

## Linearized Thermocouple Input Modules

### FEATURES

- INTERFACES TO TYPES J, K, T, E, R, S, N, AND B THERMOCOUPLES
- LINEARIZES THERMOCOUPLE SIGNAL
- HIGH LEVEL VOLTAGE OUTPUTS
- 1500Vrms TRANSFORMER ISOLATION
- ANSI/IEEE C37.90.1-1989 TRANSIENT PROTECTION
- INPUT PROTECTED TO 240VAC CONTINUOUS
- 160dB CMR
- 95dB NMR AT 60Hz, 90dB at 50Hz
- $\pm 1\mu\text{V}/^\circ\text{C}$  DRIFT
- CSA CERTIFIED, FM APPROVED, CE COMPLIANT
- MIX AND MATCH SCM5B TYPES ON BACKPANEL

### DESCRIPTION

Each SCM5B47 thermocouple input module provides a single channel of thermocouple input which is filtered, isolated, amplified, linearized and converted to a high level analog voltage output (Figure 1). This voltage output is logic-switch controlled, allowing these modules to share a common analog bus without the requirement of external multiplexers.

The SCM5B modules are designed with a completely isolated computer side circuit which can be floated to  $\pm 50\text{V}$  from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

The SCM5B47 can interface to eight industry standard thermocouple types: J, K, T, E, R, S, N, and B. Its corresponding output signal operates over a 0V to +5V range. Each module is cold-junction compensated to correct for parasitic thermocouples formed by the thermocouple wire and screw terminals on the mounting backpanel. Upscale open thermocouple detect is provided by an internal pull-up resistor. Downscale indication can be implemented by installing an external  $47\text{M}\Omega$  resistor,  $\pm 20\%$  tolerance, between screw terminals 1 and 3 on the SCMPB01/02/03/04/05/06 backpanels.

Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode-rejection at 60Hz and 90dB at 50Hz. Two poles of this filter are on the field side of the isolation barrier, and the other four are on the computer side.

After the initial field-side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC,  $\pm 5\%$ .

A special input circuit on the SCM5B47 modules provides protection against accidental connection of power-line voltages up to 240VAC.

