

# Arduino TITO and Player Tracking Project

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## PROJECT GOALS

To allow home slot machine owners the ability to add Ticket In/Ticket Out (TITO), Remote Control, Monitoring and Player Tracking (Display/Keypad/Reader) to their SAS-Compatible games using an Arduino Mega 2560 and reusing existing player tracking hardware

Portions of the Arduino SAS protocol implementation by Ian Walker

Additional testing and troubleshooting by NLG member Eddiie

## HARDWARE REQUIRED

Arduino Mega 2560 R3 or the [Songhe Mega2560 + WiFi R3 \(ESP8266\)](#)

<https://www.amazon.com/gp/product/B01H4ZLZLQ/> or

<https://www.amazon.com/gp/product/B07THDDFSJ/>

RFID RC 522 (**not needed** if you will be using a compatible magnetic card reader)

<https://www.amazon.com/gp/product/B07KGBJ9VG/>

W5100 Ethernet Shield (**not needed** if you will be using the Songhe Mega2560 or Compatible ESP8266)

<https://www.amazon.com/gp/product/B00AXVX5D0/>

MAX3232 Serial port (or compatible)

<https://www.amazon.com/gp/product/B083L99CGZ/>

HiLetgo Stackable SD Card Shield (**only** if using the Songhe Mega2560)

<https://www.amazon.com/gp/product/B006LRR0IQ/>

6' USB Cable

<https://www.amazon.com/dp/B00NH11KIK>

6' M-F 9-pin straight-through serial cable (some setups may need a shielded and chassis-grounded cable due to electrical interference from game)

<https://www.amazon.com/dp/B006W3XVZK>

Micro-SD memory card – 32GB or smaller

<https://www.amazon.com/gp/product/B073K14CVB>

Compatible slot machine

- Tested on IGT S2000/GameKings/AVP, Bally, WMS and Konami machines; will probably work on others based on the SAS 6.x protocol; you will need a compatible cable to connect to the serial port on the machine

Player tracking bracket with a compatible card reader, compatible VF (or LCD) display and a compatible keypad

Compatible Vacuum Fluorescent Display or LCD

- 1602A LCD displays using the LiquidCrystal library (Default)
- IEE Compatible VF Display such as: IEE 03601-95A-40 using included modified library
- DataVision DV-16236 displays using the LiquidCrystal library
- Noritake GU-7000 Series displays using included modified library
- Noritake CU20025ECPB-U1J display using the LiquidCrystal library in 8 bit mode
- Futaba NA202SD08FA display using the included FutabaVFD library

Compatible Keypad (Optional)

- ACT 8x2 Keypad (Default)
- Bally Systems Player Tracking 6x2 Keypad P/N 105123F
- Bally Systems Player Tracking 3x4 Keypad

## Compatible Card Readers

- Generic RFID (Default)
- UIC MSR240-02TMRNWWBR (Figure 3)
- Neuron Card Reader (Not working yet - but similar pinout to UIC)
- XS Technologies PI70-120-TLA-DFR (Figure 4)
  - o You will need to make minor adjustments to the sketch as noted in the comments
  - o To make wiring easier pick up one of these: RJ12 Male to Pin Screw Terminals:  
<https://www.amazon.com/gp/product/B07KJLDS1Q>
    - You will need to cut off a bit of the black housing to make it fit properly but it was easy to do with a razor knife

Dupont M-F jumper wires (quantity and length depends on configuration)

CAT5 cable long enough to reach from your network jack to the top box (if using the Ethernet version)

Serial cable to connect to game

- For IGT Games: 5-pin Dupont to Male DB9 Serial pigtail (I reused the one from the BETTORSlots TITO board; I have not found a source for these yet – see Figure 1)

## Compatible Player Cards (at least 3)

- RFID: <https://www.amazon.com/gp/product/B01FR66KW1>
- MAGSTRIPE: Magnetic Stripe cards with Track 2 data
  - o I tested this with a variety of casino tracking cards and other loyalty cards
  - o The program reads the serial number from track 2, drops any leading or trailing zeros and uses the last 8 digits so as to be compatible with the 8.3 filename format limitation; because of this there is a slim chance that two random cards could have the same number

5 Watt or greater USB Power Brick

3D printed case for Arduino (or something to protect Arduino from shorting-out on metal in the cabinet)

- <https://www.thingiverse.com/thing:30270>
- <https://www.thingiverse.com/thing:1364105>

## SOFTWARE REQUIRED

Latest version of Arduino IDE

<https://www.arduino.cc/en/software>

## BEFORE YOU BEGIN

These instructions assume familiarity with electronics, coding and slot machine configurations. If you are new to any of these then this project may not be for you. My instructions were not written for beginners. You may damage your game or the Arduino/TITO hardware if you do not understand what you are doing.

