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Find the *Measurement Computing / IOtech DBK82* at our website: *Click HERE*

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Reference Notes:

- Chapter 2 includes pinouts for P1, P2, P3, and P4. Refer to pinouts applicable to your system, as needed.
- In regard to calculating system power requirements, refer to *DBK Basics* located near the front of this manual.

Overview

The DBK84 is used in temperature measurement applications and provides connections for 14 thermocouples through convenient mini-TC connectors.

The DBK84 features on-board cold junction compensation (CJC) for direct measurement of type J, K, T, E, N28, N14, S, R, and B thermocouples. The following table provides the temperature range for each of these thermocouple types.

Thermocouple Temperature Ranges									
T/C Type	**J**	**K**	**T**	**E**	**N28**	**N14**	**S**	**R**	**B**
Temperature Range °C	-200 to 760	-200 to 1200	-200 to 400	-270 to 650	-270 to 400	0 to 1300	-50 to 1768	-50 to 1768	50 to 1780
Temperature Range °F	-328 to 1400	-328 to 2192	-328 to 752	-454 to 1202	-454 to 752	32 to 2372	-58 to 3214	-58 to 3214	122 to 3236

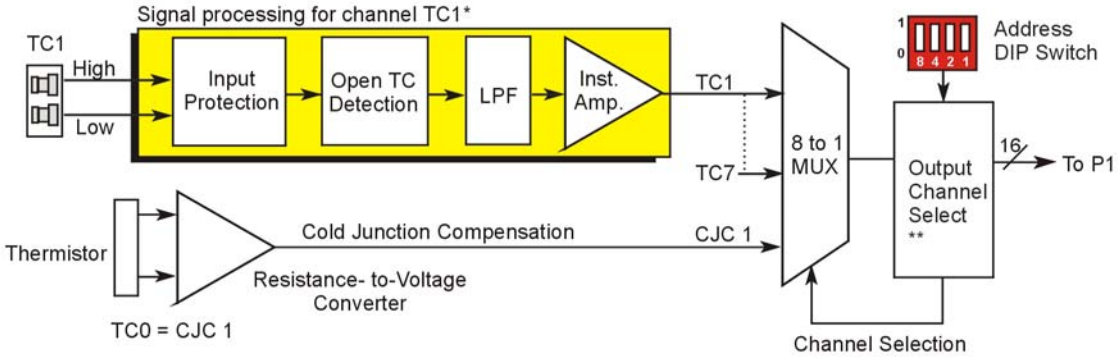
Up to fourteen external thermocouples can be connected to the DBK84 module. Channels 1 through 7 are used for the first seven thermocouples, and channels 9 through 15 are used for the second set of seven.

Note: DBK84 has two on-board CJCs. They are measured on channels 0 and 8.

In addition to thermocouple measurements, each input channel can be configured for a fixed voltage gain of 100. When in this mode, voltage can be measured in the range of ±100 mV, or ±50 mV, depending on the type of Daq device being used.

Up to sixteen DBK84 modules can be attached to a single LogBook or Daq device, providing up to 224 temperature channels.

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* The 14 thermocouple circuitry channels TC1 through TC7 and TC9 through TC15 each have their own signal processing block, which consists of Input Protection, Open Thermocouple Detection, a Low Pass Filter, and an Instrument Amplifier. Channels TC0 and TC8 are used for Cold Junction Compensation (CJC).

** A second MUX [not shown] connects to the Output Channel Select. That MUX is for channels TC9 through TC15 and CJC2 (TC8).

In comparison to typical DBK options, the DBK84 demands significant power from the system's ±15 V power supplies. It is important that you calculate your system's power demand, as you may need to add auxiliary power supplies. For additional information refer to *Power Requirements* in the *DBK Basics* section.

Hardware Setup

Module Connection

The DBK84 accepts up to 14 mini-TC plugs in its channels 1 through 7 and 9 through 15. All channels have the same level of functionality.

Thermocouple wire is standardized, color-coded, and polarized, as noted in the following table.

Thermocouple Standards				
T/C Type	(+) Lead to Channel High		(-) Lead to Channel Low	
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	

Mini-TC plugs are type-specific, and for best measurement operation the plug TC type should match the wire TC type. If necessary, copper/copper (Type U) plugs may be used, but measurement stability will be slightly degraded. Mini-TC plugs are polarized as well, and it is critical for proper measurement operation that this polarity be followed when connecting the thermocouple wire. Once wired, the TC plugs will only mate into the DBK84's connectors in one orientation, ensuring a correct connection.