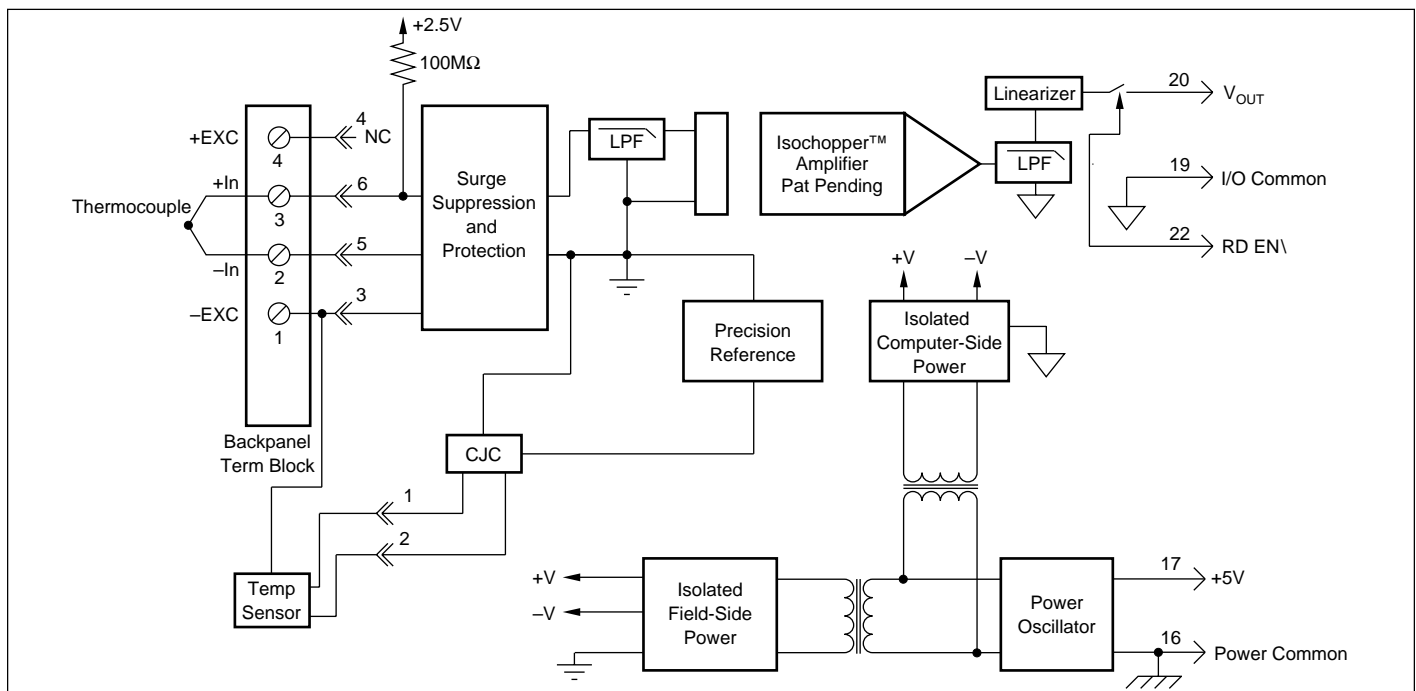


FIGURE 1. SCM5B47 Block Diagram.

# SPECIFICATIONS

Typical at  $T_A = +25^\circ\text{C}$  and +5V power.

|   |   |
|---|---|
| Module  | SCM5B47   |
| Input Range   | -0.1V to +0.5V  |
| Input Bias Current  | -25nA   |
| Input Resistance  |   |
| Normal  | 50M $\Omega$  |
| Power Off   | 40k $\Omega$  |
| Overload  | 40k $\Omega$  |
| Input Protection  |   |
| Continuous  | 240Vrms max   |
| Transient   | ANSI/IEEE C37.90.1-1989                               |
| CMV, Input to Output  |   |
| Continuous  | 1500Vrms max  |
| Transient   | ANSI/IEEE C37.90.1-1989                               |
| CMR (50Hz or 60Hz)  | 160dB   |
| NMR   | 95dB at 60Hz, 90dB at 50Hz                            |
| Accuracy  | See Ordering Information                              |
| Stability   |   |
| Input Offset  | $\pm 1\mu\text{V}/^\circ\text{C}^{(1)}$               |
| Output Offset   | $\pm 20\mu\text{V}/^\circ\text{C}$                    |
| Gain  | $\pm 25\text{ppm}/^\circ\text{C}$                     |
| Noise   |   |
| Input, 0.1 to 10Hz  | 0.2 $\mu\text{Vrms}$                                  |
| Output, 100kHz  | 300 $\mu\text{Vp-p}$ , 150 $\mu\text{Vrms}$           |
| Bandwidth, -3dB   | 4Hz   |
| Response Time, 90% Span   | 0.2s  |
| Output Range  | 0V to +5V   |
| Output Resistance   | 50 $\Omega$   |
| Output Protection   | Continuous Short to Ground                            |
| Output Selection Time<br>(to $\pm 1\text{mV}$ of $V_{\text{OUT}}$ ) | 6 $\mu\text{s}$ at $C_{\text{load}} = 0$ to 2000pF    |
| Output Current Limit  | +8mA  |
| Output Enable Control   |   |
| Max Logic "0"   | +0.8V   |
| Min Logic "1"   | +2.4V   |
| Max Logic "1"   | +36V  |
| Input Current, "0", "1"   | 0.5 $\mu\text{A}$                                     |
| Open Input Response   | Upscale   |
| Open Input Detection Time   | 10s   |
| Cold Junction Compensation  |   |
| Accuracy, $25^\circ\text{C}$  | $\pm 0.25^\circ\text{C}$                              |
| Accuracy, $+5^\circ\text{C}$ to $+45^\circ\text{C}$                 | $\pm 0.5^\circ\text{C}$                               |
| Accuracy, $-40^\circ\text{C}$ to $+85^\circ\text{C}$                | $\pm 1.25^\circ\text{C}$                              |
| Power Supply Voltage  | +5VDC $\pm 5\%$                                       |
| Power Supply Current  | 30mA  |
| Power Supply Sensitivity  | $\pm 2\mu\text{V}/\%$ RTI <sup>(2)</sup>              |
| Mechanical Dimensions   | 2.28" x 2.26" x 0.6"<br>(58mm x 57mm x 15mm)          |
| Environmental   |   |
| Operating Temp. Range   | -40 $^\circ\text{C}$ to +85 $^\circ\text{C}$          |
| Storage Temp. Range   | -40 $^\circ\text{C}$ to +85 $^\circ\text{C}$          |
| Relative Humidity   | 0 to 95% Noncondensing                                |
| Emissions   | EN50081-1, ISM Group 1, Class A (Radiated, Conducted) |
| Immunity  | EN50082-1, ISM Group 1, Class A (ESD, RF, EFT)        |

