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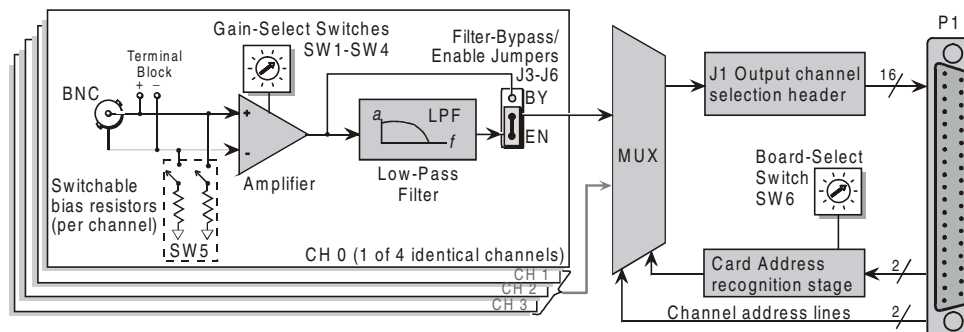
Reference Notes:

- Refer to [Chapter 2, Power Management](#), in regard to calculating system power requirements.
- [Chapter 3, System Connections and Pinouts](#), includes pinouts for P1, P2, P3, and P4. Refer to the pinouts that are applicable to your system, as needed.

Overview

Each DBK18 low-pass filter (LPF) card provides 4 input channels to a LogBook or a Daq device system. Each of sixteen channels can accept four DBK18 cards for a maximum of 256 analog inputs. The input connectors are BNC type connectors. The differential inputs are provided with switchable 100 K Ω bias resistors to analog common.

The DBK18 features an instrumentation amplifier for each channel, with switch-selected gains of $\times 1$, $\times 10$, $\times 100$, $\times 200$ and $\times 500$. A socket is provided for a gain resistor for custom gain selection instead of unity gain ($\times 1$). Gain for any channel can be set to any value between unity and $\times 500$ by installing an appropriate resistor. Four separate filter stages follow the 4 input stages. The outputs are connected to a 4-channel multiplexer stage. The enabled output MUX allows up to four DBK18s to share a common analog base channel.



DBK18 Block Diagram

Hardware Setup

Card Connection

The DBK18 is equipped with BNC connectors for easy access to all of the analog inputs. Connections are provided for 4 differential inputs. The card also includes a terminal block as a connection-option to the BNC connectors.

Note: New versions of the DBK18 have been enhanced by the addition of a terminal block. The BNC connectors are still usable, and board functions have not been changed.

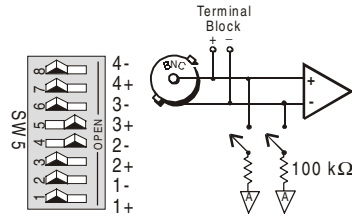
Card Configuration

Factory Defaults

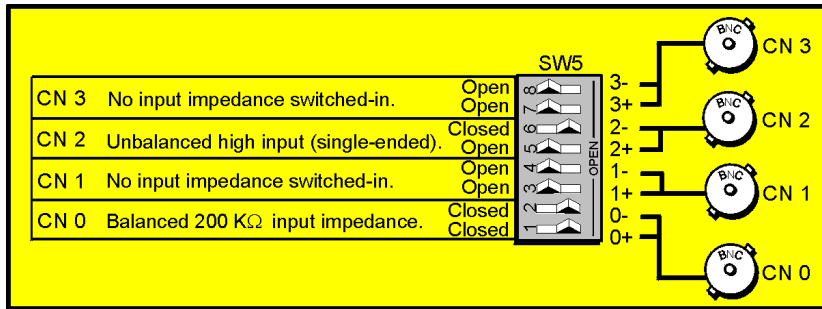
- **100K bias resistors – Enabled**
- **Low-Pass Filter – Disabled**
- **Gain – x1**

Input Termination

DBK18 provides two 100 KΩ bias resistors for each analog input. For balanced 200 KΩ input impedance, both resistors should be switched in. An 8-position DIP switch (SW5) can selectively engage the bias resistors. The input circuit and switch positions are shown in the figure. The switches must be in the closed position to engage the termination resistors. For unbalanced high input, only the (-) resistor is used. If neither resistor is used, some external bias current path is required.



