Inputs and Outputs Module

Machine Overview

During this module you will learn:

- What inputs are

Floor Operations

During this module you will learn:

- What inputs are
- What outputs are
- How to test simple inputs
- How to test simple outputs

Service and Troubleshooting

During this module you will learn:

- How I/Os are used in IGT machines
- How I/Os can be tested
- Differences between I/O trays and I/O circuit boards
- How the Comm Analyzer works

Notes

Meter Disconnected - means Bad or Poorly Seated Cabinet I/O

> **GENERAL COMPONENT DEFINITION**
>
> **Inputs:** devices that communicate commands to the processor board (example: switches)
>
> **Outputs:** devices that are told what to do by the processor board (example: sounds, lights, etc.)

DETAILED COMPONENT DEFINITIONS

I/O Boards, General

I/O boards are SENET devices. Their primary function is to:

- Relay inputs from switches to the processor
- Relay outputs from the processor to control lights and solenoids

They are serial communication boards. Each board handles up to 16 inputs and up to 16 outputs.

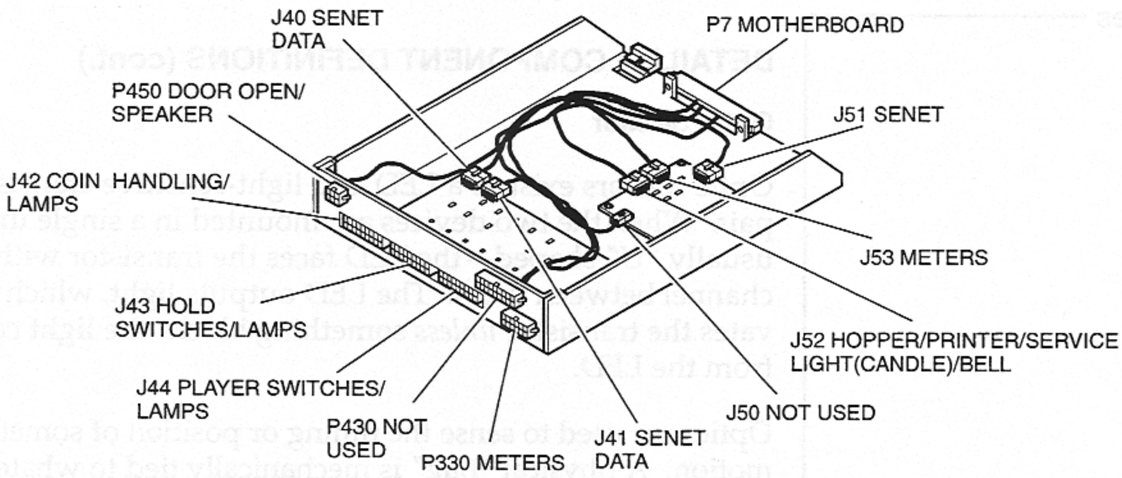
A secondary function of I/O assemblies is to act as an isolation buffer between the processor board and an I/O device. If an I/O device external to the processor shorts out, the I/O board will protect the processor board by taking the impact. At times, that impact results in physical damage to the I/O board.

Earlier Game King machines have a large I/O tray that holds two I/O boards. The smaller board is responsible for inputs/outputs in the cabinet, while the larger board is responsible for inputs/outputs on the main door.

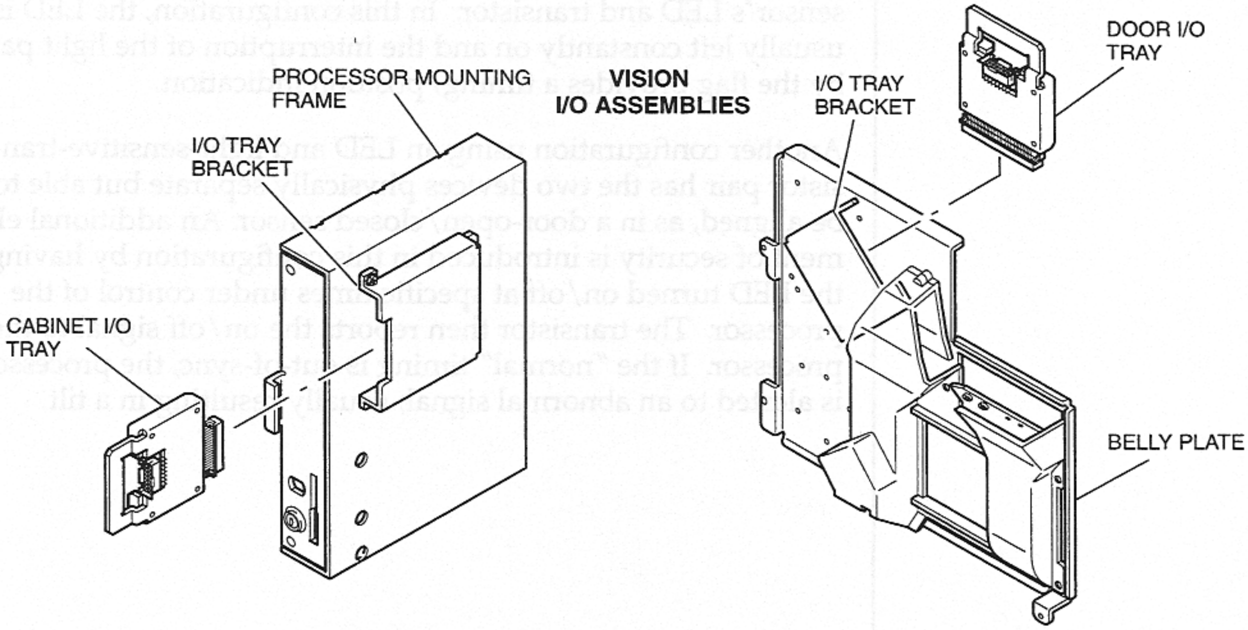
I/O Assemblies for Newer Equipment

There are at least two I/O boards in each machine: door and cabinet. The most obvious physical difference between the two are that door I/O assemblies have a 32x3 pin connector while cabinet I/O assemblies have a 16x3 pin connector. These assemblies also come in "earlier and later" versions. The latest door I/O assemblies have space for a 4-bit DIP switch. It also has four LEDs on the main component side that light up in a pattern representing the address for that card.

