Chapter 2. CPU Board, Software and Game Denomination Changes

Board and Software Changes

CPU Board or game software replacement isn't particularly difficult. Yet replacing these parts involves more than casual board or chip swapping. Before proceeding, you must understand some basics about the CPU Board and its security system. This chapter presents this information in a quick capsule form.

Denomination Changes

The procedure on changing your GD's denomination appears later in this chapter.

Card Cage Components

The CPU Board and Driver Board reside in the card cage. The card cage is inside the Main Door. *(See the illustration below.)* At the back of the card cage is a blind mating backplane. This backplane attaches peripherals to the card cage circuit boards. For security purposes, the card cage door locks. A door security switch also monitors door openings and closures.
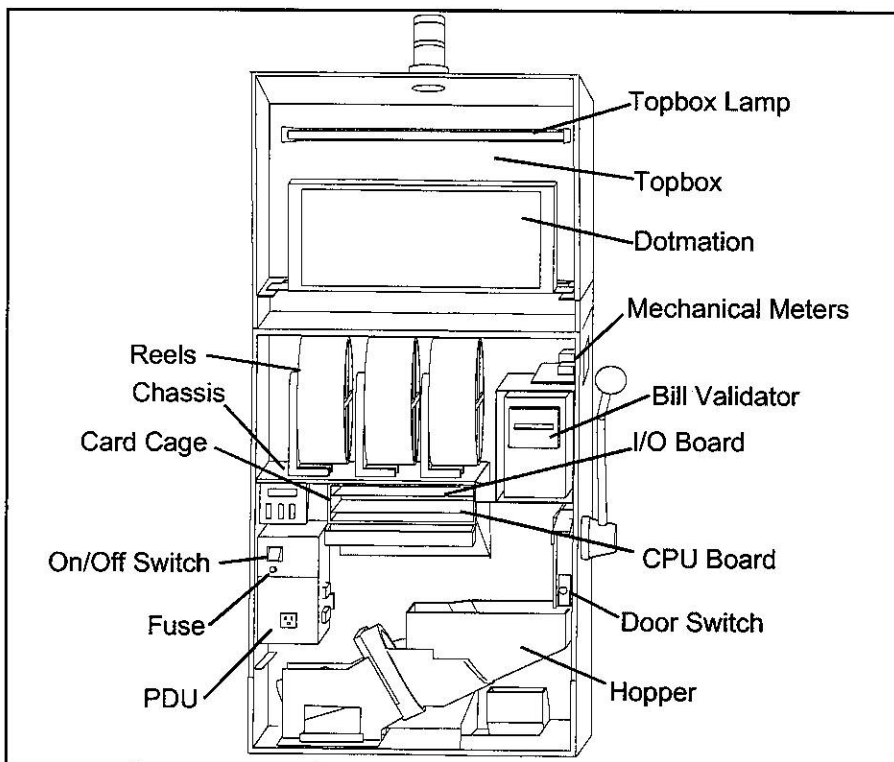
EPROM and RAM Interaction

Game EEPROM Security

When WMS develops new game EPROMs, four pieces of data define this new software...

NOTICE

In this manual, switch or button names appear in CAPITAL letters. For example, this manual often instructs you to "press DIAGNOSTIC." DIAGNOSTIC is the DIAGNOSTIC button behind the Main Door.

Interior of slot machine cabinet

- GAME TYPE (*POWER 7S, WILD & LOOSE,* ETC.)
- GAME DESCRIPTOR (GAME PERCENTAGE, MAX BET, EFFECT PACKAGES, ETC.)
- SOFTWARE VERSION
- GAME EPROM CHECKSUM

Both the Data EPROM and the static RAM store these four pieces of data. Suppose that you install a game EPROM: The CPU compares this EPROM's data with data in the static RAM. If the data doesn't match, the machine displays a tilt code...

- **"6AПΠE CHΠ6E 1"** indicates a mismatch between Game EPROM XU2 and Data EPROM XU3. That is, someone installed a non-matching Game or Data EPROM. (For example: Your machine has a *Wild and Loose* Game EPROM and a *Top Cat* Data EPROM.) You can't clear a 6AПΠE CHΠ6E 1 tilt with a mismatched set of EPROMs. Instead, you *must* install two chips of the same type.

- **"6AПΠE CHΠ6E 2"** indicates that someone changed the Game type. For example, you just changed a *Top Cat* machine to a *Wild and Loose* machine.) To clear this tilt, remove the CPU Board EPROMs and install the old ones. Or press the Diagnostic Button to load new data to the static RAM. See the "CLEARING" bullet below.

