =========================

A  POWER UP ---------------------- 00
   POWER DOWN -------------------- 01

     FUNCTION:  COMPLETE SYSTEM      00   STATUS
                PART 1 / PROC UNIT   01   ON
                PART 2               02   OFF
           B    PART 3               03   OFF
                PART 4 / CTCA        04   OFF
                PART 5               05   OFF
                PART 6               06   OFF
                PART 7 / I/O         07   OFF

C  POWER UP/DOWN: ..              FUNCTION: ..
   ** ACTION DONE **

D                TO RE-RUN ENTER >44>: ..
                                                  4341
1036  1036
```

A Information lines. To power up, enter 00; to power down, enter 01 at **C**.

B Number of the part of the system you want to power up/down. Status of the system parts (powered on or off).

C Enter power up/down value and function value.

D ID of last microcode module loaded.

MW SCREEN EXAMPLE 2

```
          PARTIAL POWER UP AND DOWN
          =========================

     POWER UP ---------------------- 00
     POWER DOWN -------------------- 01

     FUNCTION:  COMPLETE SYSTEM      00   STATUS
                PART 1 / PROC UNIT   01   ON
                PART 2               02   OFF
                PART 3               03   OFF
                PART 4 / CTCA        04   ON
                PART 5               05   OFF
                PART 6               06   OFF
                PART 7 / I/O         07   OFF

   POWER UP/DOWN: 01            FUNCTION: 04


                                                  4341
1036  1036
```

MOMENTARY STATUS DISPLAY

The momentary status display screen shows the status of all control latches, digital sensors, analog sensors, storage address, and action string of the support processor at the time the MW display was displayed.

You are directed by the power MAPs to check specific addresses and bit positions when power faults occur.

- The momentary status display is displayed by pressing the PF8 function key while in the MW screen.

The Sense Point Listing can be used to find the bit meanings. Example: Digital address 83 has a hex value of 20 or bit 2 on, indicating the line CE Switch N/O is active.

- Pressing PF9 re-reads the power status.

Note: *For control latch address and bit assignment, see Sense Point Listing (Control) on page 20 230. For analog and digital sense address and bit assignments, see Sense Point Listing (Analog And Digital) on page 20 225.*

SENSE POINT LISTING (PARTIAL) EXAMPLE

ADDR	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
81	D01	D02 J06 AFS302 CTCA	D03	D04 G06 AFS301 CTCA	D05 J04 +1.25V CL IPS301-A2 CTCA	D06 G03 -3V UV IPS301-A2 CTCA	D07 J02 -3V CL IPS301-A2 CTCA	D08
83	D09	D10	D11 J05 CE Switch N/O	D12	D13	D14	D15	D16
85	A01 B07 +8.5V PS104	A02 B10 +5V PS104	A03 B02 +5V Spec/Chdr	A04 B03 +24V Diskette	A05 D02 +5V Diskette	A06 B04 +4.25V IPS Bulk	A07 B06 +5V HWS	A08 B05 +24V MSS

MOMENTARY STATUS DISPLAY EXAMPLE

```
          MOMENTARY STATUS DISPLAY
          ========================
A  CONTROL LATCH ADDRESSES:     40424446 50525456  30
B  CONTROL LATCHES:             01450FA0 0CF00FA0  00

C  DIGITAL SENSE ADDRESSES:     81839193 A1A3B1B3
D  DIGITAL SENSES:              00200000 60000000

E  ANALOG SENSE ADDRESSES:      85879597 A5A7B5B7
F  ANALOG SENSES:               FF0EFF6C 7C010FC0

G  INTERRUPT AND STATUS BYTE:   00  02

H  ADDR OF STOP AND SEQUENCE:   2116  0F0354 0F0430 010452 400281
                                      0A0197 2038B1 100597 2002B3
                              I 0000 0000 00A3 20A3 9495


                                                              4341
J  1034  1034
```

A Control latch address. Each byte indicates one address.

B Hex value of address. (Address 56 has a hex value of A0 or bits 0 and 2 on.)

C Digital sense address. Each byte indicates one address.

D Hex value of address. (Address A1 has a hex value of 60 or bits 1 and 2 on.)

E Analog sense address. Each byte indicates one address.

F Hex value of address. (Address A7 has a hex value of 01 or bit 7 on.)

G Support processor interrupt and status byte. (For engineering use.)

H Support Processor address (2116) and power up/down microcode action string at the time the MW screen was displayed.

I Sensor address and hex value of last five errors or actions. (20A3 indicates address A3 has a hex value of 20.)

J ID of last microcode module loaded.

ERROR STATUS DISPLAY

The error status screen displays:

Status of all control latches

Status of analog and digital sensors

Compare mask for sensors

The ANDed result of sensors and mask

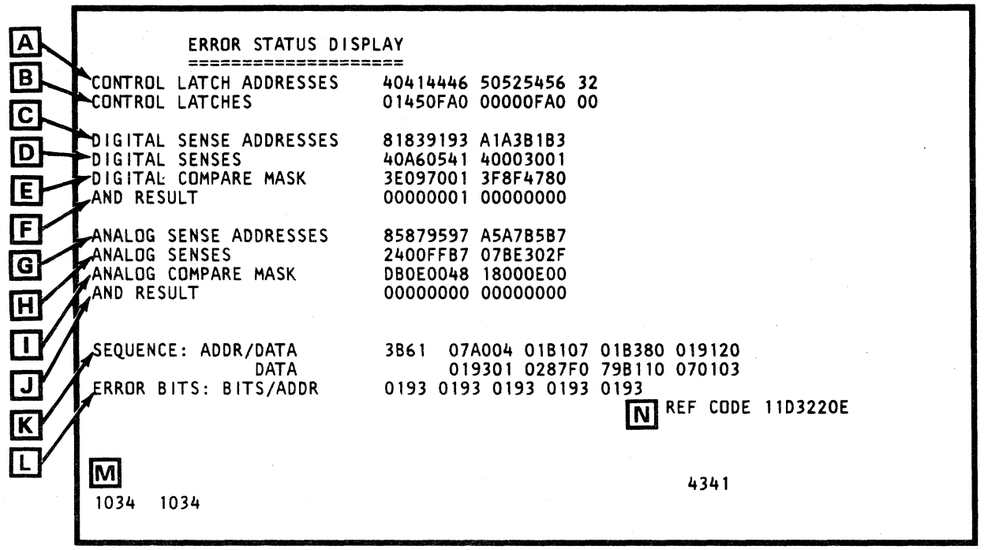
Storage address and action string of the support processor
at the time the MW screen was displayed.

The power MAPs direct you to this screen and define its usage.

- Pressing the PF8 function key twice while in the MW screen displays the error status display screen.
- Pressing PF8 returns to the partial power up/down screen.

Note: *For control latch address and bit assignment, see Sense Point Listing (Control) on page 20 230. For analog and digital sense address and bit assignments, see Sense Point Listing (Analog And Digital) on page 20 225.*

ERROR STATUS DISPLAY EXAMPLE



A Control latch address. Each byte indicates one address.

B Hex value of address.

C Digital sensor address. Each byte indicates one address.

D Hex value of address.

E Microcode set compare mask value based on machine features.

F ANDed result of compare mask and sensor value (sensor in error).

G Analog sensor address. Each byte indicates one address.

H Hex value of address.

I Microcode set compare mask value based on machine features.

J ANDed result of compare mask and sensor value (sensor in error).

K Support processor address and power up/down action string at the time the MW screen was displayed.

L Address and hex value of last five errors or actions.

M ID of last microcode module loaded.

N Error reference code

ANALOG VOLTAGE DISPLAY (MA)

The MA screen displays all system voltages.

When a voltage is above or below a microcode set value, a + (plus) or - (minus) sign is displayed. The number of signs displayed indicates the amount the voltage is above or below the set level.

In MA screen example 1, analog sense 41 shows a voltage positive of the set level and above the CE call limit. During normal operation, the CE call reference code is displayed. Analog sense 51 shows a voltage above the maximum limit. During normal operation, a voltage at this level causes a power down.

In CE mode, the maximum and minimum limit is increased.

- Entering MA from the Q screen or A from the M screen displays the analog voltage display.

  Notes: *Only switching regulator voltages can be adjusted.*

  For analog sensor assignments and entry to board 01AB2, see Sensor Entry to Board 01AB2 on page 20 230.

SWITCHING REGULATOR AND IPS VOLTAGE SENSORS

Switching Regulators

V Level	Sensor(s)	PS
+4.25	A27	213
-1.5	A17, A20, A22	211
-4.25	A18, A19, A23	210
-2.2(-6.45)	A52	212
+6 SPEC/ CHDR	A38	213

IPS301 (CTCA)

V Level	Sensor(s)
+1.25(CTCA)	A59
-3(CTCA)	A51

MA SCREEN EXAMPLE 2

```
                                                        THIS DISPLAY IS TO BE USED
A MAXIMUM      ************************************     FOR COARSE ADJUSTMENT ONLY
C C E CALL     ************************************     WHEN ADJUSTMENT IS COMPLETE,
                                                        PRESS FUNCTION KEY 9.
                -
          E  +- +-
             +- +- -+     + +          -
G ANALOG SENSE 00000000 01111111 11122222 22222333
  A01 TO A32   12345678 90123456 78901234 56789012
                                    +
B MAXIMUM      ************************************     **************************
                       +            +
D C E CALL     ************************************     **************************
                       +            +
          F  +         +            +                  ++++++++++++++++++++++++++
             +         +            +                  ++++++++++++++++++++++++++
              +        +            +                  ++++++++++++++++++++++++++
H ANALOG SENSE 33333334 44444444 45555555 55566666     33333333333333333333333333
  A33 TO A64   34567890 12345678 90123456 78901234     44444444444444444444444444

I
1002  1002                                                      4341
```

MA SCREEN EXAMPLE 1

```
                                                        THIS DISPLAY IS TO BE USED
MAXIMUM        ************************************     FOR COARSE ADJUSTMENT ONLY
C E CALL       ************************************     TO SELECT A VOLTAGE FOR
                                                        ADJUSTMENT, PRESS FUNCTION
                -                                       KEY 9.
               +- +-
               +- +- -+     + +          -
ANALOG SENSE 00000000 01111111 11122222 22222333
A01 TO A32   12345678 90123456 78901234 56789012
                                    +
MAXIMUM        ************************************     **************************
                       +            +
C E CALL       ************************************     **************************
                       +            +
                       +            +
                       +            +
                       +            +
                       +           -+ --+
ANALOG SENSE 33333334 44444444 45555555 55566666
A33 TO A64   34567890 12345678 90123456 78901234


                                                              4341
1002  1002
```

A and B Microcode set maximum voltage level.

C and D Level that causes the CE call reference code to be displayed.

E and F Indicate when a voltage is + (plus) or - (minus) of the microcode set level.

G and H Identify analog sensor by number.

I ID of last microcode module loaded.

DIGITAL DISPLAY SCREEN (MD)

This screen displays all digital sensor readings, momentary or continuously.

The MD screen is used to verify the status of any digital sensor (on or off) and tests the operation of a sensor along with testing the sense point wiring and sense card input.

Power MAPs direct you to this screen.

- Entering MD from the Q screen or D from the M screen displays the Digital Display screen.

  Note: *For digital sensor assignments and entry to board 01AB2, see Sensor Entry to Board 01AB2 on page 20 230.*

MD SCREEN EXAMPLE

```
                DIGITAL  SENSE  DATA  DISPLAY
                  - REPRESENTS INACTIVE STATE
                  * REPRESENTS ACTIVE STATE

[A]SAMPLE   MODE IS ACTIVE
      [B]   MODES: SAMPLE- READ DIGITAL INPUT ONCE AND DISPLAY
                   CONTINUOUS- READ AND DISPLAY DIGITAL INPUTS CONTINUOUSLY


[C] DIGITAL    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
                -  -  -  -  -  -  -  -  -  -  *  -  -  -  -  -  -  -  -  -  -  -  -
[D]
[E] DIGITAL   24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46
                -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
[F] DIGITAL   47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64
                -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
[G]
[H] ENTER DISPLAY CONTROL CHARACTER S, OR C : [I]      ==>


[J]                                                              4341
 1003  1003
```

[A] Mode that is active: sample (momentary) or continuous.

[B] Description of modes.

[C], [E], [G] Identify digital sensors by number.

[D], [F], [H] Indicate active or not active status of sensor. ([D] indicates sensor 11 active.)

[I] Enter control character S or C : S=sample; C=continuous.

[J] ID of last microcode module loaded.

TEMPERATURE DISPLAY SCREEN (MT)

The temperature display screen displays temperatures of the system in degrees Celsius (± 1 degree).

Four thermistors (thermals) displayed at [D] sense the temperatures.

Thermal 1: Room temperature at the air inlet to gate 01A.

Thermal 2: Gate 01A column A outlet temperature

Thermal 3: Gate 01A column B outlet temperature

Thermal 4: Gate 01A column C outlet temperature

These temperature readings can aid in finding problems in the cooling system or operating environment.

MAPs direct you to this screen and define its usage.

For example, a high thermal 4 temperature can indicate a failure of the air moving device in column C.

- Entering MT from the Q screen or T from the M screen displays the Temperature Display screen.

MT SCREEN EXAMPLE

```
                THERMAL  SENSE  DATA  DISPLAY

[A] SAMPLE  MODE IS ACTIVE
            MODES: SAMPLE- READ THERMAL INPUTS ONCE AND DISPLAY
               [B] CONTINUOUS- READ AND DISPLAY THERMAL INPUTS CONTINUOUSLY

[C] THERMAL   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
[D] DEGREES C 25 25 26 25
[E] MAXIMUM   ------------------------------------------------------------------------
[F] C E CALL  ------------------------------------------------------------------------


[G] NOMINAL   ************************************************************************

    ENTER DISPLAY CONTROL CHARACTER S, OR C : [H]

[I]                                                                        4341
    1001  1001
```

[A] Indicates which mode is active: sample (momentary) or continuous.

[B] Description of modes.

[C] Identifies thermals by number.

[D] Temperature in degrees Celsius.

[E] Maximum temperature that can be reached before a fault occurs.

[F] Microcode set level to turn on CE call reference code.

[G] Normal operating temperature.

[H] Control character S or C is entered: (S=sample; C=continuous).

[I] ID of last microcode module loaded.

VOLTAGE TRACKING SCREEN (MV)

The voltage tracking screen is used to plot the initial turn-on of selected voltages. These voltages are tracked at their sense points on a sense card in the power controller adapter. Some voltages are sensed at more than one sense point.

The voltages are tracked for 350 milliseconds from the time of their turn-on. A maximum of three voltages can be tracked at one time.

The processing unit, CTCA (if installed), and I/O devices must be powered off to run the Voltage Tracking screen.

An error message is displayed if the voltage tracking screen is executed and processing unit, CTCA, or I/O devices has power on. The error message tells you to power off the system and power on only the maintenance support subsystem.

An error message is also displayed if a tracking error occurs. A tracking error occurs when a voltage (including bias and bulk) failed to turn on before the voltage being tracked. To find the voltage that caused the tracking error, decrease the track value by one until no tracking error occurs. Now you can plot the voltage(s) to determine which one is failing to turn on. To determine the level of the failing voltage, see the Voltage Track Chart on page 20 105.

MAPs direct you to this screen and define its usage.

- Entering MV from the Q screen or V from the M screen displays the voltage tracking screen.

MV SCREEN EXAMPLE 1

```
 VOLTAGE TRACKING DISPLAYS THE TURN ON OF SELECTED VOLTAGES IN THE PROCESSING
UNIT AND CTCA (IF INSTALLED). THERE MUST BE TWO INPUTS, TRACK NUMBER (01-14)
AND VOLTAGE(S) (V1-V7). THE TRACKS ARE IN THE ORDER OF THE POWER ON SEQUENCE.


TRACK    V1          V2          V4       TRACK    V1          V2          V4
01  +24 BIAS   +5 BIAS                     08  -4.25(C1)     -4.25(B1)
02  +5 VOLTS (60-80%)                      09  -6.45
03  -6.45 INITIAL(-2.2)                    10  +5 (100%)
04  +4.25 INITIAL                          11  +6
05  -1.5(A1)   -1.5(A2)    -1.5(B1)        12  +4.25 FINAL
06  -1.5(C1)                               13  +1.25*         -3*
07  -4.25(A1)  -4.25(A2)   -4.25(B1)       14  +6

                                                 * = CTCA VOLTAGE

EXAMPLES: TRACK 01 V1 = +24 BIAS
          TRACK 01 V2 = +5 BIAS
          TRACK 01 V3 = +24 & +5 BIAS
                     ENTER: TRACK NUMBER ..  VOLTAGE(S) V .

                                                          4341
1004 1004
```

VOLTAGE TRACK CHART

Track	V1	V2	V4	Sensor(s)	Control Line	ALD Page	Power Supply
01	+24 BIAS	+5 BIAS		A36,A37	C16	YA604	PS216
02	+5 (60-80%)			A03	C27	YA607	PS212
03	-6.45 IN (-2.2)			A52	C27	YA607	PS212
04	+4.25 IN			A27	C25	YA608	PS213
05	-1.5(A1)	-1.5(A2)	-1.5(B1)	A17,A20,A22	C21	YA606	PS211
06	-1.5(C1)			A24	C21	YA606	PS211
07	-4.25(A1)	-4.25(A2)	-4.25(B1)	A18,A19,A23	C28	YA605	PS210
08	-4.25(C1)	-4.25(B1)		A25,A21	C28	YA605	PS210
09	-6.45 FI*			A52	C27	YA607	PS212
10	+5V (100%)			A03	C27	YA607	PS212
11	+6 CHDR			A38	C17	YA608	PS213
12	+4.25 FI			A27	C26	YA608	PS213
13	+1.25 CTCA	-3 CTCA		A59,A51	C24	YA682	IPS301
14	+6 CTCA			A41	C33	YA609	PS301

IN=Initial turn on of voltage. Voltage plotted turns on between 10% to 30% of its end value.

FI=Final turn on of voltage. Voltage plotted turns on from the initial value to 100% of end value.

* -4.25 FI adds to the -2.2 to get the -6.45 FI.

MV SCREEN EXAMPLE 2

```
                 000000000011111111112222222222333333333344444444445555555556666666667
POSITION         123456789012345678901234567890123456789012345678901234567890123456789
                 .....................................................................
                 .....................................................................
                 .....................................................................
A 100% V4        .....................................................................
B 100% V2        .....................................................................
C 100% V1        .....................................................................
                 .....................................................................
                 .....................................................................
                 .....................................................................
                 .....................................................................
                 .....................................................................
                 .....................................................................
D                .....................................................................
E 0% V4          .....................................................................
E 0% V2          .....................................................................
F 0% V1          .....................................................................
                          TIME = 5 MS PER POSITION    VOLTAGE = 10% PER LINE
ENTER . <== TO RETURN TO START ENTER R       TRACK NUMBER .. PLOTTED
G

                                                                        4341
1004  1004 H
```

A Voltage V4 at 100% of end value.

B Voltage V2 at 100% of end value.

C Voltage V1 at 100% of end value.

D Voltage V4 at 0% of end value.

E Voltage V2 at 0% of end value.

F Voltage V1 at 0% of end value.

G Enter value of 1-7 to track up to three voltages.

H ID of last microcode module loaded.

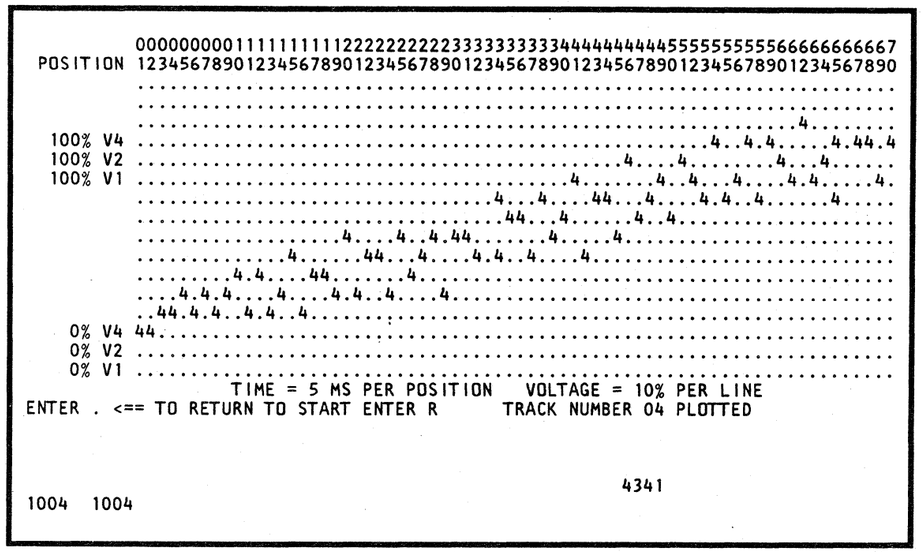
MV SCREEN EXAMPLE 3

Voltage Tracking screen example 3 shows what is displayed when a tracking error occurs.

```
 VOLTAGE TRACKING DISPLAYS THE TURN ON OF SELECTED VOLTAGES IN THE PROCESSING
UNIT AND CTCA (IF INSTALLED). THERE MUST BE TWO INPUTS, TRACK NUMBER (01-14)
AND VOLTAGE(S) (V1-V7). THE TRACKS ARE IN THE ORDER OF THE POWER ON SEQUENCE.


TRACK    V1          V2          V4        TRACK    V1          V2          V4
01  +24 BIAS    +5 BIAS                    08  -4.25(C1)    -4.25(B1)
02  +5 VOLTS (60-80%)                      09  -6.45
03  -6.45 INITIAL(-2.2)                    10  +5 (100%)
04  +4.25 INITIAL                          11  +6
05  -1.5(A1)    -1.5(A2)    -1.5(B1)       12  +4.25 FINAL
06  -1.5(C1)                               13  +1.25*         -3*
07  -4.25(A1)   -4.25(A2)   -4.25(B1)      14  +6

                                          * = CTCA VOLTAGE
                              !!  TRACKING ERROR  !!
VOLTAGE IN TRACK 07 FAILED. TRY AGAIN OR PLOT THE FAILING TRACK TO DETERMINE
THE FAILING VOLTAGE.

                     ENTER: TRACK NUMBER 14  VOLTAGE(S) V 7

                                                          4341
1004 1004
```

MV SCREEN EXAMPLE 4

Voltage Tracking screen example 4 shows the tracking of voltage V4 of a power supply with a bad filter capacitor.



MV SCREEN EXAMPLE 5

Voltage screen example 5 shows the tracking of one voltage (V1).

If a 7 is entered to plot a track that has only one voltage, three plots of that voltage are displayed.

```
          0000000001111111111222222222233333333334444444444555555555566666666667
POSITION  1234567890123456789012345678901234567890123456789012345678901234567890
          ..........................................................................
          ..........................................................................
          ..........................................................................
 100% V4  ..........................................................................
 100% V2  ..........................................................................
 100% V1  ..........................................................................11
          ..........................................................1111111..
          ..........................................................11111111.........
          ..........................................1.111111.......................
          ..........................................111111.1.......................
          ..........................1111111.........................................
          ..........................111111..........................................
          ..................1111111.................................................
    0% V4 .............111111.....................................................
    0% V2 ......1111111.........................................................
    0% V1 111111................................................................
                    TIME = 5 MS PER POSITION    VOLTAGE = 10% PER LINE
ENTER . <== TO RETURN TO START ENTER R       TRACK NUMBER 01 PLOTTED


                                                          4341
1004  1004
```

MV SCREEN EXAMPLE 6

Voltage screen example 6 shows the tracking of three voltages (V1, V2, and V4).

```
          0000000001111111111222222222233333333334444444444555555555566666666667
POSITION  1234567890123456789012345678901234567890123456789012345678901234567890
          ..........................................................................
          ..........................................................................
          ..........................................................................
 100% V4  ..........................................................................44
 100% V2  ..........................................................................4444422
 100% V1  ..........................................................444444462222311
          ..........................................4444444222222211111...
          ..........................................44444422222223111111.....
          ..........................................4444444222222111111.....
          ..........................4444462222222111111.....................
          ..................444446222222211111111..........................
          ..............4444422222231111111...............................
          ......444444444222221111111.....................................
    0% V4 444444222222221111111.....................................
    0% V2 22222211111111.....................................
    0% V1 111111.....................................
                    TIME = 5 MS PER POSITION    VOLTAGE = 10% PER LINE
ENTER . <== TO RETURN TO START ENTER R       TRACK NUMBER 08 PLOTTED


                                                          4341
1004  1004
```


EC 379583 16Apr79 EC 376694 16Jul79	PN 5666171 1 of 1	20 115

o o o

POWER LOGS

ERROR LOGOUTS SCREEN (E)

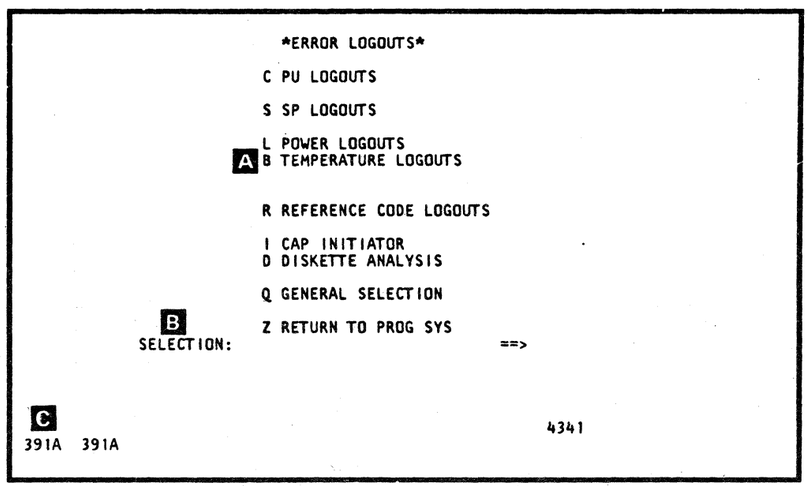
The E (error logouts) screen lists available power logs.

The available power logouts are:

- Power logouts (Expanded Power Error Information)
- Temperature logouts

Entering E from the Q (General Selection) screen displays the E screen.

E SCREEN EXAMPLE



A List of power logs.

B Enter one-letter code.
Example: Entering B displays the temperature logout.

C ID of last microcode module loaded.

EXPANDED POWER ERROR INFORMATION (EL)

The EL screen displays an expanded log out of the last four faults and reference codes for the last eight faults.

Power MAPs direct you to this screen and define its usage.

- Entering EL from the Q screen or L from the E screen displays the expanded power error information log.

Log 1, reference code **A** ,and reference code **B** , are the last fault.

Log 2 and reference code **C** are the second to the last fault.

Log 3 and reference code **D** are the third to the last fault.

Log 4 and reference code **E** are the fourth to the last fault.

Note: *For analog, digital, and control address and bit assignments see "Sense Point Listing (Control)" and "Sense Point Listing (Analog And Digital)."*

EL SCREEN EXAMPLE

```
                        EXPANDED POWER ERROR INFORMATION
                        ================================

F   LOG 1: ADDR= 81839193 A1A3B1B3 85879597 A5A7B5B7  40424446 50525456 32  ADDR
    LAST LOG     44088040 1882A001 FF8FFFF3 FFFFFFFF  00000000 00000000 00  20DA
                 1F8077FB 03807783 FFFEF662 7CC07E20

H   LOG 2: ADDR= 81839193 A1A3B1B3 85879597 A5A7B5B7  40424446 50525456 32  ADDR
                 44200000 00800001 000109B1 0383A1EF  41658FA0 8CB08FA0 00  434E
                 018077FB 00007782 FFFEF640 7C405E00

    LOG 3: ADDR= 81839193 A1A3B1B3 85879597 A5A7B5B7  40424446 50525456 32  ADDR
                 44200000 00800001 000109B1 0383A1EF  41658FA0 8CB08FA0 00  434E
                 018077FB 00007782 FFFEF640 7C405E00

    LOG 4: ADDR= 81839193 A1A3B1B3 85879597 A5A7B5B7  40424446 50525456 32  ADDR
                 44200000 00800001 000109B1 0383A1EF  41658FA0 8CB08FA0 00  434E
                 018077FB 00007782 FFFEF640 7C405E00