It should be noted that thermocouples output very small voltages and that long thermocouple leads can pickup a large amount of noise. However, the DBK84 inherently provides a high level of noise immunity via its 4 Hz signal bandwidth and input filtering. If desired, further noise reduction can be achieved

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through the use of shielded thermocouples and/or averaging.



You can minimize the effect of noise by (1) using shielded thermocouples, (2) averaging readings, or (3) employing both of these practices.

To accommodate shielding, grounded connections, labeled “Analog Common,” are provided. A typical use of the connection would be to attach the shield of a shielded thermocouple.



If a thermocouple shield is connected to the DBK84 module, leave the shield unconnected at the other end of the thermocouple.

Open Thermocouple Detection

The DBK84 is equipped with open thermocouple detection for each channel. This means that a broken thermocouple wire [or otherwise unconnected input] that is measured will result in an off-scale reading. This is accomplished by applying a small bias current to each of the channel inputs. Whenever a valid input is absent, the bias current saturates the input amplifier, resulting in the off-scale reading. When in this
“off-scale” state, however, the input amplifier draws more current from the power supply. Specifically, the power draw of the module from ±15 V will increase by 0.75 mA for each open channel.



If available power is limited, insert shorted TC plugs into unused channels. This will minimize power consumption. Note that it is not enough to simply avoid scanning unused channels; to minimize power consumption the channels must be physically shorted in the hardware.



The power requirements, detailed in the product specification, assume worst case connection conditions.

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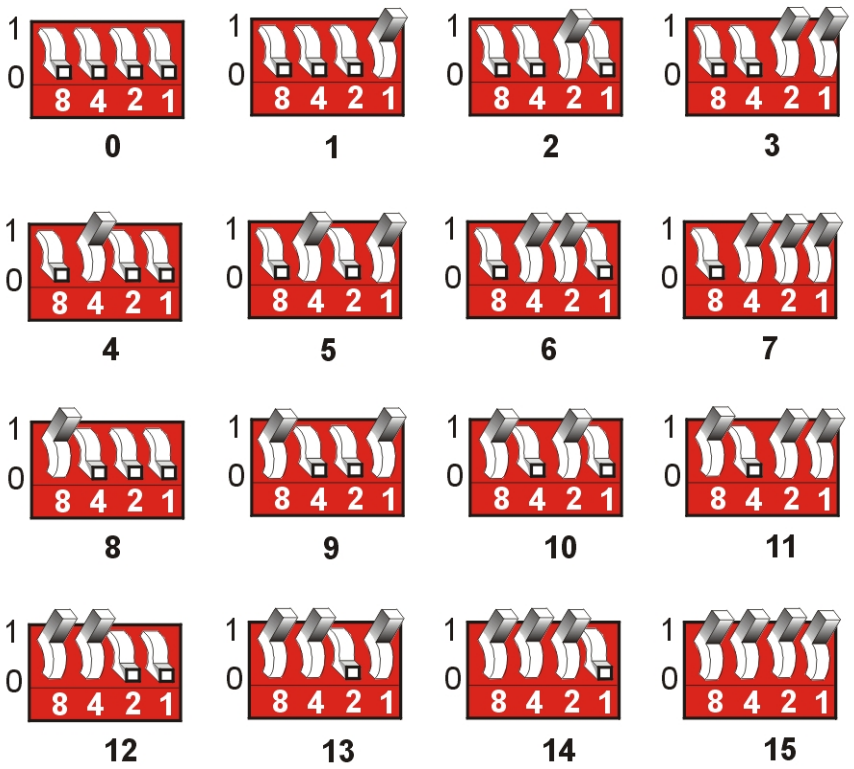
Module Configuration

Up to sixteen DBK84 modules can be attached to a single LogBook or Daq device. Since multiple modules are connected via a parallel interface, each must have a unique channel address.

CAUTION
Adjustment of the channel address must only be performed when the system power is OFF. Failure to do so may result in equipment damage.

To assign a channel address to the DBK84 module, first locate the DIP switch on the front panel (next to P1). Four micro-switches [on the DIP switch] are used to set the module's channel address in binary. After ensuring that the system power is OFF, adjust the micro-switches to set the desired address.

Each module in the system must have a unique address.



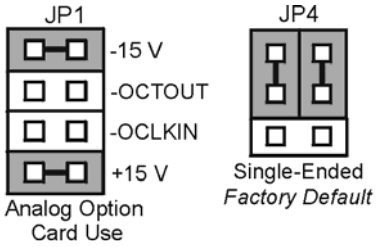
DBK84 Channel Address Settings

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

Use of a DBK84 with a DaqBook/100 Series device, DaqBook/200 Series device, or with an ISA-type DaqBoard requires the configuration of jumpers JP1 and JP4 located on the DaqBook or DaqBoard device.

