



MUSTANG

PRO



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WARNING

Important Health Warning: PHOTOSENSITIVE SEIZURES

A very small percentage of people may experience a seizure when exposed to certain visual images, including flashing lights or patterns. Even people with no history of seizures of epilepsy may have an undiagnosed condition that can cause "photosensitive epileptic seizures" due to certain visual images, flashing lights or patterns. Symptoms can include light-headedness, altered vision, eye or face twitching, jerking or shaking of arms or legs, disorientation, confusion, momentary loss of awareness, and loss of consciousness or convulsions that can lead to injury from falling down or striking nearby objects.

IMMEDIATELY STOP PLAYING AND CONSULT A DOCTOR IF YOU EXPERIENCE ANY OF THESE SYMPTOMS.

Please visit www.sternpinball.com
For part numbers and mechanical drawings.

Stern Pinball machines are assembled in Melrose Park, Illinois, USA; each pinball machine has unique characteristics that make it a one of a kind American made product. Each machine will have variations in appearance resulting from differences in the machine's particular wood parts, individual silk screened art and mechanical assemblies. Stern Pinball has inspected each game element to insure it meets our quality standards.

Pinball Service Game Manual

Please call, email, or visit us online for technical support, questions or comments regarding this pinball game.

Go to www.sternpinball.com and click **SERVICE & SUPPORT**.

Find **Service Game Manual** (with updates), **Coin Cards**, **Game Code Library**, **Appendixes**, **Care & Maintenance**, **Service Bulletins** and much more!

• Toll-Free: 1-800-KICKERS (542-5377) or 1-708-345-7700 • Email: parts.service@sternpinball.com

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JANUARY 2014

SPI Part Number
780-50F1-00

HOW TO UPDATE YOUR GAME CODE FOR S.A.M. SYSTEM MACHINES

USB Compatible Data Storage Device (Thumb, Flash or Jump Drives) required to copy game code into system.
S.A.M. System compatible, tested & SPI approved USB Data Storage Devices 128MB+ available through your local distributor: Ask for **SPI Part Number 970-0128-00**

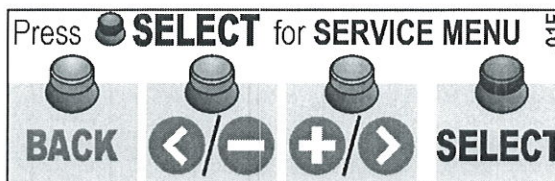
* to get the Data Storage Device with the latest **Game Code** copied to it, add "game title" to above part number.

STYLE, COLOR, SIZE AND MANUFACTURER SUBJECT TO CHANGE.

Game Code is subject to change. Update this game with the latest code downloaded from our website, from another game or order through your local distributor (use SPI PN + name above).

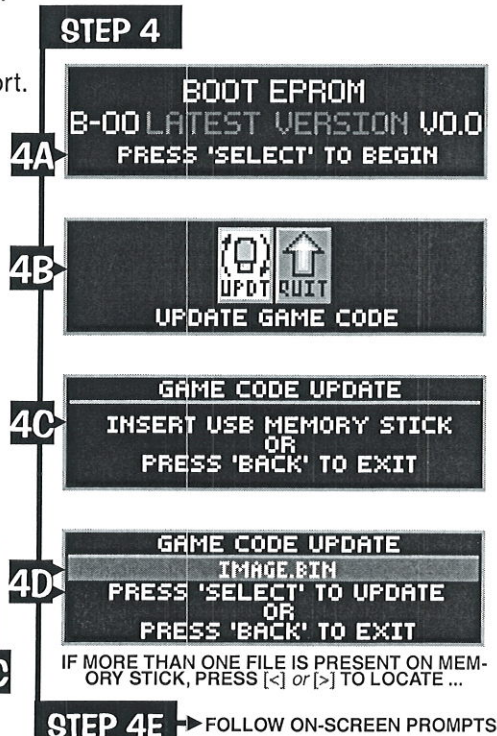
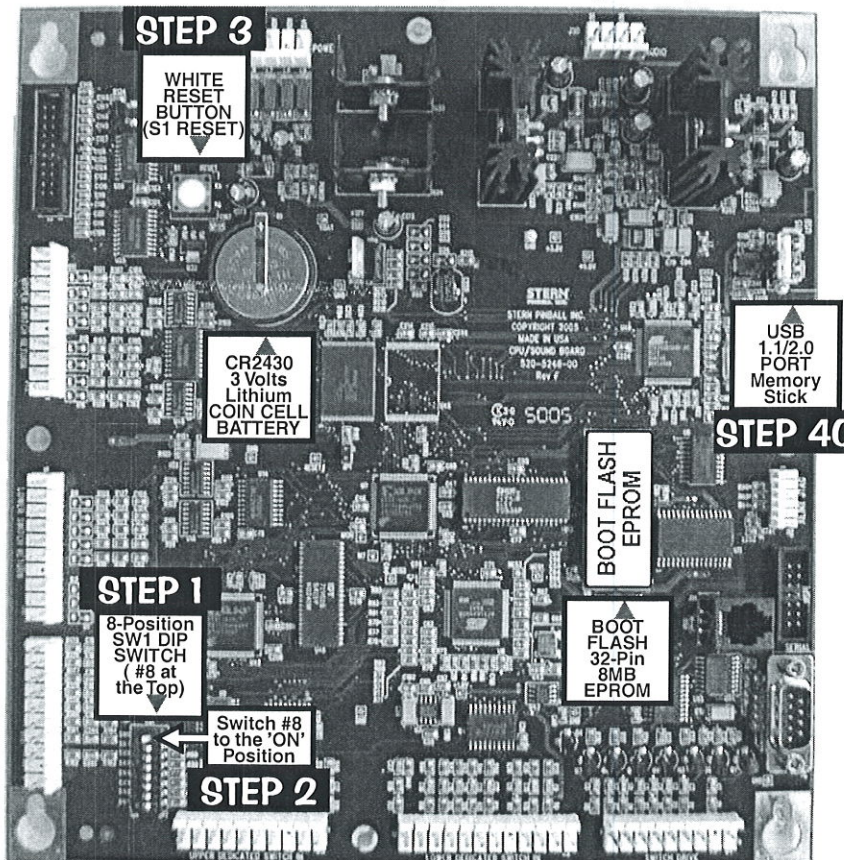
Upon power-up the display will describe the version of code installed in your game. When directed to do so (via Service Bulletin or website announcement) you will need to update your code ... with the **BOOT FLASH EPROM*** installed, **here's how:**

- STEP 1** Open the Back Box and locate the **8-Position Dip Switch (SW1 on the CPU/Sound Board)**.
- STEP 2** Switch Dip Switch #8 to 'ON'.
(***BOOT FLASH EPROM** must be installed.)
- STEP 3** Press the **White Reset Button (S1 RESET on the CPU/Sound Board)** or Power Cycle the game **OFF/ON** (ON/OFF Switch is located on the outside of the cabinet bottom, front right).
- STEP 4** Using the **4-Button Service Switch Set** (inside the Coin Door):
- 4A } Press [**SELECT**] to begin.
 - 4B } With the "UPDT" Icon highlighted, press [**SELECT**].
 - 4C } Insert the Data Storage Device [w/latest file(s)] into the USB Port.
 - 4D } If more than one file is present on the Data Storage Device, press [**<**] or [**>**] to locate your file. Press [**SELECT**] to update.
 - 4E } Follow on-screen prompts.



- **Green Button**
Press to **Escape Back** (or **Exit**).
- **Red Buttons**
Press to move **< Left , Right >**.
Press to **- Decrease** or **+ Increase** values or to change settings.
- **Black Button**
Press to **Enter Select** (or **'OK'**).

CPU/Sound Board (S.A.M. System)

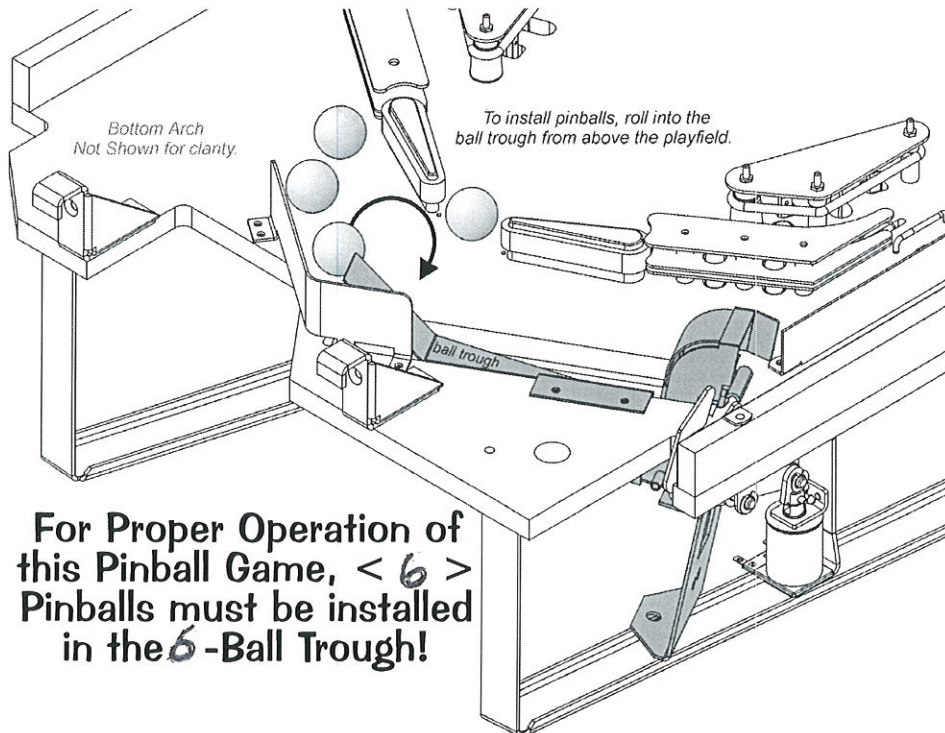


You can also retrieve your latest code from another game! From the **USB MENU** via the **UTILITIES MENU**, select the "BKUP" Icon instead and download to your Data Storage Device.



! Quick Tip ~ Try backing up your current code prior to installing your new code, just in case your Data Storage Device file was corrupted by a computer glitch while you were copying /

Got confused? Comments? Questions? Call Technical Support at 800-542-5377 or 708-345-7700 (Option 1).



**For Proper Operation of
this Pinball Game, < 6 >
Pinballs must be installed
in the 6-Ball Trough!**

Backbox Fuses*, Cabinet Fuses, Playfield Fuses and Cabinet Switches

**Note: The CPU/Sound PCB
does not have fuses.*

QUICK REFERENCE FUSE CHART

3/4A S.B. 200-5000-17 | 3A S.B. 200-5000-08 | 4A S.B. 200-5000-06 | 5A S.B. 200-5000-01 | 7A S.B. 200-5000-03 | 8A S.B. 200-5000-05

BACKBOX FUSES

I/O POWER DRIVER BOARD

with RED LED STATUS INDICATORS (if any RED LED is OFF, check the fuse)

F1	5A S.B.	5.7vac- G.I. Lamps	(BROWN-WHITE-WHT-BRN)
F2	5A S.B.	5.7vac- G.I. Lamps	(YELLOW-WHITE-YEL Circuit)
F3	5A S.B.	5.7vac- G.I. Lamps	(GREEN-WHITE-GRN Circuit)
F4	5A S.B.	5.7vac- G.I. Lamps	(VIOLET-WHITE-VIO Circuit)
F5	7A S.B.	50VDC Coils / Flippers	(48VAC feed to BRDG 1)
F6	3A S.B.	24vac- Motor or Special Application	
F7	4A S.B.	50VDC Magnet(s) or Special Application	
F8	3A S.B.	50VDC Coils	
F9	8A S.B.	18VDC Control Lamps	(13VAC feed to BRDG 4)
F10	5A S.B.	20VDC Coils / Flashers	(16VAC feed to BRDG 2)
F11	4A S.B.	5VDC Logic Power	(8VAC feed to BRDG 5)
F12	5A S.B.	12VDC Audio	(19VAC feed to BRDG 3)
F13	5A S.B.	12VDC Audio	(19VAC feed to BRDG 3)

DISPLAY POWER SUPPLY BOARD

F1	3/4A S.B.	90VDC High Voltage Dot Display Board
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CABINET FUSES

POWER (SERVICE OUTLET) BOX

(Access through Coin Door inside cabinet, front bottom.)

8A S.B.	110-120V Main Line US / Canada / Japan
5A S.B.	220-240V Main Line International

PLAYFIELD FUSES

FLIPPER OR SPECIAL APPLICATION

(Coil Fuses are located under the playfield near assembly.)

3A S.B.	50VDC R. Flipper (BLU-YEL-RED-YEL)
3A S.B.	50VDC L. Flipper (GRY-YEL-RED-YEL)
3A S.B.	50VDC Additional Flipper Coil, if used.
3A S.B.	50VDC Spcl. Application Coil, if used.

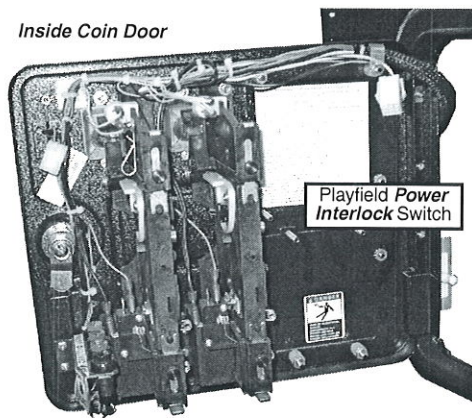
For location & more details on fuses, see Sec. 5, Chp. 2.

**ALL FUSES ARE 250V S.B. (SLO-BLO)
SEE FUSE OR TABLES FOR AMP RATING
CAUTION : FOR CONTINUED PROTECTION
AGAINST RISK OF FIRE, REPLACE ONLY WITH
SAME TYPE FUSE WITH IDENTICAL ELECTRICAL RATING!**

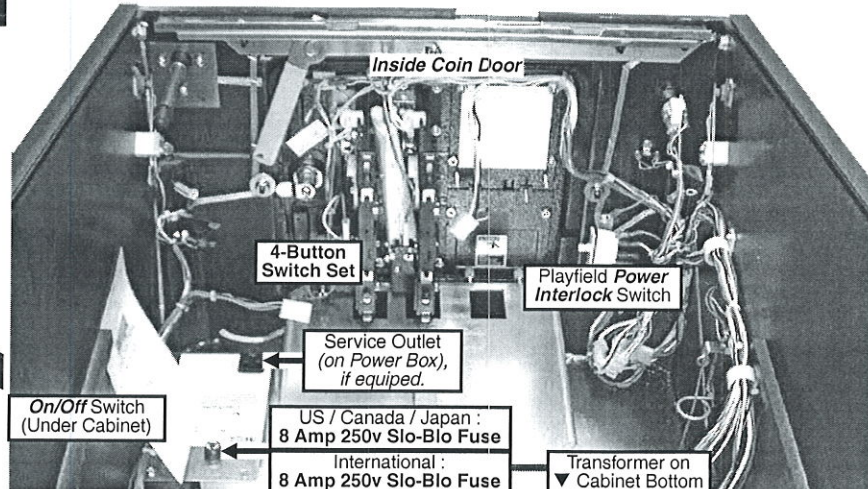
Stern Pinball®, Inc. ©2008

820-6384-00 Rev C

Inside Coin Door



4-Button Switch Set:

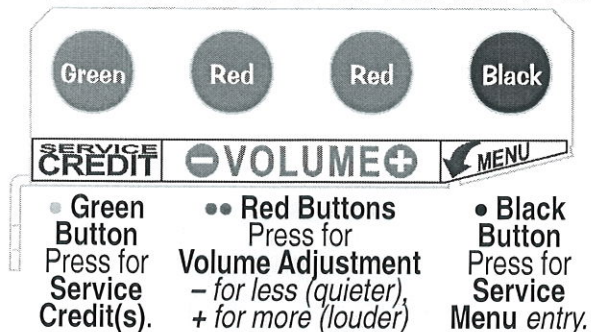


OPEN THE COIN DOOR TO ACCESS THE SERVICE SWITCH X4 SET.

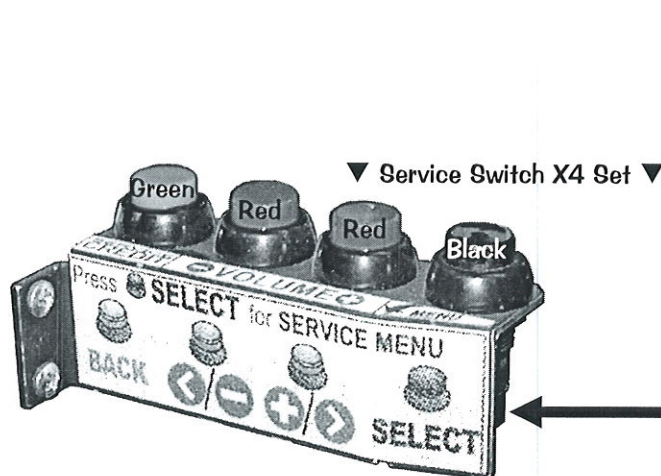
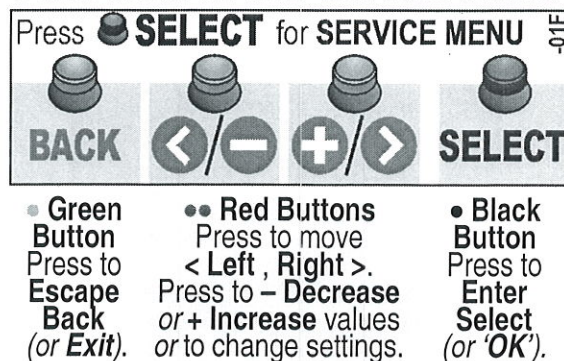
● ● ● ● Service Switch X4 Set Overview

The four buttons (inside Coin Door) have dual functions depending if you have entered the **Service Menu** or not.

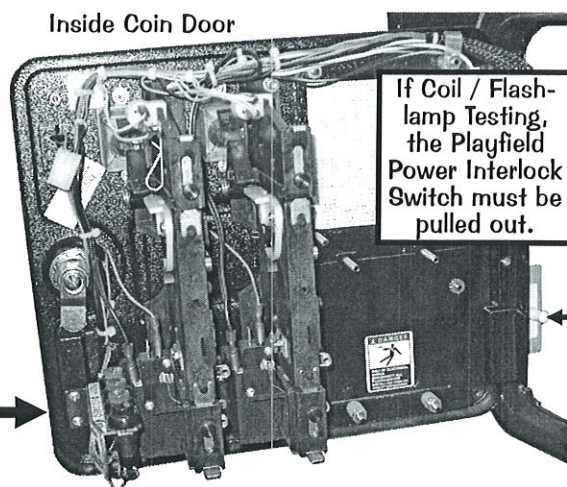
Functions in Game or Attract Mode



Functions in the Service Menu



Inside Coin Door



EXAMPLE:

To enter the **SERVICE MENU**, then enter the **SWITCH TEST MENU** via the **DIAGNOSTIC MENU**, perform the below steps.

Step 1 Press [**SELECT**].

Step 2 With the "DIAG" Icon highlighted, press [**SELECT**].

Step 3 With the "SW" Icon highlighted, press [**SELECT**].

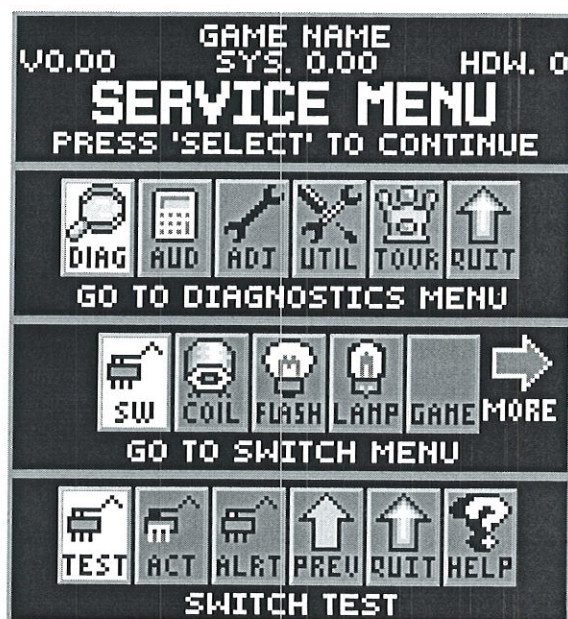
Step 4 With the "TEST" Icon highlighted, press [**SELECT**].

Press any switch. If wired correctly, the information in the display will match the information in the Switch Matrix (see DR. 4).

Press [<] or [>] to move left or right through the menus.

Press [**BACK**] to go back a menu, exit or escape at any time.

Continue through the other menus.



The Service Menu is subject to change. Update this game with the latest code downloaded from our website with a USB Data Storage Device (64MB min., recommendation 128MB or higher). See the inside front cover for directions or in the Service Menu "Go To Utilities Menu" then "Go To USB Menu" and follow prompts.

DIAGNOSTIC AIDS

50V / 20V DISABLED
CLOSE COIN DOOR
OR PULL INTERLOCK SWITCH
TO RESTORE POWER

'escape' **Green [BACK] Button** will remove the alert display. Initial display presentation is accompanied by 3 audible tones (the bright display warning will go dim after approximately 30 seconds).

OPERATOR ALERT!
AUTO PLUNGER
DEVICE MALFUNCTION

This **alert display** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a device malfunction (device or mechanism doesn't energize or is energized repeatedly). **OPERATOR ALERT!** works by monitoring any switch activated device that has the potential to trap a ball when disabled (e.g. in the Shooter Lane, Scoop or Eject Holes, etc.). This alert can also appear if a switch associated with a device (e.g. Ball Trough, Auto Plunger, etc.) is stuck closed (caused by a switch jam or stuck ball); the game will activate the device a predetermined number of times and if the problem is still detected, this device or switch will be noted in **Switch Alerts** and/or **Technician Alerts**.

VO.00 GAME NAME SYS. 0.00 HDW. 0
SERVICE MENU *
USE -/+ TO VIEW TECH. ALERTS

and "TECH" Icon for the **Technician Alerts** information.

Upon entering the **SERVICE MENU**, if an asterisk " *" is displayed after the words "SERVICE MENU," the game has detected possible faulty devices, switches and/or missing pinballs. Press the either of the **Red Buttons** (short-cut to the **TECHNICIAN ALERTS MENU**) or continue into the **SERVICE MENU** (press the **Black Button** again), select the "DIAG" Icon

CPU DIP SWITCH SETTINGS

The 8-Pos. Dip Switch [SW1] is on the CPU/Sound Board (between Conn. J3 & J13, lower left corner)

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
USA	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Germany	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Russia	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Australia	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Greece	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
So. Africa	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Austria	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Italy	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Spain	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Belgium	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Japan	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Sweden	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Canada 1	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Lithuania	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Switzerland	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Canada 2	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Middle East	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Taiwan	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Croatia	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Netherlands	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
UK	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Denmark	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
New Zealand	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU/SND PCB SETTING:	Pos.	1	2	3	4	5	6	7	8
UPDATE CODE	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Finland	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

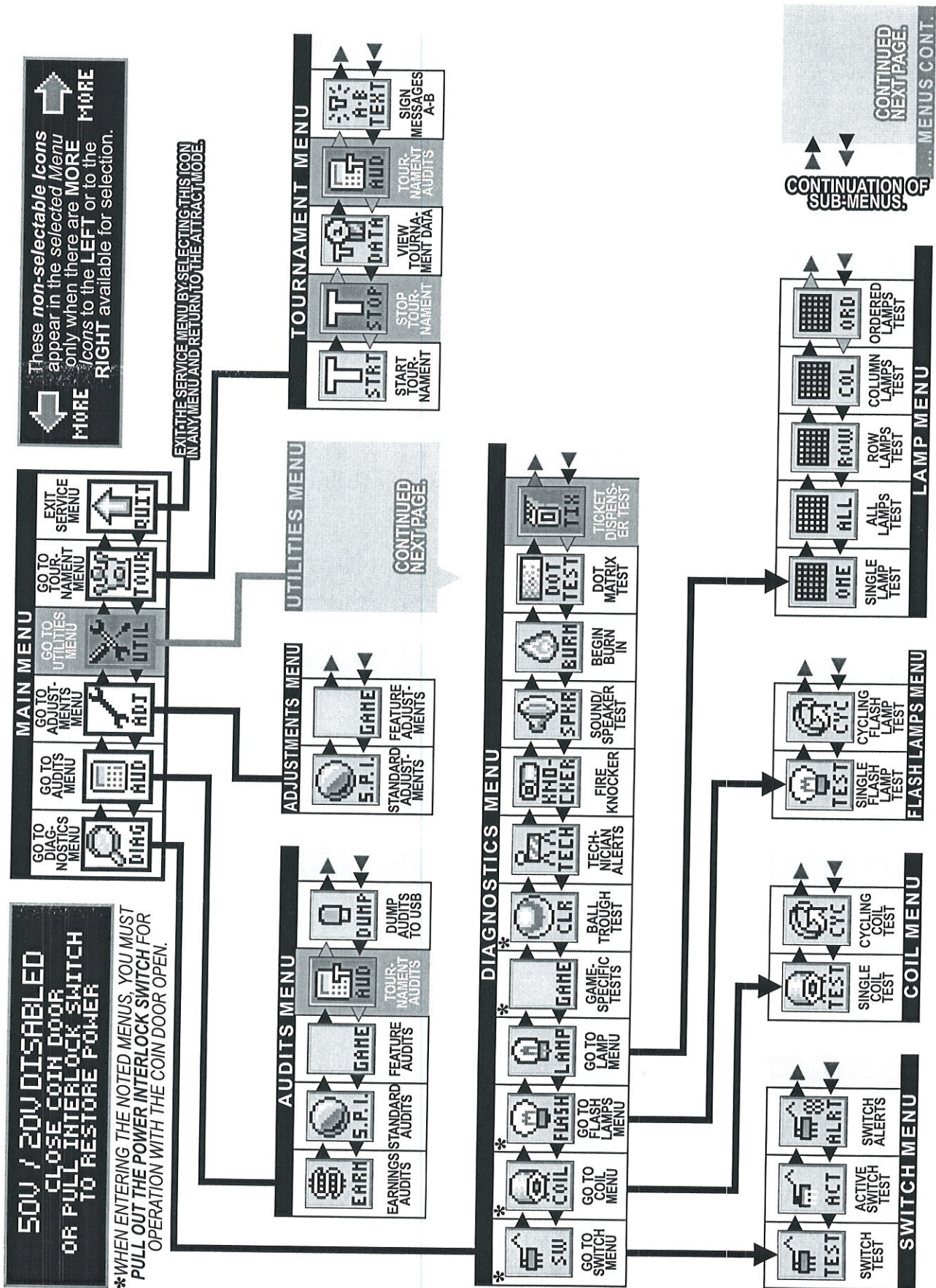
CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Norway	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
France	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

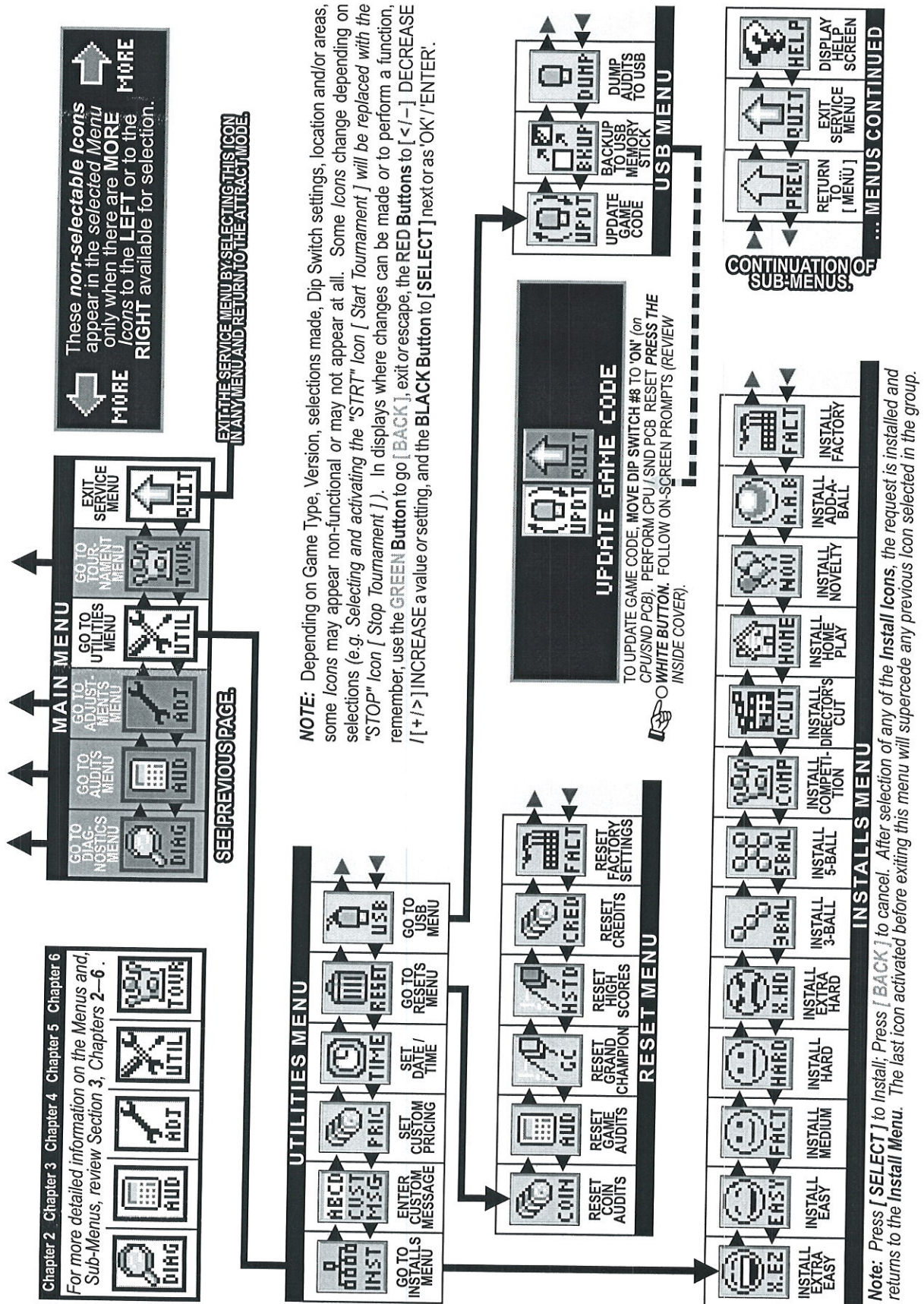
CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Portugal	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

Note: Slide Dip Switch 8 to Position **ON** (with Dip Switches 1-7 in the **OFF** Position) only to reboot the game with the latest version **BOOT EPROM** installed at **U9** on the CPU/Sound Board (S.A.M. System only). Currently, this is also the procedure to update your game with the latest software code update file. For the latest version, visit our website. If you have questions about updating your game code, call Technical Support for assistance.