I   REFERENCE CODES:
                 1111020E 1111020E 1111020E 14A5100E 14A5100E 14A5100E 14A5100E
                    A        C        D        E                 REF CODE   1111020E
                                                                                B
J                                                                  4341
    1024  1024
```

F Last log (latest). Line 1 contains analog and digital sensor, and control latch addresses. Line 2 is the hex value of the addresses. Line 3 is the compare mask determined by machine features.

G Support processor microcode address at the time of the fault.

H Data for up to three more logs.

I Reference codes of last eight logs. Reference code on the left is the latest log.

J ID of last microcode module loaded.

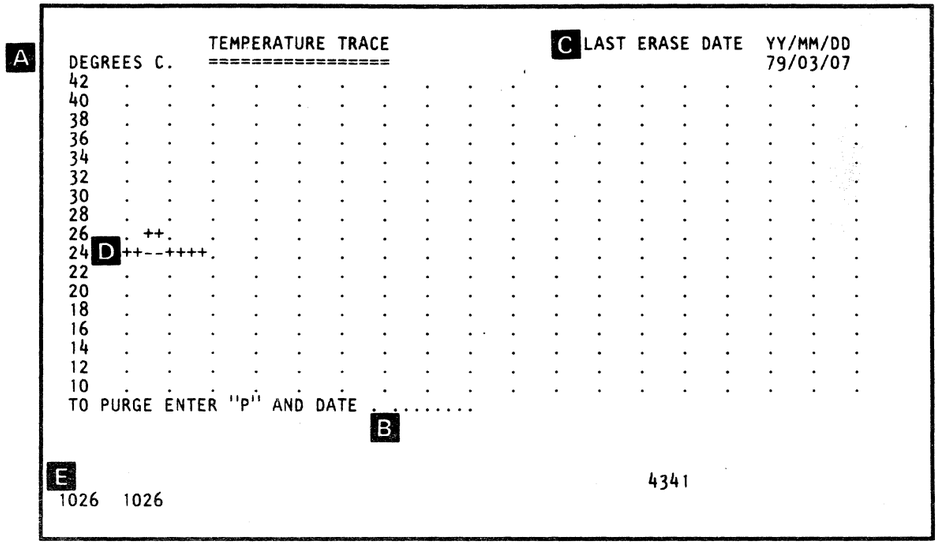
TEMPERATURE TRACE (EB)

The EB screen displays the highest and lowest temperature of the 01A gate air inlet from power on to power off. Each vertical column represents one power on to power off reading.

The logging is done during power off sequence.

- Entering EB from the Q screen or B from the E screen displays the temperature trace screen.

EB SCREEN EXAMPLE



A Temperature in degrees Celsius.

B Enter date here to reset log.

C Date log was reset.

D Highest and lowest temperature from last power on to power off.

E ID of last microcode module loaded.

DIAGNOSTICS

Power Controller Adapter Diagnostics (MP)

The PCA diagnostics test the PCA cards (MSS adapter and sense) by executing 19 test routines.

The diagnostics are run during MSS power on if not in CE mode. A reference code is displayed on the system console if a fault is sensed.

Note: *Test 19 is the EMC monitor test. MAPs/installation instructions direct you to this test and messages on the screen give you the run instructions. For details, see page 20 295.*

When the diagnostics are run in CE mode (displayed from M screen with the P option), extended error information is displayed.

The diagnostics:

Generate reference codes.

Retest failing power or display instructions.

Generate current and expected results

Display error messages.

Display microcode started and stopped status.

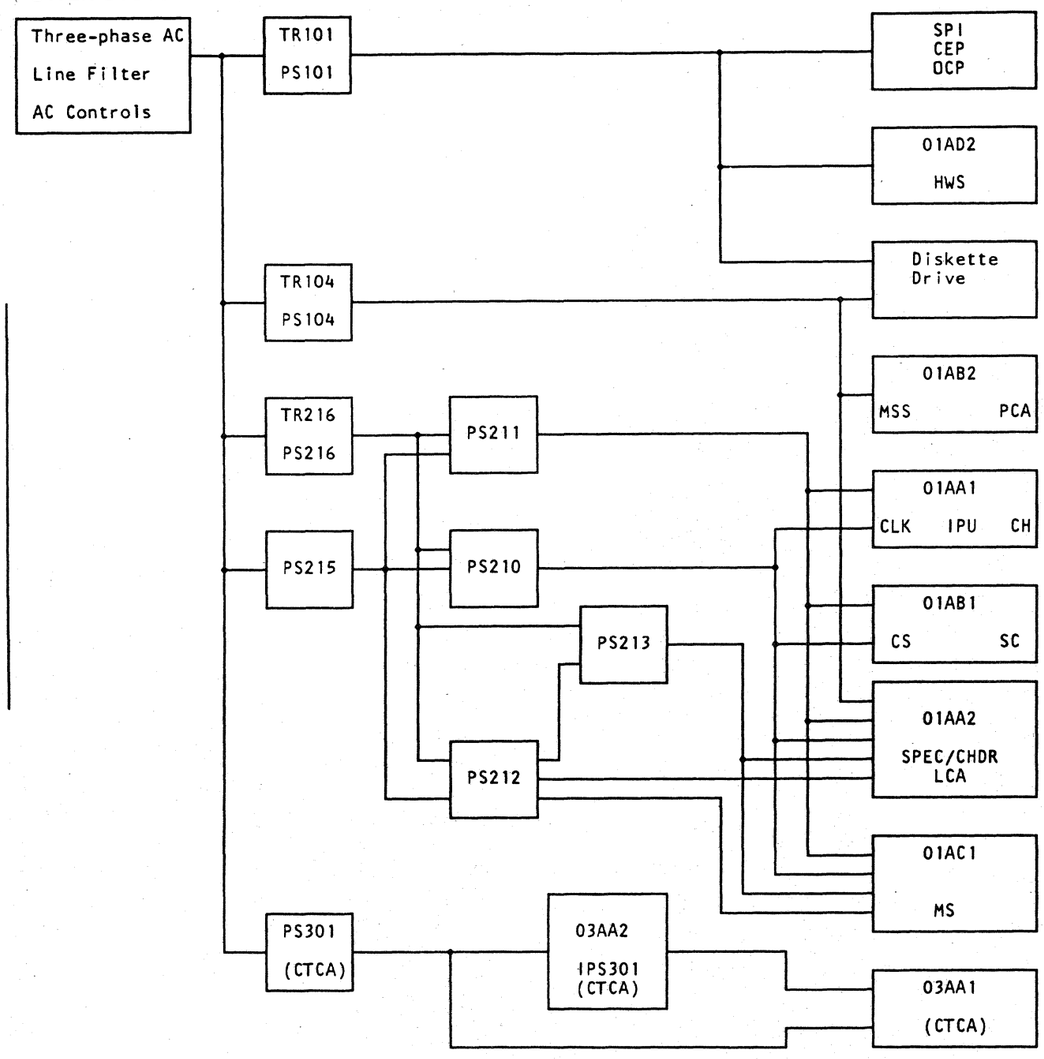
PCA diagnostic execution starts with a routine that checks feature data describing the assignment of analog sense inputs. A mask is generated for use when the analog inputs are tested. A message is displayed (on the system console) "Power Controller Diagnostics, " "Started, " and "Approximate run time 01 sec. "

With no faults, each test chains to the next until completion of all tests.

If a fault is sensed, an error reference code is generated. The current and expected results, along with a description of those results, and the microcode status 'Stopped' are displayed on the system console.

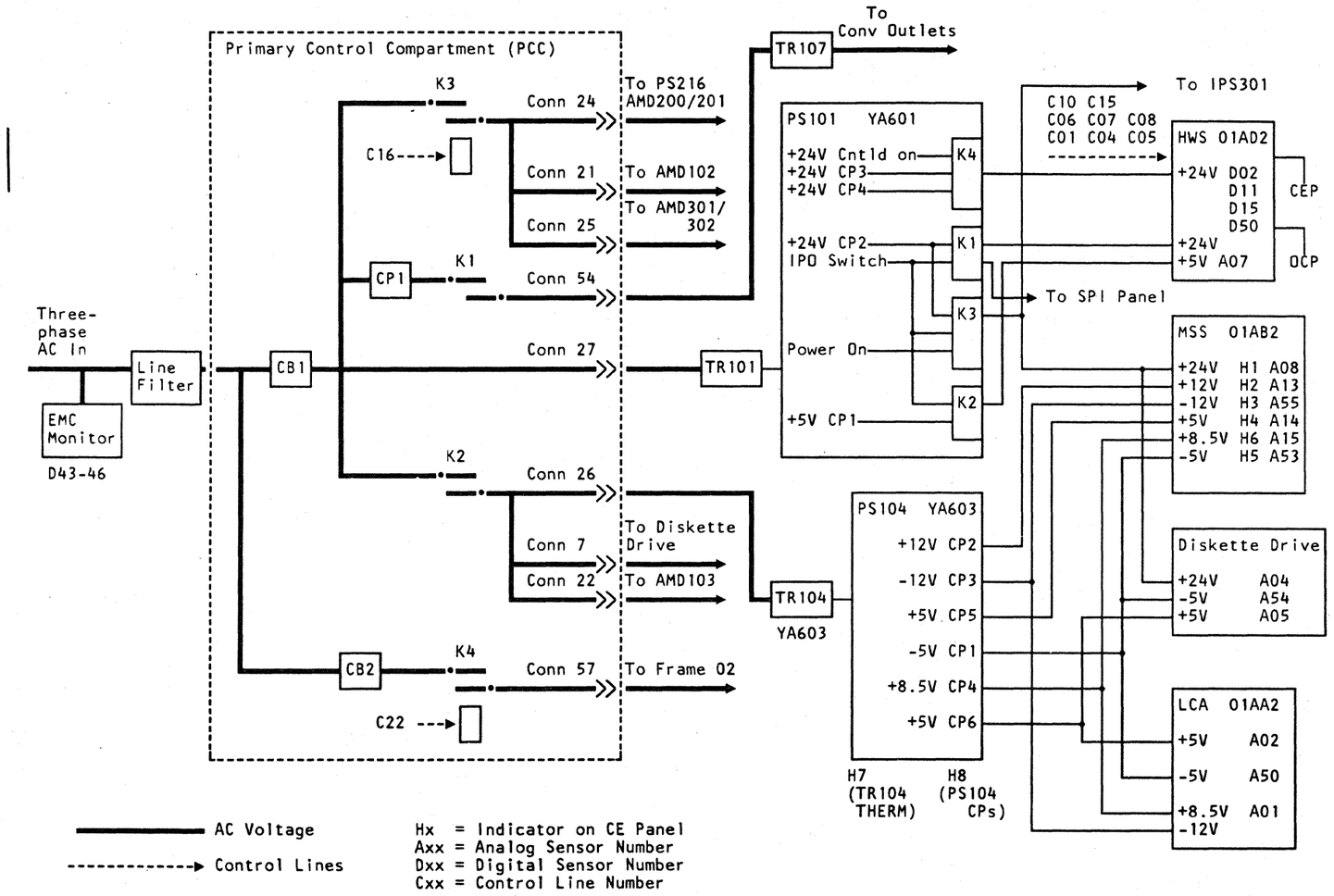
VOLTAGE DISTRIBUTION

POWER SYSTEM DIAGRAM



SPI Standard Power Interface
CEP CE Panel
OCP Operator Control Panel
HWS Hardwired Sequence
MSS Maintenance Support Subsystem
PCA Power Controller Adapter
CS Control Storage
LS Local Storage
SC Storage Control
MS Main Storage
LCA Local Channel Adapter
IPS Integrated Power Supply
TR Transformer
PS Power Supply
CTCA Channel-To-Channel Adapter
SPEC/CHDR Special Channel Driver

DC DISTRIBUTION

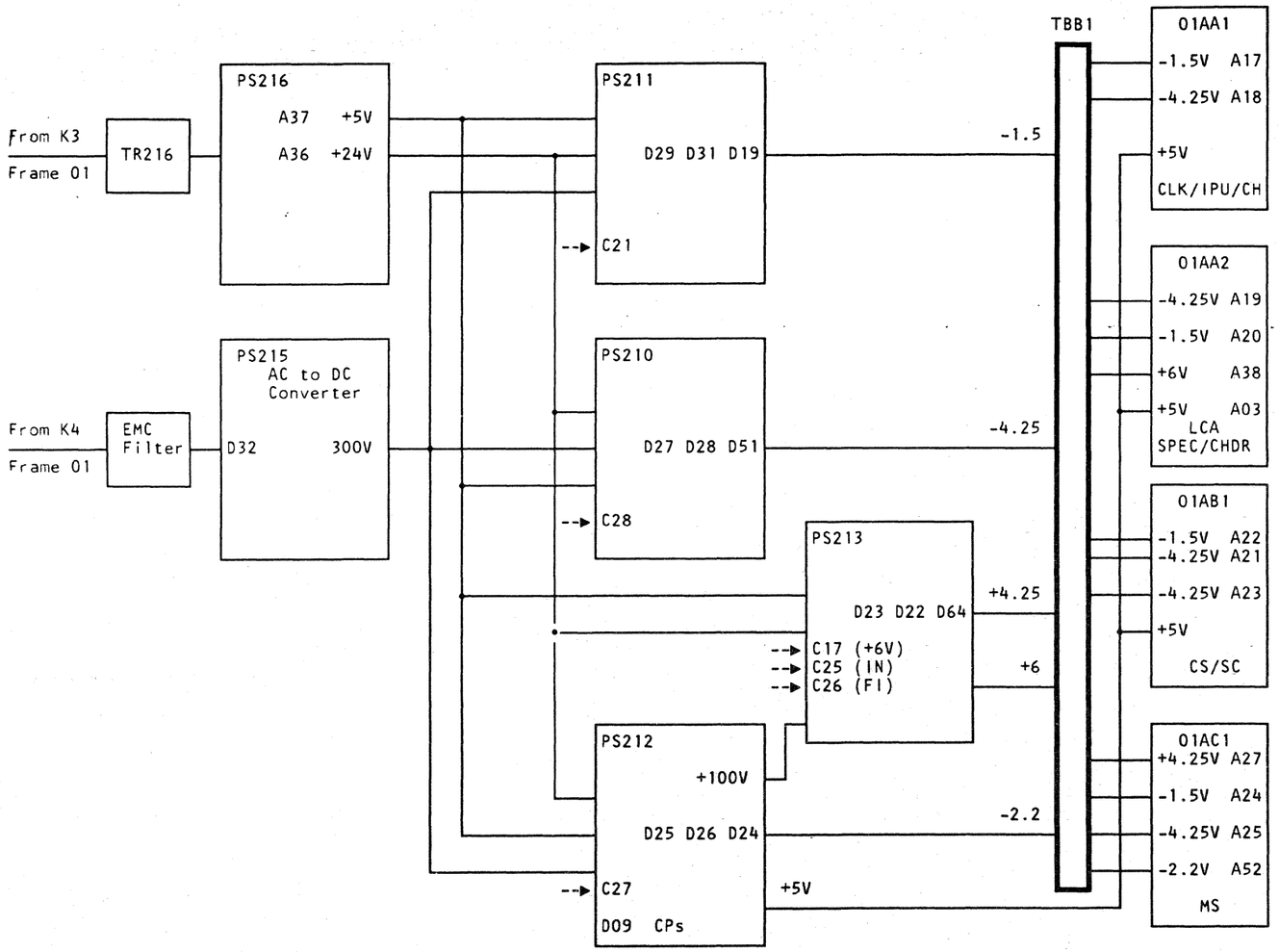


AC Voltage

Control Lines

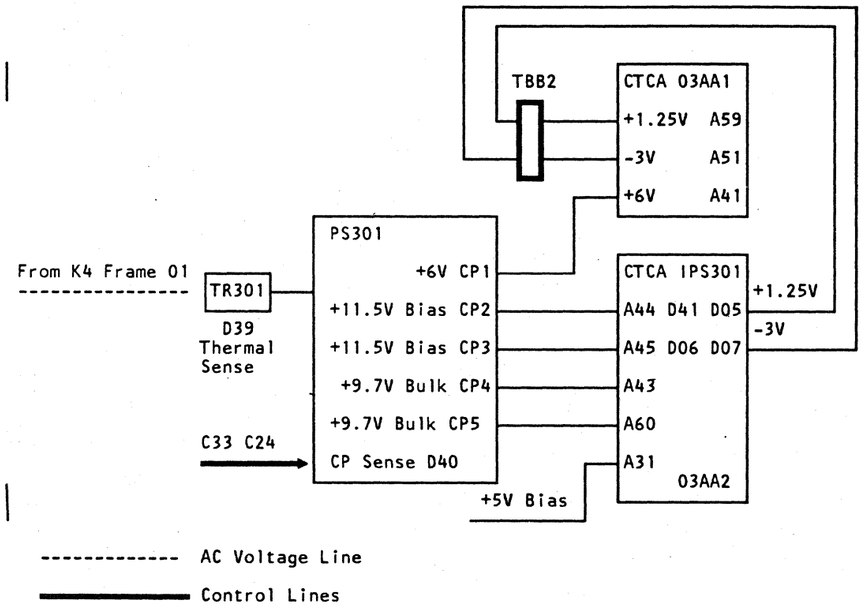
Hx = Indicator on CE Panel
Axx = Analog Sensor Number
Dxx = Digital Sensor Number
Cxx = Control Line Number

DC DISTRIBUTION (CONTINUED)



-------→ Control Line
Hx = Indicator on CE Panel
Axx = Analog Sensor
Dxx = Digital Sensor
Cxx = Control Line

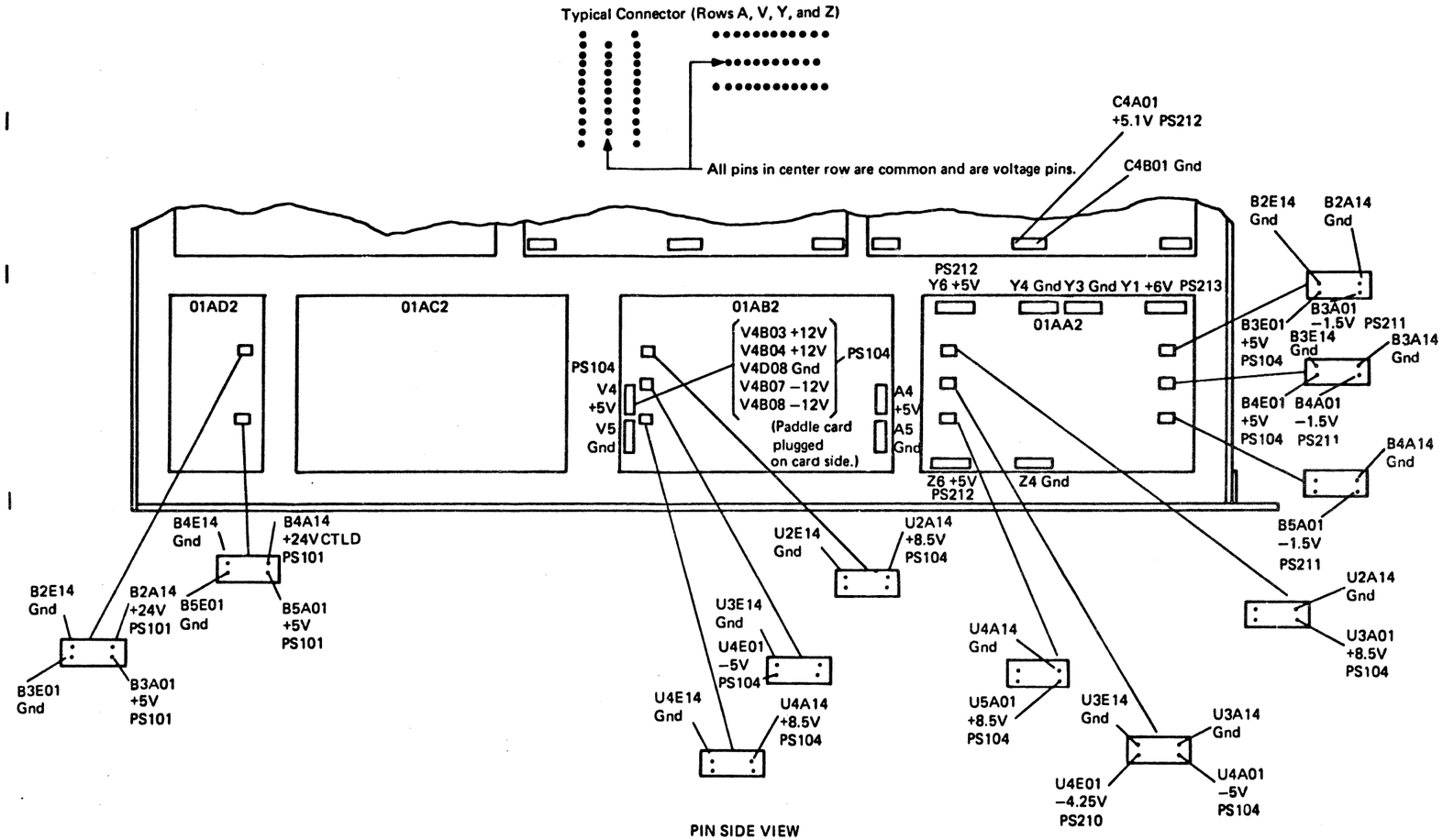
DC DISTRIBUTION (CONTINUED)



---------- AC Voltage Line

Control Lines

DC DISTRIBUTION (PS101, PS104 TO GATE 01A)



PIN SIDE VIEW

Model Group 2, Switching Regulators

EC 379816 20Oct80 EC 379607 05Jun81	PN 2676339 1 of 2	20 175d

FLEXIBLE DISTRIBUTION SYSTEM (FDS)

FDS cables are used for IPS dc distribution. An FDS cable is a thin copper strip with layers of insulation around it.

Handling FDS Cables

FDS cables must be handled carefully. Do not drag an FDS cable over sharp corners or edges. Place it carefully through gate openings.

Installation of FDS Cables

Each bill of material to install a feature contains a detailed description for handling and placing of FDS cables and a folding tool.

Trouble-Shooting on FDS Cables

Check for short circuit from cable to cable and for a short circuit to ground or the frame.

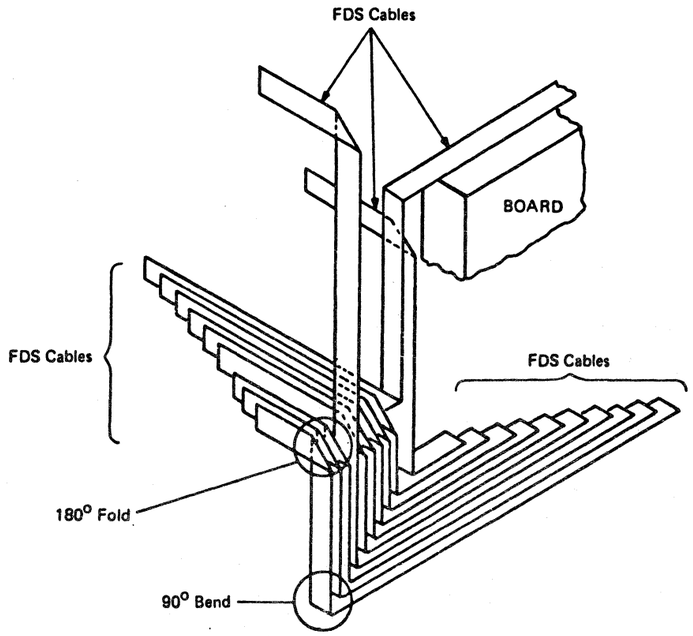
Repairing FDS Cables

Damage to insulation can be repaired by Mylar tape (IBM part 817979) or a similar tape. Use at least two complete turns of tape around the FDS cable, but not more than two and one half turns.

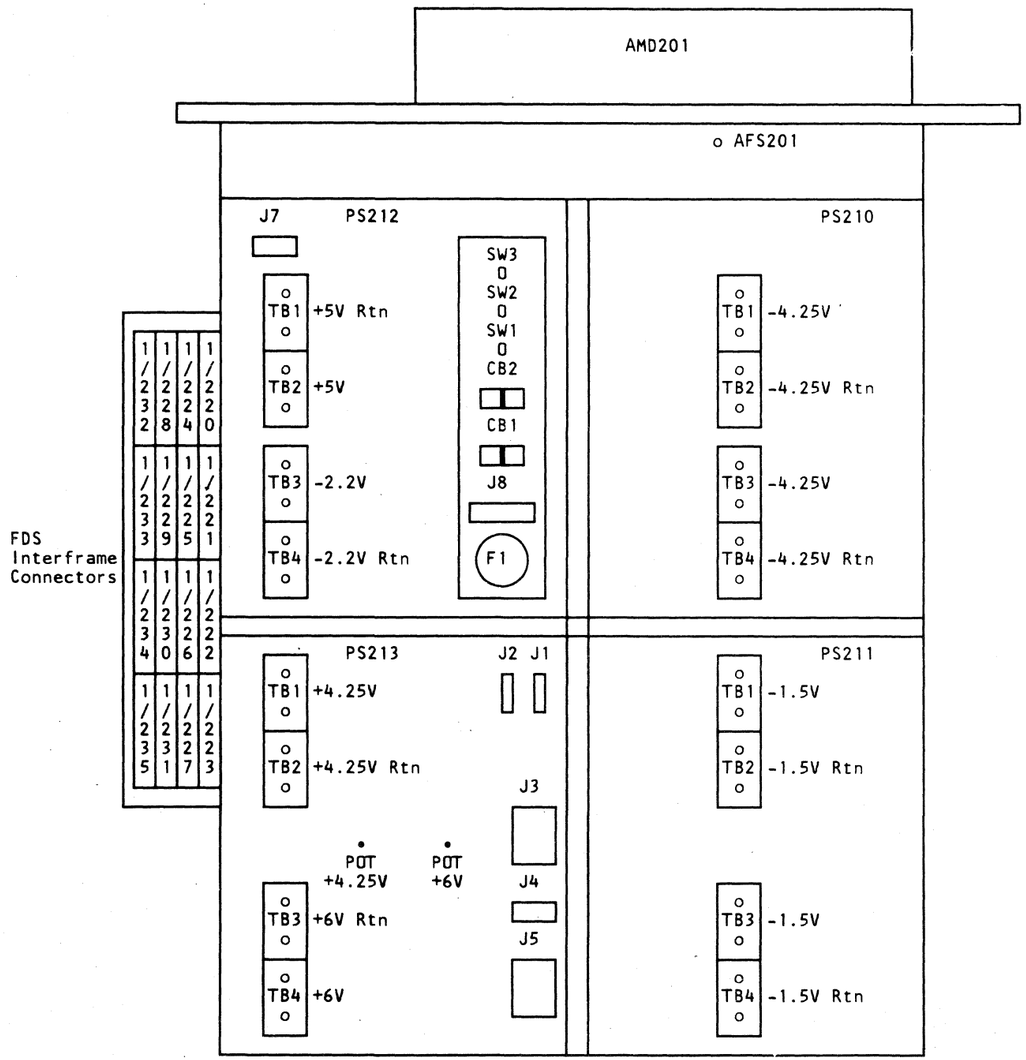
Refolding FDS Cables

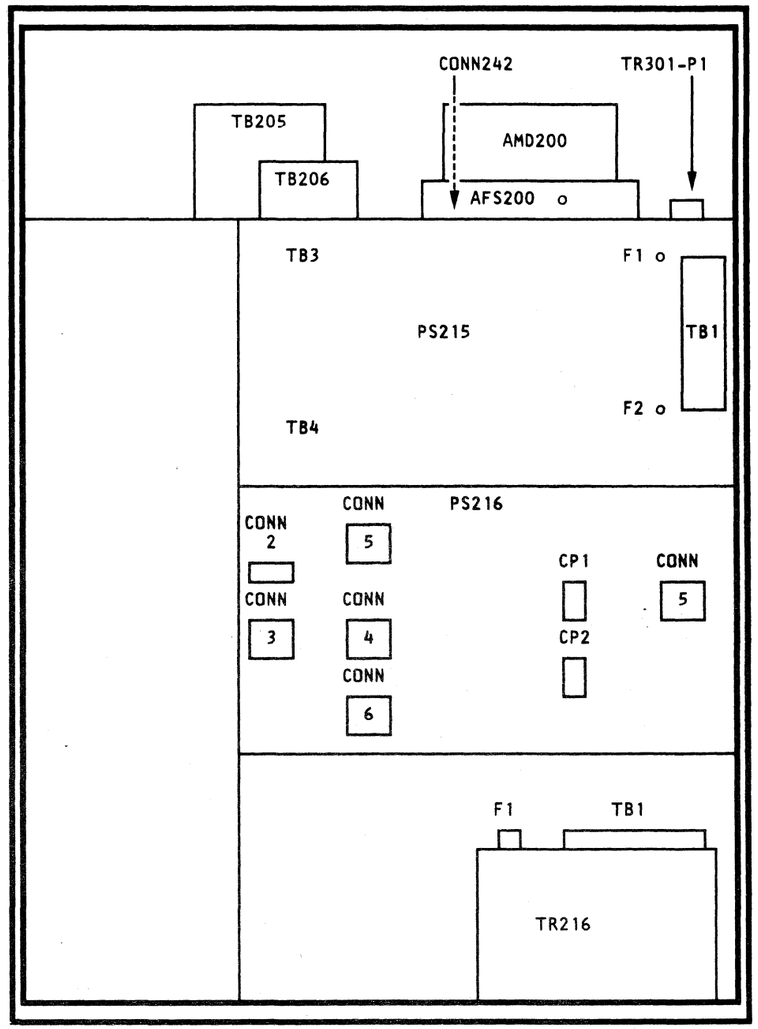
Do not refold the cable, or reverse the fold direction, more than once at any fold mark. Use the tool for recovery from misfold. Remove the folds from the FDS cable carefully and repair the insulation (see Repairing FDS Cables on page 20 180). Then fold the cable correctly by using the folding tool.

EXAMPLE OF FDS CABLE ROUTING

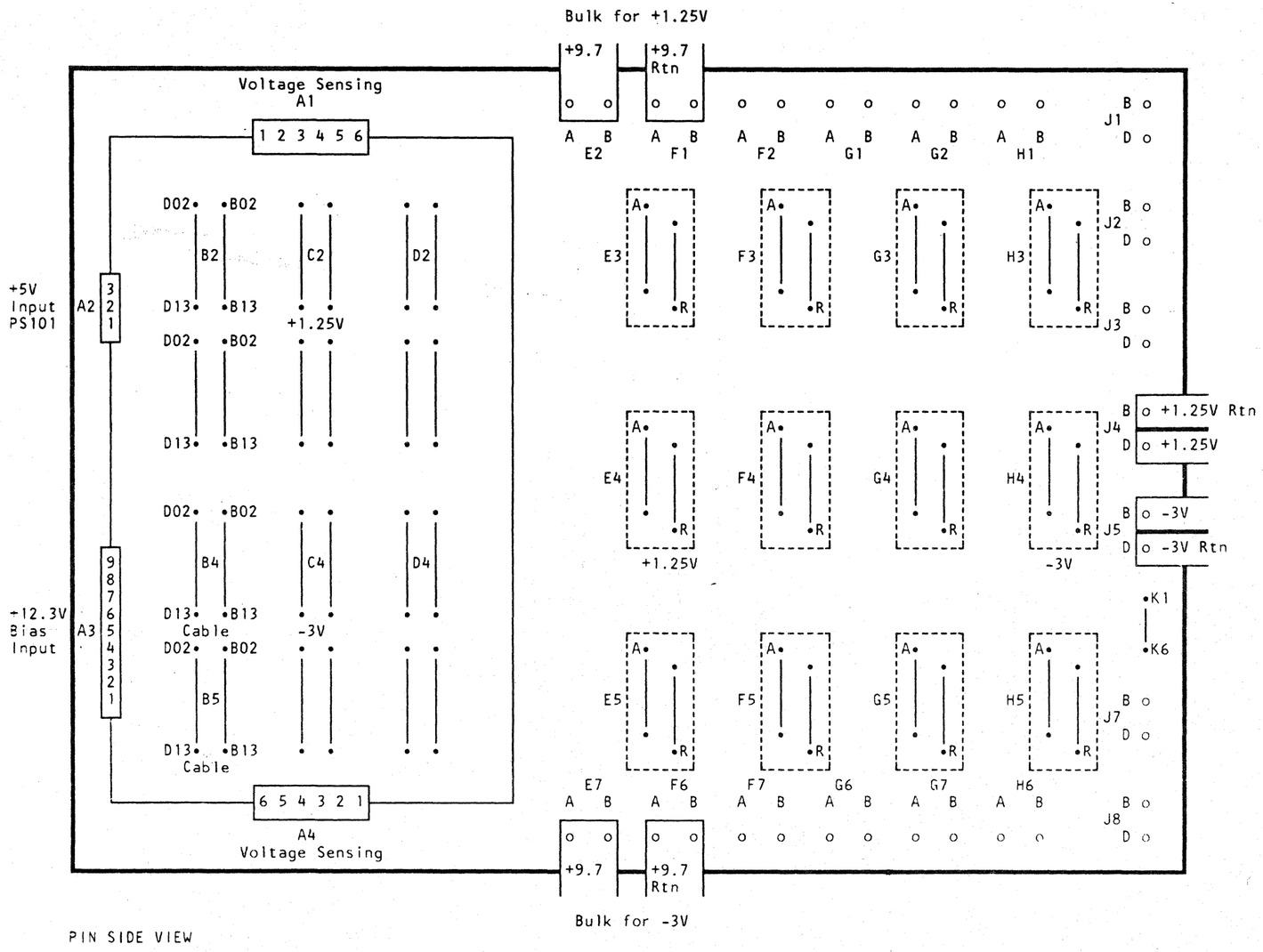


SWITCHING REGULATORS





IPS BOARD 03AA2 (CTCA)



PIN SIDE VIEW

Note: *+1.25V Rtn and -3V Rtn are not DC ground. To measure +1.25V, connect meter between J4B and J4D. To measure -3V, connect meter between J5B and J5D.*

SWITCHING REGULATOR VOLTAGE DISTRIBUTION

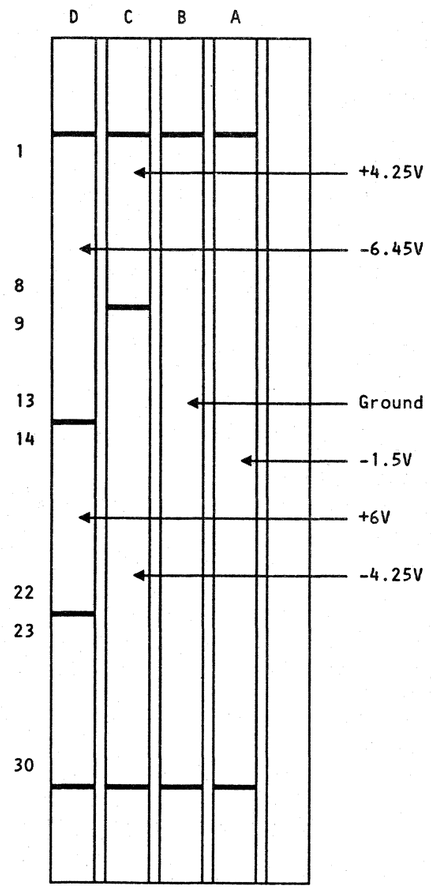
SWITCHING REGULATORS TO TBB1

Power Supply and Voltage Level	PS TB	Interframe Connector	TBB1 Connector
PS212			
-6.45V (2.2V)	TB1	220/120B	D10
-4.25V (2.2 Rtn)	TB3	220/120A	C13
PS210			
-4.25V	TB3	221/121	C13
	TB2	229/129	C10
-4.25V Rtn	TB4	225/125	B12
	TB2	233/133	B12
PS211			
-1.5V	TB1	222/122	A18
	TB3	230/130	A16
-1.5V Rtn	TB2	226/126	B16
	TB4	234/134	B09
PS213			
+4.25V	TB1	223/123	C01
+4.25V Rtn	TB2	227/127	B01
+6V	TB4	224/124	D16
+6V Rtn	TB3	224/124	B16

SWITCHING REGULATOR TO GATE 01A

Power Supply and Voltage Level	PS TB	Gate 01A Connector
PS212		
+5V	TB2	01AA2Y6, Z6
+5V Rtn	TB1	01AA2Y4, Z4

TBB1



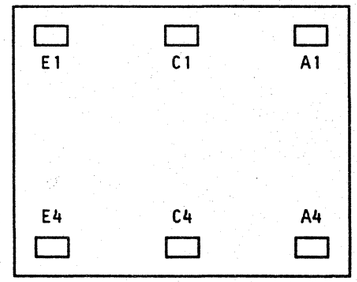
(Gate 01A Hinge End)

TBB1 TO GATE 01A

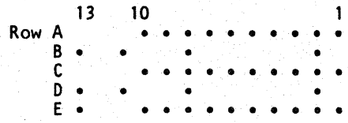
Voltage	TBB1 Conn(s)	Gate 01A Conn(s)
-6.45V	D08	B1C1E01-E04 *
	D08	B1C4A10-A13 *
	D05	C1C1A07-A10
	D05	C1C1E07-E10
	D05	C1C4A10-A13
	D05	C1C4E10-E13
-4.25V	C29, C30	A1E1A
	C29, C30	A1A4A
	C29, C30	B1C1A
	C29, C30	B1C4E
	C27, C28	B1A4A
	C27, C28	B1E1A
	C25, C26	C1E1A
	C25, C26	C1A4A
	C21	A2U4E01
-1.5V	A05, A06	A1A1E
	A05, A06	A1E1E
	A25, A26	A1A4E
	A25, A26	A1E4E
	A03, A04	B1A1E
	A03, A04	B1E1E
	A23, A24	B1A4E
	A23, A24	B1E4E
	A01, A02	C1E1E
	A21, A22	C1A4E
	A21	AA2B4A01, B3A01, A2B5A01
+4.25V	C07	B1C1E07-E10 *
	C07	B1C4A04-A07 *
	C04	C1C1A01-A04
	C04	C1C1E01-E04
	C06	C1C4A04-A07
	C06	C1C4E04-E07
+6V	D19	A2Y1
Gnd Rtn	B07, B08	A1A1C
	B07, B08	A1C1C
	B07, B08	A1E1C
	B27, B28	A1A4C
	B27, B28	A1C4C
	B27, B28	A1E4C
	B05, B06	B1A1A
	B05, B06	B1A1C
	B05, B06	B1C1C
	B05, B06	B1E1C
	B25, B26	B1A4C
	B25, B26	B1C4C
	B25, B26	B1E4C
	B25, B26	B1E4A
	B03, B04	C1C1C
	B03, B04	C1E1C
	B23, B24	C1A4C
	B23, B24	C1C4C
	B21	A2Y3, A2B3A14, A2B2A14, A2B4A14, A2U3E14

* Not used

BOARD A1 AND B1



Connectors A1, C1, and E1



Connectors A4, C4, and E4

GATE 01A VOLTAGE NET (+5V)

Voltage	01AA2 Conn(s)	Gate 01A Voltage Net
+5V	V2D03	A1C4A01
	V2D02	B1C4A01
+5V Rtn	V2D08	A1C4B01
	V2D08	B1C4B01

BOARD A1, B1, AND C1 VOLTAGE PINS

SWITCHING REGULATORS

Ground

A1	B4	C13	D10
A25	B22	C21	D34
A37	B40	C49	D52
A61	B58	C67	D64

-1.5V (PS211)

A7	B10	C1	D4
A55	B28	C19	D16
A67	B46	C37	D22
		C61	D40

-4.25V (PS210)

A13	B34	C7	D46
A19	B52	C25	D58
A31	B64	C43	
A49			

+4.25V (PS213)

B25	C34	
B43		

-6.45V (PS212)

B7	C22	
	C46	
	C64	

+5V Special (PS212)

A1F2A47	B1F2D11
A1G2D47	B1H2D11
A1H2B47	
A1J2B47	

268-Pin Card

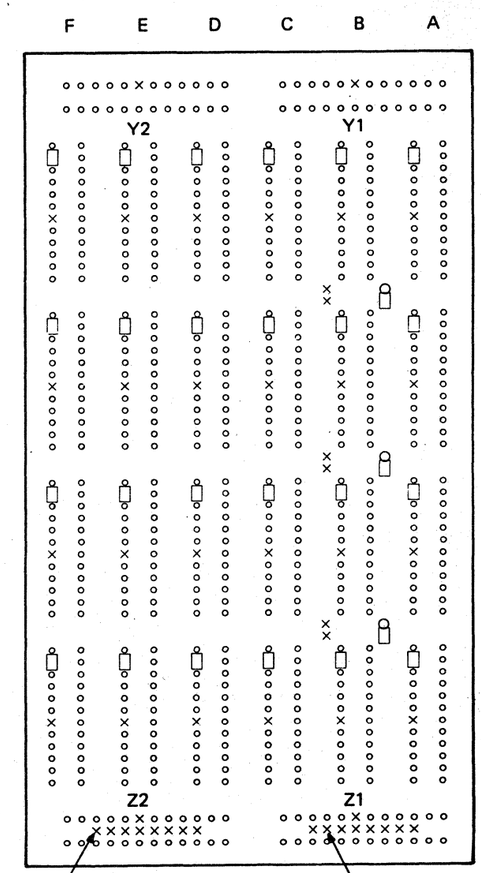