## \*\*THERMOCOUPLE ALLOY COMBINATIONS

Standards: DIN IEC 584, ANSI MC96-1-82, JIS C 1602-1981

| TYPE | MATERIAL   |
|------|--|
| J    | Iron vs. Copper-Nickel   |
| K    | Nickel-Chromium vs. Nickel-Aluminum  |
| T    | Copper vs. Copper-Nickel   |
| E    | Nickel-Chromium vs. Copper-Nickel  |
| R    | Platinum-13% Rhodium vs. Platinum  |
| S    | Platinum-10% Rhodium vs. Platinum  |
| B    | Platinum-30% Rhodium vs. Platinum-6% Rhodium                               |
| N    | Nickel-14.2% Chromium-1.4% Silicon vs. Nickel-4.4% Silicon- 0.1% Magnesium |

NOTES: (1) This is equivalent to  $^\circ\text{C}$  as follows:

Type J 0.020  $^\circ\text{C}/^\circ\text{C}$ , Types K, T 0.025  $^\circ\text{C}/^\circ\text{C}$ ,

Type E 0.016  $^\circ\text{C}/^\circ\text{C}$ , Types R, S 0.168  $^\circ\text{C}/^\circ\text{C}$ ,

Type N 0.037  $^\circ\text{C}/^\circ\text{C}$ , Type C 0.072  $^\circ\text{C}/^\circ\text{C}$ .

(2) Referenced to input.

## ORDERING INFORMATION

<sup>†</sup>Includes conformity, hysteresis and repeatability. Does not include CJC accuracy.