If you are using the SONGHE MEGA2560 + WIFI R3 (ESP8266) board – **STOP NOW** and upgrade the firmware on your board following the instructions in the section titled: **UPDATING THE FIRMWARE ON THE SONGHE MEGA2560 + WIFI R3 (ESP8266)**

## PICK YOUR VERSION

Version 3.0 reduces the number of sketches for the MEGA project to two; one for the normal MEGA board and one for the WiFi board. The sketches now contain all code to support RFID and Magnetic card readers along with the various display and keyboard types. You will need to modify the sketch for the hardware you have.

- Arduino Mega 2560 R3 with the W5100 Ethernet Shield
- Songhe Mega2560 + WiFi R3 board

## WIRING

- Ethernet/Wi-Fi Wiring
  - o If using the W5100 Ethernet Shield, attach it to the Arduino Mega via the built-in pin headers
  - o If using the Songhe Mega2560 + WiFi R3 board be sure dip switches 1-4 are ON, switches 5-8 are OFF and the RXD3/TXD3 switch is ON
  - o If you are using a generic ESP8266 module you will need to wire it into Serial3 on the Mega2560
- HiLetgo Stackable SD Card Shield (Songhe Mega2560 + WiFi R3 board only)
  - o Attach the SD Card Shield to the Songhe Mega2560 board via the built-in pin headers
  - o Set the SD/TF switch to the appropriate setting depending on the type of storage card you are using
- Display Wiring
  - o If using an IEE VFD (assumes IEE Vacuum Fluorescent Display 03601-95A-40) then wire the connections as follows:

IEE VFD	Arduino
Pin 1	Data Pin 22
Pin 2	Data Pin 23
Pin 3	Data Pin 24
Pin 4	Data Pin 25
Pin 5	Data Pin 26
Pin 6	Data Pin 27
Pin 7	Data Pin 28
Pin 8	Data Pin 29
Pin 9	Data Pin 30
Pin 10	Data Pin 31
Pin 11	5V
Pin 12	GND

- o If using a 1602a LCD or equivalent then wire the connections as follows:

LCD 1602A	Arduino
Pin 1	GND
Pin 2	5V
Pin 3	GND
Pin 4	Data Pin 22
Pin 5	GND
Pin 6	Data Pin 23
Pin 7	N/C
Pin 8	N/C
Pin 9	N/C
Pin 10	N/C

Pin 11	Data Pin 27
Pin 12	Data Pin 26
Pin 13	Data Pin 25
Pin 14	Data Pin 24
Pin 15	5V with 220ohm Resistor
Pin 16	GND

- If using a Noritake CU20025ECPB-U1J or equivalent then wire the connections as follows:

CU20025ECPB-U1J	Arduino
Pin 1	GND
Pin 2	5V
Pin 3	N/C
Pin 4	Data Pin 22
Pin 5	GND
Pin 6	Data Pin 23
Pin 7	Data Pin 31
Pin 8	Data Pin 30
Pin 9	Data Pin 29
Pin 10	Data Pin 28
Pin 11	Data Pin 27
Pin 12	Data Pin 26
Pin 13	Data Pin 25
Pin 14	Data Pin 24

Reference:

<https://media.digikey.com/pdf/Data%20Sheets/Noritake%20PDFs/CU20025ECPB-U1J.pdf>

- If using a DataVision DV-16236 or equivalent then wire the connections as follows:

DataVision	Arduino
Pin 1	GND
Pin 2	5V
Pin 3	GND
Pin 4	Data Pin 22
Pin 5	GND
Pin 6	Data Pin 23
Pin 7	N/C
Pin 8	N/C
Pin 9	N/C
Pin 10	N/C
Pin 11	Data Pin 27
Pin 12	Data Pin 26

Pin 13	Data Pin 25
Pin 14	Data Pin 24

Reference: [http://www.datavision.com.tw/en/lcm\\_01\\_1.php?P\\_Id=9](http://www.datavision.com.tw/en/lcm_01_1.php?P_Id=9)

- If using a Futaba NA202SD08FA or equivalent then wire the connections as follows:

Futaba	Arduino
Pin 1 (missing)	N/C
Pin 2	Data Pin 23
Pin 3	Data Pin 24
Pin 4	Data Pin 25
Pin 5	Data Pin 26
Pin 6	Data Pin 27
Pin 7	Data Pin 28
Pin 8	Data Pin 29
Pin 9	Data Pin 30
Pin 10	Data Pin 31
Pin 11	5V
Pin 12	GND
Pin 13	N/C
Pin 14	Data Pin 22

Reference: <https://www.torretje.nl/files/NA202SD08FA%20Datasheet.pdf>

- If using a Noritake VFD GU140X16G-7003 or equivalent then wire the connections as follows:

VFD	Arduino
Pin 1	5V
Pin 2	Data Pin 3
Pin 3	GND
Pin 4	Data Pin 5
Pin 5	N/C
Pin 6	Data Pin 7

Reference: [https://www.noritake-iron.com/site2017/images/Specs/VFD/MDG/GU140x16J-7000x/7003/gu140x16j-7003\\_e01-h8.pdf](https://www.noritake-iron.com/site2017/images/Specs/VFD/MDG/GU140x16J-7000x/7003/gu140x16j-7003_e01-h8.pdf)

