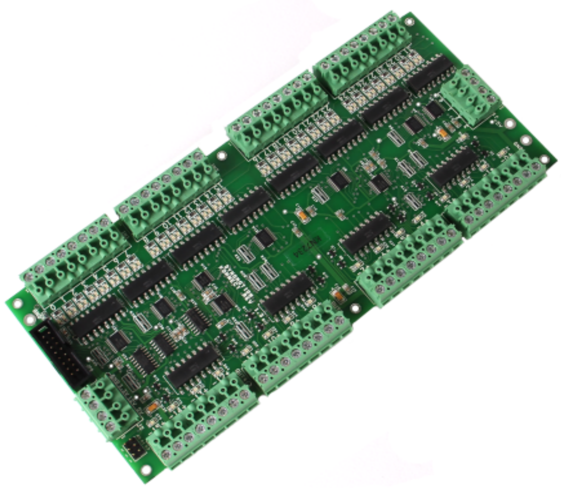
Konnect Optical I/O Expansion Board

User Manual



KONNECT - PWM to Analog Example

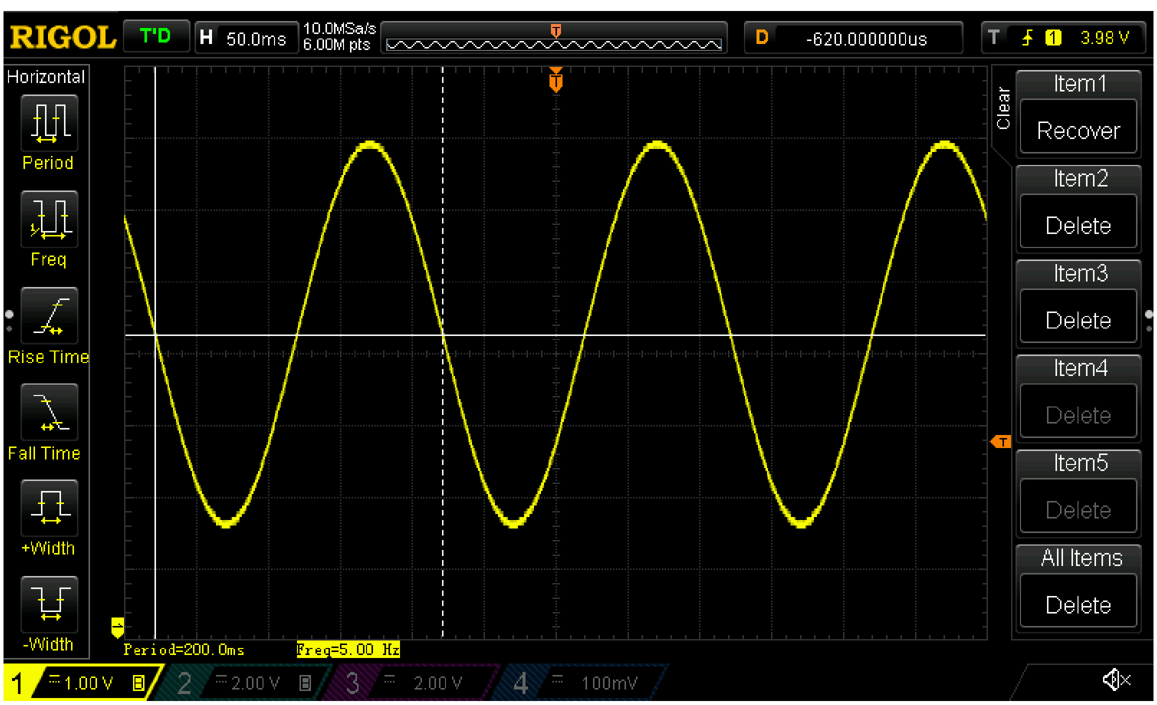
KFLOP+Konnect+Simple Filter Circuit can be used to produce a programmable analog signal. This might be used as a basic Spindle Speed Control Signal if no others are available.