	D	C	B	A
1	o	Δ	o	+
2	o	o	o	o
3	o	o	o	o
4	Δ	o	x	o
5	o	o	o	o
6	o	o	o	o
7	o	●	o	Δ
8	o	o	o	o
9	o	o	o	o
10	x	o	Δ	o
11	o	o	o	o
12	o	o	o	o
13	o	x	o	●
14	o	o	o	o
15	o	o	o	o
16	Δ	o	□	o
17	o	o	o	o
18	o	o	o	o
19	o	Δ	o	●
20	o	o	o	o
21	o	o	o	o
22	Δ	o	x	o
23	o	o	o	o
24	o	o	o	o
25	o	●	o	x
26	o	o	o	o
27	o	o	o	o
28	□	o	Δ	o
29	o	o	o	o
30	o	o	o	o
31	o	x	o	●
32	o	o	o	o
33	o	o	o	o
34	x	o	●	o
35	o	o	o	o
36	o	o	o	o
37	o	Δ	o	x
38	o	o	o	o
39	o	o	o	o
40	Δ	o	x	o
41	o	o	o	o
42	o	o	o	o
43	o	●	o	□
44	o	o	o	o
45	o	o	o	o
46	●	o	Δ	o
47	o	o	o	o
48	o	o	o	o
49	o	x	o	●
50	o	o	o	o
51	o	o	o	o
52	x	o	●	o
53	o	o	o	o
54	o	o	o	o
55	o	□	o	Δ
56	o	o	o	o
57	o	o	o	o
58	●	o	x	o
59	o	o	o	o
60	o	o	o	o
61	o	Δ	o	x
62	o	o	o	o
63	o	o	o	o
64	x	o	●	o
65	o	o	o	o
66	o	o	o	o
67	o	x	o	Δ

□ = +5V or unused
x = GND
● = −4.25V
✱ = +4.25V
Δ = −1.5V
∇ = −6.45V

134-Pin (Storage Board) Card

	C	B
1	Δ	o
2	o	o
3	o	o
4	o	x
5	o	o
6	o	o
7	o	∇
8	o	o
9	o	o
10	o	Δ
11	o	o
12	o	o
13	x	o
14	o	o
15	o	o
16	o	□
17	o	o
18	o	o
19	Δ	o
20	o	o
21	o	o
22	∇	x
23	o	o
24	o	o
25	●	✱
26	o	o
27	o	o
28	o	Δ
29	o	o
30	o	o
31	x	o
32	o	o
33	o	o
34	✱	●
35	o	o
36	o	o
37	Δ	o
38	o	o
39	o	o
40	o	x
41	o	o
42	o	o
43	●	✱
44	o	o
45	o	o
46	∇	Δ
47	o	o
48	o	o
49	x	o
50	o	o
51	o	o
52	o	●
53	o	o
54	o	o
55	□	o
56	o	o
57	o	o
58	o	x
59	o	o
60	o	o
61	Δ	o
62	o	o
63	o	o
64	∇	●
65	o	o
66	o	o
67	x	o

BOARD D2 VOLTAGE PINS

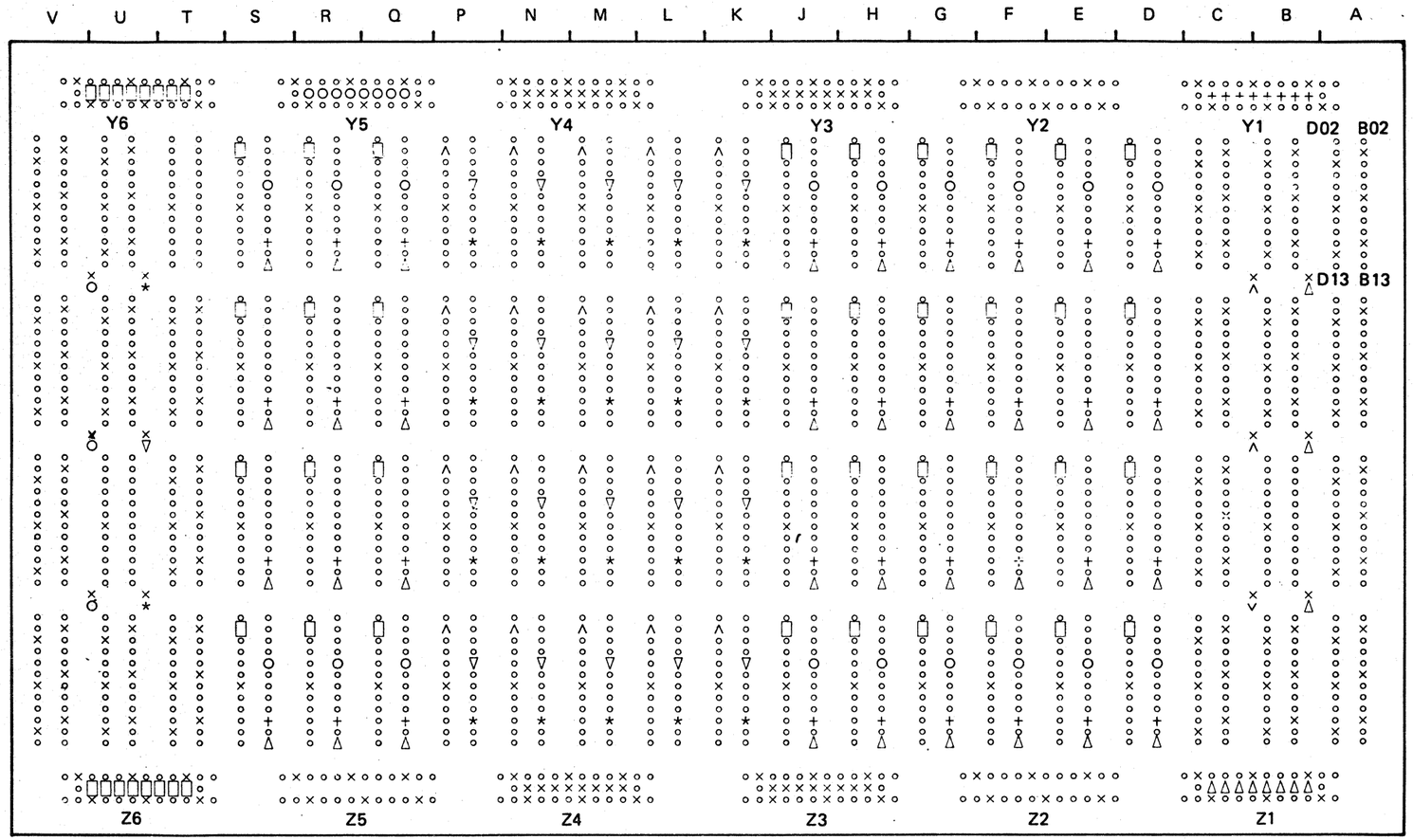


□ = +5V
× = Ground
○ = +24V

Model Group 2, Switching Regulators

EC 379816 20Oct80 EC 379607 05Jun81	PN 2676342 1 of 2	20 205d

BOARD A2 VOLTAGE PINS



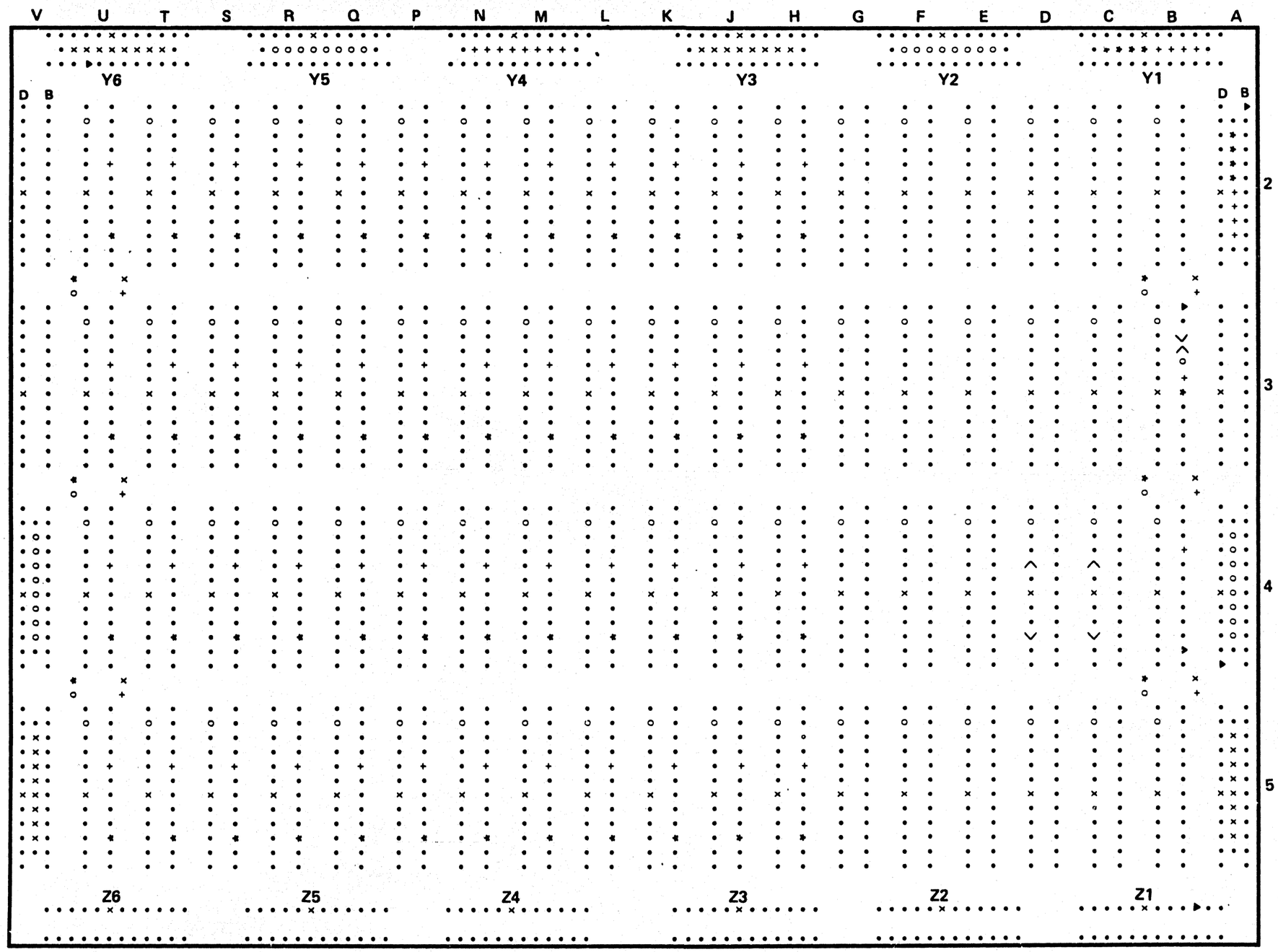
□ = +5V (PS212)
○ = –4.25V (PS210)
△ = –1.5V (PS211)
\+ = +6V (PS213)
x = Ground
* = +8.5V (PS104)
▽ = –5V (PS104)
^ = +5 (PS104)
v = –12V (PS104)

Pin-Side View

Model Group 2, Switching Regulators

EC 379816 20Oct80 EC 379607 05Jun81	PN 2676342 2 of 2	20 210d

BOARD B2 VOLTAGE PINS



PIN SIDE VIEW

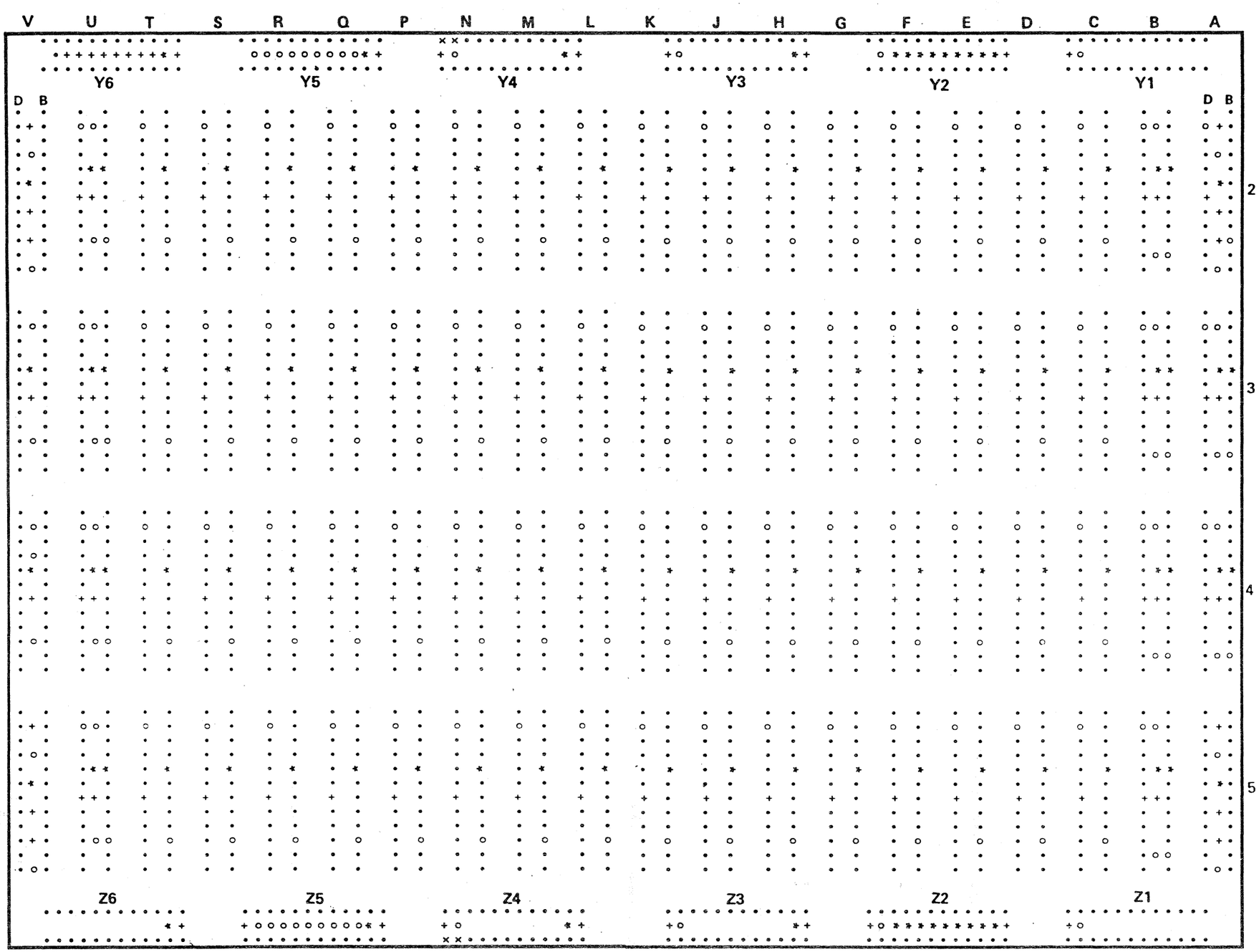
○ = +5V
x = Gnd
▶ = +24V
\+ = -5V
• = +8.5V (see note)
^ = -12V
v = +12V

Note: *If IO card is installed in M2, the following pins are +12V instead of +8.5V.*
L2B11
L2G11
L2M11

Machines with EC 874037 have three capacitors (part 0174861) installed on the following pins.

01AB2D4D08	to	01AB2D4B04
01AB2C4D08	to	01AB2D4B05
01AB2B4D08	to	01AB2C4B11

BOARD 03AA1 VOLTAGE PINS



+ = Gnd
o = +1.25V
* = -3V
x = +6V

PIN SIDE VIEW

EC 379814 02Oct81	PN 2676047	20 213
	1 of 1	

VOLTAGE ADJUSTMENTS

SWITCHING REGULATORS

For voltage adjustment procedure, see MAP 1003, Entry Point A.

For current limit (CL) adjustment procedure, see MAP 1005, Entry Point A.

For locations of current limit switches and voltage adjustment pots, see Volume 13, Removals/Replacements.

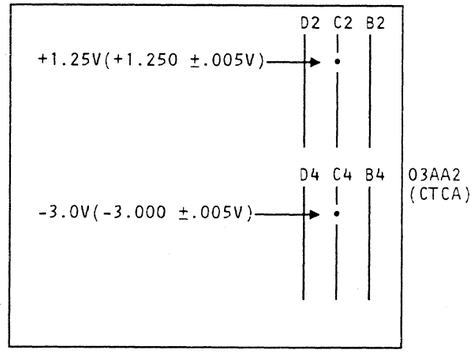
IPS (CTCA)

When IPS control cards have been replaced or exchanged, the IPS voltage controlled by this card must be adjusted. All power modules are the same part number. All control cards have the same part number.

For adjustment procedure, see MAP 1003, Entry Point A.

Note: *PS101 and PS104 outputs (24V, 5V, -12V, 12V, -5V, and 8.5V) are not adjustable. The tolerance of these levels is ±10%.*

IPS CONTROL CARD LOCATIONS



VOLTAGE ADJUST MEASUREMENT POINTS

Level	Voltage Setting	Tolerance	Measurement Points	PS/ Card
+4.25V	+4.260V	±.005V	01AC1P2B25 B22 (Gnd)	PS213
-1.5V	-1.524V	±.005V	01AA1C2B28 C31 (Gnd)	PS211
-4.25V	-4.336V	±.005V	01AA1C2B34 C31 (Gnd)	PS210
-2.2V	-2.200V	±.005V	01AC1P2C22 C25 (-4.25)	PS212
+1.25V	+1.250V	±.005V	03AA1K2D03 D08 (Gnd)	03AA2C2
-3.0V	-3.000V	±.005V	03AA1K2B06 D08 (Gnd)	03AA2C4
+6V	+6.000V	±.005V	01AA2D2B11 D08 (Gnd)	PS213

SENSORS

Note: *For details of sensor operation, see Sense Card on page 20 365.*

SENSE POINT LISTING (ANALOG AND DIGITAL)

Note: *For details of monitoring points and entry to board 01AB2, see Sensor Entry to Board 01AB2 on page 20 230.*

CARD 01AB2D2

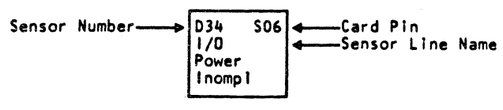
Addr	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
81	D01	D02 * J06 AFS302 CTCA PS301	D03 * G08	D04 * G06 AFS301 CTCA Gate03A	D05 * J04 +1.25V CL IPS301-A2 CTCA	D06 * G03 -3V UV IPS301-A2 CTCA	D07 * J02 -3V CL IPS301-A2 CTCA	D08 * G05
83	D09 G02 PS212 CPs	D10	D11 J05 CE Switch N/O	D12 * G04	D13 * D13	D14 * G07	D15 * J09	D16 * D09
85	A01 B07 +8.5V PS104	A02 B10 +5V PS104	A03 B02 +5V SPEC/CHDR PS212	A04 B03 +24V Diskette	A05 D02 +5V Diskette	A06	A07 B06 +5V HWS PS101	A08 B05 +24V MSS PS101
87	A09 B08 AIS 101	A10 B11 AOS 101	A11 D11 AOS 102	A12 D12 AOS 103	A13 B09 +12V MSS PS104	A14 D07 +5V MSS PS104	A15 D06 +8.5V MSS PS104	A16
91	D17	D18 P04 CPs PS216	D19 P05 -1.5V UV PS211	D20 M03 Aux Point K3 Blowers	D21	D22 M04 +4.25V OV PS213	D23 M05 +4.25V CL PS213	D24 M07 -6.45V OV PS212
93	D25 P07 -6.45V CL PS212	D26 M08 -6.45V UV PS212	D27 P09 -4.25V OV PS210	D28 M09 -4.25V CL PS210	D29 M10 -1.5V OV PS211	D30	D31 P10 -1.5V CL PS211	D32 M11 300V Bulk PS215
95	A17 U06 -1.5V IPU/CH PS211	A18 U09 -4.25V IPU/CH PS210	A19 U11 -4.25V SPEC/CHDR PS210	A20 S09 -1.5V SPEC/CHDR PS211	A21 S08 -4.25V B1 SPEC PS210	A22 S07 -1.5V CS/SC/MS PS211	A23 U10 -4.25V CS/SC/MS PS210	A24 S10 -1.5V MS PS211
97	A25 P12 -4.25V MS PS210	A26 S04 -V Ref CD 1	A27 S05 +4.25V MS PS213	A28	A29	A30	A31 S02 +5V Bias IPS301-A2 CTCA	A32

* Used during MSS power-on sequence to read the serial number card.

CARD 01AB2C2

Addr	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
A1	D33	D34 J06 I/O Power Incompl	D35	D36	D37	D38	D39 J02 TR301 Thermal CTCA	D40 G05 PS301 CPs CTCA
A3	D41 G02 +1.25V UV CTCA	D42	D43 J05 EMC Monitor	D44 G04 EMC Monitor	D45 D13 EMC Monitor	D46 G07 EMC Monitor	D47	D48
A5	A33	A34	A35	A36 B03 +24V Bias PS216	A37 D02 +5V Bias PS216	A38 B04 +6V SPEC/CHDR PS213	A39	A40
A7	A41 B08 +6V CTCA	A42	A43 D11 +1.25V Bulk IPS CTCA	A44 D12 +1.25V Bias IPS CTCA	A45 B09 -3V Bias IPS CTCA	A46	A47	A48
B1	D49	D50	D51 P05 -4.25V UV PS210	D52 M03 AUX Point K4	D53	D54	D55 M05 AFS201 Gate 02A	D56 M07 AFS102 A1-A2
B3	D57 P07 AFS200 PS215	D58 M08 +6V OV PS213	D59 P09 +6V UV PS213	D60	D61 M10 Power Off To PCA	D62	D63 P10 +6V CL PS213	D64 M11 +4.25V UV PS213
B5	A49	A50 U09 -5V PS104 LCA	A51 U11 -3V CTCA	A52 S09 -6.45V MS PS212	A53 S08 -V REF CD 2	A54 S07 -5V Diskette	A55 U10 -12V MSS	A56
B7	A57	A58	A59 S05 +1.25V CTCA	A60 U05 -3V Bulk IPS301-A2 CTCA	A61	A62	A63	A64

Example



SENSE POINT LISTING (CONTROL)

Note: *Control lines not shown below are for PCA diagnostic use.*

CARD 01AB2C2

ADDR	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
50	C17 B13 +6V Start PS213	C18	C19	C20	C21 J11 -1.5V Start PS211	C22 G11 PCC K04 Start PS215	C23	C24 J12 Start +1.25/-3V CTCA
52	C25 D04 +4.25V Initial Start PS213	C26 D10 +4.25V Final Start PS213	C27 J10 Start +5/-6.45 Initial PS212	C28 G10 -4.25V Start PS210	C29	C30	C31	C32 M02 Read Serial Number

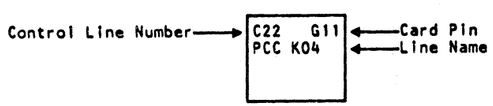
CARD 01AB2D2

ADDR	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
40	C01 B13 Reset EMC Monitor	C02 B12 Start I/O	C03 J07 Power Complete	C04 G09 Restart 30 SEC Timer	C05 J11 PROG Power Off	C06 G11 Power Off To HWS	C07 G12 Power Check To HWS	C08 J12 Power In Process
42	C09	C10 D10 PC Ready	C11 J10 NPL DR/REC CTRL	C12	C13	C14	C15 P02 EMC Test	C16 M02 Pick PCC K03 AMDs

CARD 01AB2E2

ADDR	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
30					C33 J09 +6V CTRL CTCA	C34 G03 CTCA BYPASS RELAY	C35 J11 RESET SYS PROTECT	C36 G11 IPU COMP FOR SYS PROTECT
32					MACH CHECK	STATUS CHECK	INTERPT ENABLE	INTERPT REQUEST

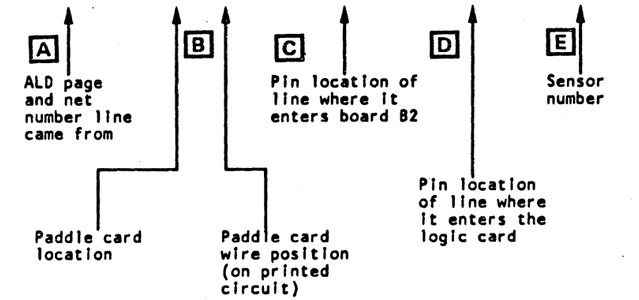
Example



SENSOR ENTRY TO BOARD 01AB2

EXAMPLE OF ALD YF171

REFERENCE ALD AND NET NUMBER	01AB2 PADDLE CARD CABLE CONNECTION	01AB2 PADDLE CARD AND BOARD I/O	01AB2 CARD I/O	SENSOR NUMBER
YF101AA11	B4-T14	B4-D12	D2-B07	*A01*
YF101AA13	B4-S14	B4-D13	D2-B10	*A02*
YF101AA15	B2-S14	B2-B12	D2-B02	*A03*
YF101AA17	B4-S06	B4-B09	D2-B03	*A04*
YF101AA19	B4-S05	B4-B10	D2-D02	*A05*
YF101AA21	A2-S09	A2-D09	D2-B04	*A06*
YF101AA23	B3-B06	B3-B12	D2-B06	*A07*

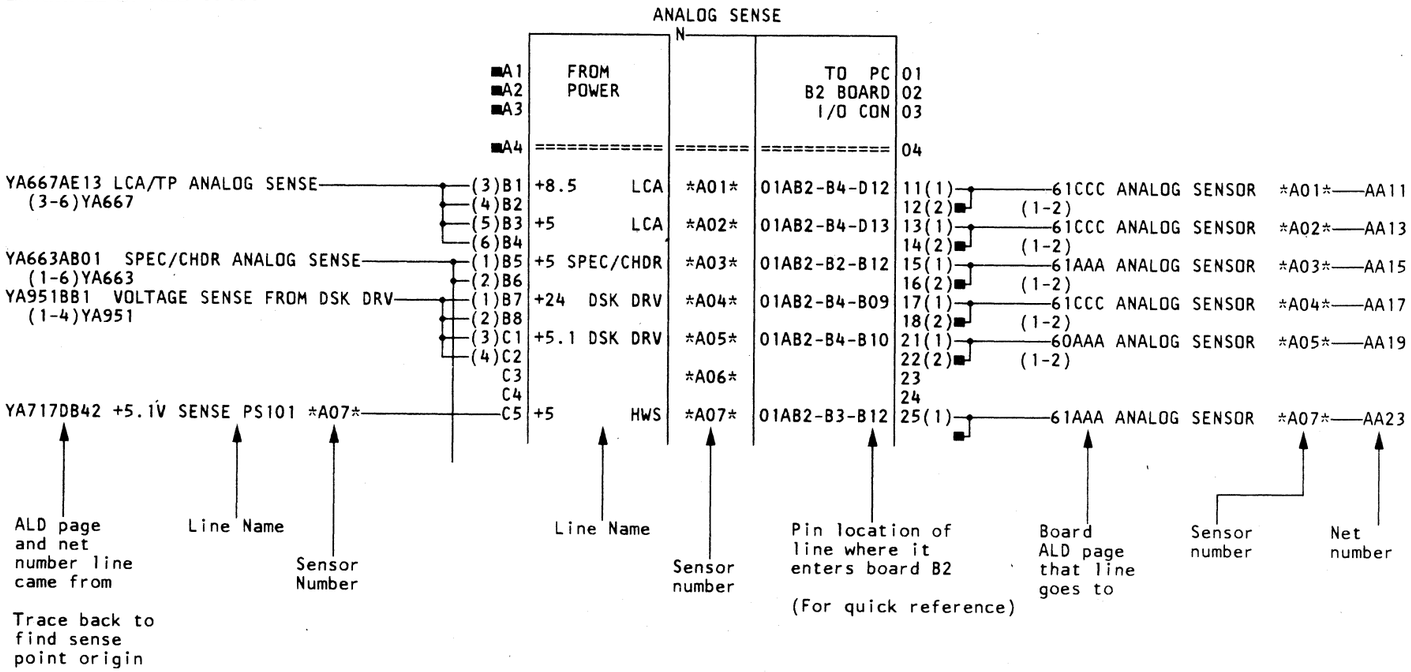


The charts on ALD page YF171 contain the following information for all analog, digital, and control lines.

