INTRODUCTION TO THE BALLY ELECTRONIC SLOT

This manual describes the operation of BALLY'S ELECTRONIC SLOT MACHINE. You will find, in comparing this machine with the electromechanical version, that the same basic functions and timing relationships exist*. In fact, the only visible difference to the player is the addition of a 5 digit LED (Light Emitting Diode) display**. This display, in addition to providing the function of WIN METER, also performs several other useful functions. For example, a slot machine attendant, called to the machine by a player, will be able to determine by observing the code on the LED display, whether the machine has detected a problem in its operation. If there is a problem, the code will tell the attendant if it is a coin jam, empty hopper, or something more serious, requiring a technician. The code displayed will also help the technician localize the problem. The LED display also permits the reading of meters without entering the machine.

For the sake of discussion, when referring to examples of the LED display, this manual describes the digit positions within the display as columns 1 thru 6, from left to right.

Examples of what might be observed in the LED displays of the Series 1000 (small round windows) and the Series 2000 (larger rectangular windows). The operation of the test procedures are very similar in both series. When preforming a test on the Series 1000 use the same codes displayed as used on the Series 2000, except in cases where variations are noted by the addition of the small round window LED displays.

Bally has taken advantage of the advanced technology of integrated circuits (IC's) to incorporate into the machine reliability, flexibility, as well as bookkeeping, security, and maintenance features which would have been impractical, if not impossible, a few years ago. A microprocessor-based system was determined to be the most effective approach to achieve these desirable objectives. The MICROPROCESSOR (CPU) is an IC that performs the functions of the central processing unit of a computer. Thus, it controls the interpretation and execution of instructions. These electrically coded instructions, called a PROGRAM, are stored in other IC's, called MEMORY CHIPS. The CPU receives information in the form of INPUTS, which tell the CPU the status of SWITCHES, REELS, ETC. This enables the CPU to determine which OUTPUTS (coils, lamps, motors) should be on or off for the particular MODE of operation that the machine is in. (ACCEPTING COINS, READING REELS, DISPENSING COINS, DISPLAYING METERS, SELF-TESTING, ETC.)

The CPU, MEMORY CHIPS, and other CONTROL LOGIC are located on a MICROPROCESSOR UNIT (MPU) BOARD.

* See Reel Spin Time Variations on Page 24.

** An exception to this is a model which contains a Replay Register (Credit Meter) or Progressive Jackpot Meter.
WHAT TO EXPECT WHEN POWER IS APPLIED

When power is applied, a brief self-test of vital functions of the MPU board will occur. During this self-test coins are locked out. After completion of this self-test, the slot machine will return to some point in its normal operation. This point is determined by what the machine was doing when power was turned off. THE CENTER TWO DECIMAL POINTS INDICATE A RESET (POWER OFF, STATIC DISCHARGE, ETC.) OCCURRED SINCE THE LAST HANDLE PULL.

The 6-DIGIT LED DISPLAY may appear as any of the 3 following examples when power is turned on. If the display exhibits a severe flicker or takes a form other than those mentioned below, see BUILT-IN TEST FUNCTIONS paragraph on following page.

1. Machine was at some point in its normal operating sequence when power was removed.

Example:

```
1.005
```

The number in the second column, in this example 1, indicates one coin was put into machine for previous game and the 005 in the fourth, fifth and sixth columns indicates number of coins paid out. (In this case 5 coins).

Example:

```
610.00
```

In this example 6 coins had been played; 1000 coins had been paid out.

2. The processor had detected a game malfunction prior to power being removed.

NOTE: Examples of malfunction codes in this text are those which correspond to the Bally Slot codes. On some models, different codes are used. A cross reference chart is provided for your convenience (page 28).

Example:

```
31.005
```

The 31 in the first two columns in this example indicate a particular malfunction. (In this case a hopper jam.) The digits in the last three columns indicate the number of coins paid out before malfunction occurred.

3. The machine was in self-test #2 mode when power was turned off.

Example:

```
8.8.8.8.8
```

If 8's are present in all six columns for about one second, the machine will energize each lamp, coil and motor in a sequence determined by the features of that particular machine. (SEE TEST #2 IN SECTION III)
If Personality PROM (M7) is not installed in the MPU Board, the following sequence will be observed on the display when power is applied:

* * * * * briefy, then
b.5.4.3.2.1. for 1 second, then
b.8.8.8.8.8 for 1 second, repeat.

(See "CAUTION" on Page 7)

*Irrelevant Data for AS-2978-5, 6 or 7; Blank for AS-2978-3.

BUILT-IN TEST FUNCTIONS

The DALLY ELECTRONIC SLOT MACHINE is equipped with two types of test functions.

First, a diagnostic self-test on POWER UP. This test is primarily used to localize a problem in the MPU BOARD. These particular problems are discussed in detail in "MPU BOARD TEST STATION OPERATORS GUIDE AND TEST PROCEDURES":

- FO-650-1 for MPU Board #AS-2978-3
- FO-650-3 for MPU Board #AS-2978-5 or -6
- FO-650-11 for MPU Board #AS-2978-7

Second, manual tests. All manual tests are initiated by using the TEST button on the hopper control board. The number of times the TEST button is pressed determines which test will be performed. The tests are numbered as follows:

1. START OF NEW GAME
2. COIL AND LAMP (LOAD) TEST
   (See "CAUTION" on Page 7)
3. SWITCH TEST
4. HOPPER TEST
5. REEL READER TEST
6. PROGRAM TEST
7. METER DISPLAY TEST
8. GAME FUNCTIONAL TEST

NOTE: The Door Switch must be open to enter any manual test.

Closing the door while in TEST MODE, (decimal points in display) terminates the test in progress, indexes the reels and causes the display to read:

Closing the door has no effect if M7 is removed.

On the Series 1000, closing the door while in the TEST MODE (decimal points in display) shows this display.
INITIAL SET-UP (MAINTENANCE TESTS)

Performing the following procedure will assure the operator that the machine is operating properly before putting it out on location. If any problem is encountered while testing the machine, the entire procedure should be repeated. This will assure the operator that some previously tested part has not been affected while correcting another problem.

Step 1. "START of NEW GAME"

With the door open, turn the power switch ON. Near the front of the HOPPER unit is a printed circuit board with two push button switches located at the top. These switches are labeled RESET (left) and TEST (right). Press the TEST button ONE TIME ONLY, while observing the digital display.

```
* * * * * !
```

While button is depressed

*For MPU Board AS-2978-3, these digits are blank. For MPU Boards AS-2879-5, 6 & 7, these digits do not change from what was showing before the button was depressed.

```
0.0.0.0.0.1
```

For approximately one second after button is released, then . . .

```
50 000
```

Remains until some action is taken such as closing door and playing machine, pressing TEST button, pressing RESET button, etc.

The DOOR OPEN lamp (in tower) is lit whenever door switch is open. COIN LOCKOUT is in effect while the machine is in any test mode. General illumination is lit whenever power is on. Closing door while in any self-test terminates it.

**HOT TIP**

The wafer connectors on the boards are designated as "J" connections. A blackened area on a wafer, usually indicates a bad or dirty connection. This problem can be remedied by cleaning the offending point.
Step 2. LOAD TEST

Press TEST button two times.

CAUTION: DO NOT perform this test without personality PROM (M7) installed, as this would cause the hopper fuse to blow.

In this test, one OUTPUT (or LOAD) is energized each second. Closing the coin switch while in this test causes the CPU to stop sequencing, continuously energizing the LOAD that was active when the switch was closed.

0.0.0.0.0.2 While button is depressed
(Zeroes are blank on AS-2978-3)

0.0.0.0.0.2 For approximately one second
after button is released, then .

1. (LED TEST)
Lit along with reel reader lamps
for approximately one second, then . . .

Example: 2.1.1.0.1

2. (TILT lamp test)
Lit along with TILT lamp for
one second, then . . .

Example: 2.1.1.0.4

3. (DEPOSIT COIN lamp test)
Lit along with DEPOSIT COIN lamp
for one second, then continues
in this manner energizing each
lamp and coil (except hopper motor
and displaying associated code).

TEST SWITCH
Located on the Hopper Board, the push button TEST SWITCH, in conjunction with the LED display, is used to perform the Maintenance Tests described on pages 6-17. The six digit LED display is mounted on the front door at the right of the reel window.

RESET SWITCH
The game Reset Switch is located on the Hopper Board at the top right hand corner. Pushing this reset button often restarts the machine after there has been a minor malfunction.
At the end of each test cycle, the contents of the "LOAD TEST METER" indicating the number of times this test has been performed are displayed. The meter reading is displayed for approximately three seconds in the following format:

Example: 0.0.0.4.4.1

This meter is incremented at the beginning of the test cycle and is not resettable.

After all loads have been tested, the CPU begins again at step 1 (LED test), continuing until test is terminated by either pressing the TEST button or closing the door.

Turning off power or pressing the RESET button while in this test causes the CPU to return to step 1 (LED test) and continue from that point. After the first step, the CPU is programmed to display a code as each output load is energized. This code is used by the technician to determine which circuit the CPU is activating, and takes the form:

Example: 2.1.4.2.0

The 2 in the first column shows that the game is in test mode #2. The 1 in the third column shows that the CPU is addressing IO Board #1 (standard IO for all games). The 4 in the fourth column shows that the CPU is addressing OUTPUT PORT #4. The 20 in the fifth and sixth columns shows that the CPU is activating the sixth circuit of the PORT. (PORT is defined to be a device which provides electrical access to a system or circuit. This system uses PORTS with six circuits or BITS, coded 01, 02, 04, 08, 10 and 20.)

---

6-DIGIT LED DISPLAY

The Display Board is located on the front door to the right of the reel window (see p. 60). Not only is it used for the test functions, but also to record the coins paid out and locate a machine malfunction. The rectangle display shown to the left is used on the 2000 Series. The one below, using small round windows, was utilized on the 1000 series.

---

| AS-2985-2 DISPLAY BOARD ASSEMBLY |
|-----------------------|------------------|
| SYMBOL   | PART NO      | DESCRIPTION                        |
| J1       | 16 CONNECTOR FLAT CABLE - INSTALLED |
| U1-U6    | E-680-11     | LINTRONIX HD-1077R, 7 SEG, DISPLAY |

1000 Series Led Display
Step 3. SWITCH TEST

Press TEST button three times.

3. While button is depressed

0.0.0.0.0.3. For approximately one second after button is released, then . . .

3. . . . . Until test is aborted or a switch is closed (a normally closed switch must be opened first)

Example: 3. 0.0.1. While coin switch held closed

Example: 3. 0.0.2. While hopper roller arm at rest (after lifting it once), until some other switch is actuated.

