

AC Power Module

Machine Overview

During this module you will learn:

- What the AC power distribution module is
- What the AC power distribution module does
- What the DC switching power supply is
- What the DC switching power supply does

Floor Operations

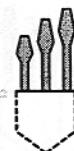
During this module you will learn:

- How power is distributed through the machine
- Key connections to the AC Power Distribution Module
- The purpose of a DC switching power supply

Service and Troubleshooting

During this module you will learn:

- How power is distributed through the machine
- What fuse devices are
- How fuse devices work
- What the AC Power Distribution Module does
- How the AC Power Distribution Module works
- Key connectors on the AC Power Distribution Module
- Key components of the AC Power Distribution Module
- How the DC switching power supply works



Notes

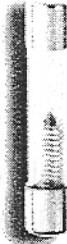
FUSE TYPES AND CIRCUIT BREAKERS



Fast blow (acting) fuse:

When would I use this fuse?

Use a fast blow when the current needs to be stopped immediately. Fast blow fuses blow the second current draw is too high.



Slow blow (Time lag) fuse:

When would I use this fuse?

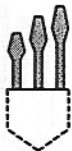
Slow blow fuses are used when it is necessary to have a higher current draw at the time of power up. Slow blow fuses won't blow until the current draw has exceeded its maximum time limit.



Slow blow (time lag) fuse ceramic body:

When would I use this fuse?

Fuses with ceramic bodies are used when excess current draw could cause the fuse to over heat, melt down and start a fire.



GENERAL COMPONENT DEFINITION

Fuses: Protection devices for various functions

Circuit Breakers: Protection devices for various functions

FUSE/CIRCUIT BREAKER THEORY

Fuses and circuit breakers are protection devices. They work by severing a current path when the designated current/time rating is exceeded.

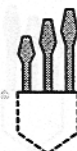
It is commonly believed that the *fuse/circuit breaker* exists to protect the *device* it is associated with – the car radio fuse protects the radio, the dryer circuit breaker protects the dryer, etc. *This is NOT true!*

The car radio fuse exists so that if a problem arises with the radio and it draws more current than it should, the fuse will “blow” (open). This stops the current flow to the radio and prevents a possible fire.

Without a fuse, the wires conducting current to the radio would be allowed to carry too much current. They would get hot, and could eventually start a fire. So, the “radio” fuse exists to protect the *car* from the *radio*, should the radio have a problem.

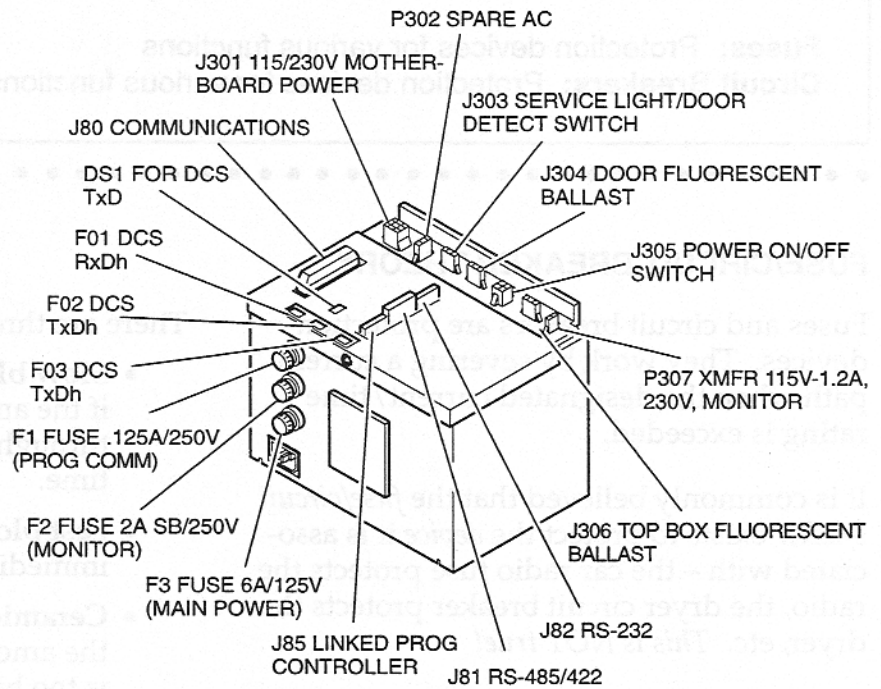
There are three types of fuses:

- **Slow blow fuses** – designed to blow if the amount of current flowing through it is too high over a length of time.
- **Fast blow fuses** – designed to blow immediately if the current is too high.
- **Ceramic fuses** – designed to blow if the amount of current flowing into it is too high over a length of time. The ceramic body prevents the fuse from melting if it gets too hot.

