

Logic Boards Module

Machine Overview

During this module you will learn:

- What the motherboard is and its functions
- What the processor board is and how it communicates to operate the machine

Floor Operations

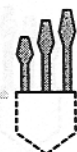
During this module you will learn:

- What the motherboard is and its functions
- What the processor board is and how it communicates to operate the machine
- How to tell if the processor is communicating with the machine

Service and Troubleshooting

During this module you will learn:

- What the motherboard is and its functions
- What a PROM is, its functions and how to remove and install it properly on the processor board
- The location and functions of key components on the processor board
- Differences between the available 80960 boards
- What the LED lights on the processor tray indicate
- How to do a software conversion



Notes

GENERAL COMPONENT DEFINITION

Motherboard: Interface between the machine and the processor board.

DETAILED COMPONENT DEFINITIONS

Motherboard

Interface between the machine and the processor board. Distributes processor control signals to the rest of the machine.

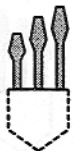
EEPROM (E²)

Computer chip located on the motherboard that holds the critical data for the machine.

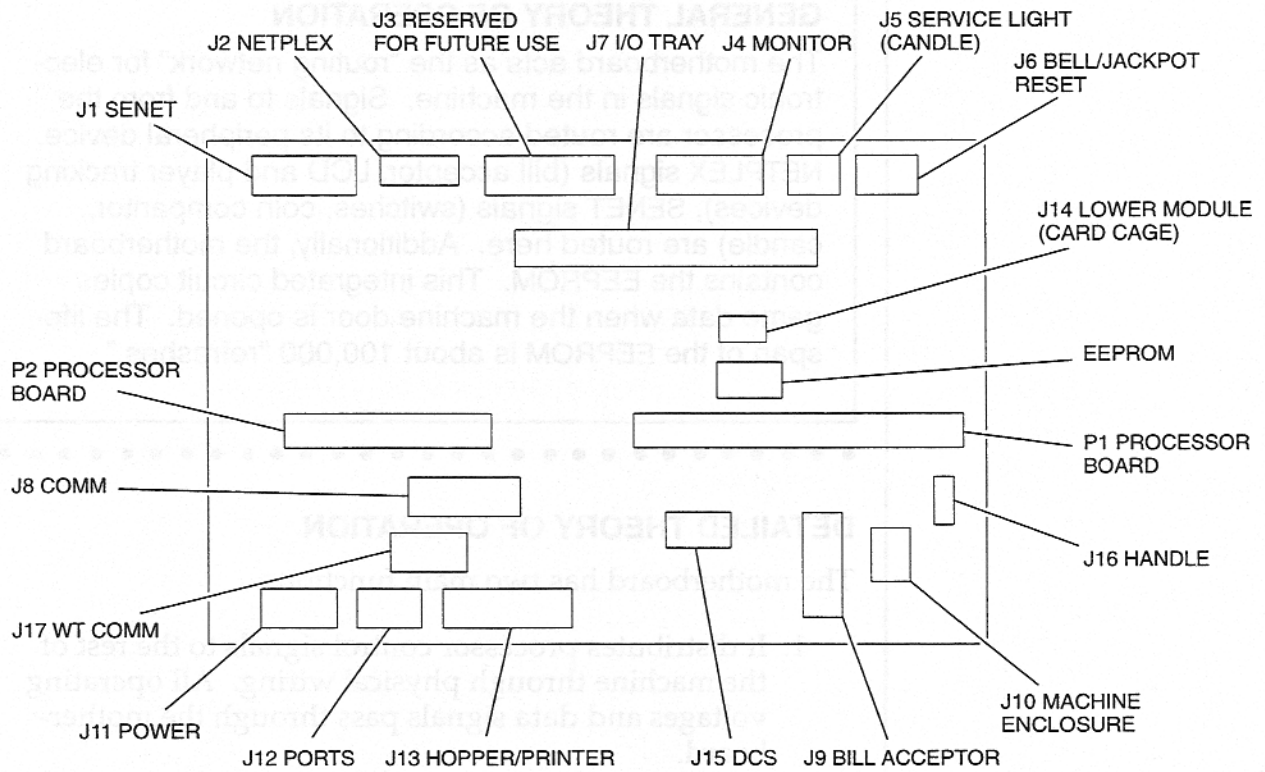
Connectors

Plug-ins for electrical wiring harnesses.

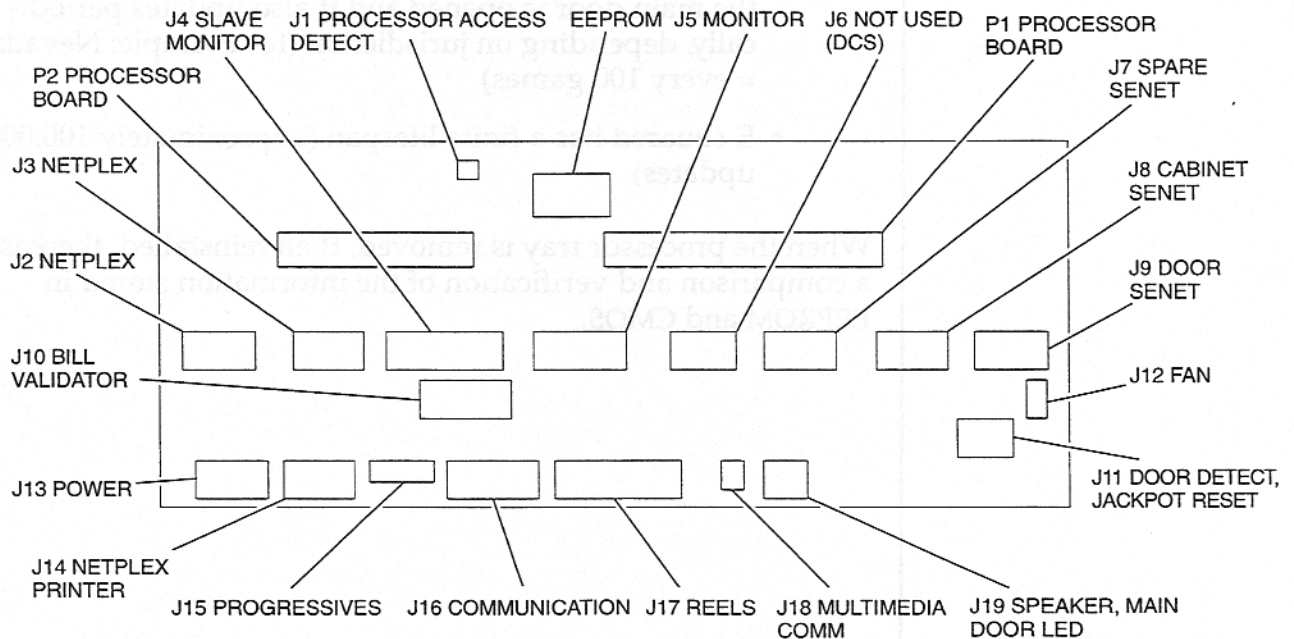
NON-VOLATILE	FLASH	
	EEPROM	
	EPROM	
	PROM	
	ROM	
VOLATILE	(CMOS) RAM	



GAME KING 19" MOTHERBOARD – 759 044 06



VISION AND iGAME-PLUS MOTHERBOARD – 759 053 0X



Notes

GENERAL THEORY OF OPERATION

The motherboard acts as the "routing network" for electronic signals in the machine. Signals to and from the processor are routed according to its peripheral device. NETPLEX signals (bill acceptor, LCD and player tracking devices), SENET signals (switches, coin comparator, candle) are routed here. Additionally, the motherboard contains the EEPROM. This integrated circuit copies game data when the machine door is opened. The lifespan of the EEPROM is about 100,000 "refreshes."