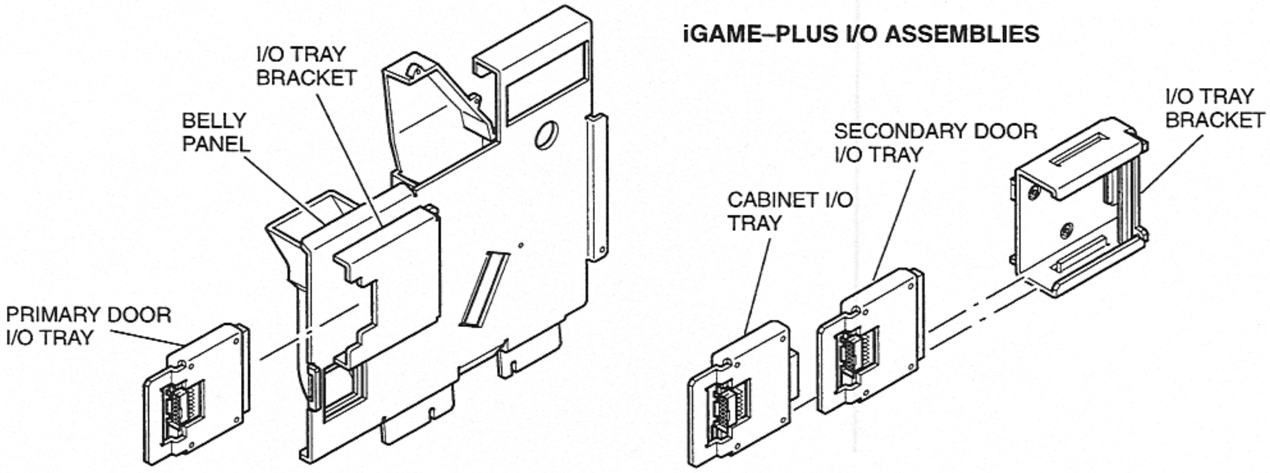
GAME KING I/O ASSEMBLY



VISION I/O ASSEMBLIES



iGAME–PLUS I/O ASSEMBLIES



Notes

DETAILED COMPONENT DEFINITIONS (cont.)

Optic Sensor

Optic sensors exist as a LED and light-sensitive-transistor pair. When the two devices are mounted in a single unit – usually "U" shaped – the LED faces the transistor with a channel between them. The LED outputs light, which activates the transistor *unless* something blocks the light coming from the LED.

Optics are used to sense the timing or position of something in motion. A physical "flag" is mechanically tied to whatever moves. The flag moves through the channel between the optic sensor's LED and transistor. In this configuration, the LED is usually left constantly on and the interruption of the light path by the flag provides a timing/position indication.

Another configuration using an LED and light-sensitive-transistor pair has the two devices physically separate but able to be aligned, as in a door-open/closed sensor. An additional element of security is introduced in this configuration by having the LED turned on/off at specific times under control of the processor. The transistor then reports the on/off signal to the processor. If the "normal" timing is out-of-sync, the processor is alerted to an abnormal signal, usually resulting in a tilt.

SENET and I/O Assemblies

The SENET is a serial communications channel for simple I/O devices (devices like switches, lamps or LEDs that require or report only a simple "on" or "off"). The SENET system on the processor board can handle 256 inputs and 256 outputs (16 inputs and 16 outputs per board multiplied times 16 boards).

The SENET system works by addressing each individual board in sequential order. It deals one board handling the first output then the first input associated with that board, then the second output then second input, etc., sequentially till all 16 inputs/outputs for that board are done. It then continues to the next board, dealing with the inputs/outputs in the same way.

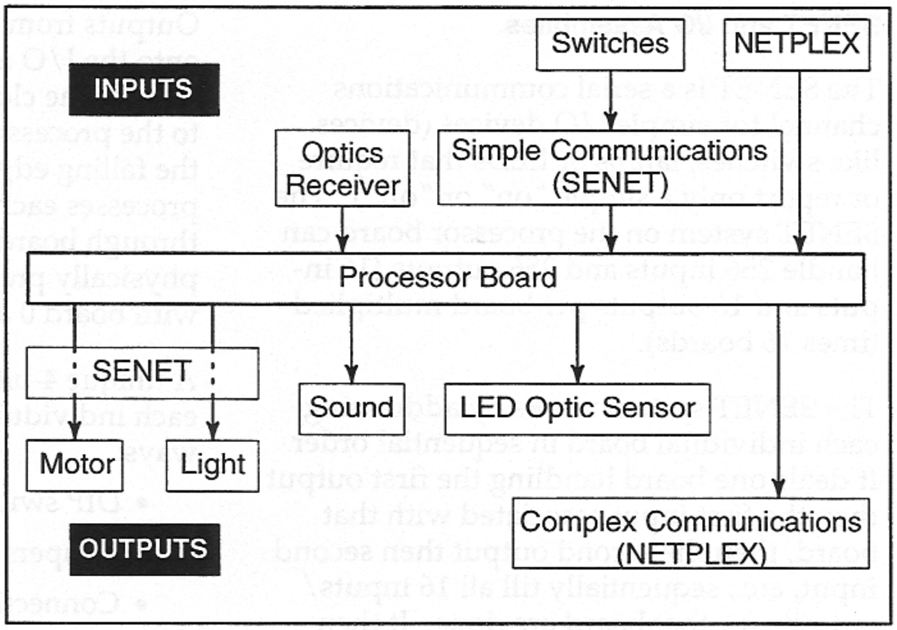
Outputs from the processor are latched onto the I/O assembly during the rising edge of the clock, inputs from the I/O card to the processor are communicated during the falling edge of the clock. The SENET processes each of 16 boards, board 0 through board 15, whether the board is physically present or not, then starts over with board 0 again.