1. If not using auxiliary power, set the JP1 jumper for **Analog Option Card Use**, also referred to as the expanded analog mode.



Note:
These jumpers do not apply to /2000 Series devices.

Required Jumper Settings in DaqBook/100 Series Devices, DaqBook/200 Series Devices, and ISA-Type DaqBoards



The JP1 default position (above) is necessary to power the interface circuitry of the DBK84 module via the internal ±15 VDC power supply. If using auxiliary power (e.g., a DBK32A or DBK33), you must remove both JP1 jumpers. Refer to *Power Requirements* in the *DBK Basics* section and to the DBK32A or DBK33 sections as applicable.

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

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

DaqBook/2000 Series and DaqBoard/2000 Series Configuration

No jumper configurations are required for the /2000 series devices.

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Software Setup

Reference Notes:

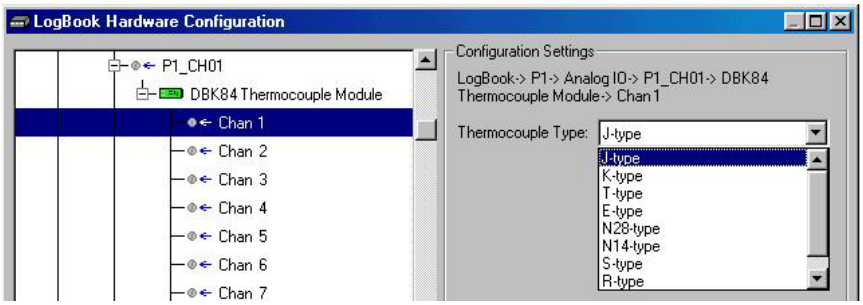
- **DaqView users** - Refer to Chapter 3, *DBK Setup in DaqView*.
- **LogView users** - Refer to Chapter 4, *DBK Setup in LogView*.
- Programmers using Daq devices should refer to related sections in the *Programmer's Manual*.

Note: LogView and DaqView software each include functions for the conversion and linearization of thermocouple readings into temperature data.

When a DBK84 is selected in DaqView or LogView, thermocouple types must also be selected for the module's channels. The two programs each use a different method for selecting the thermocouple types.

In LogView …
In LogView, the *LogBook Hardware Configuration Window* is used to select the thermocouple types. After selecting DBK84, set each of the module's channels according to the actual thermocouple being used for the channel's input.

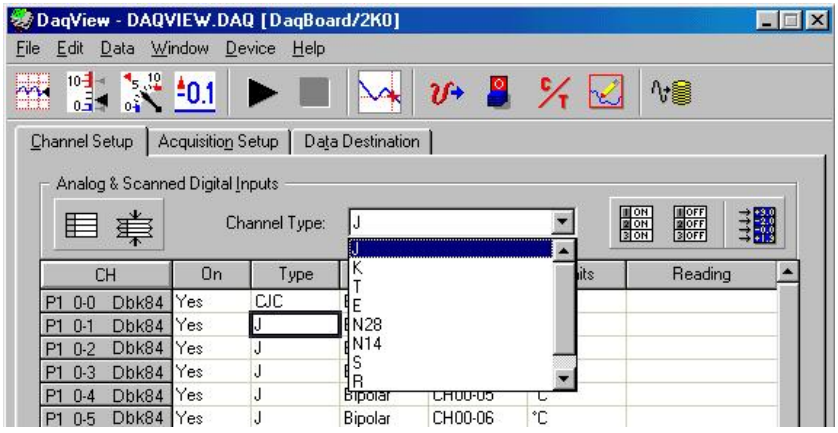
In the following screen-shot [from LogView], we see a J-type thermocouple being selected for Channel 1 of a DBK84.



LogBook Hardware Configuration Window

In DaqView ….
In DaqView, after selecting the DBK84 in the *Configure System Hardware Window*, the *Channel Setup Tab* (on the main window) is used to select the thermocouple types (see following figure). The channel types can be changed by double-clicking in the *Types* column, or by using the *Channel Type* pull-down list.

In the following screen-shot [from DaqView], we see a J-type thermocouple being selected for a DBK84 module's Channel 1. Note that the channel is designated "P1 0-1" in the Channel column.



DaqView, Channel Setup

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Using a Temperature Calibrator

The DBK84 thermocouple module provides accurate and repeatable temperature measurements across a wide range of operating conditions. However, all instrumentation is subject to drift with time and with ambient temperature change. If the ambient temperature of the operating environment is below 18°C or above 28°C, or if the product is near or outside its one-year calibration interval, then the absolute accuracy may be improved through the use of an external temperature calibrator.

