

SCM5B35

Linearized 4-Wire RTD Input Modules



Description

In RTD temperature measurement applications requiring a very high level of accuracy, the SCM5B35 4-Wire RTD input module offers a significant advantage over 3-wire measurement techniques (Figure 1). The SCM5B35 measures only the voltage dropped across the RTD and almost completely ignores the resistance or length of the RTD lead wires. The SCM5B34 3-Wire RTD module provides lead resistance compensation, but requires equal lead resistances, while the SCM5B35 does not require matched lead resistances.

Each SCM5B35 RTD input module provides a single channel of RTD input which is filtered, isolated, amplified, linearized, and converted to a high-level analog voltage output. This voltage output is logic switch controlled, which allows 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 $\pm 50V$ 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.

RTD excitation is provided from the module by a precision current source. The excitation current is available on two leads which are separate from the two input signal measuring leads. The excitation current does not flow in the input signal leads, which allows RTD measurement to be totally independent of lead resistance. The excitation current is very small (0.25mA for 100 Ω Pt and 120 Ω Ni and 1.0 mA for 10 Ω Cu) which minimizes self-heating of the RTD.

Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode rejection at 60Hz and 90dB at 50Hz. Two poles

Features

- Interfaces to 100 Ω Platinum, 10 Ω Copper, or 120 Ω Nickel RTDs
- True 4-Wire Input
- Linearizes RTD Signal
- High-Level Voltage Output
- 1500Vrms Transformer Isolation
- ANSI/IEEE C37.90.1 Transient Protection
- Input Protected to 240VAC Continuous
- 160dB CMR
- 95dB NMR at 60Hz, 90dB at 50Hz
- CSA C/US Certified
- CE and ATEX Compliant
- Mix and Match SCM5B Types on Backpanel

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 SCM5B35 modules provides protection against accidental connection of power-line voltages up to 240VAC.