A unique 4-bit address is associated with each individual board and is set one of 3 ways:

- DIP switch on the board
- Jumpers on the board
- Connections in the wiring harness.

On some boards there are 4 LEDs that display the address for that board in that position. Only one of the three possible addressing schemes should be used in any given machine.

Notes


INPUTS
Switches
NETPLEX
Optics Receiver
Simple Communications (SENET)
Processor Board
SENET
Sound
LED Optic Sensor
Motor
Light
Complex Communications (NETPLEX)
OUTPUTS

GENERAL THEORY OF OPERATION

Input signals go into the processor board.

Output signals come from the processor board.

DETAILED THEORY OF OPERATION

Inputs/outputs are usually from the processor's perspective.

- Switches (simple)
- Light-sensitive transistor half of an optic sensor (simple)
- Special communications from complex device (complex)

Outputs from the processor board can:

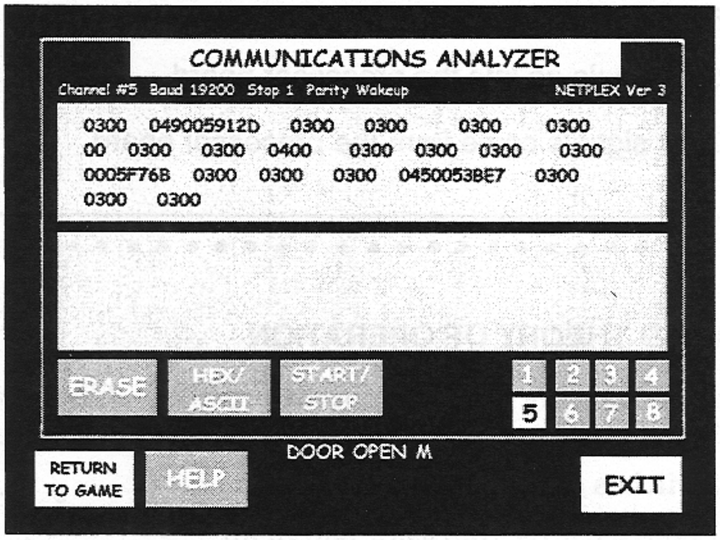
- Activate a motor (simple)
- Activate a light (simple)
- Activate sound (simple to medium)
- Turn on the LED half of an optic sensor (simple-medium)
- Send special communications to a complex device (complex)

That's it: two to three inputs, four to five outputs.

I/O SOLUTIONS

A bad I/O board can generate a "Meters Disconnected" error. If this occurs replace the I/O board or assembly with a known good one.

Notes



TRY THIS!

Go to the comm analyzer, select channel 5 (NETPLEX), observe the communication, then touch the screen and watch the communication change as the touchscreen communicates the "x-y" position of your touch.

NETPLEX

Two QUART chips (Quad Universal Asynchronous Receiver Transmitter) provide eight serial communication channels. Typically, the NETPLEX is on channel 5, which is the first channel on QUART 2. Each QUART handles four channels, giving the machine capacity to handle eight separate communication channels. Those eight channels appear in the communications analyzer. Each channel's responsibility is identified at the top of the screen when a given channel is being displayed. Current NETPLEX systems include:

- Touchscreen system and other NETPLEX devices (channel 5)
- LCD system
- Bill acceptor system

HELP Button

Information relating to specific communication channel assignments can be viewed by pushing the HELP button.

Miscellaneous Components Module

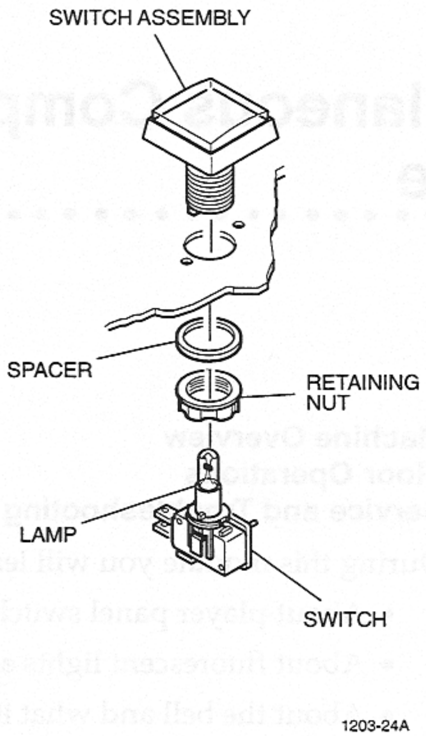
Machine Overview
Floor Operations
Service and Troubleshooting

During this module you will learn:

- About player panel switches and how they work
- About fluorescent lights and how they work
- About the bell and what it is used for
- About the service light and its uses
- About the fan and its importance
- About the slot handle and what it does

