WPC Adjustments

Document History

February 21, 2012, initial draft. Basics on WPC adjustments retrieval and the Standard and Feature adjustments tables.

Document Scope

This document is an informal write-up on what I've discovered about WPC adjustments code. The audience of this document is other s/w developers who want some details about WPC adjustments. This might be helpful for general understanding of your game's ROM, and possibly useful for adding new features and adjustments in the future (when the WPC Menu System is documented). At the very minimum, this will help you modify or add new code that can retrieve existing adjustment values and react accordingly.

The examples shown here are mainly from IJ_L7 although other games may also be referenced, as indicated. As always, the specific memory addresses are going to be different on other pins, so you need to search the ROM for other pins with matching non-address bytes (ie opcodes and data struct patterns) to determine the equivalent code and addresses used in your game.

Disclaimer

As always, this information is for educational and entertainment purposes only. Some of the interpretation about code may be incorrect so take some of what is presented with a grain of salt. As always, exercise caution when modifying ROM images as they could have real physical effects which may be undesirable, especially if you modify code that causes hardware components to operate outside of their specifications.

Adjustment Value Retrieval

There are a handful of functions that can be used to acquire an adjustment value. Below we'll go through these functions. As I don't have the WPC 100% figured out, it's possible there are variations of these functions which I haven't yet discovered. At this point in the discussion all you need to know is that every game adjustment has a unique index, and these functions are designed to fetch the adjustment value based on the index number. Later in this document we'll get into details on how each index applies to a specific adjustment.

LookupGameAdjustmentParameter1andCheckIfEqualsParameter2()

This function takes two parameter bytes (two bytes immediately following the JSR instruction that got us into this function). The first byte is the adjustment index. The second byte is the value to which the adjustment value will be compared. Upon returning from this function, the C-bit is set if the adjustment value *does not equal* the 2nd parameter byte. C-bit is clear if the adjustment value *equals* the 2nd parameter byte. This function can be used for Boolean type of adjustments (Yes/No values). It can be used for non-Boolean adjustments as well.

```
;-------------------------------------;-----------------------------------------
;
; LookupGameAdjustmentParameter1andCheckIfEqualsParameter2()  C-bit set when not-equal
;
; When the 0x80 bit is SET in the game-setting index, then the index is accessed as
;  a standard setting/HSTD setting with the RAM base address of $1C3D and ROM base address of $4422,39
; When the 0x80 bit is NOT SET in the A game-setting index, then the index is accessed as
;  a feature adjustment with the RAM base address from [$02D9] and ROM base address of $4BE1,30
;
86AE: 34 36       PSHS  Y,X,B,A          ; Push Y,X,B,A
86B0: 32 7F       LEAS  $FFFF,S          ; Decrement stack pointer to make an extra temporary byte for us to use
86B2: AE 67       LDX   $0007,S          ; Load X with the 2-byte parameter to this function call
86B4: EC 81       LDD   ,X++             ; Dereference the parameter, load D with the 2 bytes that the parameter points to
86B6: AF 67       STX   $0007,S          ; Fixup stack so we RTS to the correct location
86B8: E7 E4       STB   ,S               ; Store the byte-to-compare against, on the stack, temporary storage
                                         ;
86BA: BD 92 13    JSR   $9213            ; Get16BitSettingIntoY(), Adjustment index A
                                         ;
86BD: 1F 20       TFR   Y,D              ; Transfer the retrieved value into D
86BF: 8B FF       ADDA  #$FF             ; Add 0xFF to A (this is checking if it is zero...)
86C1: 25 05       BCS   $86C8            ; C is set if A was non-zero
                                         ;  This basically skips to the end if A was non-zero. Since this function only compares
                                         ;  a single byte, if the adjustment returns 16-bit value with anything in the high byte then
                                         ;  we know the adjustment does NOT equal the 2nd byte passed into this function.
                                         ;
86C3: E0 E4       SUBB  ,S               ; Subtract the 2nd passed in parameter to this function call from the
                                         ;  second byte of the 16-bit adjustment value.
                                         ;
86C5: CB FF       ADDB  #$FF             ; Here we end up adding 256 to B to presumably set CC flags?  Either way it
86C7: 5C          INCB                   ;  ends up with the same value...
                                         ;
86C8: 32 61       LEAS  $0001,S          ; Restore stack pointer to normal value
86CA: 35 B6       PULS  A,B,X,Y,PC       ; Done, RTS
;-------------------------------------;-----------------------------------------
```

This function (above) is aware that the adjustment value *could* be 16-bits, but this function is mainly used for Boolean values, and as a result it only takes a single 8-bit compare byte, then this function will always return C-bit set if the adjustment ends up returning a 16-bit value (a value with anything non-zero in the high-byte of the 16-bit word).

A simple example of LookupGameAdjustmentParameter1andCheckIfEqualsParameter2() is shown below.:

```
;--------------------------------------;--------------------------------------
;
; PlayIJThemeMusic()
;
; Once in awhile during attract mode play the IJ theme song.
;
75BA: BD 86 AE    JSR   $86AE           ; LookupGameAdjustmentParameter1andCheckIfEqualsParameter2()
75BD: 1D 01                             ;  TableEntry1D, Adjustments, Feature Adjustments, Attract Mode Sounds
75BF: 25 1B       BCS   $75DC
75C1: 86 00       LDA   #$00            ; A=0x00=Stop playing
75C3: BD C1 A8    JSR   $C1A8           ; PlaySoundIndexRegisterAIfNotPlaying()
75C6: 86 01       LDA   #$01            ; A=0x01=IJ Theme, End of Game music
75C8: BD C1 A8    JSR   $C1A8           ; PlaySoundIndexRegisterAIfNotPlaying()
75CB: BD 89 48    JSR   $8948           ; CallPagedFunctionPreserve_U_A_B_CC()
75CE: 68 5D 20                          ;
75D1: BD 86 CC    JSR   $86CC           ; WaitForDMDSequence()
75D4: 01 E0                             ;
75D6: BD 89 48    JSR   $8948           ; CallPagedFunctionPreserve_U_A_B_CC()
75D9: 68 49 20                          ;
75DC: 39          RTS                   ;
;--------------------------------------;--------------------------------------
```

The example function (above) gets called every 15 passes of the attract-mode light show. This function checks game adjustment 0x1d which represents “Attract Mode Sounds” adjustments (details on adjustment indexes later in this document) and compares it against value 0x01. Upon returning from the function, if C-bit is set, the function skips to the end. This means if “Attract Mode Sounds” does not equal 0x01 then the function does nothing. Otherwise, the function is aware of the fact that adjustment 0x1d is a Boolean, and as a result, since the adjustment does NOT equal 0x01 then it has to be 0x00. The implied meaning is that 0x00 represents a “No” adjustment setting and 0x01 represents “Yes” adjustment setting for “Attract Mode Sounds”.

As indicated in the function comments, when the “Attract Mode Sounds” is set to “Yes” then the function will then play the IJ theme music.

Get16BitSettingIntoY()

This function was called by the previously described function. This is a fairly straightforward function. With the adjustment index in the A register, this function will return the adjustment's 16-bit value in the Y register.

```
;--------------------------------------;------------------------------------------------------------
;
; Get16BitSettingIntoY()
;
; This function looks up game adjustment index A and returns its configured value in register Y.
; Note the adjustment index A uses 0x80 bit to determine what type of adjustment is being indexed.
;
;
9213: 34 10       PSHS  X               ; Save X
9215: 8D 20       BSR   $9237           ; GetAdjustmentIndexAIntoYAndBoundsCheck()
9217: 10 8C 00 01 CMPY  #$0001          ; Check Y (sets C bit if Y is less than 1)
921B: 35 90       PULS  X,PC            ; Done, RTS
;--------------------------------------;------------------------------------------------------------
```

Obviously, after calling this function, the caller can then check the value of Y register and react accordingly.

We will get into details of the GetAdjustmentIndexAIntoYAndBoundsCheck() function later in this document.

Get8BitSettingIntoA()

This is another general utility function to simply fetch an adjustment value.

```
;-------------------------------------;-------------------------------------------------------
;
; Get8BitSettingIntoA()
;
; This function looks up game adjustment index A and returns its configured value in register A.
; Note the adjustment index A uses 0x80 bit to determine what type of adjustment is being indexed.
;
921D: 34 24       PSHS  Y,B             ; Save Y and B
921F: 8D 16       BSR   $9237           ; GetAdjustmentIndexAIntoYAndBoundsCheck()
9221: 1F 20       TFR   Y,D             ; Transfer the result into D
9223: 10 83 00 01 CMPD  #$0001          ; Compare with 0x01 to get C bit appropriately
9227: 1F 98       TFR   B,A             ; Convert 16-bit value into 8-bit value in A
9229: 35 A4       PULS  B,Y,PC          ; Done, RTS
;-------------------------------------;-------------------------------------------------------
```

It is interesting to note that this function simply drops the high-byte from the 16-bit adjustment value. This means that callers of this function must be aware of whether the adjustment that's being referenced is, in fact, an 8-bit adjustment value. If an adjustment is allowed to be configured to, for example, some number > 255, then using this function to fetch its value would return just the low 8-bits which would not necessarily be desirable.

We will get into details of the GetAdjustmentIndexAIntoYAndBoundsCheck() function later in this document.

Get16BitSettingIntoD()

This is another general utility function. This simply returns the full 16-bit adjustment value to the caller, in the D register (A:B).

```
;-------------------------------------;-------------------------------------------------------
;
; Get16BitSettingIntoD()
;
; This function looks up game adjustment index A and returns its configured value in register D (A:B).
; Note the adjustment index A uses 0x80 bit to determine what type of adjustment is being indexed.
;
922B: 34 22       PSHS  Y,A             ; Save Y and A
922D: 8D 08       BSR   $9237           ; GetAdjustmentIndexAIntoYAndBoundsCheck()
922F: 1F 20       TFR   Y,D             ; Transfer the result into D
9231: 10 83 00 01 CMPD  #$0001          ; Compare with 0x01 to get C bit appropriately
9235: 35 A2       PULS  A,Y,PC          ; Done, RTS
;-------------------------------------;-------------------------------------------------------
```

Note this is very similar to Get16BitSettingsIntoY() shown earlier in this document. This just fetches the 16-bit adjustment value and returns its value in the D register. Note that these functions also compare the adjustment value with 0x0001 prior to returning. I believe this can be used for callers to determine a Boolean adjustment's value by simply checking the C-bit after returning.

We will get into details of the GetAdjustmentIndexAIntoYAndBoundsCheck() function later in this document.