- **"6AПΠE CHΠ6E 3"** indicates a game version change at CPU Board EPROMs XU2 and XU3. See the "CLEARING" bullet below.

- **"6AПΠE CHΠ6E 4"** indicates a checksum change at CPU Board Game EPROM XU2. See the "CLEARING" bullet below.

- **"6AПΠE CHΠ6E 5"** indicates a checksum change at CPU Board Data EPROM XU3. See the "CLEARING" bullet below.

- **CLEARING "6AПΠE CHΠ6E 2" through "6AПΠE CHΠ6E 5".** To clear any of these tilts, press DIAGNOSTIC. The machine loads the new game information. If you've cleared the RAM properly before installing new EPROMs, the machine displays "clr". (Clear this tilt by again pressing DIAGNOSTIC.) Otherwise, the "nEEd clr" tilt message appears. This tilt indicates that you must clear the RAM and reinstall the EPROMs. Use a RAM clear chip of the correct denomination.

⚠ CAUTION

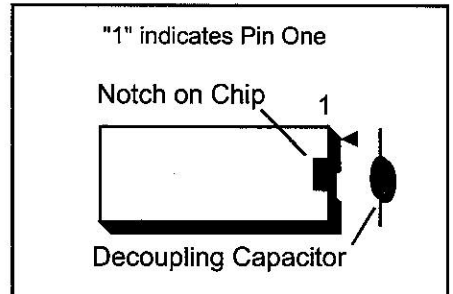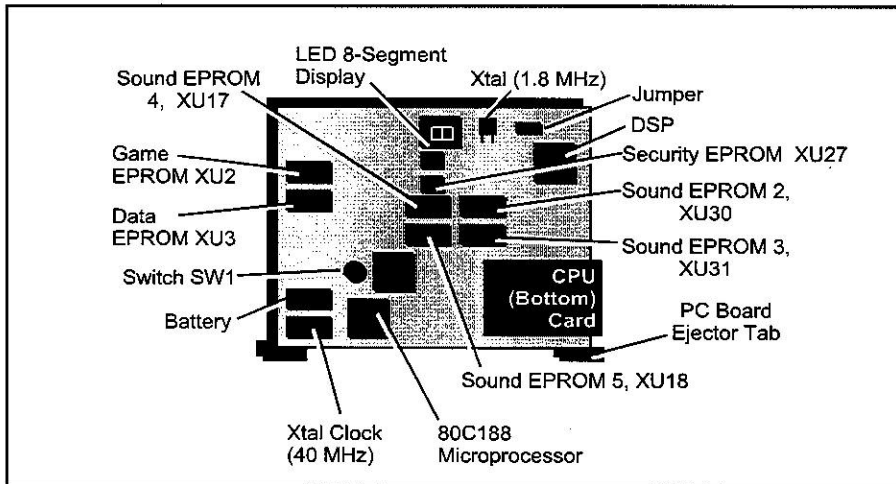Avoid equipment damage when using the RAM Clear Chip! *Take these precautions...*

- Turn the power OFF before removing or inserting logic boards.

- Turn the power OFF before removing or inserting EPROMs.

- Observe proper static prevention safeguards.

- Before you power up the unit, verify that circuit boards seat securely.

- Properly align EPROMs with socket pins. Otherwise you can severely damage the chips.

Software Installation

❑ 1. Unlock and open the Main Door.

❑ 2. Turn power off at the PDU switch.

❑ 3. *Slant top machines only:* Disengage the coin chute.

❑ 4. Unlock and open the card cage.

❑ 5. Disengage the CPU (bottom) board by pulling the white board ejector tabs toward you. Remove the board. If your GD came with diagnostic software, remove EPROM XU3. Save the Diagnostic chip for later use.

❑ 6. Obtain the RAM Clear Chip for the proper denomination. Use this

NOTICE

Some slot machines don't use all EPROM locations.

Sound EPROM 4, XU17
Game EPROM XU2
Data EPROM XU3
Switch SW1
Battery
Xtal Clock (40 MHz)
80C188 Microprocessor
LED 8-Segment Display
Xtal (1.8 MHz)
Jumper
DSP
Security EPROM XU27
Sound EPROM 2, XU30
Sound EPROM 3, XU31
CPU (Bottom) Card
PC Board Ejector Tab
Sound EPROM 5, XU18

"1" indicates Pin One
Notch on Chip 1
Decoupling Capacitor

EPROM Orientation

chip to clear the RAM and set the GD denomination. See *How to Perform a Hard (Total) RAM Clearance* in this chapter.