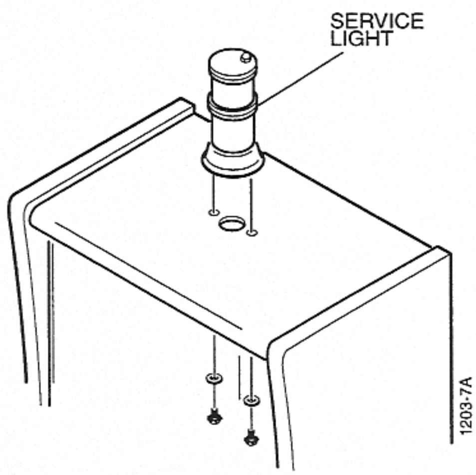
Notes

Player Panel Switches



These are both input and output devices. As an input, activation sends signals to the processor. As an output, incandescent lights housed within the switch illuminate. They are best described as normally closed, plunger style lighted switches. Signals to and from the switches are routed through the door I/O assembly and communicate with the SENET on the processor board. Bulbs are lit using 13VDC. When replacing Vision or Game King incandescent bulbs, refer to IGT parts lists for the proper wattage. Using improper bulbs can result in premature failure.

Service Light (Candle)
This lamp, located at the top of the machine, has multiple display functions. The service light can indicate a request for change from the attendant, and tilt and jackpot conditions. This lamp receives 13VDC from the processor. In some cases, tilt conditions make this light flicker progressively faster the longer it remains unattended.



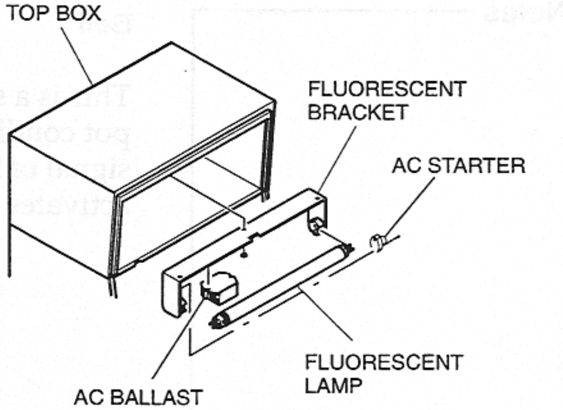
Fluorescent Lights

On some Game King models there is a traditional fluorescent lighting system using AC starters and ballasts. Vision machine and iGame models have gone to a newer DC lighting system.

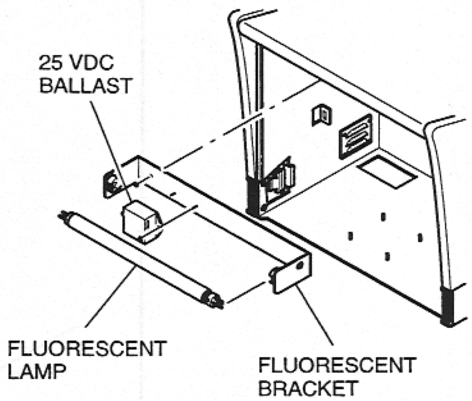
DC Ballasts

DC ballasts have replaced traditional fluorescent starters. A DC ballast unit is adjacent to every bulb. The DC ballast, using an inverted 25 VDC signal, ignites gases inside the bulb. This is more efficient and meets electric codes throughout the US, Canada and European markets.

Note: *Earlier DC ballast units could overheat. In earlier machines adding an in-line fuse board that mounted right at the connector solved this issue. IGT has redesigned the ballast in all later machines to prevent overheating.*



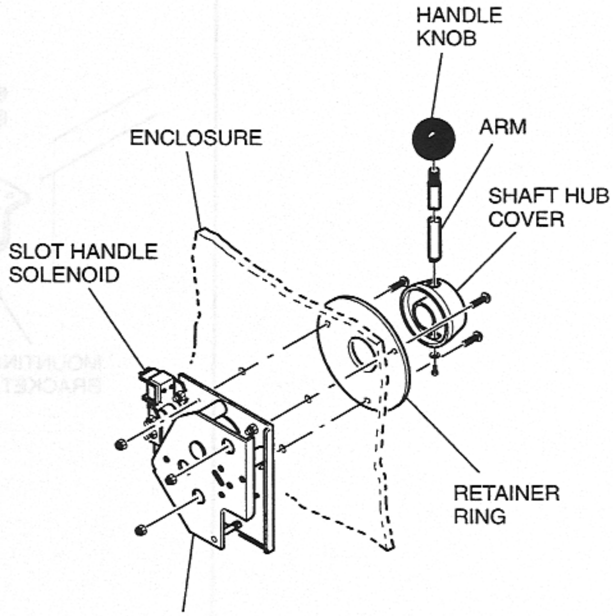
GAME KING FLUORESCENT 1236-31A



VISION FLUORESCENT 1294-26A

Slot Handle

This is a manual player input device located on the right side of the cabinet. When pulled it sends a "spin reels" signal to the processor. Its signal path is identical to that of the Spin Reels switch on the player panel. Additionally, the handle has an interior ratcheted mechanism to simulate the "feel" of the traditional electromechanical slot machine. The speed, force and release of the handle do not affect game play in any way.