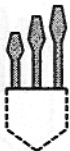


Power Module

Notes



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AC Power Distribution Module (Early Style)

GENERAL COMPONENT DEFINITION

Distribution Module: Receives AC current from wall outlet and distributes it throughout the machine.

Utility Receptacle: Used to supply AC power for various power tools, ~~vacuum cleaners~~, etc. Makes a 115 VAC receptacle conveniently available.

DETAILED COMPONENT DEFINITIONS

Power Distribution Module

Component that receives AC in from the wall, filters it, then distributes switched and unswitched AC to various devices including the main switching power supply.

Earth Ground

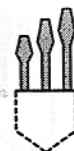
Earth ground (personnel protection ground) for the entire machine is established inside the power distribution module.

Utility Receptacle

Used to supply unswitched AC within the machine for devices that run on 110 current (such as a vacuum cleaner, light, etc.).

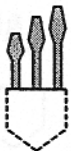
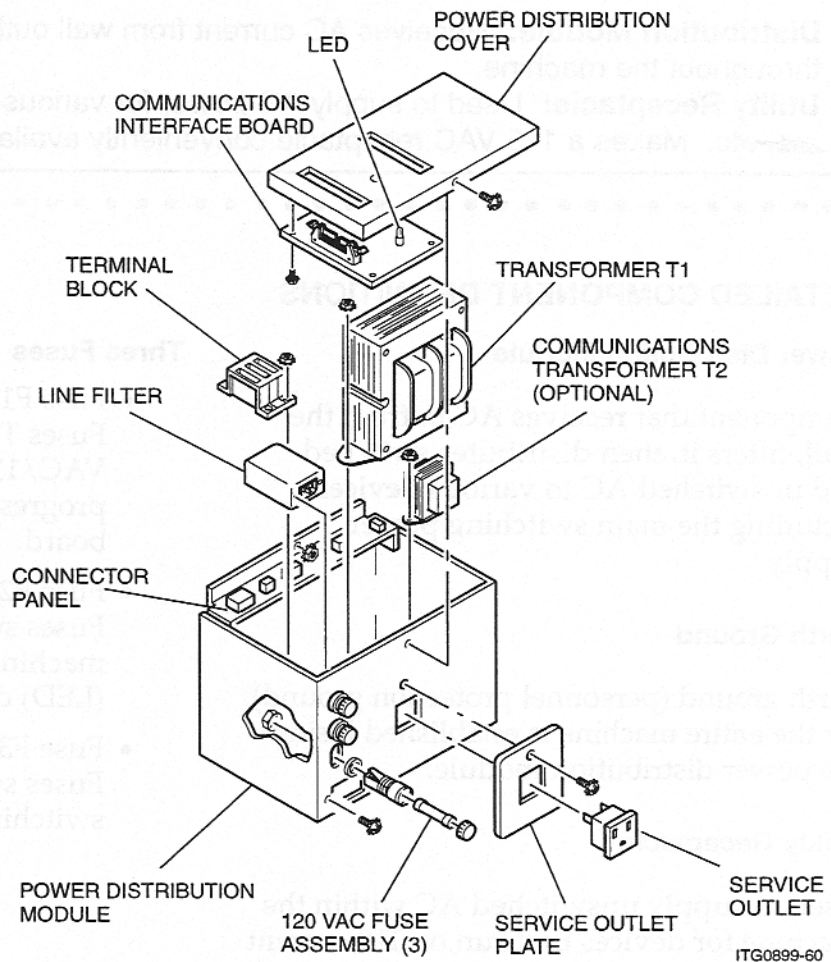
Three Fuses

- Fuse F1 (.125A) (FB)
Fuses T2, which supplies isolated 13 VAC/13 VAC center-tapped to the progressive communication interface board. (505)
- Fuse F2 (2A) (SB)
Fuses switched hot AC for the machine and the mini spectrum (progressive menu) (LED) display for progressive info. & monitor
- Fuse F3 (6A) (FB)
Fuses switched hot AC for the main switching power supply. (wholigan)



Power Module

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AC Power Distribution Module (Early Style)

DETAILED COMPONENT DEFINITIONS (cont.)

