



# ASI MULTI CARTRIDGE

This Atari System 1 multi setup was developed over 4 years. Previous to this full cartridge I had developed a plugin board version that required an original cartridge, it consisted of 10 interconnected boards. It worked fine but was fiddly and time consuming to build and install. So I decided to produce a full cartridge replacement! The plugin board system is still the only option if you have a cockpit board set so I will make this available if people contact me directly.

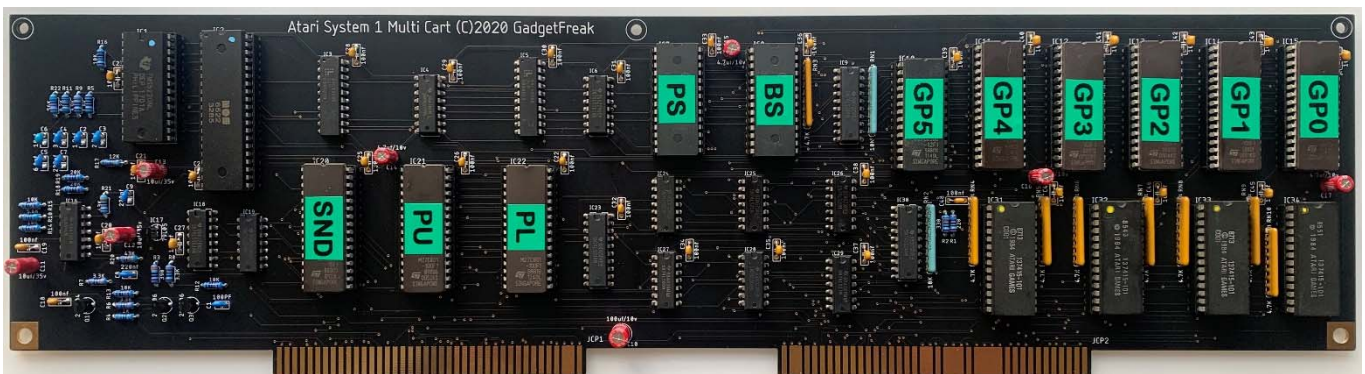
**NOTE:** If your board does not have a LETA chip at 14/15B (TTL) or 12C (LSI) then you will not be able to use trackballs for MM or the steering wheel for RB.

Also supplied with the cartridge are 2 blank PCB's. One is a blank Joystick PCB that allows the use of one or two Ultrastik 360 hall effect joysticks instead of, or as well as, a Road Runner joystick. While the other is a TTL Slag PCB which can be used instead of the 4 x Atari 137415-101 (Slag) custom IC's.

A custom Rom Generator (Windows) is part of the package and allows you to select individually for each game which version is used, especially handy if you want the German versions! The mainboard type is selectable in this program as well (TTL / LSI).

The original rom files used by this program need to be obtained by you the user as they are copyright of Atari. It is presumed that you have the appropriate game roms and are entitled to read your own copy into a folder and then to install and play the games.

## Finished Cartridge



## Required Parts



### Capacitors

C1	100pf ceramic (2.5mm)
C2	1.2nf ceramic (2.5mm)
C3	2.7nf ceramic (2.5mm)
C4	3.9nf ceramic (2.5mm)
C5	6.8nf ceramic (2.5mm)
C6	18nf ceramic (2.5mm)
C7-9	220nf ceramic (2.5mm)
C10	100uf / 10v electrolytic
C11-13	10uf / 35v electrolytic
C14-17	4.7uf / 10v electrolytic
C18-48	100nf ceramic (5mm)

### Transistors

Q1	2N3904 (TO92)
Q2	2N3906 (TO92)
Q3	2N3906 (TO92)

### Resistors

R1	220 ohm
R2	330 ohm
R3	390 ohm
R4	1K
R5	1.8K
R6-8	3.3K
R9	3.9K
R10	5.6K
R11	8.2K
R12-16	10K
R17	12K
R18-19	20K
R20-21	43K
R22	56K
RN1-2	10K SIL (9 pin)
RN3-10	4.7K SIL (9 pin)

### IC's

IC3	S Custom GAL (DIL20)
IC4	74LS174N (DIL16)
IC5	P Custom GAL (DIL20)
IC6	74LS161N (DIL16)
IC9	74LS244N (DIL20)
IC16	TL084P (DIL14)
IC17	79L05 (TO92)
IC18	74LS161N (DIL16)
IC19	74LS04N (DIL14)
IC23	74LS244N (DIL20)
IC24	74LS07N (DIL14)
IC25-26	74LS30N (DIL14)
IC27	74LS00N (DIL14)
IC28	74LS04N (DIL14)
IC29	74LS27N (DIL14)
IC30	74LS244N (DIL20)