❑ 7. Track the software change in your official logbook. Install EPROMs at these CPU Board locations...
  • Game and Data EPROMs at XU2 and XU3
  • Sound EPROMs at XU17, XU18, XU30 and XU31 *(Some GDs don't use all these EPROMs.)*

❑ 8. Return the CPU Board to the card cage. Engage the board by pushing its white board ejector tabs toward the cage.

❑ 9. Close and lock the Card Cage Door.

❑ 10. *Slant top machines only:* Reengage the coin chute.

❑ 11. Turn on the power at the PDU switch. Run a complete diagnostic check to assure that your GD functions nominally.

❑ 12. Close and lock the Main Door.

⚠ CAUTION

When inserting EPROMs, match EPROM notches to the notches on chip sockets. White markings on the board also indicate proper chip notch position. Improperly inserting a chip can destroy it.

Recoverable RAM Error:
GOOD

Recoverable RAM Error:
GOOD

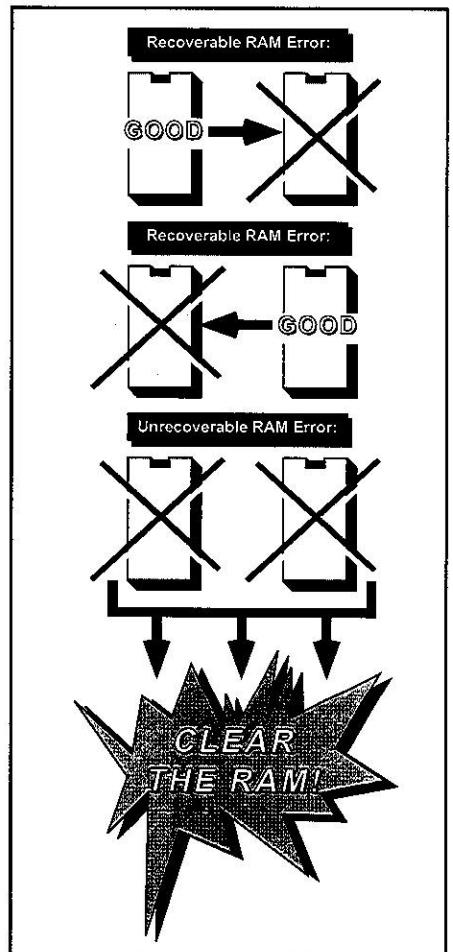**Unrecoverable RAM Error:**

CLEAR THE RAM!

Clearing the CPU Board RAM

Slot machine game software monitors important RAM blocks to verify data integrity. The monitored information includes game meters, coin timing values, configuration parameters, game log data, etc. If the GD detects corrupt data, the GD produces a tilt.

For error detection and recovery purposes, the system maintains duplicate copies of some RAM blocks. If only one copy is corrupt, the other RAM block serves as a master. The GD can copy this block over the erroneous block. This situation is an example of a recoverable RAM error. Yet, if both blocks are corrupt, full recovery is impossible. This situation exemplifies an unrecoverable RAM error.

Six unrecoverable RAM errors exist...

CRC 1	1	OPERATING SYSTEM DATA
CRC 2	1	MAIN METER DATA
LOG	1	GAME LOG DATA
PROG CRC		PROGRESSIVE DATA

RAM Mtch		RAM Game Data not equal to secure data
SIG 1	1	RAM signature or denomination data

Recovering data requires that you *clear the RAM.* You may clear RAM in either of two ways, depending on the problem's severity. A hard RAM clearance restores data to values stored in a special EPROM. A soft RAM clearance restores data to the last values stored by the GD.

When to Clear the RAM
Clear the RAM...
- If you want to change the GD denomination (Hard RAM Clear)
- Before you change a game or data ROM (Hard RAM Clear)
- If the GD alerts you of a RAM error (Hard or Soft RAM Clear)

Hard RAM Clearance *(Total RAM Clearance)*
A hard RAM clearance requires you to install a RAM Clear-Denomination EPROM in the GD. The RAM Clear EPROM initializes GD parameters that command GD software to reset. After software installation, GD game software reinitializes or clears GD parameters to their default values.