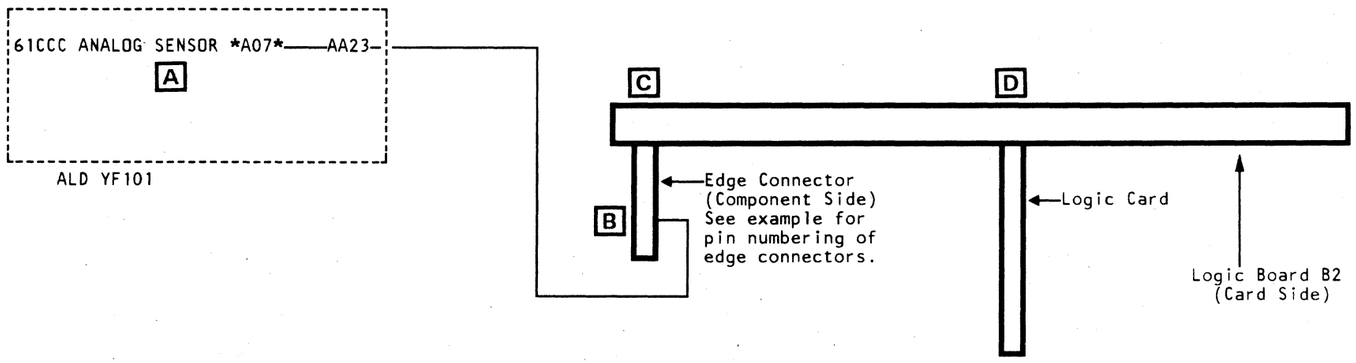
- **A** ALD Page and net number
- **B** 01AB2 paddle card cable connector
- **C** 01AB2 paddle card and board I/O
- **D** 01AB2 card I/O
- **E** Sensor number

SENSOR ENTRY TO BOARD 01AB2 (CONT)

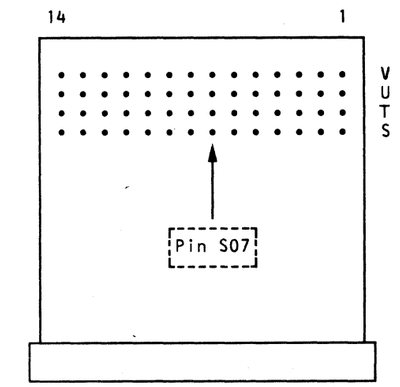
EXAMPLE OF ALD YF101



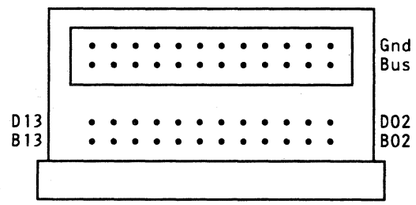
EXAMPLE OF SENSOR A07 (FROM YF101 TO LOGIC CARD)



PADDLE CARD PIN NUMBERING

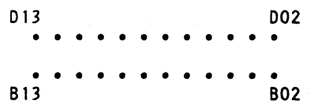


2 High Paddle Card
(component side)



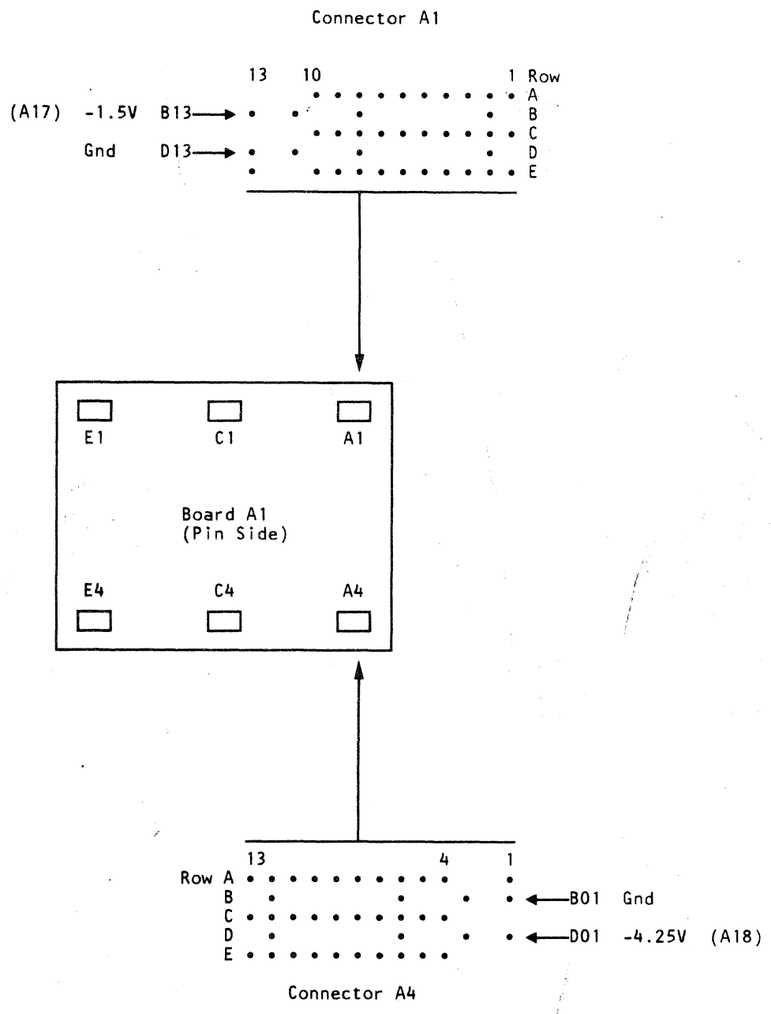
1 High Paddle Card
(Side where wires enter printed circuit)

Y AND Z ROW CONNECTOR PINS



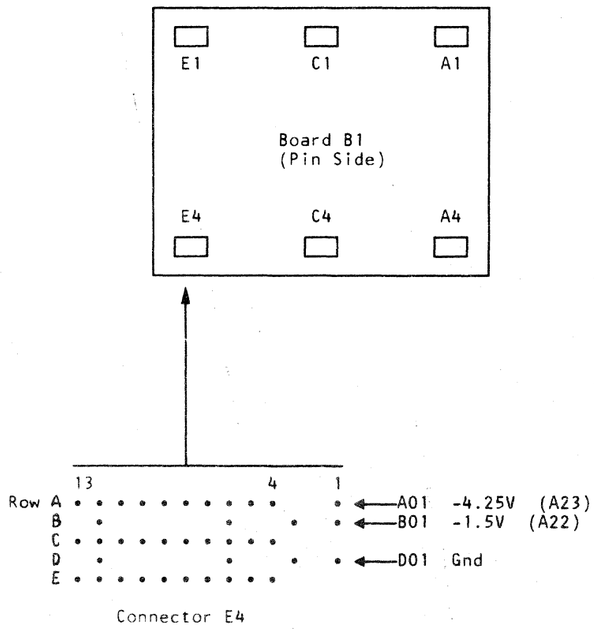
BOARD VOLTAGE SENSE POINTS (LOGIC)

BOARD 01AA1



(Axx) = Analog sensor number

BOARD 01AB1



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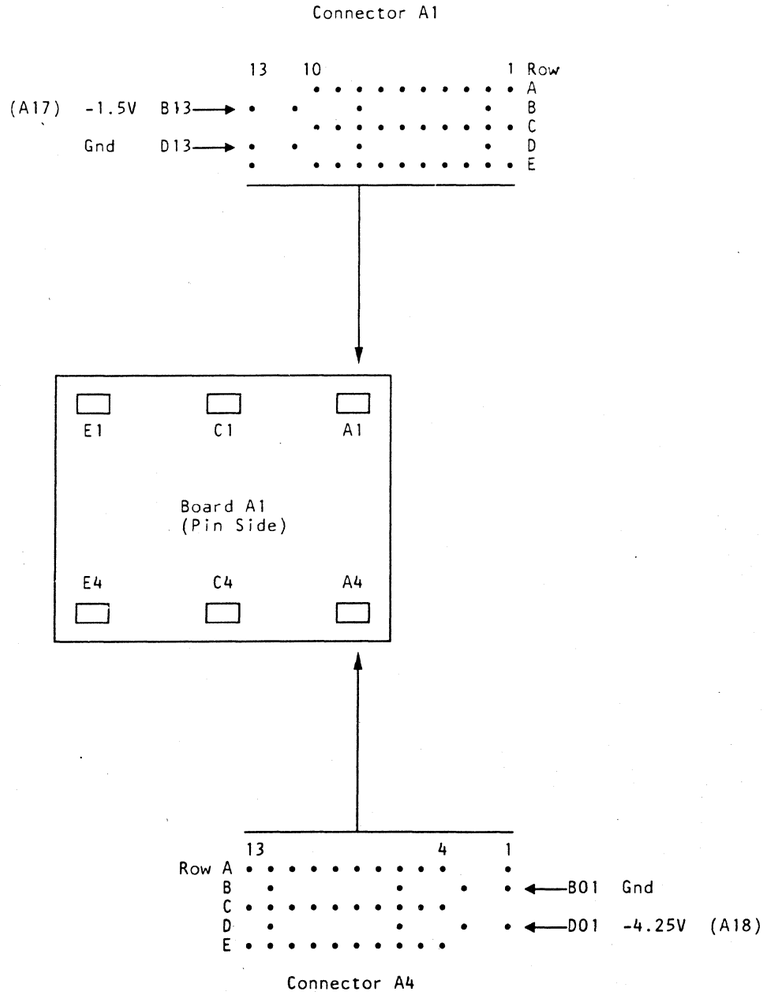
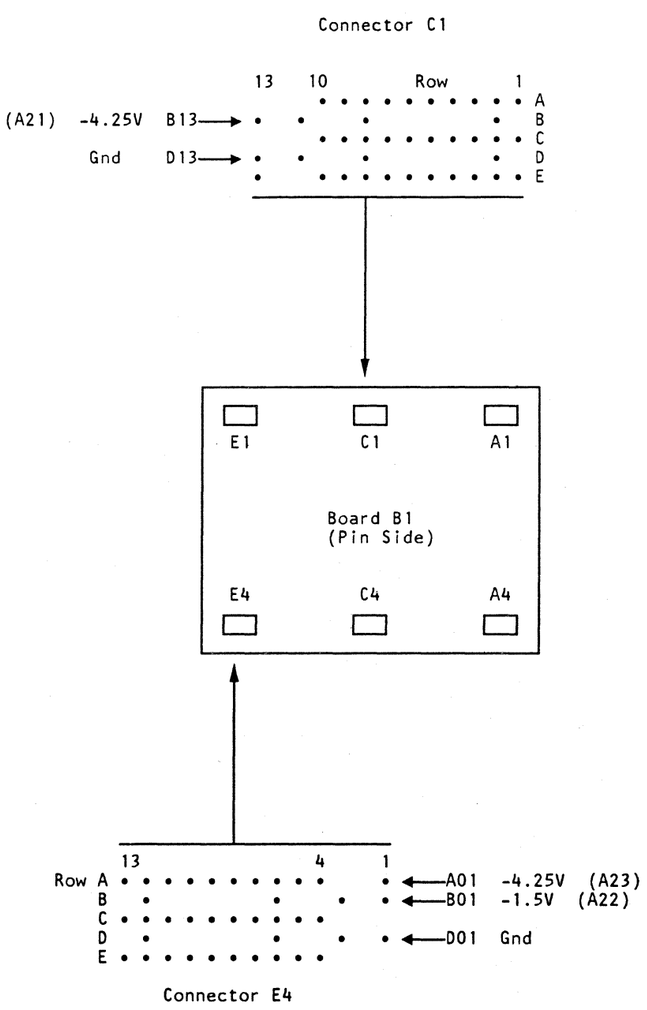
BOARD VOLTAGE SENSE POINTS (LOGIC)

BOARD 01AA1



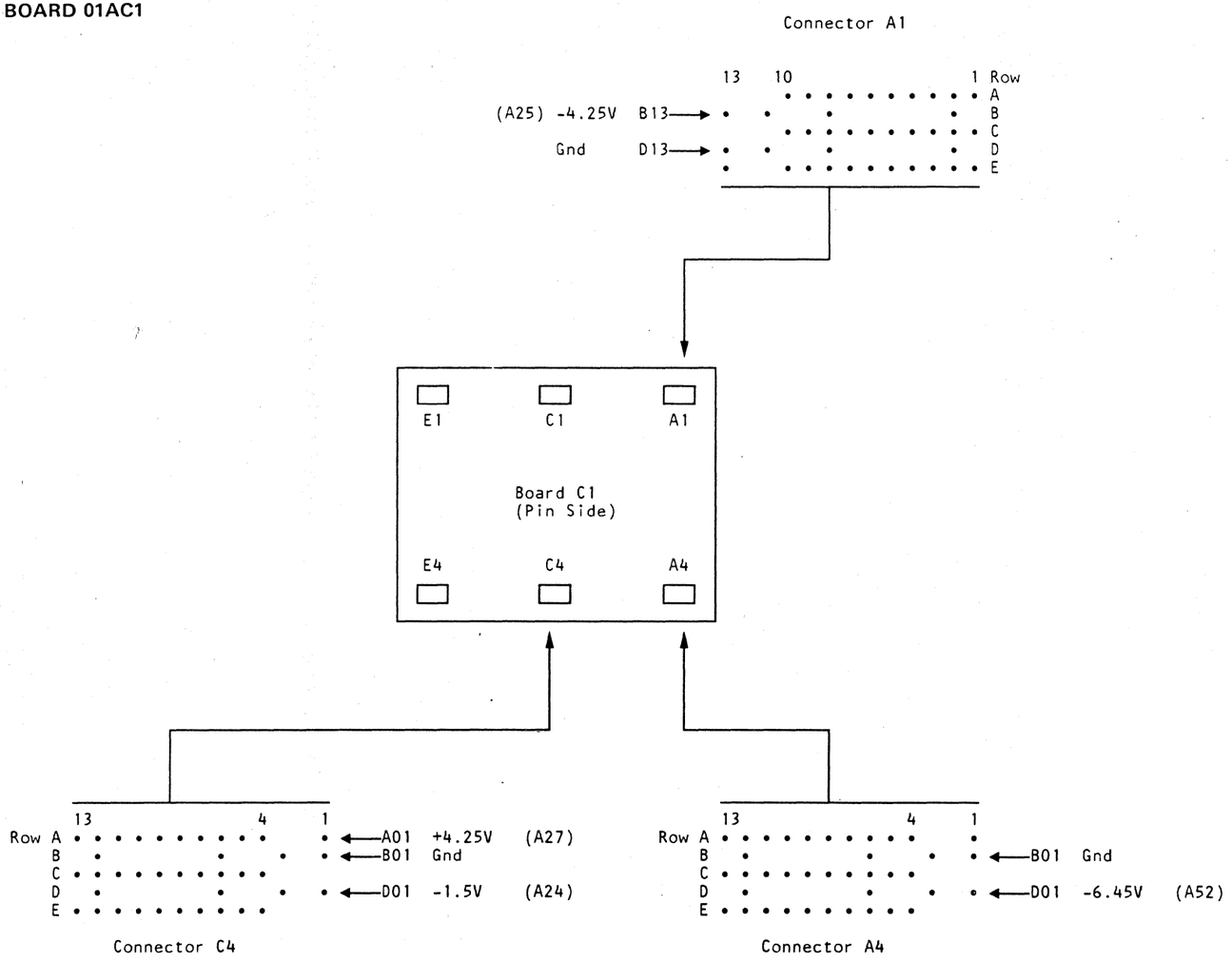
BOARD 01AB1



(Axx) = Analog sensor number

BOARD VOLTAGE SENSE POINTS (LOGIC)

BOARD 01AC1



(Axx) = Analog sensor number

AIR FLOW SENSORS

All air moving devices (AMDs) are monitored for air flow by air flow sensors (AFS). A thermistor in the air flow sensor is heated to generate an error signal. If the error signal is present (with air moving devices off), the power-on sequence continues. (If the error signal is not present, the hardwired sequence turns on the AFS FAIL (for AMD103 only) and BASIC CHECK indicator and resets power.)

After approximately six seconds, the hardwired sequence again checks the air flow sensor for the error signal. The air moving device should have cooled the thermistor and reset the error signal. The power-on sequence continues if the error signal is not present. If the error signal is present, the hardwired sequence turns on the AMD103 FAIL and BASIC CHECK indicator and resets power.

After power-on is complete to the maintenance support subsystem, the power monitor microcode and power controller adapter monitor all air flow sensors.

Note: *Only AFS103 is checked by the hardwired sequence during maintenance support subsystem power-on.*

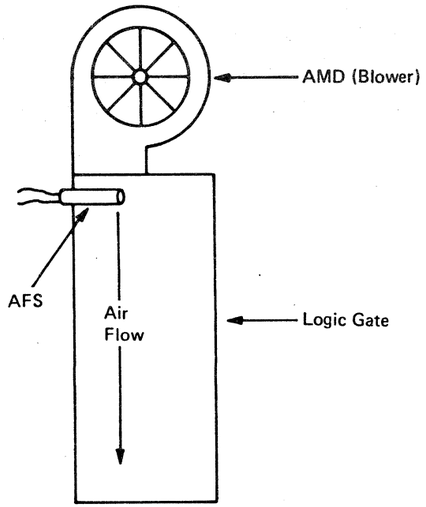
AFS Locations

AFS102	Gate 01A B/C column
AFS103	Gate 01A A/B column
AFS301	PS301
AFS302	CTCA feature gate 03A
AFS201	Gate 02A
AFS200	PS215

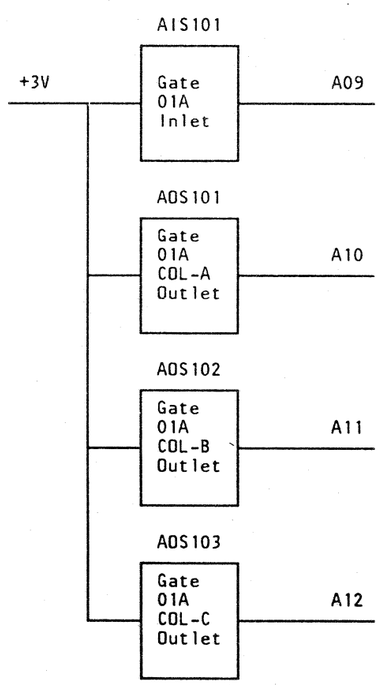
AMD (Air Moving Device) Locations

AMD102	Gate 01A B/C column
AMD103	Gate 01A A/B column
AMD301	PS301
AMD302	CTCA feature gate 03A
AMD201	Gate 02A
AMD200	PS215

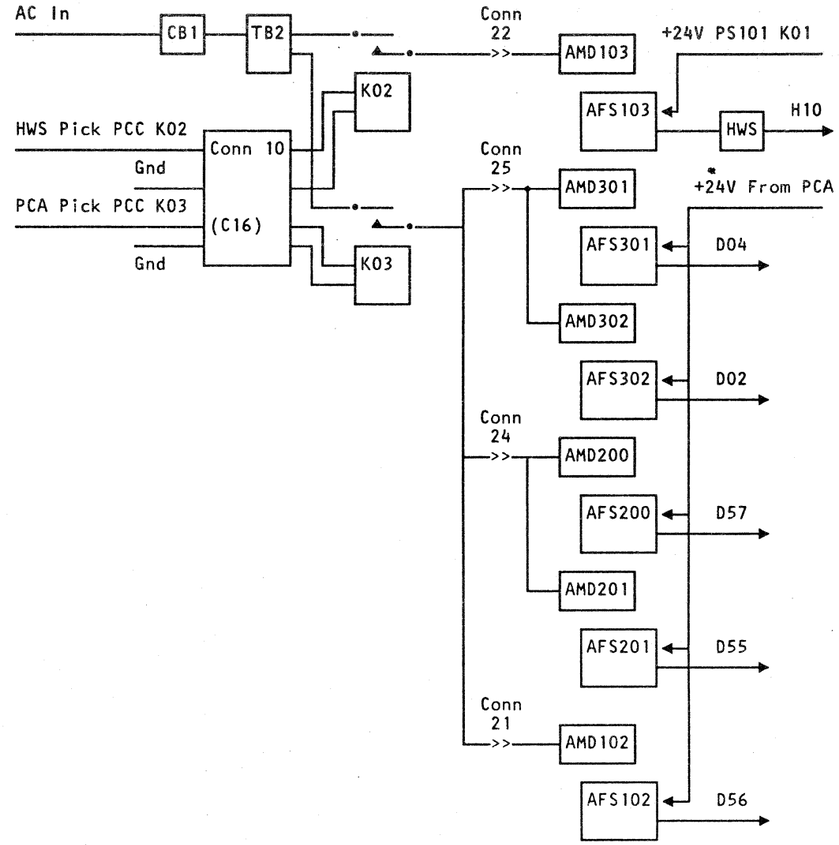
TYPICAL AIR FLOW SENSOR



AIR INLET/OUTLET SENSORS



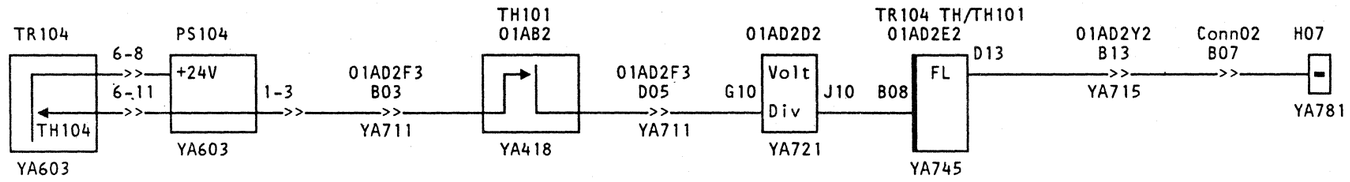
AIR MOVING DEVICES (AMDS) AND AIR FLOW SENSORS (AFS)



Axx = Analog Sensor
Dxx = Digital Sensor
Cxx = Control Line
Hxx = Indicator on CE Panel

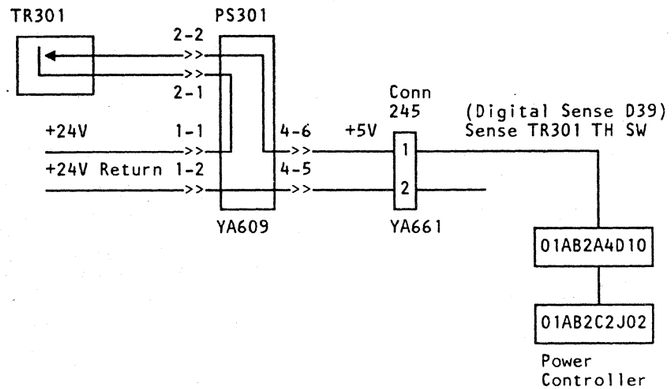
THERMALS

TR104/TH101 THERMAL



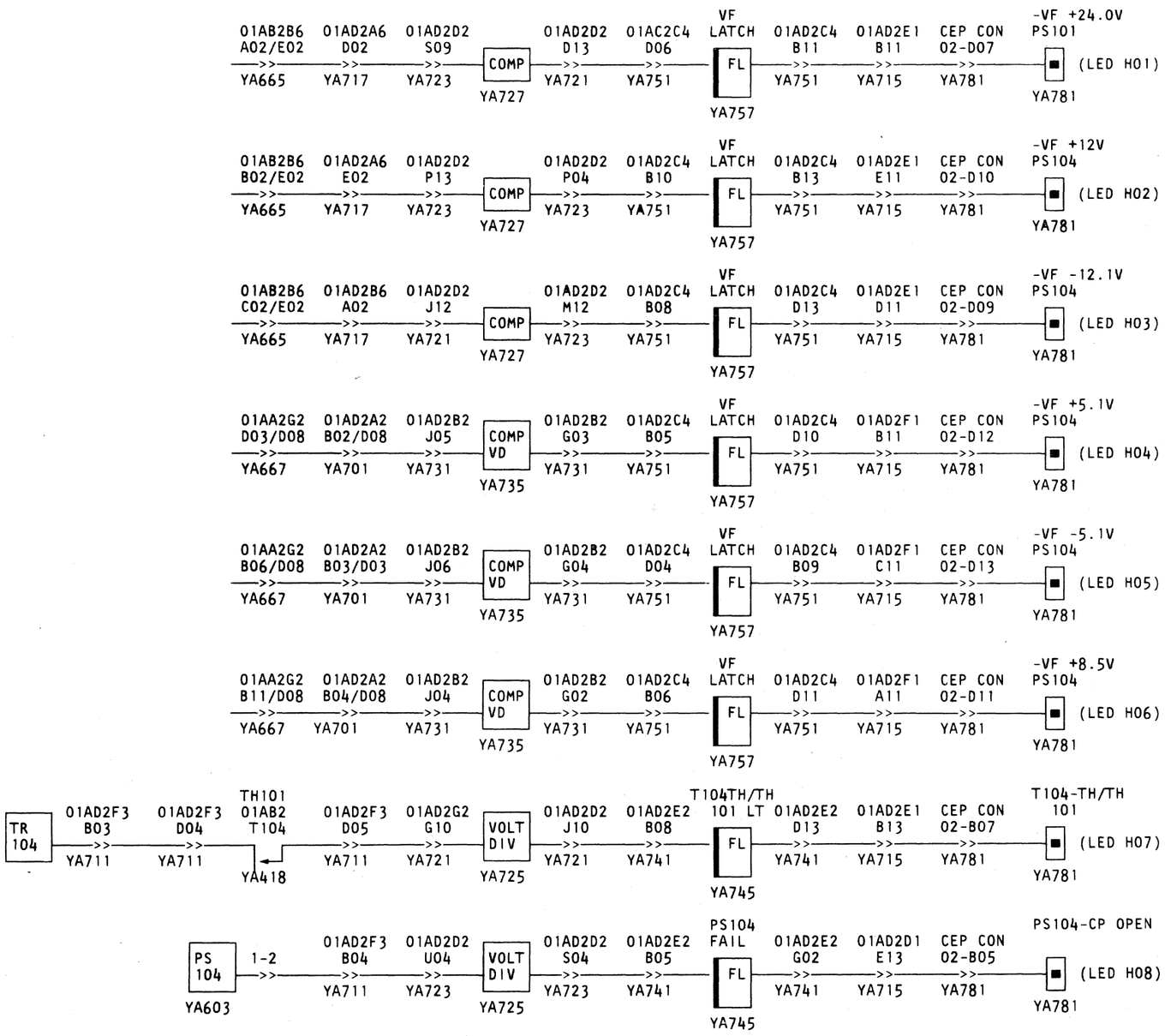
Note: +24V and +5V tolerance is ±10%.

TR301 THERMAL

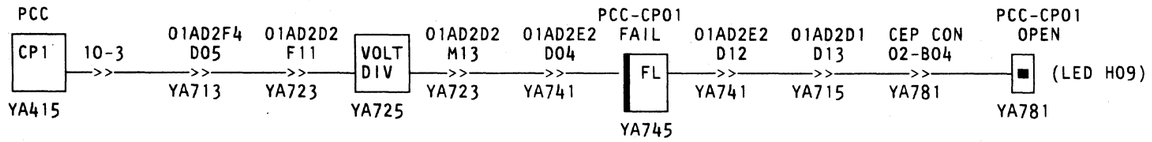


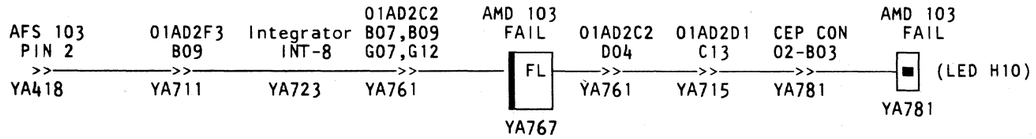
INDICATORS

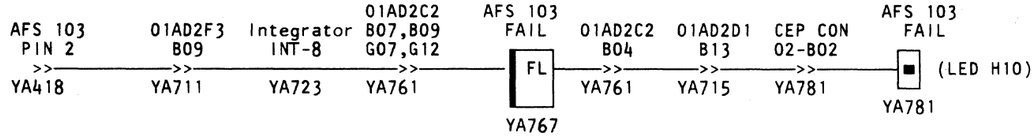
CE PANEL (CEP) INDICATORS

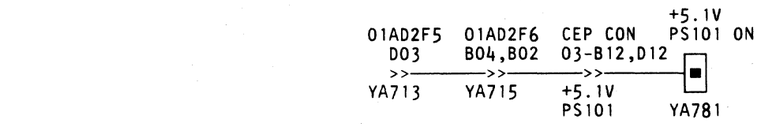


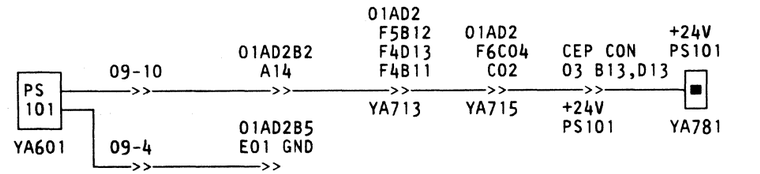
CE PANEL (CEP) INDICATORS

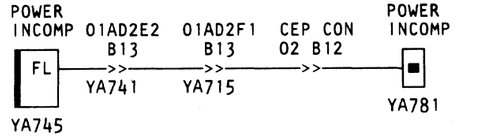


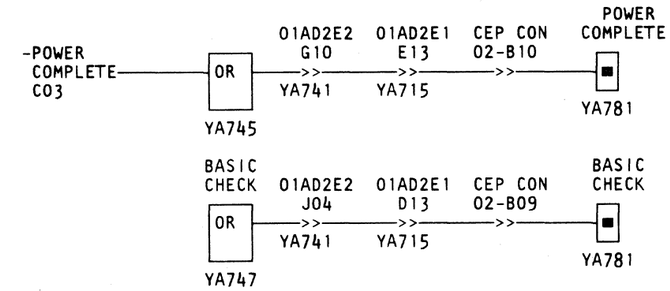






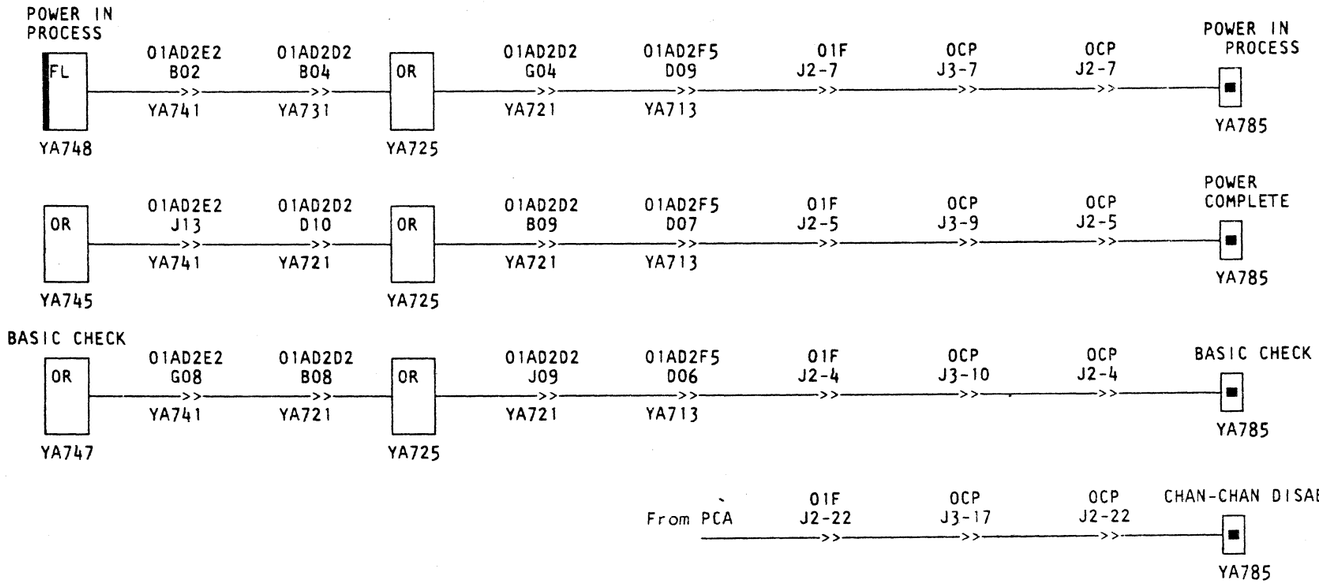




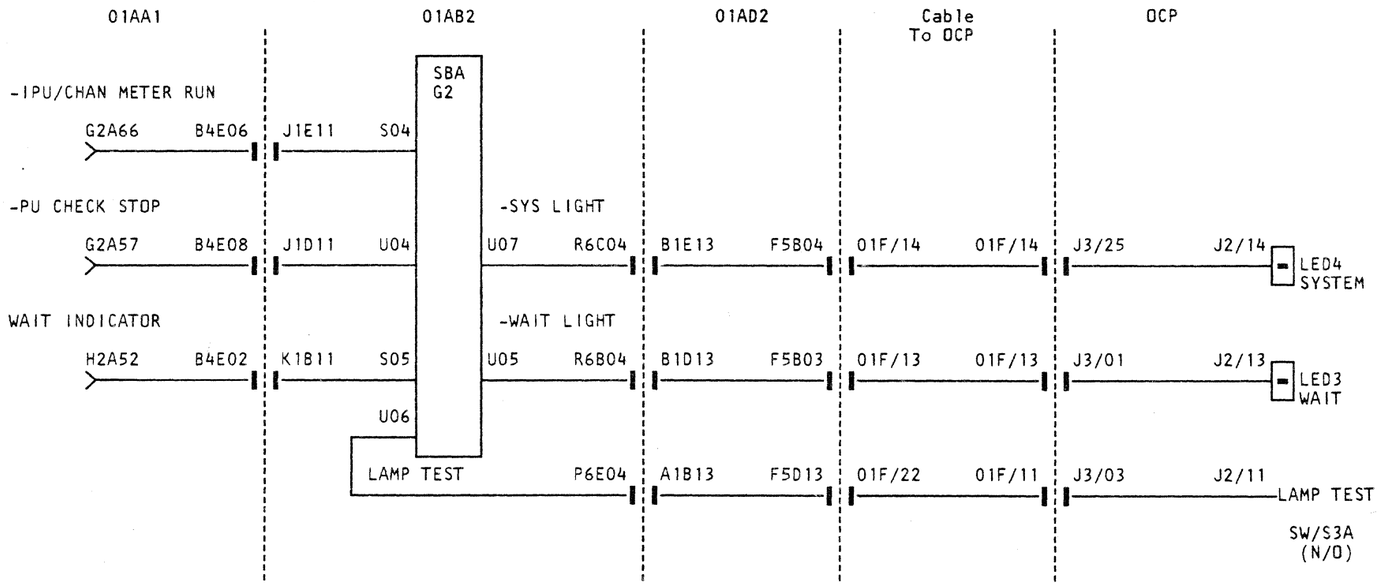


EC 379583 16Apr79 EC 376694 16Jul79	PN 5666185 2 of 2	20 260

OPERATOR CONTROL PANEL (OCP) INDICATORS



SYSTEM AND WAIT INDICATORS



Signal	Pin	Voltage Level	Result
-IPU/CHAN METER RUN -PU CHECK STOP	G2S04 G2U04	Gnd +5V	SYSTEM LIGHT ON
-IPU/CHAN METER RUN -PU CHECK STOP	G2S04 G2U04	Gnd or +5V Gnd	SYSTEM LIGHT OFF
WAIT INDICATOR	G2S05	Gnd	WAIT LIGHT ON
WAIT INDICATOR	G2S05	+5V	WAIT LIGHT OFF
LAMP TEST	G2U06	Gnd	SYSTEM LIGHT ON WAIT LIGHT ON
LAMP TEST	G2U06	+5V	SYSTEM LIGHT OFF WAIT LIGHT OFF

Note: *Lamp test will light both indicators only if power on is complete.*

STANDARD POWER INTERFACE (SPI)

For details of the Standard Power Interface (SPI) panel, see "Volume 13/16," pages 14 425 and 14 430.

POWER MICROCODE

SEQUENCING MICROCODE

Sequencing microcode executes action strings that activate control lines to power the system on or off.

The power monitor microcode runs at the same time as the sequencing microcode.

Action strings:

- Sense for analog and digital inputs off.
- Sense for analog and digital inputs on.
- Set control latches.
- Sense for initial voltage on.
- Sense for initial voltage off.
- Specify time out loops.

Masks generated by sequencing microcode describe the action expected for each sequence step.

Power monitor microcode senses if the expected response occurs as a result of the action.

If an error is sensed:

1. A reference code is displayed on the system console.
2. Affected control lines are disabled (by error action microcode).

POWER ON ACTION STRINGS

WITHOUT CTCA *	WITH CTCA *
ACTION 00 Check MSS Voltages	ACTION 00 Check MSS Voltages
ACTION 01 Check AFS and AMD	ACTION 01 Check AFS and AMD
ACTION 02 No Action	ACTION 02 Check CTCA AFS
ACTION 03 Power On Processing Unit	ACTION 03 Power On Processing Unit
ACTION 04 No Action	ACTION 04 Power On CTCA
ACTION 05 Power On I/O Devices	ACTION 05 Power On I/O Devices
ACTION 06 Power Complete Indicator	ACTION 06 Power Complete Indicator
ACTION 07 No Action	ACTION 07 No Action

* CTCA = Channel-to-Channel Adapter

POWER ON MICROCODE

Power-on microcode controls processor and I/O device power-on and is started by support processor IML.

The hard-wired sequence or pressing operator control panel (OCP) POWER ON/IML key starts a support processor IML.

POWER-OFF MICROCODE

Power-off is done in the following sequence:

1. POWER OFF key pressed.
2. Power monitor senses POWER OFF key and starts power log microcode.
3. Power log microcode starts power-off microcode.
4. Power-off microcode powers the complete system down, including the maintenance support subsystem and I/O devices.

PARTIAL POWER-UP/DOWN MICROCODE

Partial power-up/down microcode lets service personnel power up or down parts of the system.

Partial power up/down microcode is executed from the MW maintenance screen. For details, see "Partial Power Up/Down Screen (MW)" in the Maintenance Screens section of volume 16.

POWER MONITOR

The power monitor is resident microcode in support processor storage. The monitor reads all analog and digital sensors and compares (ANDs) them with a compare mask. The compare mask is determined by the system features and sequence status of system power.

During normal operation, the power monitor is executed, on the average, once every 500 milliseconds. Execution time for the monitor run is approximately 20 milliseconds.

If ANDing the sensor reading and compare mask results equals zero (no power fault), the monitor run is terminated. If the result is not zero (power fault sensed), the sensors are read and compared one more time. If both compares have a result of not zero, control is passed to the error action microcode.

ERROR-ACTION MICROCODE

The error-action microcode is resident in support processor storage. When the power monitor senses a power fault, control is passed to the error-action microcode which executes the power-down action.

If the error-action microcode loses control of the power system, the 30-second timer times out and drops all control lines, to cause power to drop immediately.

ERROR ANALYSIS AND LOGGING

The error-analysis and logging microcode reads the fault data (sensor data stored at the time of the fault) and compares it with microcode set fault patterns.

A reference code is displayed on the system console.

Extended error information is logged on the diskette by the error-analysis microcode.

During a normal power-off sequence, the error-analysis microcode logs the temperatures on the diskette.