LoadYWithTableIndexByteParameter()

This is another utility function for fetching an adjustment's value. This function utilizes the Get16BitSettingIntoY() function shown above.

```
;--------------------------------------;-----------------------------------------
;
; LoadYWithTableIndexByteParameter()
;
8345: 34 12       PSHS  X,A             ; Save registers
8347: AE 63       LDX   $0003,S         ;
8349: A6 80       LDA   ,X+             ; Get 1-byte function parameter
834B: AF 63       STX   $0003,S         ;
834D: BD 92 13    JSR   $9213           ; Get16BitSettingIntoY()
8350: 35 92       PULS  A,X,PC          ; Done, RTS
;--------------------------------------;-----------------------------------------
```

This function takes a 1-byte parameter byte (single byte following the JSR instruction that got us here) as the adjustment index and returns the 16-bit adjustment value in the Y register. Below is a small example of a place where this function is used. This is a function that handles the "Coin Meter Units" which is an adjustment that goes up to $655.35. The knocker solenoid is pulsed for every amount of money the machine takes in, corresponding to this adjustment (operators can connect a coin meter to the knocker circuit, and disconnect the knocker solenoid).

```
;--------------------------------------;-----------------------------------------
;
; ScheduleCoinMeterUnitsCallbackHdlr()
;
; B has 0-based coin switch index
;
5CD2: 34 26       PSHS  Y,B,A           ; Save registers
5CD4: 32 7E       LEAS  $FFFE,S         ; Make room for 2 bytes on the stack
5CD6: 1F 98       TFR   B,A             ; A gets 0-based coin switch index
5CD8: BD 83 45    JSR   $8345           ; LoadYWithTableIndexByteParameter()
5CDB: C4                                ; TableEntry44, Adjustments, Pricing Adjustments, Coin Meter Units
5CDC: 25 2A       BCS   $5D08           ; C-bit set, adjustment value is 0x0000, return
                                        ;
5CDE: 10 AF E4    STY   ,S              ; Save addr of Coin Meter Units table entry onto stack
.
.
.
```

LoadAWithTableIndexByteParameter ()

This function is similar to the previous function except it returns the 8-bit adjustment value in the A register. The adjustment index is passed into this function as a parameter byte (byte immediately following the JSR opcode that got us here). This function utilizes the Get8BitSettingIntoA() function described earlier, as such, it is important that the caller of this function is aware whether the adjustment that it's specifying is an 8-bit adjustment.

```
;--------------------------------------;-----------------------------------------
;
; LoadAWithTableIndexByteParameter()
;
8352: 34 10       PSHS  X               ; Save X
8354: AE 62       LDX   $0002,S         ; Get parameter to this function call
8356: A6 80       LDA   ,X+             ; A gets single byte parameter
8358: AF 62       STX   $0002,S         ; Fixup PC return value
835A: BD 92 1D    JSR   $921D           ; Get8BitSettingIntoA()
835D: 35 90       PULS  X,PC            ; Done, RTS
;--------------------------------------;-----------------------------------------
```

Below is a code snippet that utilizes the LoadAWithTableIndexByteParameter() function. This is used when the code is deciding what text to put on the display. First it loads string index for "FREE PLAY" then calls LoadAWithTableIndexByteParameter() with 0xC0 to fetch the "Free Play" adjustment. Then if the adjustment is not set to 0x01, the string index for "CREDITS %B" is used instead.

```
5EBE: 8E 81 3D    LDX   #$813D          ; X gets 0x813D
                                        ;   This is an encoded ASCII String index.
                                        ;   0x8000 means 40 01 3C  : Bank3C Local String Table A, Menus, English
                                        ;   0x013D is String 318   : Bank3C, Table A, String318, "FREE PLAY"
                                        ;
5EC1: BD 83 52    JSR   $8352           ; LoadAWithTableIndexByteParameter()
5EC4: C0                                ; 0xC0 --> TableEntry40, Adjustments, Pricing Adjustments, Free Play
                                        ;
5EC5: 81 01       CMPA  #$01            ; Is Free-Play adjustment set to TRUE?
5EC7: 27 10       BEQ   $5ED9           ; If so, skip down and show text
                                        ;
5EC9: 8E 81 3A    LDX   #$813A          ; X gets 0x813A
                                        ;   This is an encoded ASCII String index.
                                        ;   0x8000 means 40 01 3C  : Bank3C Local String Table A, Menus, English
                                        ;   0x013A is String 315   : Bank3C, Table A, String315, "CREDITS %B"
```

LoadDWithTableIndexByteParameter()

This is another function to fetch an adjustment value specified by the index in the single byte parameter byte into the function call, and return the 16-bit adjustment value in the D register (A:B). This function uses Get16BitSettingIntoD(), described earlier.

```
;--------------------------------------;-----------------------------------------
;
; LoadDWithTableIndexByteParameter()
;
835F: 34 12       PSHS  X,A             ; Save X and A
8361: AE 63       LDX   $0003,S         ; X gets PC return value
8363: A6 80       LDA   ,X+             ; A gets single byte parameter to this function call
8365: AF 63       STX   $0003,S         ; Fixup PC return value
8367: BD 92 2B    JSR   $922B           ; Get16BitSettingIntoD()
836A: 35 92       PULS  A,X,PC          ; Done, RTS
;--------------------------------------;-----------------------------------------
```

Below is an example where this function is used. This is a function that gets the current ball in play and also determines if the current ball-in-play is the last ball. Interestingly, it fetches the "Balls Per Game" adjustment using LoadDWithTableIndexByteParameter() to get the 8-bit value into B, and it knows the adjustment is only an 8-bit adjustment and it immediately overwrites the A register afterwards, knowing it doesn't matter. This function is used, in IJ_L7, to clear any fractional credits at ball 2 (how rude!).

```
;--------------------------------------;-----------------------------------------
;
; GetBallInPlayCheckIfLastBall()
;
; Set C-bit if current ball in play is not max balls per game.
; Clear C-bit if current ball in play is last ball (max balls per game).
;
B26C: 34 04       PSHS  B               ; Save B
B26E: BD 83 5F    JSR   $835F           ; LoadDWithTableIndexByteParameter()
B271: 81                                ; 0x81, Adjustments, Standard Adjustments, Balls Per Game
B272: B6 03 B0    LDA   $03B0           ; A gets $03B0, current ball # in play
B275: F0 03 B0    SUBB  $03B0           ; B -= $03B0.  Max balls minus current ball in play
B278: 22 04       BHI   $B27E           ; If not at last ball in play, branch to set C-bit and return
B27A: 1C FE       ANDCC #$00FE          ; If at last ball in play, clear C-bit and return;
B27C: 20 02       BRA   $B280           ;
B27E: 1A 01       ORCC  #$0001          ;
B280: 35 84       PULS  B,PC            ; return
;--------------------------------------;-----------------------------------------
```

GetAdjustmentIndexAIntoYAndBoundsCheck()

This is the function referenced by some of the functions described above. This function will fetch the specified adjustment index in the A register and return the adjustments 16-bit value in the Y register.

```
;-------------------------------------;-------------------------------------------------------
;
; GetAdjustmentIndexAIntoYAndBoundsCheck()
;
; When the 0x80 bit is SET in the A game-setting index, then the index is accessed as
;  a standard setting/HSTD setting with the RAM base address of $1C3D and ROM base address of $4422,39
; When the 0x80 bit is NOT SET in the A game-setting index, then the index is accessed as
;  a feature adjustment with the RAM base address from [$02D9] and ROM base address of $4BE1,30
;
;
9237: 34 16       PSHS  X,B,A           ; Save registers
9239: 8D 73       BSR   $92AE           ; GetAdjustmentIndexAramAddressIntoX() , X gets address of (A*2) + 1C3D
                                        ; ---------------------------------------------------------------
                                        ; If the A index has its 0x80 bit set, then the base address is $1C3D
                                        ; If the A index does NOT have 0x80 bit set, then the base address is
                                        ; taken from $02D9. Either way, the A index is indexed into the table
                                        ; with hard-coded 2-byte entries into RAM.
                                        ;
923B: 10 AE 84    LDY   ,X              ; Get the 2 bytes from RAM into Y
                                        ;
923E: BD 92 93    JSR   $9293           ; GetGameSettingsDataIndexA()
                                        ; --------------------------
                                        ; The address of the game-adjustment values is in X with its bank in B
                                        ; The index without any 0x80 flags is in A.
                                        ; The current value of this setting in RAM is in Y
                                        ;
9241: 96 11       LDA   $11             ; Save current page into A
9243: BD 8F FB    JSR   $8FFB           ; SetPageBANK1()  Set page to the ROM page accessed during previous table-access...
                                        ;
9246: 10 AC 02    CMPY  $0002,X         ; Compare the minimum allowable value for this adjustment with the present value
9249: 24 05       BCC   $9250           ; If present value is greater or equal to the minimum allowable value, skip down
                                        ;  to $9250 to check maximum...
                                        ;
924B: 10 AE 02    LDY   $0002,X         ; For some reason the current value was out of range, load Y with the minimum
                                        ;  allowable value..
924E: 20 08       BRA   $9258           ; Skip to $9258 to wrap up
                                        ;
9250: 10 AC 04    CMPY  $0004,X         ; Compare the maximum allowable value for this adjustment with the present value
```

```
9253: 23 03       BLS   $9258           ; If we are presently within range then we're done, skip down to wrap up
                                        ;
9255: 10 AE 04    LDY   $0004,X         ; Otherwise the adjustment was too high, we'll force the maximum value.
                                        ;
                                        ; We get here after the preceding bounds-checking of the first 2-byte value
                                        ; against the 2nd and 3rd sets of 2-byte values within the table entry.
                                        ;
9258: 1F 89       TFR   A,B             ; Restore our saved, original ROM page into b
925A: BD 8F FB    JSR   $8FFB           ; SetPageBANK1()
925D: 35 96       PULS  A,B,X,PC        ; Done, RTS
                                        ;
;---------------------------------------;-------------------------------------------------------------
```

The above function is a lot to digest. This is where we start to describe how the adjustment index is treated. Up until now, the discussion has glossed over the adjustment index itself. The above function points out the fact that the adjustment index is represented as a 7-bit value, with the 0x80 bit defining whether the low 7-bits are a Standard adjustment <or> a Feature adjustment.

- 0x80 bit set, means the low 7-bits are the index of a Standard setting.
- 0x80 bit NOT set, means the low 7-bits are the index of a Feature setting.

And still, the above statements are still somewhat vague. Later in this document we'll get into details about the Standard and Feature adjustments.

The above function is fairly straightforward and doesn't need too much additional dialog here. It is interesting how it includes a low/high bounds check and ensures that the return value is always within range for the particular adjustment. Later in this discussion we'll explore how the called functions can determine an adjustment's minimum and maximum values.