Input Impedance/Termination

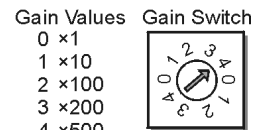


Examples of Bias Resistor Selection Options

Gain Settings

On the card, each channel has a gain-set switch labeled GAIN 1 (SW1) to GAIN 4 (SW4) and holes for gain resistors labeled RG1 to RG4. The table in the figure shows gain values for switch settings 0 to 4. If a custom gain is desired, the switch is set to position 0; and a gain resistor must be mounted and soldered onto the card. The value of the gain resistor is determined by the formula:

$$R_{GAIN} = [40,000 / (Gain - 1)] - 50 \Omega$$



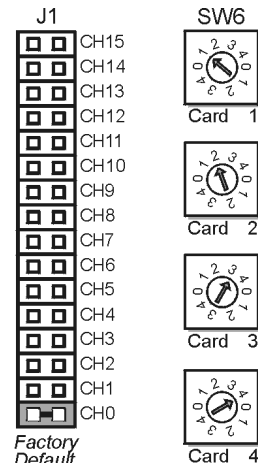
Setting Channel Gains

Address Configuration

Up to 4 DBK18s can be connected to each analog channel. Since this is a daisy-chain interface, each card must have a unique address (channel number and card number). Note that the default setting of SW6 is Card 1.

To configure the card, locate the 16 x 2-pin header labeled JP1 near the front of the board. The 16 jumper locations on this header are labeled CH0 through CH15. Place the jumper on the channel you wish to use. Only one jumper is used on a single card. Four cards in the daisy-chain can have the same channel number as long as each card number is unique.

Set switch SW6 for each of the 4 DBK18s on a single channel. Verify that only one card in a system is set to a particular channel and card number.



Address Configuration

CE Compliance



Reference Notes:

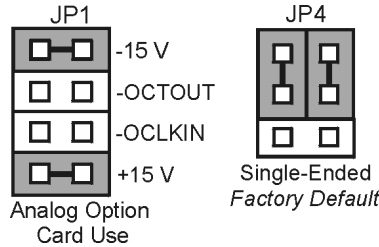
Should your data acquisition system need to comply with CE standards, refer to the *CE Compliance* section of Chapter 1.



DaqBook and DaqBoard [ISA type] Configuration

Use of the DBK18 requires setting jumpers in DaqBooks and DaqBoards [ISA type].

1. If not using auxiliary power, place the JP1 jumper in the expanded analog mode.



Configuration Jumpers

Note: The default position is necessary to power the interface circuitry of the DBK18 via the internal ± 15 VDC power supply. If using auxiliary power (e.g., DBK32A, DBK33), you must remove both JP1 jumpers (refer to chapter 2, *Power Management* and to the DBK32A and DBK33 modules as applicable).

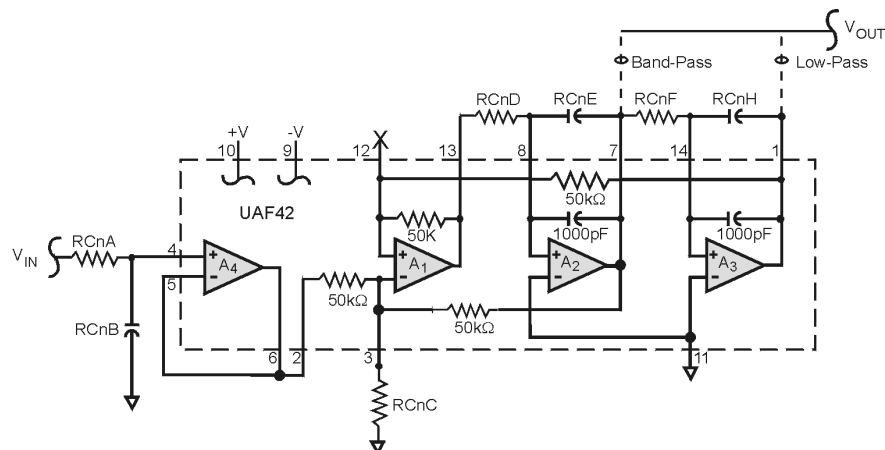
2. For DaqBook/100, /112, and /120 *only*, place the JP4 jumper in single-ended mode.

Note: Analog expansion cards convert all input signals to single-ended voltages referenced to analog common.

Configuring DBK18 Filter Sections

There are 4 low-pass, 3-pole active filters on the DBK18. Each filter can be enabled (EN) or bypassed (BY) by placement of the jumper on J3 for channel 0, J4 for channel 1, J5 for channel 2, or J6 for channel 3. The factory-default setting is **enabled (EN)** for each channel. Each filter can be configured as a Butterworth, Bessel, or Chebyshev filter with corner frequencies up to 50 kHz. Filter properties depend on the values of resistors and capacitors installed in several circuit locations. Above 10 Hz, installing capacitors is unnecessary because capacitors in the ICs are sufficient. In all cases, three resistors are required to complete the active filter circuits contained mostly within the UAF42 ICs.

