MICROSTAR LABORATORIES™

2265 116th Avenue N.E., Bellevue, WA 98004
Sales & Customer Support: (206) 453-2345
Finance & Administration: (206) 453-9489
Fax: (206) 453-3199
World Wide Web: http://www.mstarlabs.com/

Configuring Differential Inputs

Differential analog signals can be the result of various physical measurements. Listed below are a few devices that can produce a differential voltage:

- pressure transducers
- strain gauges
- thermistor bridge networks
- battery cells

Differential inputs can be configured with any Data Acquisition Processor™ board using two consecutive single-ended inputs and one of their respective grounds. Given a differential input signal D0, D0- connects to S0, D0+ connects to S1, and the system ground connects to either G0 or G1. Table 1 demonstrates the relationship for eight differential inputs, D0 through D7.

Table 1: Data Acquisition Processor Differential Input Numbering

Differential Input	Single-Ended Terminals
D0-, D0+, System ground	S0, S1, G0 or G1
D1-, D1+, System ground	S2, S3, G2 or G3
D2-, D2+, System ground	S4, S5, G4 or G5
D3-, D3+, System ground	S6, S7, G6 or G7
D4-, D4+, System ground	S8, S9, G8 or G9
D5-, D5+, System ground	S10, S11, G10 or G11
D6-, D6+, System ground	S12, S13, G12 or G13
D7-, D7+, System ground	S14, S15, G14 or G15

If more than eight differential inputs are needed, analog input expansion can be used to obtain up to 256 differential analog inputs with one Data Acquisition Processor. Differential channels above D7 correspond to single-ended inputs in the same manner as in Table 1.

Differential Signals with a System Ground

Configuring a differential input signal to use hardware channel D0 is shown in Figure 1. Either of the two single-ended ground terminals, G0 or G1, may be used as the differential signal system ground.

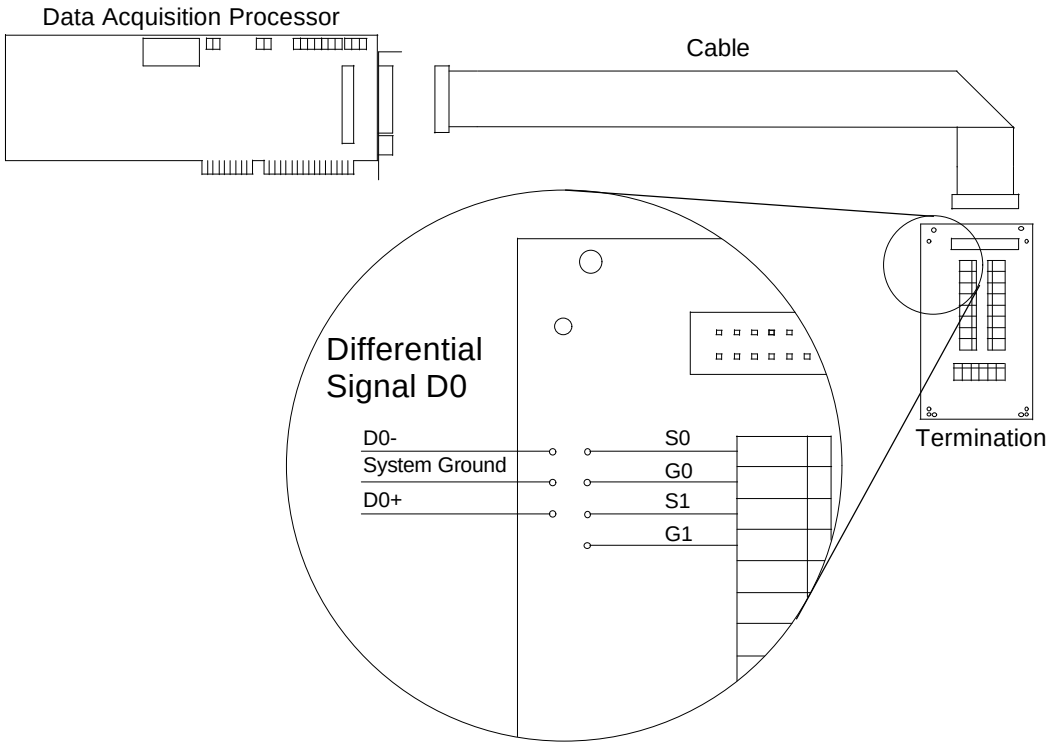

Figure 1 : Configuring Data Acquisition Processor Differential Inputs

The system ground is used to maintain a differential input that is ground-referenced. This ensures that the differential inputs do not float. If the differential inputs are allowed to float, charge injection may occur on the analog inputs, thus causing inaccurate readings.

The system ground should only be connected to the appropriate analog input ground, G0 or G1, as shown in Figure 1. Placing the signal ground into any of the other Data Acquisition Processor grounds, such as analog ground (AG), can cause ground loops which may degrade the quality of the input signal.

An example of a system ground from a differential signal source may be an earth or chassis ground.

Differential Signals with No System Ground

If a system ground is not available, a resistor may be placed between each single-ended input and ground, as shown in Figure 2.

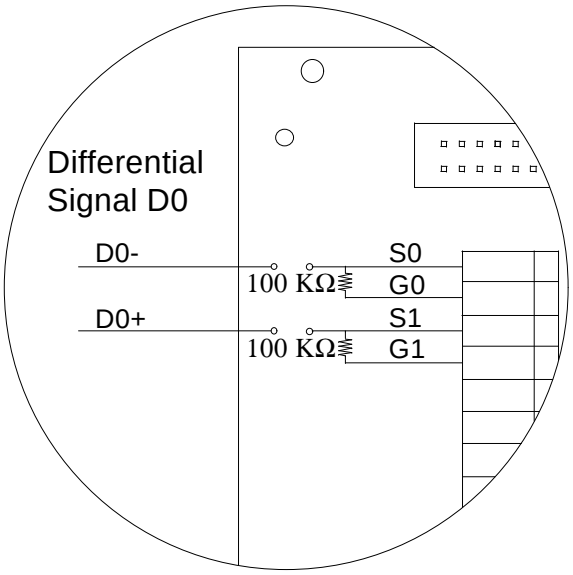

Figure 2: Configuring Differential Inputs Without a System Ground

The 100 KΩ resistors provide current paths to the differential signal to maintain a reference with the Data Acquisition Processor ground. If the output impedance of the differential signal is low, the voltage level of the signal is effectively unchanged. The impedance of the differential signal source, which can be considered as being in a voltage divider network with the 100 K Ω resistor, causes only a negligible drop in voltage.

Although the above circuit will keep unreferenced signals from floating, it should not be used to measure signals that have a large common-mode — or DC — voltage. If the voltage of either of the differential inputs exceeds the input voltage range, it will be clipped, and erroneous readings may occur.

The absolute voltage level of any analog input measured by the Data Acquisition Processor should not exceed ±12 V for unprotected analog inputs, and ±25 V for protected analog inputs. Attempting to overload the analog inputs on the Data Acquisition Processor can severely damage it. For applications where large common-mode voltages cannot be avoided, the 5B Module Analog Isolation Board should be used. 5B modules can isolate the Data Acquisition Processor from large common-mode voltages and provide external signal conditioning. Please contact Microstar Laboratories for more information.