DBK17   4-Channel Simultaneous Sample and Hold Card

Reference Notes:

o Chapter 2 includes pinouts for P1, P2, P3, and P4. Refer to pinouts applicable to your system, as needed.

o In regard to calculating system power requirements, refer to *DBK Basics* located near the front of this manual.

Overview

Each DBK17 simultaneous sample-and-hold (SSH) card provides 4 channels of voltage input to a LogBook or a Daq device system. Each of the 16 analog input channels can accept four DBK17 cards for a maximum of 256 analog input channels. The simultaneous sample-hold function is activated at the beginning of each channel scan and freezes all signals present on DBK17 inputs for the duration of the scan, allowing for non-skewed readings of all channels.
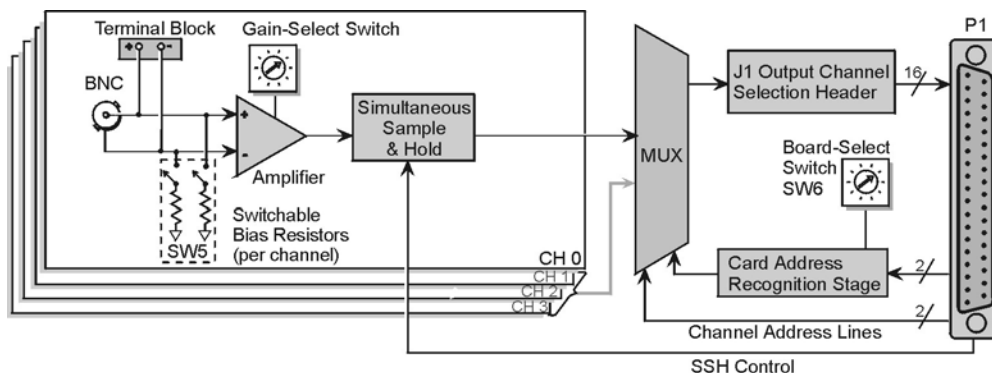
A DBK17 channel should never be the first channel in a scan due to timing of the SSH line.

DBK17 features an instrumentation amplifier for each channel, with switch-selected gains of ×1, ×10, ×100, ×200 and ×500. A socket is provided for a user-selected gain resistor for custom gain selection instead of the unity gain (×1) setting.

Four separate sample-hold stages follow the 4 input stages. The outputs are connected to a 4-channel multiplexer stage. The enabled-output MUX allows up to 4 DBK17s to share a common analog input channel.

Input can be connected to a channel's BNC connector or terminal block. The differential inputs are provided with switchable 100 KΩ bias resistors to analog common. User gain can be set to any value between unity and ×500 by installing a resistor in the user-location of each channel.

DBK17 Block Diagram

Simultaneous Sample and Hold

Some applications require every channel in a scan group to be read *at the same instant,* as opposed to being read with a delay, e.g., 10 μs between channels. Simultaneous Sample and Hold (SSH) is a means of obtaining such instantaneous data on multiple channels while avoiding time-skew problems.

A sample case in which SSH is desirable:
A performance analysis of an engine is a classic example of a case in which SSH is desirable. In our engine analysis example data is gathered on the following parameters:

- cylinder pressure
- cylinder temperature
- piston strain
- piston stroke position
- valve position
- engine rpm
- vibration

For a more exact correlation of the data, it needs to be obtained at the same instant, without time-skew. By using SSH each input signal continuously passes through an instrumentation amplifier and into a sample-and-hold stage. When the sample enable line goes high, each channel's sample-and-hold stage will "freeze" the current analog value. The values for all channels are separately "latched" within 50 ns of each other. The signals are held [in a stable condition] while the multiplexer switches through all channels and sends the signals [one-by-one] to the acquisition device. At the device, the ADC digitizes each reading. The resulting data is a snapshot of conditions at a selected instant although the multiplexing and analog-to-digital conversions are spread out over a longer interval. The simultaneous sample and hold circuit allows you to gather up to 256 simultaneous samples via sixty-four DBK17s.

Hardware Setup

Card Connection

The DBK17 is equipped with BNC connectors and terminal block connectors access to each of the four differential analog inputs. Note that the terminal block is a connection-option to the BNC connector.
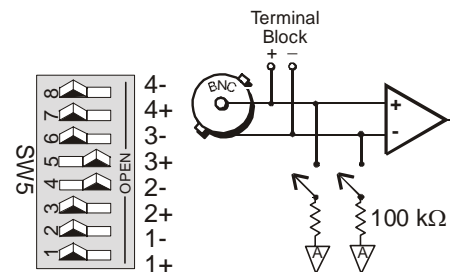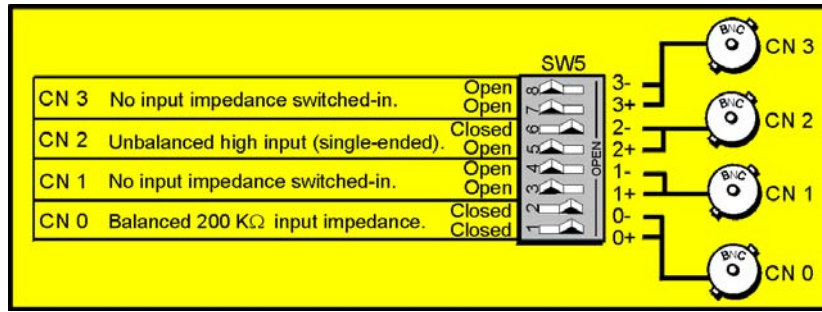
Card Configuration