Next we'll go over the individual functions that the above function called, namely:

- GetAdjustmentIndexAramAddressIntoX()
- GetGameSettingsDataIndexA()

GetAdjustmentIndexAramAddressIntoX()

This function was called by GetAdjustmentIndexAIntoYAndBoundsCheck(), as shown above:

```
;-------------------------------------;-------------------------------------------------------
; GetAdjustmentIndexAramAddressIntoX()
;
; If the A index has its 0x80 bit set,       then the base address is $1C3D, standard adjustment
; If the A index does NOT have 0x80 bit set, then the base address is taken from $02D9, feature adjustment.
;  The low 7-bits of A are then used to fetch the address of the adjustment from the base address.
;  This function knows that all adjustments are 16-bits (even for boolean adjustments).
;  Returns the address of the adjustment's value in the X register.
;
92AE: 34 06       PSHS  B,A             ; Save B and A
92B0: BE 02 D9    LDX   $02D9           ; X gets byte from RAM $02D9, pointer to Feature adjustments in ram.
92B3: 26 03       BNE   $92B8           ; If $02D9 is not zero skip over next instruction
92B5: BD 92 C7    JSR   $92C7           ; InitAdjustmentsFeatureTableAddrPtr02D9()
92B8: 4D          TSTA                  ; Check the value of A that was passed into this function (0x9E)
92B9: 2A 05       BPL   $92C0           ; Branch if 0x80 bit is NOT set in A.
                                        ;
92BB: 84 7F       ANDA  #$7F            ; Mask off the 0x80 bit in A.
92BD: 8E 1C 3D    LDX   #$1C3D          ; X gets 0x1C3D
                                        ;
92C0: C6 02       LDB   #$02            ; B gets 0x02
92C2: 3D          MUL                   ; Multiply A*B=D  0x1E*0x02 = 0x003C
92C3: 30 8B       LEAX  D,X             ; Advance X by this value, 0x1C3D-->0x1C79
92C5: 35 86       PULS  A,B,PC          ; Done, RTS
;-------------------------------------;-------------------------------------------------------
```

As commented in the code, the function first tries to fetch the address of the first Feature adjustment, in this case, it's stored in ram at $02D9. If it's 0x0000, then it will call InitAdjustmentsFeatureTableAddrPtr02D9() which will, in fact, put the address of the first Feature adjustment into $02D9. Then, if it turns out the A index has the 0x80 bit set (standard adjustment), the base address of $1c3d is used instead.

So if you can find this function in your ROM you can then determine the raw RAM addresses where your standard and feature adjustments are stored. I wouldn't recommend writing any code that accesses the ram directly, however this is good info to know for any sanity checks you might need to do. In IJ_L7, the standard adjustments start at $1c3d and the feature adjustments start at the address which is stored in $02d9. The $02d9 is just a handy pointer to get to the start of the Feature adjustments.

This function then returns the RAM address of the specified adjustment (A register) in the X register.

InitAdjustmentsFeatureTableAddrPtr02D9()

This function is called by the previous function (and called from other places as well). It simply initializes the $02D9 pointer with the address, in ram, of the first Feature Adjustment. Remember your game may use some address other than $02D9 for this pointer.

```
;-------------------------------------;-------------------------------------------------------
; InitAdjustmentsFeatureTableAddrPtr02D9()
;
92C7: 34 36       PSHS  Y,X,B,A         ; Save registers
92C9: 8E 82 07    LDX   #$8207          ; X gets 0x8207, Pointer to StandardAdjustmentsTable[]
92CC: BD AC D0    JSR   $ACD0           ; Get2BytesFromXTableInPagedROMintoY()
                                        ;  Gets first 2 bytes of the StandardAdjustmentsTable[] into Y.
                                        ;  First 2 bytes of WPC tables is simply the number of table entries.
                                        ;
92CF: 1F 20       TFR   Y,D             ; Copy the number of StandardAdjustmentsTable[] entries into D
92D1: 86 02       LDA   #$02            ; A gets 0x02 (apparantely it knows there's never more than 255 table entries)
92D3: 3D          MUL                   ; Multiply A*B=D.  2-bytes per entry, now D has total number of bytes for all Std.
adjustments.
92D4: 8E 1C 3D    LDX   #$1C3D          ; X gets 0x1C3D
92D7: 30 8B       LEAX  D,X             ; Load X with 0x1C3D + (# of std adjustments X 2).  X now sits and END of std. adjustments
values.
92D9: BF 02 D9    STX   $02D9           ; Copy this value into $02D9. So $02D9 stores start of Feature adjusments (after std.
adjustments)
92DC: 1F 20       TFR   Y,D             ; Reload D with the std adjustment count
                                        ;
92DE: 8E 82 0A    LDX   #$820A          ; X gets 0x820A, Pointer to FeatureAdjustmentsTable[]
92E1: BD AC D0    JSR   $ACD0           ; Get2BytesFromXTableInPagedROMintoY()
                                        ;  Gets first 2 bytes of the FeatureAdjustmentsTAble[] into Y
                                        ;
92E4: 31 AB       LEAY  D,Y             ; Advance Y by D. So now Y had total # of Std <and> Feature adjustments.
92E6: 10 8C 00 74 CMPY  #$0074          ; Compare Y with 0x0074, sanity check that there are no more than 0x0074 total adjustments.
92EA: 23 04       BLS   $92F0           ; If Y is lower or the same (in our trace we ARE lower...) skip to RTS
92EC: BD 82 BC    JSR   $82BC           ; ErrorHandler82BC(6C)
92EF: 6C                                ;
92F0: 35 B6       PULS  A,B,X,Y,PC      ; Done, RTS
;-------------------------------------;-------------------------------------------------------
```

This function, although it's only initializing a pointer, is useful because you can use it to determine the address of the Standard and Feature adjustments tables. We'll discuss these in detail later, but here in the case of IJ_L7 this function reveals the Standard Adjustments pointer is $8207 and the Feature Adjustments pointer is $820A. You should be able to find this function in your ROM to derive its table pointers.

GetGameSettingsDataIndexA()

This is the other significant function called by GetAdjustmentIndexAIntoYAndBoundsCheck() described above. This fetches the address of the adjustment table entry out of ROM. We will see details later in this document, but in summary, the adjustment table entry contains things like the minimum, maximum and default values for each adjustment.

```
;-------------------------------------;-------------------------------------------------------
;
; GetGameSettingsDataIndexA()
;
; When the 0x80 bit is SET in the A game-setting index, then the index is accessed as
;  a standard setting/HSTD setting with the ROM base address of $4422,39
; When the 0x80 bit is NOT SET in the A game-setting index, then the index is accessed as
;  a feature adjustment with the ROM base address of $4BE1,30
;
; When function is done, the address of the game-adjustment values is in X with its bank in B
; The index without any 0x80 flags is in A.
;
9293: 34 02       PSHS  A               ; Save X
9295: 1C FE       ANDCC #$00FE          ; Clear C bit
9297: BD 86 74    JSR   $8674           ; CallPagedFunctionPreserve_U_X_B_A_CC(), at $80C1 is 653B,20
                                        ; CheckForSpecialGameSettingValue()
929A: 80 C1                             ; -->JumpTableEntry40, LookupAInto6559_20Table().
                                        ;  This function looks up the value of A
                                        ;  into a table at 6559,20 and if a match is found Y is loaded with
                                        ;  the next 2-bytes from the table and the C bit is set.  Otherwise
                                        ;  the C bit is cleared.
                                        ;
929C: 25 0E       BCS   $92AC           ; If we DID find a match, skip to $92AC.
                                        ;  This only happens when the game-settings index A is one of 11 special
                                        ;  values.
                                        ;
                                        ; ...otherwise the game-setting index A is not one of 11 special values....
                                        ;
                                        ; The index A is used to access a particular table:
                                        ;  If the 0x80 bit is set,     table $8207 is used, 8207: 44 22 39
                                        ;  If the 0x80 bit is NOT set, table $820A is used, 820A: 4B E1 30
                                        ;
929E: 8E 82 0A    LDX   #$820A          ; X gets 0x820A, Pointer to FeatureAdjustmentsTable[]
92A1: 4D          TSTA                  ; Check A 0x80 bit
92A2: 2A 05       BPL   $92A9           ; Branch if 0x80 bit NOT set to $92A9
92A4: 84 7F       ANDA  #$7F            ; Clear the 0x80 bit of A.
92A6: 8E 82 07    LDX   #$8207          ; X gets 0x8207, Pointer to StandardAdjustmentsTable[]
```

```
                                        ;
92A9: BD AC F3    JSR   $ACF3           ; GetPageAndLoadTableEntryPointerIndexAIntoXandY()
                                        ;  This function call gets the table index A entry into the table
                                        ;  pointed to by X.  The ADDRESS of the A-index entry is put into X
                                        ;  and the first 2 bytes at the address are loaded into Y.
                                        ;
92AC: 35 82       PULS  A,PC            ; Done, RTS
                                        ;
;---------------------------------------;-------------------------------------------------------
```

The function above starts out with an interesting "special" adjustment check. If the specified adjustment isn't one of the special adjustments (described later) then the adjustment index A is used to look up either the StandardAdjustmentTable[] entry or the FeatureAdjustmentTable[] entry. Details on these tables are described later, but it is good to note the above function is consistent with previous statements:

- The StandardAdjustementTable[] is referenced via a pointer at $8207 (IJ_L7 ROM)
- The FeatureAdjustmentTable[] is referenced via a pointer at $820A (IJ_L7 ROM)

The function above will return the banked address of the adjustment's table entry in X and the bank number in B.

Next we'll take a look at the "special" function check. The function is called via $80C1 pointer (as seen at start of the above function). That is, the $80C1 contains a pointer of the function to call. In IJ_L7 at $80C1 is 653B20 which means the function at $653B,20 is called. I named the function at $653B,20 CheckForSpecialGameSettingValue() and will show it next.