This demonstrates the flexibility of the Konnect Outputs which are Isolated, can sink or source current, fast, medium power, and low impedance

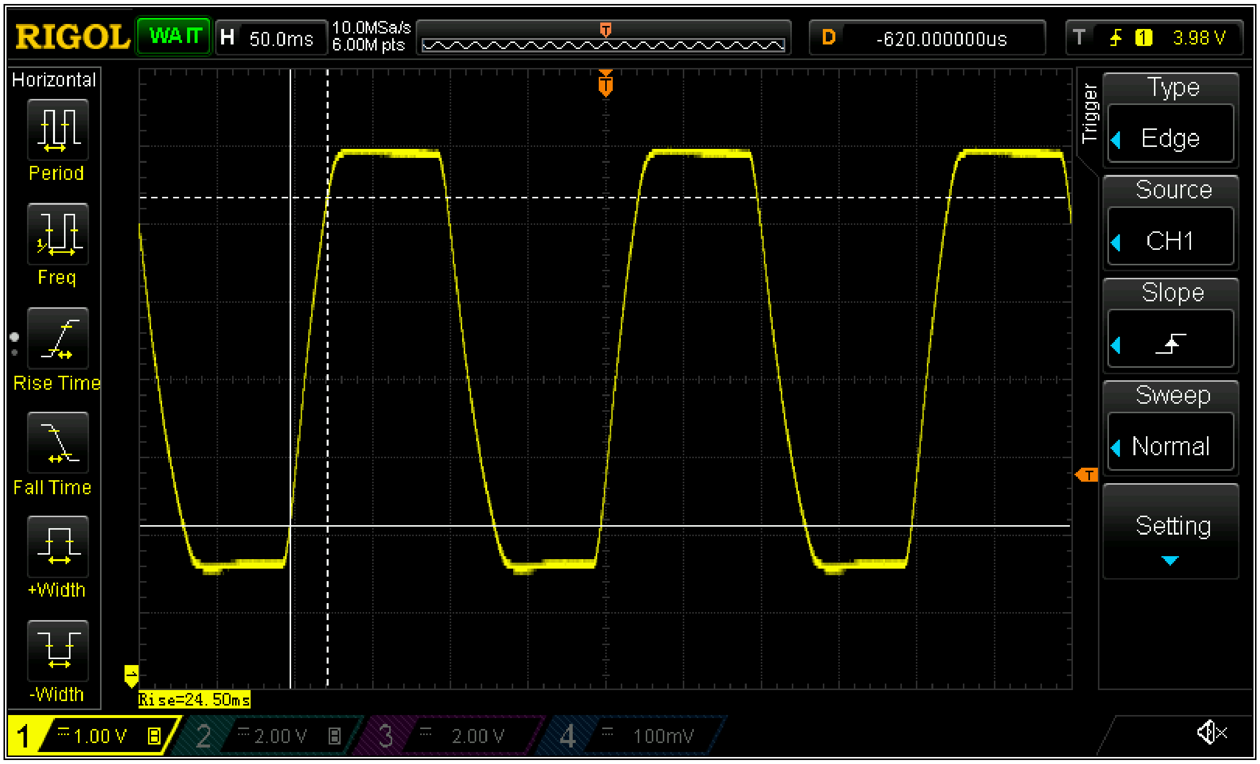
Results

Analog Oscilloscope traces of Analog signals generated by a KFLOP Software generated PWM Signal controlling two optically isolated Konnect Outputs that are then passed through a simple low pass filter.