Factory Defaults

- **100K bias resistors – Enabled**
- **SSH — Enabled. No disable option.**
- **Gain – x1**

Input Termination

DBK17 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 should be used. If neither resistor is used, some external bias current path is required.
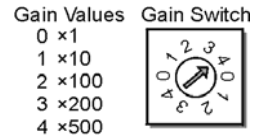

Input Impedance/Termination

Examples of Bias Resistor Selection Options

Gain Settings

On the card, each channel has a gain-set switch and holes for gain resistors labeled RG1 to RG4. The figure at the right shows gain values for switch settings 0 to 4, with 0 being equal to x1 and 4 being equal to x500. 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:

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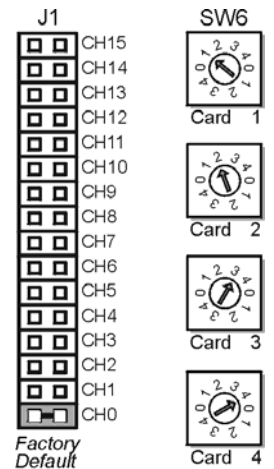
$$R_{GAIN} = [40,000 \ / \ (Gain \ \text{-}1)] \ \text{-} \ 50 \ \Omega$$

Address Configuration

As many as four DBK17s can be connected to each analog channel. With sixteen channels (and four inputs per DBK17) 256 inputs are possible. Since this is a daisy-chain interface, each card must have a unique address (channel and card number). Note that the default setting for SW6 is Card 1.

To configure the card, locate the 16×2-pin header (labeled J1) 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 their card number is unique.

Set switch SW6 for each of four DBK17s on a single channel. Verify that only one card in the system is set to a particular channel *and* card number.
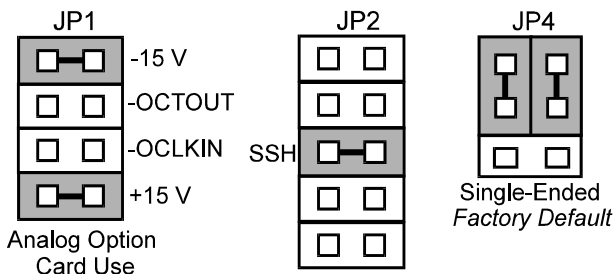

Address Configuration

CE Compliance

Reference Notes:
Should your data acquisition system need to comply with CE standards, refer to the *CE Compliance* section of the *Signal Management* chapter.

DaqBook/100 Series & /200 Series and DaqBoard [ISA type] Configuration

Use of the DBK17 requires setting jumpers in **DaqBook/100 Series & /200 Series devices** and **ISA-Type DaqBoards**.

1. If not using auxiliary power, ensure that the JP1 jumper is in the expanded analog mode (see figure).

Jumpers on DaqBook/100 Series, /200 Series, & ISA-Type DaqBoards

Note: The JP1 default position (above figure) is necessary to power the interface circuitry of the DBK17 via the internal +15 VDC power supply. See the following CAUTION regarding JP1.

CAUTION
If using auxiliary power, for example a DBK32A or a DBK33, you must remove both JP1 jumpers. Refer to *Power Requirements* in the *DBK Basics* section and to the DBK32A and DBK33 sections as applicable.

2. Place the DaqBook/100 Series or DaqBook/200 Series device's JP2 jumper in the SSH position.

CAUTION
Do not use an external voltage reference for DAC1. Applying an external voltage reference for DAC1 when using SSH output will result in equipment damage due to a conflict on P1, pin #26.

3. **For DaqBook/100, /112 and /120 _only_**, ensure that the JP4 jumper is in *single-ended* mode.

DaqBook/2000 Series and DaqBoard/2000 Series Configuration

No hardware configurations are required for the DaqBook/2000 Series or DaqBoard/2000 Series devices.

Software Setup

Reference Notes:
- o **DaqView users** - Refer to chapter 3, *DBK Setup in DaqView*.
- o **LogView users** - Refer to chapter 4, *DBK Setup in LogView*.

DBK17 – Specifications

Name/Function: Simultaneous Sample-Hold Card
Number of Channels: 4
Input Connections: 4 BNC connectors, 4 screw-terminal sets
Output Connector: DB37 male, which mates with P1 using 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/µs minimum
Acquisition Time:
  0.6 µs (10 V excursion to 0.1%)
  0.7 µs (10 V excursion to 0.01%)
Channel-to-Channel Aperture Uncertainty: 50 ns
Output Droop Rate: 0.1 µV/µs
Input Gains: ×1, ×10, ×100, ×200, ×500 & User-Set
Input Offset Voltage: 500 µV + 5000/G maximum (nullable)
Input Offset Drift: ±5 + 100/G µV/°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 KΩ (each to analog common)

Gain Errors:
  0.04% @ ×1
  0.1% @ ×10
  0.2% @ ×100
  0.4% @ ×200
  1.0% @ ×500
Gain vs Temperature:
  ×1 @ ±20 ppm/°C
  ×10 @ ±20 ppm/°C
  ×100 @ ±40 ppm/°C
  ×200 @ ±60 ppm/°C
  ×500 @ ±100 ppm/°C
Non-Linearity:
  ×1 to ±0.015% full-scale
  ×10 to ±0.015% full-scale
  ×100 to ±0.025% full-scale
  ×200 to ±0.025% full-scale
  ×500 to ±0.045% full-scale
Common-Mode Rejection Ratio (CMRR):
  70 dB minimum @ ×1
  87 dB minimum @ ×10
  100 dB minimum @ ×100
  100 dB minimum @ ×200
  100 dB minimum @ ×500

Notes