### IC's (Donor Cartridge)

IC1	TMS 5220 (DIL28)
IC2	MOS 6522 (DIL40)
IC31	Atari 137415-101 (DIL28)
IC32	Atari 137415-101 (DIL28)
IC33	Atari 137415-101 (DIL28)
IC34	Atari 137415-101 (DIL28)

### Main Board IC's

J10/J11 or L12/13	M27C128
E13 or F15	AT28C16

### Eproms

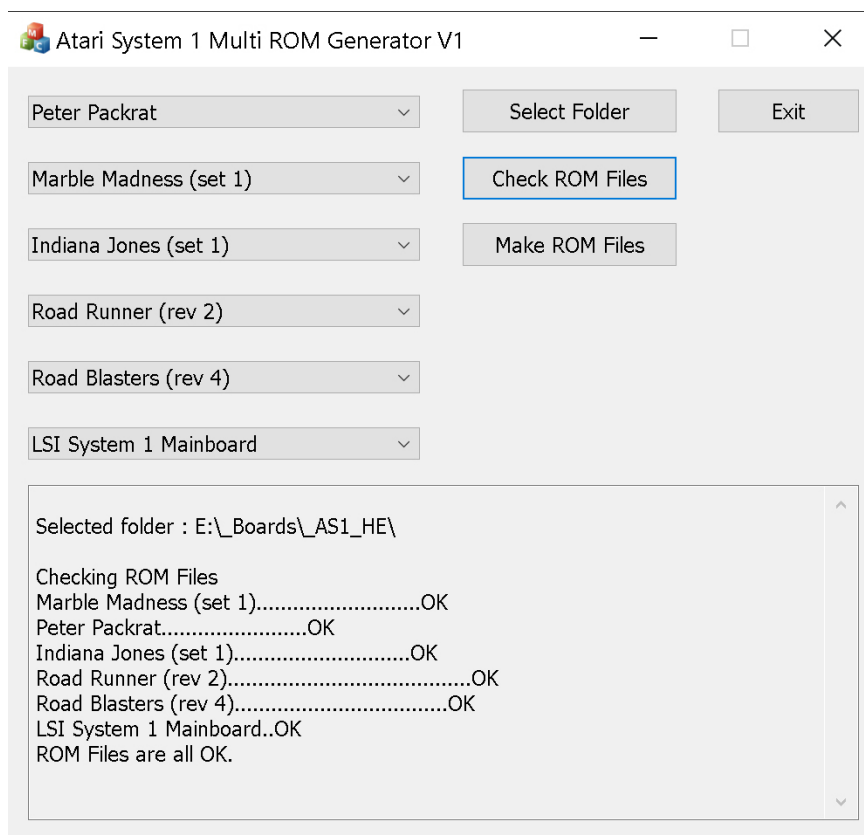
IC7	W27C512-45 PS Prom (DIL28)
IC8	W27C512-45 BS Prom (DIL28)
IC10	M27C256 GFX Plane 5 (DIL28)
IC11	M27C801 GFX Plane 4 (DIL32)
IC12	M27C801 GFX Plane 3 (DIL32)
IC13	M27C801 GFX Plane 2 (DIL32)
IC14	M27C801 GFX Plane 1 (DIL32)
IC15	M27C801 GFX Plane 0 (DIL32)
IC20	M27C020 Sound (DIL32)
IC21	M27C801 Program Upper (DIL32)
IC22	M27C801 Program Lower (DIL32)

In addition to the above components required to build the cartridge you also need 2 x M27C128 Eproms to replace the Mainboard BIOS roms at J10/11 (LSI) or L12/13 (TTL). The NV ram at E13 (LSI) or F15 (TTL) will also need to be changed for a 2Kx8 equivalent such as X28C16 or AT28C16.

## Assembling the Cartridge

If you have been supplied the cartridge as a kit you will need to solder all the components into their correct location, this should take less than 2 hours for a competent person. It is recommended to install sockets for the Donor IC's and Eproms (8 x 28 pin, 8 x 32 pin & 1 x 40 pin) but for the rest of the IC's it is down to personal preference.

## **Making Your ROM Files**



This program allows you to select which version of a game is used to make the multi rom set and which type of mainboard you have.