HARD WIRED SEQUENCE (HWS)

SUMMARY

The hard wired sequence is located on gate 01A board D2 and consists of Vendor Transistor Logic (VTL) cards, a relay driver, and EMC monitor. The hard wired sequence starts and monitors power on sequencing to the maintenance support subsystem.

Next the maintenance support subsystem powers on the rest of the processor and I/O devices by executing power sequencing microcode.

A power on complete signal is sent to the hard wired sequence when:

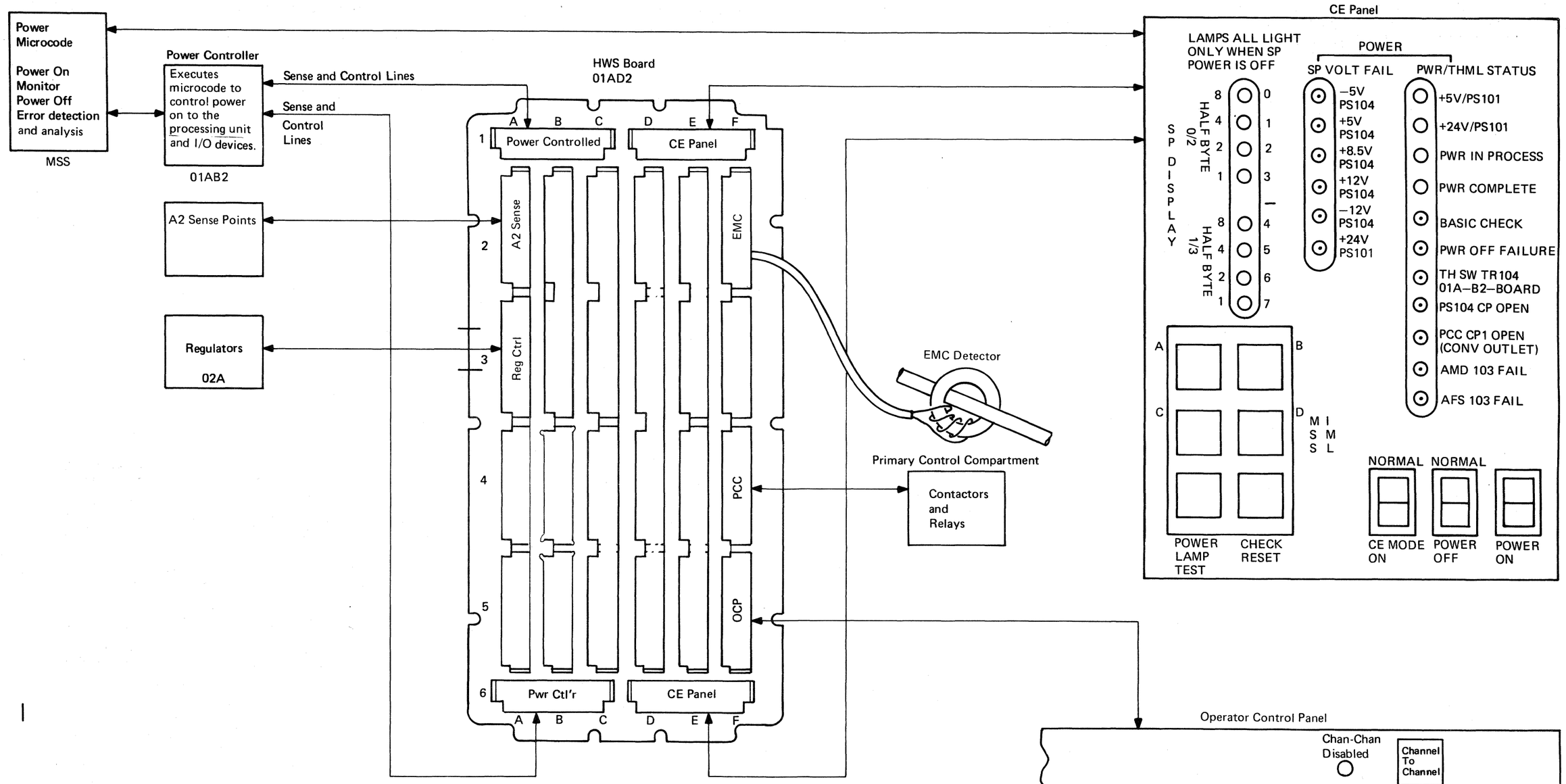
- Power on is complete to the processor.
- I/O devices are sequenced on with relay circuits.

Next the power complete indicators on the CE panel and Operator Control Panel (OCP) are turned on by the hard wired sequence.

Power MAPs and the CE panel are used to diagnose faults in the hard wired sequence and maintenance support subsystem.

For details of power on sequence, see "Detailed Power On Sequence Flowchart".

HARD WIRED SEQUENCE DIAGRAM



Model Groups 1 and 2

EC 379600 30Jun80 EC 379607 05Jun81	PN 5666188 2 of 2	20 290

ELECTROMAGNETIC COMPATIBILITY (EMC) DETECTOR AND MONITOR

The EMC detector and monitor is used to sense electrostatic discharge (ESD) and power line transients (PLT) which may cause processor faults.

The EMC detector is a ferrite core mounted in the line filter housing. The line cord passes through the ferrite core where it is monitored for noise. The noise signals are fed through a coax cable to monitoring circuits in the hard wired sequence.

The monitor is attached to the Power Controller Adapter (PCA) by two control and four digital sense lines.

ESD or PLT detected by the EMC detector are fed to a comparator. The comparator sets A to D latches depending on the level of the noise spike. An ESD sets latch A, B, C, or D. A PLT sets latch C or D.

The power controller diagnostic uses a test coil around the ferrite core connected to the hard wired sequence through conn LF2 on the line filter. Conn LF2 must be disconnected unless power controller diagnostics are run. The diagnostic (test 19) messages tell you when to connect and disconnect conn LF2. Test 19 tests the continuity of the control and sense lines and the set and reset of the four EMC latches.

The EMC monitor is enabled/disabled from the Check Control (K) screen. The two options are V and W. The V option enables/disables latches A, B, and C. The W option enables/disables latch D.

The EMC monitor is also disabled by microcode (V and W options turned off) when ten EMC incidents have occured from power-on to power-off. The count is reset to zero during power-on but the monitor is not re-enabled if previously disabled by ten incidents. The check control screen must be used to re-enable the monitor.

The EMC monitor polls when:

- The monitor is enabled from the Check Control screen (option V, option W, or both V and W).
- A system IPL is complete (IPL complete bit on in the PLDA).
- Ten EMC incidents have not occured since power-on.

EMC incidents generate four reference codes:
1EE0A008
1EE0B008
1EE0C008
1EE0D008

These reference codes do not stop the processor and are displayed along with a time stamp on the QERD screen.

EMC LATCH SET VOLTAGE LEVELS

The following charts show the lowest voltage levels that set each EMC latch. This level depends on the number of channels (bus and tag cables) connected.

EXAMPLE: Latch B with 5 channels connected sets at 2500V; latch A with 5 channels connected sets at 4500V.

ESD VOLTAGE LEVELS

Number Of Channels Connected

Latch	3	4	5	6
A	3500	4000	4500	5100
B	2100	2300	2500	2800
C	1100	1200	1400	1550
D	600	650	700	750

PLT VOLTAGE LEVELS

Number Of Channels Connected

	3	4	5	6
C	600	600	600	600
D	300	300	300	300

Voltage tolerances for the set levels are:

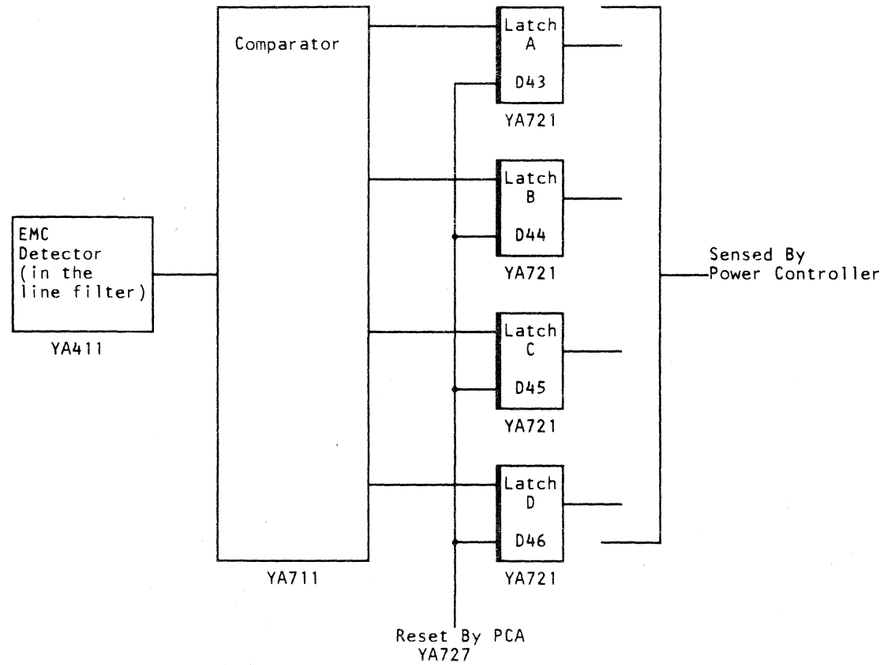
±12% for latch A
±10% for latch B
±7% for latches C and D

EMC REFERENCE VOLTAGE ADJUSTMENT

To adjust the EMC reference voltage, see MAP 1E01 (volume 2).

To adjust the HWS reference voltage, see MAP 0231 (Volume 1).

EMC DETECTOR AND MONITOR (01AD2D2)



HARD WIRED SEQUENCE CARD FUNCTIONS

01AD2B2

- Added system protect function
- IML and SP reset controlled
- Board A2 voltage sense and control circuits

01AD2C2

- Timers T1 through T4
- AMD and AFS failure latches

01AD2C4

- VF latches for PS 104 voltages
- T1 and T4 timer control
- Power off control (partial)

01AD2D2

- EMC monitor latches
- EMC test driver
- Oscillator for timers
- Lamp driver for power in process and power complete lamps on OCP.
- PS104 voltage comparator and reference voltage generation
- Voltage dividers and integrators.
- Initial reset pulse generation

01AD2E2

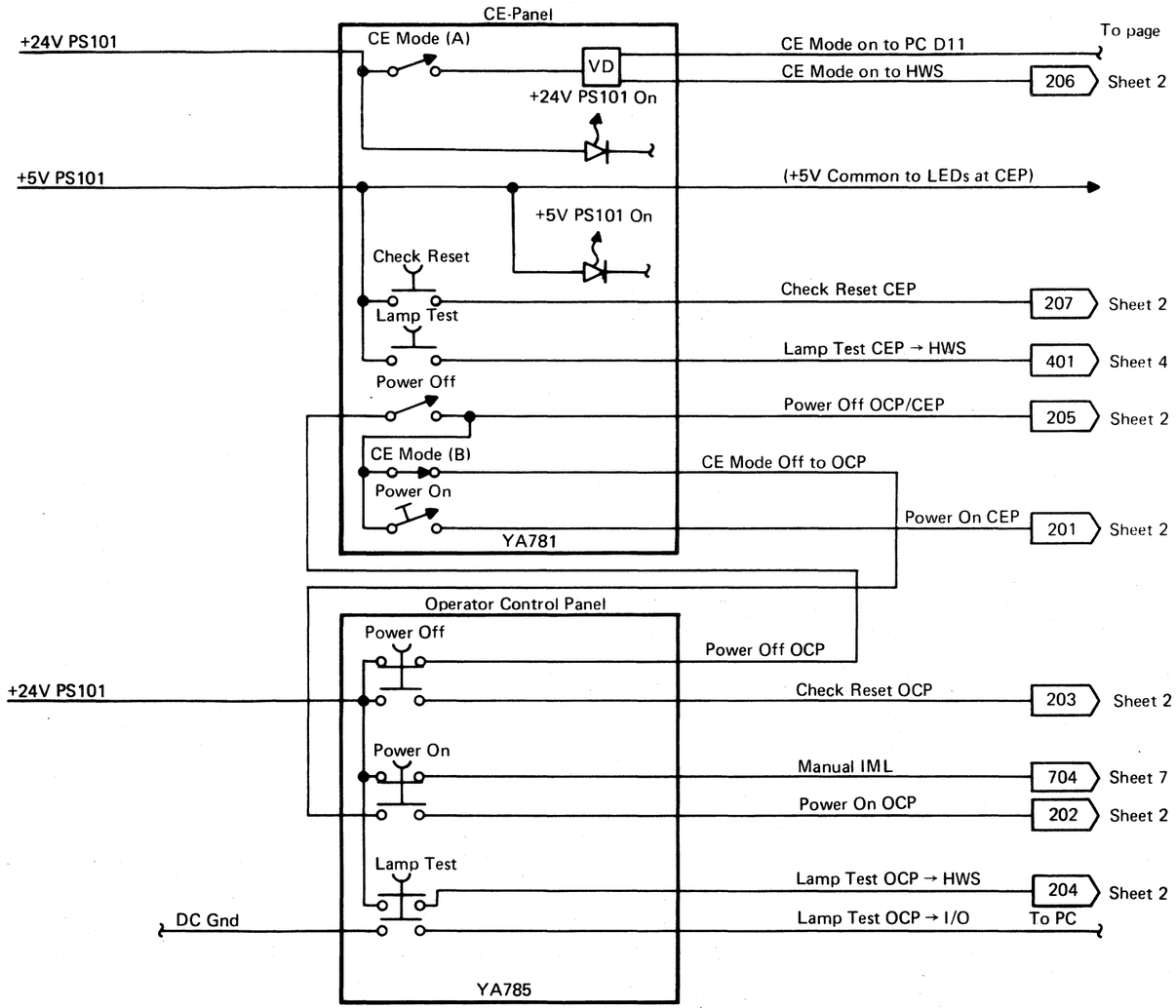
- Power on/off control
- Check reset
- Generation of reset to Support Processor and Power Controller Adapter
- LED indicator drivers

01AD2E4

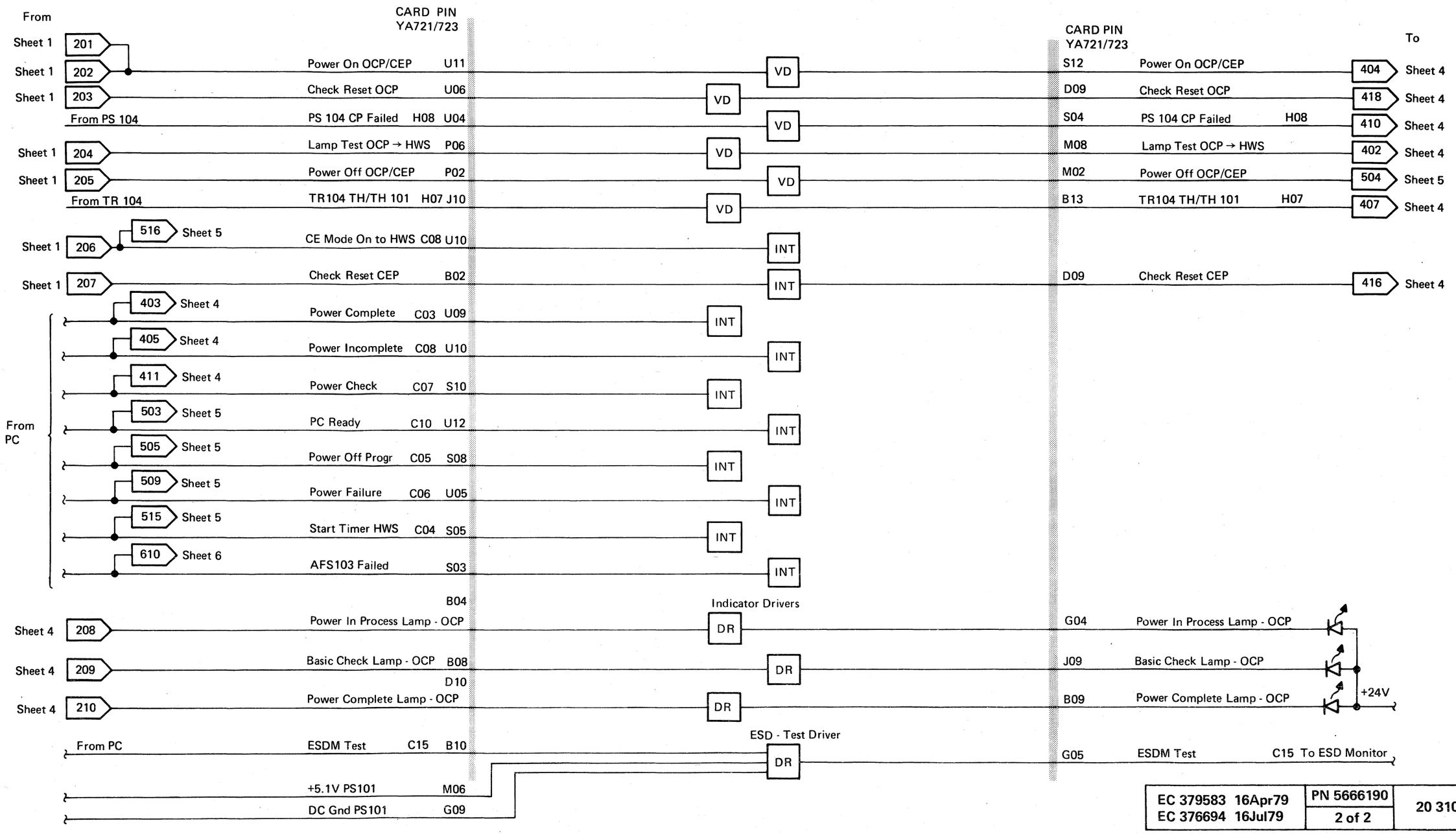
- Contactor and relay drivers

HWS SECOND LEVEL SHEET 1 OF 7

KEYS AND SWITCHES



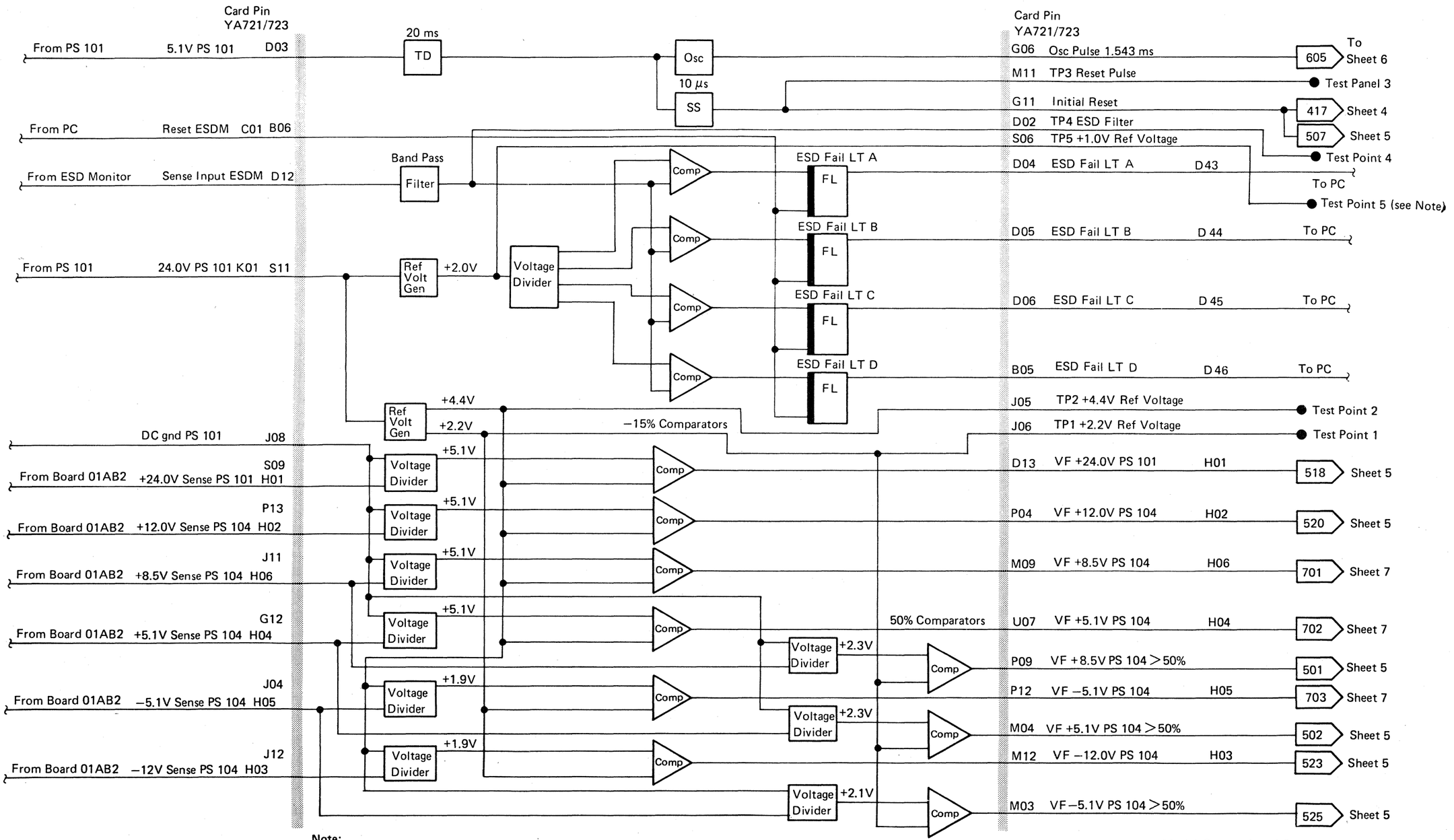
CARD 01AD2D2 (PART 1)



EC 379583 16Apr79 EC 376694 16Jul79	PN 5666190 2 of 2	20 310

HWS SECOND LEVEL SHEET 3 OF 7

CARD 01AD2D2 (PART 2)

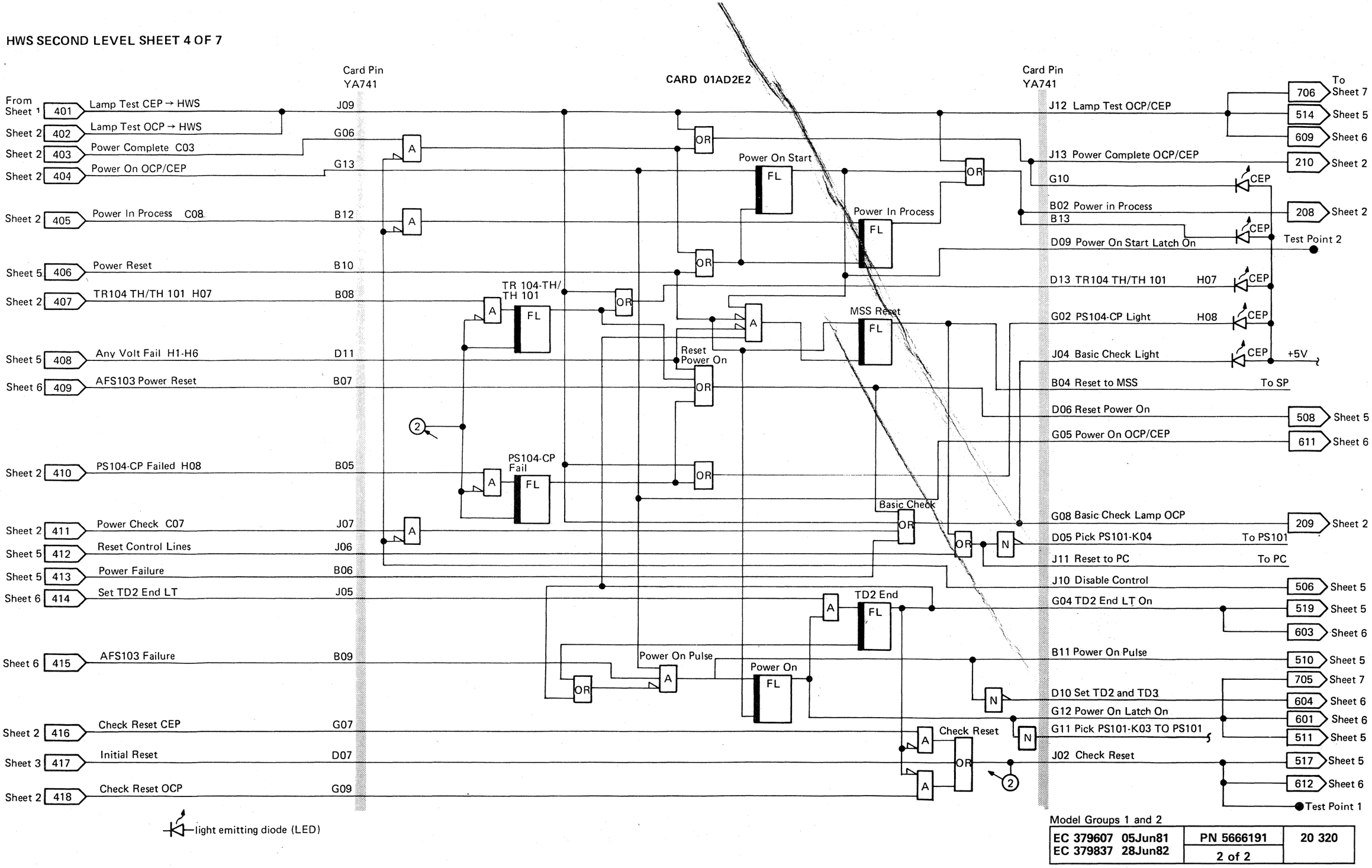


Note:
+2.0V present only when EMC monitor is active (turned on by microcode).

Model Groups 1 and 2

EC 379607 05Jun81 EC 379837 28Jun82	PN 5666191 1 of 2	20 315

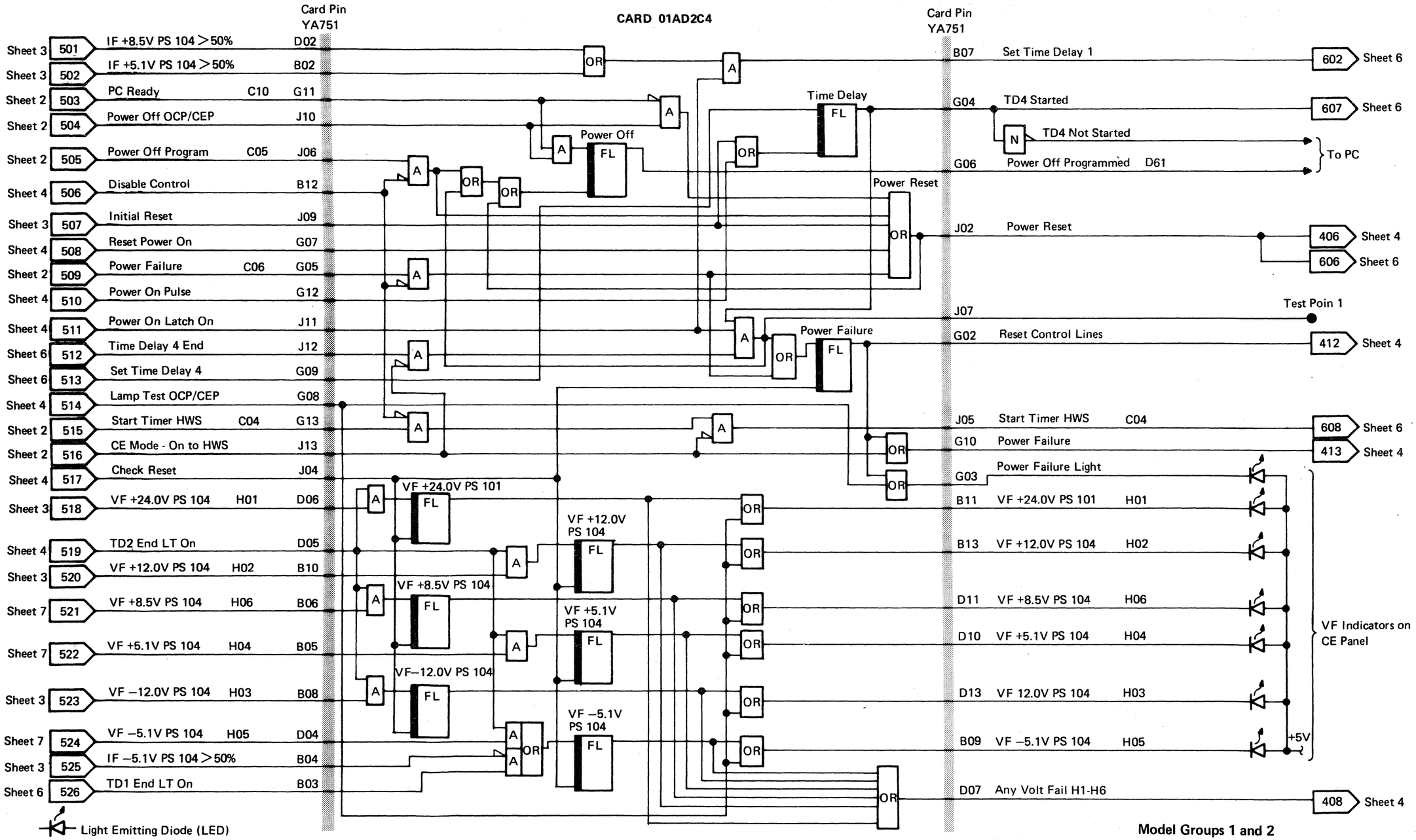
HWS SECOND LEVEL SHEET 4 OF 7



Model Groups 1 and 2

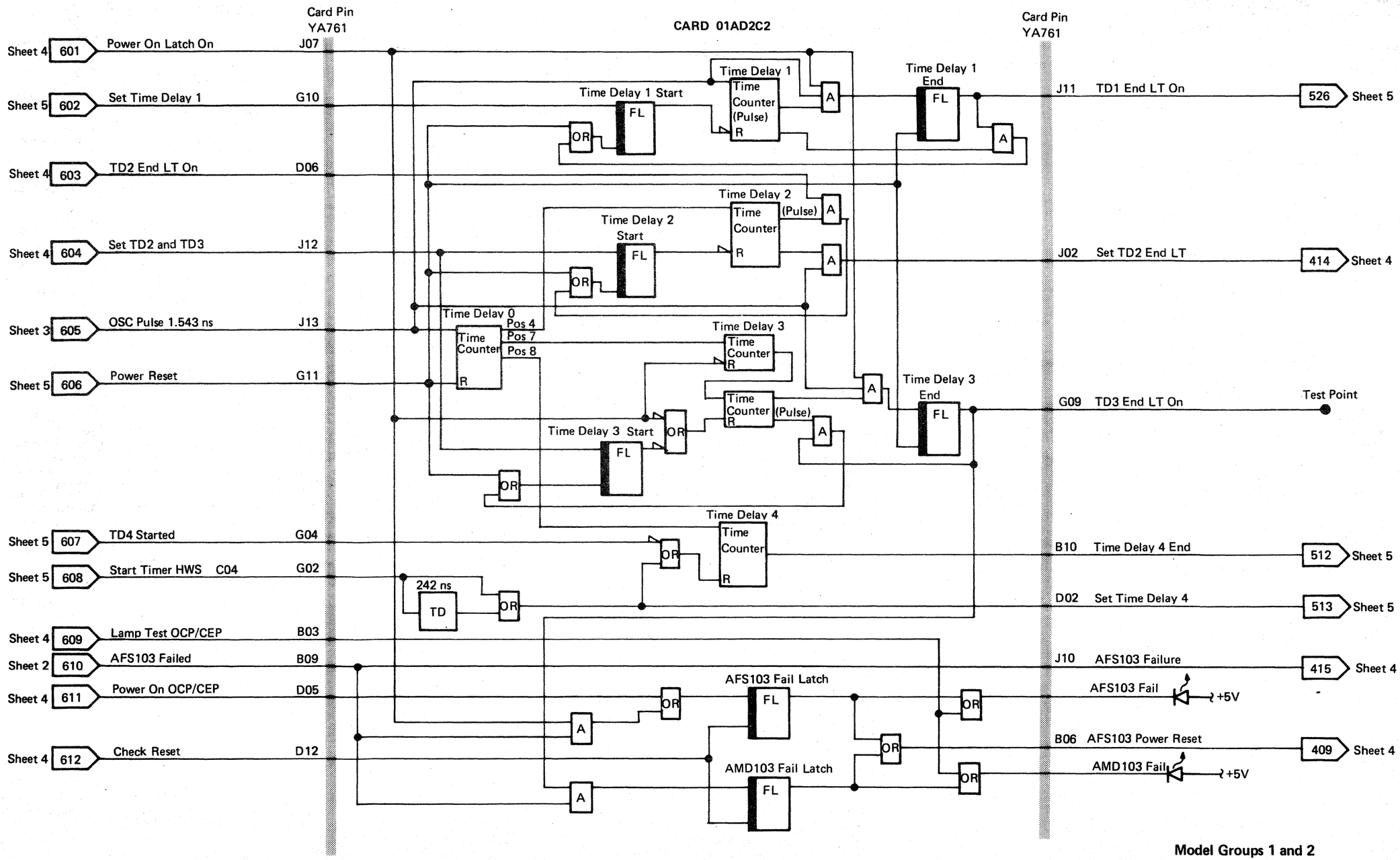
EC 379607 05Jun81 EC 379837 28Jun82	PN 5666191 2 of 2	20 320

HWS SECOND LEVEL SHEET 5 OF 7



Model Groups 1 and 2

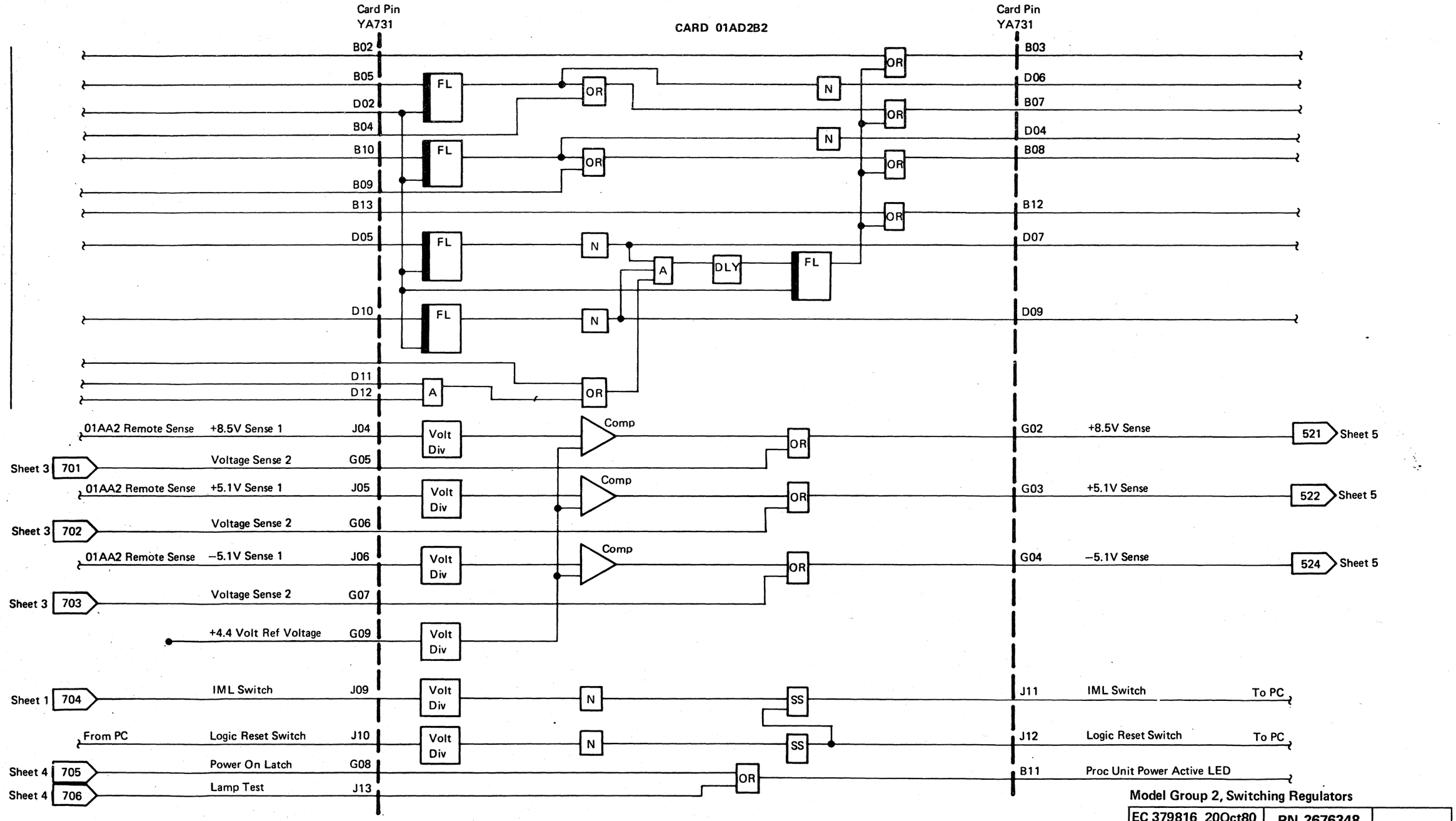
EC 379600 30Jun80 EC 379607 05Jun81	PN 5666192 1 of 2	20 325



Model Groups 1 and 2

EC 379600 30Jun80 EC 379607 05Jun81	PN 5666192 2 of 2	20 330

HWS SECOND LEVEL SHEET 7 OF 7



Model Group 2, Switching Regulators

EC 379816 20Oct80 EC 379607 05Jun81	PN 2676348 1 of 2	20 335d

HARDWIRED SEQUENCE TIMERS

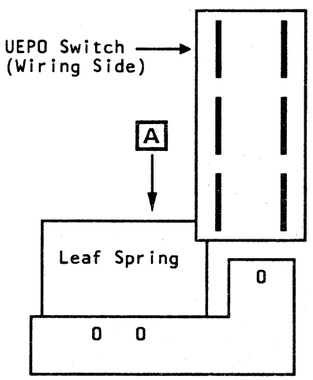
All timers shown on this page are time counters, driven by oscillator pulses.

Timer Number	Timer ms	Timer Use	Timer Start Condition	Time Of Use	Error Indication Effect On Power System
T1	394	Voltage check of -5V from PS104. Check whether -5V is equal to or greater than 50% of end value.	T1 is started when +5V PS104 or +8.5V PS104 is equal to 50% of end value.	HWS power-on Sequence.	Indication: VF -5V PS104 indicator and BASIC CHECK indicator on. Effect: Immediate power-off (drop PCC K1 and PS101 RY3).
T2	1579	Voltage check of all PS104 generated voltages. Check whether all voltages are equal to or greater than 85%.	T2 is started when POWER ON key is pressed.	HWS power-on Sequence.	Indication: VF xV PS104 indicator on. BASIC CHECK indicator on. Effect: Immediate power-off. (PCC K1 and PS101 RY3).
T3	6316	Air flow sensor check (AFS103). AFS is heated by +24V from PS101. AMD103 is started by power-on(PCC K3). 6316 ms after power-on the AFS103 error signal is checked for a not active status.	T3 is started when POWER ON key is pressed.	HWS power-on Sequence.	Indication: AMD103 FAILURE indicator on. BASIC CHECK indicator on. Effect: Immediate power-off without sequencing.
T4	30,000	Thirty second timer. T4 powers processor down when power monitoring cannot be performed (SP, PC, or control microcode problem).	T4 is reset every 500 ms during power monitoring loop of SP microcode.	T4 is used continuously during processor operation. NOTE: Timer is not active in CE mode.	Indication: BASIC CHECK and POWER OFF FAILURE indicators on. Effect: Power-off without sequencing except PS104 stays on.

UNIT EMERGENCY POWER OFF (UEPO) SWITCH RESET

To reset the UEPO switch, pry or pull the leaf spring (at point A) toward the wiring side of the UEPO switch and reset (turn on) the switch.

UEPO SWITCH ASSEMBLY (REAR VIEW)



POWER CONTROLLER ADAPTER (PCA)