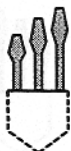


DETAILED THEORY OF OPERATION

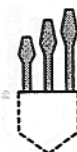
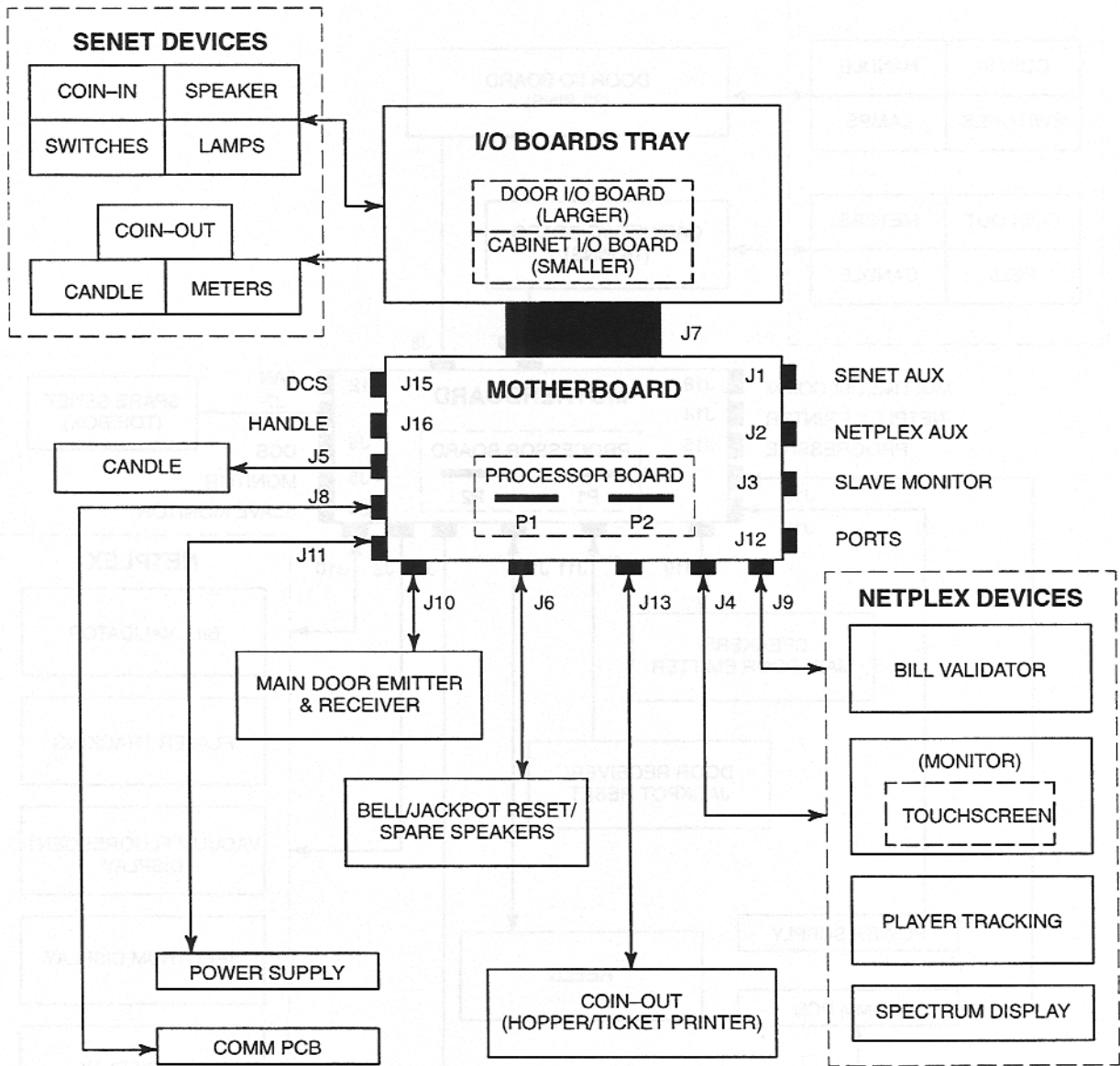
The motherboard has two main functions:

1. It distributes processor control signals to the rest of the machine through physical wiring. All operating voltages and data signals pass through the motherboard.
2. It holds the EEPROM ("E-squared") integrated circuit, which is where the critical data for the machine is stored.
 - E-squared is updated from CMOS/RAM every time the main door is opened and it also updates periodically, depending on jurisdiction (for example: Nevada = every 100 games)
 - E-squared has a finite lifespan (approximately 100,000 updates)

When the processor tray is removed, then reinstalled, there is a comparison and verification of the information stored in EEPROM and CMOS.

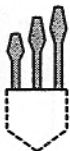
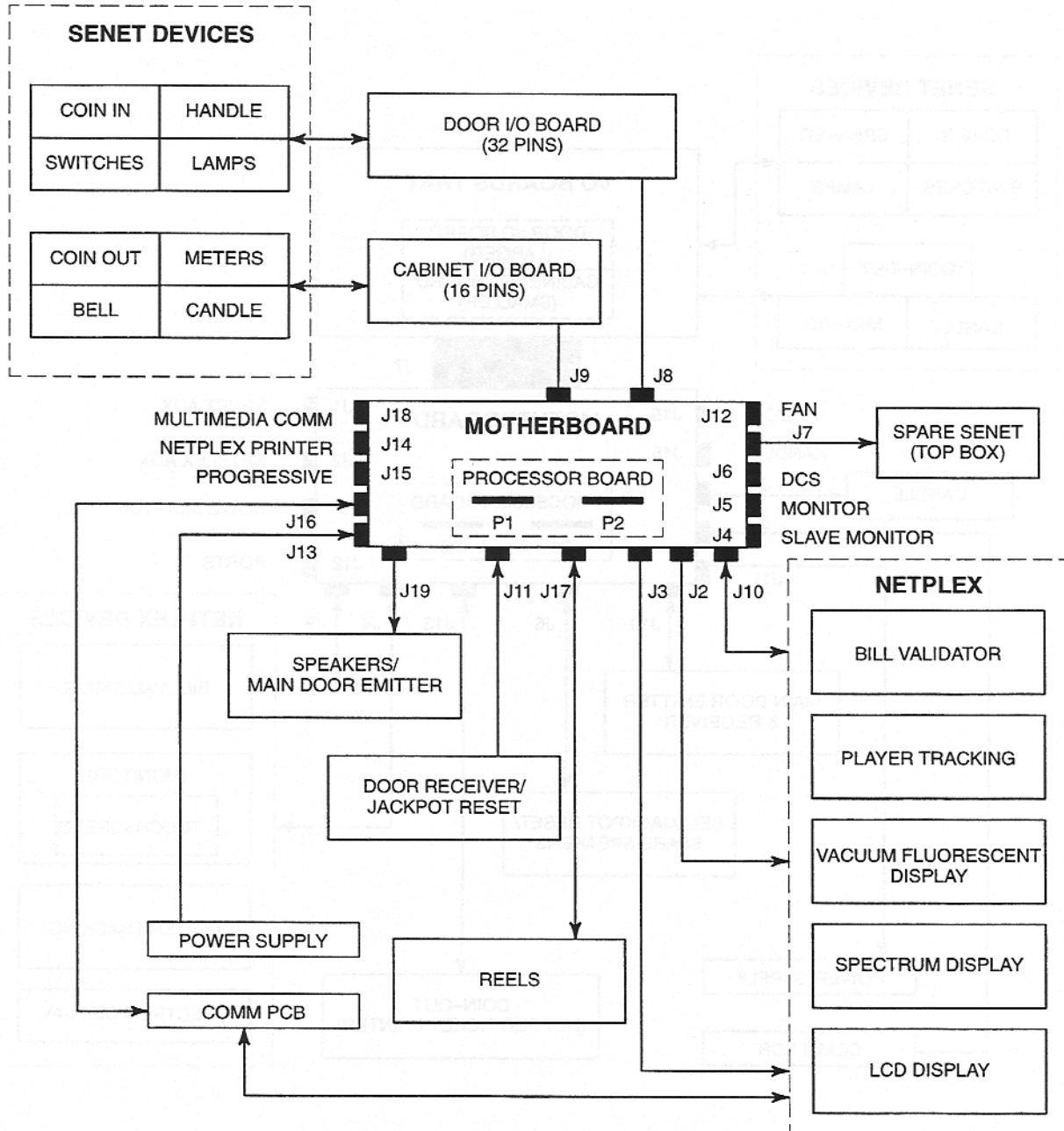


