Coleco ADAM SD DDP
Build Guide and Info Pack

BUILDING YOUR COLECO ADM SD DDP

1. Download the file sdddp_v3_gerbers_2020-08-19.zip and send to your PCB fabrication company of choice. I have used pcbway.com successfully. The PCB layout is less than 100mm x 100mm and with their 2020 pricing cost $5 plus shipping for 5 boards.
2. Download the file "Bill of Materials.xlsx". This contains all the components required to populate the PCB.
3. Solder the following components to the PCB:
    a. ATMEGA2560AU
    b. 74LS06N
    c. All capacitors
    d. All resistors
    e. 16 mHz Resonator
    f. LED
    g. ICSP header
    h. PIN 2 & 3 header
    i. MICROSD header (do not plug in the MicroSD Reader yet)
    j. OLED Power Selector Header
4. Download the file "Bootloading and Programming the ATMEGA2560.pdf". Follow the instructions in install the Arduino Bootloader and program the ATMEGA2560 with the SD DDP firmware.
5. Solder the following components to the PCB:
    a. 5 Tac switches (Red switch for RESET)
    b. OLED
    c. 9-pin male JST connector (J4)
    d. 8-pin male JST connector (J3)
6. Plug in the MicroSD reader into the MICROSD 6-pin female header following the pinout.
7. Prepare a 2GB MicroSD card formatted as FAT32. You can use larger SD cards but the primary partition should be 2GB. Copy .DDP files to the card. You can create subdirectories to organize your files. (Only .DDP files and directories will be recognized on the card). Insert the MicroSD card into the MicroSD reader.
8. Configure the OLED Power Select jumper. The PCB allows you to use 2 different, common pinouts for the OLED. Viewed from the back of the OLED the pinouts supported are:

    SDA SCL VCC GND Or **SDA SCL GND VCC**

    Notice the GND and VCC signals are swapped in the 2 versions of the OLED pinout.

To select the SDA SCL VCC GND option, configure the OLED Power Select jumper as in Figure 1:

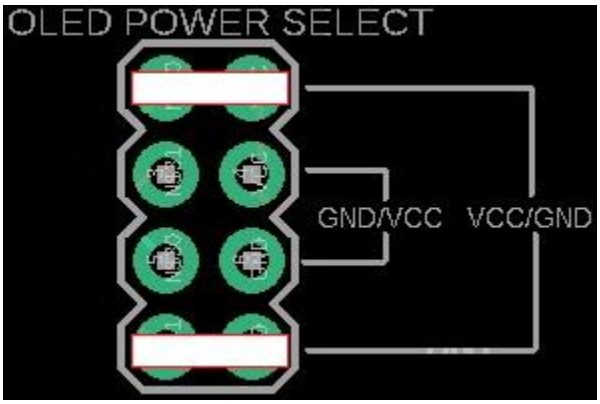

Figure 1 OLED SDA SCL VCC GND jumper setting

To select the SDA SCL GND VCC option, configure the OLED Power Select jumper as in Figure 2:

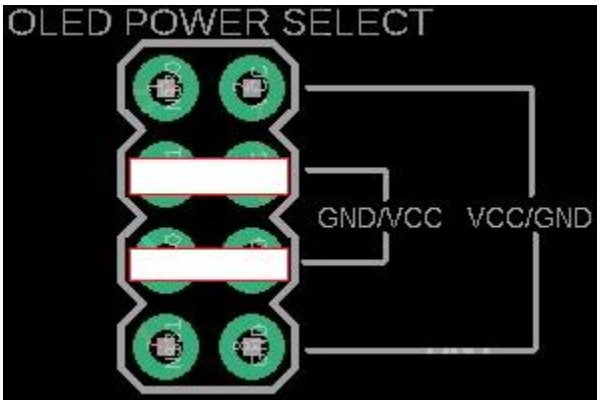

Figure 2 OLED SDA SCL GND VCC jumper setting

9. The 8 pin female to female JST connector should connect straight from SD DDP PCB to the ADAM DDP pins (J11 for DDP drive 1 or J13 for DDP drive 2) as illustrated in Figure 3.