The power controller adapter attaches to the SP bus of the maintenance support subsystem (MSS). It is a byte-wide, asynchronous adapter that operates in single-byte mode. The adapter is on three cards located at 01A-B2C2, D2, and E2.

This adapter permits two-way communication between the power and environmental subsystem and the MSS. The PCA operates in either interrupt or polling mode, as instructed by the data being handled.

Through the power adapter, the MSS controls power on/off sequencing, monitor power overvoltage and overcurrent conditions, and monitor thermal, airflow, and EMC sensors throughout the Processor.

The PCA is checked by diagnostics that are automatically invoked during the normal processor initial microcode load (IML) process.

The MSS adapter card performs SP addressing and tag functions, command decode, interrupt generation, parity generation and checking, and basic status functions.

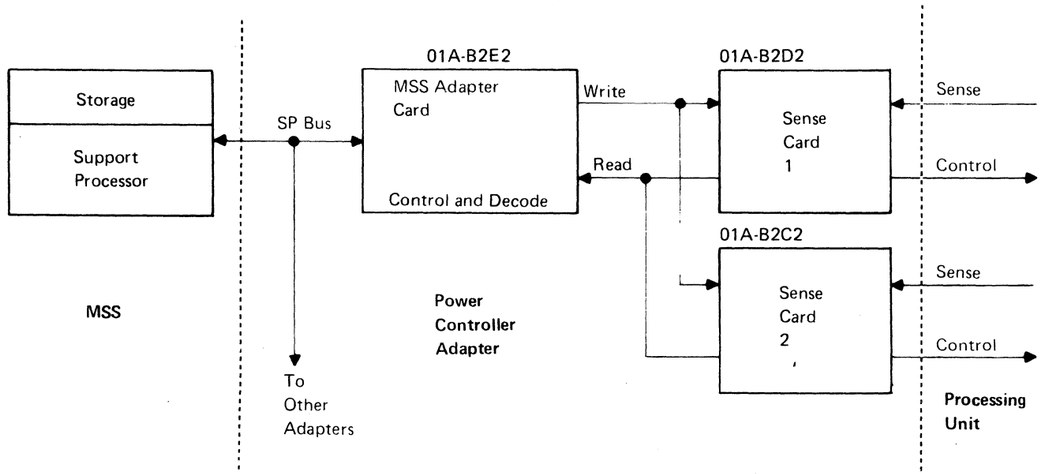
The sense cards contain circuitry that performs control functions and digital and analog sensing. The sense cards contain an 8-bit digital-to-analog converter (DAC) that permits voltage and temperature monitoring and measurement.

Each sense card has:

16	Control Outputs
32	Analog Inputs to DAC
27	Digital Inputs
4	Fixed Threshold Inputs

Control signals are generated from control latches in the power controller adapter. Some control signals are used to pick relays and to turn on series regulators. Others generate the input signals to the digital-to-analog converter. Only the support processor (SP) can set the control latches. However, they can be reset by the SP, power-on reset, or by the timeout signal.

POWER CONTROLLER ADAPTER BLOCK DIAGRAM



MSS ADAPTER CARD

Data on the SP bus (B0) from the support processor is loaded into the write bus register A when any tag is active B.

The PCA write bus C distributes the data to the power controller adapter (PCA).

PCA selected D is activated when:

- Write bus data has good parity.
- Tag line "TAC" is active.
- Address on the write bus matches the wired address of the PCA (hex 85).

Next, the command is sent to the MSS adapter card from the support processor.

The command register E is set when:

- PC selected is active.
- Tag line "TC" is active.
- Write bus data (command) has good parity.

The command register is checked (for a valid command), and decoded to generate select lines for the sense and latch modules used in the power controller adapter.

A invalid command sets command check and generates an interrupt request to the support processor.

Write Command

The "write strobe" F is generated when:

- A valid write command is decoded. (A write command to a sense module is not valid.)
- Write command data has good parity.
- Tag line "TD" is active.

All latch modules G are connected to the PCA write data bus and command register bits 5 and 6. Write data is loaded into the latch module selected by bits 5 and 6.

If an invalid command is loaded into the command register, no write strobe is generated and the "machine check" and "command check" latches are set.

If the write data has a parity check, no "write strobe" is generated and the "machine check" latch is set.

Read Command

In a read operation, any valid address can be put into the command register. When selected, the sense and latch modules place their contents on the PCA read bus H. This includes the latch register on the MSS adapter card which contains the status register.

The PCA status register has the following information:

- Machine check
- Command check
- Interrupt request
- Interrupt request enable

Command register bit 7 (ON) indicates a Read command and gates the sense and latch module contents into the read bus register I.

The read bus register contents are gated on the support processor SP bus (B1) J when tag line "TC" goes to not active.

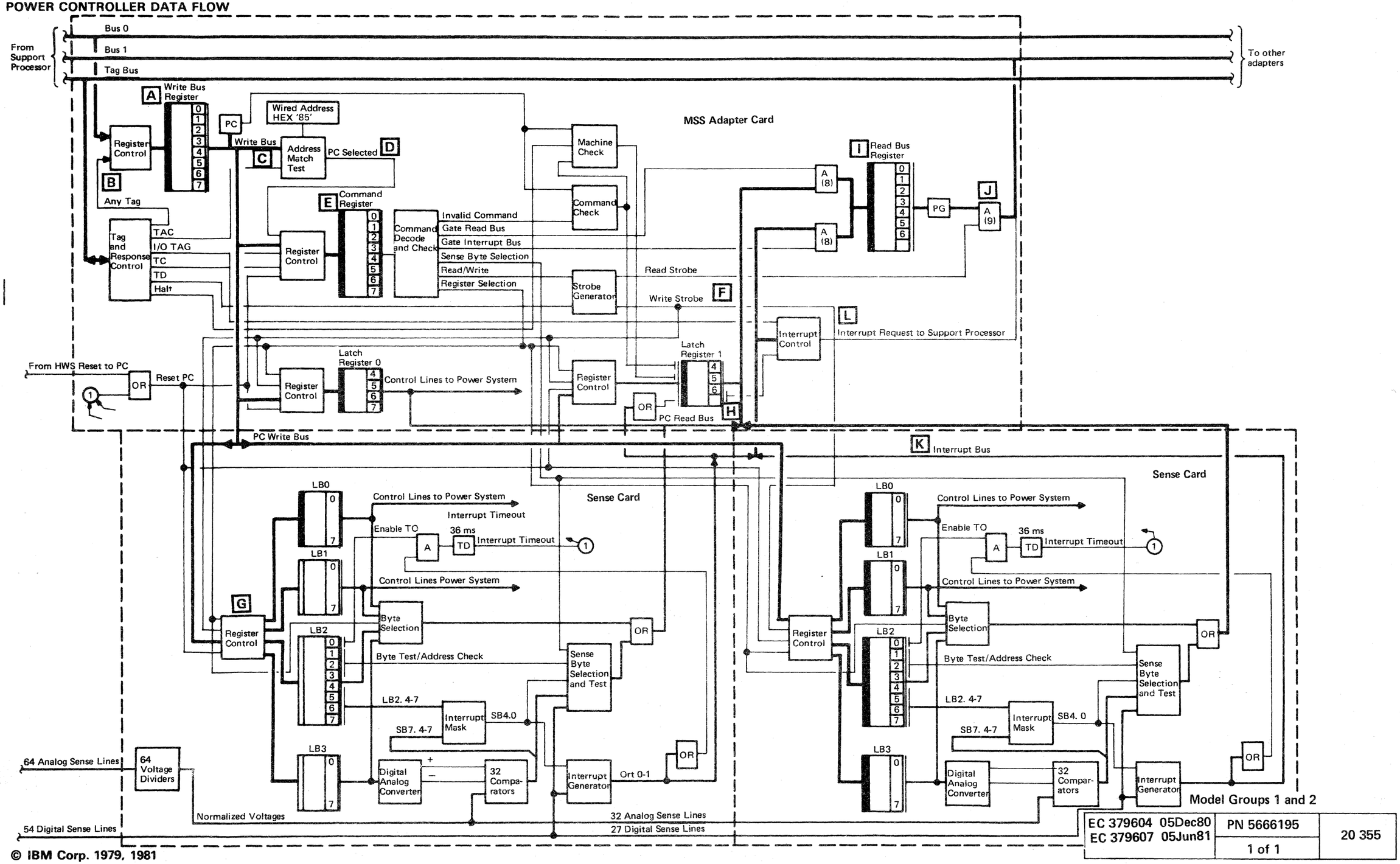
Interrupts

When a fault condition exists in the power system, the PCA generates an interrupt to the support processor.

Each sense module drives one line (maximum eight) of the interrupt bus K. The interrupt lines are ORed and the result sets interrupt request to the support processor L.

The latch module containing the status register also has four (4) power system control lines.

POWER CONTROLLER DATA FLOW



Model Groups 1 and 2

EC 379604 05Dec80 EC 379607 05Jun81	PN 5666195 1 of 1	20 355

SENSE CARD

Sense cards contain circuits that perform control, digital, and analog sensing. The digital-to-analog converter (DAC) monitors voltage and temperature with an accuracy of ±1%.

The power controller adapter uses two sense cards.

Sense card contents per card.

Control outputs	16	lines for external control
	8	lines for DAC control
	4	lines for adapter testing
	4	lines for interrupt masking
Analog inputs	32	input to DAC
Digital inputs	27	inputs to latch modules
Fixed threshold inputs	4	inputs to fixed reference comparators

In addition, the MSS adapter card has four control lines.

External Control and Sensing

Each sense card has 16 latched control outputs that are used to operate power supply on/off controls, relay drivers, and other power controls.

The control outputs are in two groups of eight lines each. One write operation can concurrently change the status of any number of lines in a group.

Sensors

Digital

Digital sensors determine the status of:

- Circuit breakers
- Circuit protectors
- Overvoltage signals
- Overcurrent signals
- Undervoltage signals
- Thermal devices
- Contactor/relay auxiliary points
- Air moving devices (AMDs)

Sense card inputs are grouped into four bytes:

- One byte of 6 bits
- Three bytes of 7 bits each

The remaining bits are for diagnostic purposes.

Analog

Analog sensors measure values needing level information, such as board voltages and temperatures.

Analog level information is converted to digital signals by comparator circuits in the PCA.

Fixed Compare

Fixed compare analog sensors are a combination of analog and binary sensors. A fixed reference voltage is used instead of the DAC because of increased speed and reliability needs.

Each sensor input has a special reference and comparator. The analog signal goes to one input of the comparator and the reference to the other input. When the analog level is equal to or more than the reference, the comparator generates a signal. The signal is binary: ON if the analog input is equal to or more than the reference, and OFF if less than the reference.

This type of sensor is primarily used to monitor for undervoltage conditions. A down-level indicates a fault condition, and an up-level indicates normal operation.

Control Signals

Control signals are generated from control latches in the PCA. Control signals pick contactors, turn on series regulators, and supply input signals to the DAC. Control signals are also used to connect to the HWS, and to test the hardware in the PCA.

Only the support processor can set control latches.

Control latches can be reset by:

- Support processor commands (all latches)
- Power-on reset (all) latches
- Timeout signal resets all control latches driving contactors and series regulators.

Monitoring Hardware

The power parts that are monitored and controlled by the Power Controller Adapter are:

Parts	Control Line	Digital Monitor	Analog Monitor	Thermal Monitor
Circuit Breaker		X		
Circuit Protector		X		
Contactors	X	X		
Ferro Supplies		X	X	X
Series Regulators	X	X	(*)	
Logic Boards			X	X
Hardwired Sequence	X	X		
EMC		X		
Air Moving Devices		X	X	X

* Not generally used.

Circuit Breakers and Circuit Protectors

- Auxiliary contacts are monitored by digital sensors. Breakers/protectors protecting the same transformer are generally wired in series and monitored by one sense line.

Contactors

- Contactors are picked and dropped by special PCA control lines.
- Monitoring contactor status is done with digital sensors.

Ferroresonant Power Supplies

- Thermal sensing is done with digital sensors.
- Output voltages (dc) are monitored with analog sensors (usually at the load).