Pinball Service Menu Icon Tree



Pinball Service Menu Icon Tree Continued



Service Menu Introduction

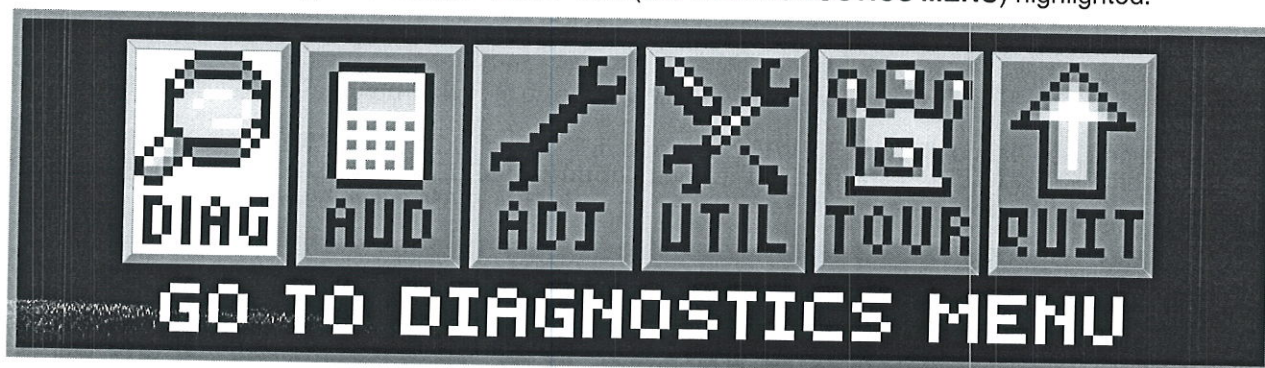
Important: The **Switch Bracket** holds the **Playfield Power Interlock**. It is located just inside the **Coin Door** frame (see pictorial of the **Coin Door** on the previous page). The **Button Switch** for the **Playfield Power Interlock Switch** must be pulled out for electro-mechanical device testing or diagnostic purposes (this is required). If this button is pushed in, the **Playfield Power** is disabled while the **Coin Door** is **OPEN**.

To get into the **SERVICE MENU MODE** review "**Function 3: SERVICE MENU**" on the next page. After Power-Up, push down the **Black [SELECT] Button** to begin. Looking at the display you will momentarily see "**SERVICE MENU**" followed by the **MAIN MENU**:



Use the **Red [< / -] / [+ / >] Buttons** to move the selected **Icon** left or right, and the **Black [SELECT] Button** to activate the selected **Icon**.

The **MAIN MENU** now appears with the "**DIAG**" **Icon** (**GO TO DIAGNOSTICS MENU**) highlighted:



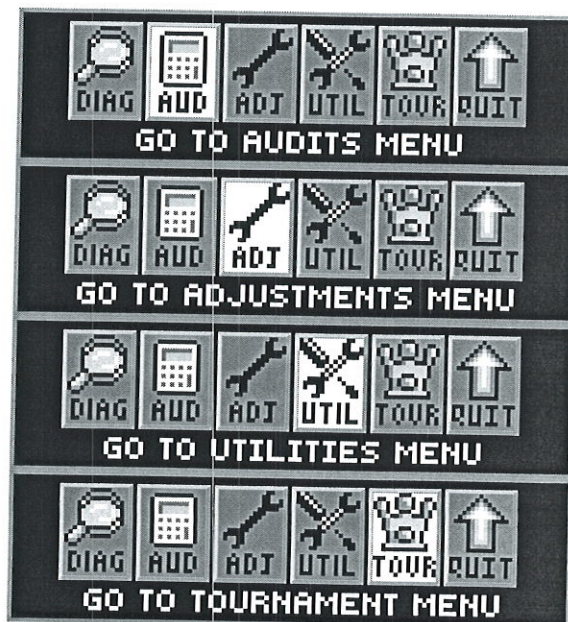
As the operator views the Menu Screen(s), the **MORE MORE** symbols indicates that there are more **Icons** to select in each direction. The **Icon** selected will blink. Pushing the **Black [SELECT] Button** will select the **Icon** and the Menu Screen will change to the menu selected. Select the **Green [BACK] Button** to move backwards through the menu levels. Press the **Green [BACK] Button** repeatedly or select the "**QUIT**" **Icon** to completely exit the **SERVICE MENU Mode**.

View the **SERVICE MENU Icon Tree** on the next pages for a complete overview of all menus used in this system. The "**HELP**" **Icon** provides an explanation of **ICON** usage or any other information in the Menu where the "**HELP**" **Icon** was selected (when available).

DIAG: GO TO DIAGNOSTICS MENU
AUD: GO TO AUDITS MENU
ADJ: GO TO ADJUSTMENTS MENU
UTIL: GO TO UTILITIES MENU
 (INSTALLS, CUSTOM MSG., CUSTOM PRICING, SET TIME, RESET & USB)
TOUR: GO TO TOURNAMENT MENU (START TOURNAMENT, VIEW TOURNAMENT DATA, SIGN MESSAGES)

>> TO UPDATE THE GAME CODE, REVIEW THE STEPS ON THE INSIDE FRONT COVER OF THIS MANUAL.

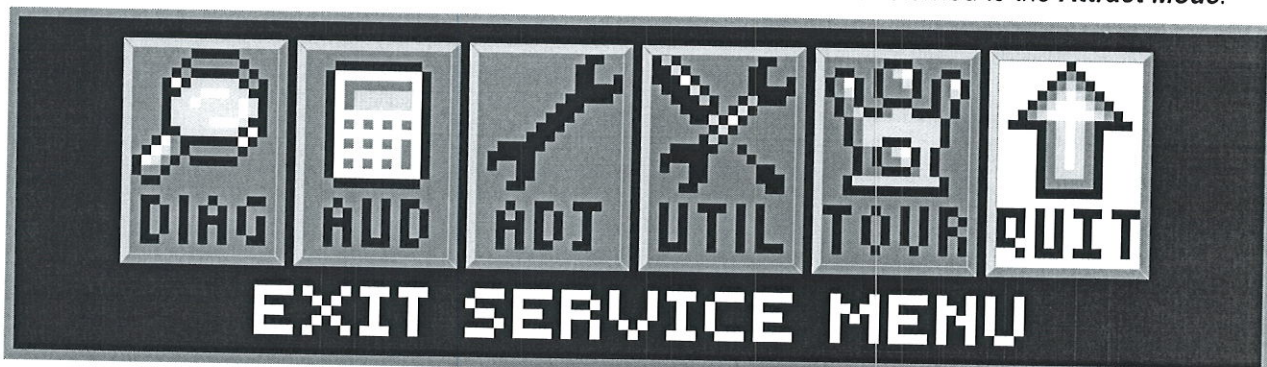
Use both the manual and the display to help customize, troubleshoot and/or diagnose faults, if any.





Exit Service Menu

In the **MAIN MENU** and in all **SUB-MENUS** (where the "QUIT" Icon is present), if the "QUIT" Icon is selected and activated, or the **Green [BACK] Button** is selected repeatedly (depending on which sub-menu you're in...), the **SERVICE MENU Session** will be exited and returned to the **Attract Mode**.



Turning the game on/off will start the *Power-Up Routine*. Upon **Power-Up**, the DISPLAY will indicate the COUNTRY, FILE VERSION and LANGUAGE(S) installed. LANGUAGE/COUNTRY: change via Dip Switch.

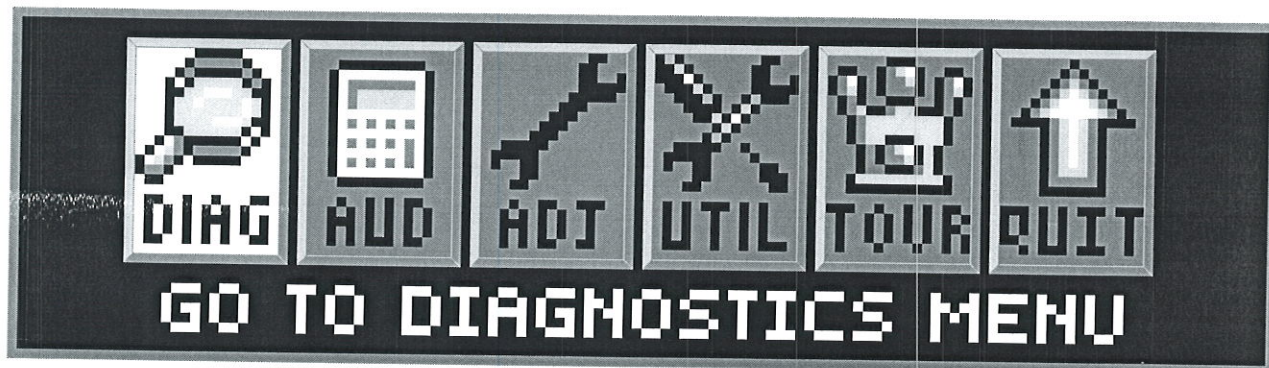


The below **Problem / Solution Table** was designed to answer some common problems frequently asked.

Problem / Solution Table

PROBLEM	SOLUTION
Will not enter the SERVICE MENU after depressing the Black [SELECT] Button .	<ul style="list-style-type: none"> • Check the Service Switches [GREEN, RED (x2) & BLACK Buttons] for loose connections or bad ground. • Check the associated wiring harness to/from the CPU/Sound Board, Connector J13. • Check CPU/Sound Board for possible failure.
All Service Buttons [• • • •] appear nonfunctional.	<ul style="list-style-type: none"> • Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The Green Button in the Attract Mode will not enter the SERVICE CREDITS MENU to add Service Credits.	<ul style="list-style-type: none"> • Check to make sure the Game is not in "Free Play." <i>If the game is set to Free Play, adding Service Credits is not required.</i> • Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The Display "blanks out."	<ul style="list-style-type: none"> • Check the Dot Matrix Display for loose wiring harness for poor or no connection and/or broken wires. • Check F1 (3/4A Fuse) on the Display Power Supply Board. <i>Refer to the Yellow Pages (SCHEMATICS & TROUBLESHOOTING).</i>
Icons "scroll" along continuously in the MAIN MENU .	<ul style="list-style-type: none"> • Check for a stuck switch on either of the Red Buttons.
The Start and Flipper Buttons do not select or activate Icons in the SWITCH TEST MENU .	<ul style="list-style-type: none"> • This is normal. These switches are deactivated, as they are a part of the Switch Test. <i>Refer to the Diagnostics Section (GO TO DIAGNOSTICS MENU, Switch Test).</i>
Can't move selection of Icon with the Left and/or Right Flipper Buttons .	<ul style="list-style-type: none"> • Check the Flipper Buttons for loose connections or bad Ground and refer to Section 5, Chapter 2, Playfield Wiring, #-Flipper Circuit Wiring Diagram. • This is normal <i>only</i> in Diagnostic's Switch & Active Switch Tests (see previous Problem).
Some Icons appear non-functional in the MENU or missing.	<ul style="list-style-type: none"> • Some functionality of the Service Menu may not have been completed during development. If exists, it should only be a non-critical function, such as the "HELP" Icon, which will explain the usage of icons. When completed, a software update will correct the problem. Software updates are announced via Service Bulletins (if critical) and on our website http://www.sternpinball.com/GAME-code.shtml; view the Game Code Library Message Board Marquee or click Previous Messages for past announcements.
In COIL TEST MENU , the coils and flashlamps do not fire after pressing the Black [SELECT] Button .	<ul style="list-style-type: none"> • Ensure the POWER INTERLOCK SWITCH is <i>pulled out</i> (see the start of this Chapter).
In the SERVICE MENU , the volume cannot be adjusted with either of the Red Buttons .	<ul style="list-style-type: none"> • The Volume adjustment can only be made when in the Attract Mode (see the start of this Chapter).
In the SERVICE MENU , the display seems to lock up, or the Help Display appears to be non-functional.	<ul style="list-style-type: none"> • If you cannot clear the situation by exiting back one Menu, exit completely out of the SERVICE MENU, and re-enter. If the problem persists, call Technical Support for additional help.

IF YOU NOTE ANY OTHER PROBLEMS or HAVE ANY SYMPTOMS NOT DESCRIBED ABOVE, PLEASE CALL TECHNICAL SUPPORT 800-542-5377 (708-345-7700 OPTION #1), SO WE MAY ASSIST YOU.



To initiate, from the **MAIN MENU**, select the "DIAG" *Icon*. The **DIAGNOSTICS MENU** provides tests for switches, coils, flash lamps, lamps, sounds and dots in the Dot Matrix Display. Each feature may be tested manually or automatically after entering the **SERVICE MENU** (see *Service Menu Introduction Section*).

The [**CYCLING COIL TEST**] / [**FLASH LAMP TEST**] may be used for a quick verification of automatic test functions. The [**SWITCH TEST**] / [**SINGLE COIL TEST**] / [**SINGLE LAMP TEST**] / [**ALL LAMPS TEST**] / [**ROW LAMPS TEST**] / [**COLUMN LAMPS TEST**] / [**FLASH LAMP TEST**] may be used for troubleshooting.

All **DIAGNOSTICS MENU** *Icons* and there usages are explained throughout this chapter in the same order as seen in the Dot Matrix Display. **NOTE:** Depending on Game Type, Version, selections made, Dip Switch settings, location and/or areas, some *Icons* may appear non-functional or may not appear at all. Some *Icons* change depending on selections (e.g. Selecting and activating the "STRT" *Icon* [Start Tournament] will be replaced with the "STOP" *Icon* [Stop Tournament]). *Icons* and/or functions, order and operation are subject to change.

In displays where changes can be made or to perform a function, use the **GREEN Button** to go [**BACK**], exit or escape, the **RED Buttons** to [< / -] MOVE BACK / LEFT / DECREASE / [+ / >] MOVE FORWARD / RIGHT / INCREASE a value or setting, and the **BLACK Button** to [**SELECT**] next or as "OK / ENTER / ENERGIZE."

Important: Upon **Power-Up** (Game CPU Reset) or opening the **Coin Door** watch the **Display** for any **Alerts**.*

50V / 20V DISABLED
CLOSE COIN DOOR
OR PULL INTERLOCK SWITCH
TO RESTORE POWER

This **audible / visual alert display** is shown when the 50V / 20V **Power** is disabled (by opening the **Coin Door**). **PULL OUT THE INTERLOCK SWITCH ONLY WHILE IN THE SERVICE MENU FOR COIL OR SWITCH TESTING & BURN-IN WHEN THE COIN DOOR IS REQUIRED TO STAY OPEN FOR SERVICE BUTTON USE!** Pulling out the Power Interlock Switch or

pressing the 'escape' **Green [BACK] Button** will remove the alert display. Initial display presentation is accompanied by 3 audible tones (the bright display warning will go dim after approximately 30 seconds).

OPERATOR ALERT!
AUTO PLUNGER
DEVICE MALFUNCTION

This **alert display** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a device malfunction (device or mechanism doesn't energize or is energized repeatedly).

OPERATOR ALERT! works by monitoring any switch activated device that has the potential to trap a ball when disabled (e.g. in the Shooter Lane, Scoop or Eject Holes, etc.). This alert can

also appear if a switch associated with a device (e.g. Ball Trough, Auto Plunger, etc.) is stuck closed (caused by a switch jam or stuck ball); the game will activate the device a predetermined number of times and if the problem is still detected, this device or switch will be noted in **Switch Alerts** (next page) and/or **Technician Alerts**.

00.00 GAME NAME
SYS. 0.00 HDW. 0
SERVICE MENU *
USE -/+ TO VIEW TECH. ALERTS

Upon entering the **SERVICE MENU**, if an asterisk " * " is displayed after the words "SERVICE MENU," the game has detected possible faulty devices, switches and/or missing pinballs. Press the either of the **Red Buttons** (short-cut to the **TECHNICIAN ALERTS MENU**) or continue into the **SERVICE MENU** (press the **Black Button** again), select the "DIAG" *Icon*

and "TECH" *Icon* for the **Technician Alerts** information.



CAUTION! Remove all pinballs from the Ball Trough prior to lifting the playfield to it's full upright position for servicing. **PULL OUT the Power Interlock Switch** for operation. To eject pinballs, select the "DIAG" *Icon* from the **MAIN MENU** to enter the **DIAGNOSTICS MENU**. Select the "CLR" *Icon* to enter the **BALL TROUGH TEST MENU**. Press the **Black [SELECT] Button**. To return to the **DIAGNOSTICS MENU**, press the **Green [BACK] Button**. This feature also useful to retrieve a pinball for game testing in **Switch** or **Coil Tests**.



Go To Switch Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "SW" *Icon*. Switches are configured in an 4 X 16 Matrix of Rows [Switch Drives] and Columns [Sw. Returns] with up to **64** possible switches. Dedicated Switches are configured in a 2 X 16 Matrix of Rows [Dedicated Sw. Drives / Ground] and Column [Ded. Switch Returns] with up to **32** possible dedicated switches (*includes the 8 dip switch positions*). The **SWITCH TEST MENU** consists of three (3) parts: **Switch & Active Switch Tests** and **Switch Alerts** to test *all* switches.

Reminder: The **Flipper & Start Buttons** (part of Switch Tests) are temporarily disabled as **Service Menu Navigation Buttons** during these test(s) so they can be tested and shown on-screen. Pressing the **Green [BACK] Button** (Dedicated Switch D-21), Light Green-Black / Black (GND), will exit **Switch Test** or **Active Switch Test**.



Switch Test

To initiate, from the **SWITCH MENU**, select the "TEST" *Icon*. Ensure the **Power Interlock Switch** is pulled out if testing with the Coin Door open and the activation of coils is required. Upon entering **Switch Test**, you will notice that some switches are already indicated as closed. In the examples, the 4-Ball Trough Switches #18, #19, #20 & #21 are shown closed (pinballs at rest in the ball trough), along with the Flipper E.O.S. Dedicated Switches D-10 & D-12 (End-of-Stroke Switches are 'normally closed'). If the game has more flippers with E.O.S. Dedicated Switches, CPU Dip Switch Setting *other than 1-8 OFF* or switches stuck closed, more dots will be indicated (*enter Active Switch Test to reveal the names*).

In **Switch Test**, close each switch and observe the display (*switch closure is accompanied by a short audible tone*). In the example, the **Black [SELECT] Button** Dedicated Switch D-24 is pressed. The Dot Matrix Display will light up (*highlight*) the corresponding dot in the on-screen matrix, display the *switch name*, *switch number* and the *Switch Drive / Return wire colors*. When not closing a switch, the display indicates **NONE** and the last switch number closure. For the Switch Matrix Grid and Dedicated Switch Grid, see **Find-It-In-Front: Dr. Pinball, DR. 4** or escape out of this test and enter **Active Switch Test** (described below) to view the names of the switches closed. **Note:** Pressing the **Green [BACK] Button** (Ded. Switch D-21), Lt. Green-Black / Black (GND), will exit the **Switch Test**.



CAUTION! COIL MECHANISMS WHEN ACTIVATED HAVE FAST MOVING PARTS! While performing **Switch Test** with the Coin Door closed or open (*with the Power Interlock Switch is pulled out*), **DO NOT USE YOUR FINGER** to test switches which are associated with a coil mechanism such as a Vertical Up-Kicker (*hole with a switch*), Slingshots, Bumpers, etc..



Active Switch Test

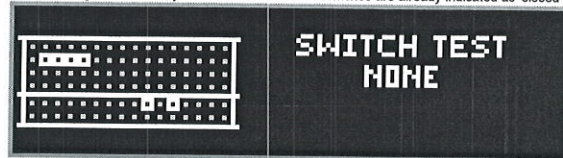
To initiate, from the **SWITCH MENU**, select the "ACT" *Icon*. In **Active Switch Test**, if any switches are stuck closed (*or normally closed from the presence of pinball(s) as in the Ball Trough*), the display will flash the corresponding dot(s) in the on-screen matrix, display the *name* and the *Switch Drive / Return wire colors*. If more than one switch is closed, the switch information will change with each switch. This cycle continues until all switches are cleared or until **Active Switch Test** is exited. In the example, the **Black [SELECT] Button** Dedicated Switch D-24 is pressed and held down. The display will cycle and flash each dot, naming each switch which is closed. To determine the *switch number*, compare the highlighted dot to the same position in the Switch Matrix Grid at the beginning of this manual.



Switch Alerts

To initiate, from the **SWITCH MENU**, select the "ALRT" *Icon*. In **Switch Alerts Menu**, possible inoperable switches are marked with an "X" (OUT OF SERVICE). Mark switches **IN** or **OUT OF SERVICE** by pressing the **Black Button** while the intended switch is highlighted and change with either of the **Red Buttons**. Switches which are determined as "OUT OF SERVICE" by the game or manually, will be automatically marked as "IN SERVICE" as soon as the game determines a valid switch closure (*after adjusting, fixing or replacing the switch, then testing/actuating the switch*). **Note:** A **Factory Reset** will also put the switch back "IN SERVICE" in which the game will need to redetermine if the switch should be marked **OUT OF SERVICE**.

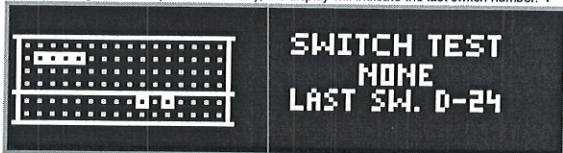
Upon entering Switch Test, you will notice that some switches are already indicated as 'closed'.



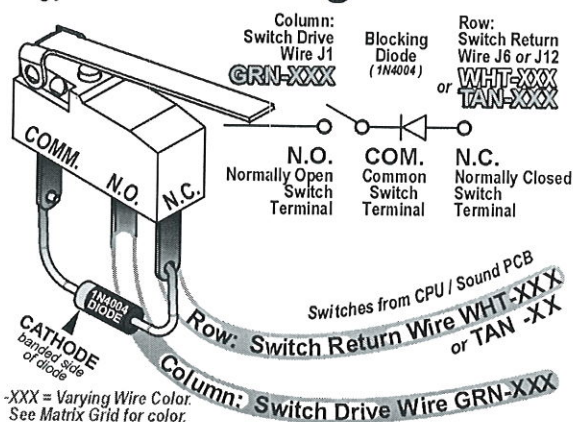
D-24 position is highlighted and accompanied by a short audible tone when pressed.



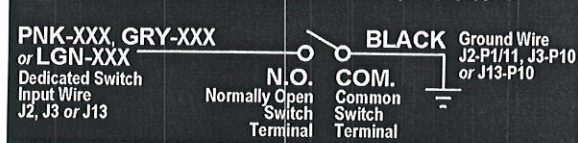
After pressing the switch (to make it close), the display will indicate the last switch number.



Typical Switch Wiring & Schematic



Dedicated Switch Schematic



... D-24 is held down. The display will cycle and flash each dot, naming each switch ... closed.