Seven Molex Connectors

- J301 for the main switching power supply.
- J302 mini spectrum (LED) display for progressive info
- J303 for the service light inside the machine
- J304 for the door fluorescents
- J305 for the power on/off switch
- J306 for the AC fluorescents
- J307 for the monitor

One-Two Transformers

- T1 for step-up (115 VAC to 230 VAC) and isolation to supply the monitor.
- T2 (optional) exists if there's a communication interface board and supplies 13 VAC/13 VAC center-tapped power to that board.

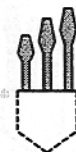
NEMA Connector (and Filter)

Connection for AC wall power in.

Communication Interface Board (optional)

There are at least three different fiber optic interface (FOI) boards used for communications in 80960 machines. The FOI board is normally found inside the AC distribution module. The connections on the FOI board are for power, fiber optic communications, communications with the machine processor board, serial communications (RS-232 and RS-422/485) to external devices, and progressive communications.

There is an LED on the FOI board, which indicates communications in process. The FOI board is the communications link used by the processor board to communicate with progressive equipment or CVT-controller equipment.



Notes

GENERAL THEORY OF OPERATION

The power distribution module receives AC wall power. It routes that power through the appropriate fuses to the machine and its components, depending on their needs.

Technical
Documentation

REFER TO:

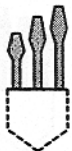
Electronic Diagrams and Parts: (Your Machine Model) (Power Distribution Wiring Diagram); **Guide to Winner's Choice Electronics Video** (pages 1-6)

DETAILED THEORY OF OPERATION

Wall AC-in goes into filter FL1. The hot leg leaving FL1 goes directly to TB2 and the neutral leg leaving FL1 goes directly to TB1. They are the distribution points for unswitched power throughout the machine. The earth ground leg leaving FL1 is tied directly to the chassis to become earth/chassis ground.

TB2 distributes the unswitched filtered AC-hot leg to P302 for the mini spectrum (progressive) display, J/P421 for the service receptacle, J305 to the power on/off switch, J303 service light detect switch, and fuse F1. The output of F1 goes into and directly back out of J301 (on the switching power supply) then to the CT leg (#2) of T2 which ultimately supplies 13 VAC to the progressive communications board. *T2 will exist only if the machine has a progressive communications board.* T2 would physically exist inside the power distribution module. The progressive communications board would physically exist inside the power distribution module with connections showing through the cover.

TB1 distributes the unswitched filtered AC-neutral leg to P302, J/P421, J305, J303 and to one primary leg of transformer T2, which supplies 13VAC/CT to the progressive communications board.



AC Power Distribution Module (Early Style)

Switched hot and neutral AC legs return to the distribution module via J305. The hot leg connects to F2 and F3. The neutral leg connects directly to TB3, which is the distribution point for switched neutral for the machine.

F2 connects to P302 for the mini spectrum display and into, then directly back out of J301 then to TB4, which is the distribution point for switched fused hot AC for the machine.

F3 connects to pin 5 of J301 on the machine's switching power supply and is switched fused AC power into the switching power supply.

TB3 distributes switched AC neutral to a primary leg of T1, which ultimately supplies AC to the monitor through P307, J304 for the door AC fluorescents, J306 for the

