High Accuracy, Thermocouple Cold Junction Compensator

Model 2B56

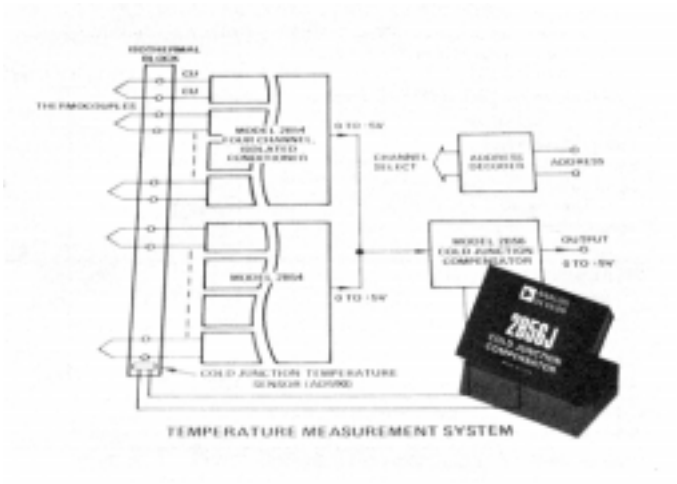
FEATURES

Universal Thermocouple Compensation:
- **Internally Provided: Types J, K, T**
- **User Configurable: Types E, R, S, B**

Digitally Programmable Type Select
High Accuracy: ±0.8°C max over +5°C to +45°C
High Ambient Rejection: 50 to 1 min.
Low Cost
Small Size: 1.5" X 2" X 0.4"

APPLICATIONS

Thermocouple Signal Conditioning
Temperature Measurement and Control Systems
Temperature Data Acquisition and Logging
Temperature Controllers



GENERAL DESCRIPTION

Model 2B56 is a high accuracy, universal thermocouple cold junction compensator. Designed to operate with an external temperature sensor in thermal contact with the cold junction, the 2B56 provides an automatic compensation for amplified thermocouple signals over wide ambient temperature variations. The 2B56 is calibrated to compensate the cold junction to a reference temperature of 0°C. The total compensation error is ±0.8°C max over +5°C to +45°C.

Designed to compensate seven different thermocouple types, the 2B56 may be digitally programmed to select compensation for types J, K and T, and one user programmed type (E, R, S, B or none). This feature makes the 2B56 especially suitable for multichannel applications involving several thermocouple types.

COLD JUNCTION COMPENSATION PRINCIPLES

In thermocouple measurements, temperature is determined by measuring the potential difference between the measurement (hot) junction of two dissimilar metals and the reference (cold) junction which is formed when thermocouple leads are connected to a measuring circuit. Since this potential difference is proportional to the temperature difference between the measurement temperature and the temperature at the reference junction, the reference junction temperature must be known. Changes in reference junction temperature influence the output voltage and, therefore, cold junction compensation is required to eliminate measurement errors.

Two methods may be used to reduce errors introduced at the thermocouple connections: keep the reference junction at a known constant temperature, or measure the reference junction temperature and cancel the changes by the appropriate correction to the thermocouple output signal. The first method, accomplished by immersing the reference junction in an ice bath maintained at 0°C is not very practical. The 2B56 employs the second method and has been specifically designed to eliminate the need for ice baths by electronically simulating the desired reference point. Digital programmability, high accuracy and low cost make the 2B56 ideal for single or multichannel thermocouple temperature measurement, indication or control systems.

FUNCTIONAL DESCRIPTION

The 2B56 compensates for cold junction temperature by adding a correction signal at the output of the user's thermocouple amplifier, as shown in Figure 1. The value of the correction signal is determined by the cold junction temperature, as measured by a sensor, and the thermocouple type in use, as specified by two digital TYPE SELECT inputs. Since compensation is done at the output of the thermocouple amplifier it is also necessary to scale the correction signal for the gain of the amplifier. This is done by a scaling circuit which has provision for a user-supplied gain-setting resistor for each thermocouple type in use.

Compensating networks for thermocouple types J, K, and T are built into the 2B56. A fourth compensation (X) can be programmed with two external resistors for any other thermocouple type. The X compensation can also be used without programming resistors to obtain an uncompensated output when sensors other than thermocouples are in use.

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