- This assumes display is preset to Async Serial; if set otherwise then a different pinout and library will be required
- **IMPORTANT!** The sketch will hang on Initializing if you test it without the Noritake display attached

- **WARNING!** This display draws more power than my desktop PC USB could provide and exhibited strange behavior when all of the hardware was tested together. A 5W wall adapter provided sufficient power to prevent this condition

- Keypad Wiring (See Figure 2 for examples of tested keypads)
  - o If using the Bally 6x2 or 3x4 keypad then wire the connections as follows:

Bally	Arduino
Pin 1	Data Pin 39
Pin 2	Data Pin 38
Pin 3	Data Pin 41
Pin 4	Data Pin 40
Pin 5	Data Pin 43
Pin 6	Data Pin 42
Pin 7	Data Pin 45
Pin 8	N/C

- o If using the ACT 8x2 keypad then wire the connections as follows:

ACT	Arduino
Pin 1	Data Pin 38
Pin 2	Data Pin 39
Pin 3	Data Pin 40
Pin 4	Data Pin 41
Pin 5	Data Pin 42
Pin 6	Data Pin 43
Pin 7	Data Pin 44
Pin 8	Data Pin 45
Pin 9	N/C

- The Serial board needs to be wired as follows:

Serial	Arduino
VCC	5V
RXD	Data Pin 19
TXD	Data Pin 18
GND	GND

- If using an existing Uniform Industrial Corp or compatible Magnetic Stripe reader (See Figure 3) then wire the connections as follows:

Card Reader	Arduino
Pin 1 (5V)	5V



Pin 2 (Data)	Data Pin 20
Pin 3 (Clock)	Data Pin 21
Pin 4 (Unused)	N/A
Pin 5 (Insert)	Data Pin 8
Pin 6 (Inserted)	Data Pin 9
Pin 7 (Ground)	GND

- If using an existing XS Technology or compatible Serial Magnetic Stripe reader (See Figure 4) then wire the connections as follows:

Card Reader	Arduino
Pin 1 (TXD)	Data Pin 17
Pin 2 (RXD)	Data Pin 16
Pin 3 (5V)	5V
Pin 4 (Ground)	GND
Pin 5 (CDR)	Data Pin 2
Pin 6 (Lamps)	N/A

- If using RFID then the reader needs to be wired into data pins 49-53 as follows:

RFID Reader	Arduino
SDA	Data Pin 53
SCK	Data Pin 52
MOSI	Data Pin 51
MISO	Data Pin 50
GND	GND
RST	Data Pin 49
3.3V	3.3V

You will need to power the Arduino board from the Accessory Outlet in the base of the slot machine using a USB power brick (5W or greater). A 6' USB cable is recommended to reach the top cabinet. It may be possible to get power from the top-cabinet but that is beyond the scope of this document

- Do not power the board from any built-in USB port on the game – it will not provide enough power

## INITIAL SETUP

- Assumes you have the Arduino IDE setup, the board and COM port settings are correct and all required libraries are installed, including
  - o IniFile\*
  - o IeeFlipNoFrills, Noritake GU-7000, FutabaVFD or LiquidCrystal
    - The sketch default configuration is a 20x2 LCD using the LiquidCrystal Library
      - The sketch defaults to 4 bit mode; there is an option for 8 bit mode
    - You will need to use the included modified libraries for the IeeFlipNoFrills, FutabaVFD or the Noritake displays
    - For the Noritake library there is another section of code to enable in the setup() function
    - The Noritake CU20025ECPB-U1J uses the LiquidCrystal library in 8 bit mode
  - o SPI\*
  - o MFRC522\*, MagStripe or MagStripeSerial
    - You will need to use the modified MagStripe libraries included in the package
  - o Ethernet\* if using the W5100 Shield or WiFiEspAT\* if using the Songhe Mega2560 + WiFi
  - o SD\*
  - o Keypad\*
    - The sketch defaults to a Bally compatible 6x2 or 3x4 matrix
- Use the latest version of the libraries available at the time you compile it; with the exception of any custom libraries I have supplied.
- Format the MicroSD Card as FAT32
- Edit the included config.txt file with your settings and preferences; then copy it and the index.htm file to the SD card
  - o The scrolling text options have a max length of 255 characters
  - o Other text options have a limit of 30 characters (with exception of Casino Name – which should not exceed max width of your display)
  - o Other options are Boolean or Integers
  - o **IMPORTANT! Set the display dimensions to the correct size based on your display**
    - Some VFDs like the Noritake calculate the display size in pixels; Example: a GU140X16G-7003 is a 140x16 display; so the displayWidth should be 140 and the displayHeight should be 16
    - You will need to adjust the displayCols and displayRows to match the character dimensions of the display; Example: the GU140X16G-7003 emulates a 20x2 character display; so the displayCols should be 20 and the displayRows should be 2
    - Setting these incorrectly will cause display problems
- Insert the SD card into the slot on the shield
- Connect the board to your computer and load the compatible ArduinoTITOPlayerTracking sketch for your hardware
- Modify the sketch as needed to enable support for your display, card reader and keypad; see inline comments for the relevant sections
- Open the Serial Monitor