Switches not included in test: Power Switch, Door Switch, Change Button Switch, TEST, RESET switches, Coin Return Switch on "IKE" Dollar Machines. For the code associated with each switch, see individual model information.

test continues

The COIN SWITCH is located on the inside of the Front Door immediately below the Coin Acceptor.

The LEVEL SWITCH is located at the base of the Hopper.

The OPTO HOPPER SWITCH is located above the Hopper Pin Wheel. On later models, the Opto Switch was replaced by a Micro Switch.

The DOOR SWITCH is located behind, and actuated by, the lower Door Hinge.

The ARM SWITCH, above the Cam, and the KICK SWITCH are located on the left Side Plate Assembly of the Mechanism.
INPUT CODE ASSIGNMENTS

See individual model information for additional switches.

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Coin Switch</td>
</tr>
<tr>
<td>002</td>
<td>Hopper Switch</td>
</tr>
<tr>
<td>004</td>
<td>Level Switch</td>
</tr>
<tr>
<td>*008</td>
<td>Door Switch (Hinge, Cam Series Comb</td>
</tr>
<tr>
<td>010</td>
<td>Kick Switch (Reel Mech)</td>
</tr>
<tr>
<td>020</td>
<td>Arm Switch (Reel Mech)</td>
</tr>
</tbody>
</table>

*Not displayed with personality PROM installed. Door switch closure terminates test.

Input Port #1 contains the reel reader inputs and normally closed coin switch input. This input (code 120) will be observed after SLOWLY releasing the coin switch. The reel reader inputs are test in step #5.

Input Ports #2 thru #4 are spare inputs for most models, except Bit #6 of Port 2 (Code 220) is used for the key switch.

The DIP Switches on the MPU Board are treated in a slightly different manner. They are read directly by the microprocessor chip, not thru an input port on the I.O. Board. The DIP switches are coded as follows:

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>Switch #1</td>
</tr>
<tr>
<td>502</td>
<td>Switch #2</td>
</tr>
<tr>
<td>504</td>
<td>Switch #3</td>
</tr>
<tr>
<td>508</td>
<td>Switch #4</td>
</tr>
<tr>
<td>510</td>
<td>Switch #5</td>
</tr>
<tr>
<td>520</td>
<td>Switch #6</td>
</tr>
<tr>
<td>Not Used</td>
<td>Switch #7</td>
</tr>
<tr>
<td>Special Function</td>
<td>Switch #8</td>
</tr>
</tbody>
</table>

To determine the functions of the dip switches, see STANDARD OPTIONS section of this manual.

AN ESSENTIAL TOOL FOR BASIC REPAIRS

The Voltmeter (Multitester) is a must for working on SERIES E machines. Used as a continuity tester, it is useful for tracing circuits, locating bad soldering joints and for checking wires and Flat Cables for breaks. Using the voltage function, the meter is necessary for checking the voltage on the boards and in various circuitry.

An inexpensive model may be purchased for as low as $20.

For difficult repairs consult your dealer,
Step 4. HOPPER TEST (10 Coin pay)

Press TEST button four times.

0.0.0.0.4 While button is depressed
(Zeroes are blank on AS-2978-3)

0.0.0.0.4 For approximately one second after
button is released, then . . .

4.0.0.0 Until coins begin to pass under
roller, at which time the win meter
begins to increment, 001, 002, 003,
etc.

4.0.1.0 When payout is complete (Hopper
Motor stops). At this time, the
winner paid lamp is lit.

If the processor detects a malfunction during this
test, the hopper motor is stopped, feature lamps are
flashed, the TILT lamp is lit and a code indicating
the type of malfunction is flashed alternately with
"coins in last game" (when in test mode, "coins in
last game" is set to zero). The malfunction codes
possible in this test are:

30 Hopper Override
31 Hopper Jam
32 Hopper Empty
33 Reset During Payout (Used on Series 1000 Only)

If power is turned off to service a malfunction, the
test will be terminated when power is turned back on.
If it is not necessary to turn off power, the RESET
button may be used to terminate this test.

test continues

HOPPER BOARDS

The Series 1000 used the
board on the left. The
Series 2000, the board on
the right. They are
interchangeable by a
minor one wire change.
For more Hopper Board
information see page 47.
Step 5. REELREADER TEST

Press TEST button five times.

0.0.0.0.5. While button is depressed
(Zeroes are blank on AS-2978-3)

0.0.0.0.5. For approximately one second after
button is released, then . . .

1.c.3.4.*. Reel reader lamps light up.
Payline-For multiple payline
models, hold coin switch until
desired payline is displayed.

Example:

1.

Code for symbol appearing on
indicated payline, first reel.

2.

Code for symbol appearing on
indicated payline, second reel.

3.

Code for symbol appearing on
indicated payline of third reel.

4.

For a 3 reel model, only decimal
point is displayed in these
positions. Codes for reel symbols
will be found on a label on the
front of the reel mech, as well
as in the individual model
information.

Note: Performing this test without Personality PROM installed
results in decimal position of reel being displayed
rather than symbol codes. (See FO-650-2: "PERIPHERAL
TEST STATION OPERATORS GUIDE AND TEST PROCEDURES").

Move each reel one position at a time while observing the display.
Check all positions on each reel. If the symbol appearing on
the indicated payline is at odds with the code being displayed,
check to be sure the correct tapes have been installed. If
the tapes are correct, proceed to the next test. test continues

HOT TIP

As with all electronic devices, it
is a very good idea to use a Surge
Protector to prevent the sensitive
electronic components against
house current surges.
This test checks program memory and displays the "personality PROM" identification number, (which is listed on the Special Model Information Form) if the test is positive. This test is also performed each time the processor returns from reset or "power down". For the possible error conditions see section titled "POWER UP MALFUNCTION CODES".

Press TEST button six times.

While button is depressed.
(Zeroes are blank on AS-2978-3)

0.0.0.0.6

For approximately one second after button is released, then . . .

Example: 0.0.0.19.7

Personality PROM I.D. Number is displayed.

Until test is terminated by pressing RESET, TEST or Door Switch.

Example: 5.6.4..1

If no Personality PROM installed, ROM information is displayed instead.

The 5 6 4 indicates program version (in this example, version 5.64). The 1 indicates "on-line" (SDS) version. This position is blank for "off-line" version.

Example: 5.6.7.55

If no Personality PROM installed on the Series 1000, ROM information is displayed instead

test continues

HOT TIP

PERSONALITY PROM

541089 5/20/83
E-2238-14

The payout percentage of a slot machine may be verified by pressing the Test Button a total of six times. It may also be confirmed, along with the model number of the machine, by checking the numbers on the Personality Prom located on the M.P.U. Board (see page 56).
Step 7. MAINTENANCE METER DISPLAY TEST

The Bally slot is equipped with a set of four meters intended to enhance the operator's maintenance program.

These meters, numbered 17 through 20, monitor:

17. RESET METER The number of times the processor has been caused to reset.

18. MALFUNCTION METER The number of malfunctions sensed by the processor.

19. LOAD TEST METER The number of times that TEST #2 has been performed.

20. DOOR OPENED METER The number of times the door has been opened.

To implement this test, press test button seven times.

While button is depressed (Zeroes are blank on AS-2978-3)

For approximately one second after button is released, then...

For one second,

For one second, maintenance meter number 1.

Example: For six seconds, value in RESET METER (counts number of times processor has gone into reset condition. MPU board circuitry forces the processor to reset to prevent erratic operation which might be caused by static electric or power fluctuations).

A BLOWN FUSE AND TROUBLESHOOTING

A blown fuse, in conjunction with the P. C. Board schematics (pages 50, 51) and the fuse box diagram (page 63) can aid in isolating the circuit that caused the failure.

HOPPER FUSE WARNING LIGHT

A red lamp on the hopper lights when the fuse is blown. Replace it with a 5 amp 3AG fuse. If it blows a second time, check the Hopper components.
For one second, each value, in turn, is shown for a period of six seconds, then the number of occurrences of the same value is counted and displayed. This process repeats until all occurrences of each value have been counted.

Example: 0.0.0.0.4.
For six seconds, value in MALFUNCTION METER (counts number of times game malfunctions have caused machine to tilt).

For one second,

Example: 0.0.0.4.4.1.
For six seconds, value in LOAD TEST METER. (Counts number of times self-test #2 has been performed).

For one second,

Example: 0.0.0.0.2.7.
For six seconds, value in DOOR OPENED METER. (Counts number of times door has been opened).

Until some action is taken. Maintenance meter display routine has been completed and machine is conditioned for the start of the next game.

TO CONTINUE SERIES 1000 TESTS OMIT THE ABOVE AND CONTINUE WITH THE STEPS BELOW

Example: 0.0.0.0.0.4.
For six seconds, value in MALFUNCTION METER (counts number of times game malfunctions have caused machine to tilt).

For one second, maintenance meter number 2.

Example: 0.0.0.0.2.7.
For six seconds, value in DOOR OPENED METER. (Counts number of times door has been opened).

Example: 0.0.4.4.1.
For Six seconds, value in LOAD TEST METER. (Counts number of times self-test #2 has been performed).

Until some action is taken. Maintenance meter display routine has been completed and machine is conditioned for the start of the next game.
Step 8. GAME FUNCTIONAL TEST

Press TEST button eight times.

0.0.0.0.8 While button is depressed
(Zeroes are blank on AS-2978-3)

0.0.0.0.8 For approximately one second
after button is released, then . . .

If Personality PROM (M7) is NOT in-
stalled, the display will fall into
the sequence described on page 5.

Example: 8.2.0.0.0 8 indicates Test #8 mode.
2 is current coins in. The slot
machine is in the game function
test, allowing normal operation
except the reels may be set up
for testing and any payout
that occurs is displayed in
the win meter but is not paid
by the hopper and the winner
paid lamp is not lit. Also, to
simplify testing, the coin switch
malfunction (See Page 27) is by-
passed while in this test.

The game will remain in this
test mode (decimal points
on display) until it is ter-
minalated by a door switch or
test button closure.

At this point all electronic functions have been
tested. After performing routine mechanical inspec-
tion (slug rejection, proper lubrication of
mechanical assemblies, proper reel kick and spin, etc.),
the machine is ready to be placed on location.

BEAUPUGL Beaupugs are the electric wire connectors that allow the Reel Mechanism
(used only on the early Series 1000 slots, and the Hopper to be removed from the cabinet. To
prevent damage to the Beaupugs remove these units carefully.

HOT TIP If there is a broken point on a Beauplug, Molex Connector or an Amp Plug,
move the wire that is connected to the broken point to an unused point — if available.

AMP PLUGS They are similar in construction and repair to the Molex Connectors (page
36). Due to their ability to conduct low voltage circuits, Amp Plugs replaced the Beaupugs on
the mechanisms on later Series 1000 and on all Series 2000 slots. These connectors are located
in pairs on the rear side frame. New Beaupugs, Molex Connectors and Amp Plugs, along with
the necessary tools, may be purchased from the Wico Corporation (see page 63).
NORMAL OPERATION

With the exception of the 6-digit numerical display, there is no appreciable difference in the operation of the ELECTRONIC SLOT when compared with the electromechanical slot from the player's viewpoint.