SWITCH MATRIX GRID [#1 - #64] {Switch Locations : next page}

SWITCH MATRIX GRID [#1 - #64] {Switch Locations : next page}																		
CPU/ Sound Board	01 IC-U22A RETURN	02 IC-U22B RETURN	03 IC-U22C RETURN	04 IC-U22D RETURN	05 IC-U16A RETURN	06 IC-U16B RETURN	07 IC-U16C RETURN	08 IC-U16D RETURN	09 IC-U36A RETURN	10 IC-U36B RETURN	11 IC-U36C RETURN	12 IC-U36D RETURN	13 IC-U40A RETURN	14 IC-U40B RETURN	15 IC-U40C RETURN	16 IC-U40D RETURN		
01 DRIVE J1-P1	S.W. #1 RT 3 BANK TARG (BOT)	S.W. #2 RT 3 BANK TARG (CEN)	S.W. #3 RT 3 BANK TARG (TOP)	S.W. #4 N20 TARG (RT)	S.W. #5 N20 TARG CEN			S.W. #6 CAPTIVE BALL (BACK)	S.W. #7 CAPTIVE BALL (FRNT)	S.W. #8 CAPTIVE BALL (FRNT)	S.W. #9 CAPTIVE BALL (FRNT)	S.W. #10 SHOT	S.W. #11 OUTER RT. TOP LN.	S.W. #12 INNER RT. TOP LN.	S.W. #13 INNER LT. TOP LN.	S.W. #14 OUTER LT. TOP LN.	S.W. #15 TOURN START	S.W. #16 TOURN START
02 DRIVE J1-P3	S.W. #17 TROUGH # 6 (L)	S.W. #18 TROUGH # 5	S.W. #19 TROUGH # 4	S.W. #20 TROUGH # 3	S.W. #21 TROUGH # 2	S.W. #22 TROUGH # 1	S.W. #23 TROUGH JAM	S.W. #24 LEFT OUTLANE	S.W. #25 L RETURN LANE (L)	S.W. #26 LEFT SLINGSHOT	S.W. #27 RIGHT SLINGSHOT	S.W. #28 RIGHT RETURN LANE	S.W. #29 RIGHT OUTLANE	S.W. #30 LEFT POP BUMPER	S.W. #31 RIGHT POP BUMPER	S.W. #32 BOTTOM POP BUMPER		
03 DRIVE J1-P4	S.W. #33 TOP BUMPER	S.W. #34 (G)EARS	S.W. #35 (G)EARS	S.W. #36 (G)EARS	S.W. #37 (G)EARS	S.W. #38 (G)EARS	S.W. #39 MID RAMP EXT	S.W. #40 UPPER RAMP EXT	S.W. #41 SHIFT TARGET (LT)	S.W. #42 SHIFT TARGET (RT)	S.W. #43 RIGHT SCOOP	S.W. #44 RIGHT ORBIT	S.W. #45 LEFT ORBIT	S.W. #46 BOWL SWITCH	S.W. #47 SHOOTER LANE	S.W. #48 SPINNER		
04 DRIVE J1-P5	S.W. #49 BELOW P.F.	S.W. #50 BELOW P.F.	S.W. #51 BELOW P.F.	S.W. #52 BELOW P.F.	S.W. #53 BELOW P.F.	S.W. #54 LEFT LANE TARGET	S.W. #55 N20 TARGET (LT)	S.W. #56 N20 TARGET (LT)	S.W. #57	S.W. #58	S.W. #59	S.W. #60	S.W. #61	S.W. #62	S.W. #63	S.W. #64		
« FOR MORE ABOUT DIODE ON TERMINAL STRIPS 4D O.T.S. », SEE SECTION 5, CHAPTER 2, PAGES 104-105 »																		

« FOR MORE ABOUT DIODE ON TERMINAL STRIPS & DOTS, SEE SECTION 5, CHAPTER 2, PAGES 104-105 »

Wire Color Abbreviations used:

BLK Black BLU Blue BRN Brown GRAY Gray GRN Green LGN Light Green ORG Orange PINK Pink RED Red TAN Tan VIO Violet WHT White YEL Yellow

Dedicated Switches [#D-1 - #D-32] {Dedicated Switch Locations : next page}

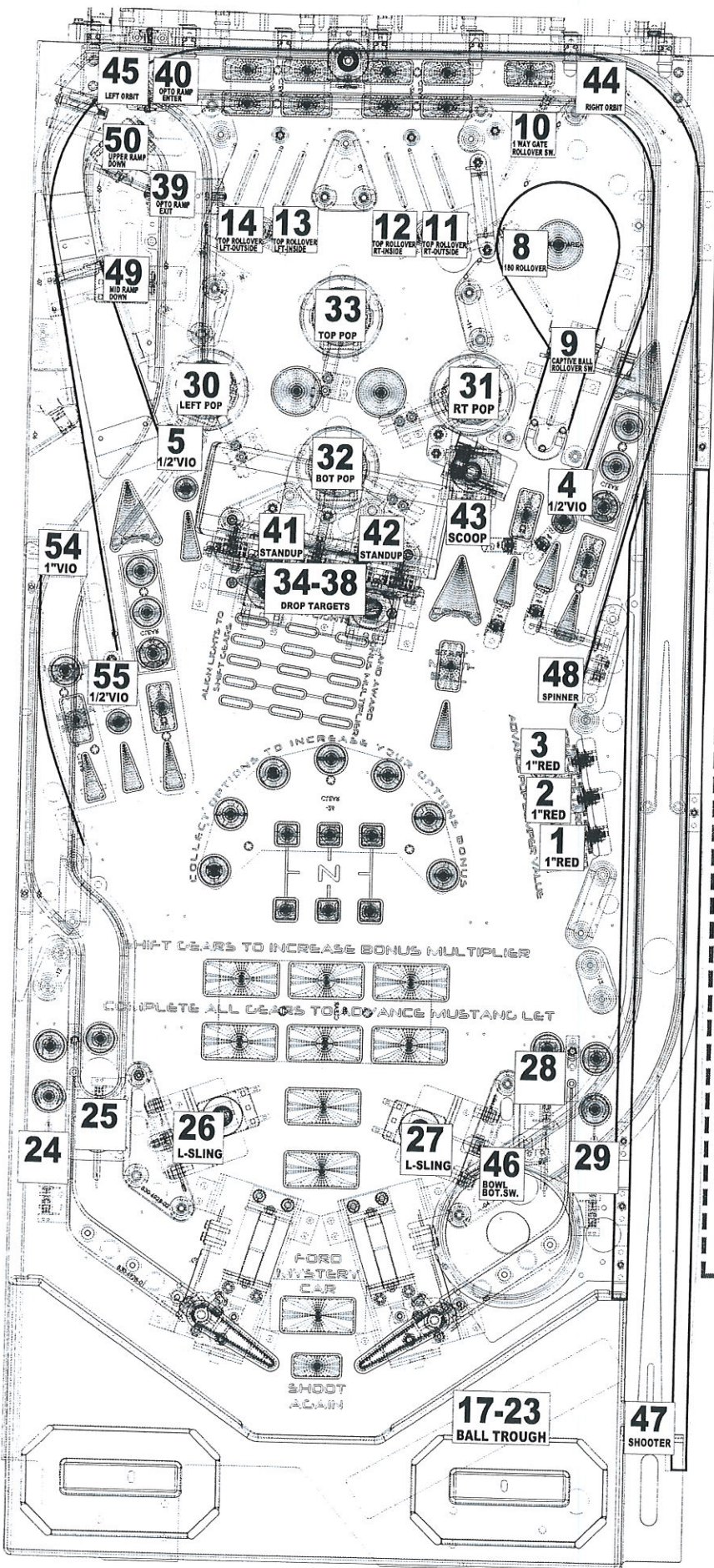
CPU/SND Board	IC-U2 PINK-BRN J2-P2	IC-U2 PINK-BRN J2-P3	IC-U2 PINK-ORG J2-P4	IC-U2 PINK-YEL J2-P5	IC-U2 PINK-BRN J2-P7	IC-U2 PINK-BLU J2-P8	IC-U2 PINK-VIO J2-P9	IC-U2 PINK-GRAY J2-P10	IC-U4 GRAY-BRN J3-P1	IC-U4 GRAY-BRN J3-P2	IC-U4 GRAY-ORG J3-P3	IC-U4 GRAY-YEL J3-P4	IC-U4 GRAY-BRN J3-P5	IC-U4 GRAY-BLU J3-P7	IC-U4 GRAY-VIO J3-P8	IC-U4 GRAY-BLK J3-P9
GROUND (BLK) J2-P1/11 & J3-P10	S.W. #D-1 LEFT COIN SLOT	S.W. #D-2 CENTER COIN SLOT	S.W. #D-3 RIGHT COIN SLOT	S.W. #D-4 FORN COIN SLOT	S.W. #D-5 FIFTH COIN SLOT	S.W. #D-6 IF USED			S.W. #D-9 LEFT FLIPPER BUTTON	S.W. #D-10 LEFT FLIPPER E.O.S.	S.W. #D-11 RIGHT FLIPPER BUTTON	S.W. #D-12 RIGHT FLIPPER E.O.S.	S.W. #D-13 RIGHT FLIPPER E.O.S.	S.W. #D-14 RIGHT FLIPPER E.O.S.	S.W. #D-15 RIGHT FLIPPER E.O.S.	S.W. #D-16 RIGHT FLIPPER E.O.S.
	180-5204-00 COIN DOOR	180-5204-00 COIN DOOR	180-5204-00 COIN DOOR	180-5204-00 COIN DOOR	180-5204-00 COIN DOOR				500-6888-01 CABINET	180-5149-00 FLIP ASSY.	500-6889-01 CABINET	180-5149-00 FLIP ASSY.				

CPU/SND Board	IC-41 LGN-BRN J13-P1	IC-41 LGN-RED J13-P3	IC-41 LGN-ORG J13-P4	IC-41 LGN-YEL J13-P5	IC-41 LGN-BLK J13-P6	IC-41 LGN-BLU J13-P7	IC-41 LGN-VIO J13-P8	IC-41 LGN-GRY J13-P9
GROUND (BLK) J13-P10	S.W. D-17 TILT PENDULUM	S.W. D-18 SLAM TILT	S.W. D-19 TICKET NOTCH	S.W. D-20	S.W. D-21 (GREEN) BACK	S.W. D-22 (RED) MINUS	S.W. D-23 (RED) PLUS	S.W. D-24 (BLACK) SELECT
CABINET	IF USED	IF USED	IF USED		180-5192-04 COIN DOOR	180-5192-02 COIN DOOR	180-5192-02 COIN DOOR	180-5192-00 COIN DOOR
CPU/SOUND BD. SW1 DIP SWITCH (located between Connectors J34/J13)								
	S.W. D-25 DIP (1)2345678	S.W. D-26 DIP (2)345678	S.W. D-27 DIP (3)45678	S.W. D-28 DIP (4)5678	S.W. D-29 DIP (5)678	S.W. D-30 DIP (6)78	S.W. D-31 DIP (7)8	S.W. D-32 DIP (8)
	S.W. POS. #1 ON	S.W. POS. #2 ON	S.W. POS. #3 ON	S.W. POS. #4 ON	S.W. POS. #5 ON	S.W. POS. #6 ON	S.W. POS. #7 ON	S.W. POS. #8 ON

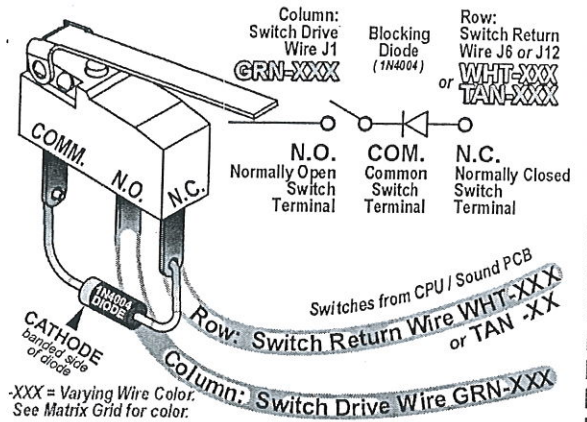
CPU/SOUND BD. SW1 DIP SWITCH (located between Connectors J3/J13)



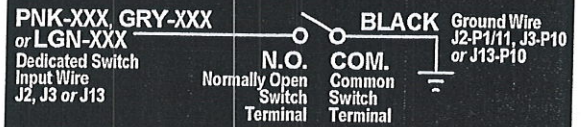
SWITCH MENU: SWITCH, ACTIVE, SINGLE & SERVICE



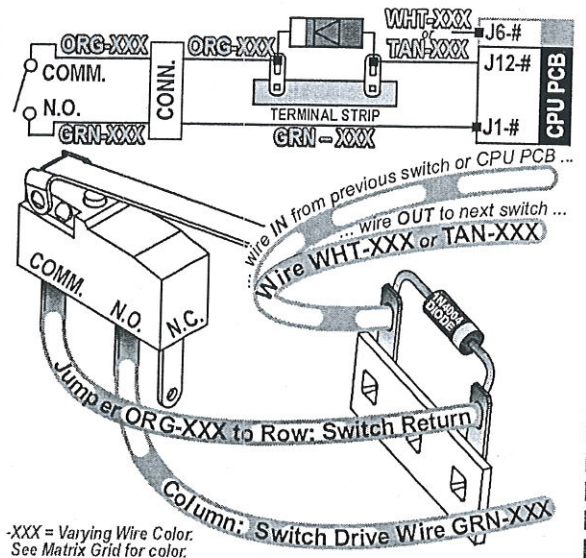
Typical Switch Wiring & Schematic



Dedicated Switch Schematic



Typical Switch Wiring & Schematic ... with Switch Diode on a Terminal Strip (DOTS)





Go To Coil Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "COIL" *Icon*. Coils **#01 – #16** are typically High Current Coils (*although Low Current Coils may be used in these positions & will be noted*). Coils **#17 – #32** are typically Low Current Coils. Flash Lamps are typically used in positions **#25 – #32** (*although Flash Lamps may be used in any position and will be noted*). Auxiliary Coils may be used in positions **#33 – #35**.

Remember, use the **GREEN Button** to go [**BACK**], exit or escape, the **RED Buttons** to [**< / -**] GO BACK / [**+ / >**] GO FORWARD, and the **BLACK Button** to [**SELECT**] ENERGIZE the coil (*solenoid*) or flash lamp.

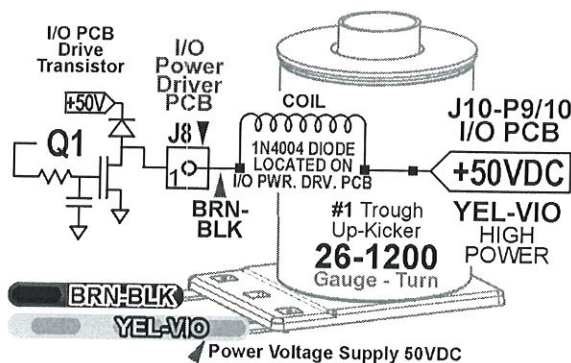


Single Coil Test

To initiate, from the **COIL MENU**, select the "TEST" *Icon*. Ensure the **Power Interlock Switch** is pulled out if testing with the Coin Door open. Upon entering **Single Coil Test**, you will notice the #1 coil is shown. The Dot Matrix Display will indicate the *coil or flash lamp name, coil (solenoid) or flash lamp number and the Coil or Flash Lamp Power Line / Drive Transistor Control Line wire colors*. To determine the "Pin-Outs" from the I/O Power Driver Board, the Coil Voltage Gauge-Turns (e.g. 23-800) or lamp type (e.g. #89 or #906 Bulb), view the Coils Detailed Chart Table at the beginning of this manual or for more on troubleshooting and diagnosing, see the Yellow Pages (*Schematics & Wiring*).



Typical Coil Wiring & Schematic



Cycling Coil Test

To initiate, from the **COIL MENU**, select the "CYC" *Icon*. Ensure the **Power Interlock Switch** is pulled out if testing with the Coin Door open. The test pulses each regular coil or flash lamp sequentially (*cycling*) on the Playfield and in the Backbox (*if coils or flash lamps are used*). The Dot Matrix Display indicates the same information you will find in **Single Coil Test**.



Go To Flash Lamps Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "FLASH" *Icon*. The two tests allows the technician to easily spot any burned-out flash lamps and replace them. Unlike **Single Coil Test**, which tests *all* coil (*solenoids*), including flash lamps, **Single and Cycling Flash Lamp Tests**, test only the flash lamps used in the game. Flash Lamps are typically used in positions **#25 – #32** (*although Flash Lamps may be used in any position and will be noted*).

Remember, use the **GREEN Button** to go [**BACK**], exit or escape, the **RED Buttons** to [**< / -**] GO BACK / [**+ / >**] GO FORWARD, and the **BLACK Button** to [**SELECT**] ENERGIZE the flash lamp.

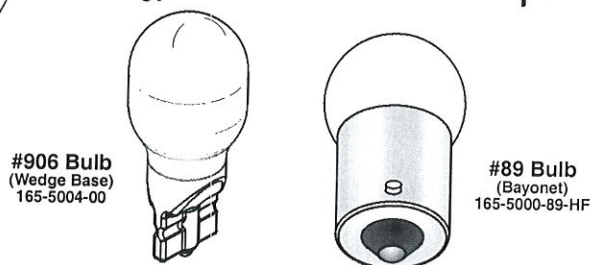


Single Flash Lamp Test

To initiate, from the **FLASH LAMPS MENU**, select the "TEST" *Icon*. Ensure the **Power Interlock Switch** is pulled out if testing with the Coin Door open. Upon entering **Single Flash Lamp Test**, you will notice the first Flash Lamp is shown. The Dot Matrix Display will indicate the *flash lamp name, flash lamp number and the Flash Lamp Power Line / Drive Transistor Control Line wire colors*. To determine the "Pin-Outs" from the I/O Power Driver Board or lamp type (e.g. #89 or #906 Bulb), view the Coils Detailed Chart Table at the beginning of this manual or for more on troubleshooting and diagnosing, see the Yellow Pages (*Schematics & Wiring*).



Bulb Types used for Flash Lamps



Cycling Flash Lamp Test

To initiate, from the **FLASH LAMPS MENU**, select the "CYC" *Icon*. Ensure the **Power Interlock Switch** is pulled out if testing with the Coin Door open. The test pulses each flash lamp sequentially (*cycling*) on the Playfield and in the Backbox (*if flash lamps are used*). The Dot Matrix Display indicates the same information you will find in **Single Flash Lamp Test**.

COILS DETAILED CHART TABLE

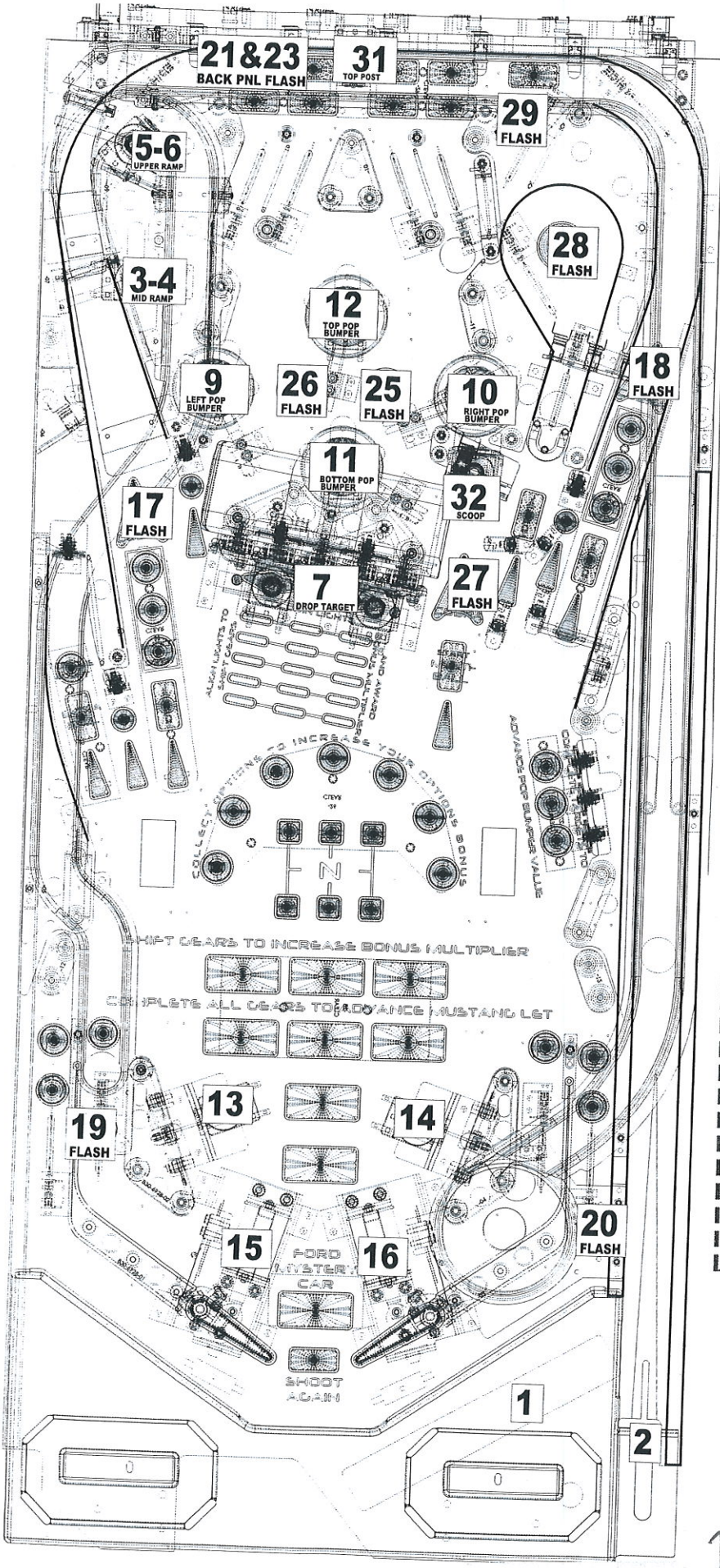
High Current Coils Group 1		Drive Transistor	Driver Output PCB	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I / O Power Driver	YEL-VIO	J10-P9/10	50VDC	BRN-BLK	J8-P1	28-1200 090-5044-ND
#2	AUTO LAUNCH	Q2		YEL-VIO	J10-P9/10	50VDC	BRN-RED	J8-P3	23-800 090-5001-ND
#3	MID RAMP	Q3		YEL-VIO	J10-P9/10	50VDC	BRN-ORG	J8-P4	22-1080 090-5083-00
#4	MID RAMP HOLD POWER	Q4		YEL-VIO	J10-P9/10	50VDC	BRN-YEL	J8-P5	22-1080 090-5083-00
#5	UPPER RAMP	Q5		YEL-VIO	J10-P9/10	50VDC	BRN-GRN	J8-P6	22-1080 090-5083-03
#6	UPPER RAMP HOLD POWER	Q6		YEL-VIO	J10-P9/10	50VDC	BRN-BLU	J8-P7	22-1080 090-5083-00
#7	CENTER 5- BANK DROP RESET	Q7		YEL-VIO	J10-P9/10	50VDC	BRN-VIO	J8-P8	25-1240 090-5034-ND
#8	SHAKER MOTOR (OPTIONAL)	Q8		RED-WHT	J17-P7	16VAC	BRN-GRY	J8-P9	502-5027-00
High Current Coils Group 2		Drive Transistor	Driver Output PCB	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	LEFT POP BUMPER	Q9	I / O Power Driver	YEL-VIO	J10-P9/10	50VDC	BLU-BRN	J9-P1	28-1200 090-5044-ND
#10	RIGHT POP BUMPER	Q10		YEL-VIO	J10-P9/10	50VDC	BLU-RED	J9-P2	28-1200 090-5044-ND
#11	BOTTOM POP BUMPER	Q11		YEL-VIO	J10-P9/10	50VDC	BLU-ORG	J9-P4	28-1200 090-5044-ND
#12	TOP POP BUMPER	Q12		YEL-VIO	J10-P9/10	50VDC	BLU-YEL	J9-P5	28-1200 090-5044-ND
#13	LEFT SLINGSHOT	Q13		YEL-VIO	J10-P9/10	50VDC	BLU-GRN	J9-P6	28-1200 090-5044-ND
#14	RIGHT SLINGSHOT	Q14		YEL-VIO	J10-P9/10	50VDC	BLU-BLU	J9-P7	28-1200 090-5044-ND
#15	LEFT FLIPPER (50V RED/YEL)	Q15		GRY-YEL-3A Fuse-RED-YEL	J10-P6/7	50VDC	ORG-GRY	J9-P8	23-900 090-5020-30
#16	RIGHT FLIPPER (50V RED/YEL)	Q16		GRY-YEL-3A Fuse-RED-YEL	J10-P6/7	50VDC	ORG-VIO	J9-P9	22-1080 090-5032-ND
Low Current Coils Group 1		Drive Transistor	Driver Output PCB	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	FLASH: LEFT ORBIT ARROW	Q17	I / O Power Driver	ORG	J6-P10	20VDC	VIO-BRN	J7-P2	LED 113-5034-08
#18	FLASH: RIGHT ORBIT ARROW	Q18		ORG	J6-P10	20VDC	VIO-RED	J7-P3	LED 113-5034-08
#19	FLASH: SLINGSHOT (LEFT)	Q19		ORG	J6-P10	20VDC	VIO-ORG	J7-P4	LED 113-5033-08
#20	FLASH: SLINGSHOT (RIGHT)	Q20		ORG	J6-P10	20VDC	VIO-YEL	J7-P6	LED 113-5033-08
#21	FLASH: BACK PANEL (LEFT)	Q21		ORG	J6-P10	20VDC	VIO-GRN	J7-P7	LED 113-5034-08
#22		Q22					VIO-BLU	J7-P8	
#23	FLASH: BACK PANEL (RIGHT)	Q23		ORG	J6-P10	20VDC	VIO-BLK	J7-P9	LED 113-5034-08
#24	OPTIONAL (e.g. COIN METER)	Q24		RED	J16-P4-8	5VDC	VIO-GRY	J7-P10	COIN METER
Low Current Coils Group 2		Drive Transistor	Driver Output PCB	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	FLASH: POP BUMPERS (RIGHT)	Q25	I / O Power Driver	ORG	J6-P10	20VDC	BLK-BRN	J6-P1	LED 113-5034-08
#26	FLASH: POP BUMPERS (LEFT)	Q26		ORG	J6-P10	20VDC	BLK-RED	J6-P2	LED 113-5034-08
#27	FLASH: (RIGHT) SCOOP ARROW	Q27		ORG	J6-P10	20VDC	BLK-ORG	J6-P3	LED 113-5034-08
#28	FLASH: 180	Q28		ORG	J6-P10	20VDC	BLK-YEL	J6-P4	LED 113-5034-08
#29	FLASH: SKILLSHOT	Q29		ORG	J6-P10	20VDC	BLK-GRN	J6-P5	LED 113-5034-08
#30		Q30					BLK-BLU	J6-P6	
#31	ORBIT POST (STEP-UP DRV BD)	Q31		YEL/VIO	J10-P9/10	50VDC	BLK-VIO	J6-P7	28-1200 090-5044-ND
#32	RIGHT SCOOP (STEP-UP DRV BD)	Q32		YEL/VIO	J10-P9/10	50VDC	BLK-GRY	J6-P8	27-1500 090-5004-ND

GO TO DIAGNOSTICS MENU

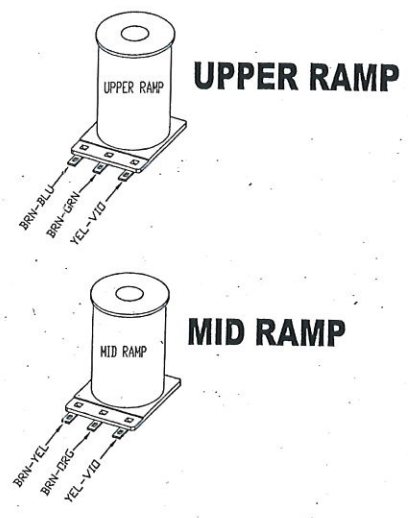
GO TO COIL MENU

SINGLE COIL TEST

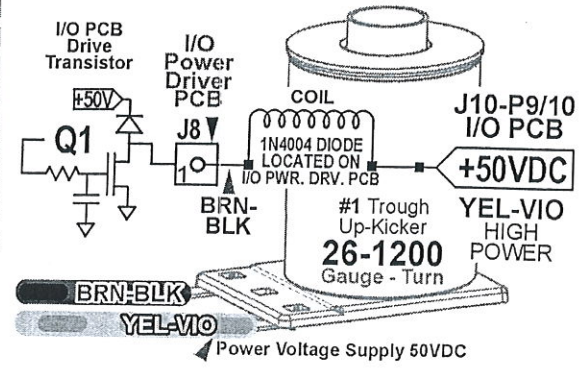
COIL MENU: SINGLE COIL & CYCLING COIL



MUSTANG TYPICAL DUAL WINDING COIL 090-5083-00-ND WIRING



Typical Coil Wiring & Schematic





Go To Lamp Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "LAMP" /*Icon*. Controlled lamps are configured in an 8 X 10 Matrix of Rows [Lamp Returns / Ground] and Columns [Lamp Drives / 18VDC] with up to 80 lamps possible. The **LAMP TEST MENU** consists of five (5) parts: **Single Lamp Test**, **Test All Lamps**, **Row Lamps Test**, **Column Lamps Test** and **Ordered Lamps Test*** to test *all* lamps.

Remember, use the **GREEN Button** to go [**BACK**], exit or escape, the **RED Buttons** to [**< / -**] GO BACK / LEFT / [**+ / >**] GO FORWARD / RIGHT, and the **BLACK Button** to [**SELECT**] next or as "OK / ENTER."

Upon entering Single Lamp Test, ... the #1 lamp is shown. Display will light up ... the dot ... ▶



Single Lamp Test

To initiate, from the **LAMP MENU**, select the "ONE" /*Icon*. As each lamp is selected, the lamp will light at its location on the playfield as well as the Dot Matrix Display.

Upon entering **Single Lamp Test**, you will notice the #1 lamp is shown. The Dot Matrix Display will light up (highlight) the corresponding dot in the on-screen matrix, display the lamp name, lamp number and the Lamp Return / Drive wire colors. For the Lamp Matrix Grid, see the beginning section of this Service Game Manual.

Upon entering All Lamps Test, ... the Dot Matrix Display is flashing "ALL LAMPS ON" ... ▶



All Lamps Test

To initiate, from the **LAMP MENU**, select the "ALL" /*Icon*. Upon entering **All Lamps Test**, you will notice the Dot Matrix Display is flashing **ALL LAMPS ON** and the lamps on the playfield will be lit, alternating between the rows in the Lamp Matrix Grid. The Dot Matrix Display will light up (highlight) all of the dots in the on-screen matrix.

Upon entering Row Lamps Test, you will notice the #1 lamp row is shown. ▶



Row Lamps Test

To initiate, from the **LAMP MENU**, select the "ROW" /*Icon*. As each lamp row is selected, the lamps in the row will light on the playfield as well as the Dot Matrix Display.

Upon entering **Row Lamps Test**, you will notice the #1 lamp row is shown. The Dot Matrix Display will light up (highlight) the corresponding row of dots in the on-screen matrix, display the lamp row number, the Lamp Return wire colors, the I/O PCB Connector and transistor number.

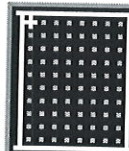
Upon entering Column Lamps Test, you will notice the #1 lamp column is shown. ▶



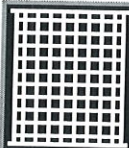
Column Lamps Test

To initiate, from the **LAMP MENU**, select the "COL" /*Icon*. As each lamp column is selected, the lamps in the column will light on the playfield as well as the Dot Matrix Display.

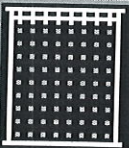
Upon entering **Column Lamps Test**, you will notice the #1 lamp column is shown. The Dot Matrix Display will light up (highlight) the corresponding row of dots in the on-screen matrix, display the lamp column number, the Lamp Drive (18VDC) wire colors, the I/O PCB Connector and IC number.