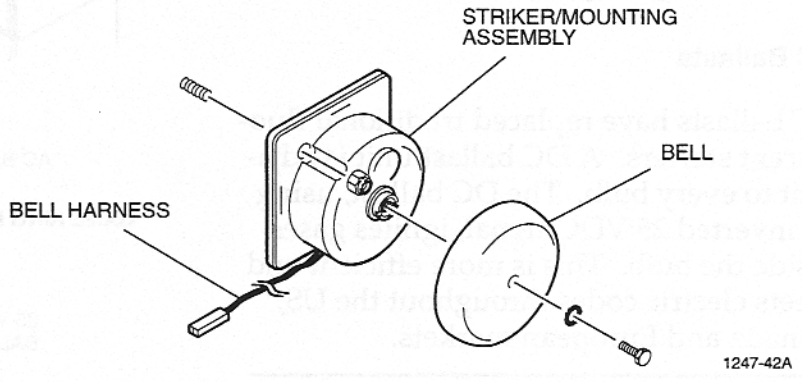


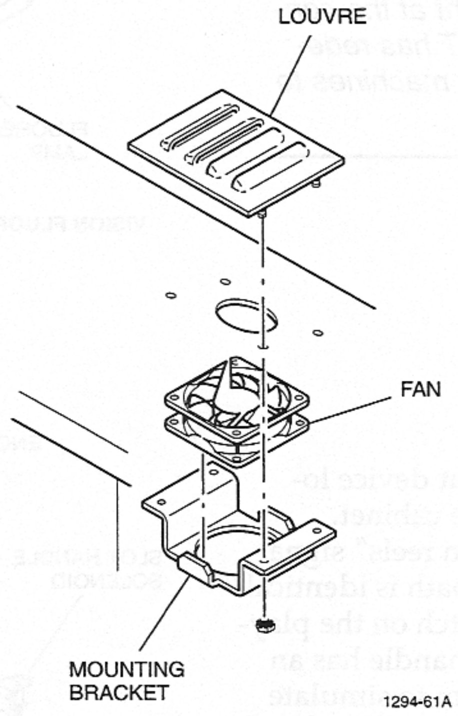
HANDLE MECHANISM 1294-29A

Notes

Bell

This is a standard relay activated bell to indicate a jackpot condition. When the processor detects a jackpot, a signal of 25 VDC is sent to activate the bell. This bell deactivates when the reset switch is turned.

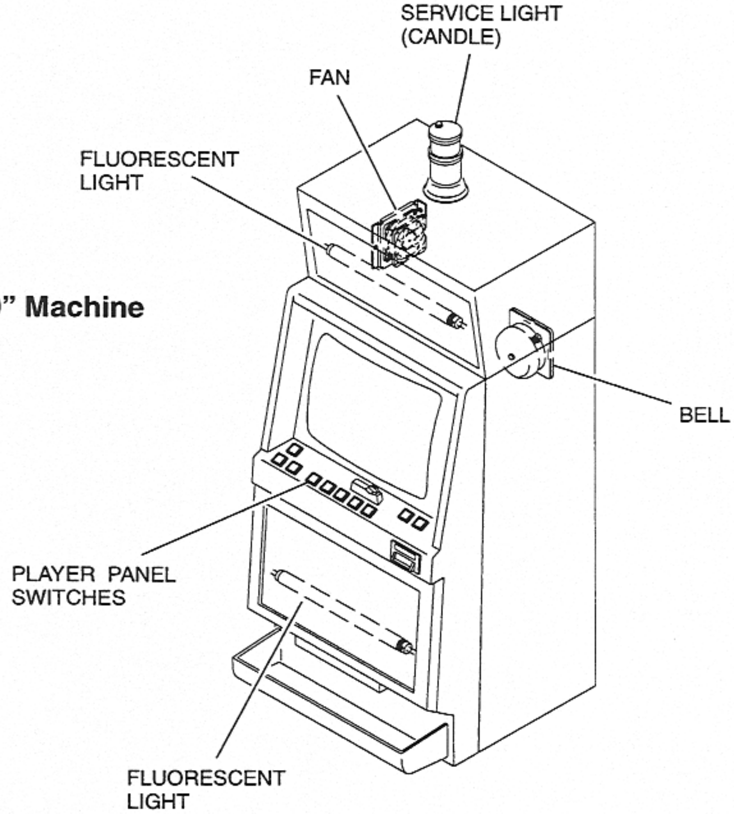




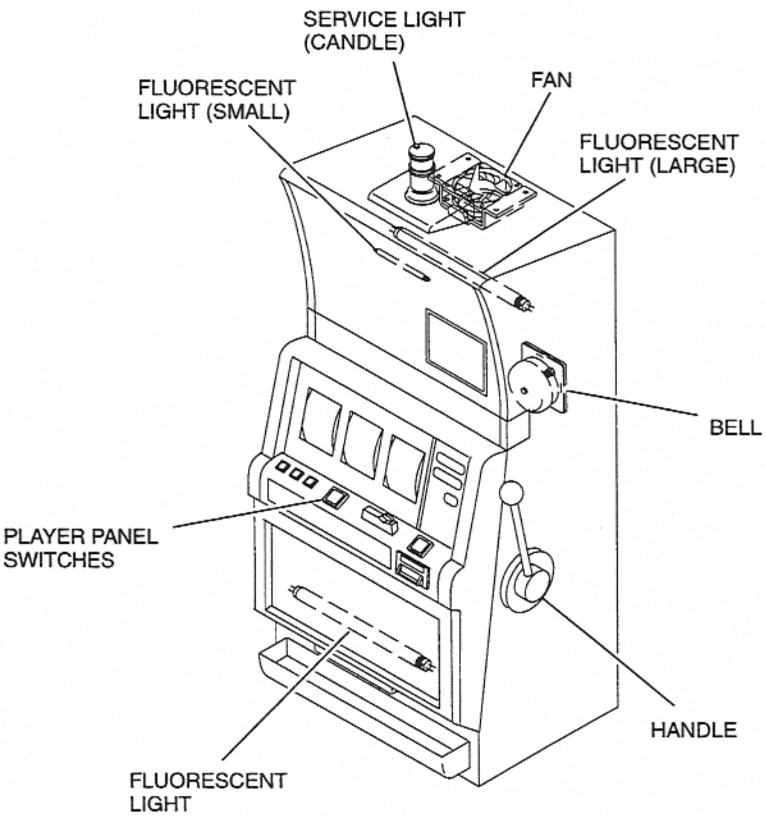
Fan

This is used to cool the machines. Normally they are a 3.15-in. "muffin fan" mounted on the interior at the very top of the machine to expel excess heat within the machine. They operate on 25 VDC.