The lighting of lamps, spinning and indexing of reels, payout, etc., follow the same pattern in both types of machines.

With the door closed, under regular game play, the display board presents two vital statistics, total in and total out count per individual game. The second digit from the left on the display indicates coin played last game. This count is updated at the indexing of reel number one each game*.

The digits in the 3rd, 4th, 5th and 6th columns of the display constitute the coins paid out during the last game. This count is zeroed on the display also at the indexing of reel number one of each game. If the door of the game is open, the door open malfunction code overrides the coins played count, but the coins paid value is still displayed. Performing any manual test causes both COIN IN and COIN OUT values to be set to zero.

The following is an example of two games (handle pulls), showing the operation of the display.

START

Player deposits one coin and pulls handle. Decimal points are turned off when handle is pulled.

This display is shown on Series 1,000 after a player deposits one coin and pulls the handle.

COINS IN are displayed when first REEL indexes.

Assume cherries land on first and second REELS.

COINS OUT are displayed as they are dispensed from the hopper. At the end of payout (and this game), the display shows TOTAL coins in and coins out for this handle pull.

SECOND GAME COMPLETED

Player deposits three coins and pulls handle.

No change in display.

When first REEL indexes, COINS IN for this game replace COINS IN for previous game and COINS OUT value for previous game is set to zero.

Assume no winning combination.

NO CHANGE in display.
BOOKKEEPING METERS

The meter readings appear, one at a time, on the 6 digit display for about 6 seconds. Before each meter value is displayed, its assigned number is displayed for approximately one second. Numbers are assigned to the meters as follows*:

1. TOTAL IN  
2. TOTAL OUT  
3. CASH BOX  
4. TOTAL GAMES PLAYED (HANDLE PULLS)

Meters one thru four are incremented according to their respective functions only with the door closed.

There are a total of 16 six digit meters available for display. The first four (five or six on models with attendant pays) are displayed with the door closed**.

The remaining meters are displayed by simply turning the door key counter clock-wise then actuating the key switch. These meters may monitor any condition specified, typically: number of 1 coin, 2 coin, 3 coin, etc. games played; number of 1st coin, 2nd coin, 3rd coin, etc. Jackpot wins that have occurred; and so on.

To determine which meters are used and the order in which they are displayed, refer to the FO-652-XXX form for the model in question.

The BOOKKEEPING METERS are displayed in the same manner as the MAINTENANCE METERS, described in SECTION III, step 7.

When the meter reading sequence is completed or if a reset occurs while reading meters, the reading sequence is terminated and the display is restored to the condition present before meter reading was started, unless the door was opened while meters were being displayed. In this case, the door open code will replace coins in count.

Example.  

50 005  

On Series 2000, 50 is door open code and 005 is the number of coins paid out in the last game.

* In some models, Maintenance Meter #20 (Door Openings) is also displayed as Bookkeeping Meter #0.

** In some models, all bookkeeping meters used are displayed with the door open or closed.

THE DISPLAYS BELOW REFER TO SERIES 1000 ONLY

If a reset occurs while reading meters, the reading sequence is terminated and the display takes this form.

Under normal conditions, when the meter reading sequence is completed, the display takes this form.
GAME CONDITION MALFUNCTION CODES

In the course of normal machine operation, the CPU is continuously monitoring conditions by sensing the INPUTS and comparing them with what the PROGRAM says they should be.
If the CPU detects a difference, it checks the PROGRAM to find out what to do next. Depending upon which INPUT is at fault, the PROGRAM instructs the CPU to take one or more of the following actions:

1. Display a MALFUNCTION CODE
   (Excepting the Door Open code (50),
    all malfunction codes are flashed alternately with COINS IN information.)
2. Suspend play
3. Flash feature lamps
4. Light the TILT lamp

These actions are terminated by correcting the malfunction and pressing the RESET button.

Note: The TEST button is disabled while the machine is in the TILT mode to prevent disruption of a game in progress.

The following is an explanation of the standard MALFUNCTION CODES used:

1. COIN IN JAM - Play suspended, feature flashed, TILT lit.

Example: [20 014]
The 20 indicates a jam on the COIN SWITCH. The 014 equals coins paid out in previous game.

Flashing alternately with: [2 014]
The 2 equals coins in for current game.
Clearing the jam and pressing the RESET switch causes the feature lites to stop flashing.

Example: [50 014]
Door may now be closed and play resumed.

Note: Any time the door is opened, the Display shows door open code. To see a malfunction code, actuate the KEY switch.

Note: Any time the RESET button is pressed, the center two decimal points are lit.

2. HOPPER OVERRIDE - Play suspended, feature flashed, TILT lit.

Example: [30 006]
The 30 indicates that too many coins were dispensed by the hopper.

Flashing alternately with: 006 equals number of coins paid out for this pull of the handle.

Example: [2 006]
2 indicates coins played for current game.
The 2 does not appear on Series 1000

Although the occurrence of this malfunction is unlikely, the possibility that it may happen does exist and will be detected by the machine. The fact that it requires a service call allows the technician to determine the cause (most likely mechanical in nature) and prevent it from recurring. Press RESET button to start next game.
3. **HOPPER JAM** - Play suspended, feature flashed, TILT lit.

Example: `31 003` 
31 is the malfunction code. 003 is the number of coins paid out.

Flashing alternately with `31 003` indicates a coin is stuck under the roller. To complete payout, clear jam and press the RESET button. The door must remain open until the TILT lamp lites, then goes out again (approx. 1 sec.), after which the operator has 3 secs. to close the door before payout resumes. Appropriate feature lites are lit before payout is completed.

The 2 is the number of coins in for the current game. It doesn’t appear in the Series 1000.

4. **HOPPER EMPTY** - Play suspended, feature flashed, TILT lit.

Example: `32 003` Indicates that the specified time limit has elapsed without a coin being detected. After determining and correcting the cause, follow the same procedure as described above to complete payout.

Flashing alternately with `32 003`.

5. **RESET DURING PAYOUT** - Play suspended, TILT lit.

Example: `33 003` 
This code appears when a reset occurs during payout. This can be caused by momentary power interruption, low line voltage, or static interference, any of which could cause the micro-processor to perform a faulty execution of program instructions. Entering the TILT mode prevents potentially disastrous results.

Flashing alternately with `33 003`.

Example: `2 003` 
To complete the payout, follow the procedure described above for **HOPPER JAM**.

6. **REEL HELD OR CANNOT BE READ** - Play suspended, feature flashed, TILT lit.

Example: `41 005` 
The `41` means the position reader on the 1st REEL has sensed one of the following: (A) No motion, (B) 3 positional errors during this spin. 42 means the 2nd REEL is at fault; 43 means the 3rd REEL; 44 the 4th REEL and 45 the 5th REEL. The reels are numbered 1 thru 5, from left to right.

Flashed alternately with `41 005`.

Example: `2 005` The 2 is the number of coins played for this handle pull.

005 is the number of coins paid out in previous game. After determining and correcting the cause, spin by hand any non-indexed reels, press the RESET button and close the door to complete the game in progress. If necessary, the game may be terminated by pressing the TEST button one time.

Note: See Part 3 of standard options on Page 24.
7. DOOR OPEN - 5 second BUZZER alarm, Door Open Lamp (in tower) lit.

Example: 

The 50 indicates the DOOR has been opened.

The DOOR OPEN lamp stays lit for as long as the door is open. Closing the door while in this state does not disturb the display. The 50 is replaced by the number of coins in for previous game when the handle is pulled.

Door opening is detected by the hinge switch or the lock cam switch. These switches are wired in series.

The BUZZER ALARM is activated for 5 seconds every minute while the door is open except during the time in which the machine is in a manual TEST mode.

Feature lamps flashing while this code is present means that some other malfunction has occurred. The KEY switch may be actuated to display the other malfunction information for as long as the KEY switch is held.

Example: 

If the door is closed on the Series 1000 while in MANUAL TEST mode, the display takes on the above display form.

8. HANDLE PULLED WITH NO COINS IN

Example: 

Play suspended, feature flashed, TILT lit.

The 70 indicates there is a malfunction in the handle mechanism allowing the handle to be pulled with no coins played. Reels are not indexed because most causes of this condition are mechanical and, therefore, repetitive in nature.

Example: 

The 0 indicates no coins have been played.

Example: 

The 002 is the number of coins paid out last game.

9. ILLEGAL PLAY - DOOR OPEN

Example: 

Play suspended, feature flashed, TILT lit. (KEY switch must be actuated to see this code)

Flashed alternately with:

Example: 

The 70 indicates play has been attempted with the door open after Reel #1 indexed; 000, no coins paid out.

Example: 

3 is the number of coins played for this game.

Note: This malfunction is sensed only when a jumper is installed from ground to J2, Pin 8 of I/O Board. (See Page 27 Item D)
10. REEL DID NOT INDEX - Play suspended, feature flashed, TILT lit.

Example: 71 000

Flashed alternately with:

Example: 2 000

The 71 means the position reader on the 1st reel is not able to obtain a consistent reading. 72 means 2nd reel is at fault; 73, 3rd reel; 74, 4th reel; 75, 5th reel. If the reel in question is properly indexed, then this tilt indicates the reel has been moved since it was indexed. (This test is not performed in SDS (-1) program versions.) If the reel is not indexed, the cause for this malfunction is most likely mechanical. Self-test #2 (see page 7) may be used to verify the operation of the index coil. After the cause has been found and corrected, press the RESET button followed by depressing the TEST button once.

Note: See Jumper Selectable Options - Item D, on page 27.

11. POSITION ERRORS IN 2 OF LAST 8 SPINS - Play suspended, feature flashed, TILT lit.

Example: 91 005

Flashing alternately with:

Example: 2 005

The 91 means the 1st Reel; 92 means 2nd Reel; 93, 3rd Reel; 94, 4th Reel; 95, 5th Reel. This tilt indicates that during the last 8 games there was a positional error during the spin of that reel in 2 of the 8 games.

Note: Displays for the previous Malfunction Codes (8. Handle Pulled With No Coins In, 9. Illegal Play—Door Open, 10. Reel Did Not Index, 11. Position Errors in 2 of the Last 8 Spins) appear also on Series 1000 LEDs that use Program Proms (M1, M2, M3) that are numbered 564 and above.

**STANDARD OPTIONS**

In addition to the usual options offered by Bally (custom glass, percentages, etc.), two more features are included in Bally's Electronic Slot Machine.