80960 GAME KING MOTHER BOARD
CONNECTOR DIAGRAM

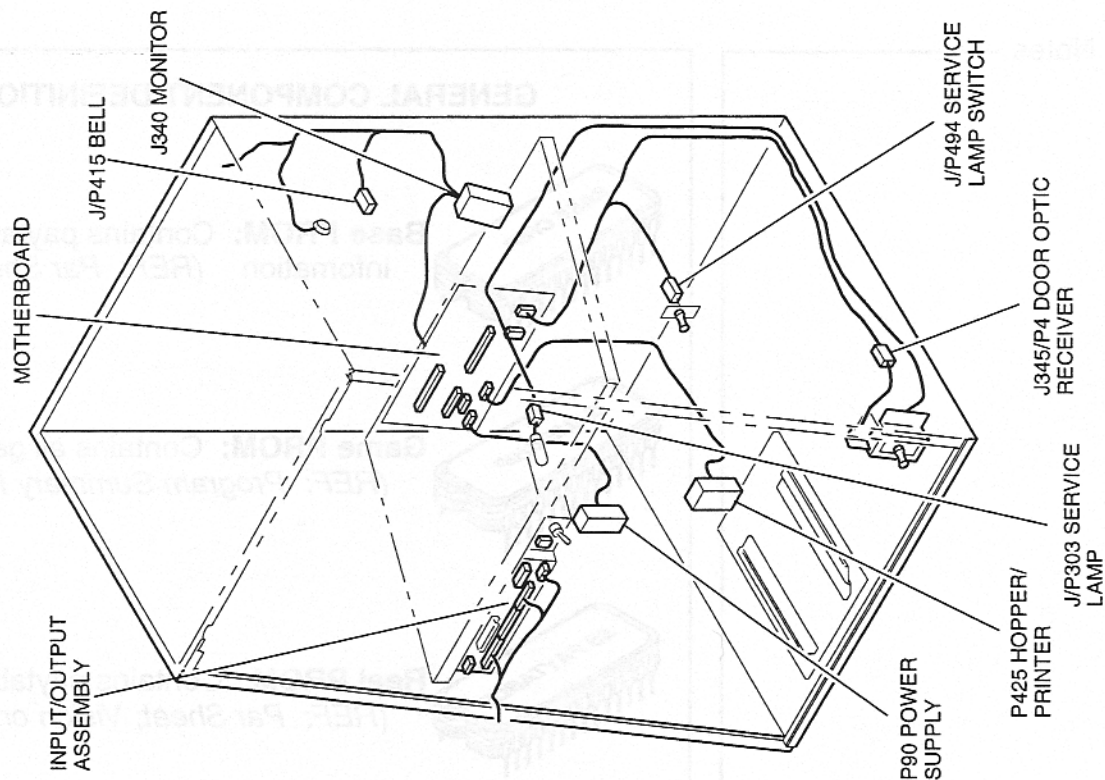


Logic Boards Module

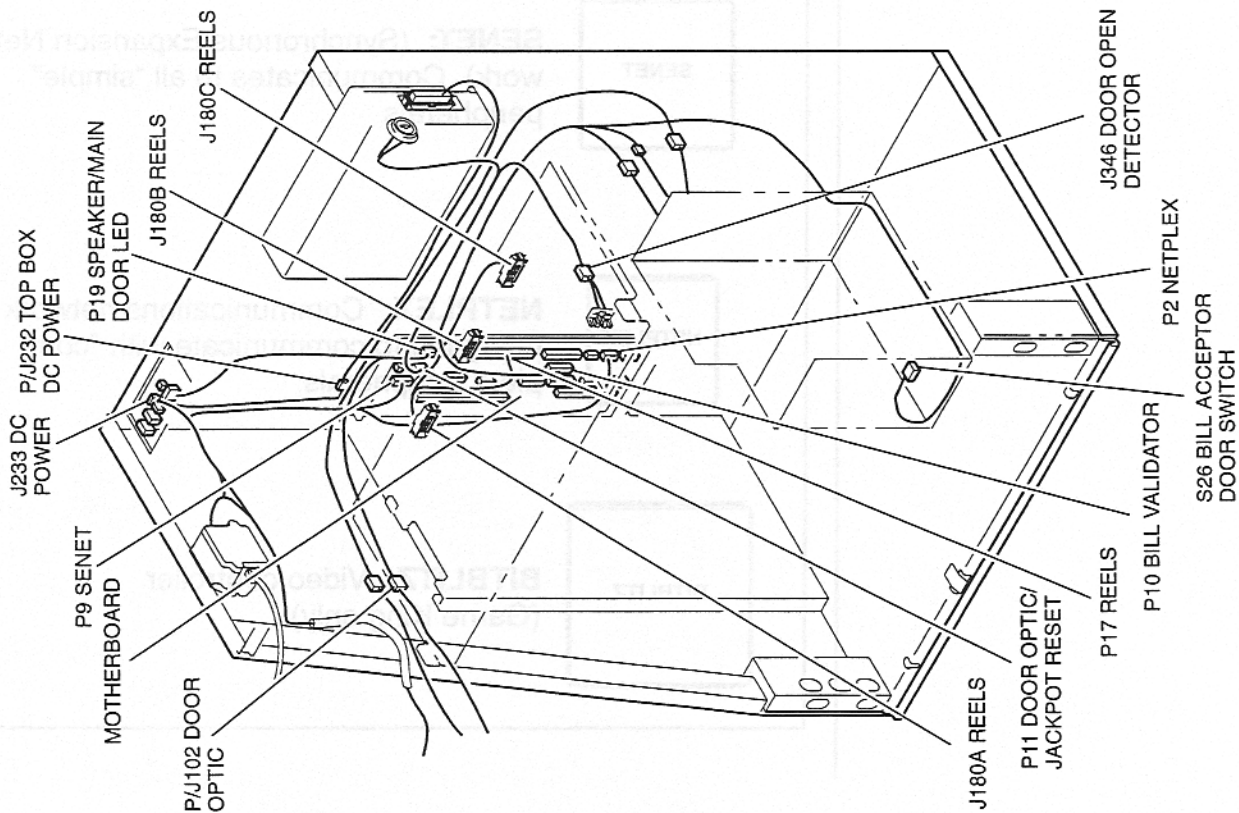
80960 VISION MOTHER BOARD CONNECTOR DIAGRAM



GAME KING 19" UPRIGHT MACHINE

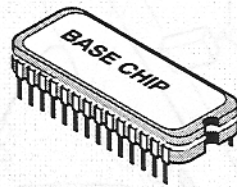


VISION UPRIGHT MACHINE

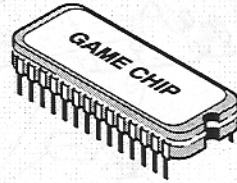


Notes

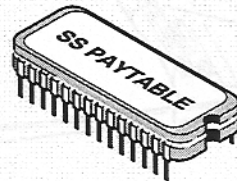
GENERAL COMPONENT DEFINITIONS



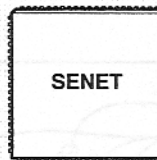
Base PROM: Contains payable information (REF: Par Sheet)



Game PROM: Contains all game data (REF: Program Summary Report)



Reel PROM: Contains paytables (REF: Par Sheet; Vision only)



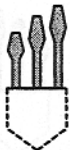
SENET: (Synchronous Expansion Network) Communicates to all "simple" peripherals



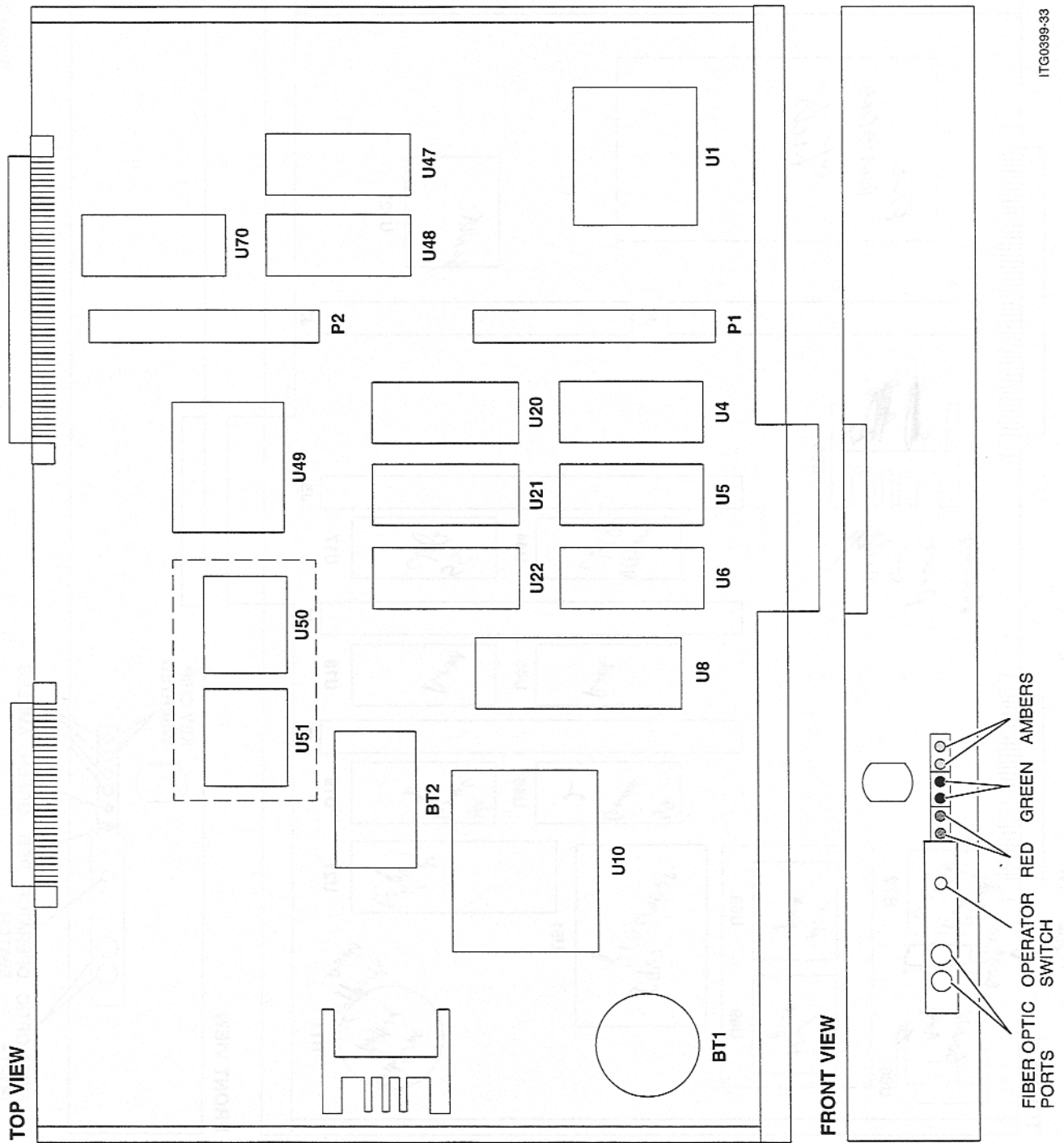
NETPLEX: Communications network designed to communicate with "complex" peripherals