CheckForSpecialGameSettingValue()

Below is the function along with the data tables immediately afterwards (which the function references):

```
;-------------------------------------;-------------------------------------------------------
;
; CheckForSpecialGameSettingValue()
;
; Search the 11-entry table below for any matching index number (A register).
; If found, then the Y register is set to the 2 bytes in the table which are
; an address of an adjustment table entry and B register is set to 0x20, this bank.
;
; This function is used to allow certain adjustment indexes to use THESE adjustment
; table entries instead of the normal StandardAdjustmentsTable[] or
; FeatureAdjustmentsTable[] entries.
;
;
653B: 34 20       PSHS  Y               ; Save Y
653D: 10 8E 65 59 LDY   #$6559          ; Y gets 0x6559, starting value for the following loop
                                        ;
6541: A1 A4       CMPA  ,Y              ; --\ Compare A with first of 3-byte entries below.  During the power-up
                                        ;   |  code-trace, the value of A is 0x9E.
                                        ;   |
6543: 27 0C       BEQ   $6551           ;   | If A matches $6559,20 then branch to $6551
6545: 31 23       LEAY  $0003,Y         ;   | Increment Y by 3 so it now becomes 0x655C
                                        ;   |  (3 bytes per table entry, see below)
6547: 10 8C 65 7A CMPY  #$657A          ;   |
                                        ;   |
                                        ;   |
654B: 25 F4       BCS   $6541           ; --/
                                        ;
654D: 1C FE       ANDCC #$00FE          ; Clear C bit, match not found
654F: 20 06       BRA   $6557           ; Skip to the end
                                        ;
6551: AE 21       LDX   $0001,Y         ; If we had a match, then we jump here from inside the above loop.
                                        ; Here X is loaded with the next two bytes from the table entry which
                                        ; are an address to an adjustment table entry below.
                                        ;
6553: C6 20       LDB   #$20            ; B gets 0x20, THIS Bank.
6555: 1A 01       ORCC  #$0001          ; Set the C bit to indicate things are good.
6557: 35 A0       PULS  Y,PC            ; Done, RTS
;-------------------------------------;-------------------------------------------------------
```

```
;
; SpecialAdjustmentsTable[]
;  Each entry is 3 bytes.
;  First byte is the adjustment index to match.
;  Next 2 bytes are its corresponding local adjustment table address (following this table).
;
                                    ;
6559: AF 65 AA                      ; 0xAF --> 0x2F, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 4
655C: AE 65 9E                      ; 0xAE --> 0x2E, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 3
655F: AD 65 92                      ; 0xAD --> 0x2D, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 2
6562: AC 65 86                      ; 0xAC --> 0x2C, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 1
6565: AB 65 7A                      ; 0xAB --> 0x2B, Adjustments, H.S.T.D. Adjustments, Backup Champion
6568: 8D 65 C2                      ; 0x8D --> 0x0D, Adjustments, Standard Adjustments, Replay Boost
656B: 8C 65 F2                      ; 0x8C --> 0x0C, Adjustments, Standard Adjustments, Replay Level 4
656E: 8B 65 E6                      ; 0x8B --> 0x0B, Adjustments, Standard Adjustments, Replay Level 3
6571: 8A 65 DA                      ; 0x8A --> 0x0A, Adjustments, Standard Adjustments, Replay Level 2
6574: 89 65 CE                      ; 0x89 --> 0x09, Adjustments, Standard Adjustments, Replay Level 1
6577: 87 65 B6                      ; 0x87 --> 0x07, Adjustments, Standard Adjustments, Replay Start
                                    ;
;-------------------------------------;-----------------------------------------------------
                                    ;
                                    ;
                                    ; 0xAB --> 0x2B, Adjustments, H.S.T.D. Adjustments, Backup Champion
                                    ; ---------------------------------------------------------------------
657A: 05 00                         ; Default Value
657C: 00 00                         ; Minimum Value
657E: 09 99                         ; Maximum Value
6580: 00 01                         ;
6582: 00 6E                         ;
6584: 49 3A                         ;
                                    ;
                                    ; 0xAC --> 0x2C, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 1
                                    ; ---------------------------------------------------------------------
6586: 04 00                         ; Default Value
6588: 00 00                         ; Minimum Value
658A: 09 99                         ; Maximum Value
658C: 00 01                         ;
658E: 00 6E                         ;
6590: 49 3A                         ;
                                    ;
                                    ; 0xAD --> 0x2D, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 2
                                    ; ---------------------------------------------------------------------
6592: 03 50                         ; Default Value
6594: 00 00                         ; Minimum Value
6596: 09 99                         ; Maximum Value
```

```
6598: 00 01                     ;
659A: 00 6E                     ;
659C: 49 3A                     ;
                                ;
                                ; 0xAE --> 0x2E, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 3
                                ; ------------------------------------------------------------------
659E: 03 00                     ; Default Value
65A0: 00 00                     ; Minimum Value
65A2: 09 99                     ; Maximum Value
65A4: 00 01                     ;
65A6: 00 6E                     ;
65A8: 49 3A                     ;
                                ;
                                ; 0xAF --> 0x2F, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 4
                                ; ------------------------------------------------------------------
65AA: 02 50                     ; Default Value
65AC: 00 00                     ; Minimum Value
65AE: 09 99                     ; Maximum Value
65B0: 00 01                     ;
65B2: 00 6E                     ;
65B4: 49 3A                     ;
                                ;
                                ; 0x87 --> 0x07, Adjustments, Standard Adjustments, Replay Start
                                ; ------------------------------------------------------------------
65B6: 02 50                     ; Default Value
65B8: 00 10                     ; Minimum Value
65BA: 05 00                     ; Maximum Value
65BC: 00 01                     ;
65BE: 00 6D                     ;
65C0: 9C 3A                     ;
                                ;
                                ; 0x8D --> 0x0D, Adjustments, Standard Adjustments, Replay Boost
                                ; ------------------------------------------------------------------
65C2: 00 50                     ; Default Value
65C4: 00 00                     ; Minimum Value
65C6: 02 00                     ; Maximum Value
65C8: 00 01                     ;
65CA: 00 6E                     ;
65CC: 56 3A                     ;
                                ;
                                ; 0x89 --> 0x09, Adjustments, Standard Adjustments, Replay Level 1
                                ; ------------------------------------------------------------------
65CE: 02 50                     ; Default Value
65D0: 00 00                     ; Minimum Value
65D2: 05 00                     ; Maximum Value
```

```
65D4: 00 01                             ;
65D6: 00 6D                             ;
65D8: BC 3A                             ;
                                        ;
                                        ; 0x8A --> 0x0A, Adjustments, Standard Adjustments, Replay Level 2
                                        ; ------------------------------------------------------------------
65DA: 00 00                             ; Default Value
65DC: 00 00                             ; Minimum Value
65DE: 05 00                             ; Maximum Value
65E0: 00 01                             ;
65E2: 00 6D                             ;
65E4: BC 3A                             ;
                                        ;
                                        ; 0x8B --> 0x0B, Adjustments, Standard Adjustments, Replay Level 3
                                        ; ------------------------------------------------------------------
65E6: 00 00                             ; Default Value
65E8: 00 00                             ; Minimum Value
65EA: 05 00                             ; Maximum Value
65EC: 00 01                             ;
65EE: 00 6D                             ;
65F0: BC 3A                             ;
                                        ;
                                        ; 0x8C --> 0x0C, Adjustments, Standard Adjustments, Replay Level 4
                                        ; ------------------------------------------------------------------
65F2: 00 00                             ; Default Value
65F4: 00 00                             ; Minimum Value
65F6: 05 00                             ; Maximum Value
65F8: 00 01                             ;
65FA: 00 6D                             ;
65FC: BC 3A                             ;
                                        ;
;---------------------------------------;-----------------------------------
```

As we can see, this special function checks for certain adjustments which contain scoring information. I haven't really traced any further into the above, so your guess is as good as mine as to the reason the above function exists. Presumably it has something to do with the fact that these all have to do with scoring adjustments. The above also gives us a sneak peak into the adjustment table format. We have a Default, Minimum, and Maximum adjustment values along with 6 bytes which I've yet to map out and understand. The normal adjustment tables will also have this format, as we'll see next.

StandardAdjustmentsTable[]

As mentioned in some of the functions above, IJ_L7 stores the pointer to the StandardAdjustmentsTable[] in $8207. At $8207 is 442239 which means the StandardAdjustmentsTable[] is located at $4422,39. This table is used when the adjustment index has the 0x80 bit SET. In this case the 0x80 bit is stripped and the low 7-bits are used to look up one of the table entries in the following table.

The format of each table entry is:

- 16-bit Default Value
- 16-bit Minimum Value
- 16-bit Maximum Value
- 6 bytes I've yet to trace through and figure out, as such I haven't neatly formatted these bytes yet…