- Download the sketch to the Arduino
- Wait for the app to finish initializing
- Disconnect the Arduino from your PC
- Mount the hardware into the slot machine's top box. Your specific player tracking bracket and options may vary – use your best judgement on how to mount the hardware
- For RFID I removed the existing card reader electronics (leaving the slot and frame) and mounted the RFID reader on top of the slot so it can read the cards when inserted
- Run the USB power wire down through the cabinet and route it to the accessory outlet
- For Ethernet Only: Run the CAT5 Ethernet cable down through the cabinet and out to your network outlet
- Run the Serial Port cable down through the cabinet and connect it to the serial pigtail (if you are replacing a BETTORSlots TITO board; otherwise an adapter will need to be created) Running this cable may be a tight fit – you may need to remove the grommet in the cabinet pass-through or shave down the cable-end to make it fit
- Power on the machine and wait for it to fully start
- While setting up or debugging you should power the Arduino from a laptop so you can see the output on the serial monitor
- Insert your first card - the app will create a default player tracking file on the SD Card. Note the cardID in the Serial Monitor. This will be your first player card
- Remove the card from the reader and insert a different card. This will create a second card file which you can edit into the Admin card. Note the cardID in the Serial Monitor
- Remove the card from the reader and insert a different card. This will create a third card file which you can edit into the System Bonus card. Note the cardID in the Serial Monitor
- Unplug the Arduino; remove the SD Card and insert it into your PC/Laptop. Edit the player tracking card files accordingly. Details on the file formats are in the 'Arduino TITO and Player Tracking Project - File Formats.txt' file
- After editing the files replace the SD card in the Arduino
- Power on the machine and test
  - o Assumes you are replacing an existing TITO board or have already setup your machine per the instructions later in this document

#### **NOTE REGARDING MAGSTRIPESERIAL**

After you load the sketch for the first time onto the hardware you need to unplug the power to the board for a few moments and then power it back up – otherwise the Serial2 port doesn't always take its new configuration and will not read cards properly. This is only after the initial load.

## CARD SERVER (OPTIONAL)

- Included in the package is a self-contained web server (APTS.EXE) designed to host and serve the card data to multiple slot machines. It can be run on any Windows 10 PC with the .NET Core 3.1 runtime (<https://dotnet.microsoft.com/download/dotnet-core/3.1>)
  - o If you have multiple machines (each with one of these boards) you can also designate one of the machines to host the card data and then set the other machines to be clients by setting their localStorage option to 0 and populating the serverIPAddress with the IP of the machine to act as host. That machine (or more specifically the board) will need to be powered for it to serve card data to the other machines
- Place the EXE in a folder on your PC. Cards will be created in this folder
- You will need to disable Windows Firewall or add a rule to allow connections to port 80
- The app must be run as an Administrator
- If you have configured your machines to use the card server and it is not running then player tracking will be unavailable
- In each config.txt file set the localStorage option to 0 and set serverIPAddress to the IP Address of the computer running the Card Server

## ADMIN MENU

- The Admin Menu can be entered by inserting the Admin Card or pressing [CLR] on the keypad and then entering the Admin Pin followed by [ENT] on the keypad
  - o The Admin Pin defaults to 1234 and is adjustable in the config.txt file
- The display will change to 'ADMIN MENU'. In this mode you can perform the following actions from the keypad:
  - o Press 1 to Add Credits; after selecting this option use the keypad to enter the number of credits to add to the game
  - o Press 2 to Unmute the game
  - o Press 3 to Mute the game
  - o Press 4 to Unlock the game
  - o Press 5 to Lock the game
  - o Press 6 to Enable the Bill Validator
  - o Press 7 to Disable the Bill Validator
  - o Press 8 to Enable Change-to-Credits feature
  - o Press 9 to Disable Change-to-Credits feature
  - o Press 0 to Exit Admin Menu
- Remove the Admin Card or press '0' to return to the attract mode

## PLAYER MENU

- The Player Menu can be entered by pressing [ENT] on the keypad while a Player Card is inserted.
- The display will change to 'PLAYER MENU'. In this mode you can perform the following actions from the keypad:
  - o Press 1 to Show Comp Balance
  - o Press 2 to Use Comp Credits
  - o Press 0 to Exit Player Menu
- Remove the Player Card or press '0' to return to the attract mode

## PLAYER COMPS

Players can earn Comp Credits while playing the game at a rate specified by the 'compPercentage' setting in the config.txt file. It defaults to 0.01 comps per credit played – so if you play 100 credits you will earn 1 comp credit. Setting compPercentage to zero will disable the comp system.

Comp Credits can be redeemed at the machine by entering the Player Menu (instructions above) and using option 2. Only whole-credits can be redeemed.

## VERSION INFO

Press 0 on the keypad while in attract mode will display the current software version and IP Address of the device.