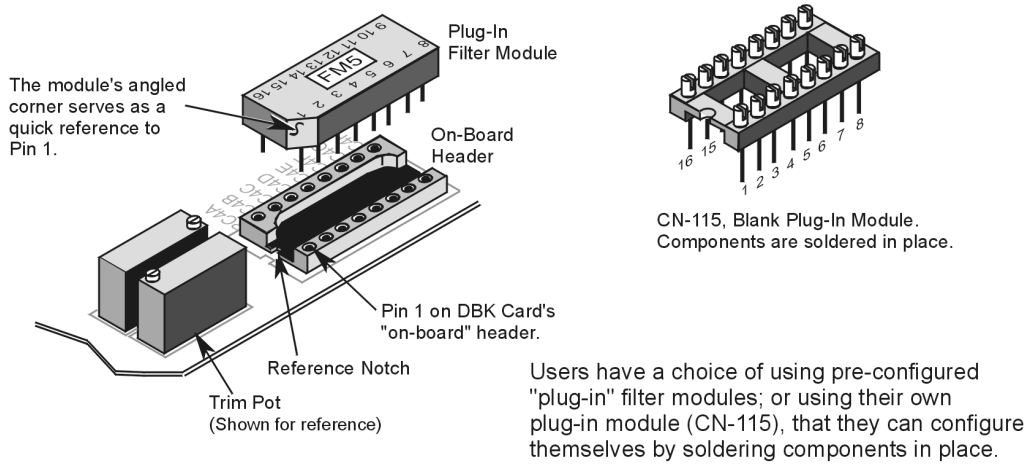
The following circuit diagram shows the active filter IC in a typical section of the DBK18. The resistors and capacitors outside the IC have a physical location in a DIP-16 socket (dual in-line, 16 pins) with an RCnn designator. The RC indicates the needed part is a resistor or capacitor; the 3rd character is the channel number; and the 4th character corresponds to the socket position (A-H).



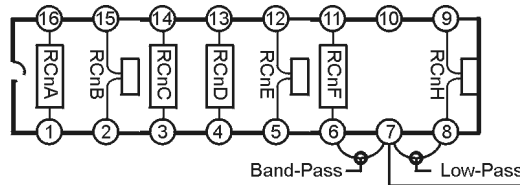
Filter Circuit Diagram

A machined-pin IC socket in each filter RC location can accept resistors and capacitors that plug directly into the socket; however, this is not recommended. Two much better approaches exist. The first is to use pre-configured plug-in filter modules; the second is to configure your own plug-in module using a blank CN-115. Both of these options are depicted in the following illustration.

The use of plug-in modules provides excellent “gold-to-gold” contact between the components of the plug-in module and the on-board header.



The following figure shows the DIP-16 component pattern typical of the 4 filter sections.



DIP-16 Component Pattern

Note: In the DIP-16 figure, “n” corresponds to “channel number.”

Note: In the DIP-16 figure, pin 7 of the DIP-16 socket:

- connects to pin 8 for low-pass filtering
- connects to pin 6 for band-pass filtering

The following table lists values of components for common corner frequencies in Butterworth filters. If designing your own filter, software from Burr-Brown provides the component values to create the desired filter. Note that the design math is beyond the scope of this manual.