BITBLITZ: Video controller (Game King only)



80960 GAME KING/iGAME PROCESSOR BOARD – 757 035 00 & 757 038 00

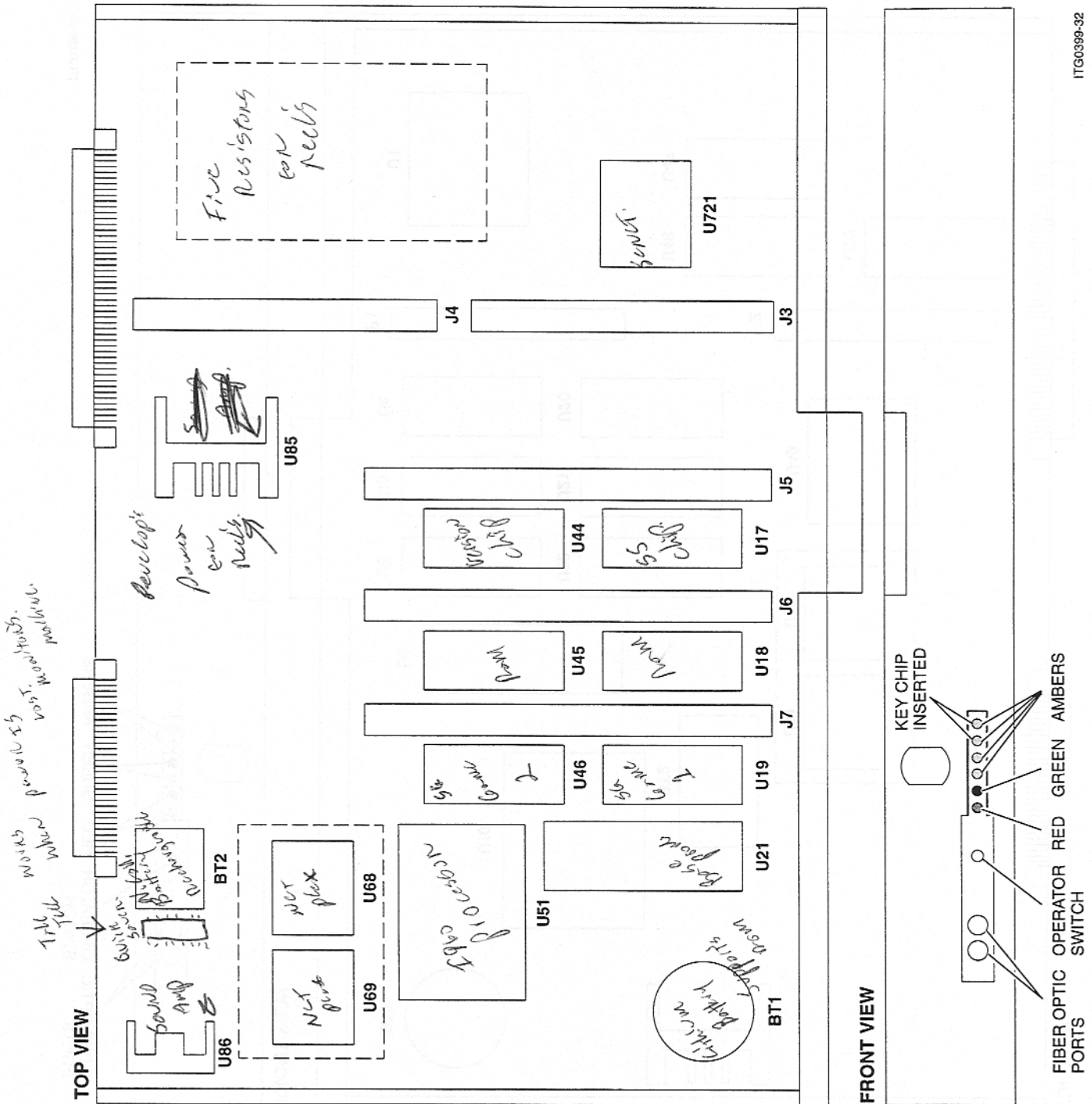


Insert circuit boards (e.g., processor, I/O boards, etc.) carefully. Connector pins can be bent easily if boards are installed backwards or lopsided. Add-on boards (i.e. multimedia board, soundboard, CG flashcard) require special attention.



Logic Boards Module

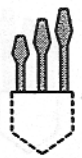
80960 VISION PROCESSOR BOARD – 755 105 00



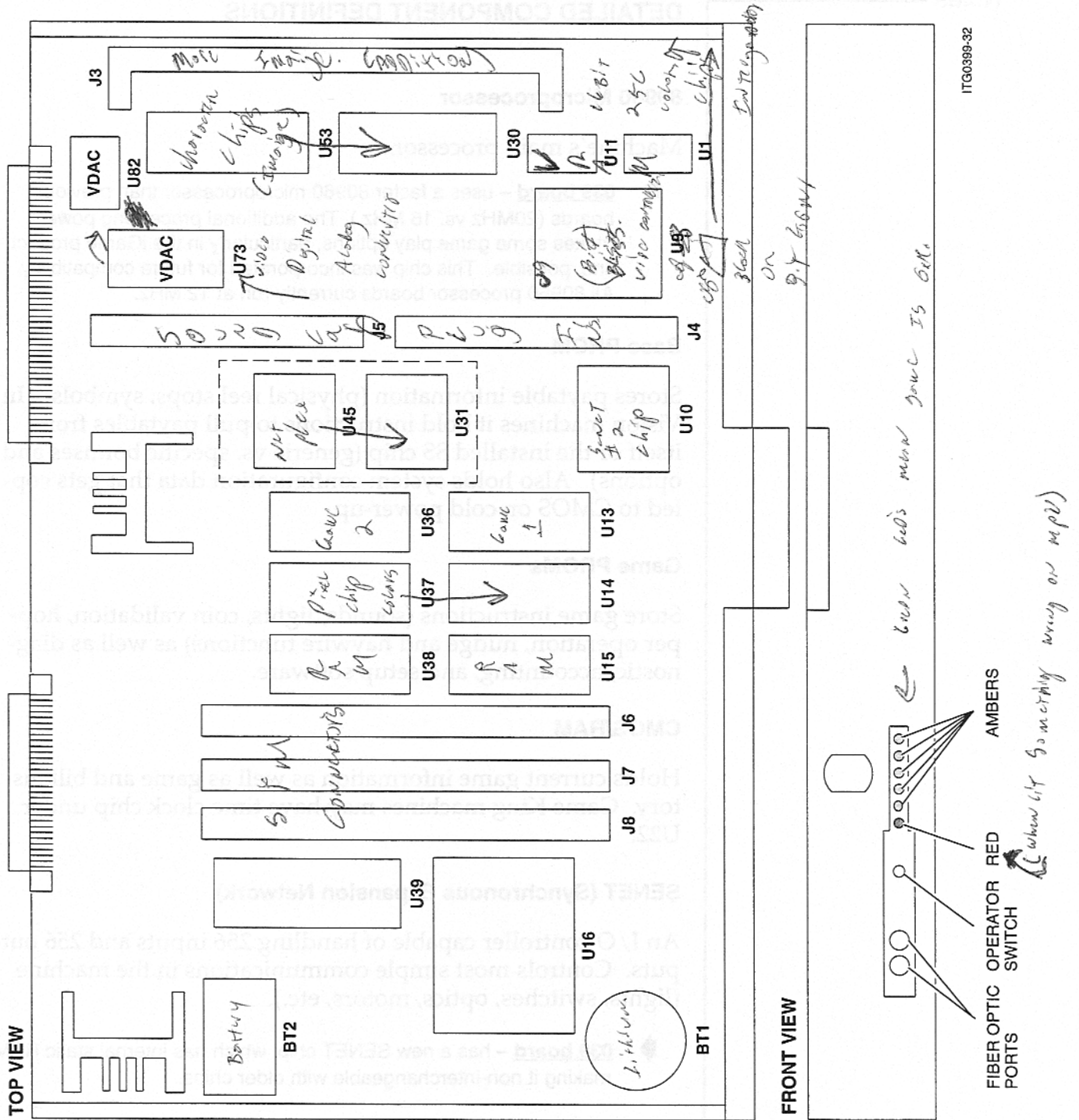
ITG0399-32



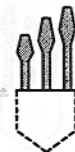
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80960 GAME KING/GAME PLUS PROCESSOR BOARD - 757 039 00



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Notes

DETAILED COMPONENT DEFINITIONS

80960 Microprocessor

Machine's main processor.

