DBK52

14-Channel Thermocouple Input Module

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

DaqView Users: When DBK52 is used with /2000 Series Devices, the Internal Clock Speed should be set to 100 kHz as described in Chapter 3, *DBK Setup in DaqView*.

The DBK52 provides the ability to scan and input thermocouple data for various computer-based temperature-monitoring systems. Features include:

- Each DBK52 can connect up to 14 thermocouples. Up to 16 DBK52s may attach to a single LogBook or Daq Device to measure a maximum of 224 (16×14) temperatures.

- Standard, miniature jacks can connect to all T/C types.

- Onboard cold junction sensor (CJS) circuitry is accessible via a built-in channel to the system.

- A built-in short-to-ground channel back to the system eliminates offset errors via software.

- RC low-pass input filters reject high frequency noise for thermocouple shields.

- An external analog-common access jack provides a bias-current return path for differential signal inputs.

- An onboard programmable gain amplifier supports most thermocouple types and temperature ranges.

- Software-based linearization (in LogView and DaqView) converts analog signals into temperature values.

Reference Note:
In regard to Daq devices, related material for programmers is included in the separate *Programmer's Manual* (p/n 1008-0901).

The following table shows the temperature range for each thermocouple type.

T/C Type	J	K	T	E	N28	N14	S	R	B
Temperature Range °C	-200 to 760	-200 to 1260	-200 to 400	-270 to 1000	-270 to 400	0 to 1300	0 to 1780	0 to 1780	0 to 1820
Temperature Range °F	-328 to 1400	-328 to 2300	-328 to 752	-454 to 1832	-454 to 752	32 to 2372	32 to 3236	32 to 3236	32 to 3308

Thermocouple accuracy depends on the thermocouple itself, the cold-junction sensor, A/D conversion, and linearization. The DBK52, LogBook, and Daq device systems use quality components and software compensation to minimize error from these sources. Systems achieve a ±1°C CJS accuracy that contributes to the overall accuracy. When the software is calibrated, gain and offset errors are virtually eliminated. The DBK52's built-in auto-zero channel dynamically eliminates any other system offset-errors.

True differential measurements of T/Cs require bias-current referenced to the analog common. Resistors from each input T/C are connected to the analog common. Filter capacitors across each input operate with input protection resistors to form a single-pole RC low-pass filter.