| 3-Pole Butterworth Filter Components | | | | | | | | |
|--------------------------------------|---------|----------|------|---------|---------|---------|------|---------|
| 3dB (Hz) | RCnA | RCnB | RCnC | RCnD | RCnE | RCnF | RCnG | RCnH |
| 0.05 | 3.16 MΩ | 1 μF | none | 3.16 MΩ | 1 μF | 3.16 MΩ | none | 1 μF |
| 0.10 | 1.58 MΩ | 1 μF | none | 1.58 MΩ | 1 μF | 1.58 MΩ | none | 1 μF |
| 0.20 | 787 kΩ | 1 μF | none | 787 kΩ | 1 μF | 787 kΩ | none | 1 μF |
| 0.50 | 3.16 MΩ | 0.1 μF | none | 3.16 MΩ | 0.1 μF | 3.16 MΩ | none | 0.1 μF |
| 1 | 1.58 MΩ | 0.1 μF | none | 1.58 MΩ | 0.1 μF | 1.58 MΩ | none | 0.1 μF |
| 2 | 787 kΩ | 0.1 μF | none | 787 kΩ | 0.1 μF | 787 kΩ | none | 0.1 μF |
| 5* | 3.16 MΩ | 0.01 μF | none | 3.16 MΩ | 0.01 μF | 3.16 MΩ | none | 0.01 μF |
| 10* | 1.58 MΩ | 0.01 μF | none | 1.58 MΩ | 0.01 μF | 1.58 MΩ | none | 0.01 μF |
| 20 | 787 kΩ | 0.01 μF | none | 787 kΩ | 0.01 μF | 787 kΩ | none | 0.01 μF |
| 50 | 3.16 MΩ | 0.001 μF | none | 3.16 MΩ | none | 3.16 MΩ | none | none |
| 100* | 1.58 MΩ | 0.001 μF | none | 1.58 MΩ | none | 1.58 MΩ | none | none |
| 200 | 787 kΩ | 0.001 μF | none | 787 kΩ | none | 787 kΩ | none | none |
| 500* | 316 kΩ | 0.001 μF | none | 316 kΩ | none | 316 kΩ | none | none |
| 1000* | 158 kΩ | 0.001 μF | none | 158 kΩ | none | 158 kΩ | none | none |
| 2000 | 78.7 kΩ | 0.001 μF | none | 78.7 kΩ | none | 78.7 kΩ | none | none |
| 5000 | 31.6 kΩ | 0.001 μF | none | 31.6 kΩ | none | 31.6 kΩ | none | none |
| 10000 | 15.8 kΩ | 0.001 μF | none | 15.8 kΩ | none | 15.8 kΩ | none | none |

*These pre-configured Butterworth frequency modules are available from the manufacturer.

You have the option to configure the filter sections as band-pass filters rather than low-pass filters. The component selection program provides band-pass component values. The program also computes and displays phase and gain characteristics of the filter sections as a function of frequency.

Software Setup

Reference Notes:



- **DaqView users** - Refer to [Chapter 4, DBK Setup in DaqView](#).
- **LogView users** - Refer to [Chapter 5, DBK Setup in LogView](#).

DBK18 – Specifications

Name/Function: Low-Pass Filter Card

Number of Channels: 4

Input Connections: 4 BNC connectors

Output Connector: DB37 male, connects to P1 with a CA-37-x cable

Number of Cards Addressable: 64

Input Type: Differential

Voltage Input Ranges:

0 to ± 5000 mVDC

0 to ± 500 mVDC

0 to ± 50 mVDC

0 to ± 25 mVDC

0 to ± 10 mVDC

Input Amplifier Slew Rate: 12 V/ μ s minimum

Input Gains: $\times 1$, $\times 10$, $\times 100$, $\times 200$, $\times 500$ and user-set

Input Offset Voltage: 500 μ V + 5000/G maximum (nullable)

Input Offset Drift: $\pm 5 + 100/G$ μ V/ $^{\circ}$ C maximum

Input Bias Current: 100 pA maximum

Input Offset Currents: 50 pA maximum

Input Impedance: 5×10^{12} parallel with 6 pF

Switchable Bias Resistors: 100 K Ω each to analog common

Gain Errors:

0.04% @ $\times 1$

0.1% @ $\times 10$

0.2% @ $\times 100$

0.4% @ $\times 200$

1.0% @ $\times 500$

Gain vs Temperature:

$\times 1$ @ ± 20 ppm/ $^{\circ}$ C

$\times 10$ @ ± 20 ppm/ $^{\circ}$ C

$\times 100$ @ ± 40 ppm/ $^{\circ}$ C

$\times 200$ @ ± 60 ppm/ $^{\circ}$ C

$\times 500$ @ ± 100 ppm/ $^{\circ}$ C

Non-Linearity:

$\times 1$ to ± 0.015 % full-scale

$\times 10$ to ± 0.015 % full-scale

$\times 100$ to ± 0.025 % full-scale

$\times 200$ to ± 0.025 % full-scale

$\times 500$ to ± 0.045 % full-scale

Common-Mode Rejection:

70 dB minimum @ $\times 1$

87 dB minimum @ $\times 10$

100 dB minimum @ $\times 100$

100 dB minimum @ $\times 200$

100 dB minimum @ $\times 500$

Active Filter Device: UAF42 (Burr-Brown)

Number of Poles/Filter: 3

Types of Filters: Bessel, Butterworth, Chebyshev

Frequency Range:

0.1 Hz to 20 kHz

The frequency is set by the installation of 4-6 resistors, and/or capacitors, in sockets.

Default Frequency:

1 Hz

Other frequencies may be implemented by soldering resistors, and/or capacitors, to locations on the 4 blank plug-in headers. Values for common frequencies and their component values are provided with the blank headers.