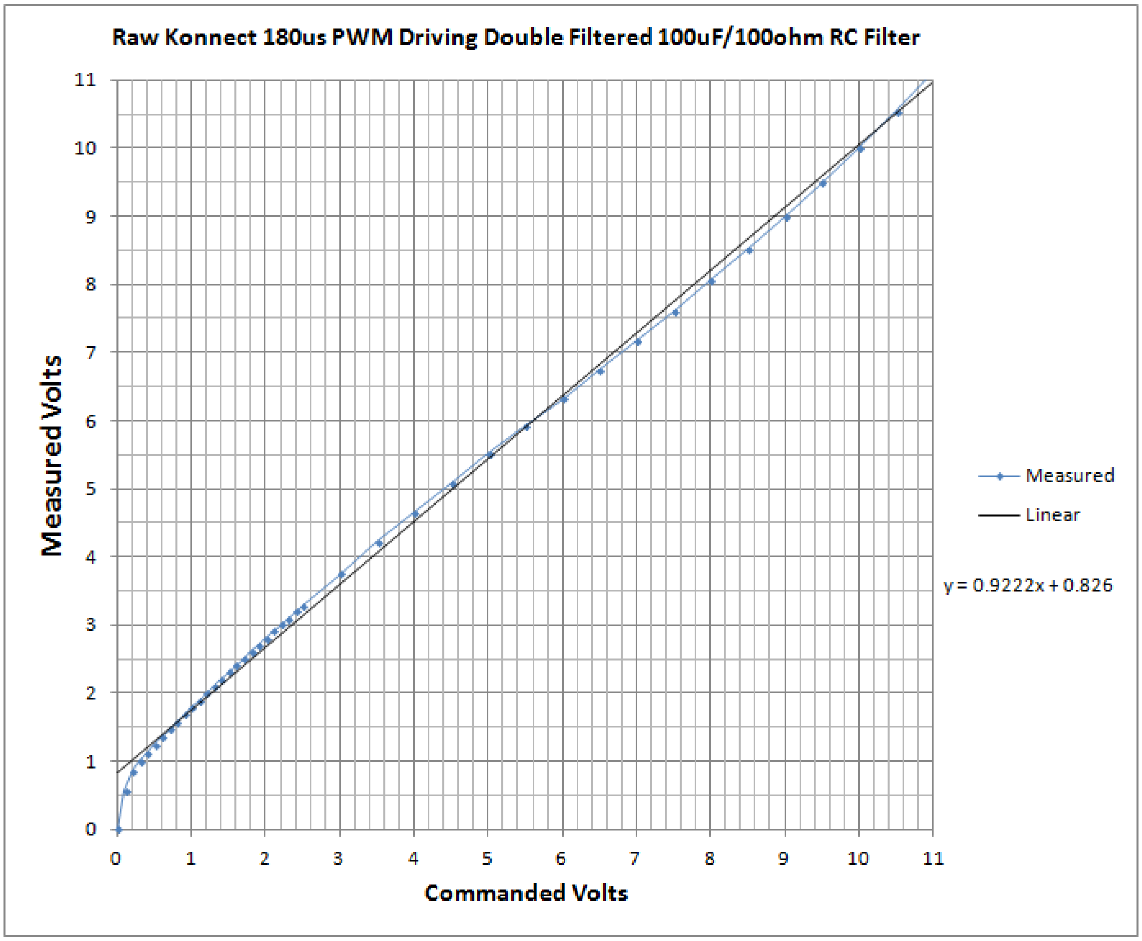
High resolution and response rates easily usable for speed control applications



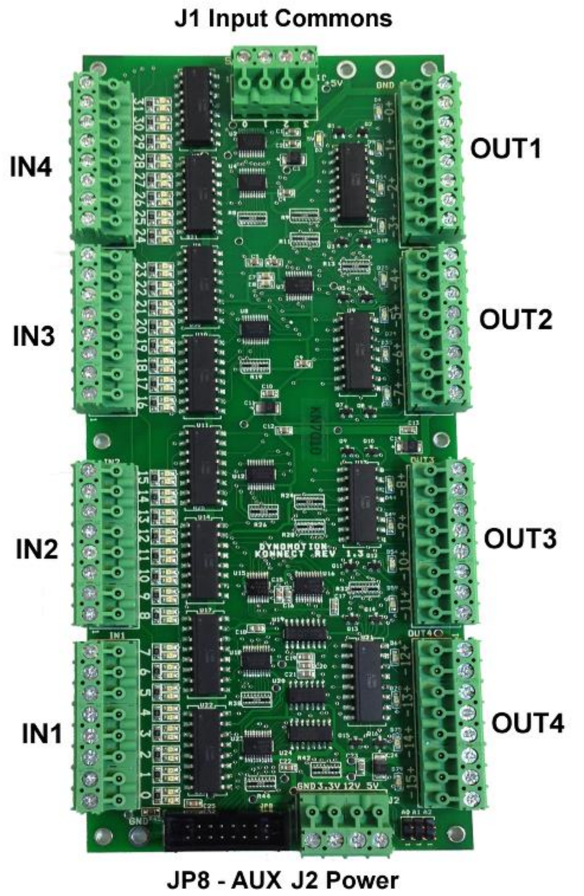
Square wave to test large signal changes. Significant change in < 25ms