Game King 19" Machine



Vision Machine



Coin-In Module

Machine Overview

In this module you will learn:

- The components of the coin-in assembly
- Component function
- General operational theory

Floor Operations

In this module you will learn:

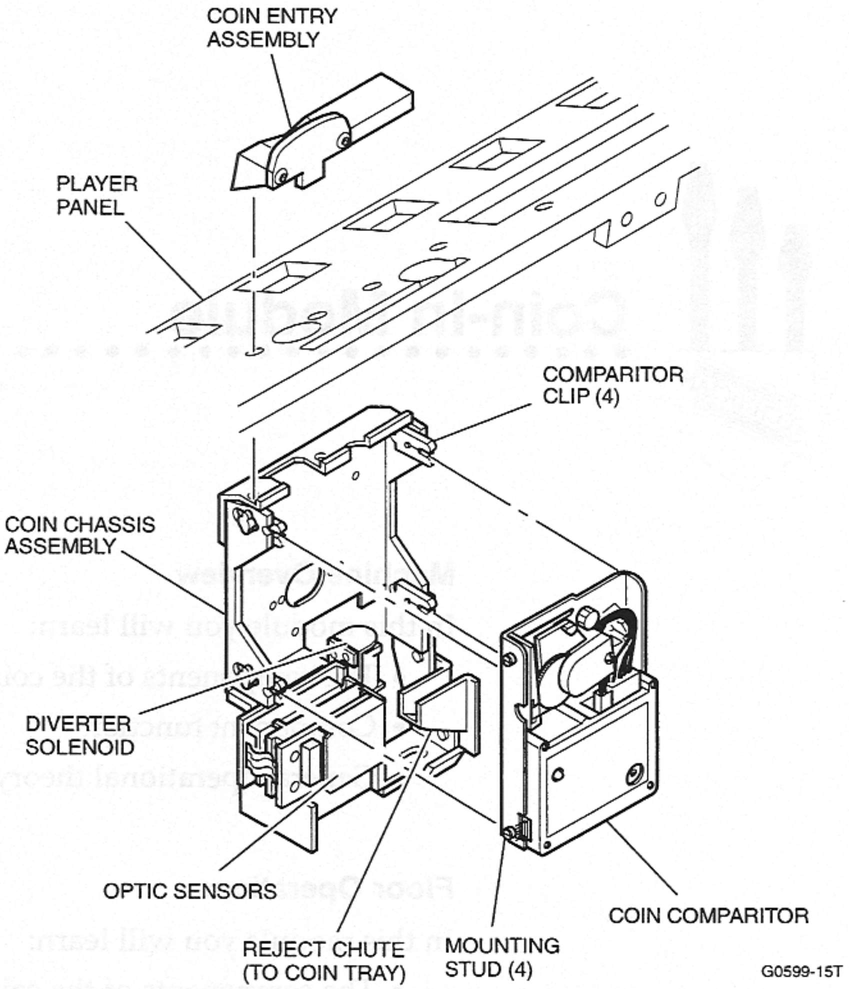
- The components of the coin-in assembly
- Component function
- Operational theory of the coin-in assembly
- How to clear coin-in jams
- How to clear coin-in tilts

Service and Troubleshooting

In this module you will learn:

- Detailed component function
- Detailed operational theory of the coin-in assembly
- Voltages related to the coin-in assembly
- Sensitivity adjustment of the comparitor

Notes


COIN ENTRY
ASSEMBLY
PLAYER
PANEL
COMPARITOR
CLIP (4)
COIN CHASSIS
ASSEMBLY
DIVERTER
SOLENOID
OPTIC SENSORS
REJECT CHUTE
(TO COIN TRAY)
MOUNTING
STUD (4)
COIN COMPARITOR
G0599-15T

GENERAL COMPONENT DEFINITION

1- **Coin Head:** Accepts coins.

2- **Coin Comparitor:** Conducts physical comparison to accept a specific kind of coin or token. Channels coins to either coin tray or diverter.

3 **Diverter:** Channels coins to either hopper or drop box.

4- optics

DETAILED COMPONENT DEFINITIONS

Coin Entry Assembly

Consists of an entry head connected to a base. Size is directly related to machine denomination.

(DC) Coin Comparitor Assembly

Has one connector with four signals to the machine. The connections are:

- Ground (in) to coin comparitor
- +13VDC (power in) to coin comparitor
- An enable signal (in) to coin comparitor
- A coin sense signal (out to processor)

The coin sense signal supplies ground to the processor when a good coin is sensed and the rake solenoid is activated.

The coin comparitor assembly has three active components: the damper lever with counterweight, the sensor assembly, and the rake/solenoid.

Optic Sensors

Consists of two LED/light sensitive transistor pairs – COIN-IN 1 (A) and COIN-IN 2 (B, SWITCH). The optics test coin direction and count good coins passing through the path. A falling coin cuts the light paths between pairs A and B, in that order.