A temperature calibrator is a temperature simulation instrument that allows selection of thermocouple type and temperature. For proper operation, it must be connected to the DBK84 with the same type thermocouple wire and connector that is used in normal testing. The calibrator then generates and supplies a voltage to the module. The supplied voltage corresponds to that which would be generated by the chosen thermocouple type at the selected temperature.

The temperature selected on the calibrator will be dictated by the nature of normal testing. 0°C is usually the best choice. Calibrators are the most accurate at this setting, and the connecting thermocouple wire will contribute very little error at this temperature. However, if the dynamic range of the normal testing is, for example, 100°C to 300°C, a selection of 200°C may give better results. In either case, the level of adjustment is determined by comparing the unit reading to the selected calibrator temperature. For example, if the calibrator is set to 0°C output, and the DBK unit reads 0.3°C, then an adjustment of –0.3°C is required. That is, the adjustment value is determined by subtracting the DBK reading from the calibrator setting.

To implement the adjustment in DaqView:

1. Ensure that the acquisition process is turned off.
2. Click on the cell in the Units column for the channel that is connected to the calibrator. The engineering units pull-down menu above the grid becomes active.
3. Click on the down arrow and select the “mx+b” option. This option allows post-acquisition mathematical manipulation.
4. For the example adjustment, enter -0.3 for “b.” The channel under calibration will now read 0°C.

Note that this adjustment is a mathematical operation only, and in no way alters the hardware calibration of the product. Moreover, it operates on a per channel basis, with the settings for a given channel having no influence on any other channels.

To implement the adjustment in LogView:

1. Ensure that the acquisition process is turned off.
2. In the Analog Input Channel Configuration window, select the “User Scaling” tab.
3. Click on the “Offset” cell for the channel that is connected to the calibrator.
4. For the example adjustment, enter -0.3 for “Offset.” The channel under calibration will now read 0°C.

Note that this adjustment is a mathematical operation only, and in no way alters the hardware calibration of the product. Moreover, it operates on a per channel basis, with the settings for a given channel having no influence on any other channels.

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DBK84 - Specifications

Name/Function:
DBK84 – 14 Channel High-Accuracy Thermocouple Module

System Connector: All DBK options have a DB37 male, which mates with P1 on the DaqBoard, DaqBook, LogBook, or other DBK options

TC/mV Connector: Mini-TC connectors
Functions: TC types J, K, S, T, E, B, R, N; x100 (voltage)

Inputs: 14 differential TC/mV inputs
Input Voltage Range: ±100 mV with a DaqBoard/2000 or LogBook
±50 mV with a DaqBook or DaqBoard

Input Impedance: 40M Ohm (differential); 20M Ohm (single-ended)

Input Bandwidth: 4 Hz

Input Bias Current: 10 nA typ

CMRR: 100dB typ

Maximum Working Voltage (signal + common mode): ±10 V

Over-Voltage Protection: ±40 V

Power Requirements: 60 mA max from ±15V; 2 mA max from +5 V
Operating Temperature: 0°C to 50°C
Voltage Accuracy: ±(0.2% of reading +50 µV)

TC Accuracy: See table and accuracy conditions. Valid for one year, 18 to 28°C

Minimum Resolution: 0.1°C for all TC types

TC Accuracy at Measurement Temperature in °C (±°C)											
Type	**Min**	**Max**	**-100**	**0**	**100**	**300**	**500**	**700**	**900**	**1100**	**1400**
J	-200	760	0.8	0.7	0.7	0.8	0.9	0.9	—	—	—
K	-200	1200	0.9	0.8	0.8	0.9	1.1	1.1	1.2	1.3	—
T	-200	400	0.9	0.8	0.8	0.8	—	—	—	—	—
E	-270	650	0.8	0.7	0.7	0.7	0.8	—	—	—	—
S	-50	1768	—	3.1	2.4	2.0	2.0	1.9	2.0	2.1	2.1
R	-50	1768	—	3.1	2.1	2.0	1.9	1.9	1.7	1.9	2.0
B	50	1780	—	—	—	4.9	3.2	2.8	2.4	2.3	2.0
N28	-270	400	1.2	0.9	0.9	0.9	—	—	—	—	—
N14	0	1300	—	0.9	0.9	0.9	1.1	1.1	1.2	1.3	—

Accuracy conditions:

- Exclusive of thermocouple errors
- Exclusive of noise
- $V_{CM} = 0$

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