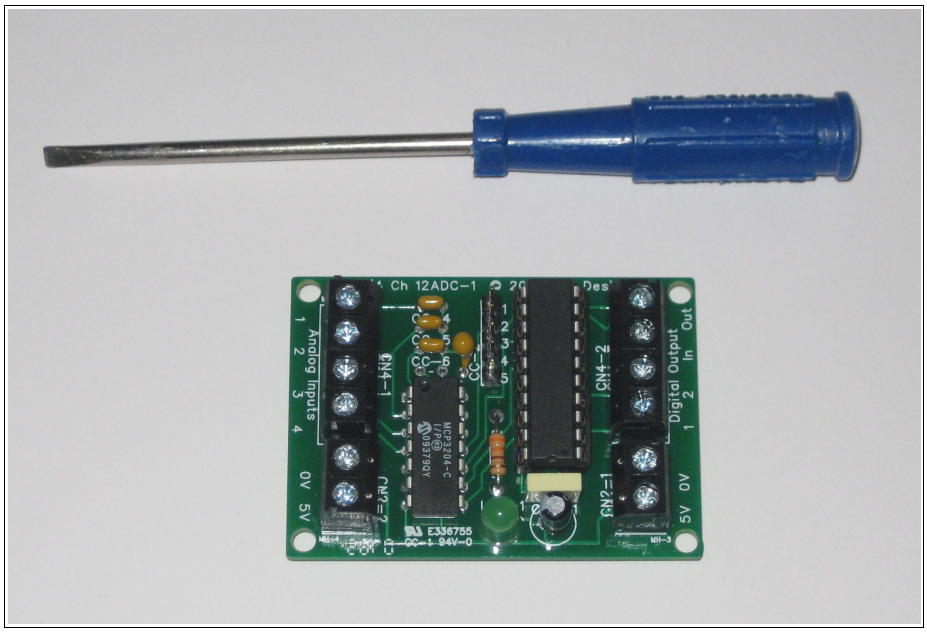
BFF Design Ltd – 12ADC-1 12bit ADC Card Data Sheet



1. Introduction

The 12ADC-1 12bit analogue to digital converter card interfaces with the 64SPU-1 motion platform drive signal processor card to upgrade potentiometer based position feedback to 12 bit resolution. The standard potentiometer feedback resolution (direct to the 64SPU-1) is 10 bit. By using the 12ADC-1 position feedback signals from potentiometers can be improved to noise and resolution levels similar to that of US Digital MA3 absolute position encoders.

The card can also be used as general ADC / microcontroller interface card by customising the logic programming of the onboard microcontroller.

The 12ADC-1 uses the Microchip Technology MCP3204 ADC chip to provide 12bit conversions for up to 4 input channels - although only three channels are used in the 12ADC-1 default programming for 3 DOF motion platform drives. The MCP3204 chip is interfaced using an on-board PICAXE 20X2 64MHz microcontroller which is programmed to export the 12bit position conversions via a single wire serial data connection to the 64SPU-1. The card can export smoothed 12bit conversions for 3 channels at approximately 70 Hz and can lift the 64SPU-1 servo loop refresh speed to the same rate. Each data set at 70Hz is the sum of 5 analogue to digital conversions for each channel to produce the smoothed output.

64SPU-1 card firmware B programming is required to support the 12ADC-1.

The 12ADC-1 can also be used with older 40SPU-1 signal processor cards. In its 40SPU-1 operating mode the digital conversions are exported as 3 separate 0-4096 µs pulse outputs which are read by the 40SPU-1 (with Firmware D programming). Unfortunately the 40SPU-1 is not able to read the high speed serial output used for the 64SPU-1 mode.