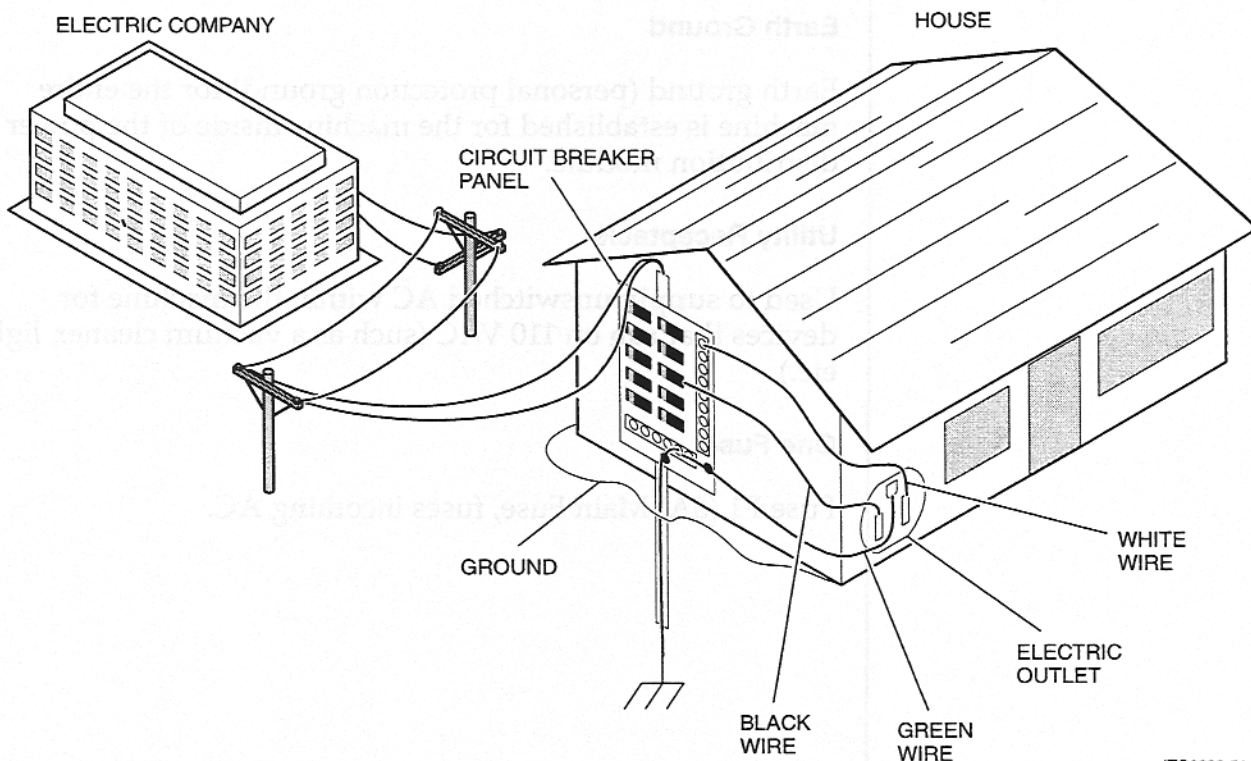
fluorescents, and J301 as switched neutral into the main switching power supply.

TB4 distributes switched AC hot to J304, J306, and to the center tap (CT) of T1.

The third primary leg of T1 comes from J301 on the main switching power supply. Both secondary legs of T1 connect to P307 which goes to the monitor.

The third primary leg of T2 comes from J301 on the main switching power supply. The secondary of T2 is also center-tapped and provides 2 legs of 13 VAC as power in to the progressive communications board.

Earth ground = personal (protection) ground. Works great *if* the "house" is wired correctly. Connected to the chassis of the machine. Theoretically the same electrical potential as the dirt outside the "house".



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Notes

GENERAL COMPONENT DEFINITION

Distribution Module: Receives AC from wall outlet and distributes switched and unswitched AC power throughout the machine.

Utility Receptacle: Used to supply AC power for various power tools, vacuum cleaners, etc.



DETAILED COMPONENT DEFINITION

Power Distribution Module

Component that receives AC in from the wall, filters it, then distributes switched and unswitched AC to various devices including the main switching power supply

NEMA Connector and Filter

Connection for AC wall power in

Earth Ground

Earth ground (personal protection ground) for the entire machine is established for the machine inside of the power distribution module.