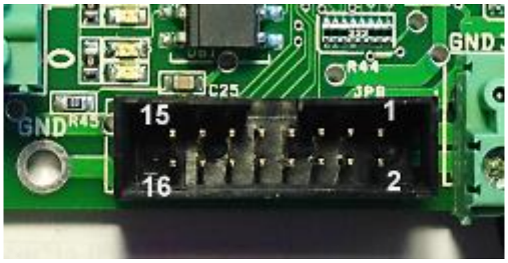
Reasonable linearity. This would require calibration if higher accuracy is needed.



Connector Pinouts:



Konnect JP8 Aux Bus Connection to KFLOP JP6



JP8 provides all internal signal and power connections to KFLOP. This 16 pin ribbon connection should be as short as possible to avoid noise and crosstalk as the cable forms a high speed communication link. The Aux Bus supports multiple boards connected tot he same cable. In most case the specifics of the Aux Bus will be handled internally by KFLOP and no knowledge of the signals will be required for use.

The 8 data bits (DB0-DB7) are bi-directional. CLKIN and STARTIN allow a board to be selected by the address placed on the bus, and then a fixed sequence of 8-bit writes (2) and reads (5) can be performed using the CLKIN signal.

Pin	KFLOP Name	Konnect Name
1	VDD5	VDD5
2	VDD12	VDD12
3	VDD33	VDD33

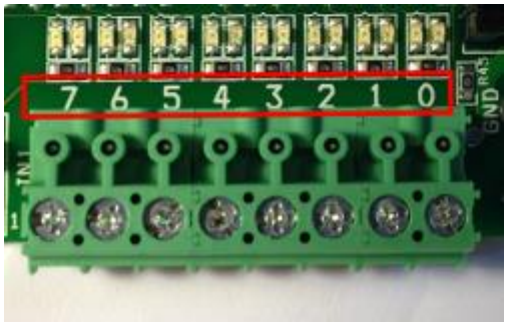
4	RESET#	RESET#
5	IO26	DB0
6	IO27	DB1
7	IO28	DB2
8	GND	GND
9	GND	GND
10	IO29	DB3
11	IO30	DB4
12	IO31	DB5
13	IO32	DB6
14	IO33	DB7
15	IO34	CLKIN
16	IO35	STARTIN

J2 Konnect Power

The power signals from KFLOP's Aux Bus are available on the J2 terminals. It is not normally necessary to apply power to these terminals as power is supplied from KFLOP through the JP8 connector. For multiple boards it may be desirable to apply additional higher gauge power and GND connections between boards. Note the Signal labeled 12V is connected to the KFLOP 12V signal but may not be necessarily 12V. KFLOP and Konnect do not require or use the 12V signal but only pass the signal through the various connectors. Disk Drive Power Supplies usually supply +12V into KFLOP JR1 Pin 1. Also note that if any of these supply voltages are used for the Inputs or outputs then the Input wiring will not be isolated from KFLOP.

It is possible to supply +5V power to KFLOP through these terminals if the power consumption on KFLOP is less than 1 Amp and the ribbon cable connection is short (several inches or less).