2. Connections and Settings

Refer to photo overleaf-

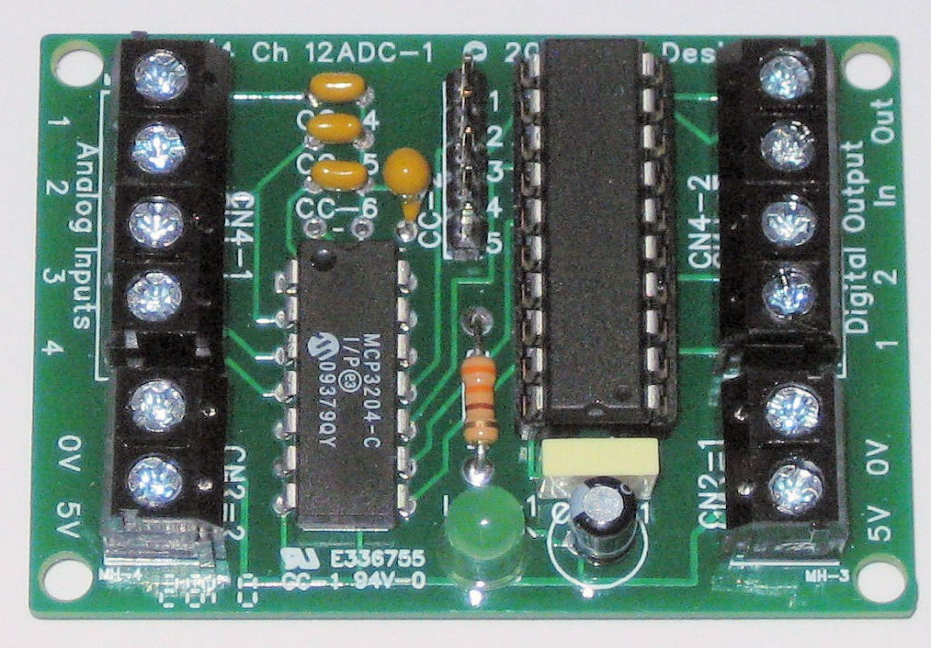
A) Analog Inputs (CN4-1) - potentiometer wiper connections for feedback channels 1, 2 and 3. Input channel 4 is NOT used for the default programming for 3 DOF motion platform drive use.

B) Output 0 & 5V supply (CN2-2) for potentiometers – the 0 and 5V terminals are supplied directly from the 0 and 5V input lines on CN2-1.

C) Digital Outputs (CN4-2) – digital interface connections for 64/40SPU-1. In 64SPU-1 mode terminal “Out” carries the 12bit position serial data output and should be connected to “Pos Feedback” input 1 on the 64SPU-1. In 40SPU-1 mode terminals “Out”, “In”, and “2” carry the 12bit position pulse data for channels 1, 2 and 3 and should be connected to “Pot Feedback” inputs 1, 2 and 3 respectively on the 40SPU-1 card.

D) 0 & 5V logic voltage inputs (CN2-1) – the 0 and 5V connections can be supplied directly from the 0 and 5V output

lines from the 64SPU-1 (connector CN2-1).



E) 5 Pin Header – for 64SPU-1 mode jump pins 3 & 4, for 40SPU-1 mode jump pins 4 & 5.

3. Operation

To get the best performance from the 12ADC-1 card use precision potentiometers such as Vishay Spectrol 533 pots. Use shielded cable and ground the shields to 0V on the 12ADC-1. Ensure the potentiometer shafts and bodies are electrically insulated from the platform drive motors / gear boxes to prevent electrical noise transmission to the feedback lines.

The 12ADC-1 card should be powered-up at the same time as the 64/40SPU-1 card. This is to ensure that the 12ADC-1 is active to enable the initialisation routines to execute properly and allow the 64/40SPU-1 card to auto-detect the 12bit output from the 12ADC-1. Supplying the 12ADC-1 5V logic voltage from the 64/40SPU-1 CN2-1 connector will ensure correct 12ADC-1 power-up timing.

The 12ADC-1 to 64SPU-1 card wiring should be kept as short as is practicable (<100mm). It is best to locate the 12ADC-1 immediately adjacent to the 64SPU-1 to keep the digital data transmission lines as short as possible.

LED SEQUENCES – in 64SPU-1 mode, on power-up the green led will begin flashing immediately at a rate of 1 flash each 20 serial data exports. This is 1 flash each 3 channels x 5 samples x 20 sets = 300 ADC conversions. The 64SPU-1 will auto-detect the serial output from the 12ADC-1 and will flash its green LED 4 times following the power-up Amber LED light. The 64SPU-1 must be set for Potentiometer input.

In 40SPU-1 mode the LED sequence is slightly different. On power-up the 12ADC-1 will show a constant green LED, at this time it sends a “12ADC-1 ready” signal to the 40SPU-1. The green LED will stay lit until the 40SPU-1 responds with a “start operation” signal at which time the 12ADC-1 starts its ADC conversions and the green LED will flash once each 20 data pulse output sets. The 40SPU-1 will flash its green LED 4 times following the power-up Amber LED light. The 40SPU-1 must be set for Potentiometer input.

4. Data Output – (For Advanced Use)

For normal use of the 12ADC-1 knowledge of the data output formats is not required – the 64/40SPU-1 cards will automatically detect and read the data output from the 12ADC-1. However for advanced users who may wish to use the 12ADC-1 in their own projects the following information may be useful.