- ▶ **039 board** – uses a faster 80960 microprocessor than previous boards (20MHz vs. 16 MHz.) The additional processing power makes some game play options, particularly in the iGame product line, possible. This chip was incorporated for future compatibility. All 80960 processor boards currently run at 12 MHz.

Base PROM

Stores payable information (physical reel stops, symbols). In Vision machines it holds instructions to pull paytables from itself or the installed SS chip (generic vs. specific bonuses and options). Also holds system configuration data that gets copied to CMOS on cold power-up.

Game PROMs

Store game instructions (sounds, lights, coin validation, hopper operation, nudge and haywire functions) as well as diagnostic, accounting, and setup software.

CMOS/RAM

Holds current game information as well as game and bill history. Game King machines may have time clock chip under U22.

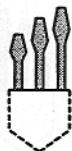
SENET (Synchronous Expansion Network)

An I/O controller capable of handling 256 inputs and 256 outputs. Controls most simple communications in the machine (lights, switches, optics, motors, etc.).

- ▶ **039 board** – has a new SENET chip, which has internal static RAM making it non-interchangeable with older chips.

Multimedia Connector

For plugging in a sound card, or another multimedia device in the future. Some IGT machines are currently using a soundboard in these connectors. (Australian sound card).



QUARTS

Serial interface for communicating with microprocessor controlled devices (bill acceptors, spectrum displays, touchscreens, etc.). The NETPLEX operates on one of the eight channels available. (The 8032 platform had a DUART to communicate with bill acceptors and player tracking systems).

NiCAD Battery (Optional 3.6 VDC)

Powers the Telltale-Plus Network. Telltale-Plus monitors access to critical machine areas when line voltage is off or disconnected.

► **039 board** – has an improved battery charger that will slowly ramp-up charges to NiCAD battery.

Lithium Battery (3.0 VDC)

Maintains CMOS/RAM data when there is no power.

Key Switch Connector

Two-pin connector that enables the use of a “key switch” instead of a key chip when accessing privileged options or key chip menus. All 80960 boards are configured to use either the privileged options key switch or a key chip, depending on jurisdiction. The Program Summary Report (PSR) for your game program should tell which one it is equipped with.

PROCESSOR TRAY INDICATORS

IGT processor boards come in many different configurations, this is a general breakdown of some of the responsibilities of the firmware-driven LED's.

Fiber-Optic Ports

Used to run diagnostics of the communication ports

Can be used to update software in NET-PLEX devices with flash download capability, such as a bill acceptor

Operator Menu Switch

Used to access the operator menu.

Red LEDs

Indicate a failure on the processor board.

Green LEDs

Indicate normal operation of the processor board, (some versions provide a steady green and others use a flashing green).

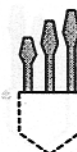
Amber LEDs

Game King / I-Game – some versions use these to indicate RAM/CMOS failures during power-up

Vision

– DS2 flashes to indicate normal communications to the LCD unit.
– DS2 and DS3 indicate a key chip has been inserted.

iGame Plus – DS1,2 and 3 remain solid to indicate normal processor operation (instead of green)



Notes

MODEL-SPECIFIC COMPONENT DEFINITIONS

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VISION

Version EPROM (U44)

Indicates a jurisdiction ID and will enable or disable functions approved for that jurisdiction.

Enables bonus games up to and including that release.

SS PROM (U17)

Stores payable information.

For vision generic games, it allows use of an already existing IGT game theme with the vision machine. (must be at least 120 NS).

Time Clock Chip – (U32)

Keeps machine time and date.

GAME KING / iGAME

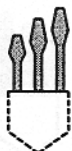
Pixel and Character Generator PROMs

A set of 4 (2 Pixel, 2 CG) EPROMs that hold image generation data for the Bitblitz chip to process.

Bitblitz Processor

Video processor that receives commands from the 960 processor and then manipulates pixel, color, and character data to create a digital image that it sends to the monitor.

- ▶ **039 board** – has a new Bitblitz chip that looks for either PROMs or flash card CG.



VISION AND iGAME-PLUS

3 SIMM Connectors (Single Inline Memory Modules)

For future memory expansion, can be used to increase memory in many areas of the board including CMOS, game PROM, base PROM, or pixel graphics.

iGAME-PLUS

- New video circuit capable of "block graphics" that can manipulate pixels or block sections onto CRT faster, making updates faster.
- New design will be able to access 256 colors simultaneously, older circuits manipulated 16 colors blocks to generate more colors.

CG Flash Connector (J3)

Allows use of a flash memory card in place of CG PROMs, which gives the board 256 color capability if the flash card is installed.

Either the flashcard or the PROMs can be installed at one time.

VDRAMs (Video Dynamic RAM) (U1, U11)

Are now two 16-bit, 256-color ICs instead of seven individual RAM chips.

V-Bit Controller (U8)

determines if data should go out in BIT or Block form.

VDAC (U82 or U73) Video Digital to Analog Converter

Converts graphics, then sends them out to CRT.

Can use either a DIP (dual-in-line package) or PLCC (plastic leaded chip carrier), depending on availability.

- Dual-in-line used with CG EPROM configuration
- PLCC (Quad) used with CG FLASH card configuration

FLASH Download Connectors (J10, J11)

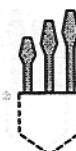
Will allow us to flash download even more data, instead of using EPROMs in the future.

Video Header (X1)

Routes video signals (red, green, blue, vertical, horizontal) out to the motherboard. A future option may require the video signals to be routed to a multi-media card for further video processing.

Time Clock Chip (U21)

Keeps machine time & date.



Notes

GAME CONVERSIONS

GAME KING/iGAME CONVERSION PROCESS

Converting a Game King/iGame machine may require replacing or installing;

- Base PROM
- Game PROMs
- Color graphics 4 PROM set (2pixel, 2CG)
- Two pixel EPROMs and flash CG board (iGame-Plus)

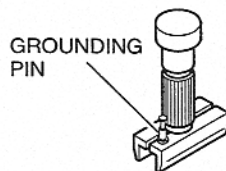
Once all appropriate software has been installed;

1. Reinstall the tray into the machine.
2. Turn power on
3. Machine will display an EEPROM or RAM error message.
4. Use reset key to clear each update screen.
5. Once the EEPROM has been updated with the new game data, the game software has been converted.
6. Verify machine options in OPERATOR and KEY-CHIP (or privileged options) menus.



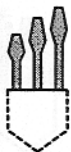
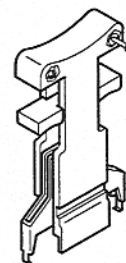
Computer chips are ESD sensitive devices. Use the appropriate tools when extracting or inserting PROMs.