Optically isolated Inputs

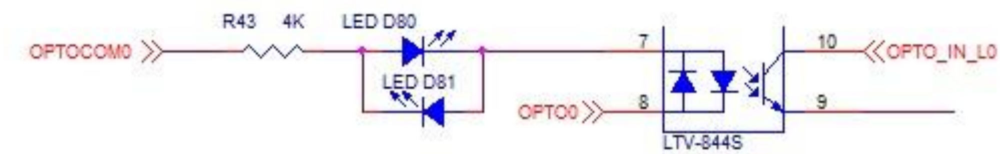


Individual Inputs (1 of 4 shown)

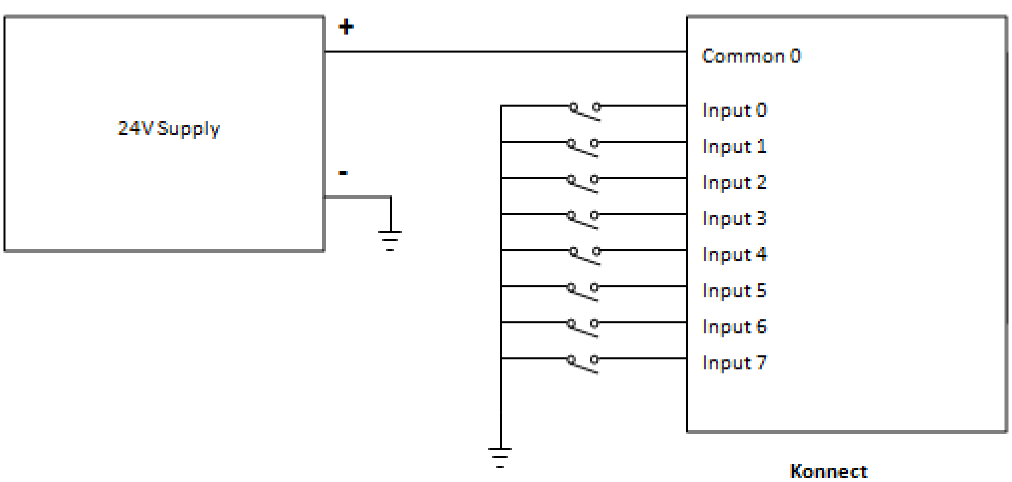
Input Bank Commons

Konnect's 32 optically isolated inputs are grouped into 4 independent Banks of 8 inputs. This allows any Bank to be used with either sourcing or sinking signals. However all inputs in the same bank share the same common and must operate in the same mode. The 4 independent Banks also allow different supply voltages and supply isolation to be used for each Bank. 24V is the preferred input voltage and will draw (24V - 1.4 - 1.4)/4K ~ 5ma of current.

Konnect's 32 optically isolated inputs can be driven from a +/- 4.75V to a +/-25V signal. Less than 2V should be applied to ensure the input is off. One of the 32 input circuits is shown below. The input consists of a AC type of Optocoupler in series with an LED indicator in series with a 4Kohm resistor. The AC type of input allows the common to be connected to either the Positive or Negative Supply voltage so that either sinking or sourcing outputs can be used (current can flow either direction to activate the input).

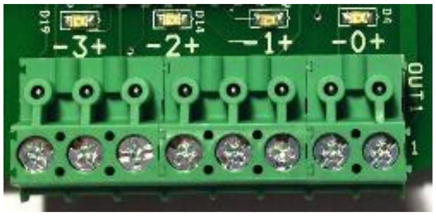


External Wiring would typically be arranged such as:



Electronics Katrangi Trading

Opto Isolated Outputs

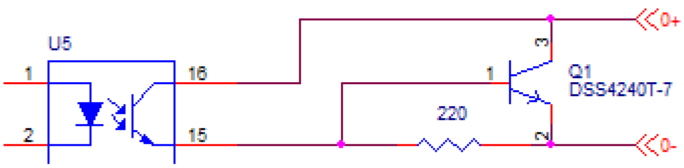


Outputs (1 of 4 shown)