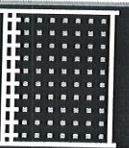
SINGLE LAMP TEST
START BUTTON
LAMP #1
YEL-BRN / RED-BRN



ALL LAMPS TEST
ALL LAMPS ON

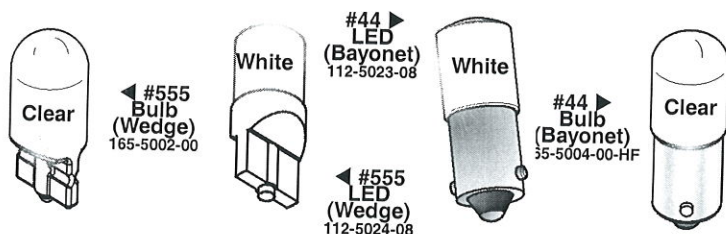


ROW LAMPS TEST
LAMP ROW #1
RED-BRN
J12-P1 / Q33

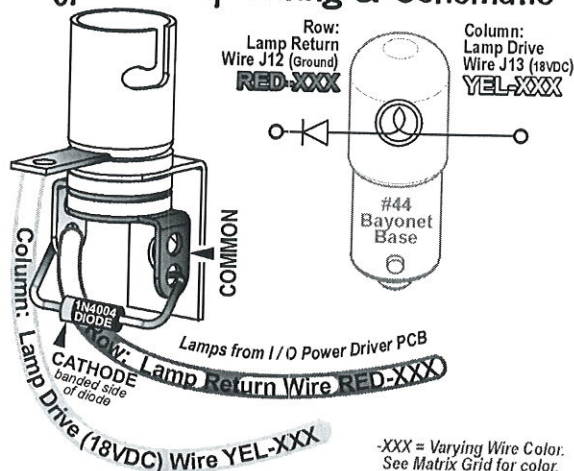


COLUMN LAMPS TEST
LAMP COLUMN #1
YEL-BRN
J13-P9 / U17

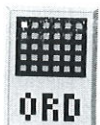
Bulb Types used for Control Lamps



Typical Lamp Wiring & Schematic



* If not required in this game, Icon will not be shown.



Ordered Lamps Test

To initiate, from the **LAMP MENU**, select the "ORD" /*Icon*. If required, this icon will appear in the **LAMP MENU**.

Identical to **Single Lamp Test**, however, the lamps lit are not in the Lamp Matrix numeric order, but ordered or arranged in separate localized grouping(s) for easier lamp checking.

LAMP MATRIX GRID [#1 - #80] {Lamp Locations : next page}

I / O	01	02	03	04	05	06	07	08
Power Driver Board	IC-U17	IC-U16	IC-U15	IC-U14	IC-U13	IC-U12	IC-U11	IC-U10
01	18VDC YEL-BRN J13-P9	18VDC YEL-RED J13-P8	18VDC YEL-ORG J13-P7	18VDC YEL-BLK J13-P6	18VDC YEL-GRN J13-P5	18VDC YEL-BLU J13-P4	18VDC YEL-VIO J13-P3	18VDC YEL-GRY J13-P1
02	LED L.P. #1	LED L.P. #2	LED L.P. #3	LED L.P. #4	LED L.P. #5	LED L.P. #6	LED L.P. #7	LED L.P. #8
03	GROUND RED-BRN J12-P1	GROUND RED-BRN J12-P1	GROUND RED-BRN J12-P1	GROUND RED-BRN J12-P1	GROUND RED-BRN J12-P1	GROUND RED-BRN J12-P1	GROUND RED-BRN J12-P1	GROUND RED-BRN J12-P1
04	GROUND RED-BLK J12-P2	GROUND RED-BLK J12-P2	GROUND RED-BLK J12-P2	GROUND RED-BLK J12-P2	GROUND RED-BLK J12-P2	GROUND RED-BLK J12-P2	GROUND RED-BLK J12-P2	GROUND RED-BLK J12-P2
05	GROUND RED-ORG J12-P3	GROUND RED-ORG J12-P3	GROUND RED-ORG J12-P3	GROUND RED-ORG J12-P3	GROUND RED-ORG J12-P3	GROUND RED-ORG J12-P3	GROUND RED-ORG J12-P3	GROUND RED-ORG J12-P3
06	GROUND RED-YEL J12-P4	GROUND RED-YEL J12-P4	GROUND RED-YEL J12-P4	GROUND RED-YEL J12-P4	GROUND RED-YEL J12-P4	GROUND RED-YEL J12-P4	GROUND RED-YEL J12-P4	GROUND RED-YEL J12-P4
07	GROUND RED-GRN J12-P5	GROUND RED-GRN J12-P5	GROUND RED-GRN J12-P5	GROUND RED-GRN J12-P5	GROUND RED-GRN J12-P5	GROUND RED-GRN J12-P5	GROUND RED-GRN J12-P5	GROUND RED-GRN J12-P5
08	GROUND RED-BLU J12-P6	GROUND RED-BLU J12-P6	GROUND RED-BLU J12-P6	GROUND RED-BLU J12-P6	GROUND RED-BLU J12-P6	GROUND RED-BLU J12-P6	GROUND RED-BLU J12-P6	GROUND RED-BLU J12-P6
09	GROUND RED-GRY J12-P9	GROUND RED-GRY J12-P9	GROUND RED-GRY J12-P9	GROUND RED-GRY J12-P9	GROUND RED-GRY J12-P9	GROUND RED-GRY J12-P9	GROUND RED-GRY J12-P9	GROUND RED-GRY J12-P9
10	GROUND RED-WHT J12-P10	GROUND RED-WHT J12-P10	GROUND RED-WHT J12-P10	GROUND RED-WHT J12-P10	GROUND RED-WHT J12-P10	GROUND RED-WHT J12-P10	GROUND RED-WHT J12-P10	GROUND RED-WHT J12-P10
11	GROUND RED-P11	GROUND RED-P11	GROUND RED-P11	GROUND RED-P11	GROUND RED-P11	GROUND RED-P11	GROUND RED-P11	GROUND RED-P11
12	LED L.P. #9	LED L.P. #10	LED L.P. #11	LED L.P. #12	LED L.P. #13	LED L.P. #14	LED L.P. #15	LED L.P. #16
13	LED L.P. #17	LED L.P. #18	LED L.P. #19	LED L.P. #20	LED L.P. #21	LED L.P. #22	LED L.P. #23	LED L.P. #24
14	LED L.P. #25	LED L.P. #26	LED L.P. #27	LED L.P. #28	LED L.P. #29	LED L.P. #30	LED L.P. #31	LED L.P. #32
15	LED L.P. #33	LED L.P. #34	LED L.P. #35	LED L.P. #36	LED L.P. #37	LED L.P. #38	LED L.P. #39	LED L.P. #40
16	LED L.P. #41	LED L.P. #42	LED L.P. #43	LED L.P. #44	LED L.P. #45	LED L.P. #46	LED L.P. #47	LED L.P. #48
17	LED L.P. #49	LED L.P. #50	LED L.P. #51	LED L.P. #52	LED L.P. #53	LED L.P. #54	LED L.P. #55	LED L.P. #56
18	LED L.P. #57	LED L.P. #58	LED L.P. #59	LED L.P. #60	LED L.P. #61	LED L.P. #62	LED L.P. #63	LED L.P. #64
19	LED L.P. #65	LED L.P. #66	LED L.P. #67	LED L.P. #68	LED L.P. #69	LED L.P. #70	LED L.P. #71	LED L.P. #72
20	LED L.P. #73	LED L.P. #74	LED L.P. #75	LED L.P. #76	LED L.P. #77	LED L.P. #78	LED L.P. #79	LED L.P. #80
21	LED L.P. #81	LED L.P. #82	LED L.P. #83	LED L.P. #84	LED L.P. #85	LED L.P. #86	LED L.P. #87	LED L.P. #88
22	LED L.P. #89	LED L.P. #90	LED L.P. #91	LED L.P. #92	LED L.P. #93	LED L.P. #94	LED L.P. #95	LED L.P. #96
23	LED L.P. #97	LED L.P. #98	LED L.P. #99	LED L.P. #100	LED L.P. #101	LED L.P. #102	LED L.P. #103	LED L.P. #104
24	LED L.P. #105	LED L.P. #106	LED L.P. #107	LED L.P. #108	LED L.P. #109	LED L.P. #110	LED L.P. #111	LED L.P. #112
25	LED L.P. #113	LED L.P. #114	LED L.P. #115	LED L.P. #116	LED L.P. #117	LED L.P. #118	LED L.P. #119	LED L.P. #120
26	LED L.P. #121	LED L.P. #122	LED L.P. #123	LED L.P. #124	LED L.P. #125	LED L.P. #126	LED L.P. #127	LED L.P. #128
27	LED L.P. #129	LED L.P. #130	LED L.P. #131	LED L.P. #132	LED L.P. #133	LED L.P. #134	LED L.P. #135	LED L.P. #136
28	LED L.P. #137	LED L.P. #138	LED L.P. #139	LED L.P. #140	LED L.P. #141	LED L.P. #142	LED L.P. #143	LED L.P. #144
29	LED L.P. #145	LED L.P. #146	LED L.P. #147	LED L.P. #148	LED L.P. #149	LED L.P. #150	LED L.P. #151	LED L.P. #152
30	LED L.P. #153	LED L.P. #154	LED L.P. #155	LED L.P. #156	LED L.P. #157	LED L.P. #158	LED L.P. #159	LED L.P. #160
31	LED L.P. #161	LED L.P. #162	LED L.P. #163	LED L.P. #164	LED L.P. #165	LED L.P. #166	LED L.P. #167	LED L.P. #168
32	LED L.P. #169	LED L.P. #170	LED L.P. #171	LED L.P. #172	LED L.P. #173	LED L.P. #174	LED L.P. #175	LED L.P. #176
33	LED L.P. #177	LED L.P. #178	LED L.P. #179	LED L.P. #180	LED L.P. #181	LED L.P. #182	LED L.P. #183	LED L.P. #184
34	LED L.P. #185	LED L.P. #186	LED L.P. #187	LED L.P. #188	LED L.P. #189	LED L.P. #190	LED L.P. #191	LED L.P. #192
35	LED L.P. #193	LED L.P. #194	LED L.P. #195	LED L.P. #196	LED L.P. #197	LED L.P. #198	LED L.P. #199	LED L.P. #200
36	LED L.P. #201	LED L.P. #202	LED L.P. #203	LED L.P. #204	LED L.P. #205	LED L.P. #206	LED L.P. #207	LED L.P. #208
37	LED L.P. #209	LED L.P. #210	LED L.P. #211	LED L.P. #212	LED L.P. #213	LED L.P. #214	LED L.P. #215	LED L.P. #216
38	LED L.P. #217	LED L.P. #218	LED L.P. #219	LED L.P. #220	LED L.P. #221	LED L.P. #222	LED L.P. #223	LED L.P. #224
39	LED L.P. #225	LED L.P. #226	LED L.P. #227	LED L.P. #228	LED L.P. #229	LED L.P. #230	LED L.P. #231	LED L.P. #232
40	LED L.P. #233	LED L.P. #234	LED L.P. #235	LED L.P. #236	LED L.P. #237	LED L.P. #238	LED L.P. #239	LED L.P. #240
41	LED L.P. #241	LED L.P. #242	LED L.P. #243	LED L.P. #244	LED L.P. #245	LED L.P. #246	LED L.P. #247	LED L.P. #248
42	LED L.P. #249	LED L.P. #250	LED L.P. #251	LED L.P. #252	LED L.P. #253	LED L.P. #254	LED L.P. #255	LED L.P. #256
43	LED L.P. #257	LED L.P. #258	LED L.P. #259	LED L.P. #260	LED L.P. #261	LED L.P. #262	LED L.P. #263	LED L.P. #264
44	LED L.P. #265	LED L.P. #266	LED L.P. #267	LED L.P. #268	LED L.P. #269	LED L.P. #270	LED L.P. #271	LED L.P. #272
45	LED L.P. #273	LED L.P. #274	LED L.P. #275	LED L.P. #276	LED L.P. #277	LED L.P. #278	LED L.P. #279	LED L.P. #280
46	LED L.P. #281	LED L.P. #282	LED L.P. #283	LED L.P. #284	LED L.P. #285	LED L.P. #286	LED L.P. #287	LED L.P. #288
47	LED L.P. #289	LED L.P. #290	LED L.P. #291	LED L.P. #292	LED L.P. #293	LED L.P. #294	LED L.P. #295	LED L.P. #296
48	LED L.P. #297	LED L.P. #298	LED L.P. #299	LED L.P. #300	LED L.P. #301	LED L.P. #302	LED L.P. #303	LED L.P. #304
49	LED L.P. #305	LED L.P. #306	LED L.P. #307	LED L.P. #308	LED L.P. #309	LED L.P. #310	LED L.P. #311	LED L.P. #312
50	LED L.P. #313	LED L.P. #314	LED L.P. #315	LED L.P. #316	LED L.P. #317	LED L.P. #318	LED L.P. #319	LED L.P. #320
51	LED L.P. #321	LED L.P. #322	LED L.P. #323	LED L.P. #324	LED L.P. #325	LED L.P. #326	LED L.P. #327	LED L.P. #328
52	LED L.P. #329	LED L.P. #330	LED L.P. #331	LED L.P. #332	LED L.P. #333	LED L.P. #334	LED L.P. #335	LED L.P. #336
53	LED L.P. #337	LED L.P. #338	LED L.P. #339	LED L.P. #340	LED L.P. #341	LED L.P. #342	LED L.P. #343	LED L.P. #344
54	LED L.P. #345	LED L.P. #346	LED L.P. #347	LED L.P. #348	LED L.P. #349	LED L.P. #350	LED L.P. #351	LED L.P. #352
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56	LED L.P. #361	LED L.P. #362	LED L.P. #363	LED L.P. #364	LED L.P. #365	LED L.P. #366	LED L.P. #367	LED L.P. #368
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61	LED L.P. #401	LED L.P. #402	LED L.P. #403	LED L.P. #404	LED L.P. #405	LED L.P. #406	LED L.P. #407	LED L.P. #408
62	LED L.P. #409	LED L.P. #410	LED L.P. #411	LED L.P. #412	LED L.P. #413	LED L.P. #414	LED L.P. #415	LED L.P. #416
63	LED L.P. #417	LED L.P. #418	LED L.P. #419	LED L.P. #420	LED L.P. #421	LED L.P. #422	LED L.P. #423	LED L.P. #424
64	LED L.P. #425	LED L.P. #426	LED L.P. #427	LED L.P. #428	LED L.P. #429	LED L.P. #430	LED L.P. #431	LED L.P. #432
65	LED L.P. #433	LED L.P. #434	LED L.P. #435	LED L.P. #436	LED L.P. #437	LED L.P. #438	LED L.P. #439	LED L.P. #440
66	LED L.P. #441	LED L.P. #442	LED L.P. #443	LED L.P. #444	LED L.P. #445	LED L.P. #446	LED L.P. #447	LED L.P. #448
67	LED L.P. #449	LED L.P. #450	LED L.P. #451	LED L.P. #452	LED L.P. #453	LED L.P. #454	LED L.P. #455	LED L.P. #456
68	LED L.P. #457	LED L.P. #458	LED L.P. #459	LED L.P. #460	LED L.P. #461	LED L.P. #462	LED L.P. #463	LED L.P. #464
69	LED L.P. #465	LED L.P. #466	LED L.P. #467	LED L.P. #468	LED L.P. #469	LED L.P. #470	LED L.P. #471	LED L.P. #472
70	LED L.P. #473	LED L.P. #474	LED L.P. #475	LED L.P. #476	LED L.P. #477	LED L.P. #478	LED L.P. #479	LED L.P. #480
71	LED L.P. #481	LED L.P. #482	LED L.P. #483	LED L.P. #484	LED L.P. #485	LED L.P. #486	LED L.P. #487	LED L.P. #488
72	LED L.P. #489	LED L.P. #490	LED L.P. #491	LED L.P. #492	LED L.P. #493	LED L.P. #494	LED L.P. #495	LED L.P. #496
73	LED L.P. #497	LED L.P. #498	LED L.P. #499	LED L.P. #500	LED L.P. #501	LED L.P. #502	LED L.P. #503	LED L.P. #504
74	LED L.P. #505	LED L.P. #506	LED L.P. #507	LED L.P. #508	LED L.P. #509	LED L.P. #510	LED L.P. #511	LED L.P. #512
75	LED L.P. #513	LED L.P. #514	LED L.P. #515	LED L.P. #516	LED L.P. #517	LED L.P. #518	LED L.P. #519	LED L.P. #520
76	LED L.P. #521	LED L.P. #522	LED L.P. #523	LED L.P. #524	LED L.P. #525	LED L.P. #526	LED L.P. #527	LED L.P. #528
77	LED L.P. #529	LED L.P. #530	LED L.P. #531	LED L.P. #532	LED L.P. #533	LED L.P. #534	LED L.P. #535	LED L.P. #536
78	LED L.P. #537	LED L.P. #538	LED L.P. #539	LED L.P. #540	LED L.P. #541	LED L.P. #542	LED L.P. #543	LED L.P. #544
79	LED L.P. #545	LED L.P. #546	LED L.P. #547	LED L.P. #548	LED L.P. #549	LED L.P. #550	LED L.P. #551	LED L.P. #552
80	LED L.P. #553	LED L.P. #554	LED L.P. #555	LED L.P. #556	LED L.P. #557	LED L.P. #558	LED L.P. #559	LED L.P. #560

« FOR MORE ABOUT DIODE ON THER-
MINAL STRIPS «D.O.T.S.» SEE
SEC.5, CHP.2, PAGES 104-105 »

Wire Color Abbreviations used:

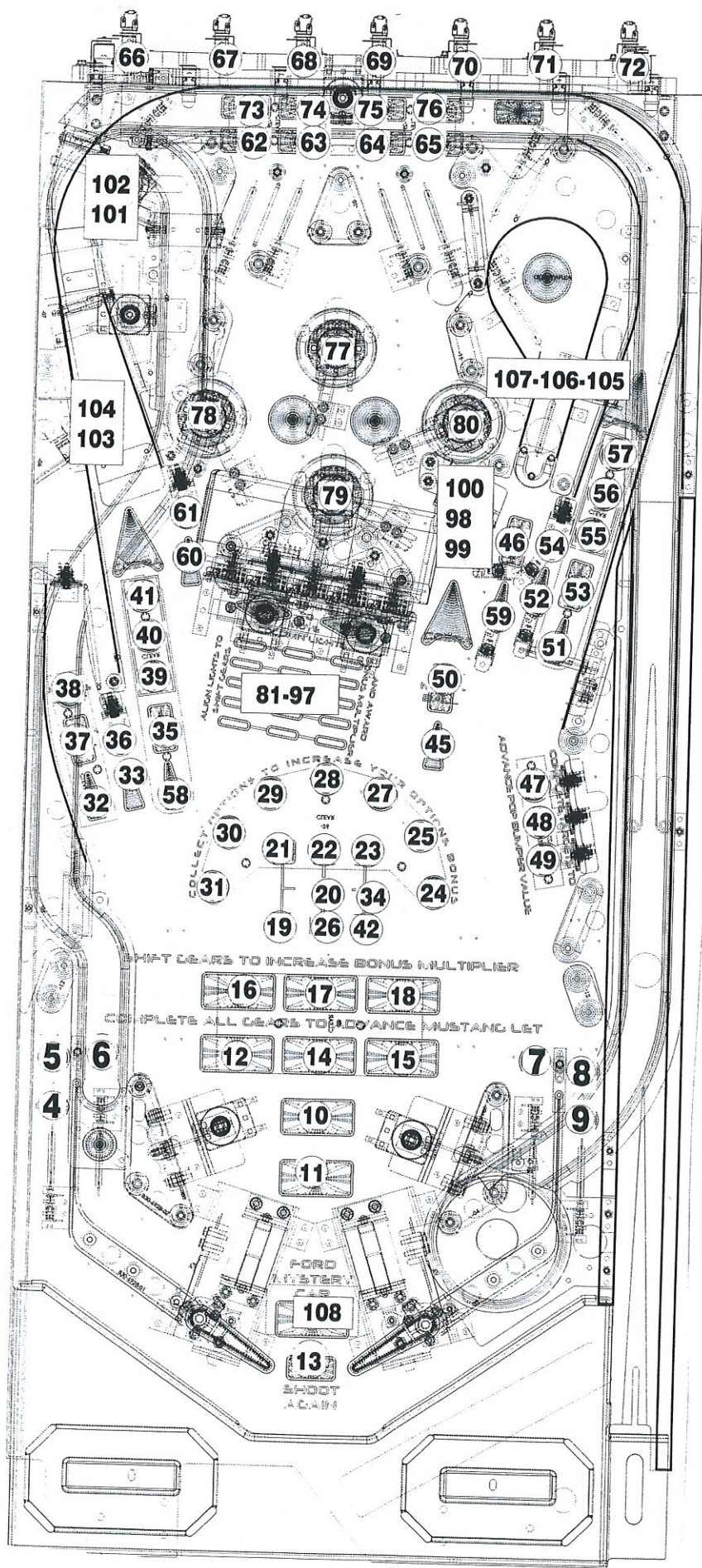
- BLK Black
- BLU Blue
- BRN Brown
- GRY Gray
- GRN Green
- ORG Orange
- RED Red
- VIO Violet
- WHT White
- YEL Yellow

GO TO DIAGNOSTICS MENU

GO TO LAMP MENU

SINGLE LAMP TEST

LAMP MENU: ONE, ALL, ROW, COLUMN & ORDERED



Typical Lamp Wiring & Schematic

Row: Lamp Return Wire J12 (Ground) **RED-XXX**

Column: Lamp Drive Wire J13 (18VDC) **YEL-XXX**

COMMON

Lamps from I/O Power Driver PCB

CATHODE banded side of diode

Row: Lamp Return Wire **RED-XXX**

Column: Lamp Drive (18VDC) Wire **YEL-XXX**

-XXX = Varying Wire Color. See Matrix Grid for color.

Typical Lamp Wiring & Schematic

... with Lamp Diode on a Terminal Strip (DOTS)

Usually when an LED Module is used as a Controlled Lamp for a Pop Bumper.

BLACK

LED Wedge Base

BLACK

TERMINAL STRIP

RED-XXX

YEL-XXX

J12-#

J13-#

I/O PCB

... with Lamp Diode on a Terminal Strip (DOTS)

Usually when a #555 Bulb is used as a Controlled Lamp for a Spot Light.

ORG-XXX

CONN.

ORG-XXX

RED-XXX

YEL-XXX

TERMINAL STRIP

YEL-XXX

J12-#

J13-#

I/O PCB

... wire IN from previous lamp or I/O PCB ...

... wire OUT to next lamp ...

Wire **RED-XXX**

Jumper **ORG-XXX** to Row: Lamp Return

Column n: Lamp Drive Wire **YEL-XXX**

-XXX = Varying Wire Color. See Matrix Grid for color.

Extended Lamps (81-108)

[illegible]



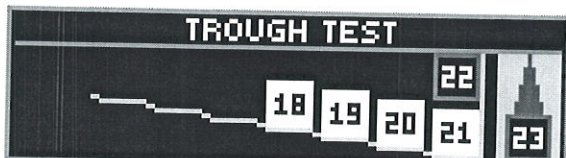
Game-Specific Tests

To initiate, from the **DIAGNOSTICS MENU**, select the "GAME" *Icon*. Ensure the **Power Interlock Switch** is pulled out when testing with the Coin Door open. This Menu is provided to allow the technician a simple method of testing game specific coils and/or switches, if required. If used, select the *Icon* (and Sub-Menu *Icons*, if any) and follow on-screen prompts.



Ball Trough Test

To initiate, from the **DIAGNOSTICS MENU**, select the "CLR" *Icon*. Ensure the **Power Interlock Switch** is pulled out if testing with the Coin Door open. This Menu is provided to allow the technician a simple method of removing the balls from the trough and also, to test functionality of the trough, ensuring proper trough operation. Upon entering **Ball Trough Test**, you will notice that four switches are already indicated as closed. In the example, the 4-Ball Trough Switches #18, #19, #20 & #21 are shown closed (pinballs at rest in the ball trough). To return to the **DIAGNOSTICS MENU**, press the **Green [BACK] Button**.



Press the **Black [SELECT] Button** to eject the ball in the first position Switch #21 (VUK OPTO Trough #1 (R)). Simultaneously, the Dot Matrix Display and the playfield will eject the ball to the Trough Up-Kicker, eject from the Trough Up-Kicker into the Shooter Lane, momentarily closing Switch #23 (Shooter Lane), and is ejected onto the playfield where the technician can easily

retrieve the pinball or allow the ball(s) to re-enter the trough to continue **Ball Trough Test**. The Dot Matrix Display indicates Switch #18 (4-Ball Trough #4 (L)) as open as the remaining three (3) pinballs shift over one (1) position to the right. If the technician allows the ejected pinball to reenter the ball trough, the Dot Matrix Display will indicate Switch #18 as closed. **REMINDER:** Switch #22 is the stacking OPTO switch; If more than five (5) pinballs are used, the additional switches will be noted. Typically, four (4) pinballs are used and required for proper operation; if this amounts differs, it will be noted on the front page of this Service Game Manual.



CAUTION! Continuous use off the above test may overheat the Trough Up-Kicker Coil.



Technician Alerts

To initiate, from the **DIAGNOSTICS MENU**, select the "TECH" *Icon*. This Menu is provided to show any switch or solenoid problems and/or missing pinballs. If upon entering the **SERVICE MENU** the display indicated an asterisk (*) and "USE -/+ TO VIEW TECH. ALERTS", alerts are present.

TECHNICIAN ALERT - (0/0)

NO TECHNICIAN ALERTS

PRESS 'BACK' TO EXIT



After pressing either **Red [</-] / [+/>] Button** or selecting this *Icon* in the **DIAGNOSTICS MENU**, the display will indicate the alert(s). If there are 2 alerts present, the display will indicate (1/2) with the 1st alert on the display. Press the **Red [+/>] Button** to view the second alert (2/2). The second number in the parenthesis () after the slash (/) indicates how many alerts are

present. Refer to the start of this chapter regarding "Upon entering the **SERVICE MENU** *" indication and to **SWITCH ALERTS**. To return to the **DIAGNOSTICS MENU**, press the **Green [BACK] Button**. **Note:** While in this menu, an option may be present to jump (short-cut) to the appropriate Testing Menu (e.g. Coil Test, Switch Test, Game Specific Test or Ticket Dispenser Test, if installed).

NOTE ON SWITCH DETECTION : During game play, activation of switches are continuously monitored. For a switch to be determined as inoperable or **OUT OF SERVICE**, up to twenty games or so must be played for a switch to be automatically marked as **OUT OF SERVICE**. In programming, if a switch is determined to be faulty, game play is compensated. Switches noted as **OUT OF SERVICE** are determined to be stuck closed or open depending on switch usage. Free up the switch actuator, adjust or replace, if necessary. Performing a valid switch closure will put the switch back "IN SERVICE."

Determination of switch usage can be checked in **Audits** (review the Audits Section). Find the associated Audit with the switch in question and check usage; compare the numbers to commonly used switches. After any switch is checked and repaired or replaced, it's suggested to test the switch in the **Switch Test** or **Single Coil Test** (reviewed earlier in this section) where the associated coil to the switch can be tested as well. After correcting the problem, the switch will marked "IN SERVICE" and the switch is again monitored as specified above. Only you can determine if a switch marked **OUT OF SERVICE** is actually inoperable, or if it is just not getting actuated during game play.

NOTE ON PINBALL DETECTION : While in **TECHNICIAN ALERTS MENU**, if the following is displayed, the game has detected one (1) or more pinball(s) missing and has compensated for the lost pinball(s) to provide normal game play.

Technician Alerts continued on the next page.



Technician Alerts continued from previous page.

During game play, a pinball can get trapped or stuck. If after approximately 15 seconds of inactivity or "no scoring," **Ball Search** is started. **Note:** If the pinball is in the Plunger Lane or "held" on the flipper, no **Ball Search** will be performed. The game will perform one **Ball Search** in an attempt to "find" or free-up the pinball.

If the game does not see a switch closure (indicating the pinball has not been found), the Dot Matrix Display may indicate [**LOCATING PINBALLS PLEASE WAIT ...**], during which **Ball Search** will continue until the timer runs out (this feature will not happen if the game is in Competition Mode; **Ball Search** will continue until the pinball is found, unstuck and/or replaced manually). The display will momentarily acknowledge the missing pinball(s). The game will provide another pinball into play and will compensate for the lost pinball. Game play will appear normal.

Note: This detection and compensation will happen with every pinball, if each suffers the same fate of a ball trap. If **all** balls get trapped, the game cannot be played or started until the situation is rectified.

Important: Determine where the pinball is! **Do not add pinball(s)** until it is determined the pinball(s) are indeed missing and not just stuck. The most common places for a pinball to be stuck is in device holes (ejects and VUKs) or ball troughs. Determine that all devices are functionally properly. Check around plastic pieces and ramps to see if the pinball got jammed or stuck.

When the found pinball or a replacement pinball is added to the Ball Trough, the **Technician Alert** will immediately clear and will then indicate any remaining alerts (if present) or **NO TECHNICIAN ALERTS**.

Enter the **BALL TROUGH TEST** (review the previous page) to cycle the pinballs and to check proper switch and coil operation. If a pinball was added, and the originally stuck pinball has freed itself at a later time, the game will not operate correctly.

NOTE ON DEVICE MALFUNCTION : While in **TECHNICIAN ALERTS MENU**, if the following is displayed, the game has detected a "device malfunction." Check the device indicated (coil and/or switch).