## REMOTE ACCESS

- The application includes a web interface for controlling various aspects of the game as well as the player tracking display
- It is compatible with the BETTORSlots IOS/Android apps (except tournament mode)

**Arduino TITO and Player Tracking**  
Game Name: **Slot Machine** Current player: **No Card Inserted**  
IP Address: **192.168.1.251** Version: **3.0.20240117**

Add Credits	1000
Sound On	Sound Off
Unlock Play	Lock Play
Enable Bill Validator	Disable Bill Validator
Change/Credits On	Change/Credits Off
Game Statistics	Player Statistics
Reboot Arduino	Jackpot Reset
Update Player Name	Set Player Comps
Show Config	

**Update Display**  
  
**Update Message**

**Update Ticket Info**  
  
  
  
**Update Ticket Info**

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Most functions are self-explanatory; The Change/Credits feature allows you to enable adding credits by pressing the Change (or Service) button. The number of credits added on each press is set in the config.txt file.

The Update Message option allows you to change the default scrolling text message; it resets to the value in the config.txt when the board is reset.

The Update Ticket Info option allows you to change the information printed on the cash-out ticket.

Not all functions work on all machines. Some features, like remote Jackpot Reset, must be enabled in the game first.

## GAME MANAGER

Game Manager allows you to manage one or more game machines via a simple interface. It can be run on any Windows 10+ PC with the .NET 5.0 runtime (<https://dotnet.microsoft.com/download/dotnet/5.0>)

Click 'Add Game' to add a new row to the grid. Only the IP Address is needed as the other fields will be populated by the game data. Double-click on the row's IP Address cell to edit it. Then press Refresh to query the game for data. You can delete a game by selecting the row in the grid and clicking 'Delete Game'. For the Game Controls – you can select one or more games to control/update by holding down the [CTRL] key while clicking on each row.

The screenshot shows the 'Arduino TITO and Player Tracking - Game Manager' application window. At the top is a table with columns: Game Name, IP Address, Is Online, Last Response, Credits, Total In, Total Won, Total Games, Games Won, Games Lost, Current Player, Games Played, Games Won, Games Lost, Total Won, and Comps Earned. Two rows are visible: 'Wild Triple ...' with IP 192.168.1.99 and 'Slot Machine' with IP 192.168.1.251. Below the table are three buttons: 'Add Game', 'Delete Game', and 'Save Config'. To the right are checkboxes for 'Apply to all games' and 'Auto Refresh', and a 'Refresh' button. The 'Game Controls' section contains a grid of buttons for 'Add Credits' (showing 100), 'Sound On/Off', 'Unlock/Lock Play', 'Enable/Disable Bill Validator', 'Change/Credits On/Off', 'Sync Date/Time', 'Jackpot Reset', 'Update SD Card', 'Show Config', and 'Reboot Arduino'. The 'Update Display' section has a text input field for a custom message and an 'Update Display' button. The 'Update Ticket Info' section has input fields for 'Casino Name/Location', 'Address Line 1', and 'Address Line 2', with an 'Update Ticket Info' button. A footer message reads: 'Reminder! Not all games support all features and options. Thank you.'

Game Name	IP Address	Is Online	Last Response	Credits	Total In	Total Won	Total Games	Games Won	Games Lost	Current Player	Games Played	Games Won	Games Lost	Total Won	Comps Earned
Wild Triple ...	192.168.1.99	<input checked="" type="checkbox"/>	COM ERROR	5688	40858	53981	11950	1337	10613	Marc Davis	19	3	16	37	200.00
Slot Machine	192.168.1.251	<input type="checkbox"/>	OK												

## NOTES ABOUT GAME MANAGER

- If a player card is inserted in a game you can edit the Player's Name by double-clicking on the name in the grid, changing it and then pressing [ENTER] or clicking away from the field
- If a player card is inserted in a game you can edit the Player's Comp Credits by double-clicking on the Comps Earned field in the grid, changing it and then pressing [ENTER] or clicking away from the field
- My games did not always accept the Sync/Date Time command on the first try; not sure if this is an issue with the game or the data yet
- Build 20210818 includes the ability to update the config.txt and index.htm files on your games without having to pull the SD cards from the board. You can use the 'Update SD Card' option to upload newer files from your PC. Be careful though! You can easily brick your device or cause it to return to default settings if you apply a bad config file
- Build 20210222 and later includes the ability to remotely reboot the Arduino board
- If you hover over the game name you will see the board software version in the hint-text.
- This is definitely a BETA app; expect bugs

## CONFIGURING YOUR IGT MACHINE (S2000/GameKing)

Before getting started with setting up your IGT machine for TITO please ensure your Bill Validator is working correctly and your Ticket Printer can print clear and legible tickets. You will also need a Keychip appropriate for your type of machine. These instructions assume familiarity with the Keychip process. Note – keychips and menu option locations vary from model-to-model. Please consult your IGT user manual or me if you have questions.