1. Switch selectable options.
2. Optional external connections.
3. Cable Jumper Selections.

1. Standard options which are selected by setting switches either to ON or to OFF have been incorporated into this system. More options are included in certain models. The switches are contained in a DIP (Dual In-Line Package) located in the lower right hand corner of the MPU Board.
2. A terminal block is provided with the following standard connections:

Typical Circuit Connections

Terminal Block is located on the back wall of the cabinet behind the Hopper.

Where a lamp is used in the machine, any external device connected to that the corresponding wire MUST be a 6 volt device.

Additional connections can be supplied upon request to meet your special requirements.

For any additions or exceptions to the above diagram, see the GAME WIRING DIAGRAM & PLUG WIRING INFO supplied with each machine.

3. JUMPER SELECTABLE OPTIONS

A) TILT CODE SELECT
With a jumper installed from J3, Pin 20 of the I/O Board to ground (J1, Pin 28), the Bally Slot Malfunction Codes are used. With this jumper removed, the SDS malfunction exception codes are used. (See Page 26)
B) SPIN CONTROL SELECT
With a jumper installed from J3, Pin 16 of the I/O Board to ground (J3, Pin 7), current game is nullified upon pressing the RESET button while a 4X malfunction is present.

C) REEL SPIN TIME VARIATIONS
In some locations it is desirable for the reels to spin for a shorter or longer period of time than that set at the factory. To allow for this flexibility, three diodes may be installed on the Reel Reader Control Board. By installing one or more of these diodes various timing combinations may be obtained as described below.

<table>
<thead>
<tr>
<th>DIODE INSTALLATION</th>
<th>NO DIODE</th>
<th>FUNCTION</th>
<th>WHAT IS AFFECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR1</td>
<td>Short</td>
<td>Max. Variation Time of All Reels</td>
<td></td>
</tr>
<tr>
<td>CR1</td>
<td>Long</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR2 &amp; 3</td>
<td>Med. Long</td>
<td>Spin Time of Reel #1</td>
<td></td>
</tr>
<tr>
<td>CR2</td>
<td>CR3</td>
<td>Long</td>
<td></td>
</tr>
<tr>
<td>CR3</td>
<td>CR2</td>
<td>Med. Short*</td>
<td></td>
</tr>
<tr>
<td>CR2 &amp; 3</td>
<td>Short*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Long for Atlantic City Models

All Diodes are 1N4148 Type
Bally P/N E-587-014

Machines produced after December, 1982 are equipped with Dip Switches on the Reel Reader Control Board (AS-2983-2) to provide these functions.

By setting these switches, various timing combinations may be obtained as described below:

<table>
<thead>
<tr>
<th>SWITCH NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Short</td>
</tr>
<tr>
<td></td>
<td>Long</td>
</tr>
<tr>
<td>2 &amp; 3</td>
<td>Med. Long</td>
</tr>
<tr>
<td>2</td>
<td>Long</td>
</tr>
<tr>
<td>3</td>
<td>Med. Short</td>
</tr>
<tr>
<td>2 &amp; 3</td>
<td>Short</td>
</tr>
</tbody>
</table>

Note: Switches #4 thru #8 are reserved for future use.
### GAME CONDITION — QUICK REFERENCE — MALFUNCTION CODES

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Coin switch jam</td>
<td>71</td>
<td>Spinning after indexing - Reel #1</td>
</tr>
<tr>
<td>30</td>
<td>Too many coins dispensed</td>
<td>72</td>
<td>Spinning after indexing - Reel #2</td>
</tr>
<tr>
<td>31</td>
<td>Hopper jam (Roller arm up too long)</td>
<td>73</td>
<td>Spinning after indexing - Reel #3</td>
</tr>
<tr>
<td>32</td>
<td>Hopper empty (Roller arm down too long)</td>
<td>74</td>
<td>Spinning after indexing - Reel #4</td>
</tr>
<tr>
<td>33</td>
<td>Reset occurred during payout</td>
<td>75</td>
<td>Spinning after indexing - Reel #5</td>
</tr>
<tr>
<td>41</td>
<td>Improper spin (Reel held, etc.) - Reel #1</td>
<td>91</td>
<td>Position error (2 of last 8 spins) - Reel #1</td>
</tr>
<tr>
<td>42</td>
<td>Improper spin (Reel held, etc.) - Reel #2</td>
<td>92</td>
<td>Position error (2 of last 8 spins) - Reel #2</td>
</tr>
<tr>
<td>43</td>
<td>Improper spin (Reel held, etc.) - Reel #3</td>
<td>93</td>
<td>Position error (2 of last 8 spins) - Reel #3</td>
</tr>
<tr>
<td>44</td>
<td>Improper spin (Reel held, etc.) - Reel #4</td>
<td>94</td>
<td>Position error (2 of last 8 spins) - Reel #4</td>
</tr>
<tr>
<td>45</td>
<td>Improper spin (Reel held, etc.) - Reel #5</td>
<td>95</td>
<td>Position error (2 of last 8 spins) - Reel #5</td>
</tr>
<tr>
<td>50</td>
<td>Door has been opened</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Illegal handle pull (No coins played); or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Illegal game (Coins played, door open)*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For a detailed explanation see pages 20-23

* This condition not applicable to games with a Replay Register or Atlantic City Models.

### POWER UP MALFUNCTION CODES SERIES 1000

The M.P.U. Board Circuitry is configured in a way that directs the microprocessor to access an area of memory which is programmed to conduct a brief self-test of basic circuit functions when power is applied.

This is referred to as "Power Up Self Test." If during this test, the processor detects a circuit failure, it is programmed to output to the display a code indicating which circuit is at fault. The codes are as follows:

- **"Watch Dog" circuit failure**
- **Ram failure Mode #1 (Normal)**
- **Ram failure Mode #1 (Safe)**
- **Incorrect or no second ROM**
- **Incorrect or no third ROM**
- **Incorrect PROM series**
- **Memory test failure**

For one second only, followed by:

- **Example**

Indicating which memory chip is at fault (M1, M2, M3 or M7)

- **No clocked interrupts**
- **No zero crossing interrupts**
- **Interrupt line (any) held low**

The number of each test is displayed as above while the processor is performing the test, but tests #1 thru #5 and #9 occur so quickly that the eye cannot detect them.
MISCELLANEOUS FEATURES

EXTRA COIN

The electronic slot is also designed to detect an over coining situation. If an extra coin, one more than the specified coin limit of the game, were to cross the coin switch, it would be shown on the display after the first reel indexes and would act as the first coin deposited for the next game. Where a Replay Register (Credit Meter) is used, the additional coin will be applied to the Credit Meter immediately and to the "Coins In" verification meter at the start of the next game.

KEY SWITCH

Another feature involving the display is that meter readings may be obtained by casino personnel without opening the door. This is accomplished by inserting and turning a key in the lock on the right side of the machine before the first coin of a new game is inserted. (On a Replay Register game, credits must be cleared from the Replay Register before meter readings can be taken). Upon conclusion of the meter display routine normal game operation will resume. This key switch serves another purpose on games with attendant paid jackpots. When the machine is in a lock-up condition, the actuation of this switch yields a jackpot cancel routine.

JACKPOT LOCK-UP

For Jackpot payouts too large to be paid from the hopper, the machine is rendered unplayable until the Key Switch is actuated. During this time, the Jackpot Bell rings, Jackpot tower lamp is lit, and when applicable, Attendant Pay lamp is lit, SDS signal is output, appropriate feature lites are lit or flashed. When the Key Switch is actuated, the Winner Paid and Insert Coin lamps are lit, feature lites stop flashing and coins are accepted. The bell continues to ring and Jackpot lamps remain lit till a coin is deposited, at which time normal play resumes. Any variations to this sequence will be described in the Special Model Information Form (FO-652-XXX) accompanying each machine.

DOOR OPEN OPTION

NEVADA GAME CONTROL
With a jumper installed from J2, Pin 8 of the I/O Board to ground, attempting to play a game with the door open will result in a TILT. The door open code will be present on the display and the feature lites will be flashing. The tilt code (70 alternating with coins played count) will appear on the display while the key switch is held. This condition will occur after all reels have indexed if the door has been opened after reel #1 is stopped. With no jumper installed in this position, normal play sequence is not disturbed, regardless of door position.
INTERNAL SERVICE & ADJUSTMENTS

For good service access to the internal working parts, remove the Reel Unit. Now wipe off excess grease and grime. The Unit can now be lightly lubricated with our lubriplate #1 Oil. Slides and units with heavy duty loads can be lightly greased using our Hydrotex Lube #651.

With the Reel Mech out of the cabinet, it can be operated with a Reel Mechanism Test Handle (Pt. No. K-574, available thru the Bally Service Dept.) You can easily see if the Trip Operating Lever Pawl is tripping off the Stop Bracket at the correct moment (see Figure 1). The Stop Bracket Adjustment can be checked by observing the action of the Toggle Levers as the Handl is slowly pulled.

The following illustrations show the Right Side of the Reel Mechanism in the 3 positions prior to Kick-off. These illustrations show the factory standard average settings of the Stop Bracket (Trip Arm) & Drive Shaft (Trip Arm). Also shown are the centerline dimensions and operating distances of various levers & Shafts (as per engineering design). It should be noted that because of variations in tolerances, these given dimensions are a general guide and may need calibrating when working on an individual machine.

REST POSITION ADJUSTMENT

The illustration (Figure 1) of the Reel Mechanism is shown in a rest position with all adjustments completed for a proper operating mechanism. The dimensions shown are reference points for checking an adjusted unit.

Set the reel mechanism on a flat surface. The setting to be made is the height of the Roller Stud on the Gear Assembly. When checking the dimension be sure the Link is against Stop Bracket (Link) at rear of cylinder.

To make this adjustment, turn the Elastic Stop Nut (outer) on the Drive Shaft of the Trip Operating Lever to obtain a 1-11/16" dimension shown.

The Elastic Stop Nut (Inner) is now adjusted to give approximately 1/16" of play between nut and coupling as shown.

Note: under certain conditions the 1/16" play may not apply.

STOP BRACKET ADJUSTMENT

The next setting to be made is the Stop Bracket (Trip Arm). This is done by moving the bracket to a position when measured, that should read approximately 1-15/16" from the end of the Side Plate to the inside form of bracket (see Figure 1).

If the Stop Bracket is set back too far the Trip Arm will fire off before the toggles are locked up (Latch Pawl) causing and uncoordinated reel spin. If the Stop Bracket is set forward too far the Trip Operating Lever Pawl cannot trip off the Stop Bracket because the Handle is in a full "down" position (full stroke limit). At this time the Handle will stick in a down position until a Service Man opens the Machine and manually releases the Trip Pawl.