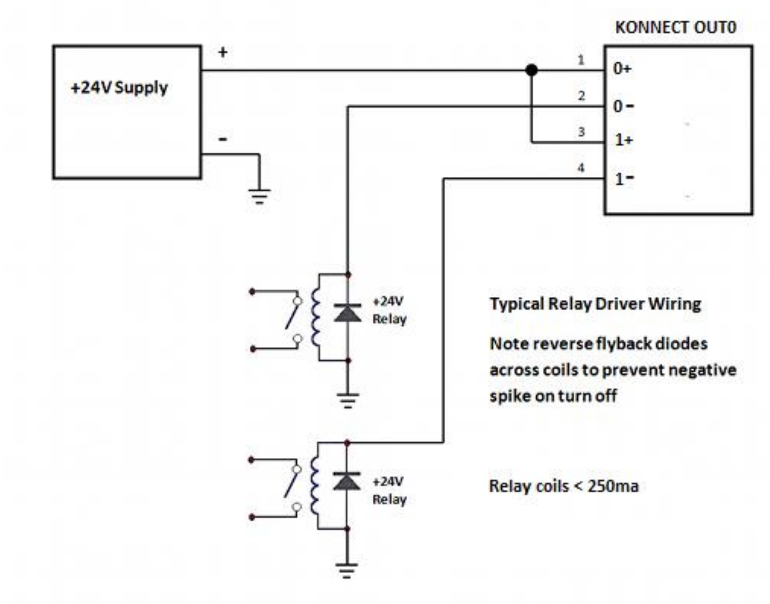
Each of the 16 Optically Isolated Outputs is completely isolated with a + and - terminal. When active the output passes current from the + to - terminals much like a relay contact would.

The Outputs are capable of driving medium power devices such as relay coils.   Loads up to 30V @ 250ma may be driven.

The internal Konnect Output Circuitry is shown below which converts a photo transistor output to darlington transistor output. The 220Ohm resistor allows the output have a low on voltage for low currents before the transistor turns on. This allows the output to drive low current circuits with a smaller on voltage(2ma @ < 0.6V). For example LVTTL/TTL inputs require less than 0.8V to guarantee a low input. At higher currents Q1 becomes active and keeps the on voltage drop below 0.9V at 0.25A. Switching 0.25A at 24V allows loads up to 6W to be driven.



A typical wiring diagram driving 24V relays. Because of the less than 0.9V drop on the Konnect outputs the load will be driven with more than 23.1V.



Board Address Selection Jumpers

The KFLOP's Auxiliary Port works as a Bus where multiple boards can be connected to the same Port. Each board has an address so it can be selected as active. For a single Konnect board in the system removing all Jumpers will configure the Konnect Board Address as zero. If multiple boards are to be used set each board to an unique address.

A0	A1	A2	Address
Removed	Removed	Removed	0
Installed	Removed	Removed	1
Removed	Installed	Removed	2
Installed	Installed	Removed	3
Removed	Removed	Installed	4
Installed	Removed	Installed	5
Removed	Installed	Installed	6
Installed	Installed	Installed	7

KFLOP can be configured to service each Konnect Board using the AddKonnect function. The first parameter is the board address. The second parameter is the address of where KFLOP should obtain data to send to Konnect's 16 Outputs. The 3rd Parameter the address of where KFLOP should place the data received from Konnects 32 Inputs.

In most cases the addresses will be KFLOP Virtual I/O bit locations. KFLOP has two sets of Virtual I/O Bits, standard and extended. The standard consists of 16 Bits in VirtualBits, and the Extended consist of 1024 Bits in VirtualBitsEx[32].