TECHNICIAN ALERT - (2/2)
DEVICE MALFUNCTION
AUTO PLUNGER
USE -/+ TO VIEW OTHER ALERTS



Knocker Test

To initiate, from the **DIAGNOSTICS MENU**, select the "KNO- CKER" Icon. The digitally mastered "Knocker" is sounded. The *knocker sound* is used to alert the player if he/she has received a special, replay or a credit from the Match Award feature. Press the **Black [SELECT] Button** to activate the knocker. To return to the **DIAGNOSTICS MENU**, press the **Green [BACK] Button**.

FACTOID: The knocker got it's name from the 'original knocker' (20th century pinball games), which used a coil and when energized (fired), the plunger would strike a wood panel inside the cabinet.



Sound / Speaker Test

To initiate, from the **DIAGNOSTICS MENU**, select the "SPKR" Icon. This system produces true digital stereo sound from Backbox & Cabinet Speakers or "Mono" on the Cabinet Speaker (when used by itself). This Menu is provided to allow the technician a simple method of testing the speakers if rewired or replaced.

Upon entering **Sound / Speaker Test**, you will notice the Dot Matrix Display indicating the first option of *available music and/or sound(s)* in this test. Press the **Red [+ / >] Button** to cycle through the *available music and/or sounds*, and press the **Black [SELECT] Button** to play the option shown in the Dot Matrix Display. Press the **Green [BACK] Button** to exit.

Speaker Phase Testing

Connections to each of speakers are polarized and each must be connected appropriately for the best quality sound. If one speaker has the positive and negative connections reversed with respect to the other one, bass frequencies will not be produced properly and the overall sound quality will be poor. To test for proper speaker phasing, use the **Sound / Speaker Test** to cycle through the available music and sound.

Speaker Phase Testing cont. next page.

TECHNICIAN ALERT - (1/2)
2
BALLS MISSING
PRESS 'SELECT' FOR TROUGH TEST

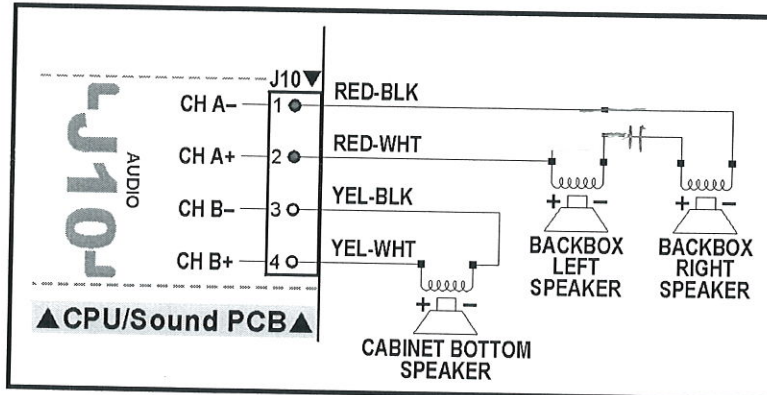
SOUND / SPEAKER TEST
MUSIC: MAIN PLAY
#1
PRESS 'SELECT' TO PLAY

SOUND / SPEAKER TEST
MUSIC: MAIN PLAY
#1
PLAYING SOUND #1



Speaker Phase Testing continued from previous page.

If the sound is not balanced or doesn't sound correct, check the speaker wiring.



1. Check each speaker for polarity markings. If the speakers have polarity markings, verify that the Backbox Speaker's **RED-BLK** Wires and the Cabinet Speaker **YEL-BLK** Wire(s) are connected to the negative (-) terminal.

2. Disconnect the speaker output **Connector J10 (AUDIO)** from the CPU / Sound PCB (in the Backbox) and connect a 1.5-volt battery across each speaker pair one at a time while observing the speakers.

3. Make sure the positive (+) battery terminal is connected to the positive lead [J10, Pin-2, **CH A+**] (**RED-WHT**) or [J10, Pin-4, **CH B+**]

(**YEL-WHT**) each time. As the connection is made, check speaker cone movement; proper connections are indicated by outward movement.



Begin Burn-In

To initiate, from the **DIAGNOSTICS MENU**, select the "BURN" *Icon*. After selecting this *Icon*, press the **Black [SELECT] Button** to begin (initiate) the **Burn-In Test**. Ensure the **Power Interlock Switch** is pulled out if testing with the Coin Door open (required for coil function). Upon entering **Burn-In Test**, the game will exercise all CPU I/O Functions: **Dot Matrix Display Test**, **Coil Cycling Testing**, **All Lamps Test** and **Sound / Speaker Test**. Press the **Green [BACK] Button**, to pause and to view the cumulative Burn-In minutes. Press the **Green [BACK] Button** again to return to the **DIAGNOSTICS MENU**.

Note: To reset Burn-In minutes back to **0:00**, see Section 3, Chapter 5, **GO TO RESET MENU** (via the **UTILITIES MENU**), **Reset Factory Settings**. **CAUTION:** Performing a **FACTORY RESET** will reset all other information as well (read the Utilities Section (**GO TO RESET MENU**), for more information).



Dot Matrix Test

To initiate, from the **DIAGNOSTICS MENU**, select the "DOT TEST" *Icon*. After selecting this *Icon* the **Dot Matrix Test** immediately begins. The Dot Matrix Display will immediately and continuously illuminate and cycle each of the **5 Tests for 1 pass each**. To return to the **DIAGNOSTICS MENU**, press the **Green [BACK] Button**.

Test 1

Illuminates **1 vertical column of dots**, turning it off & illuminating the next column, until each column has been individually lit, while the other columns are off.

Test 2

Illuminates **1 horizontal row of dots**, turning it off & illuminating the next row, until each row has been individually lit, while the other rows are off.

Test 3

Illuminates **all the dots, except for one column** from left to right.

Test 4

Illuminates **all the dots, except for one row** from top to bottom.

Test 5

Illuminates **all the dots alternating even & odd**, in both the rows and columns.

Test 1

Illuminates **1 vertical column of dots**, turning it off & illuminating the next column, until each column has been individually lit, while the other columns are off.



Ticket Dispenser Test

To initiate, from the **DIAGNOSTICS MENU**, select the "TIX" *Icon*. This Menu (*Icon*) will only appear if **Standard Adjustment 56, Ticket Dispenser**, is set to **YES** (Default = **NO***). ***Note:** *Some games shipped from the factory with a unique Dip Switch Setting will default to YES*. To view and/or change your setting, see Adjustments Section (**GO TO ADJUSTMENTS MENU**). Please remember, if you install an optional Ticket Dispenser, and your default setting is "NO," you will have to reset it back to "YES" if a **Factory Reset** is performed.

After selecting this *Icon*, the **Ticket Dispenser Test** will start. With the Ticket Dispenser properly installed, manually feed your tickets into the dispenser. The dispenser will activate and pull in the first ticket. Press the **Black [SELECT] Button** (which energizes Coil #35, Aux 3: Switched Ground) to advance a ticket. Feeding your Tickets into the dispenser works because Coil #33, Aux 1: Ticket Advance (Enable) is always 'energized'. With a Ticket Meter installed, as one Ticket Passes through the Ticket Dispenser, one 'click' is fired to the Meter (Coil #34, Aux 2: Ticket Meter) for each ticket passing through. Dedicated Switch **D-19, Ticket Notch**, will also be indicated on-screen (*in combination with a audible sound*) as "closing" as the notch between the tickets passes through. In this test you can clear ticket jams and check and/or clear tickets in Escrow, if necessary. To return to the **DIAGNOSTICS MENU**, press the **Green [BACK] Button**.



CHOOSE EARNINGS or STANDARD AUDITS

GO TO AUDITS MENU: EARNINGS AUDITS [#1 – #13] / STANDARD AUDITS [#1 – #59]

Perform the below steps to review the audits. Enter the **SERVICE MENU**, then enter the **EARNINGS AUDITS** or **STANDARD AUDITS MENUS**. For audit definitions or summary, review the Audits Section (**GO TO AUDITS MENU**). Try the **"DUMP AUDITS TO USB"** Feature to create a text file of your audits. Don't forget to set the **DATE & TIME** in the **UTILITIES MENU**. See the Utilities Section (**GO TO UTILITIES MENU**).

Step 1 Press [**SELECT**].

Press [**BACK**] to exit for escape at any time.

Step 2 Press [**>**]. Go to the "AUD" Icon.

Press [**SELECT**].

Step 3 Press [**>**]. Go to the "EARN" or "S.P.I." Icon.

Press [**SELECT**].

Step 4 Press [**<**] [**>**] to move between audits.

Audit Number

Audit Name

Audit Result

EARNINGS AUDIT #1
TOTAL PAID CREDITS
0

EARNINGS AUDITS [#1 – #13] ▼

Nr.	EARNINGS AUDIT NAME	YOUR RESULT
1	TOTAL PAID CREDITS	
2	FREE GAME PERCENTAGE	
3	AVERAGE BALL TIME	
4	AVERAGE GAME TIME	
5	COINS THROUGH LEFT SLOT	
6	COINS THROUGH RIGHT SLOT	
7	COINS THROUGH CENTER SLOT	

Nr.	EARNINGS AUDIT NAME	YOUR RESULT
8	COINS THROUGH FOURTH SLOT	
9	COINS THROUGH FIFTH SLOT	
10	TOTAL COINS	
11	TOTAL EARNINGS	
12	METER CLICKS	
13	SOFTWARE METER	

STANDARD AUDITS [#1 – #59] ▼

Nr.	STANDARD AUDIT NAME	YOUR RESULT
1	TOTAL BALLS PLAYED	
2	TOTAL EXTRA BALLS	
3	EXTRA BALL PERCENTAGE	
4	REPLAY 1 AWARDS	
5	REPLAY 2 AWARDS	
6	REPLAY 3 AWARDS	
7	REPLAY 4 AWARDS	
8	TOTAL REPLAYS	
9	REPLAY PERCENTAGE	
10	TOTAL SPECIALS	
11	SPECIAL PERCENTAGE	
12	TOTAL MATCHES	
13	HIGH SCORE AWARDS	
14	HIGH SCORE PERCENT	
15	TOTAL FREE PLAYS	
16	TOTAL PLAYS	
17	0.0M – 1.99M SCORES	
18	2.0M – 3.99M SCORES	
19	4.0M – 5.99M SCORES	
20	6.0M – 7.99M SCORES	

Nr.	STANDARD AUDIT NAME	YOUR RESULT
21	8.0M – 9.99M SCORES	
22	10.0M – 12.49M SCORES	
23	12.5M – 14.99M SCORES	
24	15.0M – 17.49M SCORES	
25	17.5M – 19.99M SCORES	
26	20.0M – 24.99M SCORES	
27	25.0M – 29.99M SCORES	
28	30.0M – 39.99M SCORES	
29	40.0M – 49.99M SCORES	
30	50.0M – 74.99M SCORES	
31	75.0M – 99.99M SCORES	
32	100.0M – 149.99M SCORES	
33	150.0M+ SCORES	
34	AVERAGE SCORES	
35	SERVICE CREDITS	
36	BALL SEARCH STARTED	
37	LOST BALL FEEDS	
38	LOST BALL GAME STARTS	
39	LEFT DRAINS	
40	CENTER DRAINS	

Nr.	STANDARD AUDIT NAME	YOUR RESULT
41	RIGHT DRAINS	
42	TILTS	
43	TOTAL BALLS SAVED	
44	LEFT FLIPPER USED	
45	RIGHT FLIPPER USED	
46	0 – 1 MINUTE GAMES	
47	1 – 1.5 MINUTE GAMES	
48	1.5 – 2 MINUTE GAMES	
49	2 – 2.5 MINUTE GAMES	
50	2.5 – 3 MINUTE GAMES	
51	3 – 3.5 MINUTE GAMES	
52	3.5 – 4 MINUTE GAMES	
53	4 – 5 MINUTE GAMES	
54	5 – 6 MINUTE GAMES	
55	6 – 8 MINUTE GAMES	
56	8 – 10 MINUTE GAMES	
57	10 – 15 MINUTE GAMES	
58	15+ MINUTE GAMES	
59	RECENT REPLAY PERCENT	

Note: Audits are subject to change (with or without notice).

STANDARD ADJUSTMENTS [#1 – #63] ▼

Nr.	STANDARD ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING	Nr.	STANDARD ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
1	REPLAY TYPE	AUTO		32	HIGH SCORE #1	___,000,000	
2	‡ REPLAY PERCENTAGE	10%		33	HIGH SCORE #2	___,000,000	
3	‡ REPLAY AWARD	CREDIT		34	HIGH SCORE #3	___,000,000	
4	‡ REPLAY LEVELS	1		35	HIGH SCORE #4	___,000,000	
5	‡ AUTO REPLAY START	___,000,000		36	HSTD INITIALS	3 INITIALS	
6	‡ DYNAMIC REPLAY START	___,000,000		37	HSTD RESET COUNT	2000	
7	‡ REPLAY LEVEL #1	___,000,000		38	FREE PLAY	NO	
8	‡ REPLAY LEVEL #2	___,000,000		39	LANGUAGE	ENGLISH	
9	‡ REPLAY LEVEL #3	___,000,000		40	PLAYER LANGUAGE SELECT	YES	
10	‡ REPLAY LEVEL #4	___,000,000		41	CUSTOM MESSAGE	ON	
11	‡ REPLAY BOOST	YES		42	FLASH LAMP POWER	NORMAL	
12	SPECIAL LIMIT	1		43	COIL PULSE POWER	NORMAL	
13	‡ SPECIAL PERCENTAGE	10%		44	KNOCKER VOLUME	NORMAL	
14	SPECIAL AWARD	CREDIT		45	GAME RESTART	YES	
15	FREE GAME LIMIT	5		46	BILL VALIDATOR	NO	
16	EXTRA BALL LIMIT	5		47	MUSIC VOLUME	1	
17	‡ EXTRA BALL PERCENTAGE	25%		48	BALL SAVE TIME	0:05	
18	GAME PRICING	USA 10		49	TIMED PLUNGER	OFF	
19	MATCH PERCENTAGE	9%		50	FLIPPER BALL LAUNCH	OFF	
20	MATCH AWARD	CREDIT		51	COINDOOR BALL SAVER	NO	
21	BALLS PER GAME	3		52	COMPETITION MODE	NO	
22	TILT WARNINGS	2		53	CONSOLATION BALL	YES	
23	CREDIT LIMIT	30		54	FAST BOOT	YES	
24	ALLOW HIGH SCORES	YES		55	Q24 OPTION	COIN METER	
25	HIGH SCORE AWARD	CREDIT		56	TICKET DISPENSER	NO	
26	GRAND CHAMPION AWARDS	1		57	PLAYER COMPETITION	YES	
27	HIGH SCORE #1 AWARDS	1		58	TEAM SCORES	NO	
28	HIGH SCORE #2 AWARDS	0		59	LOCATION ID	0	
29	HIGH SCORE #3 AWARDS	0		60	GAME ID	0	
30	HIGH SCORE #4 AWARDS	0		61	TIME FORMAT	12-HOUR	
31	GRAND CHAMPION SCORE	___,000,000		62	COIN INPUT DELAY	30	
				63	LOST BALL RECOVERY	YES	

Factory Defaults Settings are subject to change during production (especially Standard Adjustments 2, 4, 5, 13, 16-17, 19, 31-35 & 47).

‡ Not all Standard Adjustments are shown. Depending on the setting (whether Factory Default or if changed by the operator), associated adjustments do not appear, if not required. **Note:** If **Game Dip Switch** other than USA is installed, different Defaults will appear.

Feature Adjustments [#1 – #+]



To initiate, from the **ADJUSTMENTS MENU**, select the "GAME" Icon. The Dot Matrix Display will indicate the adjustment number (in this group), adjust. name, adjust. setting and comment line. The current adjustment will remain on the display until the next adjustment is viewed or when this sub-menu is exited.

>>> **FACTORY RESET or CODE UPDATE NOTE:** Don't forget, any changes you make to your adjustments will revert back to the Factory Default settings if you perform a Factory Reset or update your Game Code. See **Utilities Section (GO TO RESETS MENU and GO TO USB MENU)**.

View the **Coils Detailed Chart Menu** to see if this game is **Shaker Motor Enabled**. If it is, set the options in the **Feature Adjustment** as seen below. (typically the last one).

SHAKER MOTOR (OPTIONAL): Set to **NONE, MINIMAL USE, MODERATE USE or MAXIMAL USE**.
Factory Default = **MODERATE USE**. Set to any of the varying "... USES" if an **Optional Shaker Motor Kit (SPI Part Number 502-5027-00)** was installed correctly in this pinball machine. See the assembly (kit) on the last page of **Blue Pages (Major Assemblies)**. Also see **Shaker Motor Coil (Q8)** in the **Coils Detailed Chart Table** at the beginning of this **Service Game Manual** or the beginning of the **Yellow Pages**.

USA & International (non-Euro) Standard Pricing Select Table

CPU/SOUND PCB
DIP SWITCH SW1
SETTING

Pos.	1	2	3	4	5	6	7	8
ON								
OFF	▼	▼	▼	▼	▼	▼	▼	▼

HIGHLIGHTED
= Factory Default

HIGHLIGHTED
= Not Shown on Coin Card

COUNTRY
SETTING
OPTION(S)

Pos.	1	2	3	4	5	6	7	8
ON								
OFF	▼	▼	▼	▼	▼	▼	▼	▼

USA 1
USA 2
USA 3
USA 4
USA 5
USA 6
USA 7
USA 8
USA 9
USA 10
USA 11

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

AUSTRALIA 1
AUSTRALIA 2
AUSTRALIA 3
AUSTRALIA 4
AUSTRALIA 5
AUSTRALIA 6

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲						
OFF	▼	▼	▼	▼	▼	▼	▼	▼

CANADA 1
[25¢ door]
CANADA 2
[dollar door]

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

CROATIA

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲						
OFF	▼	▼	▼	▼	▼	▼	▼	▼

DENMARK 1
DENMARK 2

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

JAPAN 1
JAPAN 2

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲	▲				
OFF	▼	▼	▼	▼	▼	▼	▼	▼

LITHUANIA

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲	▲				
OFF	▼	▼	▼	▼	▼	▼	▼	▼

MIDDLE EAST

Pos.	1	2	3	4	5	6	7	8
ON				▲				
OFF	▼	▼	▼	▼	▼	▼	▼	▼

NEW ZEALAND 1
NEW ZEALAND 2

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

NORWAY 1
NORWAY 2
NORWAY 3
NORWAY 4
NORWAY 5
NORWAY 6
NORWAY 7
NORWAY

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲	▲				
OFF	▼	▼	▼	▼	▼	▼	▼	▼

RUSSIA

Pos.	1	2	3	4	5	6	7	8
ON		▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

SO. AFRICA 1
SO. AFRICA 2

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

SWEDEN 1
SWEDEN 2

Pos.	1	2	3	4	5	6	7	8
ON		▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

SWITZERLAND 1
SWITZERLAND 2

Pos.	1	2	3	4	5	6	7	8
ON			▲	▲				
OFF	▼	▼	▼	▼	▼	▼	▼	▼

TAIWAN

Pos.	1	2	3	4	5	6	7	8
ON	▲	▲	▲					
OFF	▼	▼	▼	▼	▼	▼	▼	▼

UK 1
UK 2
UK 3
UK 4
UK 5
UK 6

ATTENTION: UK 5TH
COIN SLOT TIED TO 6TH
CHANNEL ON ELEC.
COIN MECH

COIN MECHANISMS (SWITCHES)

COINS THRU ... SLOT:

LEFT CENTER RIGHT 4TH

0.25	1.00	0.25	
------	------	------	--

0.20	1.00	2.00	
------	------	------	--

0.25	0.25	1.00	2.00
------	------	------	------

1.00		2.00	
------	--	------	--

1	2	5	
---	---	---	--

1	5	10	20
---	---	----	----

100		100	
-----	--	-----	--

1	2	5	
---	---	---	--

token		token	
-------	--	-------	--

1		2	
---	--	---	--

10	5	20	
----	---	----	--

10	5	1	
----	---	---	--

0.50	1.00	2.00	5.00
------	------	------	------

1	5	10	
---	---	----	--

1	2	5	
---	---	---	--

10		10	
----	--	----	--

LEFT	CENTER	RIGHT	4TH	5TH
------	--------	-------	-----	-----

0.10	0.50	1.00	0.20	2£
------	------	------	------	----

Coin Only

PRICING SCHEME

Number of Plays (Credits) for Price Amount Shown
See "Appendix J" for Coin Cards Examples & Info!

Requires SPI
Coin Card(s)
Part Number

USD // UNITED STATES DOLLAR // [\$]

1/0.25			755-5400-01-Y
1/0.50	2/0.75	3/1.00	755-5400-09-Y
1/0.50			755-5400-02-Y
1/0.50			755-5400-02-Y
1/0.50	2/1.00	3/1.50	755-5400-08-Y
1/0.50	2 1/4 X 25¢	3 /\$ 1.00 Bill	755-5400-00-Y
1/0.50	2/1.00	4/1.50	755-5400-07-Y
1/0.50		3/1.00	755-5400-11-Y
1/1.00			
1/0.75	2/1.50	3/2.00	
1/1.00	3/2.00		

AUD // AUSTRALIAN DOLLARS // [\$AUS]

1/1.00	3/2.00		755-5406-00-Y
1/1.00			(1 Side)
1/2.00			
1/2.00	2/4.00	3/5.00	
1/3.00	2/5.00	3/8.00	5/10.00
1/2.00	2/3.00		

CAD // CANADIAN DOLLARS // [\$CAN]

1/0.50	2/0.75	3/1.00	755-5400-00-Y
1/1.00	3/2.00		-01-Y or -02-Y
1/1.00			755-5400-10-Y

HRK // CROATIAN KUNA // [kuna]

1/3	2/5		755-5410-00-Y
			(2-Sided)

DKK // DANISH KRONER // [Kr]

1/3	2/5		755-5402-00-Y
1/2	2/4	3/5	4/7
		5/9	7/10
			(2-Sided)

JPY // JAPANESE YEN // [¥]

1/100			755-5408-01-Y
1/100	3/200		(2-Sided)

LTL // LITHUANIA LITAI // [Lt]

1/2			755-5416-00-Y
			(1 Side)

TOKEN // Middle East currency used to buy token // [TOKEN]

1/1			755-5416-00-Y
			(use Side 1)

NZD // NEW ZEALAND DOLLAR // [\$NZD]

1/1			755-5406-00-Y
1/1	3/2		(Side 2)

NOK // NORWEGIAN KRONE // [Kr]

1/10			755-5403-01-Y or
1/10	3/20		-02-Y / (2-Sided)
1/20			755-5403-03-Y
1/20	3/40		(2-Sided)

1/10

1/10 3/20

1/20

1/20 3/40

RUB // RUSSIAN RUBLE // [Ruble]

1/5			755-5411-00-Y
			(2-Sided)

ZAR // SOUTH AFRICAN RAND // [R]

1/2.00			755-5409-01-Y
1/3.00	2/5.00		(2-Sided)

SEK // SWEDISH KRONOR // [kr]

1/10	2/15	3/20	755-5404-00-Y
1/5			(2-Sided)

CHF // SWISS FRANCS // [\$f]

1/1	2/2	3/3	4/4	6/5	755-5405-00-Y
1/1	3/2	5/3	7/4	9/5	(2-Sided)

TWD // TAIWANESE DOLLAR // [TWD]

1/10			755-5412-00-Y
			(use Side 1)

GBP // UNITED KINGDOM POUNDS // [£]

3/1.00	7/2.00		755-5407-00-Y
4/1.00			755-5407-01-Y*
1/0.50	2/1.00	3/1.50	5/2.00
1/0.30	2/0.60	3/0.90	4/1.00
1/1.00	3/2.00		755-5407-01
3/2.00			*use blank side 755-5407-01-Y*



Standard Adjustment 18, Game Pricing, continued.

Euro 1-12 Summary & International (Euro) Standard Pricing Select Table

CPU/SOUND PCB DIP SWITCH SW1 SETTING		COUNTRY SETTING OPTION(S)	COIN MECHANISMS (SWITCHES) COINS THRU ... SLOT:				PRICING SCHEME Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!	Requires SPI Coin Card(s) Part Number
Pos.	1 2 3 4 5 6 7 8	Default Highlighted	LEFT	CENTER	RIGHT	4TH		
ON	S E E B E L O W	Euro 1	0.50	1.00	2.00	0.20 optional	EUR // EUROPEAN UNION EUROS // €	755-5401-01-Y
OFF	S E T T I N G S	Euro 2					1/0.50	755-5401-02-Y
		Euro 3					1/0.50 2/1.00 3/1.50 5/2.00	755-5401-03-Y
		Euro 4					1/0.50 3/1.00	755-5401-04-Y
		Euro 5					1/0.50 2/1.00 3/1.50 6/2.00	755-5401-05-Y
		Euro 6					1/0.50 3/1.00 4/1.50 7/2.00	755-5401-06-Y
		Euro 7					2/0.50	755-5401-07-Y
		Euro 8					1/1.00 2/2.00 3/3.00 5/4.00	755-5401-08-Y
		Euro 9					1/1.00 3/2.00	755-5401-09-Y
		Euro 10					1/1.00 2/1.50 3/2.00 7/3.00	755-5401-10-Y
		Euro 11					1/1.00 3/2.00 7/3.00	755-5401-11-Y
		Euro 12					1/1.00 4/2.00 6/3.00 9/4.00	755-5401-12-Y

For a different **Euro Pricing Scheme** (other than Factory Default listed below), scroll through **Standard Adjustment 18:**
Euro 1-12 or CUSTOM* for new setting (reference above Euro 1-12 Summary). Keep the Country Dip Switch Setting the same as listed below.

Pos.	1 2 3 4 5 6 7 8	Default Highlighted					EUR // EUROPEAN UNION EUROS // €	
ON	▲	AUSTRIA	0.50	1.00	2.00		1/1.00 2/1.50 3/2.00	755-5401-09-Y
OFF	▼	Euro 9						
ON	▲	BELGIUM	0.50	1.00	2.00		1/0.50	755-5401-01-Y
OFF	▼	Euro 1						
ON	▲	FINLAND	0.50	1.00	2.00		1/1.00 3/2.00	755-5401-08-Y
OFF	▼	Euro 8						
ON	▲	FRANCE	0.50	1.00	2.00		1/1.00 3/2.00 7/3.00	755-5401-10-Y
OFF	▼	Euro 10						
ON	▲	GERMANY 1	0.50	1.00	2.00		1/0.50	755-5401-01-Y
OFF	▼	GERMANY 2					1/0.50 2/1.00 3/1.50 5/2.00	755-5401-02-Y
		GERMANY 3					1/0.50 2/1.00 3/1.50 6/2.00	755-5401-04-Y
ON	▲	GREECE	0.50	1.00	2.00		1/1.00 3/2.00	755-5401-08-Y
OFF	▼	Euro 8						
ON	▲	ITALY 1	0.50		0.50		1/0.50	755-5401-01-Y
OFF	▼	ITALY 2					1/1.00 3/2.00	755-5401-08-Y
ON	▲	NETHERLANDS	0.50	1.00	2.00		1/0.50 3/1.00	755-5401-03-Y
OFF	▼	Euro 3						
ON	▲	PORTUGAL	0.50		0.50		1/0.50	755-5401-01-Y
OFF	▼	Euro 1						
ON	▲	SPAIN	0.50	1.00	2.00		1/1.00 3/2.00	755-5401-08-Y
OFF	▼	Euro 8						

HIGHLIGHTED = Factory Default **HIGHLIGHTED** = Not Shown on Coin Card

For the associated **Coinage Card** required if the Factory Default Setting was changed, view on-line at:

<http://www.sternpinball.com/coinagecards.shtml>

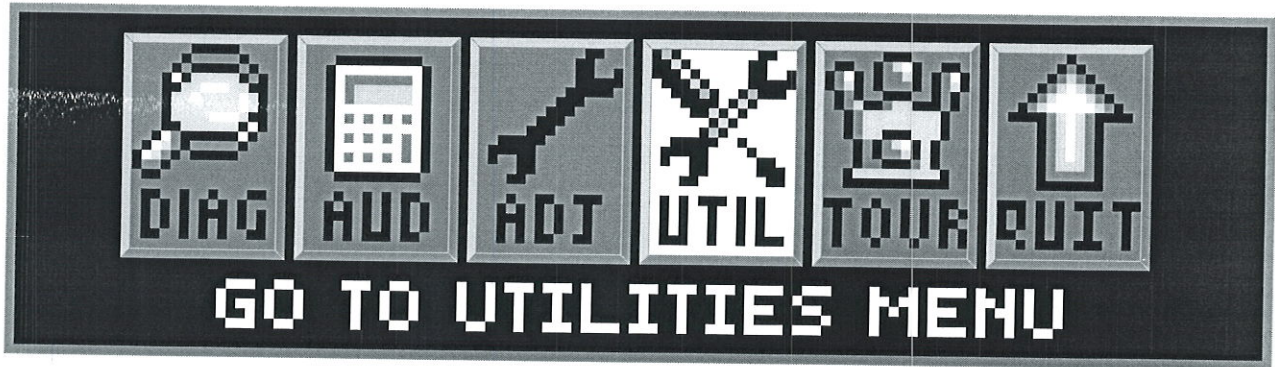
You can download and print the replacement card. Adobe® Reader 5.0 or higher required (links on site). Use **Yellow Card Stock:**
ASTROBRIGHTS® SOLAR YELLOW #65 FROM WAUSAU PAPER PRODUCTS (Stock #22731)

#19 **MATCH PERCENTAGE:** Set between 0% – 10% or OFF. Factory Default = 9%. At 0% the Match Animation Feature occurs at the end of the game but never awards the Match Award (Standard Adjustment 20). Set to OFF, no Match Animation Feature is shown.