DBK52 Block Diagram
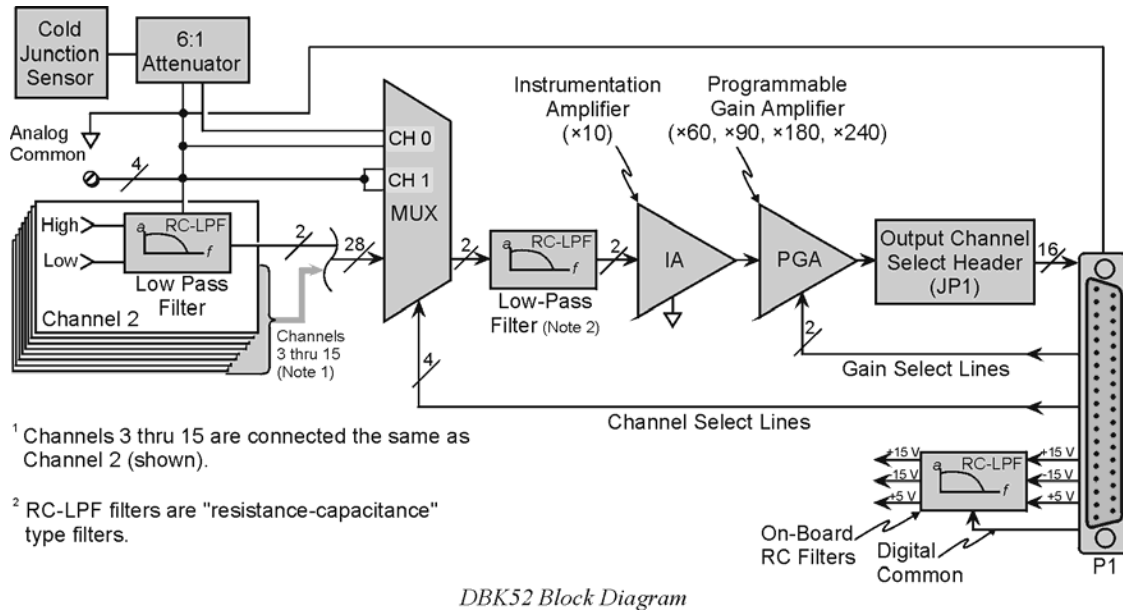
Hardware Setup

Module Connection

The DBK52 has miniature T/C jacks to connect different types of thermocouples and an analog-ground access point. Connections are provided for 14 thermocouples. **Thermocouple polarities must be observed**. Thermocouple types J, K, T, E, N28, N14, S, R and B are supported by the LogView or DaqView software and may be connected to DBK52 board channels CH2 through CH15.

T/C Type	(+) Lead to Channel-Hi		(-) Lead to Channel-Lo	
J	White		Red	
K	Yellow		Red	
T	Blue		Red	
E	Violet		Red	
N28	Orange		Red	
N14	Orange		Red	
S	Black		Red	
R	Black		Red	
B	Gray		Red	

Note: **CH0** is reserved for the cold-junction compensation sensor (factory installed).
CH1 is permanently shorted to allow software-driven auto-zero to compensate for temperature drift.
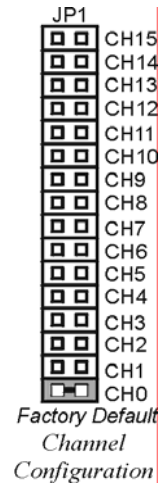
Thermocouple wire is standardized and color-coded as shown in the table. T/Cs have a very small output. Long T/C leads can pickup lots of noise. Use shielding as needed, and average several readings in software to minimize noise effects.

After all connections are in place, secure wires to captive areas (pre-drilled holes) at the rear edge of the board. Nylon tie wraps (not included) work well for this purpose.

Module Configuration

Up to 16 DBK52s may be connected to a LogBook or a Daq Device. As a daisy-chain interface, each module must appear unique. Each module uses a different analog input channel. To configure the module:

1. Assign a channel number to the module. **The assigned number must not be used by any other DBK card or module.**

2. Locate the 16×2-pin header near the front of the board labeled JP1, and place the jumper on the LogBook or Daq Device channel you wish to use. There are 16 jumper locations on this header labeled CH0 through CH15. Only one jumper setting is used on a single module; no other module in a common daisy-chain can use the same jumper setting.

JP1
CH15
CH14
CH13
CH12
CH11
CH10
CH9
CH8
CH7
CH6
CH5
CH4
CH3
CH2
CH1
CH0

Factory Default Channel Configuration

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

Three setup steps and needed to configure DaqBooks/100 Series & /200 Series devices and DaqBoards [ISA type] for a DBK52.

1. If not using auxiliary power, place the JP1 jumper in the Analog Option Card Use (expanded analog) mode.

JP1
-15V
-OCTOUT
-OCLKIN
+15v
Analog Option Card Use

JP3
UNI-
BI-
Bipolar Mode

JP4
SE
DIFF
Single-Ended Mode
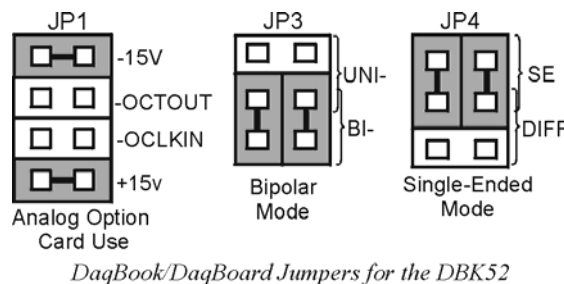
Note:
These jumpers do not apply to /2000 Series devices.