Once you have setup your versions and used the 'Select Folder' button to pick the location for your rom files. You should click the 'Check ROM Files' button to verify all the required files are present and correct. If they are, the 'Make ROM Files' button will become active and allow you to create your ROM set. All source rom files should be uncompressed in this folder and be named the same as the MAME rom sets.

## **Installing the Kit**

Once you have generated your ROM files and have programmed them to the eproms you need to populate all the sockets on the AS1 Multi Cartridge with the correct chips. The filenames, PCB silkscreen and cartridge picture seen earlier in this manual should help you get this right.

You will also need to supply and fit a TMS5220 (IC1) and 6522 (IC2) as well as the 4 x Atari Slags 137415-101 (IC31-34) or the Quad TTL Slag PCB.

You should also have now programmed the 2 x M27C128 motherboard eproms and now is the time to put these into the appropriate sockets on your mainboard as well as replacing the X2804 NV ram with a 2Kx8 version.

You can now plug the AS1 Multi Cartridge into your mainboard and enjoy all 5 games!



## Using the System



The menus are designed to be used using just the 2 buttons available on all types of control panel. Their action is indicated near the bottom of each screen.

The Multi Settings menu will only appear when the Self Test Switch is on and the game is powered up. The Settings / Boot Game option I think is pretty obvious.

The Menu Mode has 3 options. When set to 'Test Mode Only' the multi is pretty much hidden as on power up the Boot Game will run and there is no access to the Game Select menu. When set to 'Power & Ingame' or 'Ingame Only' you can get back to the Game Select menu by pressing both buttons at the same time during any games demo mode. The 'Power & Ingame' option will also display the Game Select menu on power up whereas the 'Ingame Only' will boot the default / last game.

The remaining settings options are to do with the control type to be used for each of the games apart from Road Runner which requires a hall effect stick. All the games can be set to use 'RR/HALL EFFECT' or the Original control types. This means that if you have a Road Runner panel you can set all games to be played with it and no panel swapping will be required.

The Peter Packrat joystick has a stick top Jump button which is wired to SW3, if you don't wish to modify your control panel with an extra button you can change this to be the 2 Player button instead. The only side effect of this is that you cannot escape the Game Continue screen.

## Joystick Calibration

If you are using a Road Runner or Ultrastik 360 joystick then it will need to be correctly calibrated. The Road Runner test mode has a specific page that will enable you to do this for Joystick 1. The horizontal reading should range from \$D8-\$E0 (left) to \$28-\$20 (right) and the vertical should range from \$D8-\$E0 (bottom) to \$28-\$20 (top). The centre values should be in the range \$7F-\$81.

The Road Runner joysticks have small pots on their pcb which allow adjustment of the centre point. The AS1 Ultrastik360 (J102) board I provide has centre point trim pots for X & Y for up to 2 joysticks and also has Range trim pots for both X & Y due to the higher voltage range of the Ultrastik 360 in analogue mode.

## **AS1 Ultrastik360 Joystick PCB**

To assemble the Joystick PCB you will need the following which are **not supplied** :

1 / 2 of (2 x 2.2K resistor, 2 x 5.6K resistor, 2 x 8.2K resistor, 4 x 5k Horizontal trimpot)

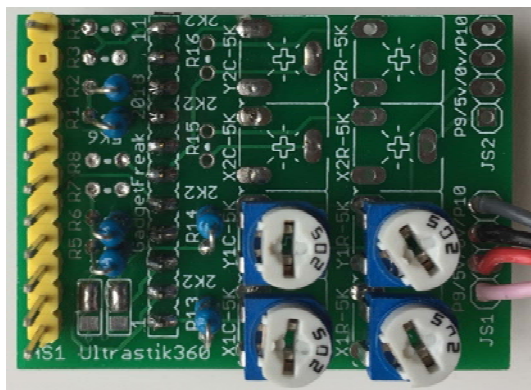
1 x 11 pin 0.1" (2.54mm) strip header

1 x 11 pin 0.1" (2.54mm) strip socket header

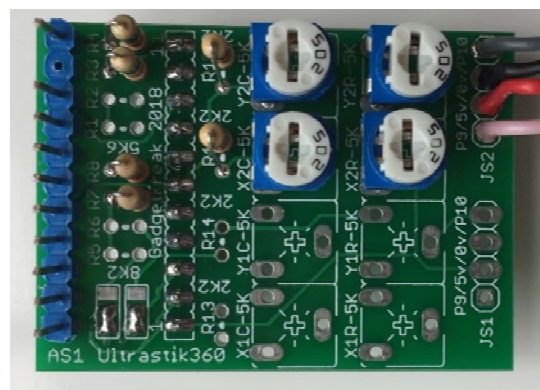
If you intend to use an UltraStik 360 you will also need to make up the included Joystick board which plugs into the J102 mainboard header.