The optics can be tested via input tests. The little white button switch on the optic circuit board, called B SWITCH, is in parallel with the COIN-IN 2 (B, SWITCH) optic, and can also be tested via input tests.

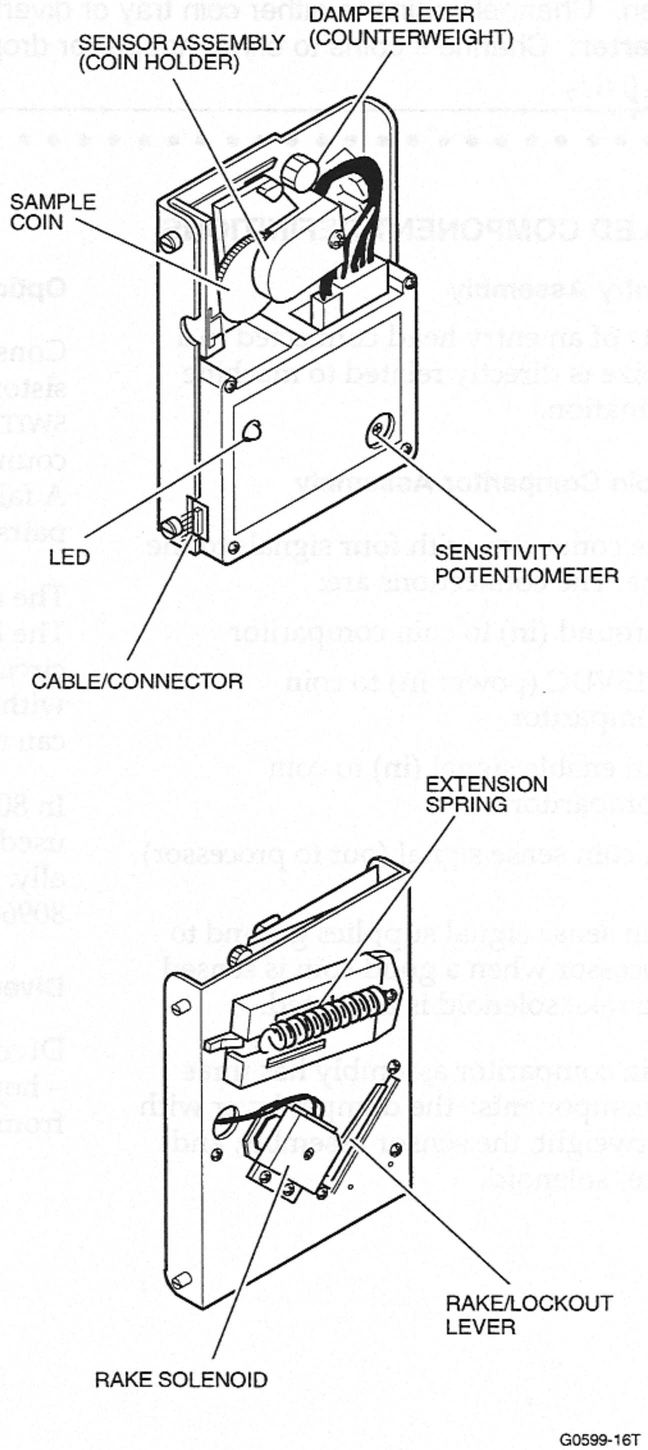
In 8032 machines, this switch could be used to enter credits on the machine manually. That capability is not activated on 80960 machines.

Diverter Solenoid

Diverts accepted coins to one of two paths – hopper or drop box – based on input from the coin level probe on the hopper.

Notes

COIN COMPARITOR DETAIL



DETAILED COMPONENT DEFINITIONS (cont.)

Damper Lever With Counterweight

A mechanical arm with counterweight that stabilizes the fall of an inserted coin. The size of the counterweight is dependent upon the size and mass of the coin.

Electromagnetic Sensor Assembly & Sample Coin

The sensor assembly is made up of two sets of electromagnetic coils. The coils function like a tiny metal detector. The first evaluates the electromagnetic properties of the sample coin, establishing a sample standard. The second coil evaluates the electromagnetic properties of the played coin as it falls past.

LED

Lights when +13VDC is applied to the coin comparitor circuitry.

Sensitivity Potentiometer

Adjusts the sensitivity level for the sample coin/played coin comparison.