The setting of the Stop Bracket (Trip Arm) is extremely critical
for a proper kick-off and spin. As you see in the Reel Mechanism's Trip Position (Figure 3), the Toggle Levers are in a "full up" position against the Toggle Stop Rod and the Latch Pawl has moved under the Toggle Levers to just touch the Toggle Stop Rod Locking the Toggles in an "up" position (in turn cocking back the Index Levers which release the Reels). Also notice that the Trip Operating Lever Pawl is against the Stop Bracket and ready to fire off. This is the correct Stop Bracket adjustment position.

**DRIVE SHAFT ADJUSTMENT**

The Trip Arm Drive Shaft Adjustment is factory set according to the dimensions shown in Figure 1. This setting gives a full stroke to the Trip Operating Lever and aligns the roller stud (actuating Gear) with the Handle Mech. Actuating Arm. The alignment into the Handle Mech. Actuating Arm is essential so that the Handle Mechanism's full stroke actuation corresponds to the Trip Operating Levers full stroke actuation and trip-off. When installing a Reel Mech. back into the Cabinet see that the Roller Stud aligns perfectly with the Handle Mech. Actuating Arm.

**START MOTION POSITION ADJUSTMENT**

The Start Motion Position (Fig. 2) shows the starting movement of the Gear Assembly, Shaft Assembly and Trip Operating Lever Assembly Pawl until making contact with Trip Lever Assembly. At this point the internal mechanism's cycle begins its motion for cocking the Reels.
Figure 2. Reel Mechanism in Start Motion Position

TRIP POSITION ADJUSTMENT

The Trip Position (Figure 3) shows the cocked mechanism just at the time of tripping the Trip Operating Lever Pawl which in turn fires the Drive Lever (not shown) to spin the Reels and unlatch the Latch Pawl Assembly.

Further rotation gives the proper overtravel to allow completion of all motion and positive latch. The further rotation also brings the Toggle Levers up to just touch the Toggle Stop Rod. At this exact moment, the Trip Operating Pawl is pulled off by the Stop Bracket and the trip off is accomplished, resulting in spin of the reels.

CYCLE TIMING SEQUENCE

The cycle timing is sequenced as follows: As the Handle is pulled, the Trip Operating Pawl contacts the Trip Lever and rotates it clockwise. Being pinned to the Trip Shaft, it rotates all of the Crank Assemblies which are also pinned to the Trip Shaft. These Crank Assemblies lift the Toggle Lever upward and as they pass the notch on the Latch Pawls, the springs pull the Latch Pawls under the Toggle Lever.

REEL MECH. TO HANDLE MECH. TIMING

When all bench adjustments are made to the Reel Mechanism we must now insure proper relationship of timing the Reel Mech to the Handle Mechanism in the cabinet. The Handle Mechanism is designed with two features directly related to the Reel Mechanism; the Full Stroke Pawl which insures against reversal of handle movement until trip of reels and the Secondary
Figure 3. Reel Mechanism in Trip Position

Latch which locks the Handle in the pulled position until the Reel Mechanism has tripped.

With the Reel Mechanism in place and locked into position, the Handle can be pulled by manually holding the release arm at the top of the Handle Mechanism. By pulling the Handle very slowly you can check to make sure that the Pull Stroke Pawl on the Handle Mechanism does not reverse and release until the Reel Mechanism has tripped.

If this does not occur, you must remove the Reel Mechanism from the cabinet and set the center nut on the Drive Shaft slightly toward the rear to insure simultaneous trip with release of pawl.

The second timing then corrects itself to release the secondary latch with the trip of the Reel Mechanism.

AIR CYLINDER OPERATION and SERVICE

The function of the Air Cylinder is to insure a slight delay during a fast handle pull to allow the Toggle Links to overtravel and become held in the "latched" position by the Latch Pawl Assemblies. This slight delay gives time for the reaction of the related parts to fully function, i.e., springs to pull latches under Toggle Link and Lever Assemblies.

Fast pull is also resulting in holding back motion of the Drive Shaft by the Air Cylinder. This compresses the Spring Assembly in the Drive Arm during the slight delay and these springs then complete the motion and insure proper function.

If it appears there is undue resistance to a Handle Pull, check to see if the tiny hole
in the end of Cylinder (center) is plugged (causing compression resistance). If it appears there is no delay action to cushion hard, fast handle pulls, you may need a new Piston Cup Seal. The Piston Cylinder should be greased occasionally.

It is very important that this Unit function correctly to insure latch of toggles and proper spin and index.

REEL UNIT OPERATION and SERVICE

The Reel Units should spin smoothly and freely on the Shaft with no resistance. They should also spin straight and true with no warpage or wobble.

The Reel Hubs are equipped with Needle Bearings for top performance and long life. Lubricate this Hub Unit (note hole) occasionally with a drop of our Lubriplate No. 1 Oil, then wipe the Unit off to prevent any oil spin-off on the Reel Tapes.

You will also notice a Screw Operated Brake on the Hub. At the present time factory adjusted machines do not use the Brakes. It is felt that a good spin gives the best reel symbol mix. However the Braking Screw has certain applications where Reel Speed control is desired.

In 1973 Bally introduced a new stainless steel, anti-magnetic reel as standard equipment. This Reel is now available as a replacement part from Bally Parts and Service. When re-installing or replacing reel Tapes be sure they are securely fastened. The Reel tapes are plastic laminated and have a very tough smooth surface which is virtually stain proof and indestructable. Because of the very slick surface, the Tape must be properly clamped down in the Reel gripping edge or slippage can occur. Any slippage can throw off the relationship of the Symbol to the Index Wheel causing a confused payout pattern.

----------- ELECTRICAL ADJUSTMENTS -----------

REEL READER ASSEMBLY ADJUSTMENT

The electronic Reel Mech offers an optical reading system which requires proper positioning of the Reel Reader Assemblies to their respective Index Wheels. To accomplish this adjustment, simply loosen the 2 mounting screws holding the Reader assembly to the Reel Front Plate (see Figure 4). Position the Index Wheel (as indicated in Figure 4) and retighten the mounting screws. Repeat this operation for each Reel Reader Assembly used, 3 times for a 3 Reel game, 4 times for a 4 Reel, etc.

FIGURE 4.
Reel Reader Assembly Adjustment
CAM SWITCH TIMING

Also, the electronic Reel Mech incorporates a Cam Switch timing which is quite simple to adjust. All that is needed for this adjustment is the loosening of the Reel Mech Cam (located on the L.H. Side Plate) and moving it to conform with the proper sequencing of the Cam Switches. Proper sequencing of the Cam Switches for electronic games is described as follows:

<table>
<thead>
<tr>
<th>Proper Cam Switch Sequence</th>
<th>Arm Switch</th>
<th>Kick Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rest Position</td>
<td>Normally Open</td>
<td>Normally Closed</td>
</tr>
<tr>
<td>2. Start Handle Pull</td>
<td>No Change (Open)</td>
<td>Opens</td>
</tr>
<tr>
<td>3. Continue Handle Pull - Arm Switch Closes</td>
<td>Closes</td>
<td>No Change (Open)</td>
</tr>
<tr>
<td>4. Spin Starts Switches Back to Rest Position</td>
<td>Opens</td>
<td>Closes</td>
</tr>
</tbody>
</table>

Figure 5. Cam Switch Sequence

Arm Switch - 53 Wire
Wired Normally Open Switch

Kick Switch - 54 Wire
Wired Normally Closed Switch

The states of these two switches from rest position through one game cycle, back to rest position again, are described in Figure 5 showing the proper switch-cam relationships.

--------- HOPPER PAYOUT UNIT SERVICE & ADJUSTMENTS ---------

For a complete overhaul of the Hopper Payout Unit, remove the Unit from the game and remove the scoop cover. Now follow the general point by point procedure.

A good cleaning of the unit is in order. An aerosol type degreaser or contact cleaner can be used, however, all parts must be wiped off with a clean cloth to remove any residue and desolv-ed scum.

After cleaning the Hopper Unit, we can inspect and adjust the Hopper in the following order:

HOPPER WIPER ADJUSTMENT

Adjust wiper so that clearance between pin wheel & wiper will allow a single coin to pass.

POSITION OF HOPPER KNIFE

Check the Hopper Knife (see Fig. 6). The forward edge must be
against the Pin Wheel and touching the edge of the Shelf Wheel. No coin should be able to wedge itself between the blade and the coin disc when being dispensed. Absolutely no grease or oil should be applied to the area or any other area that comes in contact with coins.

HOPPER OPTO-SWITCH ADJUSTMENT

The next item to be checked & adjusted is the Hopper Opto-Switch. This Opto-Switch does the actual coin counting as coins move out under the roller of the Rocker & Roller Assembly. The pivot action of the Roller Assy. allows the rear leg of the roller assembly to be removed from in between the light emitting source and photo transistor of the Opto-Switch. Each transition from light blocking, to Opto-Switch operation by removing pivot arm from light path, back to light blocking, records one coin-out pulse (See Figure 7).

The main points in adjusting the Opto-Switch are to insure that the rear leg of the pivot arm is completely blocking the light source from the photo transistor of the Opto-Switch when the arm is at rest, and the leg is completely out of the way of the Opto-Switch as a coin passes under the roller. These conditions can be had by either slightly increasing or decreasing the form on the Opto-Switch mounting bracket to allow proper pivot arm-to-light source clearance.

HOPPER MICRO SWITCH ADJUSTMENT

The old Hopper Opto-Switch has been replaced by a conventional Micro-Switch to allow for more precise adjustment. The switch contacts are of the low current capability, gold-crospoint nature.

Adjustment on this new switch is quite simple. Loosen the nut on the rocker and roller assembly, screw the adjustment screw down to within 1/32" of the switch actuator blade and then re-tighten the nut. (See Figure 8)

Check the switch with an actual coin under the roller arm to insure a positive switch actuation. Also, make sure that the switch is at a rest position when no coin is present under the roller.

Detecting the coin earlier or later as it passes under the roller is controlled by the screw adjustment on the rocker and roller arm assembly. Bending the switch actuator is not necessary.
ROCKER PIN SET SCREW ADJUSTMENT

Draw set screw snug so that all play is taken up. Then back off screw slightly, and rotate pinwheel by hand. Pinwheel should turn without binding (screw too tight) or wobbling (screw too loose).

CAUTION: Over tightening will overload bearing and pinwheel will not turn freely.

Figure 9. Rocker Pin Adjustment

HOPPER COUNTER BALANCE ADJUSTMENT

Adjustment is made by first filling the Hopper with the desired level of coins. Then start the adjustment with the Micro-Switch in the up position (see Fig. 10). Adjust set screw screwed into a clockwise position. Now back off set screw counter-clockwise very gradually until Micro Switch clicks into the down position. Now Hopper is set at the given desired capacity.