#20 **MATCH AWARD:** Set to CREDIT, TICKET* or TOKEN*. Factory Default = CREDIT. This adjustment is not shown if OFF is installed in Match Percentage (Standard Adjustment 19).

*Note: If TICKET or TOKEN is selected, the game will require an optional Ticket or Token Dispenser and then Q24 Option (Standard Adj. 55) must be changed accordingly.

#21 **BALLS PER GAME:** Set between 1 – 10. Factory Default = 3. Set the number of balls per game.



To initiate, from the **MAIN MENU**, select the "UTIL" *Icon*. The **UTILITIES MENU** provides ways to quickly and easily customize your game with **Installs** (pre-sets for game *Standard & Feature Adjustments*), set-up a **Custom Message** (short-cut to *Standard Adjustment 41, Custom Message*), set-up **Custom Pricing** (short-cut to *Standard Adjustment 18, to the Custom Pricing Sub-Menu*), set-up the **Date and Time** (required if the date and time is needed to be accurate for data dumps and for tournaments), reset certain particular game data or perform a complete **Factory Reset** and to download game data, update or backup game code in the **USB MENU**.

All **UTILITIES, INSTALLS, RESETS MENU** and **USB MENU** *Icons* and there usages are explained throughout this chapter in the same order as seen in the Dot Matrix Display. **NOTE:** Depending on Game Type, Version, selections made, Dip Switch settings, location and/or areas, some *Icons* may appear non-functional or may not appear at all. **Installs (Adjustments), Icons and/or functions, order and operation are subject to change. If in doubt use the Factory Default Settings (review Install Factory on the next page).**

In displays where changes can be made or to perform a function, use the **GREEN Button** to go [**BACK**], exit or escape, the **RED Buttons** to [< / -] **MOVE BACK / LEFT** / [+ / >] **MOVE FORWARD / RIGHT** to view the next audit in the group, and the **BLACK Button** to [**SELECT**] the sub-menus.



Go To Installs Menu

To initiate, from the **UTILITIES MENU**, select the "INST" *Icon*. The **INSTALLS MENU** provides 13 **Installs** to vary **Game Play Difficulty** (set with *Feature Adjustments*) or **Game Play Type** and **Install Factory** (restores all adjustments to *Factory Defaults*).

For **detailed customization** or to check current **Adjustments Defaults** (either changed by *YOU* in the *Adjustments Menu* or by this **INSTALLS MENU** or for *Factory Default Settings*), see **Section 3, Chapter 4, GO TO ADJUSTMENTS MENU**. After completing one or more of the **Installs** in this chapter, go back to the **ADJUSTMENTS MENU** to see which **Standard and/or Feature Adjustments** have changed (*Feature Adjustments and/or settings are subject to change during production, and may differ than what is described in the tables at the end of this chapter*). The Dot Display will indicate if a setting is a *Factory Default* or not. If the settings are not to your liking, perform **one** of the following:

- 1.: **Manually** change the **Standard & Feature Adjustments** Settings (perform this task in the **ADJUSTMENTS MENU**, see the *Adjustments Section*).
- 2.: **Install Factory** (see the last install) on how to reset all of the **Standard & Feature Adjustments** back to the *Factory Default Settings*.

Multiple **Installs can be set** to vary game play; however, for **Installs** that have *one or more* Adjustments in common, the **last** "Install" selected & *activated*, will **supersede** any previously changed Adjustment(s) from any prior **Installs**. Any adjustments which you changed and are not affected by the Install will remain as set.

For example, if you want a **5-BALL Game** set to **EXTRA EASY**: Select and *activate* the "5BAL" *Icon* first (which will typically change any **Feature** Difficulty Adjustments to **HARD**), then select & *activate* the "X.EZ" *Icon* to **change back** the Difficulty Adjustments to **EXTRA EASY**. However, if the "X.EZ" *Icon* was selected & *activated* first, then the "5BAL" *Icon* was selected & *activated*, the game will be set to a **5-BALL Game** set to **HARD**.

Remember, use the **GREEN Button** to go [**BACK**], exit or escape and the **BLACK Button** to [**SELECT**] to **INSTALL** your new setting(s).



Install Extra Easy

To initiate, from the **INSTALLS MENU**, select the "X.EZ" *Icon*. The Dot Matrix Display will indicate the **INSTALL EXTRA EASY**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Difficulty** level.

Installs Menu continued on the next page.



Install Easy

To initiate, from the **INSTALLS MENU**, select the "EASY" *Icon*. The Dot Matrix Display will indicate the **INSTALL EASY**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Difficulty** level.



Install Medium (Normal or Factory Settings)

To initiate, from the **INSTALLS MENU**, select the "FACT" *Icon*. The Dot Matrix Display will indicate the **INSTALL MEDIUM**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Difficulty** level.



Install Hard

To initiate, from the **INSTALLS MENU**, select the "HARD" *Icon*. The Dot Matrix Display will indicate the **INSTALL HARD**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Difficulty** level.



Install Extra Hard

To initiate, from the **INSTALLS MENU**, select the "X.HD" *Icon*. The Dot Matrix Display will indicate the **INSTALL EXTRA HARD**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Difficulty** level.



Install 3-Ball or 5-Ball

To initiate, from the **INSTALLS MENU**, select either the "3BAL" or "5BAL" *Icons*. The Dot Matrix Display will indicate the **INSTALL 3-BALL** or **5-BALL** depending on choice. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Type** to 3 Balls per game
(Factory Default is 3 Balls per game, not including extra balls earned by the player, if any).



Install Competition

To initiate, from the **INSTALLS MENU**, select the "COMP" *Icon*. The Dot Matrix Display will indicate the **INSTALL COMPETITION**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Type** to "Tournament" Rules. *Programming varies and is subject to change.*



Install Director's Cut

To initiate, from the **INSTALLS MENU**, select the "DCUT" *Icon*. The Dot Matrix Display will indicate the **INSTALL DIRECTOR'S CUT**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Type** to programmer's choice. *Programming varies and is subject to change.*



Install Home Play

To initiate, from the **INSTALLS MENU**, select the "HOME" *Icon*. The Dot Matrix Display will indicate the **INSTALL HOME PLAY**. Follow the on-screen prompts to perform the **Install**. Set the **Game Play Type** to "Home" Rules. *Programming varies and is subject to change.*



Install Novelty

To initiate, from the **INSTALLS MENU**, select the "NOV" *Icon*. The Dot Matrix Display will indicate the **INSTALL NOVELTY**. Follow the on-screen prompts to perform the **Install**.
***** This setting is recommended where local laws restrict certain game features. *****
Set the **Game Play Type** to "Restricted" Rules. *Programming varies and is subject to change.*



Install Add-A-Ball

To initiate, from the **INSTALLS MENU**, select the "A.A.B." *Icon*. The Dot Matrix Display will indicate the **INSTALL ADD-A-BALL**. Follow the on-screen prompts to perform the **Install**.
***** This setting is recommended where local laws restrict certain game features. *****
Set the **Game Play Type** to "Restricted" Rules. *Programming varies and is subject to change.*



Install Factory

To initiate, from the **INSTALLS MENU**, select the "FACT" *Icon*. The Dot Matrix Display will indicate the **INSTALL FACTORY**. Follow the on-screen prompts to perform the **Install**. **▲ CAUTION!** All **Standard and Feature Adjustments** which were changed in the **INSTALLS MENU** or **ADJUSTMENTS MENU** are returned to the **Factory Defaults** (as indicated in the Dot Display in the **ADJUSTMENTS MENU**). *Note:* To perform a complete **Factory Reset**, **GO TO THE RESETS MENU**. Escape back to the **UTILITIES MENU**, select the "RESET" *Icon*, then select the "FACT" *Icon* in the **RESETS MENU** (review the end of this section, **Reset Factory Settings**).



Enter Custom Message

To initiate, from the **UTILITIES MENU**, select the "ABCD CUST MSG" *Icon*. The **SET CUSTOM MESSAGE** (a short-cut for Standard Adjustment 41, **Custom Message**) provides an opportunity to have a text message appear in the the **Attract Mode**. Follow the on-screen prompts to complete [END].

Remember, use the **GREEN Button** to go [**BACK**], exit or escape, the **RED Buttons** to [< / -] MOVE LEFT / CHOOSE NEXT [+ / >] MOVE RIGHT / CHOOSE PREVIOUS, and the **BLACK Button** to [**SELECT**] as 'OK'.



Set Custom Pricing

To initiate, from the **UTILITIES MENU**, select the "PRIC" *Icon*. The **CUSTOM PRICING MENU** (a short-cut for Standard Adjustment 18, **Game Pricing**, and setting selected is **CUSTOM**) provides an opportunity to set **Custom Pricing**.

Note ! MONETARY AMOUNT MUST BE SELECTED FIRST! Press [**BACK**] to - DECREASE or [**SELECT**] to + INCREASE the [< \$ >] **monetary amount** (e.g. look at the right side of the display from \$0.25 to \$0.50). Press [< / -] to - DECREASE or [+ / >] to + INCREASE the **credit quantity** (e.g. look at the left side of the display from 0 CREDITS AT: to 1 CREDIT AT:).

REMINDER
In these menus:

Press [**BACK**] to - DECREASE [< \$]

Press [**SELECT**] to + INCREASE [\$ >]

IF EXAMPLE CUSTOM PRICING SETTING DESIRED IS :

1 Play for \$0.50, 3 Plays for \$1.00 and 7 Plays for \$2.00

THEN YOU WILL NEED TO PERFORM THE FOLLOWING :

Step 1 The starting display appears as below if no prior **Custom Pricing** was installed.

CUSTOM PRICING	
0 CREDITS AT:	\$0.25
USE -/+ TO CHANGE CREDITS	

Step 2 Press [**SELECT**] to + INCREASE to \$0.50.
Press [+ / >] to + INCREASE to 1 CREDIT AT:

CUSTOM PRICING	
1 CREDIT AT:	\$0.50
1/0.50	
USE -/+ TO 'INSTALL'	

Step 3 Press [**SELECT**] to + INCREASE to \$1.00.
Press [+ / >] to + INCREASE to 2 CREDITS AT:

CUSTOM PRICING	
2 CREDITS AT:	\$1.00
1/0.50 3/1.00	
USE -/+ TO CHANGE CREDITS	

Step 4 Press [**SELECT**] to + INCREASE to \$2.00.
Press [+ / >] to + INCREASE to 4 CREDITS AT:

CUSTOM PRICING	
4 CREDITS AT:	\$2.00
1/0.50 3/1.00 7/2.00	
USE -/+ TO CHANGE CREDITS	

Step 5 Press [**SELECT**] to + INCREASE the amount once (example = \$2.25).

CUSTOM PRICING	
0 CREDITS AT:	\$2.25
1/0.50 3/1.00 7/2.00	
USE -/+ TO 'INSTALL'	

Press [< / -] once or press [+ / >] eleven times until **INSTALL** appears.

Step 6 Press [**SELECT**] to **INSTALL**.
Press [< / -] / [+ / >] or [**BACK**] to edit.

CUSTOM PRICING	
INSTALL	
1/0.50 3/1.00 7/2.00	
PRESS 'SELECT' TO INSTALL	

Step 7 Press [**SELECT**], press [**BACK**] twice to exit the **SERVICE MENU** with your **Custom Pricing** installed.

CUSTOM PRICING	
INSTALLED	
PRESS 'SELECT' TO CONTINUE	

To correct or make new changes, reenter, which brings you to **Step 6**. Press [**BACK**] repeatedly until the monetary amount shown is the desired amount and then continue following the above steps with your new or corrected settings. If you are still having difficulty or if you have any questions, please call Technical Support 800-542-5377 or 708-345-7700, option 1.



Set Date / Time

To initiate, from the **UTILITIES MENU**, select the "TIME" *Icon*. The **SET TIME MENU** appears with the **MONTH** flashing. Setting the date and time is required for 'Data Dumps' and Tournament Start and End Dates. If the setting of Standard Adjustment 61, **Time Format**, is set to **12-HOUR** (*Factory Default*) the time will be expressed in the **AM / PM format**. If Standard Adjustment 61, **Time Format**, is set to **24-HOUR** the time will be expressed in the **24-hour format**.



Go To Resets Menu

To initiate, from the **UTILITIES MENU**, select the "RESET" *Icon*. The **RESETS MENU** provides six (6) functions to reset *only the Coin Audits*, reset *only the Game Audits*, reset *only the Grand Champion Score*, reset *only the High Score(s)*, reset *only the paid Credits (includes Service Credits)* or to reset **ALL DATA** back to the **Factory Default Settings**.



Reset Coin Audits

To initiate, from the **RESET MENU**, select the "COIN" *Icon*. ⚠ **ONLY the Coin Audits** [Earnings Audits 5–12], will be reset to zero (0), *Factory Default Settings*. Follow the on-screen prompts to perform the **Reset**.



Reset Game Audits

To initiate, from the **RESET MENU**, select the "AUD" *Icon*. ⚠ **ONLY the Game Audits** [Earnings Audits 1–4, Standard Audits 1–59 and Feature Audits 1–XX*], will be reset to zero (0), *Factory Default Settings*. Follow the on-screen prompts to perform the **Reset**. *varies per game title.



Reset Grand Champion (Score)

To initiate, from the **RESET MENU**, select the "GC" *Icon*. ⚠ **ONLY the Grand Champion Score** [adjustable via Standard Adjustment 31], will be reset to *Factory Default Setting*. Follow the on-screen prompts to perform the **Reset**.



Reset High Scores

To initiate, from the **RESET MENU**, select the "HSTD" *Icon*. ⚠ **ONLY the High Score(s)** [adjustable via Standard Adjustments 32–35], will be reset to *Factory Default Setting(s)*. Follow the on-screen prompts to perform the **Reset**. **Note:** *High Scores (but not Grand Champion Score) are reset automatically every 2,000 games (Factory Default Setting) [adjustable via Standard Adjustment 37, HSTD Reset Count]*.



Reset Credits

To initiate, from the **RESET MENU**, select the "CRED" *Icon*. ⚠ **ONLY the Credits (includes Service Credits)** [adjustable via Standard Adjustment 23, **Credit Limit**], will be reset to zero (0), *Factory Default Settings*. Follow the on-screen prompts to perform the **Reset**.



Reset Factory Settings

To initiate, from the **RESET MENU**, select the "FACT" *Icon*. ⚠ **ALL GAME DATA IS RESET!** (*with the exception of Earnings Audit 13, Software Meter*). **NOTE: IF YOU HAD SET-UP CUSTOM PRICING OR HAD CHANGED ANY ADJUSTMENTS OR PERFORMED INSTALLS, IT IS SUGGESTED TO WRITE DOWN YOUR CHANGES PRIOR TO THE FACTORY RESET.** Follow the on-screen prompts to perform the **Reset**.



Go To USB Menu

To initiate, from the **UTILITIES MENU**, select the "USB" *Icon*. The **USB MENU** provides three (3) functions to download game data, update your game code or backup your code onto a USB Memory Stick. *Review the inside cover for information on how to update your game code.*



Update Game Code

To initiate, from the **USB MENU**, select the "UPDT" *Icon*. Follow the on-screen prompts or review the inside cover for more information.



Backup to USB Memory Stick

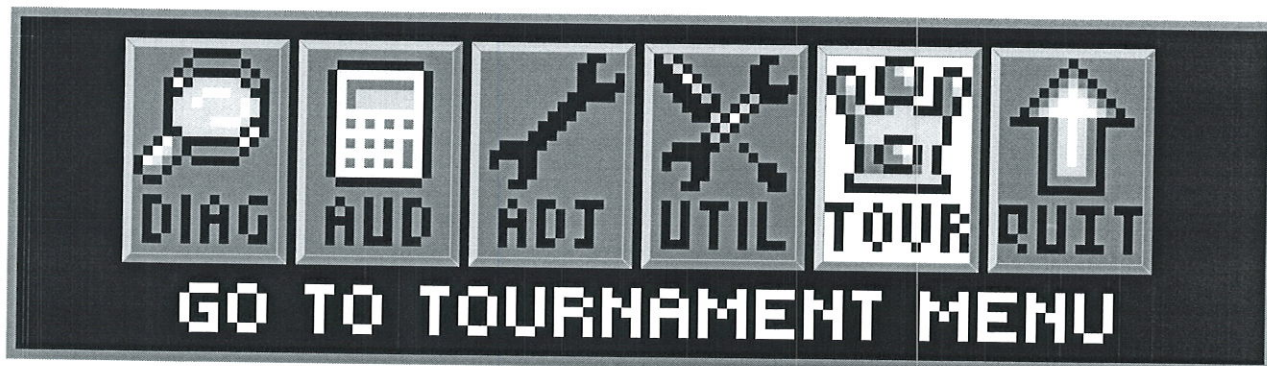
To initiate, from the **USB MENU**, select the "BKUP" *Icon*. Follow the on-screen prompts to perform a **Backup** (game code only). This backup feature does not retain adjustments and/or settings changes made.



Dump Audits to USB

To initiate, from the **USB MENU**, select the "DUMP" *Icon*. Follow the on-screen prompts to perform a **Data Dump** (download).

Note: *If Icon is not present, access via the Audits Menu, see the Audits Section.*



To initiate, from the **MAIN MENU**, select the "TOUR" *Icon*. The **TOURNAMENT MENU** provides ways to quickly and easily start and stop a tournament. Also, tournament data can be viewed (*audits, prize info, etc.*).

All **TOURNAMENT MENU** *Icons* and there usages are explained throughout this chapter in the same order as seen in the Dot Matrix Display. **NOTE:** Depending on Game Type, Version, selections made, Dip Switch settings, location and/or areas, some *Icons* may appear non-functional or may not appear at all. **Icons and/or functions, order and operation are subject to change.**

In displays where changes can be made or to perform a function, use the **GREEN Button** to go [**BACK**], exit or escape, the **RED Buttons** to [< / -] HIGHLIGHT PREVIOUS or DECREASE / [+ / >] HIGHLIGHT NEXT or INCREASE to highlight the desired option, and the **BLACK Button** to [**SELECT**] it or activate.



Start Tournament

To initiate, from the **TOURNAMENT MENU**, select the "STRT" *Icon*. The **START TOURNAMENT MENU** allows the operator to start a tournament. Select **QUICK START** or **CUSTOM** Tournament Start. For the first time Tournament Set-Up, it is recommended to select **CUSTOM**. Follow the on-screen prompts. After completion of all options in **QUICK START** or **CUSTOM**, the Tournament is started, the **START TOURNAMENT MENU** is exited and returns to the **TOURNAMENT MENU**.

QUICK START :

Increase or decrease the: • **DAYS, HOURS and MINUTES** • **PRIZE POOL \$ (DOLLAR) and ¢ (CENT) AMOUNT**
• **INCREMENT THE PRIZE POOL PER PLAY INCREASES \$ and ¢ AMOUNT**

CUSTOM START :

- Confirm the current date and time (*if it was not set previous via the UTILITIES MENU it can be set-up in this display as well*). Enter the **MONTH, DAY, YEAR** and **TIME**
- Choose the Tournament **Start Date: MONTH, DAY, YEAR** and **TIME**
- Choose the Tournament **End Date: MONTH, DAY, YEAR** and **TIME**
- Choose the **CREDITS** per play desired (01-10). Set the maximum number of *Credits* that may be accumulated per game. **Note:** The current pricing is displayed; to change pricing **GO TO THE ADJUSTMENTS MENU**.

Increase or decrease the: • **PRIZE POOL \$ (DOLLAR) and ¢ (CENT) AMOUNT**
• **INCREMENT THE PRIZE POOL PER PLAY INCREASES \$ and ¢ AMOUNT**
• **MAXIMUM (CAP) PRIZE POOL \$ and ¢ AMOUNT.**

- Increase or decrease the number of **PRIZES** (01-05 **HIGH SCORE**; 02-05 **B'N'W**). Set the maximum # of *Prize Positions* to be awarded during a Tournament. **Selections are as follows** (% distribution cannot be changed):

HIGH SCORE:				BUMP N' WIN :			
Set to 01	1 Winner	100% (1)	Prize Pool	Cannot set to 01. Minimum of 2 winners required.			
Set to 02	2 Winners	65% (1)	35% (2)	Set to 02	2 Winners	65% (1)	35% (2)
Set to 03	3 Winners	50% (1)	30% (2) 20% (3)	Set to 03	3 Winners	50% (1)	25% (2) 25% (3)
Set to 04	4 Winners	50% (1)	25% (2) 15% (3) 10% (4)	Set to 04	4 Winners	40% (1)	20% (2) 20% (3) 20% (4)
Set to 05	5 Winners	50% (1)	20% (2) 15% (3) 10% (4) 5% (5)	Set to 05	5 Winners	40% (1)	15% (2) 15% (3) 15% (4) 15% (5)

- Select the **AWARD TYPE** (CASH, POINTS, PRIZE, TICKETS or NONE). Select **CASH** for the displays to represent the Prize Pool amount (*based on Jackpot Base and Max.*) in **\$Dollars**. Select **POINTS** for the display to represent the Prize Pool amount in **Points**. Select **PRIZE**, if applicable. Select **TICKET** for the display to represent the Prize Pool amount in **Tickets**. Select **NONE NOT TO** represent anything.

POWER REQUIREMENTS



This game **must be connected to a properly grounded outlet to reduce shock hazard** and insure proper game operation. See the Yellow Pages (Schematics & Wiring), for transformer connections required for **Normal, High, and Low Line** conditions.



Normal Line:		110v AC - 125v AC @ 60Hz	
Domestic use an 8AMP 250v Slo-Blo Fuse.	AVG OPERATION		MAX OPERATION
	CURRENT: 2.8AMP	CURRENT: 8AMP	
	WATTAGE: 329w	WATTAGE: 940w	
High Line:		218v AC - 240v AC @ 50Hz	
Export use 2x 5AMP 250v Slo-Blo Fuses. (*England & Hong Kong use an 8AMP 250v S/B Fuse.)	AVG OPERATION		MAX OPERATION
	CURRENT: 1.8AMP	CURRENT: 5AMP	8AMP*
	WATTAGE: 412w	WATTAGE: 1145w	1832w*
Low Line:		95v AC - 108v AC @ 50Hz / 60Hz	
Export Japan Only use an 8AMP 250v Slo-Blo Fuse.	AVG OPERATION		MAX OPERATION
	CURRENT: 2.6AMP	CURRENT: 8AMP	
	WATTAGE: 264w	WATTAGE: 812w	

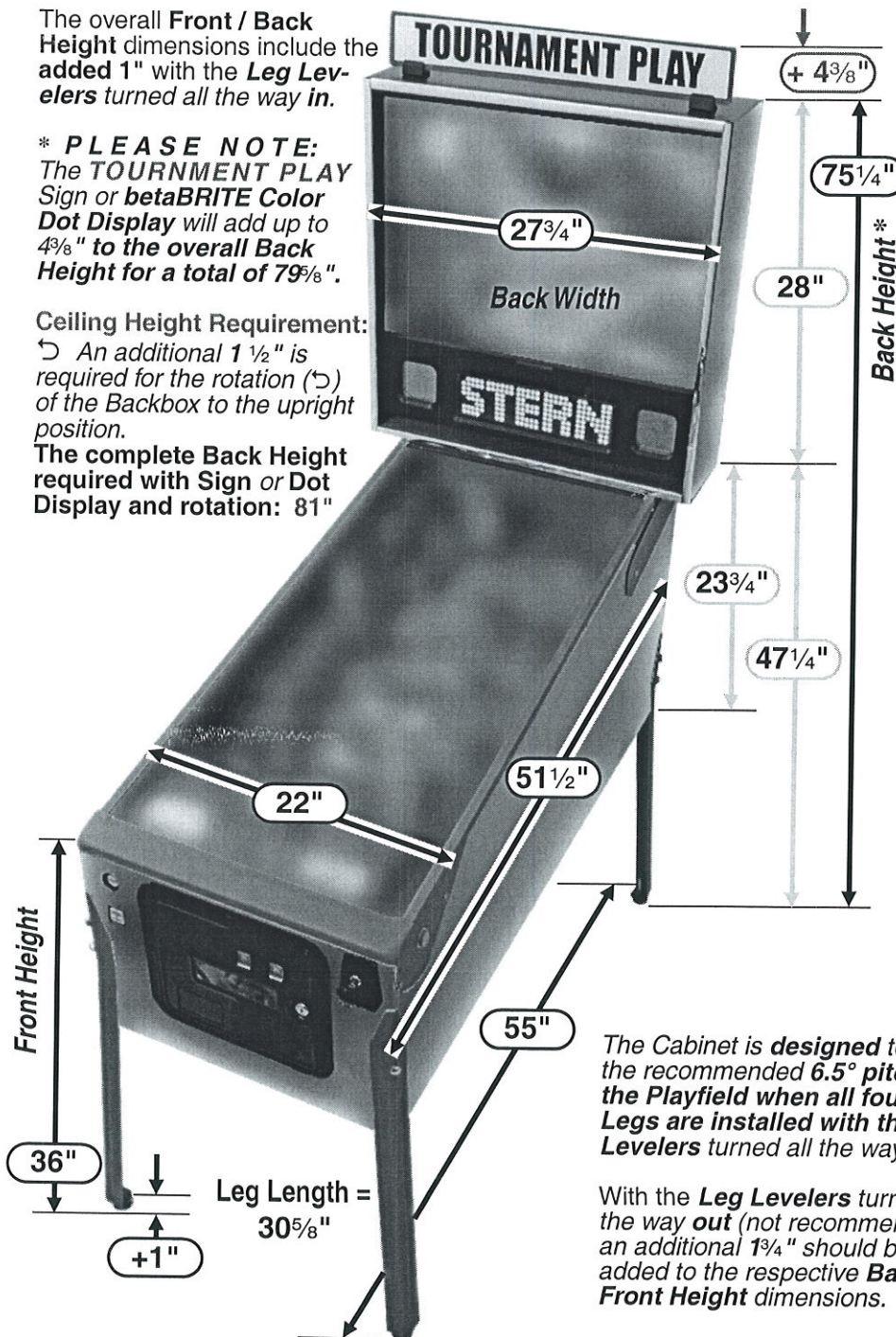
GAME DIMENSIONS

TRANSPORTATION

The overall **Front / Back Height** dimensions include the added 1" with the **Leg Levelers** turned all the way in.

*** PLEASE NOTE:**
The **TOURNAMENT PLAY Sign** or **betaBRITE Color Dot Display** will add up to $4\frac{3}{8}"$ to the overall **Back Height** for a total of $79\frac{1}{8}"$.

Ceiling Height Requirement:
↵ An additional $1\frac{1}{2}"$ is required for the rotation (↵) of the Backbox to the upright position.
The complete **Back Height** required with **Sign** or **Dot Display** and rotation: **81"**



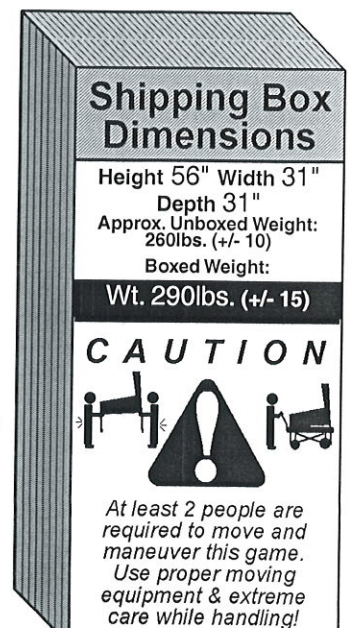
BEFORE TRANSPORTING



To reduce the possibility of damage, observe **ALL** precautions whenever transporting the game.

Read & follow the next page on How to Secure the Backbox for Transporting.
Remove the legs and secure the game within the transporting vehicle.

SAVE AND RETAIN ALL PRINTED INFORMATION INSIDE THE CABINET !