Utility Receptacle

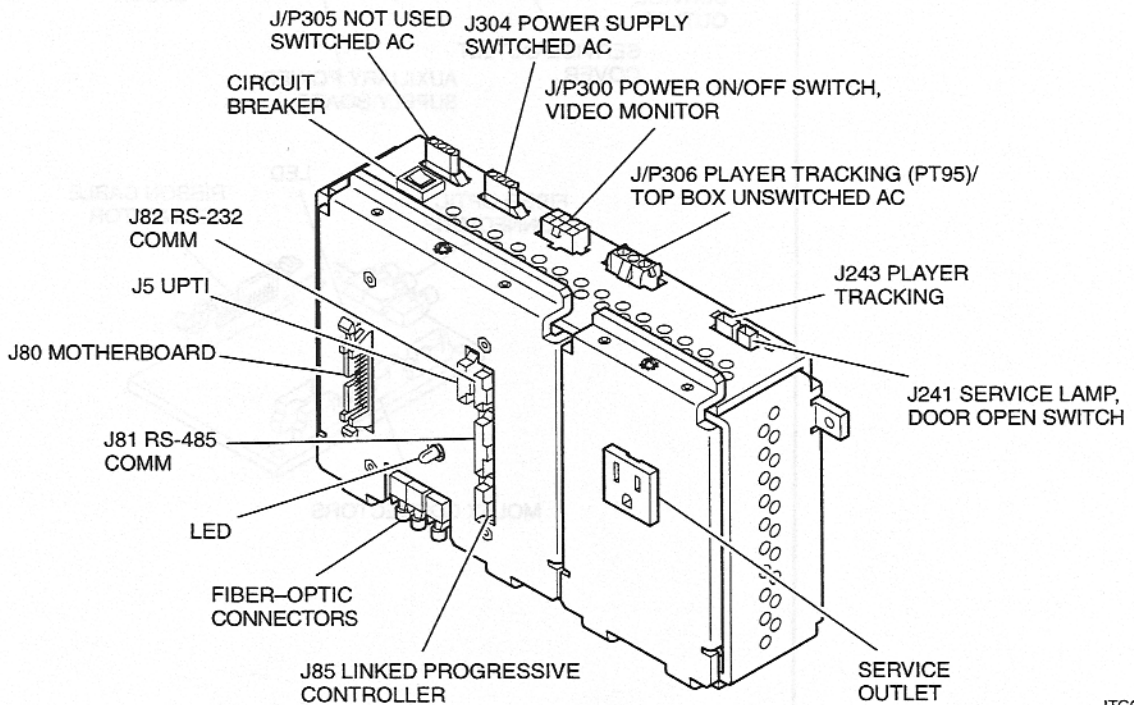
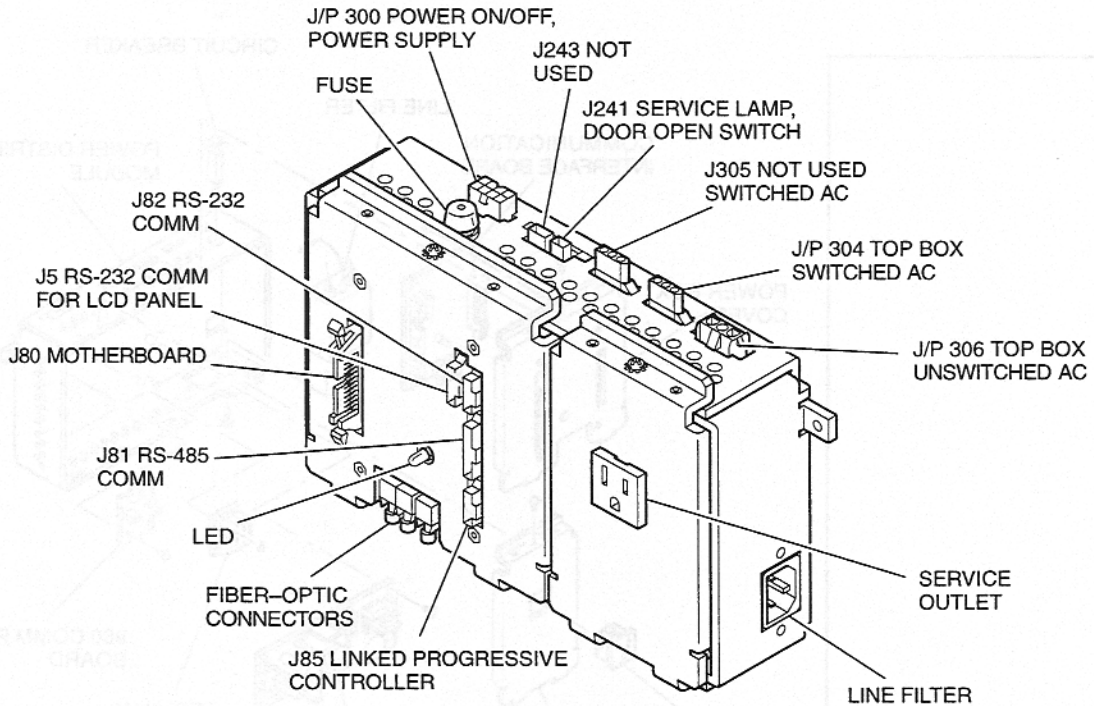
Used to supply unswitched AC within the machine for devices that run on 110 VAC (such as a vacuum cleaner, light, etc.).

One Fuse

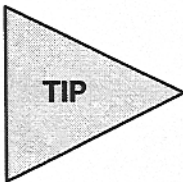
Fuse F1 (6A) Main Fuse, fuses incoming AC.