Figure 10. Hopper Counter Balance Adjustment

HOPPER COIN CONVERSION

Coins of diameter .669 to 1.115 use parts: Pin Wheel P-842 (16 pins), Shelf Wheel P-847 (specify coin). In the conversion to the Dollar, the Coin Spider Assy. A-3750 is deleted, and replaced with a Drive Bushing S-231-826 and Screw LSPR-1032-1116. Pin Wheel P-842-1 (12 pins) is used for all coin diameter 1.120 to 1.500. Shelf Wheel P-847-6 is used for the Dollar coin along with a new Agitator, R-526. A Hopper liner P-834 is also added to the Hopper for the large Dollar coins.

-------- HANDLE MECHANISM SERVICE --------

It is the Handle Mechanism which initially receives the impact of a hard Handle pull. Because of the tough requirements, this unit must be of the strongest construction. As a safety factor the Handle Mechanism is built to specifications ten times the necessary strength to protect the Reel Mechanism from the most aggressive player.

There have been several new developments designed to strengthen and protect the Handle Mech. First an anti-fast pull Speed Lock (note ratchet) was added in 1970. In mid-1973 the Pull Stroke Pawl & Locking Links were re-designed and strengthened.

You will notice that these improvements can be incorporated on
Older Machines. It is also suggested that the new front, Anti-Wiring Shield be in place at all times.

Because of the heavy duty use, the Handle Mech. should be lubricated periodically. Use our Lubriplate No. 1 Oil on the light duty pivot points and our Hydro-tex Lube #651 on points of heavy stress and sliding parts.

Be sure the anti-fast pull, Speed Lock Pawl swings freely on its pivot, since it engages the Ratchet on a centrifugal force principle (do not lubricate).

MOLEX PLUG SERVICE

NOTE: The Molex Pin Extractor Tool enables easy service of the Molex Plug, Pins both male and female are removable. Holding Extractor Tool as shown in Illustration, placing Forefinger over shaft as to hold it from turning (as shown), push Shaft over Pin giving Tool a slight twist allowing the Pin Fins to compress easily, thus enabling the Pin to be pushed through Nylon Housing.

<table>
<thead>
<tr>
<th>BALLY NO.</th>
<th>MOLEX NO.</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMALE</td>
<td>E-663-2</td>
<td>02-09-1104</td>
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<tr>
<td>FEMALE</td>
<td>E-663-4</td>
<td>02-09-1119</td>
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<tr>
<td>MALE</td>
<td>E-661-2</td>
<td>02-09-2103</td>
</tr>
<tr>
<td>MALE</td>
<td>E-661-4</td>
<td>02-09-2118</td>
</tr>
</tbody>
</table>

TYPE 1189-90 LONG EAR
TYPE 1380-81 SHORT EAR
HAND CRIMPING TOOL HT-1031

NOTE: REPLACEMENT ITEMS CAN BE ORDERED THRU BALLY DIST. OR NEAREST MOLEX REP. IN COUNTRY OF USE.


Any Machine Legal: Alaska, Arizona, Arkansas, Kentucky, Maine, Minnesota, New Mexico, Nevada, Ohio, Texas, Utah, Virginia, West Virginia. Pre-1984 Models: Colorado
Machine Must be 20 Years or Older: Florida; 25 Years or Older: California, Delaware, Illinois, Iowa, Louisiana, Maryland, Michigan, Mississippi, Montana, New Hampshire, North Carolina, North Dakota, Rhode Island, Oklahoma, Washington, Wyoming and Wisconsin.
30 Years or Older: Massachusetts, Missouri and New Jersey
(ownership is still illegal in the unlisted states, but check with a dealer, trade magazine or your state officials frequently as the laws are becoming more favorable)

HOT TIP
To purchase Bally SERIES E slots contact your local dealer, attend the antique coin shows and check the ads in the trade magazines and the classified section in newspapers. To verify the model of a machine with the year of manufacture refer to Bally Slot Machines: An Illustrated Guide to the 114 Most Popular Ballys Made from 1964-1987. For ordering a copy of this book, see page 64 of this manual.
Figure 13. Handle Mechanism

Figure 14. Hopper & Rocker Assembly

Figure 15. Front Door Hinge
Figure 12. Reel Mechanism - (Soft Cushion)
Figure 11. Reel Mechanism
### FRONT DOOR ASSEMBLY
(Front View)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>1</td>
<td>C-859</td>
<td>Upper Door Frame</td>
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<tr>
<td>2</td>
<td>R-380</td>
<td>Sponge Rubber - Seal</td>
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<tr>
<td>3</td>
<td>R-221-43</td>
<td>Rubber Strip</td>
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<td>4</td>
<td>A-2875-1</td>
<td>Hinge Assembly</td>
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<tr>
<td>5</td>
<td>E-108-97</td>
<td>Push Button Switch</td>
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<tr>
<td>6</td>
<td>AS-2342-1</td>
<td>Coin Slide Assembly (50)</td>
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<tr>
<td>7</td>
<td>AS-2342-3</td>
<td>Coin Slide Assembly (50)</td>
</tr>
<tr>
<td>8</td>
<td>AS-2342-4</td>
<td>Coin Slide Assembly (50)</td>
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<tr>
<td>9</td>
<td>P-7119-4</td>
<td>Coin Ramp Shield</td>
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<tr>
<td>10</td>
<td>C-271</td>
<td>Clip</td>
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<td>11</td>
<td>N-832-2112</td>
<td>Nut</td>
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<td>12</td>
<td>P-4926</td>
<td>Scavenger M.G. Bracket</td>
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<td>13</td>
<td>SP-300-0</td>
<td>Torsion Spring</td>
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<td>14</td>
<td>A-2629</td>
<td>Scavenger Assembly</td>
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<td>15</td>
<td>C-364</td>
<td>Lower Door Frame (5, 10, 25)</td>
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<tr>
<td>16</td>
<td>C-364-6</td>
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<td>17</td>
<td>E-665-75</td>
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<tr>
<td>18</td>
<td>K-495-29</td>
<td>Extruded Trim (5, 10, 25)</td>
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<td>19</td>
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<td>Extruded Trim (50)</td>
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<td>C-660-11</td>
<td>Trim Panel</td>
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<td>21</td>
<td>E-7209</td>
<td>Coin Cup Guard Plate</td>
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<tr>
<td>22</td>
<td>E-409-10</td>
<td>Coin Cup</td>
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<td>23</td>
<td>R-111-8</td>
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<td>2 Pt. Molex Plug (4)</td>
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<td>Screw</td>
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<td>36</td>
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<td>Starter Socket</td>
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<td>37</td>
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<td>Screw</td>
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<td>38</td>
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<td># Torx Socket Plug (2)</td>
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<td>47</td>
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<td>Push Button Dac</td>
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<td>48</td>
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<td>Retaining Ring</td>
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<tr>
<td>50</td>
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<td>Retaining Ring</td>
</tr>
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</table>
3 REEL MECHANISM ASSEMBLY — Wide

1 Side Plate Assembly - Right
2 Tier Bar Bracket
3 Selector Base
4 Plug Mounting Bracket
5 Nyliner
6 Trip Shaft Assembly
   (includes items 8, 9 & 10
7 Bushing
8 Toggle Lever & Bushing Assembly
9 Crank Assembly
10 Bushing (2)
11 Toggle Lever & Link Assembly
12 Spring (3)
13 Index Lever Shaft
14 Index Lever Assembly
15 Index Lever Arm Assembly
16 Roller
17 Index Lever Arm Assembly
18 Nut & Spring Support
19 Torsion Spring
20 Toggle Link (20 or 22, 25)
21 Pin
22 Index Lever Arm Assembly
   (20 or 22, 25 stop)
23 Spring
24 Drive Lever & Roller Assembly
25 Bushing (part of item 24)
26 Nyliner
27 Toggle Stop Rod
28 Latch Pawl Assembly
29 Pin
30 Spring - Green (3)
31 Spring Rod
32 Side Plate Assembly - Left
33 Switch Bracket
34 Arm Switch
35 Kick Switch & Bracket Assembly
36 Cam & Hub Assembly
37 Reeler Bracket Assembly Right
38 Illumination Bracket Assembly
39 Position Bracket Assembly
   (includes items 37 & 38)
40 Front Plate
41 Front Plate Stiffener
42 Plastic Spacer
43 Reel Reader Control Board
44 Channel - Reel Support
45 Reel Shaft Support
46 Index Coil & Base Assembly
47 Plunger Guide Bracket
48 Snap-in-Liner
49 Plunger
50 Compression Spring
51 'J' Coil Assembly
52 Core Plug assembly
53 Reel shaft
54 Reel
55 Spacer (Wide)
56 Reel Tapes (20, 22, or 25 stop)
57 Reel Clamp (Wide)
58 Hub & Bearing Assembly
59 Index Disc (20, 22, or 25 stop)
60 Retaining Ring
The Reel Reader Control Board is located on front frame of Mech.
*Cabinet Cable I/O Board Connector J1-Pins 19 & 20 are used for 3, 4 Reel Mech. J2-Pins 14 & 16 are used for 5 Reel Mech.

On the early models, above, the paylines on each reel are read by a 5-volt lamp that actuates a photo-transistor, Q1-Q5, sending a signal to the reel reader board. On the later models the CR1-CR5 on the Position Reader, left, are the Infra-Red LED source for Q1-Q5 Phototransistors.
HOPPER CONTROL BOARDS

The board controls the Hopper Motor which dispenses coins, calculates the coins paid out via the Opto Switch (p. 33) and maintains the coin level by means of the Coin Level Switch (P.35). Located at the front of the Hopper, it contains both the Test & Reset Switches (p. 7).