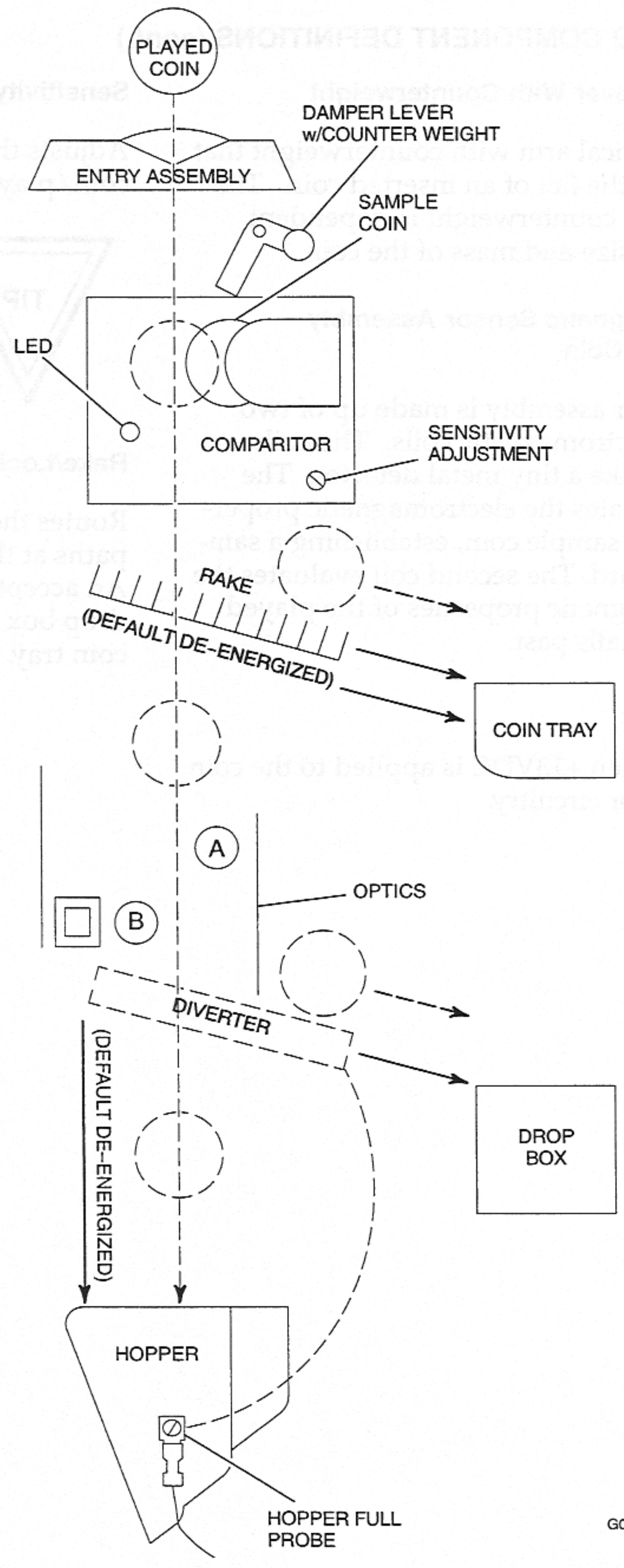
TIP

Use a **nonmetallic** potentiometer tool when adjusting sensitivity.

Rake/Lockout Lever & Rake Solenoid

Routes the dropped coin to one of two paths at the completion of a comparison. An accepted coin goes to the hopper or drop box. A rejected coin goes into the coin tray.

Notes


PLAYED COIN
DAMPER LEVER w/COUNTER WEIGHT
ENTRY ASSEMBLY
SAMPLE COIN
LED
COMPARITOR
SENSITIVITY ADJUSTMENT
RAKE
(DEFAULT DE-ENERGIZED)
COIN TRAY
A
B
OPTICS
DIVERTER
(DEFAULT DE-ENERGIZED)
DROP BOX
HOPPER
HOPPER FULL PROBE
G0599-8T

GENERAL THEORY OF OPERATION

As a coin is inserted, the coin entry, damper lever and counterweight stabilize it so that it passes through the coin comparitor properly. The comparitor holds a sample coin. The comparitor compares the inserted coin to a sample coin. If the coin matches, it passes through the comparitor to the optics for security and count. It then goes through the diverter, which sends the coin to either the hopper or the drop box. The hopper is the default destination. When the coin level probe senses a full hopper, the diverter activates and the coin is routed to the drop box.

ALWAYS turn the machine off BEFORE unplugging the coin comparitor.

DETAILED THEORY OF OPERATION

A player drops a coin into the coin entry assembly. The coin encounters the damper lever and counterweight, which slow the coin to a known drop rate and a specific position in the path. The damper lever can also act as a one-way valve in case someone tries to pull a coin with a string attached back out (stringing).

The played coin drops past the coin comparitor sensor assembly, where it is electromagnetically compared to the sample coin. If the comparison shows the two coins are not similar enough, the coin encounters the rake and solenoid in their default nonactivated position, and the coin is diverted to the coin tray outside the machine. If the two coins are similar enough, the coin comparitor signals the rake solenoid to energize, pulling the rake out of the coin's drop path. This allows the coin to proceed to the optic sensors.

The rake stays open a designated amount of time (factory-configured in the comparitor.) After the good coin passes the rake, the rake closes. The rake is a second place where a stringed coin can be stopped if someone tries to pull the coin back out.

When the good coin passes the rake, it drops through the optics in A-then-B order. A coin breaking both beams is counted as a good played coin. A coin drawn back up through the optics in reverse order generates a coin in/coin jammed tilt. It also sends a signal to the processor to apply a credit to the machine.

After proceeding through the optics, the good coin encounters the diverter controlled by the diverter solenoid. The diverter solenoid reacts to a signal originating from the coin level probe in the hopper.

With a signal indicating that the hopper is *NOT* full, the diverter solenoid is *NOT* activated and the coin drops into the hopper. If the indication is that the hopper *IS* full, the diverter solenoid *IS* activated and the coin is diverted into the drop box.

Notes

COIN-IN JAMS

Coin jams are often caused by:

- Paper getting caught in the mechanism
- Sticky coins
- Improperly aligned coin mechanisms

These are some items that can cause coins to jam at various levels within the coin-in assembly:

- Coin head
- Coin comparitor
- Diverter

COIN-IN SOLUTIONS

The biggest problem areas in relation to coin-in jams are the coin paths. Careful inspection of coin paths for obstructions such as paper, liquid residue will help to identify quickly the causes of coin-in jams.

Coin paths can also be affected by misaligned components. Inspect coin-in assembly components to ensure they are mounted correctly and tightly (i.e., the coin comparitor is clipped in correctly and all mounting clips are serviceable).

If no obstructions are found and the components are mounted correctly, inspect the diverter and lockout rake for smooth operation.

WORK EXERCISE

Turn to exercise 4 in the Workbook section of this training guide.