After hard RAM clearance initialization, the GD system writes several values to the secure EEPROM. These values include...
- Unique GD data
- Denomination coin timings
- RAM signature values

(This data remains unchanged until after another hard RAM clearance initialization.) The machine meters also reset to zero. The GD copies the meters to the secure device.

Soft RAM Clearance *(Partial RAM Clearance)*
To get the GD running again, you can perform a soft (partial) RAM clearance. Unlike a hard RAM clearance, a soft RAM clearance doesn't require EPROM installation. A soft RAM clearance recovers secure EEPROM data and reinstalls it into the Game RAM. Other parameters reinitialize to their hard RAM clearance values or their values before the error.

What Soft RAM Clearance Achieves
After a Soft RAM clearance, several values reset to hard RAM clearance values. Among these are Bill Log Data, Line Info Meters and GD configuration parameters. GD configuration parameters include...
- Sound Volume Levels
- Hopper Pay Limit
- Reel Speed

(Configuration parameter examples... Sound Vol Level: 1 - 70; Hopper Pay Limit: 500; Reel Speed: Medium; etc. You can check or alter these parameters in Administration Mode. To read Bill Log Data and Line Info Meters, enter Bookkeeping Mode.)

The Game Log and Game Credits reinstall, if possible. (If the Game Log isn't

corrupt, it reinitializes to resolve customer disputes. Game Credits follow the same rule. Credits return to the last credit value before the RAM error occurred. If the Game Log or Game Credits value is corrupt, the system can't reinstall it.)

Due to the unrecoverable RAM error, the system resets all other RAM data. Reinitializing this data assures that the GD returns to a stable, known state. The system also restores EEPROM data (coin timings, RAM signature data, and essential GD meters). The GD system loses very little information.

After every 100 games, GD software updates machine metering information on the secure EEPROM. Metering information also updates when you enter Administration Mode or Bookkeeping Mode. A soft RAM clearance may lose up to 99 games worth of meter information.

How to Perform a Soft (Partial) RAM Clearance

A soft RAM clearance is easy to perform. After an unrecoverable RAM tilt occurs, press DIAGNOSTIC. When the system finishes the soft RAM clearance, press DIAGNOSTIC again. At this point, a "Soft Clear" tilt occurs.

How to Perform a Hard (Total) RAM Clearance

The RAM-clearing procedure requires a special RAM Clear Chip. Before you can clear the RAM, you must install this chip in the GD. The RAM Clear Chip...
- SETS THE GD DENOMINATION
- CLEARS OUT THE GD's RAM *(INCLUDING SOFT METERS)*

You have to temporarily install the RAM Clear Chip in your GD. After you power up the chip, it initializes the GD denomination. The new denomination value appears on the Win Meter Display. A '6' appears on the Bet Display. For each denomination, you'll need a different RAM Clear Chip. *(WMS can provide clear chips for most coin denominations.)*

The RAM Clear Chip also initializes the RAM signature variable. After you reinstall the game EPROM, it checks the RAM signature. This signature signals the game EPROM that...
- YOU CLEARED THE RAM
- YOU CHANGED THE DENOMINATION
- YOU MUST REINITIALIZE THE GAME

Required Equipment
- RAM CLEAR KIT FOR APPROPRIATE DENOMINATION
  - CHIP EXTRACTION TOOL   • ANTISTATIC WRIST STRAP

Hard RAM Clear Chip Procedure

- ***Remove the CPU Board***
  - ☐ 1.   Unlock and open the Main Door.
  - ☐ 2.   Turn power off at the PDU switch.

⚠️ **CAUTION**

Clearing the RAM erases stored information. Don't clear the RAM unless host system personnel authorize you to proceed.
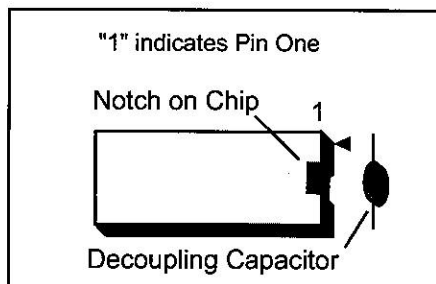
⚠️ **CAUTION**