The entire table is as follows:

```
;--------------------------------------;--------------------------------------
;
; TablePointer14, StandardAdjustmentsTable[]
;
;
4422: 00 4F                           ; Table entries is 0x4F (79 entries)
4424: 0C                              ; Bytes per table entry is 0x0C (12 bytes)
                                      ; ---------------------------------------------------------------
                                      ; TableEntry00,
                                      ; ---------------------------------------------------------------
4425: 00 00                           ; Default Value
4427: 00 00                           ; Minimum Value
4429: 00 00                           ; Maximum Value
442B: 00                              ;
442C: 01                              ;
442D: 00 8F                           ;
442F: 54                              ;
4430: FF                              ;
                                      ;
                                      ;-----------------------------------------------------
                                      ;
                                      ; ADJUSTMENTS, STANDARD ADJUSTMENTS
                                      ;
                                      ;-----------------------------------------------------
                                      ;
```

```
                                ;
                                ; TableEntry01, Adjustments, Standard Adjustments, Balls Per Game
                                ; ---------------------------------------------------------------
4431: 00 03                     ; Default Value
4433: 00 01                     ; Minimum Value
4435: 00 0A                     ; Maximum Value
4437: 00 01                     ;
4439: 00 6E                     ;
443B: 83 3A                     ;
                                ;
                                ; TableEntry02, Adjustments, Standard Adjustments, Tilt Warnings
                                ; ---------------------------------------------------------------
443D: 00 03                     ; Default Value
443E: 00 01                     ; Minimum Value
4441: 00 0A                     ; Maximum Value
4443: 00 01                     ;
4445: 00 6E                     ;
4447: 7A 3A                     ;
                                ;
                                ; TableEntry03, Adjustments, Standard Adjustments, Maximum Extra Balls
                                ; ---------------------------------------------------------------
4449: 00 04                     ; Default Value
444B: 00 00                     ; Minimum Value
444D: 00 0A                     ; Maximum Value
444F: 00                        ;
4450: 01                        ;
4451: 00 6E                     ;
4453: 2F 3A                     ;
                                ;
                                ; TableEntry04, Adjustments, Standard Adjustments, Maximum Extra Balls/Ball in Play
                                ; ---------------------------------------------------------------
4455: 00 00                     ; Default Value
4457: 00 00                     ; Minimum Value
4459: 00 0A                     ; Maximum Value
445B: 00 01                     ;
445D: 00 6D                     ;
445F: F7 3A                     ;
                                ;
                                ; TableEntry05, Adjustments, Standard Adjustments, Replay System
                                ; ---------------------------------------------------------------
4461: 00 00                     ; Default Value
4463: 00 00                     ; Minimum Value
4465: 00 01                     ; Maximum Value
4467: 70 35 3A                  ;
446A: 6E 71                     ;
```

```
446C: 3A                        ;
                                ;
                                ; TableEntry06, Adjustments, Standard Adjustments, Replay Percent
                                ; ---------------------------------------------------------------
446D: 00 0A                     ; Default Value
446F: 00 05                     ; Minimum Value
4471: 00 32                     ; Maximum Value
4473: 00 01                     ;
4475: 00 6D                     ;
4477: 8E 3A                     ;
                                ;
                                ; TableEntry07, Adjustments, Standard Adjustments, Replay Start
                                ; ---------------------------------------------------------------
4479: 05 00                     ; Default Value
4481: 01 00                     ; Minimum Value
4483: 15 00                     ; Maximum Value
4485: 00                        ;
4480: 10 00                     ;
4482: 6D 9C 3A                  ;
                                ;
                                ; TableEntry08, Adjustments, Standard Adjustments, Replay Levels
                                ; ---------------------------------------------------------------
4485: 00 01                     ; Default Value
4487: 00 01                     ; Minimum Value
4489: 00 04                     ; Maximum Value
448B: 00 01                     ;
448D: 00 6D                     ;
448F: AE 3A                     ;
                                ;
                                ; TableEntry09, Adjustments, Standard Adjustments, Replay Level 1
                                ; ---------------------------------------------------------------
4491: 05 00                     ; Default Value
4493: 00 00                     ; Minimum Value
4495: 25 00                     ; Maximum Value
4497: 00                        ;
4498: 10 00                     ;
449A: 6D BC 3A                  ;
                                ;
                                ; TableEntry0A, Adjustments, Standard Adjustments, Replay Level 2
                                ; ---------------------------------------------------------------
449D: 00 00                     ; Default Value
449F: 00 00                     ; Minimum Value
44A1: 25 00                     ; Maximum Value
44A3: 00 10                     ;
44A5: 00 6D                     ;
```

```
44A7: BC 3A                     ;
                                ;
                                ; TableEntry0B, Adjustments, Standard Adjustments, Replay Level 3
                                ; ---------------------------------------------------------------
44A9: 00 00                     ; Default Value
44AB: 00 00                     ; Minimum Value
44AD: 25 00                     ; Maximum Value
44AF: 00                        ;
44B0: 10 00                     ;
44B2: 6D BC 3A                  ;
                                ;
                                ; TableEntry0C, Adjustments, Standard Adjustments, Replay Level 4
                                ; ---------------------------------------------------------------
44B5: 00 00                     ; Default Value
44B7: 00 00                     ; Minimum Value
44B9: 25 00                     ; Maximum Value
44BB: 00 10                     ;
44BD: 00 6D                     ;
44BF: BC 3A                     ;
                                ;
                                ; TableEntry0D, Adjustments, Standard Adjustments, Replay Boost
                                ; ---------------------------------------------------------------
44C1: 01 00                     ; Default Value
44C3: 00 00                     ; Minimum Value
44C5: 05 00                     ; Maximum Value
44C7: 00                        ;
44C8: 50                        ;
44C9: 00 6E                     ;
44CB: 56                        ;
44CC: 3A                        ;
                                ;
                                ; TableEntry0E, Adjustments, Standard Adjustments, Replay Award
                                ; ---------------------------------------------------------------
44CD: 00 00                     ; Default Value
44CF: 00 00                     ; Minimum Value
44D1: 00 03                     ; Maximum Value
44D3: 70 39 3A                  ;
44D6: 6E 71                     ;
44D8: 3A                        ;
                                ;
                                ; TableEntry0F, Adjustments, Standard Adjustments, Special Award
                                ; ---------------------------------------------------------------
44D9: 00 00                     ; Default Value
44DB: 00 00                     ; Minimum Value
44DD: 00 03                     ; Maximum Value
```

```
44DF: 70 41 3A                          ;
44E2: 6E 71                             ;
44E4: 3A                                ;
                                        ;
                                        ; TableEntry10, Adjustments, Standard Adjustments, Match Award
                                        ; ------------------------------------------------------------
44E5: 00 00                             ; Default Value
44E7: 00 00                             ; Minimum Value
44E9: 00 01                             ; Maximum Value
44EB: 70 49 3A                          ;
44EE: 6E 71                             ;
44F0: 3A                                ;
                                        ;
                                        ; TableEntry11, Adjustments, Standard Adjustments, Extra Ball Ticket
                                        ; ------------------------------------------------------------
44F1: 00 00                             ; Default Value
44F3: 00 00                             ; Minimum Value
44F5: 00 01                             ; Maximum Value
44F7: 70 27 3A                          ;
44FA: 6E 71                             ;
44FC: 3A                                ;
                                        ;
                                        ; TableEntry12, Adjustments, Standard Adjustments, Maximum Ticket/Player
                                        ; ------------------------------------------------------------
44FD: 00 19                             ; Default Value
44FF: 00 00                             ; Minimum Value
4501: 00 64                             ; Maximum Value
4503: 00 01                             ;
4505: 00 6E                             ;
4507: 7A 3A                             ;
                                        ;
                                        ; TableEntry13, Adjustments, Standard Adjustments, Match Feature
                                        ; ------------------------------------------------------------
4509: 00 07                             ; Default Value
450B: 00 00                             ; Minimum Value
450D: 00 32                             ; Maximum Value
450F: 00                                ;
4510: 01                                ;
4511: 00 6D                             ;
4513: E9 3A                             ;
                                        ;
                                        ; TableEntry14, Adjustments, Standard Adjustments, Custom Message
                                        ; ------------------------------------------------------------
4515: 00 01                             ; Default Value
4517: 00 00                             ; Minimum Value
```

```
4519: 00 01                         ; Maximum Value
451B: 70 2B 3A                      ;
451E: 6E 71                         ;
4520: 3A                            ;
                                    ;
                                    ; TableEntry15, Adjustments, Standard Adjustments, Language
                                    ; ------------------------------------------------------------
4521: 00 00                         ; Default Value
4523: 00 00                         ; Minimum Value
4525: 00 02                         ; Maximum Value
4527: 70 4D 3A                      ;
452A: 6E 71 3A                      ;
                                    ;
                                    ; TableEntry16, Adjustments, Standard Adjustments, Clock Style
                                    ; ------------------------------------------------------------
452D: 00 00                         ; Default Value
452F: 00 00                         ; Minimum Value
4531: 00 01                         ; Maximum Value
4533: 70 53 3A                      ;
4536: 6E 71                         ;
4538: 3A                            ;
                                    ;
                                    ; TableEntry17, Adjustments, Standard Adjustments, Date Style
                                    ; ------------------------------------------------------------
4539: 00 00                         ; Default Value
453B: 00 00                         ; Minimum Value
453D: 00 01                         ; Maximum Value
453F: 00 01                         ;