The code below configures KFLOP to service 4 Konnect Boards (192 IO bits):

```
InitAux();
AddKonnect(0,&VirtualBits,VirtualBitsEx);
		AddKonnect(1,VirtualBitsEx+1,VirtualBitsEx+2);
		AddKonnect(2,VirtualBitsEx+3,VirtualBitsEx+4);
		AddKonnect(3,VirtualBitsEx+5,VirtualBitsEx+6);
```

Board 0 has Output Bits mapped to 48 - 63 and Input Bits Mapped to 1024-1055
Board 1 has Output Bits mapped to 1056-1071 and Input Bits Mapped to 1088-1119
Board 2 has Output Bits mapped to 1120-1135 and Input Bits Mapped to 1152-1183
Board 2 has Output Bits mapped to 1184-1199 and Input Bits Mapped to 1216-1247

Typical IO Mapping for Standard Single Konnect

AddKonnect(0,&VirtualBits,VirtualBitsEx);

Outputs	Virtual IO Number
0	48
1	49
2	50
3	51
4	52
5	53
6	54
7	55
8	56
9	57
10	58
11	59
12	60
13	61
14	62
15	63

Inputs	Virtual IO Number
0	1024
1	1025
2	1026
3	1027
4	1028
5	1029
6	1030
7	1031
8	1032
9	1033
10	1034
11	1035
12	1036
13	1037
14	1038
15	1039
16	1040

17	1041
18	1042
19	1043
20	1044
21	1045
22	1046
23	1047
24	1048
25	1049
26	1050
27	1051
28	1052
29	1053
30	1054
31	1055

Circuit

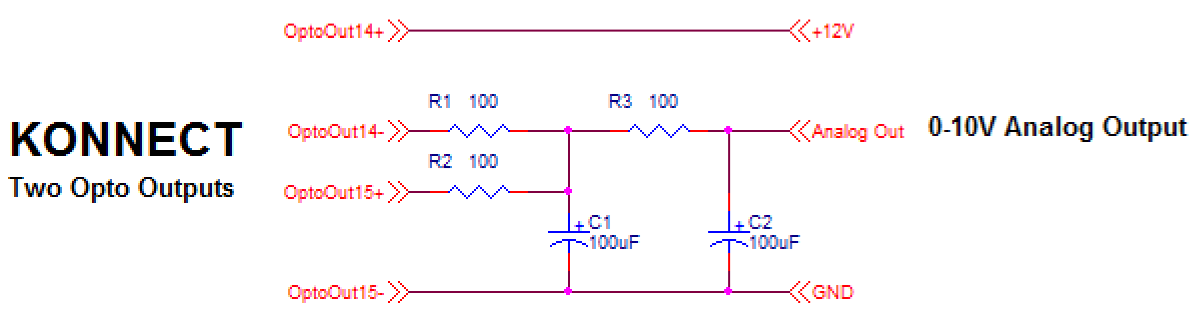
Simple cascaded dual low pass filters. Only 5 components. One resistor type and one capacitor type. Component values are not critical (R1 and R2 should be matched).

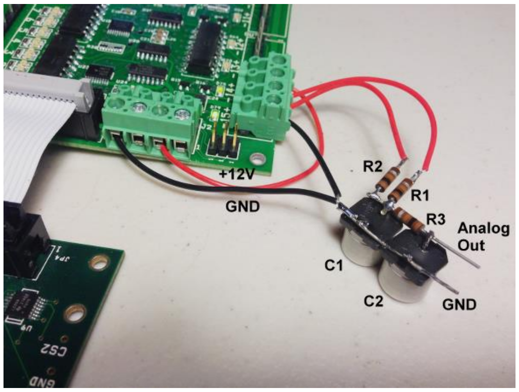
One Konnect Output charges the capacitors and one output discharges them. Both should not be turned on simultaneously (but no damage will occur if they are as R1+R2 will limit the current).