In 64SPU-1 mode the 12bit ADC conversions are exported from the Digital Output “Out” terminal using inverted logic (idle low) TTL level 8, N, 1 serial format at 76800 baud. The byte format is:

“XY” b1 b2 b3 b4 b5 b6 b7

where: XY is two byte ascii string qualifier

b1 – LSB of channel 1 data word

b2 – MSB of channel 1 data word (word value in range 0 to 20480 (= sum of 5 x 12bit readings))

b3 – LSB of channel 2 data word

b4 – MSB of channel 2 data word

b5 – LSB of channel 3 data word

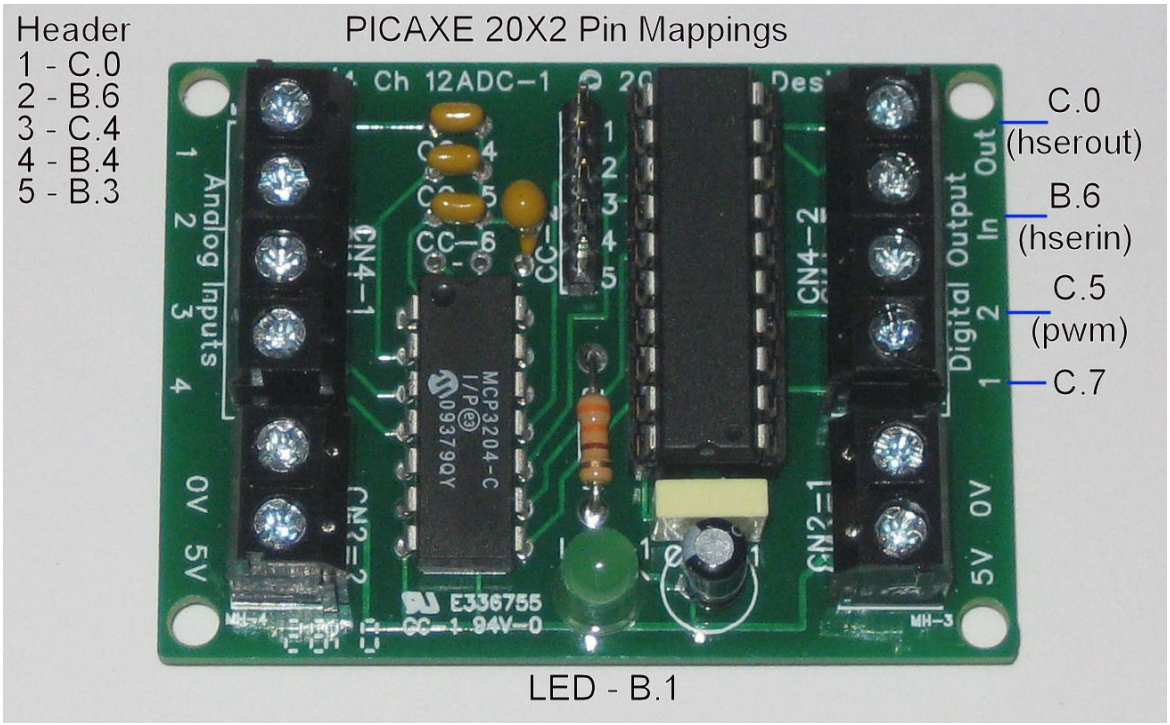
b6 – MSB of channel 3 data word

b7 – checksum byte

The check sum byte is calculated as the summation of the b1 to b6 data bytes each with their bits 6, 7 & 8 masked to zero.

The MC3204 ADC IC is interfaced through a PICAXE 20X2 microcontroller which runs at 64MHz. The 20X2 is socket mounted and can be removed for re-programming to customise the logic programming of the 12ADC-1. Customisation could be to alter the baud rate or serial data format of the digital output.

For users wishing to customise the 12ADC-1 logic programming the 20X2 microcontroller pin to 12ADC-1 connector and header mapping is as shown below.



The Digital Output connection uses the 20X2 microcontroller's hardware serial output and input pins, its PWM output pin and a standard I/O pin. The 20X2 hserial pins support a wide range of serial baud rates (up to typically 500000 baud) and the pwm output pin is fully programmable. The 5 pin header provides options for jumper programming. The on-board LED is driven from pin B.1.

For information the default PICAXE 20X2 programming can be downloaded here -

http://buggies.builtforfun.co.uk/Sim/12ADC-1/12BitADC_20X2_Flash_Program.zip

NOTE for “normal” use of the 12ADC-1 with 64SPU-1 or 40SPU-1 motion drive cards **NO** customisation of the 12ADC-1 programming is required. The above information is provided for developers/users who wish to customise the 12ADC-1 logic to suit their own projects.

5. Typical System Wiring

The 12ADC-1 card wiring arrangements are shown below.