### AS-2981-1 HOPPER CONTROL BOARD ASSEMBLY

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>E-586-200</td>
<td>.22MF, 40V, Metalized Film</td>
</tr>
<tr>
<td>C2</td>
<td>E-586-200</td>
<td>.22MF, 40V, Metalized Film</td>
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<tr>
<td>C3</td>
<td>E-586-106</td>
<td>200 MF, 10, Electrolytic</td>
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<tr>
<td>C4</td>
<td>E-587-144</td>
<td>1N4148 Diode</td>
</tr>
<tr>
<td>C5</td>
<td>E-587-6</td>
<td>1N4004 Diode (located on back)</td>
</tr>
<tr>
<td>R1</td>
<td>E-105-306</td>
<td>10 Ohm, Resistor 1/4 Watt 5%</td>
</tr>
<tr>
<td>R2</td>
<td>E-105-290</td>
<td>470 Ohm, Resistor 1/4 Watt 5%</td>
</tr>
<tr>
<td>R3</td>
<td>E-105-306</td>
<td>10 Ohm, Resistor 1/4 Watt 5%</td>
</tr>
<tr>
<td>R4</td>
<td>E-105-301</td>
<td>100 Ohm, Resistor 1/4 Watt 5%</td>
</tr>
<tr>
<td>R5</td>
<td>E-105-280</td>
<td>470 Ohm, Resistor 1/4 Watt 5%</td>
</tr>
<tr>
<td>RLY1-LRY2</td>
<td>E-146-796</td>
<td>Electrol Academy 21441015 Reed Relay</td>
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<td>S1</td>
<td>E-658-1</td>
<td>P.B. P.C. Mount Switch</td>
</tr>
<tr>
<td>S2</td>
<td>E-658-1</td>
<td>P.B. P.C. Mount Switch</td>
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<tr>
<td>J1</td>
<td>E-758-15</td>
<td>15 Ctt. KK Right Angle Whaler</td>
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### AS-2981-4 HOPPER CONTROL BOARD ASSEMBLY

<table>
<thead>
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<th>SYMBOL</th>
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<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>U1, U3, U4</td>
<td>E-620-243</td>
<td>MOS119 Opto Coupler</td>
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<tr>
<td>U2</td>
<td>E-620-172</td>
<td>Optically Isolated Optical Driver</td>
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<tr>
<td>U5</td>
<td>E-681-1</td>
<td>3601 NPN Transistor Array</td>
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<tr>
<td>Q1, Q2</td>
<td>E-585-76</td>
<td>S405L 15A 400V, SCR</td>
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<tr>
<td>Q3</td>
<td>E-585-54</td>
<td>MAC15-6 15A 400V, Triac</td>
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<tr>
<td>Q1 thru Q3</td>
<td>M-496-1</td>
<td>Pull-Off Stud</td>
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<tr>
<td>CR1 thru CR4</td>
<td>E-887-14</td>
<td>1N4148 Diode</td>
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<td>CR5</td>
<td>E-587-1</td>
<td>1N4704 Diode</td>
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<tr>
<td>CR6</td>
<td>E-598-20</td>
<td>2N2220A Zener Diode</td>
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<tr>
<td>CR7, CR9</td>
<td>E-587-6</td>
<td>1N4004 Diode</td>
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<tr>
<td>CR8, CR10</td>
<td>E-688-38</td>
<td>1N294A ZENER Diode</td>
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<tr>
<td>CR11, CR12</td>
<td>E-688-75</td>
<td>1N5609 Diode</td>
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<tr>
<td>E-679-1</td>
<td>E-586-207</td>
<td>220v, 400V Polyester Capacitor</td>
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<tr>
<td>E-586-211</td>
<td>E-586-202</td>
<td>100 MF, 100V Tantalum Capacitor</td>
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<tr>
<td>E-586-202</td>
<td>E-586-205</td>
<td>100 MF, 200V Tantalum Capacitor</td>
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<tr>
<td>E-586-85</td>
<td>E-586-209</td>
<td>100 MF, 400V Polyester Capacitor</td>
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<tr>
<td>E-586-283</td>
<td>E-105-76</td>
<td>12K Ohm 2W 10% Resistor</td>
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<tr>
<td>E-105-235</td>
<td>E-105-230</td>
<td>180 Ohm 1/4W 5% Resistor</td>
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<tr>
<td>E-105-235</td>
<td>E-105-230</td>
<td>180 Ohm 1/4W 5% Resistor</td>
</tr>
<tr>
<td>E-105-235</td>
<td>E-105-230</td>
<td>270 Ohm 1/4W 5% Resistor</td>
</tr>
<tr>
<td>E-105-235</td>
<td>E-105-230</td>
<td>1K Ohm 1/4W 5% Resistor</td>
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</tbody>
</table>

### 2000 Series

![Diagram of the 2000 Series](image)
The Electronic Slot Machine Input/Output Board located behind the mechanism, p. 60, provides the circuitry to interface the MPU address, data and control signals to the slot machine peripheral devices (lamps, solenoids, switches, motors, LEDs, reel reader lights, hopper timer, etc.). Use the two Test Clips near the top left corner to test for voltage at the board. See the two previous pages for the I/O schematics and "J" 1-3 inputs/outputs.
SOUND BOARD

Found only on the Series 2000, sound is used when coins are played and paid out. When the reels are spinning and security when the door is opened. The volume is regulated by the round, black knob located near the center of the board.

The switch at the top of the board, is used to test the board. Voltage at Test Clip TP1 should read: approx. 35 VAC; TP2 approx. +2.5VDC; and TP3 approx. +2.5 VDC. TP1 & TP2 have no reading without sound.
M.P.U. BOARD (Microprocessor Unit)

The MICROPROCESSOR UNIT BOARD ASSEMBLY (located on the left side of the cabinet, p 60) is the controlling element of the slot machine. The photo on the left is a Series 1000 M.P.U. Unit and the diagram below is a Series 2000 M.P.U. The logic circuitry contained on these boards performs many functions which are similar to other microprocessor systems, but in addition, specialized circuits are utilized for security and versatility.

The CPU (U15) is the heart of the MPU Board. This Integrated Circuit (I.C.) performs such functions as retrieving instructions coded in memory EPROMs, interpreting the instructions, processing any arithmetic and logic operation required and manipulating control and bus signals.

The PERSONALITY PROM (U12) is unique to each game. It determines the type of machine (line or multiplier), number of coins played and the amount of individual pay. The payout percentage of a slot may be altered by changing this PROM. A second PERSONALITY PROM (U13), found only on Series 2000, is not necessary in most games. It is used when there are a number of extra pays or if the machine has a progressive jackpot.

<table>
<thead>
<tr>
<th>PERSONALITY PROM</th>
<th>Percentage of Payout (89%)</th>
</tr>
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<tbody>
<tr>
<td>Bally Reference Number (5410)</td>
<td>541089 5/20/83 E-2236-14</td>
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Date of Manufacture

Model Number of Slot
### SERIES 1000 M. P. U. BOARD (Parts Descriptions)

<table>
<thead>
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<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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<td>U1</td>
<td>E-0088-0010</td>
<td>14 Pin D.I.P. Socket</td>
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<tr>
<td>U2</td>
<td>E-0088-0011</td>
<td>14 Pin D.I.P. Socket</td>
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<tr>
<td>U3</td>
<td>E-0088-0012</td>
<td>74123 HEX Inverter</td>
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<td>U4</td>
<td>E-0088-0013</td>
<td>74123 HEX Inverter</td>
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<td>E-0088-0014</td>
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**NOTE:** All resistors are C0805 type, 1/4 W, 5% unless noted.

### SERIES 2000 M. P. U. BOARD (Parts Descriptions)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>U1</td>
<td>E-0098-0010</td>
<td>14 Pin D.I.P. Socket</td>
</tr>
<tr>
<td>U2</td>
<td>E-0098-0011</td>
<td>14 Pin D.I.P. Socket</td>
</tr>
<tr>
<td>U3</td>
<td>E-0098-0012</td>
<td>74123 HEX Inverter</td>
</tr>
<tr>
<td>U4</td>
<td>E-0098-0013</td>
<td>74123 HEX Inverter</td>
</tr>
<tr>
<td>U5</td>
<td>E-0098-0014</td>
<td>74163 Dual D.T. Buffer</td>
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<tr>
<td>U6</td>
<td>E-0098-0015</td>
<td>74163 Dual D.T. Buffer</td>
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<td>U7</td>
<td>E-0098-0016</td>
<td>74163 Dual D.T. Buffer</td>
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<td>U8</td>
<td>E-0098-0017</td>
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<td>U9</td>
<td>E-0098-0018</td>
<td>74163 Dual D.T. Buffer</td>
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<td>U10</td>
<td>E-0098-0019</td>
<td>74163 Dual D.T. Buffer</td>
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<tr>
<td>U11</td>
<td>E-0098-0020</td>
<td>74163 Dual D.T. Buffer</td>
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<td>U12</td>
<td>E-0098-0021</td>
<td>74163 Dual D.T. Buffer</td>
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<tr>
<td>U13</td>
<td>E-0098-0022</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U14</td>
<td>E-0098-0023</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U15</td>
<td>E-0098-0024</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U16</td>
<td>E-0098-0025</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U17</td>
<td>E-0098-0026</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U18</td>
<td>E-0098-0027</td>
<td>74163 Dual D.T. Buffer</td>
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<tr>
<td>U19</td>
<td>E-0098-0028</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U20</td>
<td>E-0098-0029</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U21</td>
<td>E-0098-0030</td>
<td>74163 Dual D.T. Buffer</td>
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<td>U22</td>
<td>E-0098-0031</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
<tr>
<td>U23</td>
<td>E-0098-0032</td>
<td>74163 Dual D.T. Buffer</td>
</tr>
</tbody>
</table>

**NOTE:** All resistors are C0805 type, 1/4 W, 5% unless noted.
This board provides the slot machine with two power sources and one signal source. They are V+ (10.5 VDC), VCC (+5VDC) and the zero crossing signal. The latter are generated by converting 9.5 to 11 volts AC secondary supply voltage from the Game Transformer.

### POWER SUPPLY BOARD

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>E-629-66</td>
<td>LM-3401-5 5 V.A.C. VOLTAGE REGULATOR</td>
</tr>
<tr>
<td></td>
<td>E-602-10</td>
<td>HEAT SINK THERMALLOY 8070</td>
</tr>
<tr>
<td></td>
<td>LP08-632-1106</td>
<td>SCREW</td>
</tr>
<tr>
<td></td>
<td>M-1708-6</td>
<td>LOCKNUT</td>
</tr>
<tr>
<td></td>
<td>N-832-2112</td>
<td>NUT</td>
</tr>
<tr>
<td>BR1</td>
<td>E-102-3</td>
<td>50A BRIDGE RECTIFIER</td>
</tr>
<tr>
<td></td>
<td>P-8820-158</td>
<td>HEAT SINK (LARGE)</td>
</tr>
<tr>
<td></td>
<td>P-8829-101</td>
<td>HEAT SINK (SMALL)</td>
</tr>
<tr>
<td></td>
<td>LP08-632-1110</td>
<td>SCREW</td>
</tr>
<tr>
<td></td>
<td>N-1706-6</td>
<td>LOCKNUT</td>
</tr>
<tr>
<td></td>
<td>N-832-2112</td>
<td>NUT</td>
</tr>
<tr>
<td>CR1 THRU CR4</td>
<td>E-387-6</td>
<td>1400A4 DIODE</td>
</tr>
<tr>
<td>V1</td>
<td>E-713-2</td>
<td>G.E. 6222A1 B.O.V.</td>
</tr>
<tr>
<td>R1</td>
<td>E-105-238</td>
<td>1 OHM, RESISTOR 1/4 WATT 5%</td>
</tr>
<tr>
<td>R2</td>
<td>E-105-185</td>
<td>5 OHM, RESISTOR 1/4 WATT 5%</td>
</tr>
<tr>
<td>C1</td>
<td>E-566-32</td>
<td>11,700 MFD, 20 V. ELECTROLYTIC</td>
</tr>
<tr>
<td>C2</td>
<td>E-647-3</td>
<td>TIE WIRE (TWO USED)</td>
</tr>
<tr>
<td>C3</td>
<td>E-566-3</td>
<td>2 MFD, 50 V. ELECTROLYTIC</td>
</tr>
<tr>
<td>L1</td>
<td>E-604-3</td>
<td>.72 M H. INDUCTOR</td>
</tr>
<tr>
<td>TP1 THRU TP4</td>
<td>F-5300</td>
<td>TEST CLIP (TEST POINT)</td>
</tr>
<tr>
<td>J1</td>
<td>E-738-10</td>
<td>10 CT., 24K RESISTOR (2)</td>
</tr>
<tr>
<td>S1</td>
<td>J178-25</td>
<td>WIRE JUMPER IN CIRCUIT</td>
</tr>
</tbody>
</table>

### TESTING THE POWER SUPPLY BOARD

Using a Volt-Ohm meter, check the three secondary voltages with one lead on the ground (GND) Test clip (TP3) and the other lead on one of the 3 other Test Clips (looped wires).