4541: 00 6C                         ;
4543: 19                            ;
4544: 3A                            ;
                                    ;
                                    ; TableEntry18, Adjustments, Standard Adjustments, Show Date and Time
                                    ; ------------------------------------------------------------
4545: 00 00                         ; Default Value
4547: 00 00                         ; Minimum Value
4549: 00 01                         ; Maximum Value
454B: 70 27 3A                      ;
454E: 6E 71                         ;
4550: 3A                            ;
                                    ;
                                    ; TableEntry19, Adjustments, Standard Adjustments, Allow Dim Illumination
                                    ; ------------------------------------------------------------
4551: 00 01                         ; Default Value
4553: 00 00                         ; Minimum Value
```

```
4555: 00 01                         ; Maximum Value
4557: 70 27 3A                      ;
455A: 6E 71                         ;
455C: 3A                            ;
                                    ;
                                    ; TableEntry1A, Adjustments, Standard Adjustments, Tournament Play
                                    ; ----------------------------------------------------------------
455D: 00 00                         ; Default Value
455F: 00 00                         ; Minimum Value
4561: 00 01                         ; Maximum Value
4563: 70 27 3A                      ;
4566: 6E 71                         ;
4568: 3A                            ;
                                    ;
                                    ; TableEntry1B, Adjustments, Standard Adjustments, Euro. Scr. Format
                                    ; ----------------------------------------------------------------
4569: 00 00                         ; Default Value
456B: 00 00                         ; Minimum Value
456D: 00 01                         ; Maximum Value
456F: 70 27 3A                      ;
4572: 6E 71                         ;
4574: 3A                            ;
                                    ;
                                    ; TableEntry1C, Adjustments, Standard Adjustments, Minimum Volume Control
                                    ; ----------------------------------------------------------------
4575: 00 00                         ; Default Value
4577: 00 00                         ; Minimum Value
4579: 00 01                         ; Maximum Value
457B: 70 27 3A                      ;
457E: 6E 71                         ;
4580: 3A                            ;
                                    ;
                                    ; TableEntry1D, Adjustments, Standard Adjustments, General Illumination Power Saver
                                    ; ----------------------------------------------------------------
4581: 00 0F                         ; Default Value
4583: 00 01                         ; Minimum Value
4585: 00 3C                         ; Maximum Value
4587: 00 01                         ;
4589: 00 6E                         ;
458B: 17 3A                         ;
                                    ;
                                    ; TableEntry1E, Adjustments, Standard Adjustments, Power Saver Level
                                    ; ----------------------------------------------------------------
458D: 00 05                         ; Default Value TableEntry1E  This referenced during power-up tracing
458F: 00 04                         ; Minimum Value
```

```
4591: 00 07                         ; Maximum Value
4593: 00 01                         ;
4595: 00 6E                         ;
4597: 7A 3A                         ;
                                    ;
                                    ; TableEntry1F, Adjustments, Standard Adjustments, Ticket Expansion Board
                                    ; ---------------------------------------------------------------
4599: 00 00                         ; Default Value
449B: 00 00                         ; Minimum Value
449D: 00 01                         ; Maximum Value
459F: 70 27 3A                      ;
45A2: 6E 71                         ;
45A4: 3A                            ;
                                    ;
                                    ; TableEntry20, Adjustments, Standard Adjustments, No Bonus Flips
                                    ; ---------------------------------------------------------------
45A5: 00 00                         ; Default Value
45A7: 00 00                         ; Minimum Value
45A9: 00 01                         ; Maximum Value
45AB: 70 27 3A                      ;
45AE: 6E 71                         ;
45B0: 3A                            ;
                                    ;
                                    ; TableEntry21, Adjustments, Standard Adjustments, Game Restart
                                    ; ---------------------------------------------------------------
45B1: 00 01                         ; Default Value
45B3: 00 00                         ; Minimum Value
45B5: 00 02                         ; Maximum Value
45B7: 70 73 3A                      ;
45BA: 6E 71                         ;
45BC: 3A                            ;
                                    ;
                                    ;-------------------------------------------------
                                    ;
                                    ; ADJUSTMENTS, H.S.T.D. ADJUSTMENTS
                                    ;
                                    ;-------------------------------------------------
                                    ;
                                    ;
                                    ;
                                    ; TableEntry22, Adjustments, H.S.T.D. Adjustments, Highest Scores
                                    ; ---------------------------------------------------------------
45BD: 00 01                         ; Default Value
45BF: 00 00                         ; Minimum Value
45C1: 00 01                         ; Maximum Value
```

```
45C3: 70 2B 3A                          ;
45C6: 6E 71                             ;
45C8: 3A                                ;
                                        ;
                                        ; TableEntry23, Adjustments, H.S.T.D. Adjustments, H.S.T.D. Award
                                        ; ---------------------------------------------------------------
45C9: 00 00                             ; Default Value
45CB: 00 00                             ; Minimum Value
45CD: 00 01                             ; Maximum Value
45CF: 70 49 3A                          ;
45D2: 6E 71                             ;
45D4: 3A                                ;
                                        ;
                                        ; TableEntry24, Adjustments, H.S.T.D. Adjustments, Champion H.S.T.D.
                                        ; ---------------------------------------------------------------
45D5: 00 01                             ; Default Value
45D7: 00 00                             ; Minimum Value
45D9: 00 01                             ; Maximum Value
45DB: 70 2B 3A                          ;
45DE: 6E 71                             ;
45E0: 3A                                ;
                                        ;
                                        ; TableEntry25, Adjustments, H.S.T.D. Adjustments, Champion Credits
                                        ; ---------------------------------------------------------------
45E1: 00 02                             ; Default Value
45E3: 00 00                             ; Minimum Value
45E5: 00 0A                             ; Maximum Value
45E7: 00 01                             ;
45E9: 00 6E                             ;
45EB: 7A 3A                             ;
                                        ;
                                        ; TableEntry26, Adjustments, H.S.T.D. Adjustments, H.S.T.D. 1 Credits
                                        ; ---------------------------------------------------------------
44ED: 00 01                             ; Default Value
45EF: 00 00                             ; Minimum Value
45F1: 00 0A                             ; Maximum Value
45F3: 00 01                             ;
45F5: 00 6E                             ;
45F7: 7A 3A                             ;
                                        ;
                                        ; TableEntry27, Adjustments, H.S.T.D. Adjustments, H.S.T.D. 2 Credits
                                        ; ---------------------------------------------------------------
45F9: 00 01                             ; Default Value
45FB: 00 00                             ; Minimum Value
45FD: 00 0A                             ; Maximum Value
```

```
45FF: 00 01
4601: 00 6E
4603: 7A 3A
                                ;
                                ; TableEntry28, Adjustments, H.S.T.D. Adjustments, H.S.T.D. 3 Credits
                                ; -------------------------------------------------------------
4605: 00 01                     ; Default Value
4607: 00 00                     ; Minimum Value
4609: 00 0A                     ; Maximum Value
460B: 00 01
460D: 00 6E
460F: 7A 3A
                                ;
                                ; TableEntry29, Adjustments, H.S.T.D. Adjustments, H.S.T.D. 4 Credits
                                ; -------------------------------------------------------------
4611: 00 01                     ; Default Value
4613: 00 00                     ; Minimum Value
4615: 00 0A                     ; Maximum Value
4617: 00 01
4619: 00 6E
461B: 7A 3A
                                ;
                                ; TableEntry2A, Adjustments, H.S.T.D. Adjustments, High Score Reset Every
                                ; -------------------------------------------------------------
461D: 0B B8                     ; Default Value
461F: 00 00                     ; Minimum Value
4621: 4E 20                     ; Maximum Value
4623: 00
4624: FA 00 6D
4627: F7 3A
                                ;
                                ; TableEntry2B, Adjustments, H.S.T.D. Adjustments, Backup Champion
                                ; -------------------------------------------------------------
4629: 15 00                     ; Default Value
462B: 00 00                     ; Minimum Value
462D: 99 90                     ; Maximum Value
462F: 00
4630: 10 00
4632: 6E 49
4634: 3A
                                ;
                                ; TableEntry2C, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 1
                                ; -------------------------------------------------------------
4635: 12 00                     ; Default Value
4637: 00 00                     ; Minimum Value
```

```
4639: 99 90                         ; Maximum Value
463B: 00
463C: 10 00
463E: 6E 49
4640: 3A
                                    ;
                                    ; TableEntry2D, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 2
                                    ; ------------------------------------------------------------------
4641: 11 00                         ; Default Value
4643: 00 00                         ; Minimum Value
4645: 99 90                         ; Maximum Value
4647: 00 10
4649: 00 6E
464B: 49
464C: 3A
                                    ;
                                    ; TableEntry2E, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 3
                                    ; ------------------------------------------------------------------
464D: 10 00                         ; Default Value
464F: 00 00                         ; Minimum Value
4651: 99 90                         ; Maximum Value
4653: 00 10
4655: 00 6E
4657: 49
4658: 3A
                                    ;
                                    ; TableEntry2F, Adjustments, H.S.T.D. Adjustments, Backup H.S.T.D. 4
                                    ; ------------------------------------------------------------------
4659: 09 00                         ; Default Value
465B: 00 00                         ; Minimum Value
465D: 99 90                         ; Maximum Value
465F: 00 10
4661: 00 6E
4663: 49
4664: 3A
                                    ;
                                    ; TableEntry30, Adjustments, Pricing Adjustments, Game Pricing
                                    ; ------------------------------------------------------------------
4665: 00 02                         ; Default Value
4667: 00 00                         ; Minimum Value
4669: 00 38                         ; Maximum Value