Insertion Tool



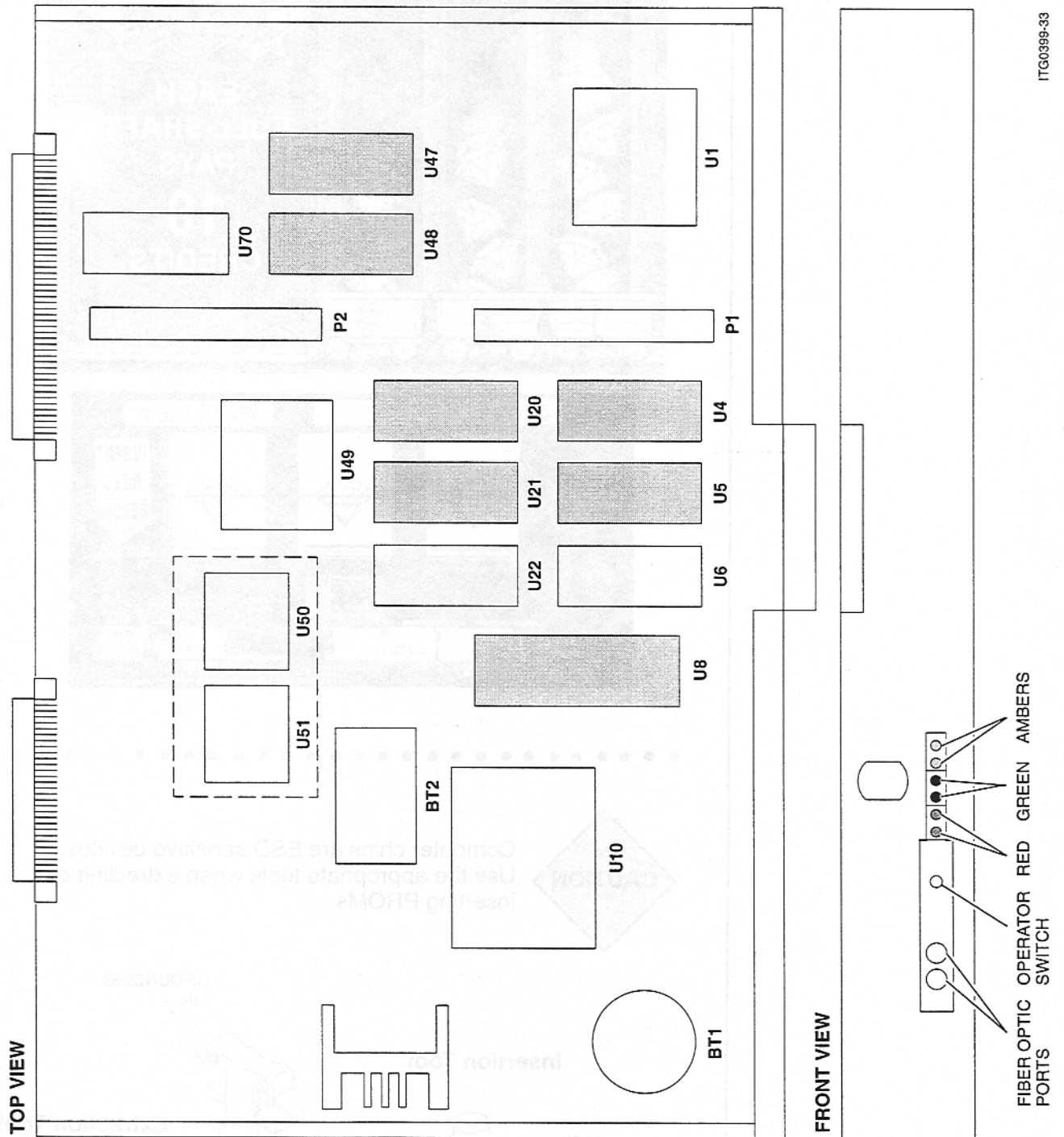
GROUNDING PIN

Extraction Tool

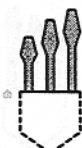


Game Conversion – Game King / iGame

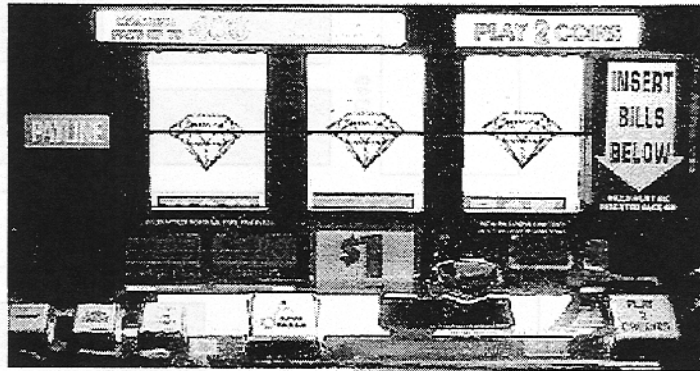
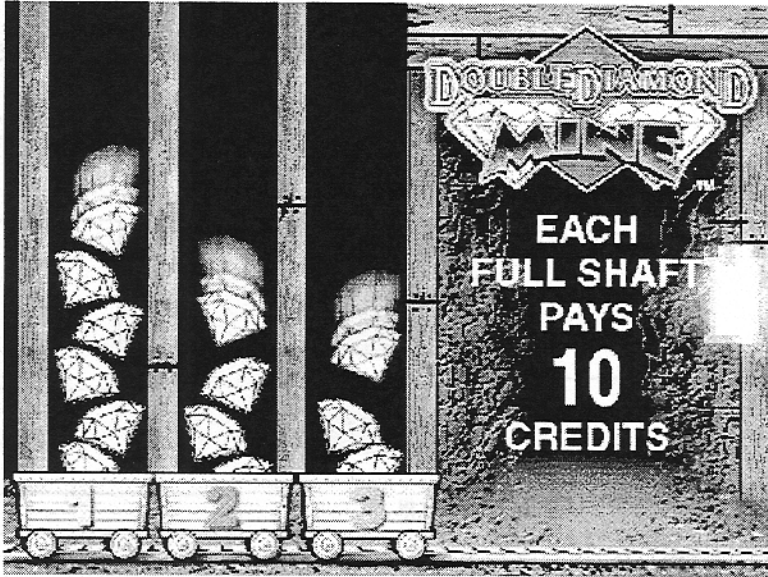
80960 GAME KING/iGAME PROCESSOR BOARD – 757 035 00 & 757 038 00



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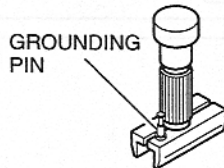


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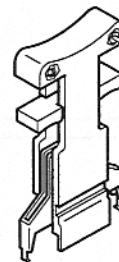


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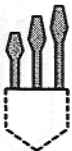
Insertion Tool



GROUNDING PIN



Extraction Tool



VISION THEME CONVERSIONS

To convert a Vision game you should understand:

1. Your jurisdictional requirements on version chips.
2. The difference between *game specific* configurations and *generic game* configurations.

GAME SPECIFIC

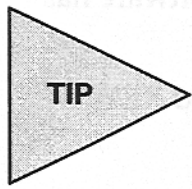
- The bonus game (in the LCD) is linked directly to the overall machine theme. (Double Mine machine = Diamond Mine bonus game).
- When a designated reel symbol lands on a payline, it triggers something in the bonus game to increment accordingly.

For Example: On the Diamond Mine game, when a diamond lands on payline 1, 2, or 3, a diamond falls into the corresponding mine shaft (1, 2, or 3).

- There is only one bonus game module loaded into the ATA card.
- From seven-to-ten overall machine payback percentages are loaded on the base PROM and enabled individually through the KEYCHIP MENU.

GENERIC GAME

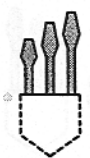
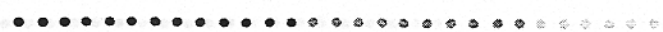
- The bonus game (in the LCD) is not linked to the machine theme.
- The bonus game is incremented when a designated coin-in or coin-out value has been reached.
- Coin-in/ coin-out values can be set with a KEYCHIP.
- Setting up coin-in/ coin-out values will affect the bonus game's payback percentage.
- The main game and the bonus game have two different payback percentages. The overall machine payback percentage combines main game and bonus game percentages.
- The generic game configuration allows the use of older/familiar S-Plus game themes on the 80960 platform.
- A GENERIC GAME configuration also requires the use of a REEL EPROM (SS chip) from the appropriate game theme (120ns or faster).
- ATA card is loaded with several BGMs. Individual games can be enabled through software (KEYCHIP MENU).



Bonus Game Modules
ATA
Game Program
Base Program
Version



All of these software components must be compatible with each other for the game to function properly.



Notes

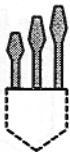
VISION THEME CONVERSION PROCESS

Converting a Vision machine may require replacing or installing:

- Base PROM
- Game PROMs
- Version PROMs
- SS Chip
- ATA card with appropriate bonus game modules (BGMs) loaded
- Appropriate RFA Upload (windows version)
 - RFA Card uploads the LCD with appropriate version of MS Windows software.
 - Once RFA upload is complete, remove the RFA card (it cannot stay in machine).
 - 1 RFA card can upload many LCDs, but each machine needs its own ATA card.