DaqBook/DaqBoard Jumpers for the DBK52

To power the interface circuitry of the DBK52 via the internal ±15 VDC power supply, JP1 must be set to "Analog Option Card Use." However, if using auxiliary power, e.g., the DBK32A or the DBK33, you must remove both JP1 jumpers. Refer to *Power Requirements* **in the** *DBK Basics* **section and to the DBK32A and DBK33 sections for additional information, as applicable.**

2. For DaqBook/100, DaqBook/112 and DaqBook/120 *only*, place the JP3 jumper in *bipolar mode*.

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

Note: The DaqBook/200 Series devices and DaqBoards do not have a JP4. The single-ended or differential choice is made via software configuration commands.

DaqBook/2000 Series and DaqBoard/2000 Series Configuration

No jumper configurations are required for the /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*.

o **DBK52 Calibration Disk** – Each DBK52 card is shipped with a calibration disk with constants used to correct gain and offset errors inherent in the hardware. This calibration is done automatically by DaqView and LogView. Refer to the **readme.txt file** on the disk.

DaqView Users: When DBK52 is used with /2000 Series Devices, the Internal Clock Speed should be set to 100 kHz as described in Chapter 4, *DBK Setup in DaqView*.

The DBK52 selection allows the user to define the thermocouple types by using the Type column of the analog input spreadsheet.

Each DBK52 card is shipped with a calibration disk with constants used **to correct gain and offset errors** inherent in the hardware. This gain and offset calibration is done automatically by DaqView and LogView. See the DBK52 readme.txt file on the disk shipped with the board for details on creating this file.

DBK52 - Specifications

Name/Function: Thermocouple Input Module

Connectors:
DB37 male, mates with P1.
Thermocouples attach directly to on-board jacks.

Thermocouple Types: J, K, S, T, E, B, R, N

Gain Ranges: ×60, ×90, ×180, ×240

Inputs:
14 differential thermocouples
1 cold-junction compensation
1 auto zero

Cold Junction Sensor Output: 100 mV/°C

Voltage Ranges/Gains:
0 to 80 mV ×60
0 to 50 mV ×90
0 to 25 mV ×180
0 to 20 mV ×240
0 to ±10 mVDC

Input Impedance: 20 kΩ

Input RC Filter -3 dB Frequency: 15.9 kHz

Gain Accuracy:
Uncalibrated: 0.15%
Calibrated: 0.02%

Maximum Input Voltage: 35 VDC

CMRR (Input Stage): 110 dB type DC to 60 Hz

Offset: Software compensated

Type/Range/Accuracy/Resolution: refer to the following table

Thermocouple Reference								
	Range		Accuracy		Resolution			
Type	**Min**	**Max**	**(<0°C)**	**(>0°C)**	**12-bit <0°C**	**12-bit >0°C**	**16-bit <0°C**	**16-bit >0°C**
J	-200°C	760°C	0.6°C	0.6°C	1.2°C	0.5°C	0.1°C	0.1°C
K	-200°C	1260°C	1.6°C	1.0°C	1.1°C	0.8°C	0.1°C	0.1°C
T	-200°C	400°C	1.4°C	0.8°C	0.8°C	0.3°C	0.1°C	0.1°C
E	-270°C	1000°C	1.4°C	0.9°C	1.6°C	0.7°C	0.1°C	0.1°C
N28	-270°C	400°C	0.8°C	0.8°C	1.0°C	1.0°C	0.1°C	0.1°C
N14	0°C	1300°C	—	1.0°C	—	5.0°C	—	5.0°C
S	0°C	1780°C	—	1.6°C	—	1.3°C	—	0.1°C
R	0°C	1780°C	—	1.6°C	—	1.7°C	—	0.1°C
B	0°C	1820°C	—	1.8°C	—	1.5°C	—	0.1°C