1. Clear any credits off your machine
2. Keychip your machine
3. Once in the Keychip Menu, ensure your Denomination, Devices, Limits and Game settings are as you want them
4. Setup the Comm Options as follows
  - a. IGT SAS Primary Channel = Channel 3
  - b. SAS Secondary = Off
  - c. Bally Miser = Off
  - d. Progressive Link = 7
  - e. WAMM 1.0 = Off
5. Setup the Validation/Redemption Options as follows
  - a. Validation = System Validation
  - b. Redemption = SAS Redemption
6. Setup the IGT SAS Options as follows
  - a. System Bonusing = SAS Legacy
7. Setup the SAS Channel (Primary Channel) Options as follows
  - a. Address = 1
  - b. Legacy Bonus = Enabled (X)
  - c. Validation = Enabled (X)
8. Setup the Machine Terminal Options as follows
  - a. Voucher Limit Follows = Credit Limit
9. Save all options and make any other changes you wish before pressing Return to Game to exit the keychip menu

Test the game by inserting money and then pressing Cash Out to generate a ticket. The ticket serial number should match the number of credits you inserted. Insert the ticket into the machine, it should accept it for the same number of credits.

## CONFIGURING YOUR IGT MACHINE (AVP)

Please see this video for how to configure your AVP Game:

<https://www.youtube.com/watch?v=JKjyeFQPltA>



## NOTES

- If you do not have a display or card slot (or only wish to use this as a TITO solution) you can set the option 'onlyTITO' to 1 in the config.txt
- Not all machines support controlling the sound or the Remote Jackpot Resets – in those cases the commands will be ignored by the machine
- A user reported erratic behavior on an IGT AVP game; it was traced to interference on the serial cable; to fix it they used a shielded DB9 cable and grounded the cable to the game chassis
- I was only able to successfully test the Bally Magnetic Card reader pictured in Figure 3. The Neuron card reader should have the same pinouts however the one I have may be defective as the switch pins were floating high randomly. Your mileage may vary

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## UPDATING THE FIRMWARE ON THE SONGHE MEGA2560 + WIFI R3 (ESP8266)

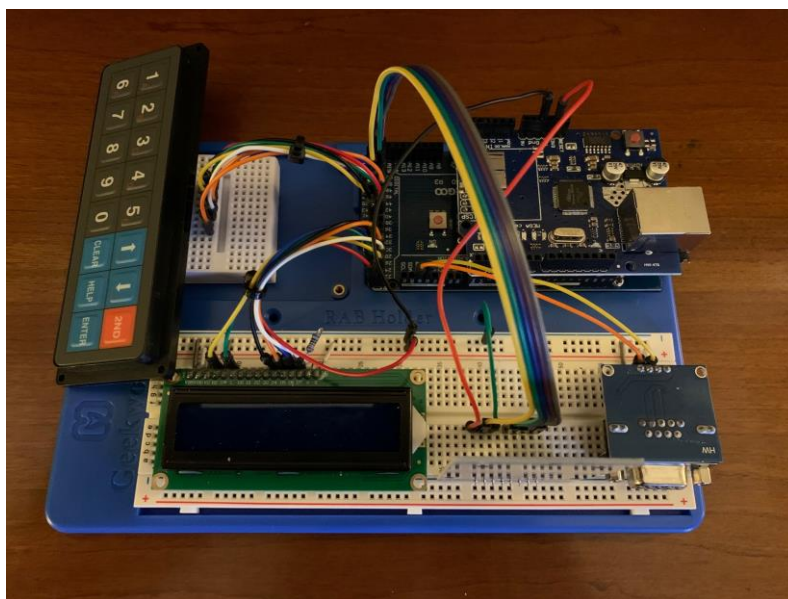
The Songhe Mega2560 + WiFi R3 board from Amazon usually comes with a very old version of the ESP8266 firmware. You must update this firmware before installing the project software onto the board. These instructions assume you are running Windows 10 or later. There are a lot of steps – but it is mostly painless.

**WARNING:** These instructions assume you are using the Songhe Mega2560 + WiFi R3 board. This board had a 4MB Flash. Some ESP8266 modules have less which will require a different address setup for esptool.