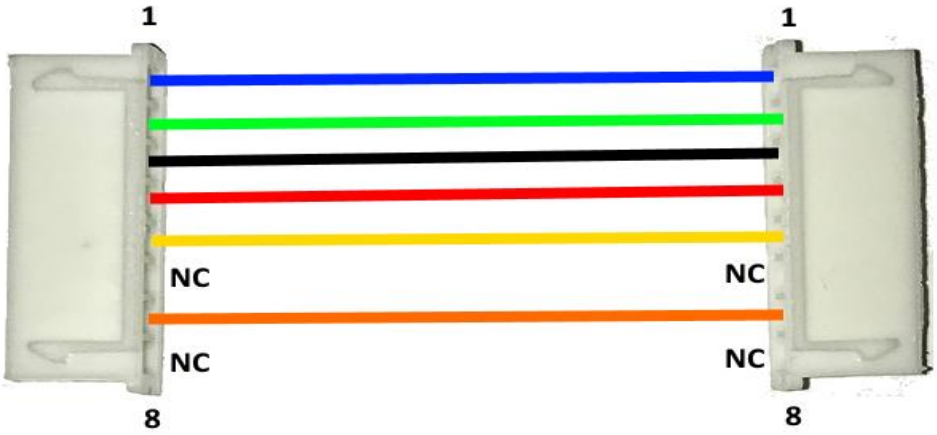

Figure 3 8-pin female to female JST wiring

10. The 9 pin female to female JST connector should connect straight from SD DDP PCB to the ADAM DDP pins (J10 for DDP drive 1 or J12 for DDP drive 2) as illustrated in Figure 4.

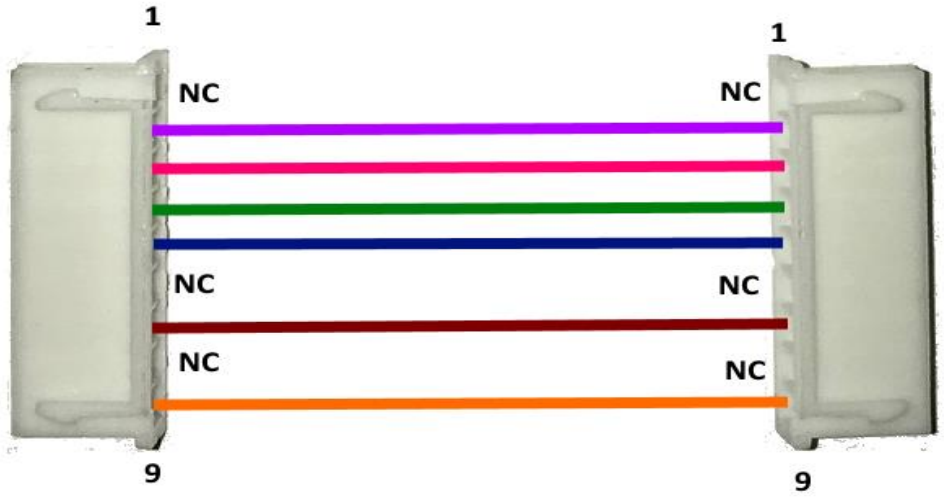

Figure 4 9-pin female to female JST wiring

11. Connect the 8 pin female to female JST cable to the 8 pin male connector on the SD DDP PCB and to the appropriate 8 pin male ADAM DDP connector.
12. Connect the 9 pin female to female JST cable to the 9 pin male connector on the SD DDP PCB and to the appropriate 9 pin male ADAM DDP connector.

13. Power on the ADAM computer. If everything has been installed correctly you should be presented with the “ADAM SD DDP” splash screen on the SD DDP OLED. See Figure 5.

Figure 5 ADAM SD DDP splash screen

Congratulations!

ADAM DIGITAL DATA PACK (DDP) TAPE INFORMATION

Tape Specifications

```
Effective data transfer rate   1.4K per second
Tape Speed
       Normal                  20in per second
       Fast Forward/Rewind     80in per second

Tape Capacity                  256K bytes
                               2 tracks
                               128 blocks per track
                               1 block = 1K
```

Encoding

Data on the tape is encoded using Differential Manchester Encoding (DM) also called bi-phase mark encoding. DM encoding is a line code in which data and clock signals are combined to form a single 2-level self-synchronizing data stream.

From Howard Eglowstein:
"…a game tape uses the format developed by Gerry Wheeler who worked with Walter Banks. Tape blocks are identified by the letters 'GW'. After I put the tape drive on Adamnet and we decided to make the alternative format for files, they became 'HE' format tape blocks."