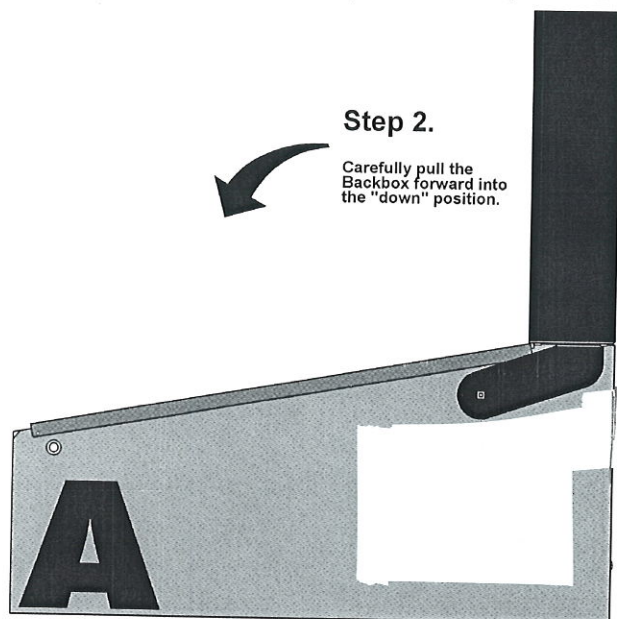


The Cabinet is **designed** to give the recommended **6.5° pitch** to the Playfield when all four (4) Legs are installed with the **Leg Levelers** turned all the way in.

With the **Leg Levelers** turned all the way **out** (not recommended), an additional $1\frac{1}{4}"$ should be added to the respective **Back** or **Front Height** dimensions.

How to Secure the Backbox for Transporting

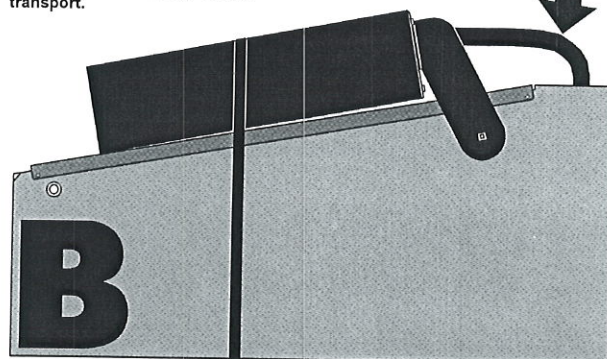
For more Backbox details & part numbers, see the Pink Pages (*Parts Identification & Location, Backbox ...*).



Step 3.

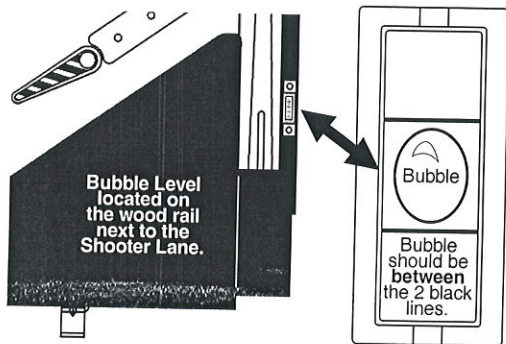
The top of the Backbox will rest on the Pinball Side Armor. Strap or tie down the Backbox to keep from "bouncing" during transport.

Ensure Cables do not bind, pinch or are being pulled tight. Hand-Feed out with Backbox so Cables are not tight.



Leg Leveler Adjustment

Attach the four (4) Leg Assemblies to cabinet corners with the eight (8) leg bolts provided.



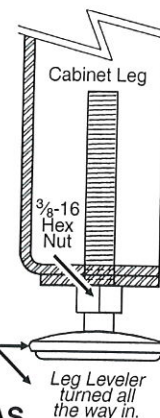
Start adjustment with the leg levelers turned all the way in.

View the bubble in the level provided on the right side wood rail.

Adjust the front or rear levelers as necessary to cause the bubble to float between the two (2) black lines.

Use a pinball to roll down the center of the playfield for side-to-side leveling.

YOUR PLAYFIELD PITCH IS NOW AT 6.5° AS REQUIRED FOR PROPER GAME PLAY!



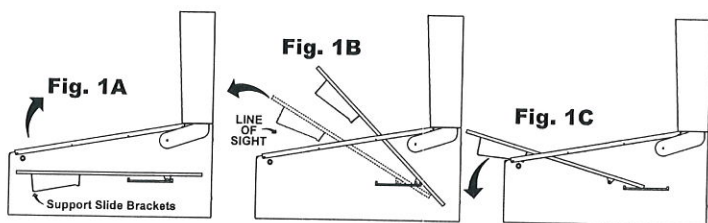
Note: For custom adjustment greater than >6.5° can be achieved by turning out the rear leg leveler(s), however, it is not recommended.

Easy Access Service System - 2 Positions

With the front molding & glass removed, carefully lift the playfield (take care when using the Bottom Arch to hoist).

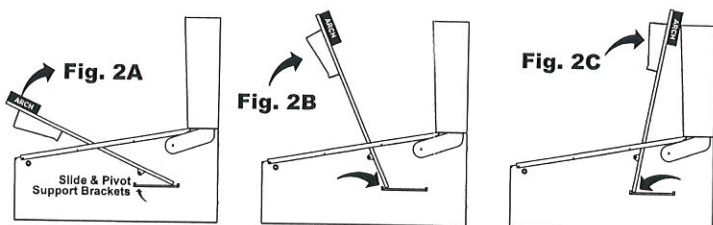
Position 1

When lifted high enough, the **Playfield Support Slide Brackets** (Fig. 1A) can be seen and can clear the cabinet front (Fig. 1B). At this time, pull the playfield toward the front of the cabinet, checking that the mechanical components clear the cabinet front, then rest the playfield on the **Playfield Support Slide Brackets** at the front channel of cabinet (Fig. 1C);



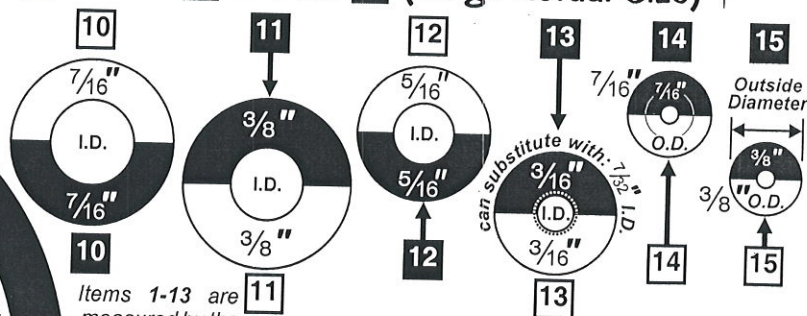
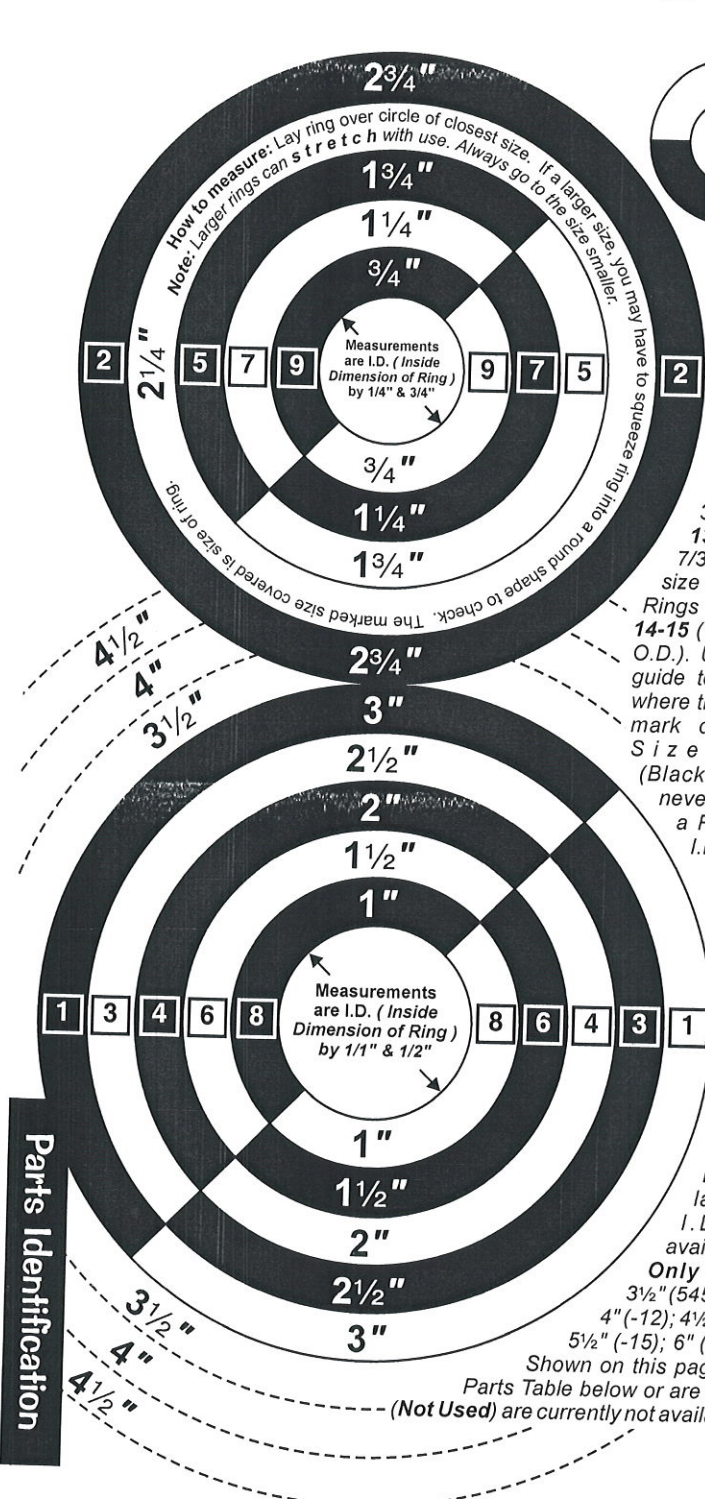
Position 2

With the playfield at rest, hold the sides & pull toward the front of the cabinet (approx. 6" to 8"), until resistance is felt from **Edge Slide Brackets** stopping against the **Slide & Pivot Support Brackets** located on either side of the cabinet (Fig. 2A). At this time, swivel the playfield toward the Backbox, then rest on the top edge (Fig. 2B & 2C).



Game Name	CPU Bd. No.	I/O PWR DRV Bd. No.	U9 Pinball Boot ROM
World Poker Tour	520-5246-00	520-5249-00	V3.1
Pirates Of The Caribbean	520-5246-00	520-5249-00	V3.1
Family Guy	520-5246-00	520-5249-00	V3.1
Spider-Man	520-5246-00	520-5249-00	V3.1
Wheel Of Fortune	520-5246-00	520-5249-00	V3.1
NBA	520-5246-00	520-5249-00	V3.1
CSI	520-5246-00	520-5249-00	V3.1
Batman	520-5246-00	520-5249-00	V3.1
Indiana Jones	520-5246-00	520-5249-00	V3.1
Shrek	520-5246-00	520-5249-00	V3.1
24	520-5246-00	520-5249-00	V3.1
Avatar	520-5246-00	520-5249-00	V3.1
Big Buck Hunter	520-5246-00	520-5249-00	V3.1
Iron Man	520-5246-00	520-5249-00	V3.1
The Rolling Stones	520-5246-00	520-5249-00	V3.1
Tron	520-5246-00	520-5249-00	V3.1
Avatar L/E	520-5303-03	520-5249-00	V3.1
The Rolling Stones L/E	520-5303-03	520-5249-00	V3.1
Tron L/E	520-5303-03	520-5317-00	V3.1
Transformers	520-5246-02	520-5249-00	V2.0
Transformers L/E	520-5303-04	520-5317-00	V2.0
AC/DC	520-5337-01	520-5249-00	AC/DC 1.0
AC/DC (L/E)	520-5337-00	520-5317-00	AC/DC 1.0
X-MEN	520-5246-02	520-5249-00	V2.0
X-MEN (L/E)	520-5303-04	520-5317-00	V2.0
Avengers	520-5246-02	520-5249-00	V2.0
Avengers L/E	520-5303-04	520-5317-00	V2.0
Metallica	520-5337-01	520-5249-00	V1.0
Metallica L/E	520-5337-00	520-5317-00	V1.0
Star Trek	520-5352-00	520-5249-00 (REV. D)	V1.0 (64M)
Star Trek L/E	520-5352-01	520-5317-00	V1.0 (64M)
Mustang	520-5352-00	520-5249-00 (REV. D)	V1.0 (64M)
Mustang L/E	520-5352-01	520-5249-00 (REV. D)	V1.0 (64M)
Batman (Standard)	520-5303-00	520-5249-00	V3.1
Iron Man (Classic)	520-5303-01	520-5304-00	Not Used
The Simpsons Kooky Carnival (RED)	520-5246-00	520-5249-00	V3.1

Playfield - Rubber Parts Black ■, White □ & Blue ■ (Rings Actual Size) †



Nr.	RUBBER RINGS	QTY.	SPI PART Nr.
1	3" I.D. Rubber Ring BLACK		545-5348-10
	3" I.D. Rubber Ring WHITE		545-5348-60
2	2 3/4" I.D. Rubber Ring BLK		545-5348-20
	2 3/4" I.D. Rubber Ring WHT	N/U	545-5348-70
3	2 1/2" I.D. Rubber Ring BLK	2	545-5348-09
	2 1/2" I.D. Rubber Ring WHT		545-5348-59
4	2" I.D. Rubber Ring BLACK		545-5348-08
	2" I.D. Rubber Ring WHITE		545-5348-58
5	1 3/4" I.D. Rubber Ring BLK		545-5348-21
	1 3/4" I.D. Rubber Ring WHT	N/U	545-5348-71
6	1 1/2" I.D. Rubber Ring BLK		545-5348-07
	1 1/2" I.D. Rubber Ring WHT		545-5348-57
7	1 1/4" I.D. Rubber Ring BLK	3	545-5348-06
	1 1/4" I.D. Rubber Ring WHT		545-5348-56
8	1" I.D. Rubber Ring BLACK	4	545-5348-05
	1" I.D. Rubber Ring WHITE		545-5348-55
9	3/4" I.D. Rubber Ring BLACK	2	545-5348-04
	3/4" I.D. Rubber Ring WHITE		545-5348-54
10	7/16" I.D. Rubber Ring BLK		545-5348-18
	7/16" I.D. Rubber Ring WHT		545-5348-68
11	3/8" I.D. Rubber Ring BLACK		545-5348-03
	3/8" I.D. Rubber Ring WHITE	N/U	545-5348-53
12	5/16" I.D. Rubber Ring BLK	7	545-5348-02
	5/16" I.D. Rubber Ring WHT		545-5348-52
13	3/16" I.D. Rubber Ring BLK	4	545-5348-01
	3/16" I.D. Rubber Ring WHT		545-5348-51
14	7/16" O.D. Rubber Ring BLK	10	545-5348-17
	7/16" O.D. Rubber Ring WHT		545-5348-67
Note: Item 14, 7/16" O.D. Black Rings (Qty. 44 of 49) are used to cushion the Bayonet Sockets under the playfield (between bracket & playfield).			
15	3/8" O.D. Rubber Ring BLK		545-5348-19
	3/8" O.D. Rubber Ring WHT		545-5348-69
16	Small Flipper BLACK Ring (Soft Duro)		545-5207-00
	Small Flipper RED Ring (Soft Duro)		545-5207-22
	Large Flipper BLACK Ring (50 Duro)	2	545-5277-00
	Large Flipper YELLOW Ring (50 Duro) (use -06 40 Duro)		545-5277-04
17	Large Flipper WHITE Ring (50 Duro)		545-5277-08
	Large Flipper RED Ring (Soft Duro)		545-5277-22

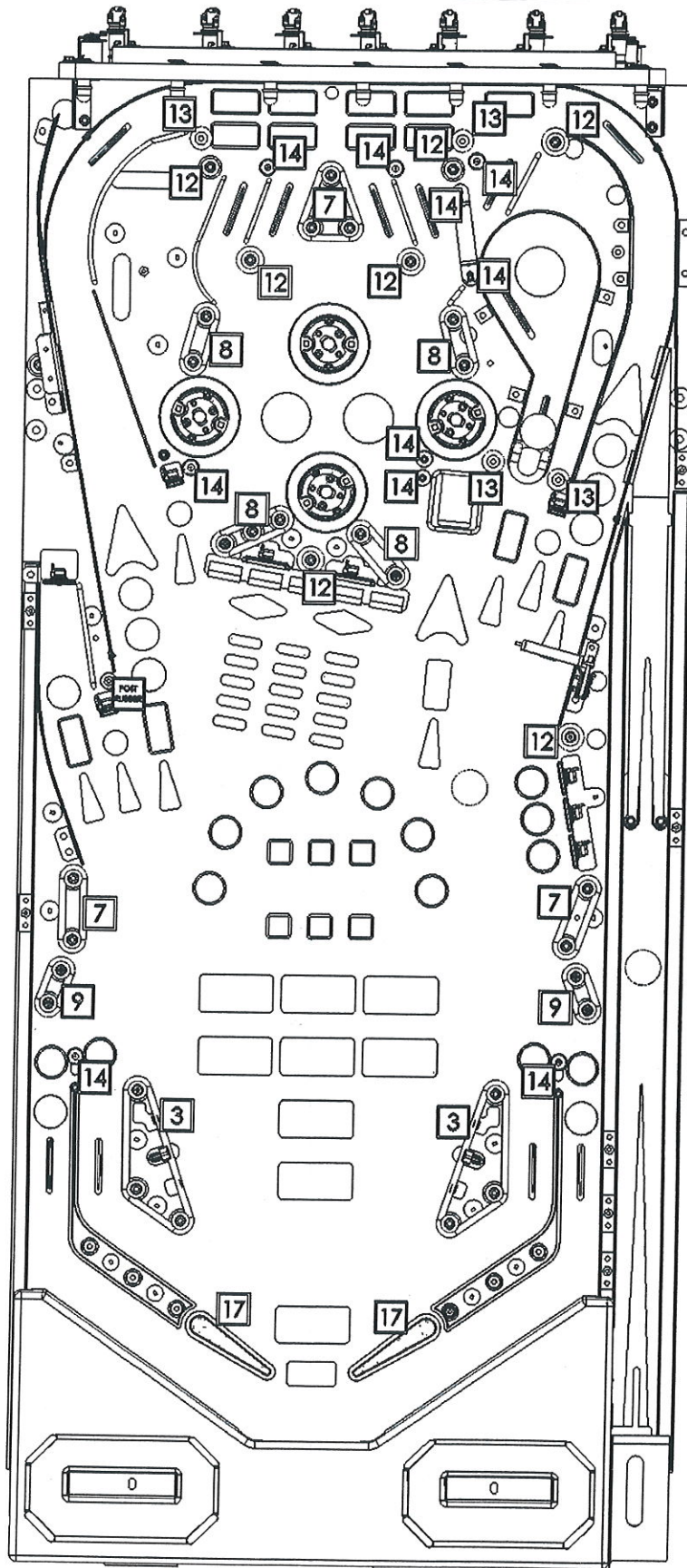
Take Note:

For Blue Rubber Pads, see the next page and/or the Blue Pages for the assembly the pads are found on for the part number.

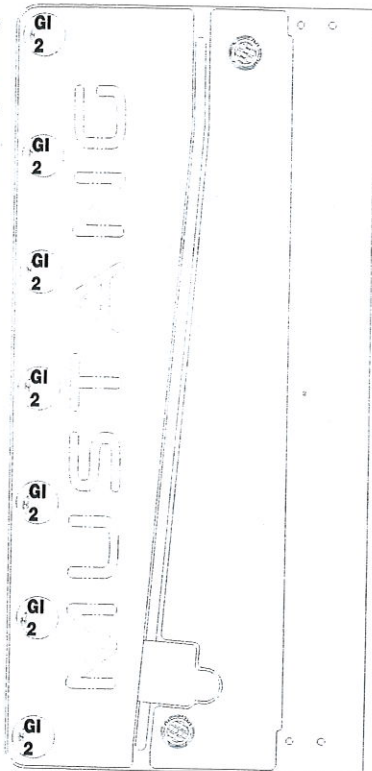
Nr.	RUBBER BUMPER PADS	QTY.	SPI PART Nr.
A*	Bumper BLK Pad (Lg. w/ grommet)	4	545-5428-00
Item A are located on Flipper Assemblies. See next page for location.			
B*	Bumper BLK Pad (Sm. w/ grommet)		545-5105-00
Item B are located on multiple assemblies. See next page for location.			

Nr.	RBR. BUMPER POST SLVS.	QTY.	SPI PART Nr.
D*	Bumper BLACK Post Sleeve (Tall)		545-5308-65
Item D in RED use 545-5308-22; Item D in WHITE use 545-5308-08.			
E*	Bumper Post Sleeve (Short)		545-5151-00

Playfield Rubber Parts

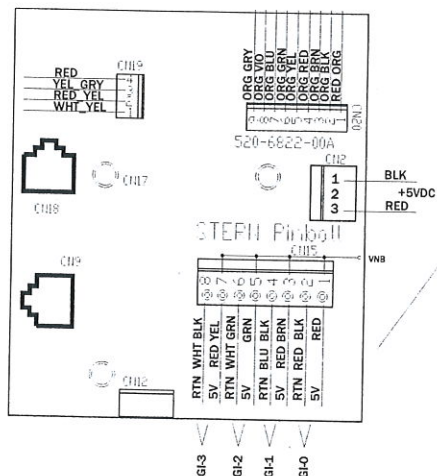


077-5000-00 (7)
STAPLE BAYONET DOCKET

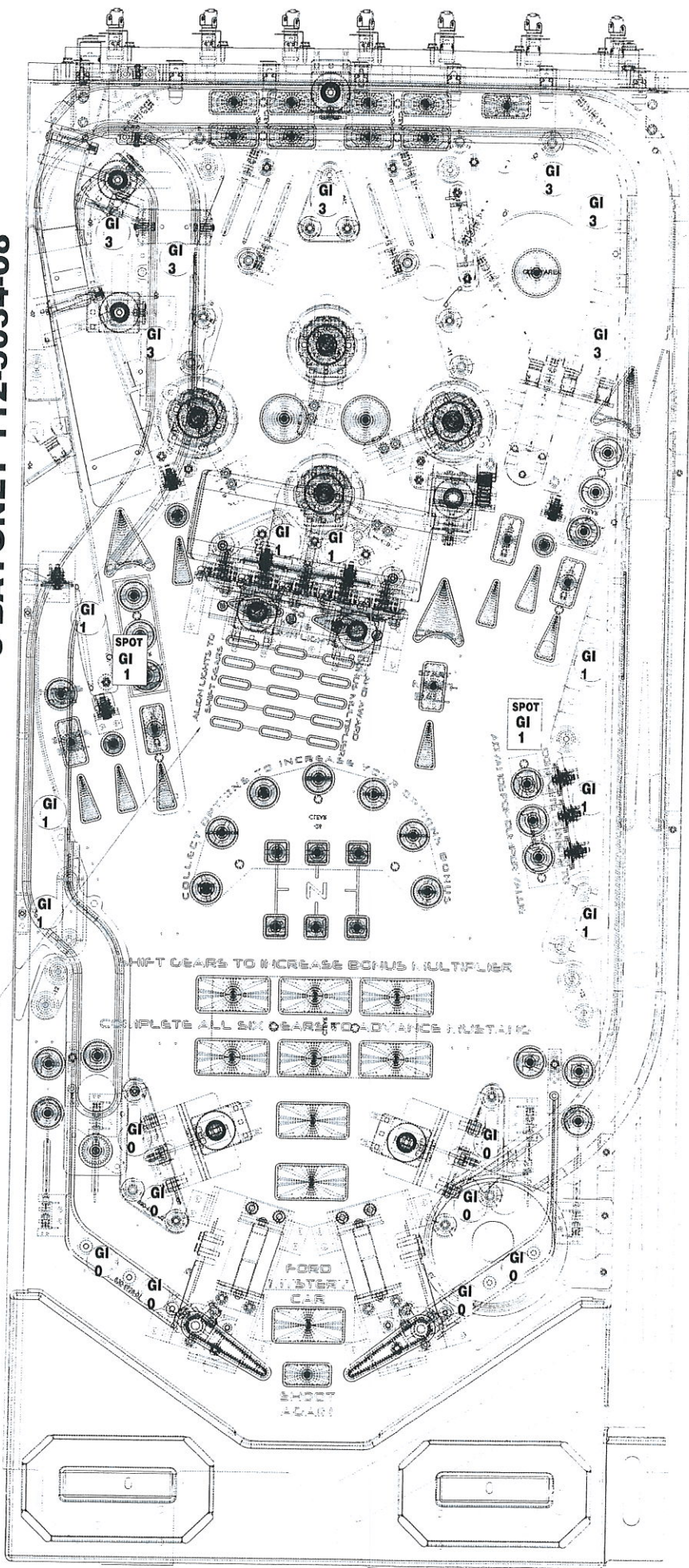


15 WEDGE BASE 112-5033-08
8 BAYONET 112-5034-08

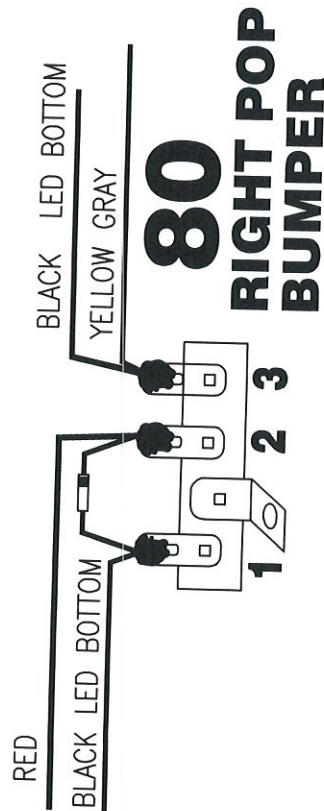
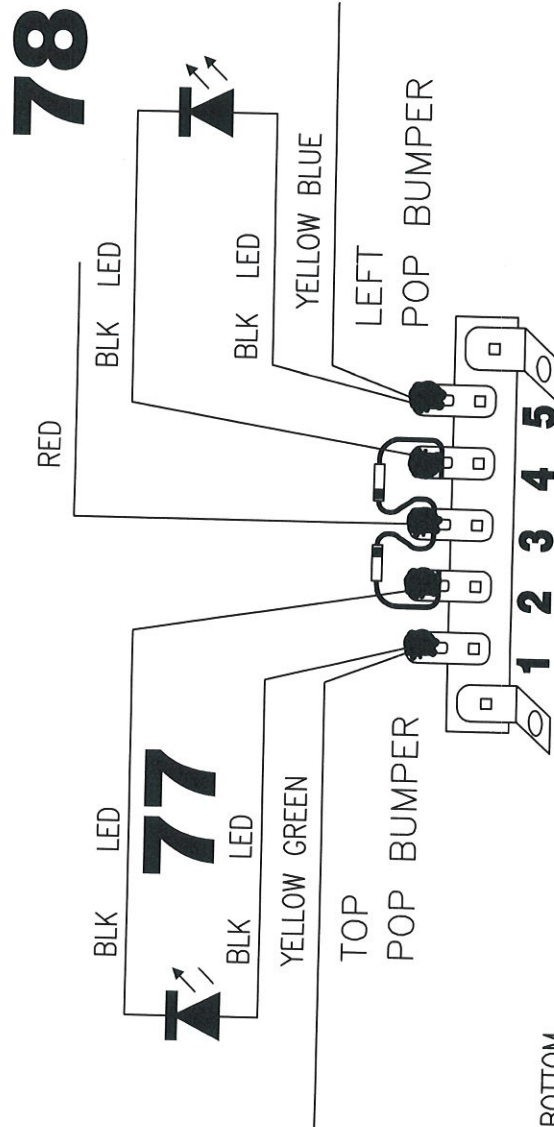
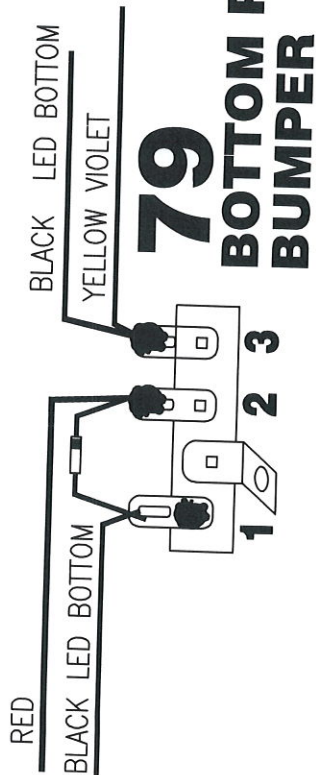
BOARD 5



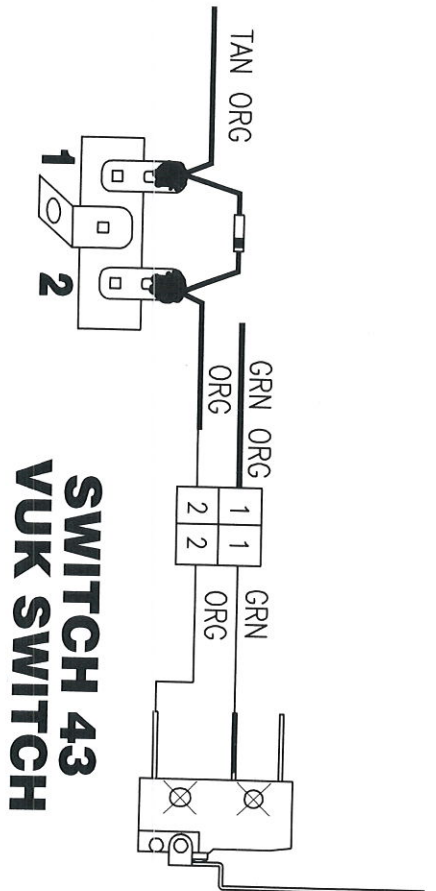
G/I MAP



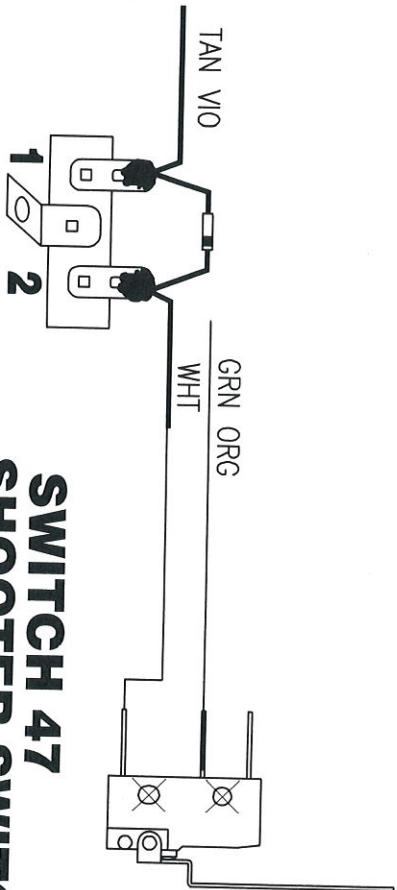
DTS LAMP



DWN.	REYNA	DATE	12-11-13	TITLE	DTS Configuration
1st USE		SCALE	1:1	REV	MUSTANG(PRO)
Stern Pinball, Inc				PART NO.	DTS-MAP
2020 JANICE AVE., MELROSE PARK, IL. 60160					



**SWITCH 43
VUK SWITCH**



**SWITCH 47
SHOOTER SWITCH**

07

DWN.	REYNA	DATE	01-10-14	TITLE	DTS Configuration
1st USE	SCALE	1:1	REV	-	MUSTANG (PRO)

Stern Pinball, Inc

2020 JANICE AVE., MELROSE PARK, IL. 60160

PART NO.