1. Plug the Songhe Mega2560 + WiFi R3 board into your computer via the included USB cable
2. Open the Arduino IDE
  - a. Under Tools, Board – be sure the Mega 2560 or Compatible is selected
  - b. Under Tools, Port – select the COM port for the board
  - c. Confirm it is correct by running 'Get Board Info' under Tools
  - d. Note down the COM port number – you will need this information later
  - e. Close the Arduino IDE
3. Unplug the board from the computer
4. On the board: set dip switches 1-4 to OFF, switches 5-8 to ON and the RXD0/TXD0 switch to ON
5. Plug the board back into the computer
6. The firmware is located in the project ESP8266\Firmware folder
7. Create a folder called ESP8266 in the root of your C: drive; example C:\ESP8266
8. Extract the ESP8266\_NonOS\_AT\_Bin\_V1.7.4.zip file into C:\ESP8266
9. Install Python from this location: <https://www.python.org/ftp/python/3.10.8/python-3.10.8-amd64.exe>
  - a. During the install, enable the 'Add Python to PATH' option and then click 'Install Now'
  - b. Wait for installation to finish and close the installer
10. Open a command prompt (START, RUN and type 'CMD' followed by the ENTER key)
11. In the Command Prompt window, type 'pip install esptool' and press ENTER
12. Change Directory to the C:\ESP8266\ESP8266\_NonOS\_AT\_Bin\_V1.7.4\bin folder (CD C:\ESP8266\ESP8266\_NonOS\_AT\_Bin\_V1.7.4\bin and press ENTER)
13. Run this command; replacing COMX with the COM port you identified in the Arduino IDE from step 2 above; this is one long line that will wrap on your console window:  
  

```
esptool.py --port COMX write_flash --flash_size detect 0x00000 boot_v1.7.bin 0x01000  
"at\1024+1024\user1.2048.new.5.bin" 0x1fb000 blank.bin 0x1fc000  
esp_init_data_default_v08.bin 0xfe000 blank.bin 0x1fe000 blank.bin
```
14. Wait for the update process to finish. Do NOT unplug the board during this process or serious damage will occur!
15. After the update has finished, unplug the board from the computer
16. On the board: set dip switches 1-4 to ON, switches 5-8 to OFF and the RXD3/TXD3 switch to ON
17. Plug the board back into the computer
18. You are now ready to deploy the project sketch to the board

## EXAMPLE PHOTOS



Mockup using 1602LCD, 8x2 Keypad and RFID reader

FIGURE 1: IGT Serial Cable



IGT S2000/GameKing Serial Pinout

DB9 Male	Signal direction	S2000 J82
3 Receive Data	←	1 Transmit Data
2 Transmit Data	→	2 Receive Data
5 Signal Ground	---	5 Signal Ground

Option: DB9 to Dupont Serial Cable: <https://www.amazon.com/gp/product/B081GJR1MN>