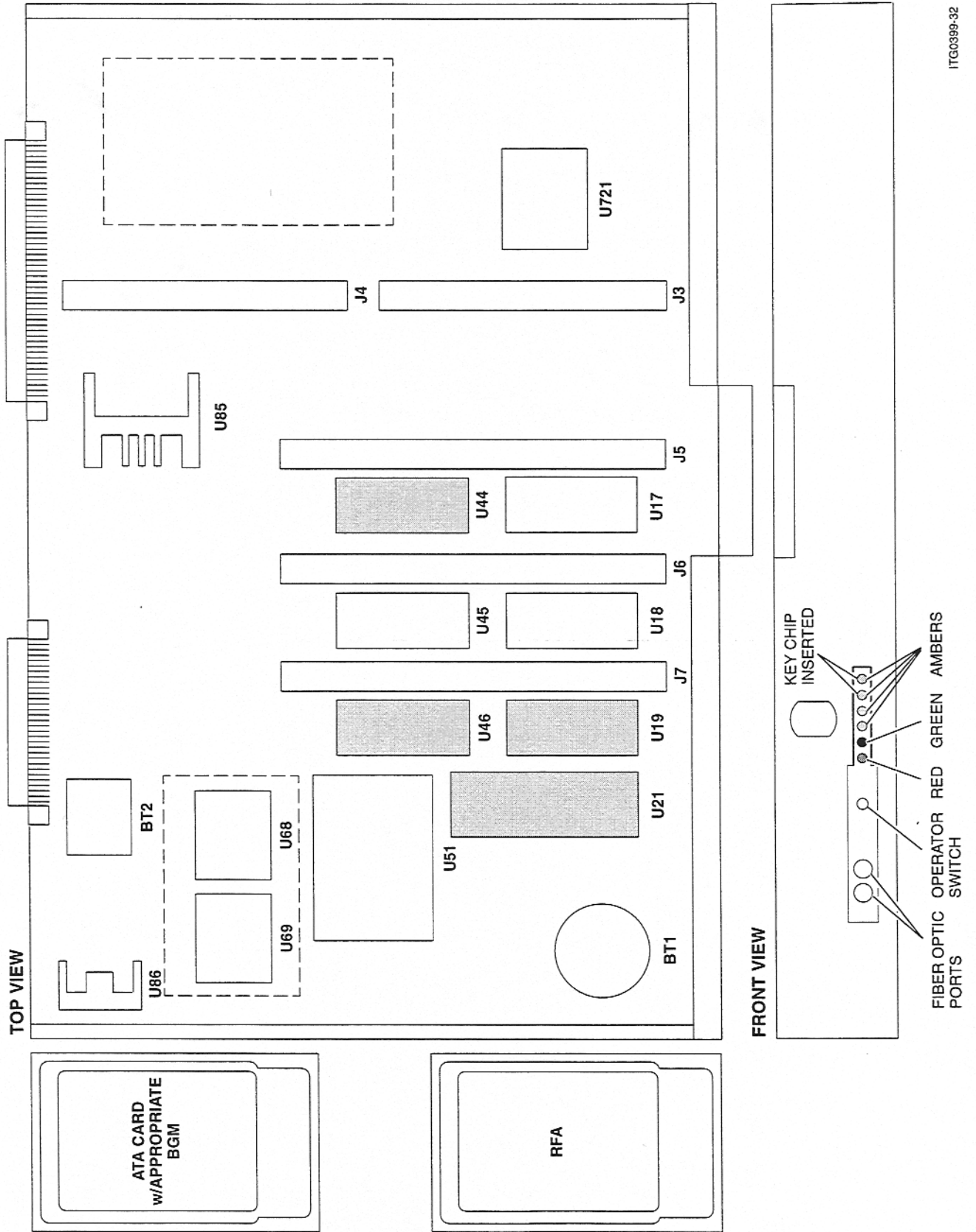
Once all appropriate software has been installed;

1. Reinstall the tray into the machine.
2. Verify ATA card is installed in LCD.
3. Turn power on.
4. Machine will display an EEPROM or RAM error message.
5. Turn the reset key to clear each of the EEPROM update messages.
6. Machine displays will guide you through the rest of the update.
7. When updates are completed, machine software has been converted.
8. Verify machine options in OPERATOR and KEY-CHIP menus.



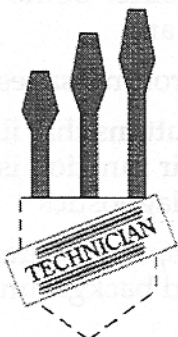
Game Conversion – Vision Theme

80960 VISION PROCESSOR BOARD – 755 105 00



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Game Software Module

Machine Overview

In this module you will learn:

- About accounting menus and their importance

Floor Operations

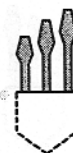
In this module you will learn:

- About the attendant menu and its options
- About simple menu diagnostic options
- How to set the machine in the Out-Of-Service mode
- How to access and use Bill-In History
- How to access and use Game History

Service and Troubleshooting

In this module you will learn:

- About the operator menu and its options
- How to access and use diagnostics
- How to perform machine setup
- How to perform machine conversions



Notes

SOFTWARE OVERVIEW

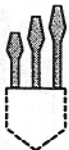
Game King and Vision programs, both based on 80960 platform technology, have many similar characteristics. Some of the key operating features this platform offers are:

- On-screen game play instructions and error messages
- Player panel switches and touchscreen buttons that illuminate or appear on the screen when their function is relevant during game play, testing and diagnostics
- Software-enabled options, such as game speed, visual and/or attract modes, sound volume, and background color
- Options, such as on-screen viewing of accounting, diagnostics, play history, event logs, modify meters, setup, game tests, and out of service
- A key chip feature that prevents unauthorized changes to sensitive options such as denomination and game selection
- Built-in diagnostic capabilities, with both automatic software review and technician-controlled diagnostic steps that allow the manual test of player switches, touchscreen, hopper, coin acceptor, bill acceptor, access door switches, sound effects, and ticket printer

Information about any diagnostic or set-up option not documented in technical manuals may be obtained by requesting a copy of the PSR (program summary report) for a specific game version (number on game chip). PSRs may be obtained from IGT's Product Information Network or from IGT Customer Service.

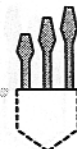


Note: Specific screen displays and software options vary depending upon the jurisdiction involved. The information presented in this training guide is common to most jurisdictions. The illustrations and tables provided represent typical software functions.



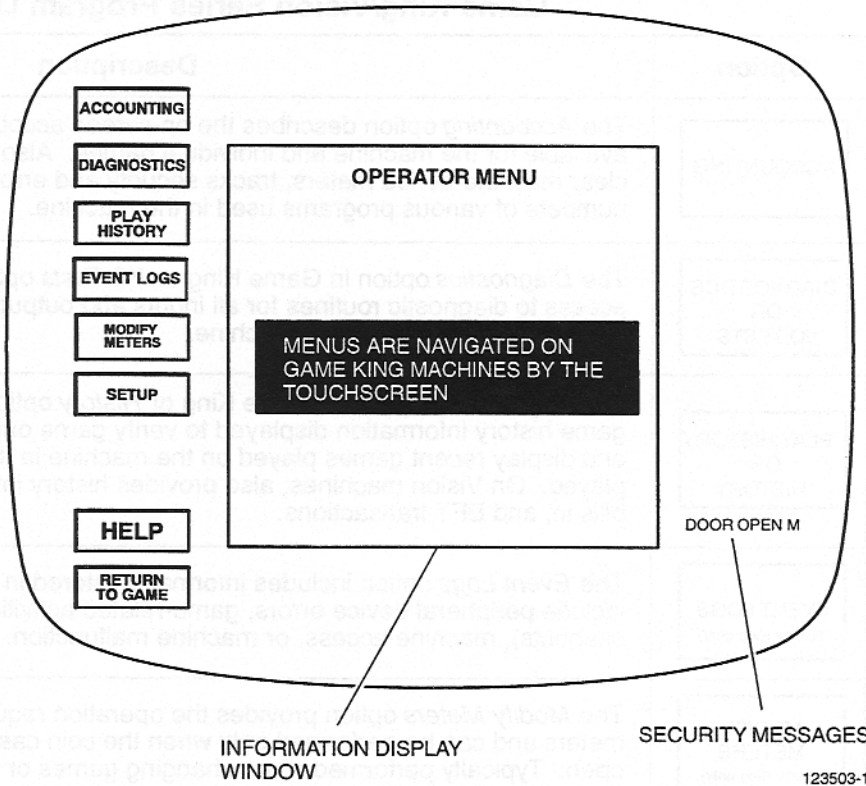
Game King and Vision Slot game programs have many basic program options available from the main menu.