DTS-MAP

MUSTANG PRO

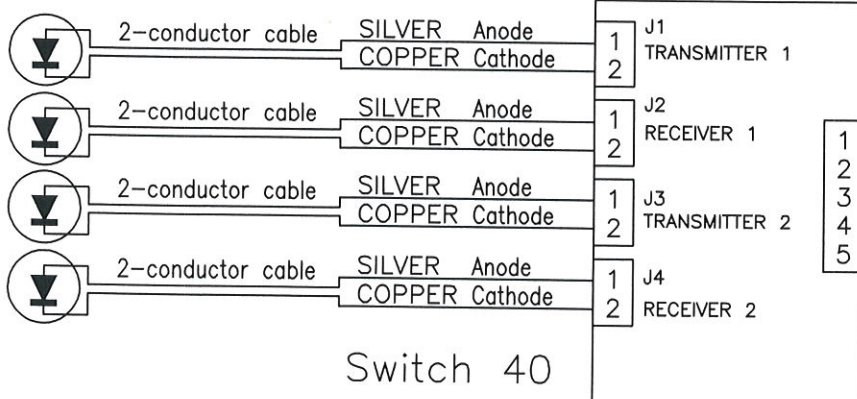
Opto Amplifier Board

Wiring Configuration

Transceiver Boards
500-6775-01

Switch 39

Amplifier Board #
520-5239-01



1	WHT	VIO	Matrix Rows	To CPU Board J6-2
2	WHT	GRY	Matrix Rows	To CPU Board J6-1
3	GRN	ORG	Matrix Columns	To CPU Board J1-4
4	BLK		Ground	To CPU Board J13 pin 10
5	RED		+5V DC	To I/O Board J16 pin 7

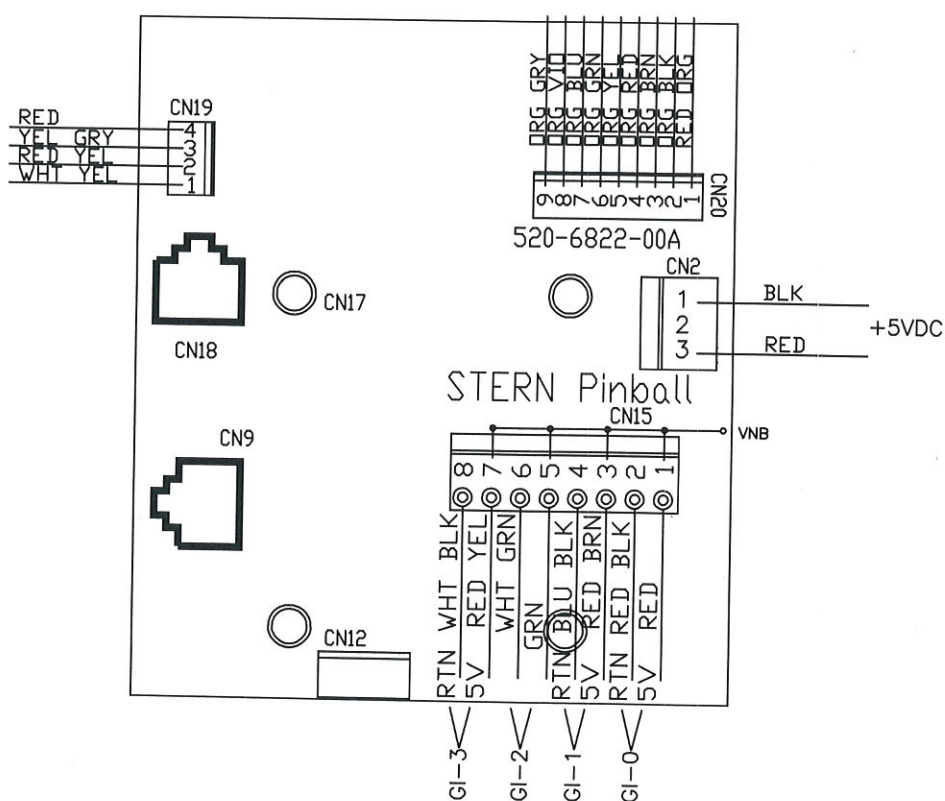
Part of Playfield Cable

Date: 12-11-13		TITLE	
Scale: N/S	Rev: -	Opto Amplifier Board Wiring	
STERN		DWN. REYNA	41
PINBALL, INC.		1st USE MUSTANG	

MUSTANG

TOP LED Board 520-6822-00

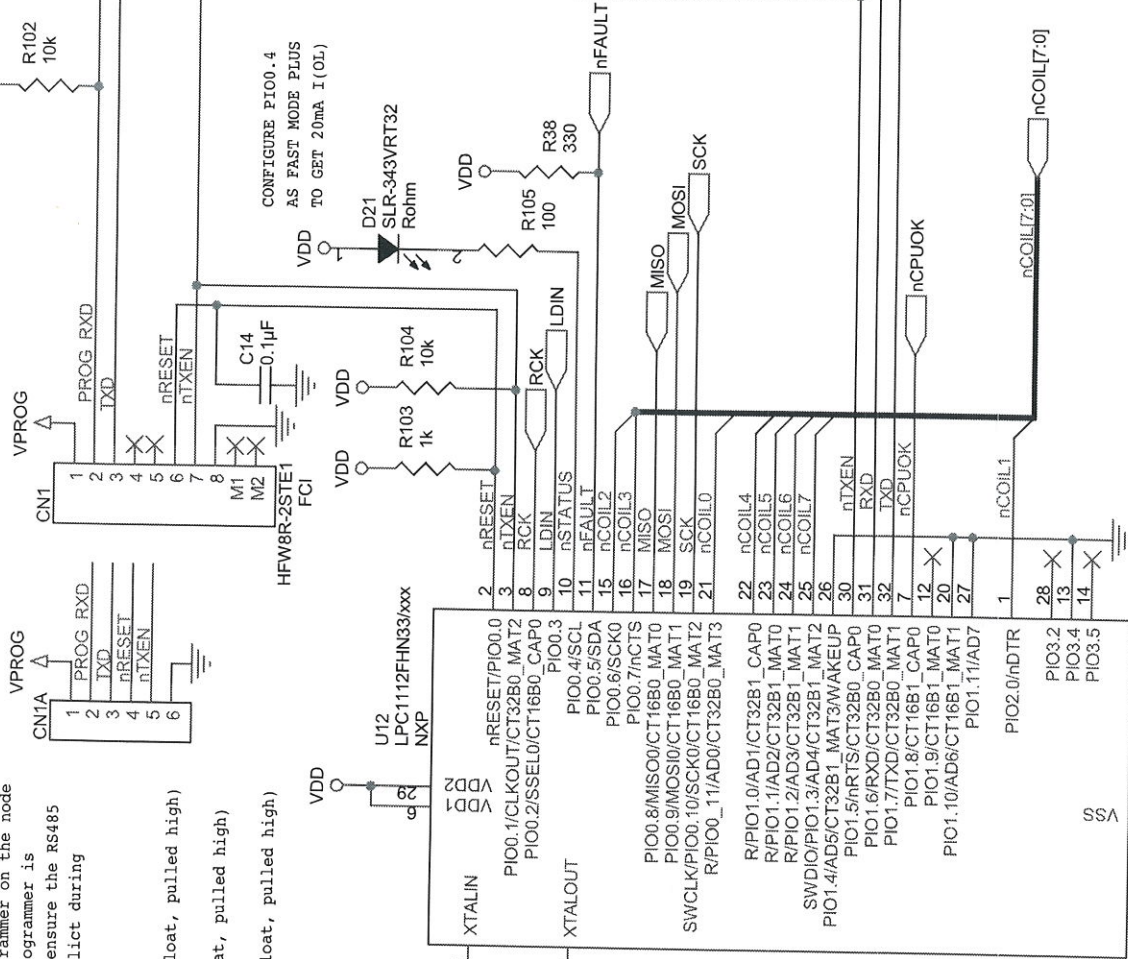
Board 5



- 1) drive nRESET low
- 2) drive nISP low
- 3) release nRESET (float, pulled high)
- 4) download new code
- 5) release nISP (float, pulled high)
- 6) drive nRESET low
- 7) release nRESET (float, pulled high)

VBB=48V
VNB=8V
VLED=6V
VCC=5V
VDD=3.3V

LPC1112
inputs are
5V tolerant
when not
configured
as ADC



FIDUCIALS **MOUNTING HOLES**

Title		Top-- cpu	
Size	A	Document Number	520-6822-00
Date:	Friday, January 17, 2014	Sheet	4 of 4
		Rev	A

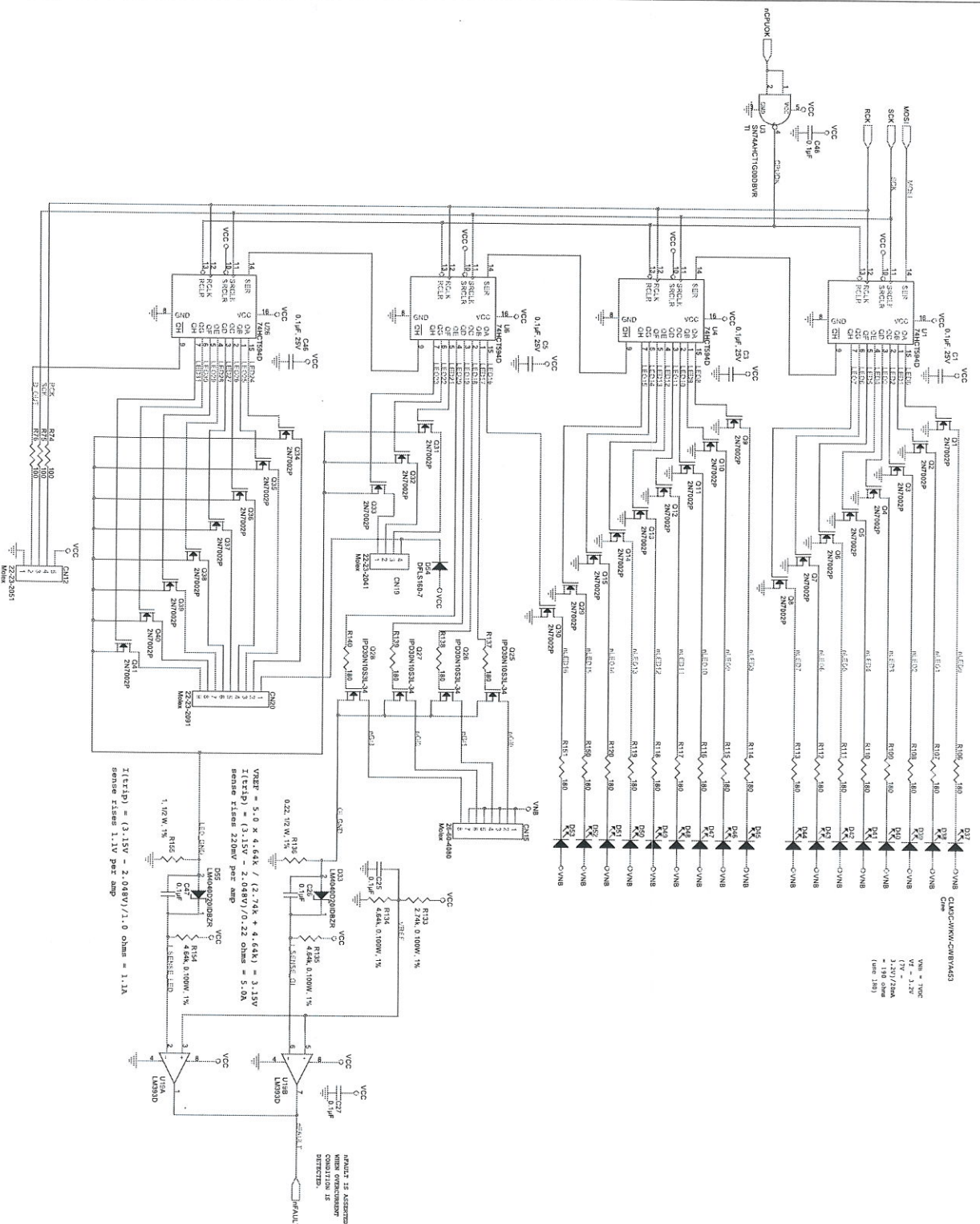
PI01.10/AD6 TIED LOW
INDICATES TXEN AND COIL
OUTPUTS SHOULD BE ACTIVE
LOW (WERE ACTIVE HIGH ON
EARLIER VERSIONS)

```

MODE ADDRESS CODING:
    PI01.11: b3 (0=HARD WIRED, 1=SWITCHABLE)
    PI03.2: b2
    PI03.4: b1
    PI03.5: b0
    HARD WIRED TO ADDRESS 5

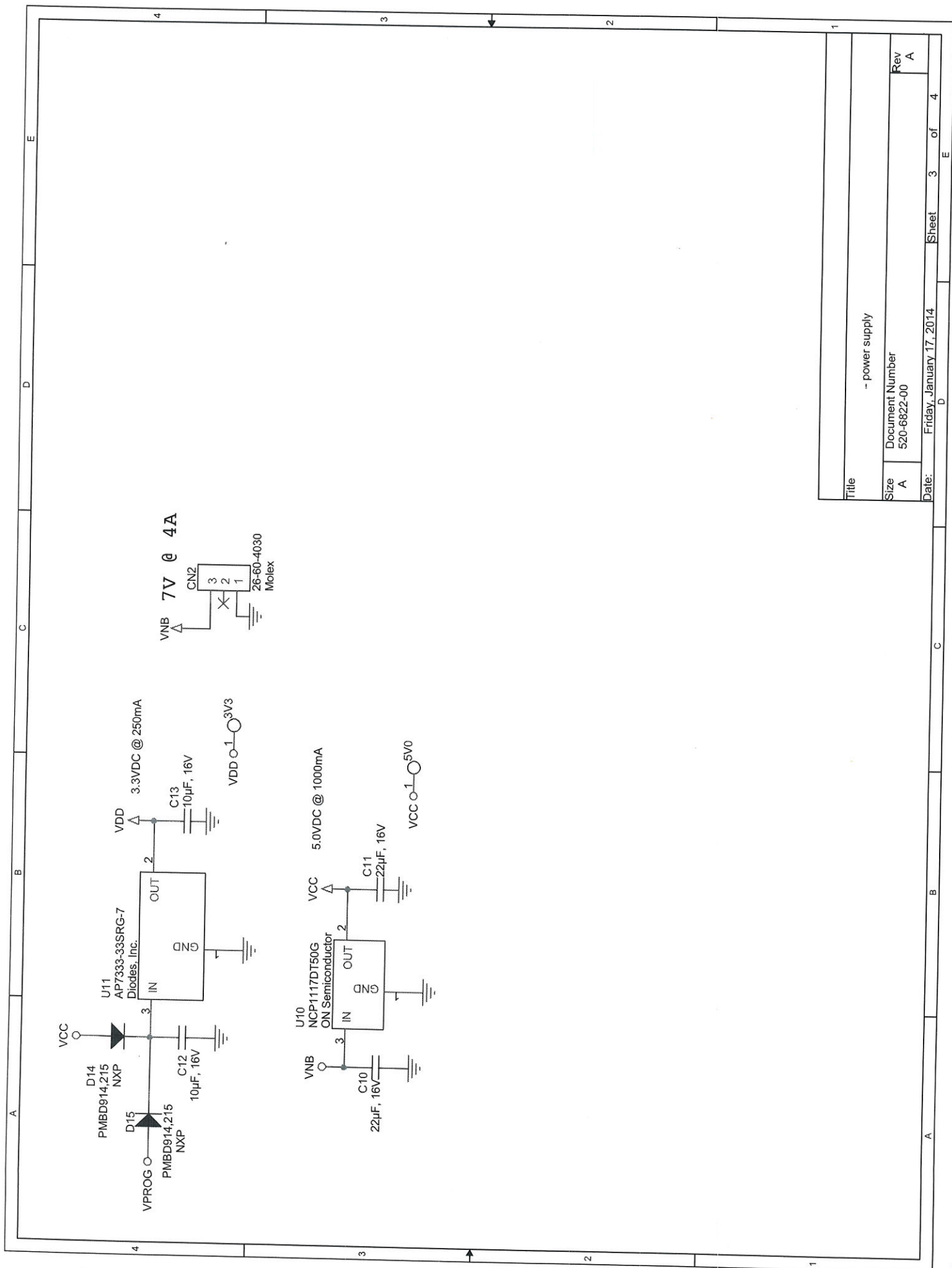
```

PPIO1.4 HIGH INDICATES
VBB ABSENT. SINCE THIS
BOARD DOESN'T EXPECT VBB
THIS PIN IS TIED LOW.

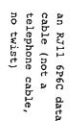


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Doc	Docuement Number
Doc	5204872-00
Doc	Printed January 17, 2014
Doc	Sheet 1 of 1
Doc	Page 1

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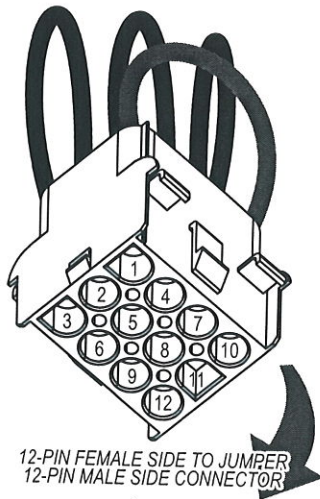


Title		- power supply	
Size	A	Document Number	520-6822-00
Rev	A	Date:	Friday, January 17, 2014
Sheet		3	of 4

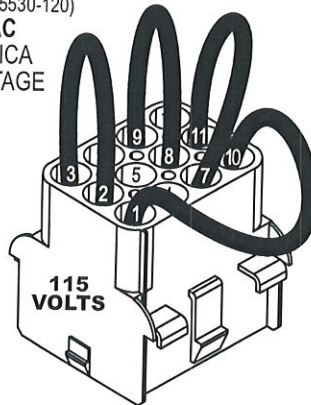


Title				
Top- communication				
Size				
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Date:	Friday, January 17, 2014	Sheet	2	of 4
				Rev A

Cabinet Universal Voltage Jumper Plugs (for use with Universal AC Cable, 036-5530-00 ONLY)



JUMPER PLUG ▼
(SPI PART #036-5530-120)
110+VAC
N. AMERICA
LINE VOLTAGE

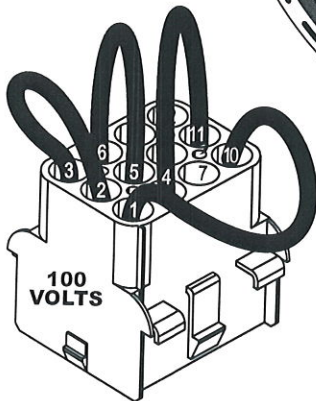


9-PIN MALE SIDE TO TRANSFORMER
9-PIN FEMALE SIDE CONN.

- 1 BLK
- 2 BLK
- 3 WHT-BLK
- 4 WHT-BRN
- 5 WHT-BRN
- 6 BRN (or YEL-WHT)
- 7 WHT-ORG
- 8 WHT-ORG
- 9 ORG
- 10 BLK
- 11 WHT
- 12 N/U

12-PIN F/M CONN.
BACK VIEW ▲

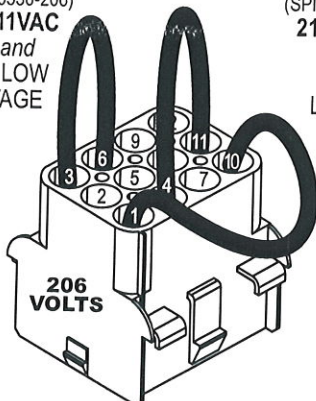
9-PIN F/M CONN.
▲ BACK VIEW



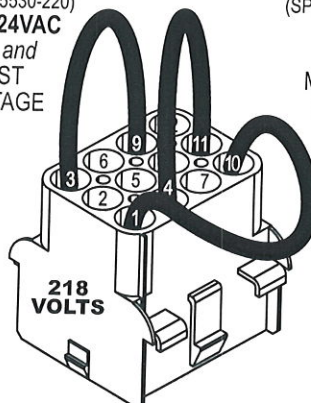
JUMPER PLUG ▼
(SPI PART #036-5530-100)
98VAC – 109VAC
JAPAN or
N. AMERICA LOW
LINE VOLTAGE

Black & White wires from
the POWER BOX, cabinet bottom
to 12-Pin Conn., Pins 10 & 11..

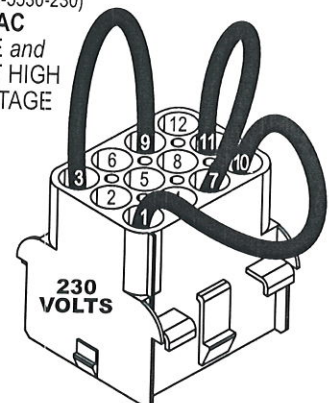
JUMPER PLUG ▼
(SPI PART #036-5530-206)
200VAC – 211VAC
EUROPE and
MID. EAST LOW
LINE VOLTAGE



JUMPER PLUG ▼
(SPI PART #036-5530-220)
212VAC – 224VAC
EUROPE and
MID. EAST
LINE VOLTAGE



JUMPER PLUG ▼
(SPI PART #036-5530-230)
225+VAC
EUROPE and
MID. EAST HIGH
LINE VOLTAGE



**Cabinet and Coin
Door Wiring**

Technicians Notes

STERN® PINBALL, INC. LIMITED WARRANTY

Stern® Pinball, Inc., ("seller") warrants only to the initial purchaser of its products that the items listed below are free from defects in material and workmanship under normal use and service for the **warranty period specified**:

Printed Circuit Boards PCBs (game logic):	2 months
Dot Matrix Display PCB:	9 months

No other parts of seller's product are warranted. Warranty periods are effective from the initial date of shipment from seller to its authorized distributors.

Seller's sole liability shall be, at its option, to repair or replace products which are returned to seller during the warranty periods specified, provided:

1. Seller is notified promptly upon discovery by purchaser that stated products are defective.
2. Such products are properly packaged and then returned freight prepaid, to seller's plant.

This warranty does not apply to any parts damaged during shipment and/or due to improper handling, or due to improper installation or usage, or alteration. In no event shall the seller be liable for any anticipated profits, loss of profits, loss of use, accidental or consequential damages or any other losses incurred by the customer in connection with the purchase of a Stern® Pinball, Inc. product.

WARRANTY DISCLAIMER

Except as specifically provided in a written contract between seller and purchaser, there are no other warranties, express or implied, including any implied warranties of merchantability or fitness for a particular purpose.

CAUTIONS, WARNINGS & NOTICES

For safety and reliability, substitute parts and equipment modifications are not recommended (*and may void any warranties*). Use of non-Stern® Pinball Inc. parts or modifications of game circuitry, may adversely affect game play, or may cause injuries. Transport pinball games with hinged backbox in the down position only! Always take great care when servicing any game. Always read the service manual before replacing or servicing components. **SUBSTITUTIONS OF PARTS OR EQUIPMENT MODIFICATIONS** may void FCC Type acceptance.



Always disconnect the line voltage before servicing. Some parts may still hold current when unplugged.

WARNING

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a class A computing device pursuant to SUBPART J OF PART 15 OF FCC RULES, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

RF INTERFERENCE NOTICE: Cable harness placements and ground strap routing on this game have been designed to keep RF radiation and conduction within levels accepted by the FCC rules. To maintain these levels, reposition harnesses and reconnect ground straps to their original placements, if they become disconnected during maintenance.

- (a) "The appliance has to be placed in a horizontal position."
- (b) "This appliance is not to be cleaned by a *Water Jet*."



603335-7.12.1 (i) "Do not locate this appliance in an area where a *Water Jet* is used." (ii) "Do not clean this appliance with a *Water Jet*." 603335-7.12.5 (b) If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

IEC 60825-1 2ND EDITION AND WAS ISSUED IN 2007

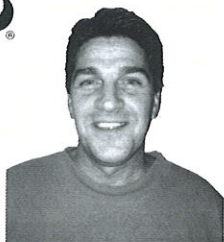
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Director of Technical Support



Dorothy Brown
Part Sales Supervisor



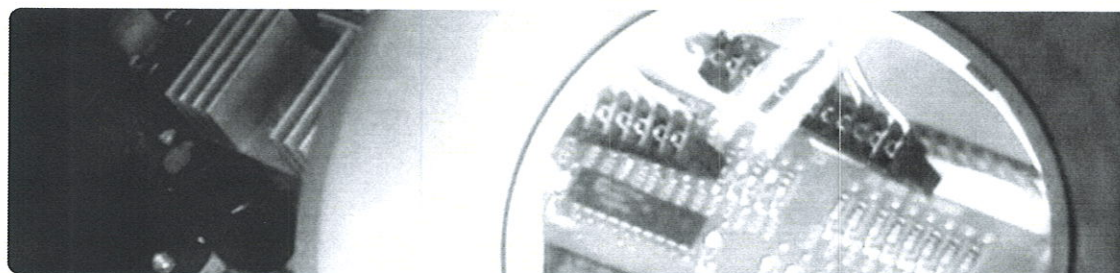
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Technical Support Engineer



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Service Bulletins

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- Cautions, Warnings & Notices (Image file from the last page in Service Game Manual.)

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- Current S.A.M. System Games complete Schematic Section
- Archived Drawings for the White Star Board System™

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- Offering a range of Coinage Cards for download
- Country Setting, Pricing Scheme, Dip Switch Setting
- [New Default Pricing to USA 10 \(for USA Games ONLY\)](#)
- [Custom Pricing Demonstration \(for S.A.M. System\)](#)

Game Code Library

[Click Here to view Our Game Code Library](#)

- Offering S.A.M. System Game Code
- Offering archived White Star Game Code for all Data East®, Sega™ and STERN® Pinballs (EPROM Programmer required)

Parts

[Click Here to view Our Parts Information](#)

- 2006 - 2008+ Complete Pinball Service Game Manuals in PDF Format available (includes parts and schematics).
- 2004 - 2005 Select Pinball Service Game Manual Excerpts only: Parts Identification & Location (The Pink Pages), Drawings for Major Assemblies & Ramps (The Blue Pages)
- Appendixes A - J (updated with each game)

Repair

[Click Here to view Our NTE Semi-Conductor Cross Reference](#)

- [Radio Shack Component Catalogue](#)

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Tricks & Tips

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- Pinball Machine Foam Cushion Packing
- 1st Time Pinball Set-Up & Preventative Maintenance
- Pinball Location Maintenance
- How to Update Your Game Code (S.A.M. System)

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U.S.
Customary
Inch Ruler



800-KICKERS

5 4 2 5 3 7 7

SPI Part Number
780-50F1-00