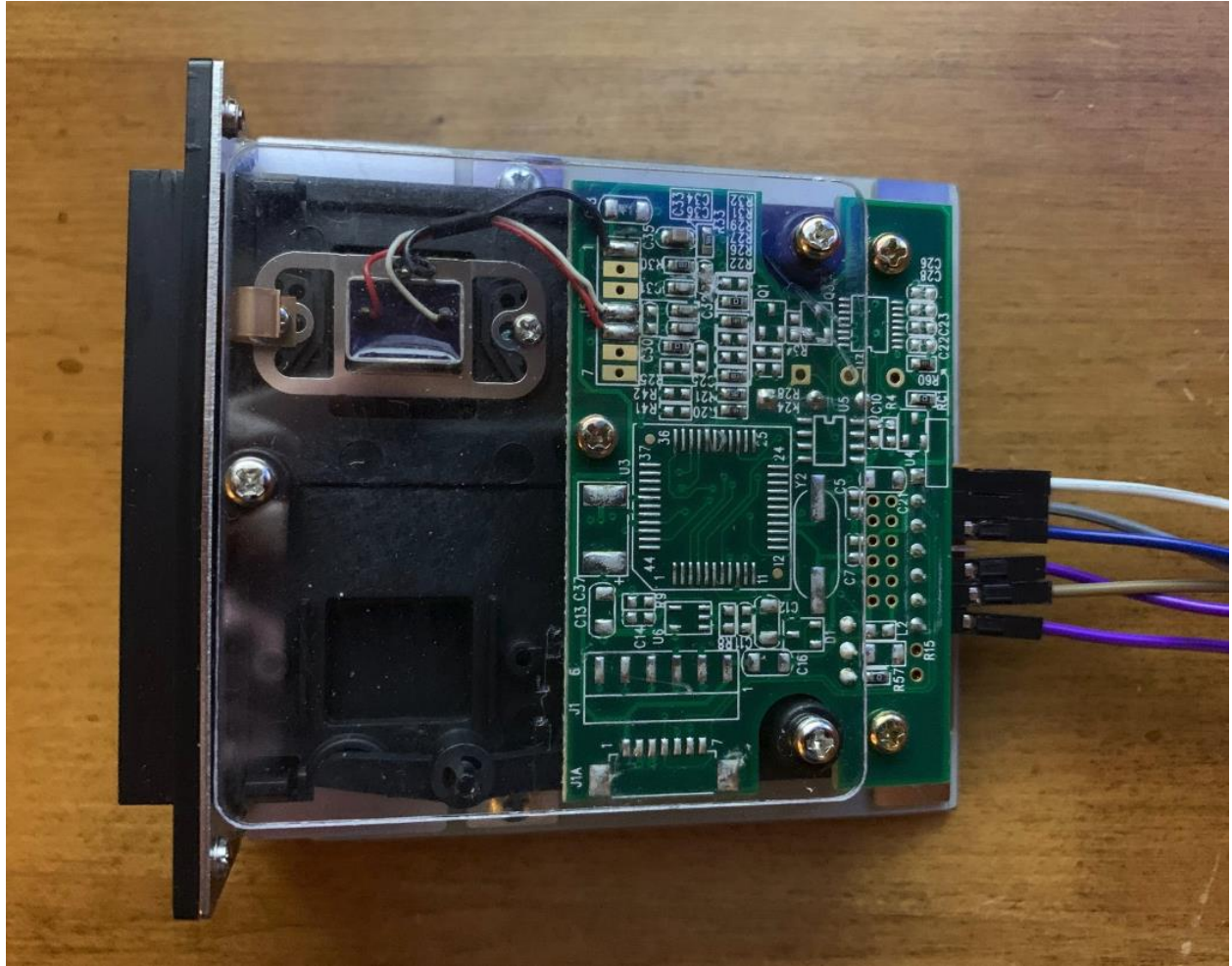




FIGURE 2: Compatible/Tested Keypads

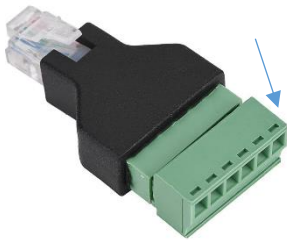
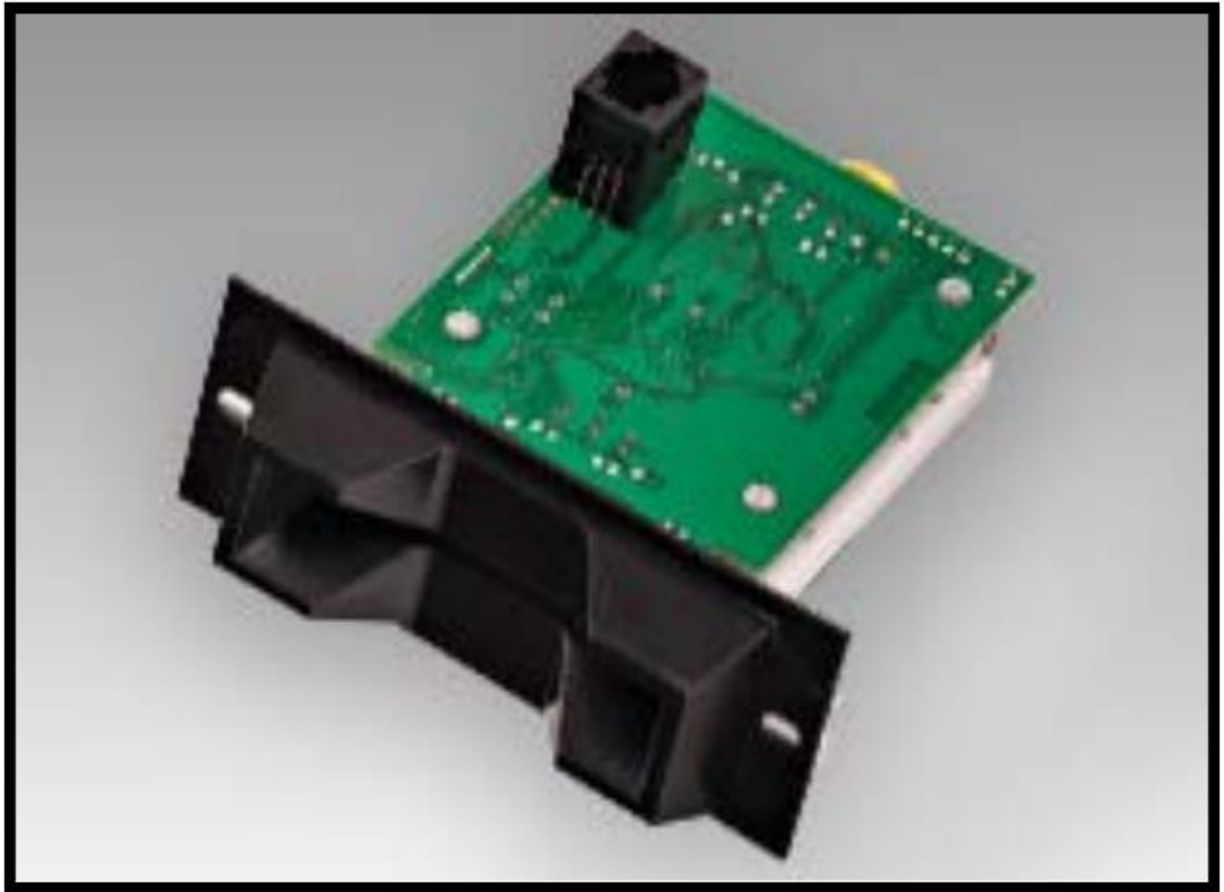


FIGURE 3: MSR240-02TMRNWWBR Card Readers



Pin 1 in this orientation is at the top (white)

FIGURE 4: PI70-120-TLA-DFR Card Readers



Cable Audio Adapter, Ethernet RJ12 6P6C Male to 6 Pin Screw Terminals Adapter Connector (<https://www.amazon.com/gp/product/B07KJLDS1Q>)

In this orientation Pin 1 is on the right as shown.

Only Pins 1-5 are required for this application.

I used male Dupont cables and snipped off one end for the connector side