AC Power Distribution Module (Later Style)



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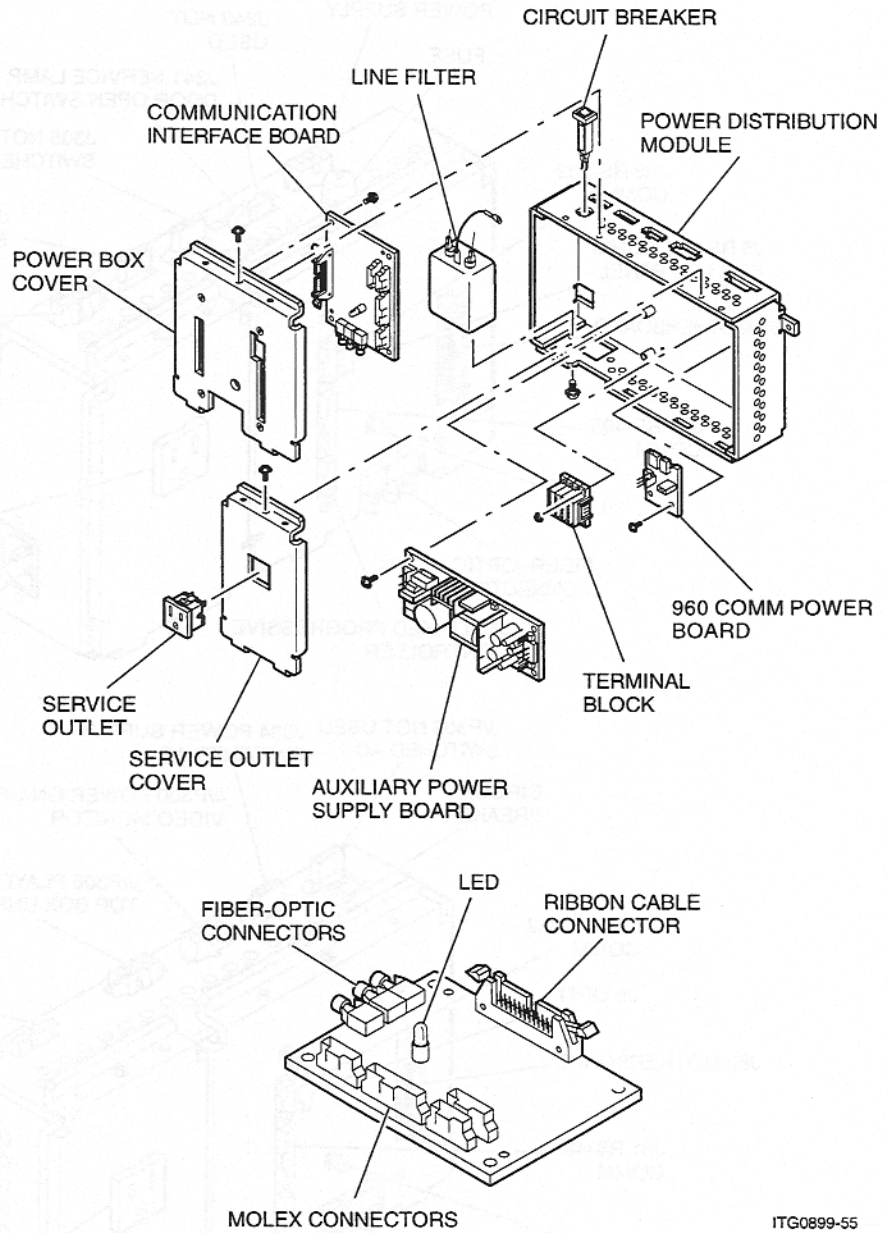


You may find your 80960 machine has a 6-amp circuit breaker instead of a fuse. The internal working of the distribution modules are the same – physically some of the connectors have been relocated and given different tasks. Also, there is a large ferrite bead, used to “clean up” the power, between the filter and the terminal blocks.

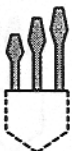


Power Module

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AC Power Distribution Module (Later Style)

DETAILED COMPONENT DEFINITION (cont.)

Four External Molex Connectors

- J300 for the power on/off switch & switched AC to the switching power supply
- J304 for switched AC to the top box
- J305 for switched AC (spare)
- J306 for unswitched AC to the top box

Two Internal Molex Connectors

- J/P421 for the service receptacle
- J/CN1 for the internal switching power supply board

Auxiliary Power Supply Board

Supplies +5 VDC for the progressive communication interface board and +12 VDC and +5 VDC to the auxiliary "960 COMM/PT/SV LT PWR" board (internal to distribution module). +12 VDC is distributed to J241 for the service lamp and +5 VDC distributed to J243 to power the universal player tracking interface board (UPTI).