| MODEL       | TYPE ** | INPUT RANGE  | OUTPUT RANGE | ACCURACY <sup>†</sup> |                          |
|-------------|---------|--|--------------|-----------------------|--------------------------|
| SCM5B47J-01 | Type J  | 0 $^\circ\text{C}$ to +760 $^\circ\text{C}$ (+32 $^\circ\text{F}$ to +1400 $^\circ\text{F}$ )      | 0V to +5V    | $\pm 0.08\%$          | $\pm 0.61^\circ\text{C}$ |
| SCM5B47J-02 | Type J  | -100 $^\circ\text{C}$ to +300 $^\circ\text{C}$ (-148 $^\circ\text{F}$ to +572 $^\circ\text{F}$ )   | 0V to +5V    | $\pm 0.08\%$          | $\pm 0.32^\circ\text{C}$ |
| SCM5B47J-03 | Type J  | 0 $^\circ\text{C}$ to +500 $^\circ\text{C}$ (+32 $^\circ\text{F}$ to 932 $^\circ\text{F}$ )        | 0V to +5V    | $\pm 0.07\%$          | $\pm 0.36^\circ\text{C}$ |
| SCM5B47K-04 | Type K  | 0 $^\circ\text{C}$ to +1000 $^\circ\text{C}$ (+32 $^\circ\text{F}$ to +1832 $^\circ\text{F}$ )     | 0V to +5V    | $\pm 0.08\%$          | $\pm 0.80^\circ\text{C}$ |
| SCM5B47K-05 | Type K  | 0 $^\circ\text{C}$ to +500 $^\circ\text{C}$ (+32 $^\circ\text{F}$ to +932 $^\circ\text{F}$ )       | 0V to +5V    | $\pm 0.08\%$          | $\pm 0.38^\circ\text{C}$ |
| SCM5B47T-06 | Type T  | -100 $^\circ\text{C}$ to +400 $^\circ\text{C}$ (-148 $^\circ\text{F}$ to +752 $^\circ\text{F}$ )   | 0V to +5V    | $\pm 0.16\%$          | $\pm 0.80^\circ\text{C}$ |
| SCM5B47T-07 | Type T  | 0 $^\circ\text{C}$ to +200 $^\circ\text{C}$ (+32 $^\circ\text{F}$ to +392 $^\circ\text{F}$ )       | 0V to +5V    | $\pm 0.13\%$          | $\pm 0.25^\circ\text{C}$ |
| SCM5B47E-08 | Type E  | 0 $^\circ\text{C}$ to +1000 $^\circ\text{C}$ (+32 $^\circ\text{F}$ to +1832 $^\circ\text{F}$ )     | 0V to +5V    | $\pm 0.10\%$          | $\pm 1.0^\circ\text{C}$  |
| SCM5B47R-09 | Type R  | +500 $^\circ\text{C}$ to +1750 $^\circ\text{C}$ (+932 $^\circ\text{F}$ to +3182 $^\circ\text{F}$ ) | 0V to +5V    | $\pm 0.10\%$          | $\pm 1.3^\circ\text{C}$  |
| SCM5B47S-10 | Type S  | +500 $^\circ\text{C}$ to +1750 $^\circ\text{C}$ (+932 $^\circ\text{F}$ to +3182 $^\circ\text{F}$ ) | 0V to +5V    | $\pm 0.10\%$          | $\pm 1.3^\circ\text{C}$  |
| SCM5B47B-11 | Type B  | +500 $^\circ\text{C}$ to +1800 $^\circ\text{C}$ (+932 $^\circ\text{F}$ to +3272 $^\circ\text{F}$ ) | 0V to +5V    | $\pm 0.15\%$          | $\pm 2.0^\circ\text{C}$  |
| SCM5B47J-12 | Type J  | -100 $^\circ\text{C}$ to +760 $^\circ\text{C}$ (-148 $^\circ\text{F}$ to +1400 $^\circ\text{F}$ )  | 0V to +5V    | $\pm 0.08\%$          | $\pm 0.70^\circ\text{C}$ |
| SCM5B47K-13 | Type K  | -100 $^\circ\text{C}$ to +1350 $^\circ\text{C}$ (-148 $^\circ\text{F}$ to +2462 $^\circ\text{F}$ ) | 0V to +5V    | $\pm 0.08\%$          | $\pm 1.20^\circ\text{C}$ |
| SCM5B47K-14 | Type K  | 0 $^\circ\text{C}$ to +1200 $^\circ\text{C}$ (+32 $^\circ\text{F}$ to +2192 $^\circ\text{F}$ )     | 0V to +5V    | $\pm 0.08\%$          | $\pm 0.96^\circ\text{C}$ |
| SCM5B47N-15 | Type N  | -100 $^\circ\text{C}$ to +1300 $^\circ\text{C}$ (-148 $^\circ\text{F}$ to +2372 $^\circ\text{F}$ ) | 0V to +5V    | $\pm 0.08\%$          | $\pm 1.15^\circ\text{C}$ |

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