- Power supplies are controlled by contactors.

Series Regulators

- Regulators are turned on and off by control lines from the PCA.
- Overvoltage, current limit, and undervoltage sensing is performed internally in the regulator. The status of these (ON or OFF) is monitored by digital sensors. The series regulator latches the overvoltage signal. Reset is done by removing the remote start signal. The overcurrent (OC) present. For high current levels, added system protect card on board D2 latches OC signal to the power controller adapter and turns that level off (secondary circuit protection).
- Regulator bulk and bias voltages are monitored by analog sensors.

Logic Boards

- Board voltages are monitored by analog sensors.

CE Panel

- Control lines connect to hardwired sequence circuits.
- Digital sensors connect to hardwired sequence circuits.
- Board voltage (01AD2) monitored by analog sensors.

EMC Sensing

- Sensing latches (4) monitored by digital sensors.

AMDs (Air Moving Devices)

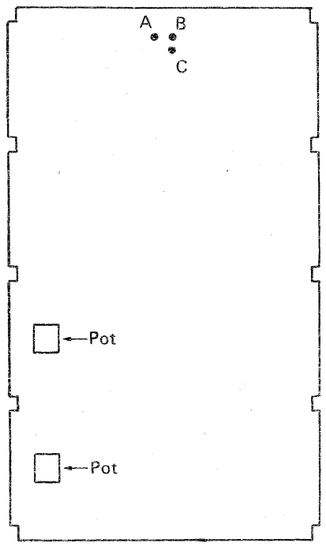
- Air flow is monitored by digital and analog sensors.

Thermals

- Thermals are monitored by digital and analog sensors.

SENSE CARD JUMPERS

Install jumper from A to B on cards in locations 01AB2C2 and 01AB2D2.



VOLTAGE MONITORING

During normal system operation the support processor (SP) performs a voltage monitoring routine, about 7 ms in length, approximately every 500 ms. During these 500 ms no voltage monitoring is possible because the SP microcode performs other jobs. Some voltages do not permit a gap of 500 ms for voltage monitoring. These critical voltages generate an interrupt request to the SP if the voltage drops below the microcode-set limit of the normal value.

Interrupt Generation

(The key symbols refer to the key symbols in the diagram.)

At the end of each voltage monitoring routine, a bit pattern for a voltage tolerance is written into LB3 of each sense card **A**. The output of LB3 is the digital input for the digital analog converter (DAC).

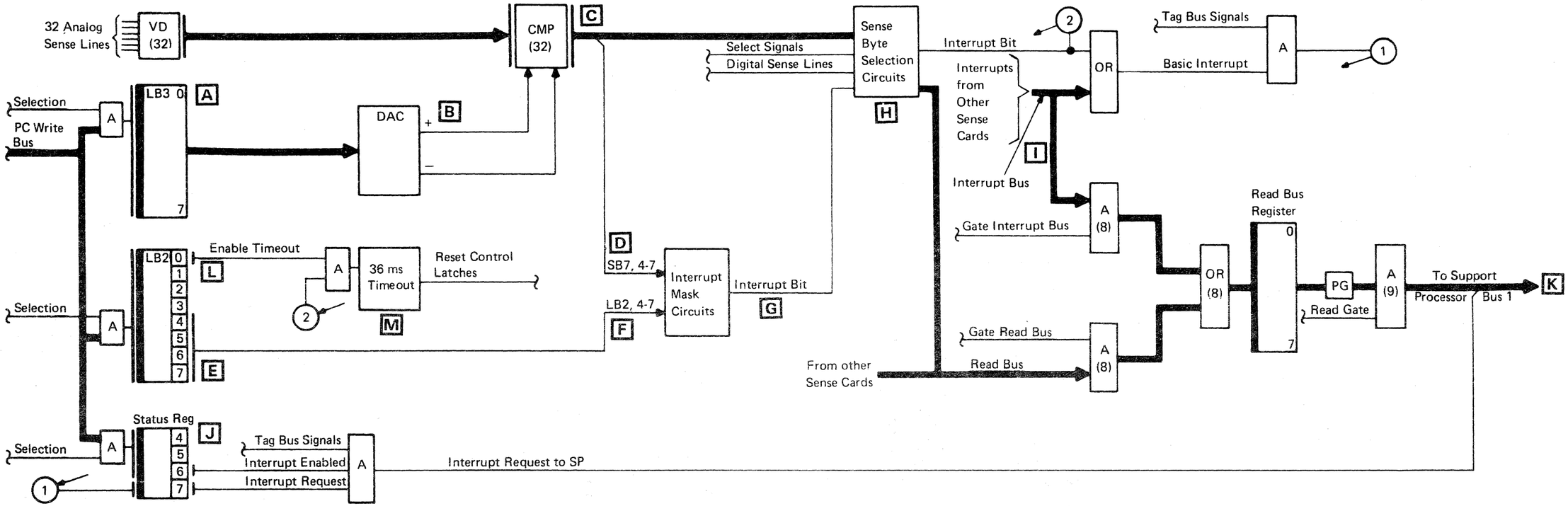
B The DAC generates a voltage that is determined by its digital input. The DAC output is used by the 32 comparators **C**. The comparators compare the voltages from the sense points with the voltage generated by the DAC, but the compare result is not sent to the SP because the SP microcode is performing other jobs at this time. The comparator output of four important voltages per sense card (which must be continuously checked) is also wired to the interrupt mask circuit **D**. A four-bit mask is written into LB2 bits 4 through 7 **E** and the output of bits 4 through 7 is also connected to the mask circuit. If any of the monitored voltages drops below the limit (determined by the digital DAC input), the comparator output changes its level. If an interrupt request from this voltage is permitted by the mask in LB2 bits 4 through 7 **F**, the interrupt mask circuit activates an interrupt bit **G**. The active interrupt bit passes the sense byte selection circuits **H** and goes on the interrupt bus **I**. Any active bit on the interrupt bus sets the interrupt bit 7 in the status register.

An interrupt request **J** to the support processor is only possible if a preceding SP operation control microcode steps have enabled an interrupt request by setting bit 6 in the status register.

If status register bits 6 and 7 are on, an interrupt request to the SP is generated **K**. During interrupt handling, the SP operation control microcode gets more detailed error information from PCA senses. When an interrupt bit is activated and the timeout bit 0 in LB2 is on **L**, the 36-ms timeout circuit is started **M**.

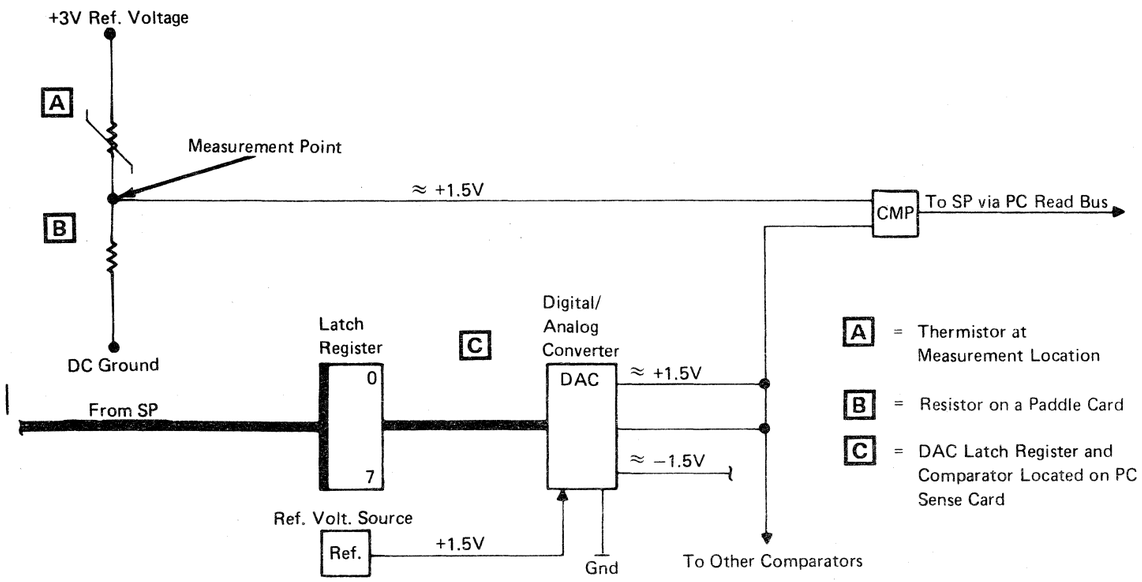
If the interrupt request to the SP is not handled in 36 ms, all PCA control latches are reset. This function has the same effect as immediate power-off. PS101 and PS104 remain powered on. The 36-ms timeout circuit is used as an additional timer to ensure machine power-off in case of SP, PCA, or SP bus problems.

VOLTAGE MONITORING



TEMPERATURE MEASUREMENT

The air inlet and outlet temperatures are measured by the Support Processor (SP). The temperature measurement uses a thermistor, wired as shown.



A = Thermistor at Measurement Location

B = Resistor on a Paddle Card

C = DAC Latch Register and Comparator Located on PC Sense Card

The voltage at the measurement point changes with the resistance of the thermistor. Approximately +1.5 volts represents the normal temperature of the thermistor.

To read the temperature, the SP addresses the latch register of the power controller and writes a bit pattern into it. This bit pattern, causes the digital-to-analog converter (DAC) to generate an analog output of approximately +1.5V. The DAC output voltage changes with the different bit patterns at the DAC input. The DAC output voltage is compared with the voltage from the measurement point by a hardware comparator. The comparator output, binary signal, is sent to the SP via the PCA Read Bus. The SP performs a string of measurements and compares the results with stored tables to determine the normal temperature of the thermistor.

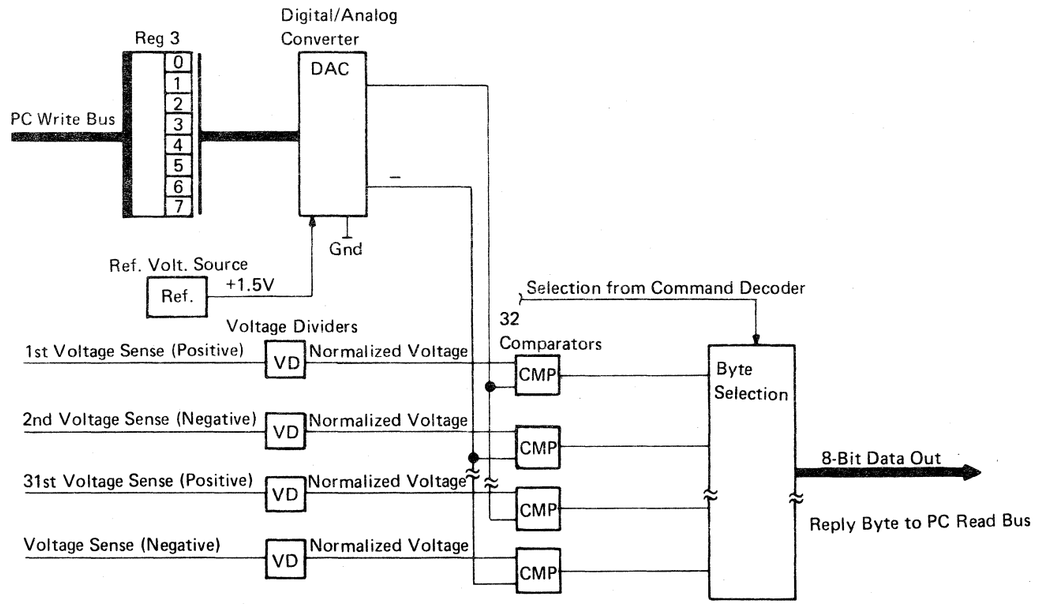
ANALOG MEASUREMENT

Analog data (voltages and temperatures) is measured by the PCA with the aid of a digital-to-analog converter (DAC) and comparators.

The analog data to be sensed is decreased to 1.5V by voltage dividers. If the sensed voltage is equal to the normal voltage, the output of the voltage divider is 1.5V. If the sensed voltage is higher or lower than the normal voltage, the decreased voltage (through the voltage divider) is also higher or lower than 1.5V. The positive or negative voltages from the voltage dividers are compared by the comparators with the positive and negative voltages from the DAC. The positive and negative voltages from the DAC are determined by the bit configuration of latch byte 3 (contents of register 3) at DAC entry. The positive and negative DAC output always has the same voltage with reference to ground, and is available at the same time.

To determine the real value of a voltage, a string of compares with different DAC settings is necessary. The result of each compare is read and analyzed by the support processor's operation control.

ANALOG MEASUREMENT CIRCUIT (TYPICAL)



Model Groups 1 and 2

EC 376694 16Jul79 EC 379607 05Jun81	PN 5666197 2 of 2	20 380

INTEGRATED POWER SYSTEM (IPS)

The integrated power system (IPS) is located on board 03AA2 (CTCA). The voltages generated by the IPS are +1.25V, and -3.0V. Power-on and power-off is controlled by remote start signals (control lines) from the power controller adapter (PCA). Each voltage is generated by one or more pluggable power modules (SMS-type card).

POWER MODULES

The power modules are series regulators with two heatsink-mounted power transistors. They are controlled by circuits located on the control cards.

CONTROL CARDS

Each voltage level has its own control card. The control cards, located to the left of the power modules, contain additional circuits for overvoltage (OV), undervoltage (UV), and overcurrent (OC) sensing. The error signals OV, UV, and OC are latched on the card and activate digital sense lines to the PCA. Each active digital sense line generates an interrupt request to the support processor (SP) via the PCA and starts a timeout circuit on the PCA sense card. The control microcode branches to the interrupt microcode and to the power error action microcode. If the PCA interrupt request is not handled in 16 milliseconds, the timeout circuit on the PCA sense card powers down the complete system.

OVERVOLTAGE PROTECTION

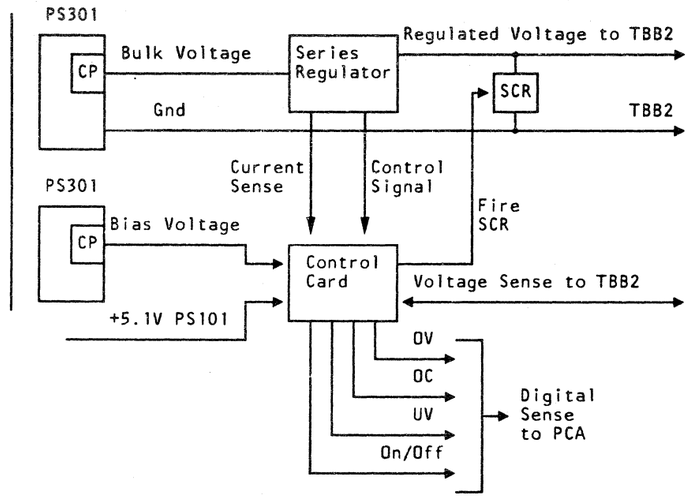