Communication Interface Board (optional)

There are at least three different fiber optic interface (FOI) boards used for communications in 80960 machines. The FOI board is normally found inside the AC distribution module. The connections on the FOI board are for power, fiber optic communications, communications with the machine processor board, serial communications (RS-232 and RS-422/485) to external devices, and progressive communications.

There is an LED on the FOI board, which indicates communications in process. The FOI board is the communications link used by the processor board to communicate with progressive equipment or CVT-controller equipment.

In Vision machines, the FOI board has an additional connector for serial communications with the LCD. The fiber optic connections themselves are color-coded. Blue is for transmit, gray or black is for receive.

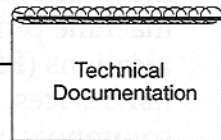


Notes

GENERAL COMPONENT DEFINITION

Distribution Module: Receives AC from wall outlet and distributes switched and unswitched AC power throughout the machine.

Utility Receptacle: Used to supply AC power for various power tools, vacuum cleaners, etc.



REFER TO:

Electronic Diagrams and Parts: (Your Machine Model) (Power Distribution or Main Wiring Diagram)

DETAILED THEORY OF OPERATION – WITH FUSES

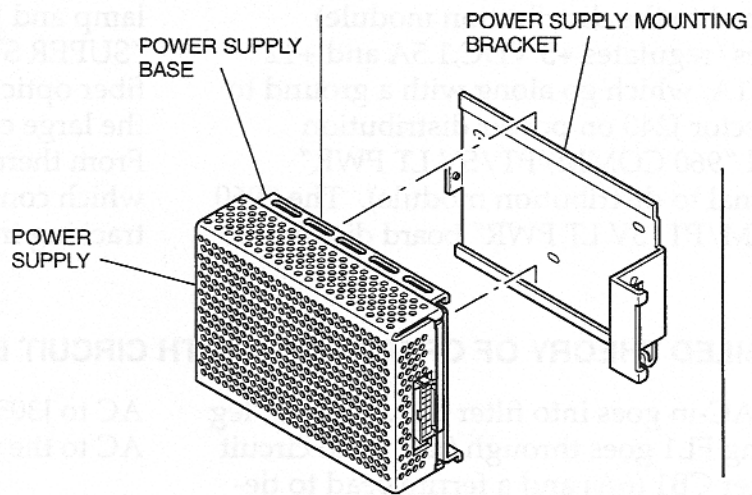
Wall AC-in goes into filter FL1. The hot leg leaving FL1 goes through main fuse F1 (BUSS AGC-5, 6A) to tie-block TB1. The neutral leg leaving FL1 goes directly to TB2. Earth ground leaving FL1 is tied directly to the chassis to become earth/chassis ground.

TB1 & TB2 are the unswitched filtered AC-in distribution points. They distribute to connectors J/P306 for the top box, J/P300 for the power on/off switch, J/P421 (inside the distribution module) for the main service receptacle, and P/CN1 for the +5 VDC/+12 VDC switching power supply, which is physically inside the distribution module.

TB3 & TB4 are out-going distribution points. Switched hot and neutral AC legs return to the distribution module via J/P300 and go to TB3 and TB4, the distribution points for switched- AC. TB3 and TB4 distribute back to J/P300 to be power-on for the machine's main switching power supply. TB3 and TB4 also distribute switched-AC to J305 (currently unused) and J/P304 (switched AC to the top box).



Notes



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Note: Removal of this device varies with machine configuration and the location of the power supply within the machine.



AC Power Distribution Module (Later Style)

The internal Switching Power Supply (internal to the distribution module) creates/regulates +5 VDC,1.5A and +12 VDC,1A, which go along with a ground to connector J240 on power distribution board "960 COMM/PT/SV LT PWR" (internal to distribution module). The "960 COMM/PT/SV LT PWR" board distributes

the +12 VDC to J241, which goes to service lamp and J242, which goes to J83 on the "SUPER STEPPER COMM" (progressive fiber optic comm) board attached inside the large cover of the distribution module. From there, it distributes +5 VDC to J243, which connects to the universal player tracking interface board.

DETAILED THEORY OF OPERATION – WITH CIRCUIT BREAKER

Wall AC-in goes into filter FL1. The hot leg leaving FL1 goes through fuse main circuit breaker CB1 (6A) and a ferrite bead to tie-block TB1. The neutral leg leaving FL1 goes directly to TB2. Earth ground leaving FL1 is tied directly to the chassis to become earth/chassis ground.