- If Joystick 1 is a Road Runner stick, solder link the pad nearest the board edge with the middle one on both 3 way option pads. If you have an Ultrastik 360 to use instead, solder link the middle pad to the pad furthest from the board edge on both.
- If Joystick 1 is an Ultrastik 360, put resistors into R1, R2, R5, R6, R13, R14 and put trimpots into X1C, Y1C, X1R, Y1R.
- If Joystick 2 is an Ultrastik 360, put resistors into R3, R4, R7, R8, R15, R16 and put trimpots into X2C, Y2C, X2R, Y2R.
- Solder the strip header pins to the holes nearest the edge on top of the board and solder the strip socket header to the holes marked 1-11 on the bottom of the board.

**JS1 Ultrastik, No JS2**



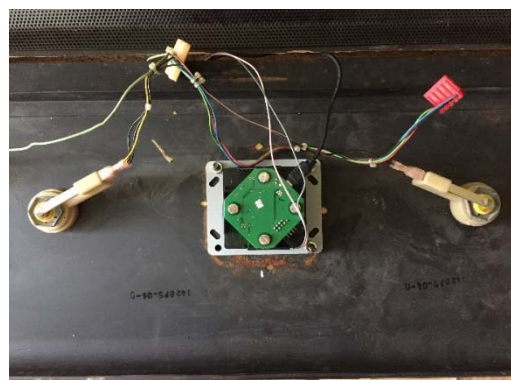
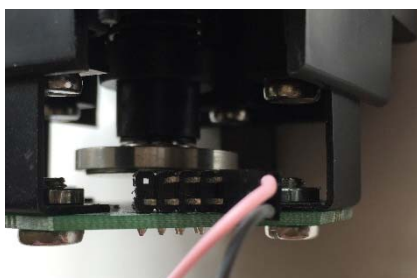
**JS1 RR, JS2 Ultrastik**



The Ultrastik 360 as supplied by Ultimarc will need to be re-flashed with the Analogue output firmware, Ultimarc can supply this along with the flash utility. You will also need to rotate the pcb on the base of the joystick by 90 degrees counter clockwise (see picture below, note the USB connector is now top right with the joystick upside down). This can be done easily by removing the 4 bolts holding it in place. Besides connecting pins 9 & 10 as in the above pictures you will need to strip back the USB cable for the Ultrastik to connect the 5v and ground wires to the Joystick pcb.

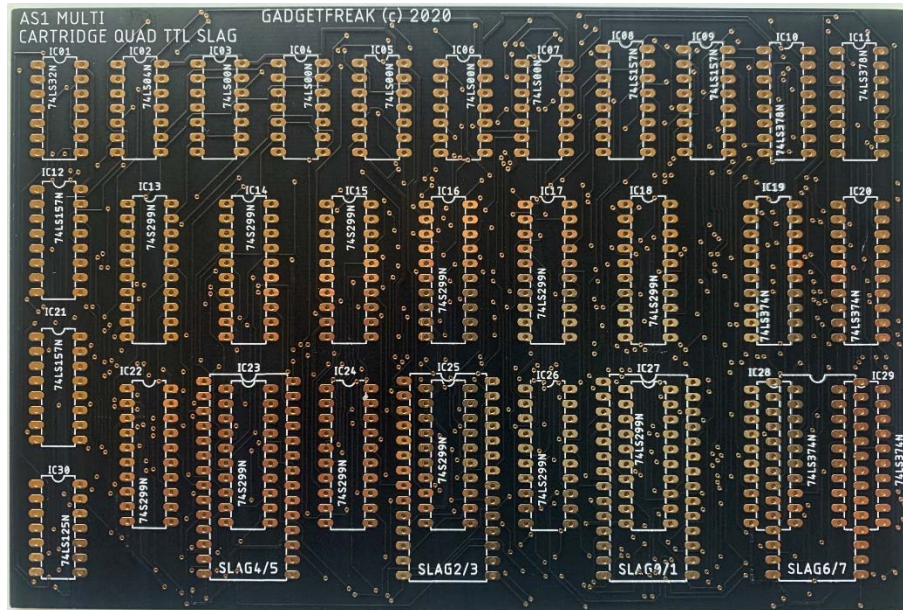
## **Ultrastik360 in Original Indiana Jones Panel**