- TP1 (+5) to TP3 (GND) — Approx. +5.0 Volts DC
- TP2 (ZC) to TP3 (GND) — Approx. +7.5 Volts DC
- TP4 (+UR) to TP3 (GND) — Approx. +10 Volts DC
Located behind the Hopper, the Delay Relay Board was used only on the Series 1000. It was replaced by an encapsulated CR Relay, located near the Hopper Beau Plug. For the description and the operation of the Delay Relay Board see page 61.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>E-596-148</td>
<td>Axial 10μF ±10% 50V, Cap.</td>
</tr>
<tr>
<td>CR1</td>
<td>E-596-19</td>
<td>1N4004 Diode</td>
</tr>
<tr>
<td>CR2</td>
<td>E-596-6</td>
<td>5.3V, 2mA 1N Zener</td>
</tr>
<tr>
<td>CR3</td>
<td>E-596-6</td>
<td>1N4004 Diode</td>
</tr>
<tr>
<td>CR4</td>
<td>E-596-6</td>
<td>1N4004 Diode</td>
</tr>
<tr>
<td>J1</td>
<td>E-756-9</td>
<td>9 Pin KK 156 Conn</td>
</tr>
<tr>
<td>K1</td>
<td>E-14C-795</td>
<td>48VDC Relay</td>
</tr>
<tr>
<td>P.I.</td>
<td>P-2848-472</td>
<td>P.C. Board M-645-606</td>
</tr>
<tr>
<td>R1</td>
<td>E-105-271</td>
<td>2N4401 Transistor</td>
</tr>
<tr>
<td>R2</td>
<td>E-105-277</td>
<td>MPS-4A2 Transistor</td>
</tr>
<tr>
<td>R3</td>
<td>E-105-106</td>
<td>10 Ohm 1/4 Watt 5%</td>
</tr>
<tr>
<td>R4</td>
<td>E-105-219</td>
<td>330 Ohm 1/4 Watt 5%</td>
</tr>
<tr>
<td>R5</td>
<td>E-105-219</td>
<td>330 Ohm 1/4 Watt 5%</td>
</tr>
<tr>
<td>S1</td>
<td>Wire Jumper Installed</td>
<td></td>
</tr>
</tbody>
</table>

### SLOT SIMULATOR TEST STATION

![Diagram of Slot Simulator Test Station]

The best way to check a defective board, or boards, is to have a qualified technician inspect them on a Slot Simulator Test Station. This device simulates the operating functions used on all Series E Slot Machines.
The example shown at right is for a 5-line, 10-way pay.

The Triacs Q1-Q32, located in five rows on the I/O Board, are the electronic switches that control the operations of the game. For their various combinations of uses refer to the I/O Board schematics on pages 52 and 53.

All 32 Triacs use the Bally part number E-585-44 which is a TI06A1SG Triac. These components are available from the Wico Corporation. Their replacement number is Wico 21-311100.

A Triac switching function may be checked by connecting the Triac tab to ground which energizes the respective load. They are replaced by removing the I/O Board from the cabinet, turning the board over and unsoldering the connections. Place the new Triac in position and resolder.

**DESCRIPTIONS OF BOARDS**

**BADGE BOARD (Slot I.D.):**

CREDIT DISPLAY BOARD: Consists of seven LED display modules which are used for displaying credit winnings and credit totals and for displaying the number of credits gambled on each handle pull.

*DELAY RELAY BOARD (P59): Used only on the Series 1000, this unit consists of a 50 VDC relay which switches the 50 VAC from the transformer secondary voltage supply. Other components on the board provide the control for the relay and the assertion of a reset signal in the event of a power failure.

*DISPLAY BOARD: (p.8) Consists of six LED display modules which are used for displaying coins paid in and out, test functions and to identify machine malfunctions.

DISPLAY CREDIT BOARD (Replay Register): Used on machines with Credit Play, it is a four digit, seven segment display board that is controlled by the M.P.U. Board.

DISPLAY DRIVER BOARD: It provides decoded signal outputs directed to the Small and Large Replay Display Board Assemblies.

*DOUBLE PROGRESSIVE DISPLAY UNIT: It is a peripheral device that displays seven or eight digit numbers, that represent the progressive jackpot pot. The unit consists of two printed circuit boards the PROGRESSIVE DISPLAY BOARD (p. 9) and the DISPLAY DRIVER BOARD (Progressive Display Controller Board).

*HOPPER CONTROL BOARDS: (See page 47)

*I.O. BOARD (INPUT/OUTPUT): (See pages 52-54)

*I.O. BUFFER: This board is used to amplify and isolate address bus, data bus and control lines going into the sound insert display interface board.


*POWER SUPPLY BOARD: (See page 58)

*REEL READER CONTROL BOARD: (See page 46)

*SLOT I.D. BOARD: Located on the I.O. Board,

SLOT MONITOR BOARD (RX/TX): This board serves as an interface between the I/O Board and an external transmit and receive element (ie, slot monitor system). The signal transferred over these lines are typically slot machine meter status (ie, coin in, coin out, etc.).

SOUND BOARD: (See page 56)

SMART BOARD: Interfaces with the Badge Board, sends a signal to the Interrupt Decoder on the M.P.U. and is utilized in conjunction with an Electric Door lock.

* Denotes boards that can be checked on the Slot Stimulator Test Station page 59.
GAME TRANSFORMERS (Input / Output Voltages)

DOUBLE PROGRESSIVE BOARD POWER

SOUND BOARD POWER

MAIN GAME POWER

INPUT / OUTPUT VOLTAGE SCHEMATIC

WIRE COLORS USED FOR BASIC VOLTAGES

110 Volts: Wires 50 & 60
50 Volts: Wires 70 & 90
9.5 Volts: Wires 30 & 90
7.5 Volts: Wires 20 & 90

Flourescent Lights & Hopper Motor
Relays, Coils. Buzzer, Chime, etc.
General Illumination
Bell, Coin Played Lights, Winner Paid Lights, etc.

Note: The Delay Relay Board was only used on the Series 1000. On the Series 2000 it was replaced by an encapsulated CR Relay.
Troubleshooting

MACHINE IS DEAD and the fluorescent lights do not light:
1. Check to see if there is 110 volts at wall receptacle.
2. Plug a 110 volt item into the 110V Outlet inside the machine to verify that the line cord is good.
3. Check to see if the 5 amp line fuse (no. 6) is not blown.

MACHINE IS DEAD and the fluorescent lights are lit and the LED Display is not lit:
1. Check the fuses (nos. 1-5). Play the machine a few times after replacing the fuse and if it blows again locate the problem.
2. Unplug each peripheral component separately (Reel Mech, Hopper, Sound Board, Top Sign Unit, and Progressive Unit). TURN OFF POWER SWITCH while unplugging each component. If the problem is in any of these units the LED lights will come on.
3. Check the Power Supply Unit: 1. Check the three voltages on the Test Clips (page 58).
   If the "J1" Wafer is blackened chances are that the Power Supply Board is at fault. This may be caused by a faulty part or a bad connection. To correct the latter, pull out the corresponding pin, clean and replace.

MACHINE IS MALFUNCTIONING and the LED Display is lit: Refer to Malfunction Codes on pages 20-23 & 26.

Replacing Fuses: Turn off the main POWER SWITCH before inspecting fuses. Replace the fuse and test the machine. If the fuse blows again locate the problem.

Hopper Fuse: 5 Amp 3 AG Hopper Fuse is located on the front frame of the Hopper. A red lamp, located above the fuse, lights when the fuse is burned out.

Swapping Boards: If a second machine is available a problem may be located by swapping boards, The M.P.U. Boards on a Series 1000 and Series 2000 can not be interchanged.

Reels Keep Spinning. Check the Kick and Arm Switches (see page 33).

Not Reading Reels: Check the Reel Reader Assembly for a light reading malfunction. The early models used a 50 volt lamp (#860) and on the later ones utilized an infra-red LED. (See page 46). To adjust the Position Readers refer to page 32. To check to see if the Position Reader is aligned with the holes on Index Discs see page 13.

Checking Power On Boards: Check the individual voltages on the Test Clips (TP1, etc.) for each board. I/O Board, page 54 (5 volts); M.P.U. Board, page 56 (5 volts); Sound Board, page 55; and Power Supply Board page 58.

Checking P.C. Board Flat Cables, Turn off POWER SWITCH remove carefully and test corresponding pins on each end of the cable for continuity with a tester.

Always turn off the main Power Switch and unplug the line cord before removing or installing any assembly, connector or component. Before handling Integrated Circuits be sure to dissipate any static charges which may have built up in the body. Some of the Integrated Circuits may be damaged by direct contact with static electricity.

A Partial List of Dealers That Sell Parts

Bally Gaming, Inc., 1-(800) HOT SLOT, 6601 So. Bermuda Rd. Las Vegas, NV 89119 Bally Gaming, Inc., Northern Nevada, (702) 685-7737, 1400 Greg St., Sparks, NV 89431

Bally Gaming, Inc. will only sell and repair parts with customers that are a Nevada resident and have a valid Nevada driver's license. Non-residents may obtain parts and repairs through independent dealers in legal states.

Wico Corporation, 1-(800) FOR WICO (some electronic & mechanism parts) 6400 West Gross Point Rd., Niles, IL 60714. Wico offers a catalog that pictures E machine parts and lists their cross reference numbers.

For a local parts dealer in "legal states" refer to the "Slot Machines — Antique" listing in the phone book's yellow page index. These dealers names and addresses are also available in the many trade publications.

Dealer Repairs

For a local repair technician in "legal states" refer to the "Slot Machines — Antique" listing in the phone book's yellow page index or a trade publication. For major board repair check with your local dealer. If you feel you need extensive board repair, it may be advisable to locate a technician with a Slot Simulator Test Station (page 59).