TB1 and TB2 are the unswitched filtered AC-in distribution points that distribute to connectors J/P306 for the top box, J/P300 for the power on/off switch, J/P421 (inside the distribution module) for the main service receptacle, and P/CN1 for the +5 VDC/+12 VDC switching power supply, located inside the distribution module.

Switched hot and neutral AC legs return to the distribution module via J/P300 and goes to TB3 and TB4, the distribution points for switched-AC. TB3 and TB4 distribute back to J/P300 to be power-on for the machine's main switching power supply. TB3 and TB4 also distribute switched-

AC to J305 (unused) and J/P304 switched AC to the top box.

The internal switching power supply (internal to the distribution module) creates/regulates +5 VDC,1.5A and +12 VDC,1A, which go along with a ground to connector J240 on power distribution board "960 COMM/PT/SV LT PWR" (internal to distribution module). The "960 COMM/PT/SV LT PWR" board distributes the +5 VDC to J241, which goes to UPTI board and J242, which goes to J83 on the "SUPER STEPPER COMM" (progressive fiber optic comm) board attached inside the large cover of the distribution module and distributes +12 VDC to J243, which connects to the service lamp.

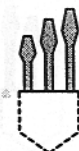
Earth ground = personal (protection) ground. Works great *if* the "house" is wired correctly. Connected to the chassis of the machine. Theoretically the same electrical potential as the dirt outside the "house".



POWER DISTRIBUTION SOLUTIONS

How does the power distribution module affect the machine?

Quick troubleshooting on the machine can be done using your knowledge of fuses, circuit breakers and power distribution. If the machine or a specific component isn't working check the fuses and connections first. It could be as simple as that!



GENERAL COMPONENT DEFINITION

DC Power Supply: A circuit that supplies the DC voltages required to operate electronic devices.

+13 VDC: This voltage is distributed through the machine. Devices using this voltage include the processor board, seven-segment display, VFD, optics, coin comparator, bill acceptor and incandescent lamps.

+25 VDC: This voltage is distributed to "motor" type functions. Devices such as reel drivers, hopper motor, DC ballasts, bell, LCD, hard meters, handle solenoid, diverter and muffin fan.

LEDs: In some power supply units two light emitting diodes will light to indicate that the 13 VDC and 25 VDC are present and have stabilized.

DETAILED COMPONENT DEFINITION

The main switching power supply receives switched AC from power distribution module:

- **Early Style Modules** – through J301 switching power supply.
- **Later Style Modules** – through J/P300 on the distribution module and P90 on the power supply.

There may or may not be 2 LEDs inside the power supply. They represent stabilized +13 VDC and +25 VDC, and illuminate when the respective voltage stabilizes.

There may or may not be a non-user-accessible fuse inside the power supply.

The power supply should be considered a field replaceable unit (FRU).

Creates/regulates +13 VDC (9.4A and A-Ground)

This voltage is distributed throughout the machine to generate "electronic" type levels locally. Devices using +13 VDC in the machine include the processor board, seven-segment display, VFD, optics throughout the machine, coin comparator assembly including rake-solenoid, bill acceptor, and incandescent lamps. TTL +5 VDC levels are developed and regulated locally from +13 VDC.

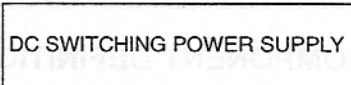
Creates/regulates +25 VDC (4.4A and B-Ground)

This voltage is distributed throughout the machine to generate "motor" type levels locally. Devices using +25 VDC in the machine include reel drivers on the processor board hopper motor, DC electronic fluorescent ballasts, bell, LCD, hard meters, handle solenoid, diverter and fan (if applicable).



Notes

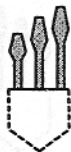
AC IN



13V DC OUT

25V DC OUT

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GENERAL THEORY OF OPERATION

A switching power supply transforms AC power into DC to be used by electronic components in the machine. This streamlined design allows only the precise amount of voltage demanded by the circuit to get to the circuit while reducing the excessive heat that exist in linear power supplies.

DETAILED THEORY OF OPERATION

Switching power supplies rectify AC in to a DC level, then convert that DC to a high frequency square wave AC, the duty cycle of which can be changed via pulse width modulation.

The high frequency square wave is filtered and available as power out. This allows the switching power supply to supply precisely the power demanded by the load while avoiding the bulky/heavy transformers and large heat sinks & heat dissipation requirements that occur in linear power supplies.

Switching power supplies often require a load before they generate voltages. This may or may not be true for your unit. There are *no* fuses or user maintainable components inside this switching power supply.

This power supply unit should be considered a field replaceable unit (FRU).