Protection circuits are installed to prevent parts damage of the logic circuits in case of overvoltage from a power module. The protection circuit is a silicon-controlled rectifier (SCR) for each IPS generated voltage. If an overvoltage condition is sensed, the comparable SCR is fired (by the control card) to short the IPS output. This may trip the comparable CP in PS301 and causes UV and OC sensing by the IPS control card. To prevent damage to the power module if no CP in PS301 trips, the power module operates in current-limit mode after the SCR has fired.

VOLTAGE ADJUSTMENTS

Each IPS voltage can be adjusted by a potentiometer on the comparable control card.

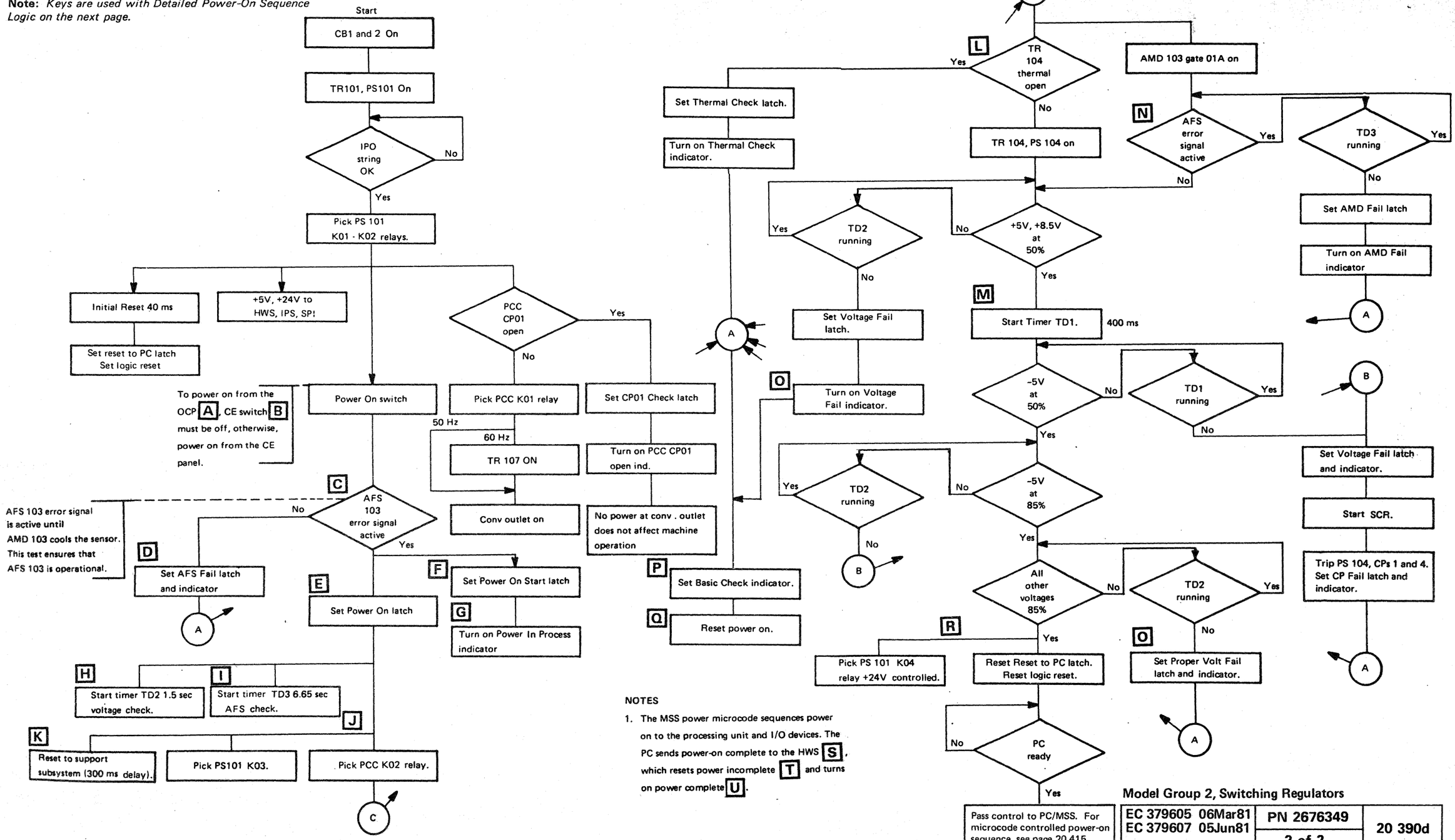
For adjustment procedure, see MAP 1003, Entry Point A.

IPS PRINCIPLE



DETAILED POWER-ON SEQUENCE FLOWCHART

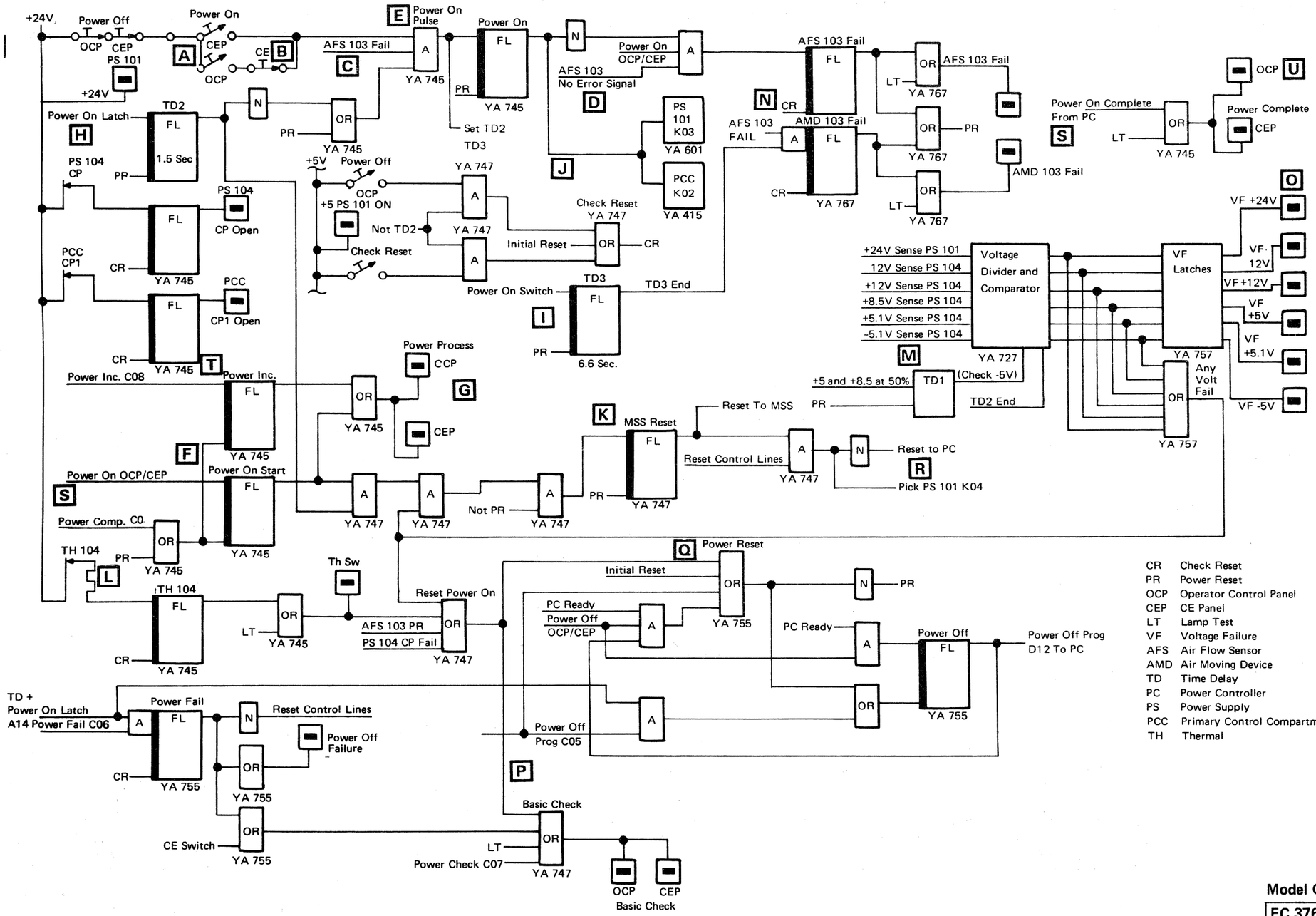
Note: *Keys are used with Detailed Power-On Sequence Logic on the next page.*



NOTES

1. The MSS power microcode sequences power on to the processing unit and I/O devices. The PC sends power-on complete to the HWS S, which resets power incomplete T and turns on power complete U.

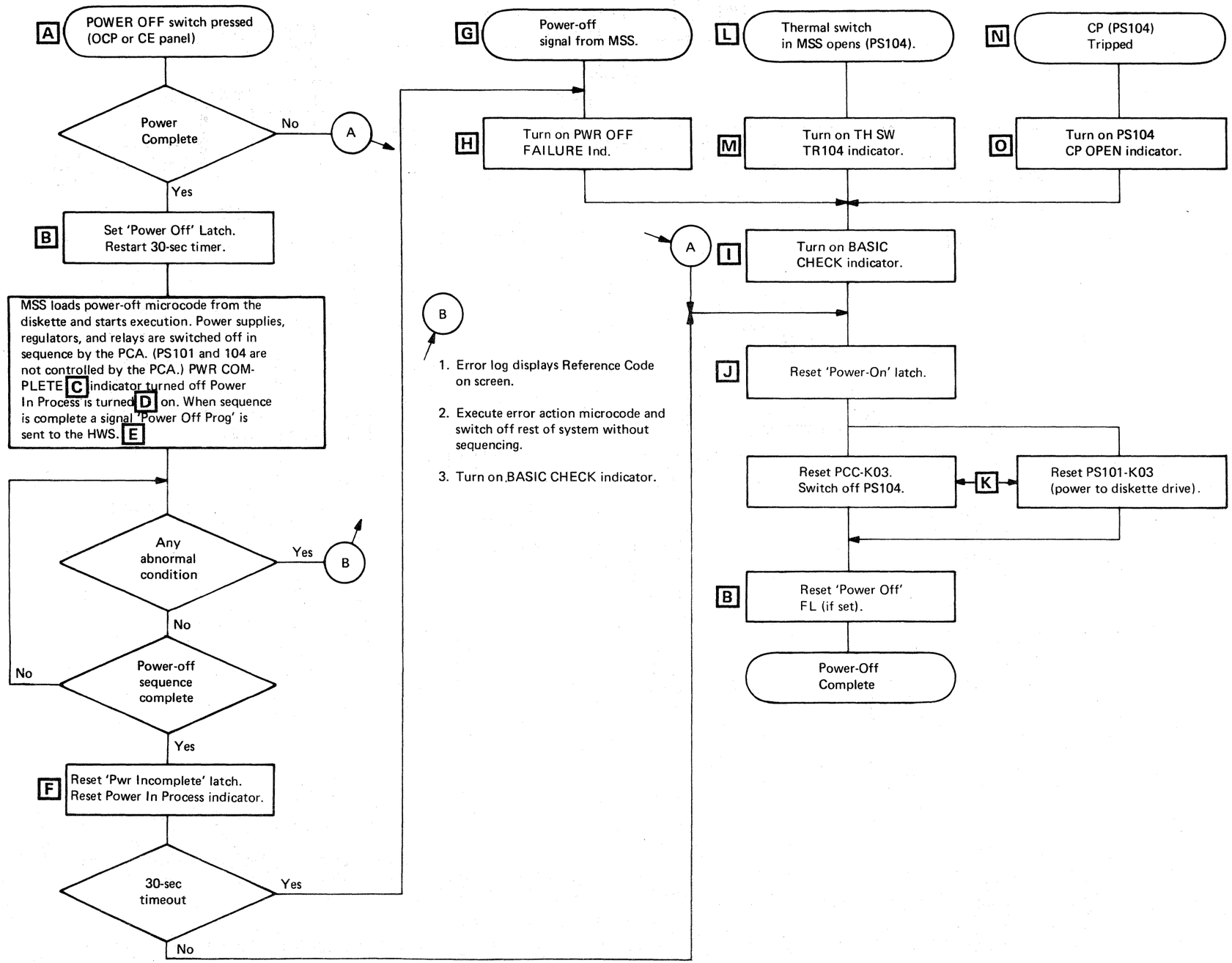
DETAILED POWER-ON SEQUENCE LOGIC



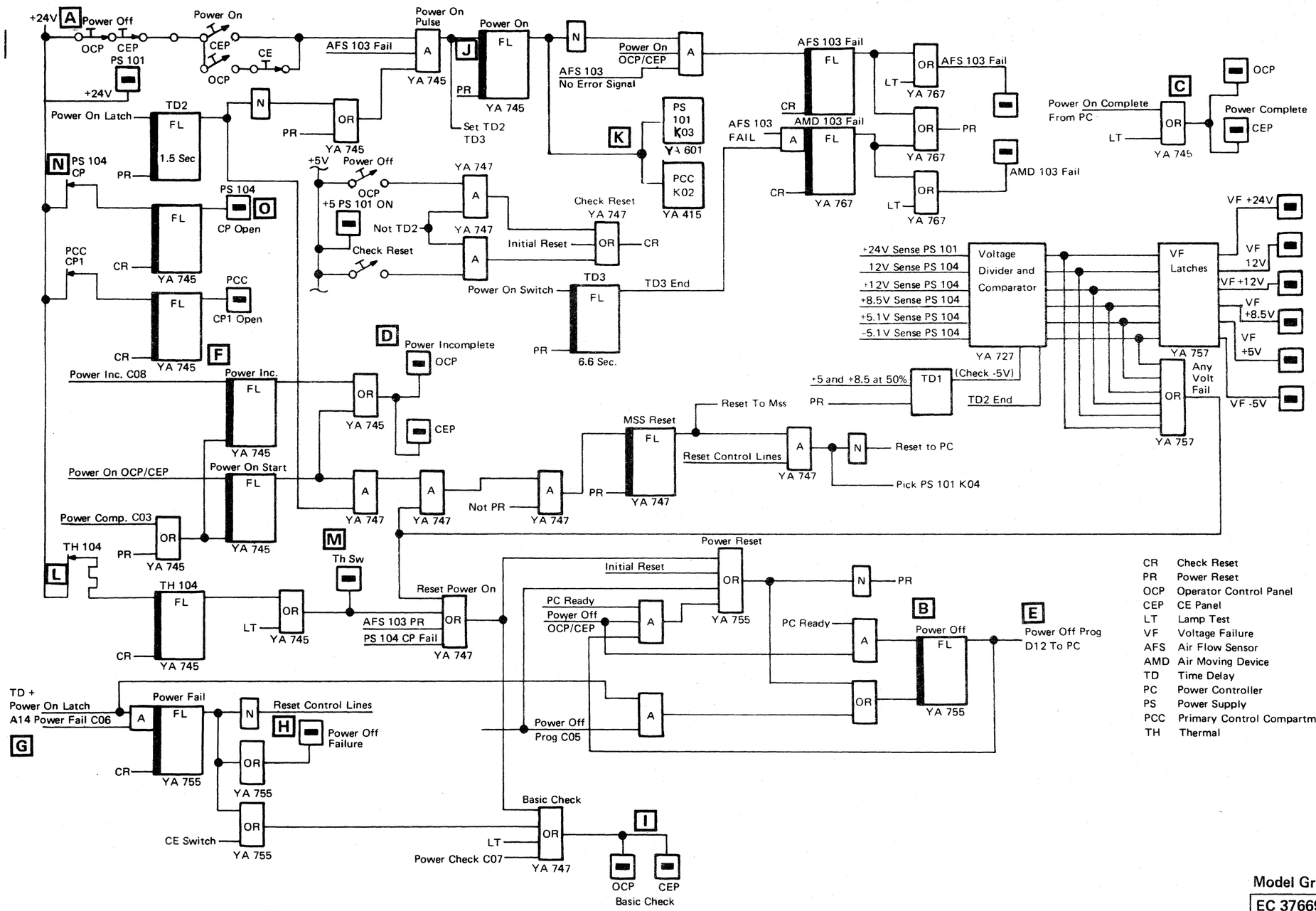
CR Check Reset
PR Power Reset
OCP Operator Control Panel
CEP CE Panel
LT Lamp Test
VF Voltage Failure
AFS Air Flow Sensor
AMD Air Moving Device
TD Time Delay
PC Power Controller
PS Power Supply
PCC Primary Control Compartment
TH Thermal

DETAILED POWER-OFF SEQUENCE FLOWCHART

Note: *Keys are used with "Detailed Power-Off Sequence Logic" on the next page.*



DETAILED POWER OFF SEQUENCE LOGIC



CR Check Reset
PR Power Reset
OCP Operator Control Panel
CEP CE Panel
LT Lamp Test
VF Voltage Failure
AFS Air Flow Sensor
AMD Air Moving Device
TD Time Delay
PC Power Controller
PS Power Supply
PCC Primary Control Compartment
TH Thermal

POWER-ON ACTION STRINGS

Model Group 2, Switching Regulators

Checkpoint: PS215 installed in frame 02 (rear side).

Listed below are the microcode controlled power-on action strings. Action strings are microcode instructions that power on the processing unit, I/O devices, and the Channel-to-Channel (CTCA) feature.

The column headings include:

Action: List of actions in the sequence of execution.

Sensor: Sensor used by the action.

01AB2 Pin: Logic pin location (ALD YF171) where the sensor enters/exits the power controller.

Voltage Level: Voltage on the 01AB2 pin when the action is executed.

To find the action that failed:

Power on in normal mode. When the fault is sensed a reference code and "ACTION xx COMPLETE" are displayed. The fault is in Action xx (even though COMPLETE is displayed).

Note: *If the fault is in Action 03, use the Voltage Tracking (MV) screen to find the failing voltage.*

ACTION 00

Check output of PS101 and PS104.

Action	Sensor	01AB2 Pin	Voltage Level
Turn on 'Power In Process'	C08	D2J12	0 to +.8
Turn off 'Power Complete'	C03	D2J07	+2.8 to +5.4
Turn on 'PC Ready'	C10	D2D10	0 to +.8
Test for on			
+8.5V PS104	A01	D2B07	+1.3 to +1.7
+5V PS104	A02	D2B10	+1.3 to +1.7
+24V Diskette	A04	D2B03	+1.3 to +1.7
+5V Diskette	A05	D2D02	+1.3 to +1.7
+5V HWS	A07	D2B06	+1.3 to +1.7
+24V MSS	A08	D2B05	+1.3 to +1.7
+12V MSS	A13	D2B09	+1.3 to +1.7
+5V MSS	A14	D2D07	+1.3 to +1.7
+8.5V MSS	A15	D2D06	+1.3 to +1.7
V REF CD1	A26	D2S04	-1.3 to -1.7
-5V PS104	A50	C2U09	-1.3 to -1.7
V REF CD2	A53	C2S08	-1.3 to -1.7
-5V Diskette	A54	C2S07	-1.3 to -1.7
-12V MSS	A55	C2U10	-1.3 to -1.7

ACTION 01

Test air flow sensors (AFSs) in frame 01 and 02. Error signal must be present because air moving devices (AMDs) are not running.

Action	Sensor	01AB2 Pin	Voltage Level
Test AFS			
(Error must be on)			
AFS201	D55	C2M05	0 to +.8
AFS102	D56	C2M07	0 to +.8
AFS200	D57	C2P07	0 to +.8
Test K3 not picked (aux contact)	D20	D2M03	0 to +.8

ACTION 02 (CTCA)

Channel-to-Channel feature only. Test air flow sensors (AFSs) in frame 03. Error signal must be present because air moving devices (AMDs) are not running.

Action	Sensor	01AB2 Pin	Voltage Level
Test AFS			
(Error must be on)			
AFS302	D02	D2J06	0 to +.8
AFS301	D04	D2G06	0 to +.8

ACTION 03

Turn on ac to air moving devices and test air flow sensors (error off). Turn on ac to bulk and bias power supplies. Turn on switching regulator voltages and check output. Reset scan rings.

Action	Sensor	01AB2 Pin	Voltage Level
Test for CPs tripped			
PS212	D09	D2G02	+2.8 to +5.4
PS216	D18	D2P04	+2.8 to +5.4
Pick K3 (Blowers and Bias)	C16	D2M02	0 to +.8
Test for K3 picked (aux contact)	D20	D2M03	+2.8 to +5.4
Test error signal off			
AFS201	D55	C2M05	+2.8 to +5.4
AFS102	D56	C2M07	+2.8 to +5.4
AFS200	D57	C2P07	+2.8 to +5.4
Test for temperature in tolerance			
AIS101	A09	D2B08	+0.4 to +1.1
AOS101	A10	D2B11	+0.4 to +1.4
AOS102	A11	D2D11	+0.4 to +1.4
AOS103	A12	D2D12	+0.4 to +1.4
Test for on			
+24V PS216 Bias	A36	C2B03	+1.3 to +1.7
+5V PS216 Bias	A37	C2D02	+1.3 to +1.7
Test for off			
+4.25V OV	D22	D2M04	+2.8 to +5.4
+4.25V CL (Current Limit)	D23	D2M05	+2.8 to +5.4
-6.45V OV	D24	D2M07	+2.8 to +5.4
-6.45V CL (Current Limit)	D25	D2P07	+2.8 to +5.4
-4.25V OV	D27	D2P09	+2.8 to +5.4
-4.25V CL (Current Limit)	D28	D2M09	+2.8 to +5.4
-1.5V OV	D29	D2M10	+2.8 to +5.4
-1.5V CL (Current Limit)	D31	D2P10	+2.8 to +5.4
+6V OV	D58	C2M08	+2.8 to +5.4
+6V CL (Current Limit)	D63	C2P10	+2.8 to +5.4
Pick K4 (TSR Bulk)	C22	C2G11	0 to +.8
Test for PS215 Bulk on	D32	D2M11	+2.8 to +5.4
Test for UV (error must be on)			
-6.45V UV	D26	D2M08	0 to +.8
-4.25V UV	D51	C2P05	0 to +.8
+6V UV	D59	C2P09	0 to +.8
+4.25V UV	D64	C2M11	0 to +.8
Test for -1.5V less than 80%			
-1.5V 01AA1	A17	D2U06	0 to -1.2
-1.5V 01AA2	A20	D2S09	0 to -1.2
-1.5V 01AB1	A22	D2S07	0 to -1.2
Test K4 picked (aux contact)	D52	C2M03	+2.8 to +5.4
Turn on -6.45 Initial	C27	C2J10	0 to +.8
Test for off			
-6.45V UV	D26	D2M08	+2.8 to +5.4
Test for on			
-6.45V	A52	C2S09	-0.15 to -.5
Turn on +4.25V Initial	C25	C2D04	0 to +.8
Test +4.25V not over 30% (Initial level)	A27	D2S05	+0.15 to +.5
Turn on -1.5V	C21	C2J11	0 to +.8
Test for on			
-1.5V 01AA1	A17	D2U06	-1.4 to -1.6
-1.5V 01AA2	A20	D2S09	-1.4 to -1.6
-1.5V 01AB1	A22	D2S07	-1.4 to -1.6
-1.5V 01AC1	A24	D2S10	-1.4 to -1.6
Test for -1.5V UV off	D19	D2P05	+2.8 to +5.4
Turn on -4.25V	C28	C2G10	0 to +.8
Test for on			
-4.25V 01AA1	A18	D2U09	-1.4 to -1.6
-4.25V 01AA2	A19	D2U11	-1.4 to -1.6
-4.25V 01AB1	A21	D2S08	-1.4 to -1.6
-4.25V 01AB1	A23	D2U10	-1.4 to -1.6
-4.25V 01AC1	A25	D2P12	-1.4 to -1.6
Test for -4.25V UV off	D51	C2P05	+2.8 to +5.4
Test for -6.45 Final on	A52	C2S09	-1.47 to -1.53
Test for on			
+5V 01AA2	A03	D2B02	+1.3 to +1.7
Turn on +6V	C17	C2B13	0 to +.8
Test for +6V on	A38	C2B04	+1.4 to +1.6
Test for +6V UV off	D59	C2P09	+2.8 to +5.4
Turn on NPL DR/REC	C11	D2J10	0 to +.8
Reset scan rings			
Turn on +4.25V Final	C26	C2D10	0 to +.8
Test for +4.25V Final on	A27	D2S05	+1.4 to +1.6
Test for +4.25V UV off	D64	C2M11	+2.8 to +5.4

ACTION 04 (CTCA)

Channel-to-Channel feature only. Turn on IPS voltages in frame 03 and check output.

Action	Sensor	01AB2 Pin	Voltage Level
Test not tripped			
TR301 Therm	D39	C2J02	+2.8 to +5.4
PS301 CPs	D40	C2G05	+2.8 to +5.4
Test AFS and CL (Current Limit) (Error must be on)			
AFS302	D02	D2J06	0 to +.8
AFS301	D04	D2G06	0 to +.8
+1.25V CL (Current Limit)	D05	D2J04	0 to +.8
-3V CL	D07	D2J02	0 to +.8
Test for on			
+5V Bias	A31	D2S02	+1.2 to +1.8
+1.25V Bulk	A43	C2D11	+1.2 to +1.8
+1.25V Bias	A44	C2D12	+1.2 to +1.8
-3V Bias	A45	C2B09	+1.2 to +1.8
-3V Bulk	A60	C2U05	+1.2 to +1.8
Test for UV (Error must be on)			
+1.25V UV	D41	C2G02	0 to +.8
-3V UV	D06	D2G03	0 to +.8
Turn on +1.25V and -3V	C24	C2J12	0 to +.8
Test for voltage present			
-3V	A51	C2U11	-1.4 to -1.6
+1.25V	A59	C2S05	+1.4 to +1.6
Test for UV off			
+1.25V UV	D41	C2G02	+2.8 to +5.4
-3V UV	D06	D2G03	+2.8 to +5.4
Turn on +6V	C33	E2J09	0 to +.8
Test for +6V on	A41	C2B08	+1.47 to +1.53
Pick CTCA bypass relay	C34	E2G03	0 to +.8

ACTION 05

Action	Sensor	01AB2 Pin	Voltage Level
Pick 'Start I/O'	C02	D2B12	0 to +.8
Test for 'I/O Complete' on	D34	C2J06	+2.8 to +5.4

ACTION 06

Action	Sensor	01AB2 Pin	Voltage Level
Turn on 'Power Complete'	C03	D2J07	0 to +.8
Turn off 'Power in Process'	C08	D2J12	+2.8 to +5.4