**Ultrastik pins 9 & 10**





## AS1 Quad TTL Slag PCB



To assemble the Quad TTL Slag PCB you will need the following which are **not supplied** :

74LS00	(5 x DIL14)	IC03, IC04, IC05, IC06, IC07
74LS04	(1 x DIL14)	IC02
74LS32	(1 x DIL14)	IC01
74LS125	(1 x DIL14)	IC30
74LS157	(4 x DIL16)	IC08, IC09, IC12, IC21
74LS299	(12 x DIL20)	IC13, IC14, IC15, IC16, IC17, IC18, IC22, IC23, IC24, IC25, IC26, IC27
74LS374	(4 x DIL20)	IC19, IC20, IC28, IC29
74LS378	(2 x DIL16)	IC10, IC11

For connection to the cartridge Slags sockets, extra height is required due to the socketed eproms on the cart. So on my test board I have used 4 x 28 turned pin DIL sockets soldered into the bottom side of the PCB and then used the turned pin header strips to plug into these sockets. This should then give you enough separation between the 2 PCB's when plugged together.

It is important to solder the Slag 6/7 board interconnection before IC's 28 & 29 as these locations bridge the pins.



**Standard Control Wiring for Atari System 1 Games****Connector J102 (Analogue)**

Pin	EC	ID	Marble Madness	Indiana Jones	Peter Packrat	Road Runner	Road Blasters	Patched
1	6/F/20/X	+5v	nc	COMMON	COMMON	+5V	+5V	+5V
2	15	V4	nc	nc	nc	VERTICAL	nc	VERT 1
3	13/ST5	H4	nc	nc	nc	HORIZONTAL	nc	HORZ 1
4	12/ST7	V3	nc	nc	nc	nc	nc	VERT 2
5	R	H1	nc	RIGHT	RIGHT	nc	nc	nc
6	14	H3	nc	nc	nc	nc	nc	HORZ 2
7	N/ST3	V1	nc	LEFT	LEFT	nc	nc	nc
8	S	V2	nc	UP	UP	nc	nc	nc
9	P/ST1	H2	nc	DOWN	DOWN	nc	PEDAL	nc
10	---	Key	---	---	---	---	---	---
11	1/A/22/Z	Gnd	nc	nc	nc	GND	GND	GND

**Connector J103 (Optical)**

Pin	EC	ID	Marble Madness	Indiana Jones	Peter Packrat	Road Runner	Road Blasters	Patched
1	6/F/20/X	+5v	+5V	nc	nc	nc	+5V	nc
2	12/ST8	HC2	TRACKBALL 2	nc	nc	nc	nc	nc
3	13/ST6	HD2	TRACKBALL 2	nc	nc	nc	nc	nc
4	N/ST4	VC2	TRACKBALL 2	nc	nc	nc	nc	nc
5	P/ST2	VD2	TRACKBALL 2	nc	nc	nc	nc	nc
6	T	HC1	TRACKBALL 1	nc	nc	nc	nc	nc
7	U	HD1	TRACKBALL 1	nc	nc	nc	nc	nc
8	16	VC1	TRACKBALL 1	nc	nc	nc	Steering	nc
9	---	Key	---	---	---	---	---	--
10	17	VD1	TRACKBALL 1	nc	nc	nc	Steering	nc
11	1/A/22/Z	Gnd	GND	nc	nc	nc	GND	nc

**Connector J106 (Switches)**

Pin	EC	ID	Marble Madness	Indiana Jones	Peter Packrat	Road Runner	Road Blasters	Patched
1	6/F/20/X	+5v	+5V	nc	nc	nc	nc	nc
2	---	nc	nc	nc	nc	nc	nc	nc
3	4	LED	Start 2	nc	nc	nc	nc	nc
4	D	LED	Start 1	nc	nc	nc	nc	nc
5	---	Key	---	---	---	---	---	---
6	19	SW5	nc	nc	nc	nc	nc	nc
7	10	SW2	START 2	WHIP	THROW	HOP	TRIGGER	START 2
8	11	SW4	nc	nc	nc	nc	nc	nc
9	L	SW1	START 1	WHIP	THROW	HOP	THUMB	START 1
10	M	SW3	nc	nc	JUMP	nc	nc	JUMP
11	1/A/22/Z	Gnd	Common	Common	Common	Common	Common	Common

**\*The EC column in the above tables is the Cockpit board Edge Connector. If using the joystick board then instead of using the socket header on pins 1-11 you would need to solder wires connecting these pins to the correct edge connector pin.**

**Also note that if the odd number ST link is made then the following even number one should be left open.**