466B: 72
466C: BB 3A 6C
466F: 39
4670: 3A
```

```
                                ;
                                ; TableEntry31, Adjustments, Pricing Adjustments, Left Coin Units
                                ; ---------------------------------------------------------------
4671: 00 01                     ; Default Value
4673: 00 00                     ; Minimum Value
4675: 00 63                     ; Maximum Value
4677: 00 01
4679: 00 6C
467B: 92 3A
                                ;
                                ; TableEntry32, Adjustments, Pricing Adjustments, Center Coin Units
                                ; ---------------------------------------------------------------
467D: 00 01                     ; Default Value
467F: 00 00                     ; Minimum Value
4681: 00 63                     ; Maximum Value
4683: 00 01
4685: 00 6C
4687: 92 3A
                                ;
                                ; TableEntry33, Adjustments, Pricing Adjustments, Right Coin Units
                                ; ---------------------------------------------------------------
4689: 00 01                     ; Default Value
468B: 00 00                     ; Minimum Value
468D: 00 63                     ; Maximum Value
468F: 00 01
4691: 00 6C
4693: 92 3A
                                ;
                                ; TableEntry34, Adjustments, Pricing Adjustments, 4th Slot Units
                                ; ---------------------------------------------------------------
4695: 00 01                     ; Default Value
4697: 00 00                     ; Minimum Value
4699: 00 63                     ; Maximum Value
469B: 00 01
469D: 00 6C
469F: 92 3A
                                ;
                                ; TableEntry35, Adjustments, Pricing Adjustments, Units/Credits
                                ; ---------------------------------------------------------------
46A1: 00 01                     ; Default Value
46A3: 00 01                     ; Minimum Value
46A5: 00 63                     ; Maximum Value
46A7: 00 01
46A9: 00 6C
46AB: 92 3A
```

```
                                ;
                                ; TableEntry36, Adjustments, Pricing Adjustments, Units/Bonus
                                ; ---------------------------------------------------------------
46AD: 00 00                     ; Default Value
46AF: 00 00                     ; Minimum Value
46B1: 00 63                     ; Maximum Value
46B3: 00 01
46B5: 00 6C
46B7: 92 3A
                                ;
                                ; TableEntry37, Adjustments, Pricing Adjustments, Bonus Credits
                                ; ---------------------------------------------------------------
46B9: 00 00                     ; Default Value
46BB: 00 00                     ; Minimum Value
46BD: 00 63                     ; Maximum Value
46BF: 00 01
46C1: 00 6C
46C3: 92 3A
                                ;
                                ; TableEntry38, Adjustments, Pricing Adjustments, Minimum Units
                                ; ---------------------------------------------------------------
46C5: 00 00                     ; Default Value
46C7: 00 00                     ; Minimum Value
46C9: 00 63                     ; Maximum Value
46CB: 00 01
46CD: 00 6C
46CF: 92 3A
                                ;
                                ; TableEntry39, Adjustments, Pricing Adjustments, Coin Door Type
                                ; ---------------------------------------------------------------
46D1: 00 01                     ; Default Value
46D3: 00 00                     ; Minimum Value
46D5: 00 20                     ; Maximum Value
46D7: 70 A8 3A
46DA: 6C BC 3A
                                ;
                                ; TableEntry3A, Adjustments, Pricing Adjustments, Collection Text
                                ; ---------------------------------------------------------------
46DD: 80 CF                     ; Default Value
46DF: 80 CF                     ; Minimum Value
46E1: 80 DE                     ; Maximum Value
46E3: 00 01
46E5: 00 6D
46E7: 34 3A
                                ;
```

```
                                ; TableEntry3B, Adjustments, Pricing Adjustments, Left Slot Value
                                ; ----------------------------------------------------------------
46E9: 00 19                     ; Default Value
46EB: 00 00                     ; Minimum Value
46ED: FF FF                     ; Maximum Value
46EF: 00
46F0: 01
46F1: 00 6D
46F3: 56
46F4: 3A
                                ;
                                ; TableEntry3C, Adjustments, Pricing Adjustments, Center Slot Value
                                ; ----------------------------------------------------------------
46F5: 00 00                     ; Default Value
46F7: 00 00                     ; Minimum Value
46F9: FF FF                     ; Maximum Value
46FB: 00
46FC: 01
46FD: 00 6D
46FF: 56
4700: 3A
                                ;
                                ; TableEntry3D, Adjustments, Pricing Adjustments, Right Slot Value
                                ; ----------------------------------------------------------------
4701: 00 19                     ; Default Value
4703: 00 00                     ; Minimum Value
4705: FF FF                     ; Maximum Value
4707: 00
4708: 01
4709: 00 6D
470B: 56
470C: 3A
                                ;
                                ; TableEntry3E, Adjustments, Pricing Adjustments, 4th Slot Value
                                ; ----------------------------------------------------------------
470D: 00 00                     ; Default Value
470F: 00 00                     ; Minimum Value
4711: FF FF                     ; Maximum Value
4713: 00
4714: 01
4715: 00 6D
4717: 56
4718: 3A
                                ;
                                ; TableEntry3F, Adjustments, Pricing Adjustments, Maximum Credits
```

```
                                ; ---------------------------------------------------------------
4719: 00 0A                     ; Default Value
471B: 00 05                     ; Minimum Value
471D: 00 63                     ; Maximum Value
471F: 00 01
4721: 00 6E
4723: 7A 3A
                                ;
                                ; TableEntry40, Adjustments, Pricing Adjustments, Free Play
                                ; ---------------------------------------------------------------
4725: 00 00                     ; Default Value
4727: 00 00                     ; Minimum Value
4729: 00 01                     ; Maximum Value
472B: 70 27 3A
472E: 6E 71
4730: 3A
                                ;
                                ; TableEntry41, Adjustments, Pricing Adjustments, Hide Coin Audits
                                ; ---------------------------------------------------------------
4731: 00 00                     ; Default Value
4733: 00 00                     ; Minimum Value
4735: 00 02                     ; Maximum Value
4737: 70 2F 3A
473A: 6E 71
473C: 3A
                                ;
                                ; TableEntry42, Adjustments, Pricing Adjustments, 1 Coin Buy-In
                                ; ---------------------------------------------------------------
473D: 00 00                     ; Default Value
473F: 00 00                     ; Minimum Value
4741: 00 01                     ; Maximum Value
4743: 70 27 3A
4746: 6E 71
4748: 3A
                                ;
                                ; TableEntry43, Adjustments, Pricing Adjustments, Base Coin Size
                                ; ---------------------------------------------------------------
4749: 00 19                     ; Default Value
474B: 00 01                     ; Minimum Value
474D: FF FF                     ; Maximum Value
474F: 00
4750: 01
4751: 00 6D
4753: 56
4754: 3A
```

```
                                ;
                                ; TableEntry44, Adjustments, Pricing Adjustments, Coin Meter Units
                                ; ---------------------------------------------------------------
4755: 00 00                     ; Default Value
4757: 00 00                     ; Minimum Value
4759: FF FF                     ; Maximum Value
475B: 00
475C: 01
475D: 00 6F
475F: 16 3A
                                ;
                                ; TableEntry45, Adjustments, Pricing Adjustments, Dollar Bill Slot
                                ; ---------------------------------------------------------------
4761: 00 00                     ; Default Value
4763: 00 00                     ; Minimum Value
4765: 00 04                     ; Maximum Value
4767: 70
4768: 79 3A 6E
476B: 71
476C: 3A
                                ;
                                ; TableEntry46, Adjustments, Pricing Adjustments, Minimum Coin Msec.
                                ; ---------------------------------------------------------------
476D: 00 14                     ; Default Value
476F: 00 0A                     ; Minimum Value
4771: 00 3C                     ; Maximum Value
4773: 00 02
4775: 00 6E
4777: 7A 3A
                                ;
                                ; TableEntry47, Adjustments, Pricing Adjustments, SlamTilt Penalty (non accessible adjustment)
                                ; ---------------------------------------------------------------
4779: 00 00                     ; Default Value
477B: 00 00                     ; Minimum Value
477D: 00 01                     ; Maximum Value
477F: 70 27 3A
4782: 6E 71
4784: 3A
                                ;
                                ; TableEntry48, Adjustments, Printer Adjustments, Lines Per Page
                                ; ---------------------------------------------------------------
4785: 00 50                     ; Default Value
4787: 00 15                     ; Minimum Value
4789: 00 50                     ; Maximum Value
478B: 00 01
```

```
478D: 00 6E
478F: 7A 3A
                                    ;
                                    ; TableEntry49, Adjustments, Printer Adjustments, Lines Per Page
                                    ; ---------------------------------------------------------------
4791: 00 42                         ; Default Value
4793: 00 0F                         ; Minimum Value
4795: 00 78                         ; Maximum Value
4797: 00 01
4799: 00 6E
479B: 05
479C: 3A
                                    ;
                                    ; TableEntry4A, Adjustments, Printer Adjustments, Pause Every Page
                                    ; ---------------------------------------------------------------
479D: 00 01                         ; Default Value
479F: 00 00                         ; Minimum Value
47A1: 00 01                         ; Maximum Value
47A3: 70 27 3A
47A6: 6E 71
47A8: 3A
                                    ;
                                    ; TableEntry4B, Adjustments, Printer Adjustments, Printer Type
                                    ; ---------------------------------------------------------------
47A9: 00 00                         ; Default Value
47AB: 00 00                         ; Minimum Value
47AD: 00 04                         ; Maximum Value
47AF: 70 57 3A
47B2: 6E A7
47B4: 3A
                                    ;
                                    ; TableEntry4C, Adjustments, Printer Adjustments, Serial Baud Rate
                                    ; ---------------------------------------------------------------
47B5: 00 05                         ; Default Value
47B7: 00 00                         ; Minimum Value
47B9: 00 05                         ; Maximum Value
47BB: 70 61 3A
47BE: 6E 71
47C0: 3A
                                    ;
                                    ; TableEntry4D, Adjustments, Printer Adjustments, Serial DTR
                                    ; ---------------------------------------------------------------
47C1: 00 00                         ; Default Value
47C3: 00 00                         ; Minimum Value
47C5: 00 02                         ; Maximum Value
```

```
47C7: 70 6D 3A
47CA: 6E 71
47CC: 3A
                                    ;
                                    ; TableEntry4E, Adjustments, Printer Adjustments, DTR NSM Stub Only (non accessible
adjustment)
                                    ; ---------------------------------------------------------------
47CD: 00 00                         ; Default Value
47CF: 00 00                         ; Minimum Value
47D1: 00 01                         ; Maximum Value
47D3: 70 27 3A
47D6: 6F 66
47D8: 3A
                                    ;
                                    ;
;-------------------------------------;-----------------------------------
```