GW format (Right Directory)

Block Layout
```
Track 0 blocks 00-7F
Track 1 blocks 80-FF
```

Block Physical Layout
```
Track 0 blocks 00-7F   Directory starts at block 01h
Track 1 blocks 00-7F
```

HE format (Center Directory)

Block Layout
```
Track 0 blocks 40-7F, 0-3F
Track 1 blocks 80-FF
```

Block Physical Layout
```
Track 0 blocks 00-7F   Directory starts at block 41h (65)
                       Track 65 as block 1
Track 1 blocks 00-7F
```

Track Format

Tape Block Header

```
        2-byte header ID
                4757h   =       GW
                OR
                4845h   =       HE
        2-byte block number, this is translated block to the tape physical
                block. The tape 6801 uses the routine CALC_PHYS to calculate
                this. (00h...7Fh)
        2-byte one's complement of block number
        2-byte max block number
                number of blocks on this track, this is always: 80H = 128
        1-byte Checksum
                one's complement sum of above
```

The Coleco ADAM SD DDP uses the HE (center directory format).

C**ALC_PHYS code in C:**

```
//calculate tape physical block
phys_block = 64 + WantedBlock;
if (phys_block > 128)
    phys_block = 128 - phys_block;
```

Track Data (1048 bytes) sent to Tape 6801

Sync character 16H

0 byte | 0 byte | 0 byte | SYNC byte 16H | TAPE HEADER (9 bytes) | 0 byte | 0 byte | 0 byte | 0 byte | SYNC byte 16H | DATA (1024 bytes) | 0 byte | 0 byte | SYNC byte 16H | CRC hi byte | CRC lo byte |0 byte

ADAM DDP Drive Connector Pinout

On the ADAM motherboard there are two pairs of connectors to attach two physical DDP drives to the computer. The first pair is J10 and J11 for drive 1. The second pair is J12 and J13 for drive 2.

J10 and J12 on the ADAM motherboard are the 9-pin connectors. This example uses J10.

```
J10-1   Brake (active high)
J10-2   Go reverse (active low)
J10-3   Go forward (active low)
J10-4*  Stop (active high)
J10-5   Speed select 0 = slow or 1 = fast
J10-6   Ground
J10-7*+ MSense 1 tape is moving, 0 tape is stopped
J10-8   -12V
J10-9*+ Tape indicator (active low tape inserted)
```

J11 and J13 on the ADAM motherboard are the 8-pin connectors. This example uses J11.

```
J11-1   Data in - from Tape 6801 to drive
J11-2   Track A/B high track A, low track B
J11-3   Ground
J11-4   +5V
J11-5+  Data out - from drive to Tape 6801
J11-6   +12V
J11-7*  Write Mode write logic 0, read logic 1
J11-8   No Connection
```

\+ = pins the data drive can write to

* = pins that are independent for each data drive

Motherboard Pinout Diagram

```
TAPE A 1   2   3   4   5   6   7   8   9
TAPE B 1   2   3   4   5   6   7   8   9

TAPE A   1   2   3   4   5   6   7   8
TAPE B   1   2   3   4   5   6   7   8
```

Signals needed for SD DDP

```
TAPE A J10-1   J10-2   J10-3   J10-4   J10-5   J10-6   J10-7   J10-8   J10-9
       BRAKE   REVERSE FORWARD STOP    SPEED   GROUND  MSENSE  -12V    TAPEIN

TAPE A   J11-1   J11-2   J11-3   J11-4   J11-5   J11-6   J11-7   J11-8
         TOTAPE  TRACK   GROUND   +5V    TO6801   +12V   MODE    NO CONNECT
```

NOTE: DO NOT connect anything to the pins marked in RED. These either have live voltages or are not needed!

Tape Drive Notes

The tape drive is dumb. It does not know what block the 6801 wants to read. The only commands sent to the drive are BRAKE, STOP, FORWARD, REVERSE, SPEED, TRACK, MODE (READ or WRITE).

The only data sent to the tape 6801 from the drive is the Track Data (see above).

The only data sent to the drive from the tape 6801 is the Write Data (see below).

When the tape drive receives signal to fast forward start clock. When fast forward stops, stop clock and calculate how many blocks have passed:

Length of time for 1 block to pass under the tape head:
15000 bits @ 714.3 bpi = 21.00 in.

At 80 ips, 21.00 in. travels by in 0.26 seconds
1 block = 0.26 seconds

When writing the tape 6801 sends 1035 bytes for each block in the following sequence:

Write Data

0 byte | 0 byte | 0 byte | 0 byte | SYNC byte | Data 1024 bytes | 0 byte | 0 byte | SYNC BYTE | CRC High Byte | CRC Low byte | 0 byte |