Failure to observe static protection procedures can damage computer components and void your warranty.
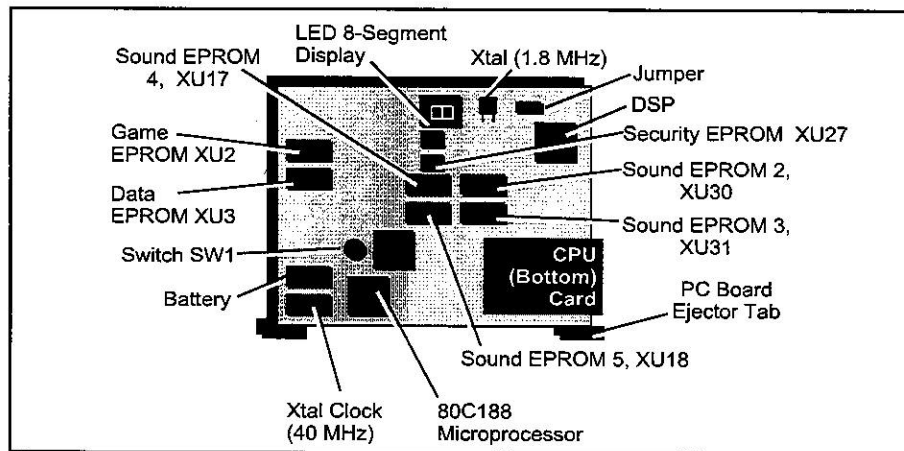
⚠️ **CAUTION**

When inserting EPROMs, match EPROM notches to the notches on chip sockets. White markings on the board also indicate proper chip notch position. Improperly inserting a chip can destroy it.

"1" indicates Pin One

Notch on Chip

Decoupling Capacitor

RAM Clear Chip Orientation

LED 8-Segment Display
Sound EPROM 4, XU17
Game EPROM XU2
Data EPROM XU3
Switch SW1
Battery
Xtal (1.8 MHz)
Jumper
DSP
Security EPROM XU27
Sound EPROM 2, XU30
Sound EPROM 3, XU31
CPU (Bottom) Card
PC Board Ejector Tab
Sound EPROM 5, XU18
Xtal Clock (40 MHz)
80C188 Microprocessor

☐ 3. Unlock and open the card cage.

☐ 4. *Slant top machines only:* Disengage the coin chute.

☐ 5. The CPU Board is the bottom card in the card cage. Disengage the CPU Board by pulling its white board ejector tabs toward you. Remove the board.

☐ 6. Remove Data EPROM XU3 from its socket. *(Leave the other EPROM XU2, in its socket.)*

• **Install and Use the RAM Clear Chip**

☐ 7. Install the RAM Clear Chip in EPROM socket XU3. As you insert the chip, be careful to align chip pins. Inserting the chip backwards can damage it.

☐ 8. Return the CPU Board to the card cage. Engage the board by pushing its white board ejector tabs toward the cage.

☐ 9. Close the Card Cage Door.

☐ 10. Turn GD power ON. Verify that the proper denomination appears on the LED displays.

☐ 11. Turn GD power OFF.

☐ 12. Open the card cage.

☐ 13. Disengage the CPU Board by pulling its white board ejector tabs toward you. Remove the board.

☐ 14. Remove the RAM Clear Chip.

• **Install the Game Chip**

☐ 15. Reinsert the Data EPROM in socket XU3.

☐ 16. Return the CPU Board to the card cage. Engage the board by pushing its white board ejector tabs toward the cage.

☐ 17. Close the Card Cage Door.

☐ 18. *Slant top machines only:* Reengage the coin chute.

☐ 19. Turn GD power ON. The message "clr" should appear on the Credit Display. This message indicates proper clearing of the RAM. If you've also performed a game change, "6ANNE CHAN6E" appears first. Press DIAGNOSTIC to load the new game information. Then "clr" appears, indicating the cleared RAM.

❏   20. Lock the card cage.

* ***Reinitialize the System***
  ❏   21. Push the DIAGNOSTIC button. The machine shuts down and reboots. If you cleared the machine properly, the message "clr" appears on the Credit Display. Push the DIAGNOSTIC button to acknowledge this message.
  ❏   22. Close and lock the Main Door.

Changing the Denomination

❏   1.   Unlock and open the Main Door.
❏   2.   Turn power off at the PDU switch.
❏   3.   *Slant top machines only:* Disengage the coin chute.
❏   4.   Change the denomination decals on the GD's Reel Hatch.
❏   5.   Change the coin denomination of the coin comparator. (Or change the coin comparator.)
❏   6.   Change the front of the coin entry.
❏   7.   *Hopper Machines:* Change the hopper.
❏   8.   Perform a hard RAM clear with the proper RAM Clear Chip. See the procedure above.