Game King/Vision Series Program Options	
Option	Description
ACCOUNTING	The <i>Accounting</i> option describes the on-screen accounting information displays available for the machine and individual games. Also provides the operation required to clear machine period meters, tracks security and error events, and displays version numbers of various programs used in the machine.
DIAGNOSTICS OR I/O TESTS	The <i>Diagnostics</i> option in Game King or <i>I/O Tests</i> option in Vision software provides access to diagnostic routines for all inputs and outputs for the purpose of testing various displays and features in the machine.
PLAY HISTORY OR HISTORY	The <i>Play History</i> option in Game King or <i>History</i> option in Vision software provides game history information displayed to verify game outcome, resolve player disputes, and display recent games played on the machine in the chronological order they were played. On Vision machines, also provides history information for security events, tilts, bills in, and EFT transactions.
EVENT LOGS (Game King only)	The <i>Event Logs</i> option includes information stored in the event logs. Events may include peripheral device errors, game-related activities (e.g., coins accepted, player cashouts), machine access, or machine malfunction.
MODIFY METERS (Game King only)	The <i>Modify Meters</i> option provides the operation required to clear machine period meters and can be performed only when the coin cash box or bill acceptor cash box is open. Typically performed when changing games or filling the hopper.
SETUP OR OPTIONS	The <i>Setup</i> option in Game King or <i>Options</i> selection in Vision software includes steps available to set machine-wide preferences, game-specific preferences and communication setup (e.g., modem and baud rate protocol, encryption key reset).
GAME TESTS (Vision only)	The Game Tests option allows a technician to test game pay tables and to verify reel strip stops.
OUT OF SERVICE OR SERVICE	The <i>Out of Service</i> option in Game King or <i>Service</i> option in Vision software displays "Out of Service" on the video monitor or LCD to render a machine inoperative without turning the power off.
KEY CHIP (Vision only)	The <i>Key Chip</i> option includes setup/enable routines for the highest security level access functions, including denomination selection, game selection, and bonus game selection or setup where applicable.



Notes

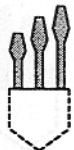
GAME KING PROGRAM OPTIONS



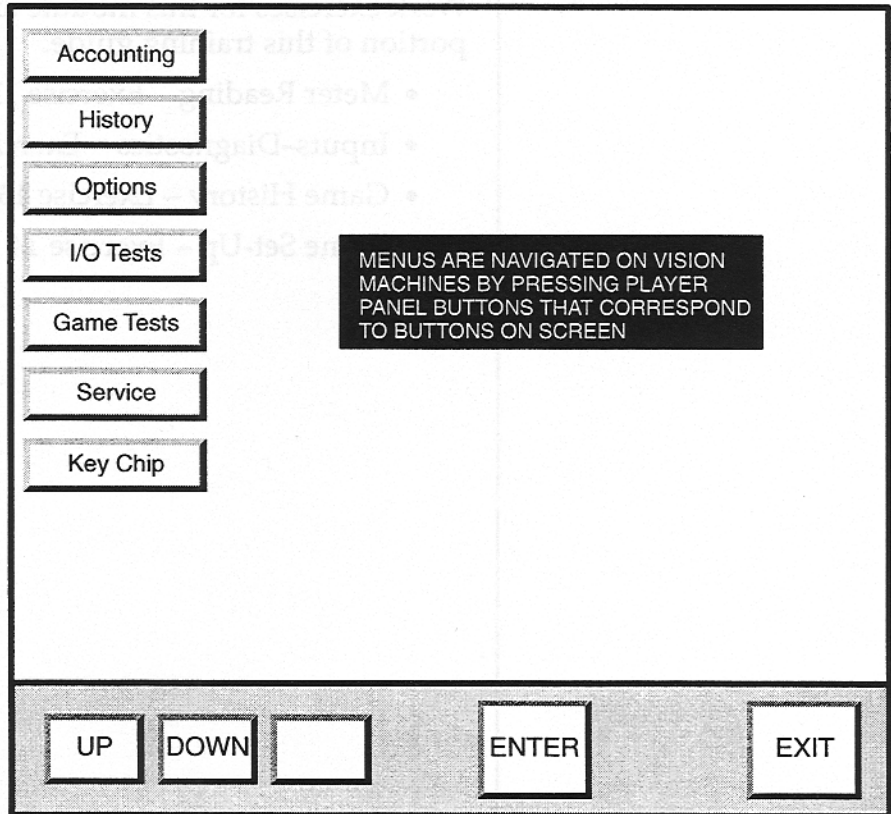
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Game King Attendant/Operator Access Matrix

	Attendant Menu	Operator Menu
Option	Access through reset key switch.	Access through operator switch on processor tray.
Accounting	X	X
Diagnostics	X	X
Play History	X	X
Event Logs	X	X
Modify Meters	X	X
Setup		X
Sound Setup	X	
Out of Service	X	



VISION PROGRAM OPTIONS



1299-5A

Vision Attendant/Operator Access Matrix		
	Attendant Menu	Operator Menu
Option	Access through reset key switch.	Access through operator switch on processor tray.
Accounting	X	X
History	X	X
Options		X
I/O Tests	X*	X
Game Tests		X
Service		X
Key Chip		X**
* Partial access only. ** A view only menu, unless a key chip procedure is followed for setup of options contained within this menu.		

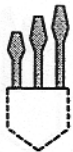


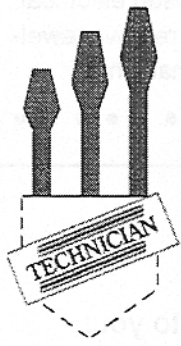
Notes

WORK EXERCISES

Work exercises for this module are located in the Workbook portion of this training guide.

- Meter Reading – Exercise 11
- Inputs-Diagnostics – Exercise 12
- Game History – Exercise 13
- Game Set-Up – Exercise 14





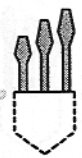
Troubleshooting Theory Module



Service and Troubleshooting

During this module you will learn:

- Methods to troubleshoot machines



Notes



SAFETY FIRST!

Whenever working on a machine, be cognizant of personal safety issues, sharp edges, catch points, pinch points, balance, exposed electrical connections, etc. It's advisable to remove jewelry & watches when working on a machine.

Troubleshooting Input to the Technician

You have five senses, which generate input to you:

- Sight
- Hearing
- Touch
- Smell
- Taste

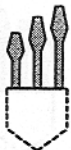
All senses can be used to discern the state of a machine. We advise against extensive use of taste when troubleshooting a machine.

KNOW YOUR MACHINE

In order to be able to troubleshoot a "bad" machine, you first have to know what a "good" machine is. This class teaches you about the technical systems on a technical/intellectual level, BUT ... you also need to know the machine on a personal sensory level.

One of the primary areas that you need to know is the power-up sequence. Learn what sounds the machine makes, in what order, at what times. Then do the same with lights. Get to know what is normal for readouts, etc. When you know what's right, then encounter a machine that is not right, determine what is different by using your senses. Determine what system the "wrong" thing is associated with.

Experience is key here. You need to go out and play with the machines.



Another skill/sense you need to develop is what do right things look and feel like. How tight should a connector be? When a coin comparator is correctly in place, what does it look like? What should it feel like when you give it a slight pull? Should a wire connecting to a pin have a greater than 90-degree sharp bend in it, or might that mean that the conductor inside the plastic insulation has broken and only the insulation is connected to the pin? Does a button normally take 10 seconds to rebound to the start position or is all that drink residue slowing it down a bit?

Become aware. Become knowledgeable.

Determine "what just happened" to the machine. If the machine was working fine

10 minutes ago, and someone has since poured three drinks into the machine, that might have something to do with the fact the machine no longer works.

Sometimes your senses aren't refined enough to detect problems. Sometimes you can be fooled by what you think you sense. Example: Look at a fuse, see the element intact, conclude the fuse is good. But the fuse is only good if that element delivers continuity from one end cap to the other. The only way to know if the element is doing its job is to test continuity from cap to cap.

Don't let preconceived ideas become road-blocks to successful troubleshooting.



A/B COMPARE, "KNOWN GOOD VS SUSPECTED BAD", & SUBSTITUTION

Our industry often provides us with a convenient troubleshooting arrangement not seen in most other industries. Right next to the machine that is giving you trouble will be a certain number of machines just like it. This provides you with an easy means of comparing a known good machine or component with a suspected bad machine or component.

This technique is referred to as A/B compare. Compare machine A to machine B. Another important part of this technique is the practice of swapping the suspected bad part with a known good part. Does the problem follow the suspected bad part? Is the "bad" machine no longer bad with the known good part substituted? This is the most typical technique used in our industry to troubleshoot machines.

KISS = Keep It Simple Sam
(Sam being you).

Example: If an electrical device doesn't appear to be receiving electricity, check to see if there's voltage to the device or not. If not, check for that voltage at the source. If there, then check the connections between.

The Half-Split Method – In the case of involved systems, you can minimize steps for troubleshooting by checking source, checking output. If source is there but output isn't, check output at the halfway point between source and output. If there, check output at 3/4 point. If not there, check output at 1/4 point, etc. Continue to divide in half until the problem is found.