FeatureAdjustmentsTable[]

As mentioned in some of the functions above, IJ_L7 stores the pointer to the FeatureAdjustmentsTable[] in $820A. At $820A is 4BE130 which means the FeatureAdjustmentsTable[] is located at $4BE1,30. This table is used when the adjustment index has the 0x80 bit CLEAR.

The format of each table entry is:

- 16-bit Default Value
- 16-bit Minimum Value
- 16-bit Maximum Value
- 6 bytes I've yet to trace through and figure out, as such I haven't neatly formatted these bytes yet…

The entire table is as follows:

```
;--------------------------------------;-------------------------------------
;
; TablePointer15, FeatureAdjustmentsTable[]
;
;
4BE1: 00 24                            ; Table entries is 0x24 (36 entries)
4BE3: 0C                               ; Bytes per table entry is 0x0C (12 bytes)
                                       ; ------------------------------------------------------------
4BE4: 00 00                            ; Default Value
4BE6: 00 00                            ; Minimum Value
4BE8: 00 00                            ; Maximum Value
4BEA: 00                               ;
4BEB: 01                               ;
4BEC: 00 8F                            ;
4BEE: 54                               ;
4BEF: FF                               ;
                                       ;
                                       ;-----------------------------------------------------
                                       ;
                                       ; ADJUSTMENTS, FEATURE ADJUSTMENTS
                                       ;
                                       ;-----------------------------------------------------
                                       ;
                                       ;
                                       ; TableEntry01, Adjustments, Feature Adjustments, Timed Plunger
                                       ; ------------------------------------------------------------
```

```
4BF0: 00 00                     ; Default Value
4BF2: 00 00                     ; Minimum Value
4BF4: 00 78                     ; Maximum Value
4BF6: 00 05 00                  ;
4BF9: 52 C7 30                  ;
                                ;
                                ; TableEntry02, Adjustments, Feature Adjustments, Flipper Plunger
                                ; ---------------------------------------------------------------
4BFC: 00 00                     ; Default Value
4BFE: 00 00                     ; Minimum Value
4C00: 00 01                     ; Maximum Value
4C02: 70 2B 3A                  ;
4C05: 6E 71 3A                  ;
                                ;
                                ; TableEntry03, Adjustments, Feature Adjustments, Loop Lit Timer
                                ; ---------------------------------------------------------------
4C08: 00 0A                     ; Default Value
4C0A: 00 01                     ; Minimum Value
4C0C: 00 78                     ; Maximum Value
4C0E: 00 01 00                  ;
4C11: 52 E8 30                  ;
                                ;
                                ; TableEntry04, Adjustments, Feature Adjustments, Ramp Lit Timer
                                ; ---------------------------------------------------------------
4C14: 00 08                     ; Default Value
4C16: 00 01                     ; Minimum Value
4C18: 00 78                     ; Maximum Value
4C1A: 00 01 00                  ;
4C1D: 52 E8 30                  ;
                                ;
                                ; TableEntry05, Adjustments, Feature Adjustments, Ball Saver Timer
                                ; ---------------------------------------------------------------
4C20: 00 05                     ; Default Value
4C22: 00 00                     ; Minimum Value
4C24: 00 3C                     ; Maximum Value
4C26: 00 01 00                  ;
4C29: 52 C7 30                  ;
                                ;
                                ; TableEntry06, Adjustments, Feature Adjustments, Ball Saver Timer - 3 Ball Multiball
                                ; ---------------------------------------------------------------
4C2C: 00 0A                     ; Default Value
4C2E: 00 00                     ; Minimum Value
4C30: 00 3C                     ; Maximum Value
4C32: 00 01 00                  ;
4C35: 52 C7 30                  ;
```

```
                                ;
                                ; TableEntry07, Adjustments, Feature Adjustments, Ball Save Timer - 2 Ball Multiball
                                ; ---------------------------------------------------------------
4C38: 00 03                     ; Default Value
4C3A: 00 00                     ; Minimum Value
4C3C: 00 3C                     ; Maximum Value
4C3E: 00 01 00                  ;
4C41: 52 C7 30                  ;
                                ;
                                ; TableEntry08, Adjustments, Feature Adjustments, Captive Multiball Start
                                ; ---------------------------------------------------------------
4C44: 00 03                     ; Default Value
4C46: 00 01                     ; Minimum Value
4C48: 00 19                     ; Maximum Value
4C4A: 00 01 00                  ;
4C4D: 52 F8 30                  ;
                                ;
                                ; TableEntry09, Adjustments, Feature Adjustments, Captive Multiball Start Timer
                                ; ---------------------------------------------------------------
4C50: 00 14                     ; Default Value
4C52: 00 05                     ; Minimum Value
4C54: 00 78                     ; Maximum Value
4C56: 00 01 00                  ;
4C59: 52 E8 30                  ;
                                ;
                                ; TableEntry0A, Adjustments, Feature Adjustments, Get the Idol Timer
                                ; ---------------------------------------------------------------
4C5C: 00 1E                     ; Default Value
4C5E: 00 05                     ; Minimum Value
4C60: 00 78                     ; Maximum Value
4C62: 00 01 00                  ;
4C65: 52 E8 30                  ;
                                ;
                                ; TableEntry0B, Adjustments, Feature Adjustments, Streets of Cairo Timer
                                ; ---------------------------------------------------------------
4C68: 00 1E                     ; Default Value
4C6A: 00 05                     ; Minimum Value
4C6C: 00 78                     ; Maximum Value
4C6E: 00 01 00                  ;
4C71: 52 E8 30                  ;
                                ;
                                ; TableEntry0C, Adjustments, Feature Adjustments, Monkey Brains Timer
                                ; ---------------------------------------------------------------
4C74: 00 1E                     ; Default Value
4C76: 00 05                     ; Minimum Value
```

```
4C78: 00 78                     ; Maximum Value
4C7A: 00 01 00                  ;
4C7D: 52 E8 30                  ;
                                ;
                                ; TableEntry0D, Adjustments, Feature Adjustments, Steal the Stones Timer
                                ; ---------------------------------------------------------------
4C80: 00 1E                     ; Default Value
4C82: 00 05                     ; Minimum Value
4C84: 00 78                     ; Maximum Value
4C86: 00 01 00                  ;
4C89: 52 E8 30                  ;
                                ;
                                ; TableEntry0E, Adjustments, Feature Adjustments, Rope Bridge Timer
                                ; ---------------------------------------------------------------
4C8C: 00 1E                     ; Default Value
4C8E: 00 05                     ; Minimum Value
4C90: 00 78                     ; Maximum Value
4C92: 00 01 00                  ;
4C95: 52 E8 30                  ;
                                ;
                                ; TableEntry0F, Adjustments, Feature Adjustments, Castle Grunewald Timer
                                ; ---------------------------------------------------------------
4C98: 00 1E                     ; Default Value
4C9A: 00 05                     ; Minimum Value
4C9C: 00 78                     ; Maximum Value
4C9E: 00 01 00                  ;
4CA1: 52 E8 30                  ;
                                ;
                                ; TableEntry10, Adjustments, Feature Adjustments, Tank Chase Timer
                                ; ---------------------------------------------------------------
4CA4: 00 1E                     ; Default Value
4CA6: 00 05                     ; Minimum Value
4CA8: 00 78                     ; Maximum Value
4CAA: 00 01 00                  ;
4CAD: 52 E8 30                  ;
                                ;
                                ; TableEntry11, Adjustments, Feature Adjustments, The 3 Challenges Timer
                                ; ---------------------------------------------------------------
4CB0: 00 1E                     ; Default Value
4CB2: 00 05                     ; Minimum Value
4CB4: 00 78                     ; Maximum Value
4CB6: 00 01 00                  ;
4CB9: 52 E8 30                  ;
                                ;
                                ; TableEntry12, Adjustments, Feature Adjustments, Raven Bar Level Started
```

```
                                ; ---------------------------------------------------------------
4CBC: 00 01                     ; Default Value
4CBE: 00 01                     ; Minimum Value
4CC0: 00 04                     ; Maximum Value
4CC2: 00 01 00                  ;
4CC5: 53 23 30                  ;
                                ;
                                ; TableEntry13, Adjustments, Feature Adjustments, Choose Wisely Level Start
                                ; ---------------------------------------------------------------
4CC8: 00 01                     ; Default Value
4CCA: 00 01                     ; Minimum Value
4CCC: 00 02                     ; Maximum Value
4CCE: 00 01 00                  ;
4CD1: 53 23 30                  ;
                                ;
                                ; TableEntry14, Adjustments, Feature Adjustments, Jackpot Multiplier Timer
                                ; ---------------------------------------------------------------
4CD4: 00 0A                     ; Default Value
4CD6: 00 05                     ; Minimum Value
4CD8: 00 78                     ; Maximum Value
4CDA: 00 01 00                  ;
4CDD: 52 E8 30                  ;
                                ;
                                ; TableEntry15, Adjustments, Feature Adjustments, Path of Adventure Start Level
                                ; ---------------------------------------------------------------
4CE0: 00 01                     ; Default Value
4CE2: 00 01                     ; Minimum Value
4CE4: 00 04                     ; Maximum Value
4CE6: 70 2B 00                  ;
4CE9: 6E 7A 3A                  ;
                                ;
                                ; TableEntry16, Adjustments, Feature Adjustments, Adventure Continue Timer
                                ; ---------------------------------------------------------------
4CEC: 00 0F                     ; Default Value
4CEE: 00 00                     ; Minimum Value
4CF0: 00 3C                     ; Maximum Value
4CF2: 00 01 00                  ;
4CF5: 52 C7 30                  ;
                                ;
                                ; TableEntry17, Adjustments, Feature Adjustments, Path of Adventure Extra Ball/Pit Lit
Difficulty
                                ; ---------------------------------------------------------------
4CF8: 00 00                     ; Default Value
4CFA: 00 00                     ; Minimum Value
4CFC: 00 01                     ; Maximum Value
```

```
4CFE: 53 33 30                  ;
4D01: 6E 71 3A                  ;
                                ;
                                ; TableEntry18, Adjustments, Feature Adjustments, Lower Playfield Extra Ball Lit Hold
                                ; ---------------------------------------------------------------
4D04: 00 01                     ; Default Value
4D06: 00 00                     ; Minimum Value
4D08: 00 01                     ; Maximum Value
4D0A: 70 2B 3A                  ;
4D0D: 6E 71 3A                  ;
                                ;
                                ; TableEntry19, Adjustments, Feature Adjustments, Super Jets Start
                                ; ---------------------------------------------------------------
4D10: 00 4B                     ; Default Value
4D12: 00 0A                     ; Minimum Value
4D14: 00 FF                     ; Maximum Value
4D16: 00 01 00                  ;
4D19: 52 F8 30                  ;
                                ;
                                ; TableEntry1A, Adjustments, Feature Adjustments, Hand of Fate Lit Difficulty
                                ; ---------------------------------------------------------------
4D1C: 00 00                     ; Default Value
4D1E: 00 00                     ; Minimum Value
4D20: 00 01                     ; Maximum Value
4D22: 53 33 30                  ;
4D25: 6E 71 3A                  ;
                                ;
                                ; TableEntry1B, Adjustments, Feature Adjustments, Hand of Fate Timer
                                ; ---------------------------------------------------------------
4D28: 00 0A                     ; Default Value
4D2A: 00 00                     ; Minimum Value
4D2C: 00 78                     ; Maximum Value
4D2E: 00 01 00                  ;
4D31: 53 08 30                  ;
                                ;
                                ; TableEntry1C, Adjustments, Feature Adjustments, Hold Idol Locks at Game Over
                                ; ---------------------------------------------------------------
4D34: 00 01                     ; Default Value
4D36: 00 00                     ; Minimum Value
4D38: 00 01                     ; Maximum Value
4D3A: 70 27 3A                  ;
4D3D: 6E 71 3A                  ;
                                ;
                                ; TableEntry1D, Adjustments, Feature Adjustments, Attract Mode Sounds
                                ; ---------------------------------------------------------------
```

```
4D40: 00 00                     ; Default Value
4D42: 00 00                     ; Minimum Value
4D44: 00 01                     ; Maximum Value
4D46: 70 2B 3A                  ;
4D49: 6E 71 3A                  ;
                                ;
                                ; TableEntry1E, Adjustments, Feature Adjustments, Attract Mode Music
                                ; ---------------------------------------------------------------
4D4C: 00 01                     ; Default Value
4D4E: 00 00                     ; Minimum Value
4D50: 00 01                     ; Maximum Value
4D52: 70 2B 3A                  ;
4D55: 6E 71 3A                  ;
                                ;
                                ; TableEntry1F, Adjustments, Feature Adjustments, Buy Extra Ball - Buy-in Feature
                                ; ---------------------------------------------------------------
4D58: 00 01                     ; Default Value
4D5A: 00 00                     ; Minimum Value
4D5C: 00 02                     ; Maximum Value
4D5E: 53 37 30                  ;
4D61: 6E 71 3A                  ;
                                ;
                                ; TableEntry20, Adjustments, Feature Adjustments, Buy-in Ball Saver Timer
                                ; ---------------------------------------------------------------
4D64: 00 0A                     ; Default Value
4D66: 00 00                     ; Minimum Value
4D68: 00 3C                     ; Maximum Value
4D6A: 00 01 00                  ;
4D6D: 52 C7 30                  ;
                                ;
                                ; TableEntry21, Adjustments, Feature Adjustments, Gun Trigger During Buy-in
                                ; ---------------------------------------------------------------
4D70: 00 02                     ; Default Value
4D72: 00 00                     ; Minimum Value
4D74: 00 02                     ; Maximum Value
4D76: 53 3D 30                  ;
4D79: 6E 71 3A                  ;
                                ;
                                ; TableEntry22, Adjustments, Feature Adjustments, Outlane Ball Save from Idol Lock or Center
Drop Targets
                                ; ---------------------------------------------------------------
4D7C: 00 01                     ; Default Value
4D7E: 00 00                     ; Minimum Value
4D80: 00 01                     ; Maximum Value
4D82: 70 2B 3A                  ;
```

```
4D85: 6E 71 3A                          ;
                                        ;
                                        ; TableEntry23, Adjustments, Feature Adjustments, Jackpot Difficulty
                                        ; ---------------------------------------------------------------
4D88: 00 01                             ; Default Value
4D8A: 00 00                             ; Minimum Value
4D8C: 00 01                             ; Maximum Value
4D8E: 53 33 30                          ;
4D91: 6E 71 3A                          ;
                                        ;
                                        ;
;---------------------------------------;-------------------------------------------------------
```

Using the information in this document

Assuming all WPC games use similar code (which I find is most often the case), you should be able to determine the adjustments tables in your ROM. You can experiment with adding your own adjustment lookups into your own hacks. You can also play with the min/max values allowed for each adjustment. Additionally you can also figure out when the game is referencing a particular adjustment by using breakpoints or scanning the ROM image for invocations for the lookup functions with particular indexes.

With this information you can NOT add a new adjustment to the ROM. At first I was going to write a little about this, however I realize the WPC menu system code deserves its own document in itself, and a few pages in this document couldn't do it justice. Additionally I don't yet have the entire WPC Menu system figured out, but in the future this will be fully documented and we'll be able to freely modify the WPC menus with new adjustments and other exciting things. It is worth mentioning that the WPC menu system can allow for an alternate default setting for adjustments which are different than the default setting listed in the AdjustmentTable[] entry, so if you ever have problems with the menu "Fac. Setting" not seeming to work properly it could be due to such mechanism.

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