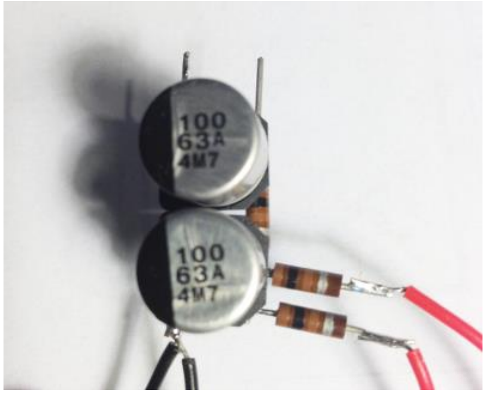
The relatively low resistance values (100 Ohms) provides low output impedance so that any connected load should have a minimal effect. A load of 10Kohms or higher should work well.

Double filtering provides low output ripple, while still having relatively quick response to changes, uses reasonably small capacitors, even with relatively low PWM rates.

Konnect Outputs can be updated every 180us. So 180us is the basic PWM quantum. This results in ~ 10mV p-p ripple…







Software

This software example simulates how an RC circuit would respond to an applied, switched, high/low voltage.

If the simulated voltage is below the desired output voltage then the output is switched high to charge up the capacitor, otherwise it is switched low to discharge the capacitor.

The same state that is simulated is also sent to the Konnect Outputs to drive the real circuit. The real circuit is a bit more complex but the simple model works reasonably well. The two RC circuits will eventually evolve to the same voltage as the average PWM Voltage in the steady state. Only the transient response will be slightly different. Similarly, somewhat incorrect component values will only affect the transient response. The progra values were adjusted to get the best response.

The #define statements may require changes for your specific circuit and I/O Bit used.

The Vout value is coded to create a sine wave, but more typically the value would be passed in through a global persist variable as a Spindle Speed Setting.

```
#include "KMotionDef.h"

// Enables a Konnect on KFLOP JP4 Aux Port then
// PWM's two outputs as push-pull drivers such that
// when low passed filtered with an RC circuit becomes
// a variable analog source.
//
// Configure KFLOP to service Konnect 32 Input 16 output IO board
// Board address is 0,
// 16 Outputs are mapped to Virtual IO 48-63 (VirtualBits)
// 32 Inputs are mapped to Virtual IO 1024-1055 (VirtualBits[0])
//
// Attach Service to Aux0 Port (KFLOP JP4) instead of standard Aux1 Port (KFLOP JP6)
//

void ServiceKonnectPWM(void);

double T,T0=0;
float Vout=0.0;  // desired voltage

main()
{
    InitAux();
    AddKonnect_Aux0(0,&VirtualBits,VirtualBitsEx);

    for(;;)
    {
        T=WaitNextTimeSlice();
        ServiceKonnectPWM();
```

```
        // Fixed
        //              Vout = 0.1;


        //Generate a 5 Hz 3V Sine Wave
        Vout = 3.0f*sin(T * TWO_PI * 5.0) + 5.0;


        //Generate a Saw Tooth wave
        //              Vout = 2 + 6.0* (5.0*T - ((int)(5.0*T)));

        //Generate a 5 Hz Square wave
        //              Vout = (5.0*T - ((int)(5.0*T))) > 0.5 ? 8 : 2;
    }
}

#define C 0.00029f // 1000uF
#define R 100.0f // 100 ohms
#define Vcc 11.230f // supply voltage
#define HIGH_BIT 62 // This output drives Cap high
#define LOW_BIT  63 // This output drives Cap low


void ServiceKonnectPWM(void)
{
    static int FirstTime=TRUE;
    static float Vc=0.0f;
    static double T0;
    static int State;
    double T=Time_sec();

    if (FirstTime)
    {
        FirstTime=FALSE;
        T0=T;
        State=0;
    }
    else
    {
        float V,I;

        // Compute Voltage applied to Cap
        V=Vcc*State;

        // Compute current
        I=(V-Vc)/R;

        // Compute new Cap Voltage
        Vc += I/C*(T-T0);

        // determine next state

        if (Vc > Vout)
        {
            ClearBit(HIGH_BIT);
            SetBit(LOW_BIT);
            State=0;
        }
        else
        {
            ClearBit(LOW_BIT);
            SetBit(HIGH_BIT);
            State=1;
        }

        T0=T; // save time when applied
    }
}
```