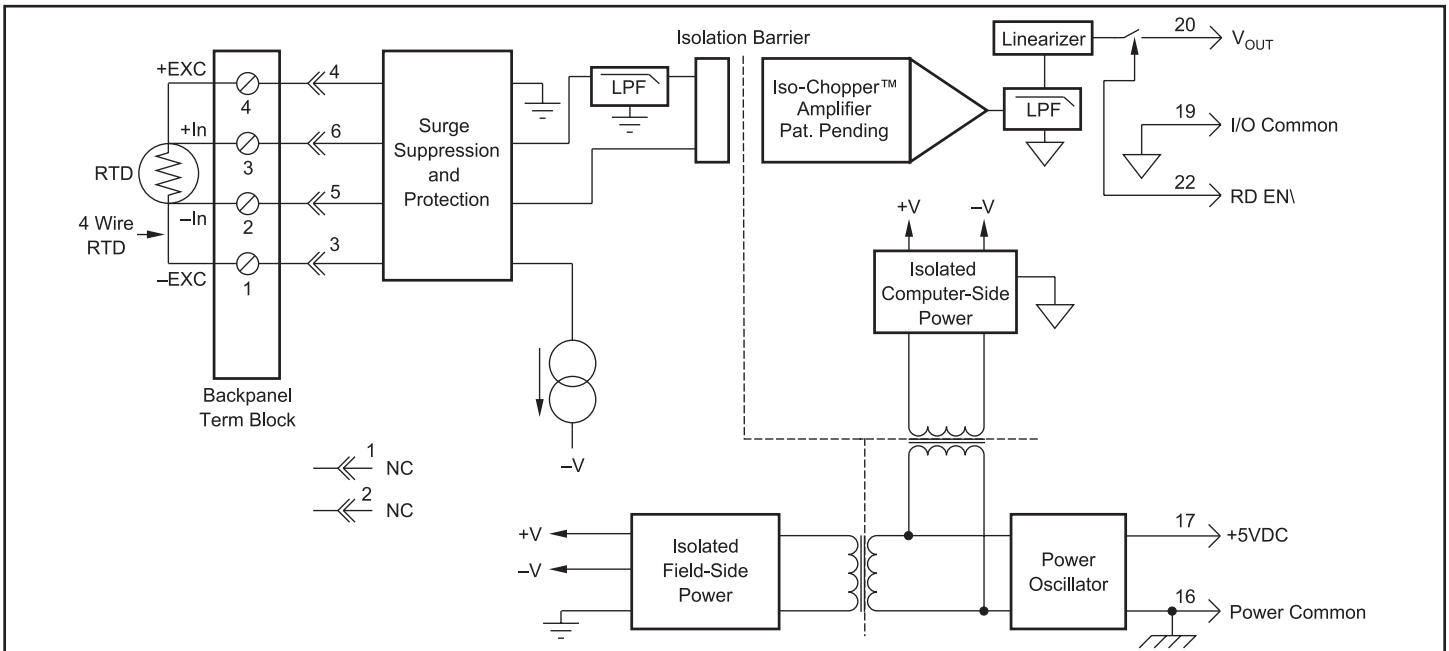


Figure 1: SCM5B35 Block Diagram

Specifications Typical* at $T_A = +25^\circ\text{C}$ and +5VDC power

| Module | SCM5B35 |
|---|--|
| Input Range Limits | -200°C to +850°C (100Ω Pt) -80°C to +320°C (120Ω Ni) -100°C to +260°C (10Ω Cu) |
| Input Resistance | 50MΩ |
| Normal | 50MΩ |
| Power Off | 40kΩ |
| Overload | 40kΩ |
| Input Protection | |
| Continuous | 240Vrms max |
| Transient | ANSI/IEEE C37.90.1 |
| Sensor Excitation Current | |
| 100Ω Pt, 120Ω Ni | 0.25mA |
| 10Ω Cu | 1.0mA |
| Lead Resistance Effect | |
| 100Ω Pt, 120Ω Ni | $\pm 0.0005^\circ\text{C}/\Omega^{(1)}$ |
| 10Ω Cu | $\pm 0.005^\circ\text{C}/\Omega^{(1)}$ |
| CMV, Input to Output | |
| Continuous | 1500Vrms max |
| Transient | ANSI/IEEE C37.90.1 |
| CMR (50Hz or 60Hz) | 160dB |
| NMR | 95dB at 60Hz, 90dB at 50Hz |
| Accuracy | See Ordering Information |
| Conformity Error ⁽³⁾ | $\pm 0.025\%$ Span |
| Stability | |
| Input Offset | $\pm 0.01^\circ\text{C}/^\circ\text{C}$ |
| Output Offset | $\pm 20\mu\text{V}/^\circ\text{C}$ |
| Gain | $\pm 35\text{ppm}$ of Reading/ $^\circ\text{C}$ |
| Noise | |
| Input, 0.1 to 10Hz | 0.2μVrms |
| Output, 100kHz | 200μVrms |
| Bandwidth, -3dB | 4Hz |
| Response Time, 90% Span | 0.2s |
| Output Range | See Ordering Information |
| Output Resistance | 50Ω |
| Output Protection | Continuous Short to Ground |
| Output Selection Time (to $\pm 1\text{mV}$ of V_{OUT}) | 6μs 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" | 0.5μA |
| Open Input Response | |
| Lead 1,4 | Downscale |
| Lead 2,3 | Non-deterministic |
| Open Input Detection Time | 3s |
| Power Supply Voltage | +5VDC $\pm 5\%$ |
| Power Supply Current | 30mA |
| Power Supply Sensitivity | |
| 100Ω Pt, 120Ω Ni | $\pm 0.2^\circ\text{C}/\text{V}$ |
| 10Ω Cu | $\pm 0.5^\circ\text{C}/\text{V}$ |
| Mechanical Dimensions (h)(w)(d) | 2.28" x 2.26" x 0.60" (58mm x 57mm x 15mm) |
| Environmental | |
| Operating Temperature Range | -40°C to +85°C |
| Storage Temperature Range | -40°C to +85°C |
| Relative Humidity | 0 to 95% Noncondensing |
| Emissions EN61000-6-4 | ISM, Group 1 |
| Radiated, Conducted | Class A |
| Immunity EN61000-6-2 | ISM, Group 1 |
| RF | Performance A $\pm 0.5\%$ Span Error |
| ESD, EFT | Performance B |

Ordering Information

| Model | Input Range | Output Range [†] | Accuracy ⁽²⁾ |
|-------------------|---|---------------------------|--------------------------|
| 100Ω Pt ** | | | |
| SCM5B35-01 | -100°C to +100°C (-148°F to +212°F) | 3, 4 | $\pm 0.12^\circ\text{C}$ |
| SCM5B35-02 | 0°C to +100°C (+32°F to +212°F) | 3, 4 | $\pm 0.06^\circ\text{C}$ |
| SCM5B35-03 | 0°C to +200°C (+32°F to +392°F) | 3, 4 | $\pm 0.12^\circ\text{C}$ |
| SCM5B35-04 | 0°C to +600°C (+32°F to +1112°F) | 3, 4 | $\pm 0.36^\circ\text{C}$ |
| SCM5B35-05 | -100°C to +200°C (-148°F to +392°F) | 3, 4 | $\pm 0.18^\circ\text{C}$ |
| 10Ω Cu ** | | | |
| SCM5B35C-01 | 0°C to +120°C (10Ω at 0°C) (+32°F to +248°F) | 3, 4 | $\pm 0.23^\circ\text{C}$ |
| SCM5B35C-02 | 0°C to +120°C (10Ω at 25°C) (+32°F to +248°F) | 3, 4 | $\pm 0.23^\circ\text{C}$ |
| SCM5B35C-03 | 0°C to +160°C (10Ω at 0°C) (+32°F to +320°F) | 3, 4 | $\pm 0.32^\circ\text{C}$ |
| 120Ω Ni ** | | | |
| SCM5B35N-01 | 0°C to +300°C (+32°F to +572°F) | 3, 4 | $\pm 0.23^\circ\text{C}$ |

****RTD Standards**

| Type | Alpha Coefficient | DIN | JIS | IEC |
|---------|-------------------|-------|-----------------|---------|
| 100Ω Pt | 0.00385 | DIN | JIS C 1604-1989 | IEC 751 |
| 120Ω Ni | 0.00672 | 43760 | | |
| 10Ω Cu | 0.004274 | | | |

†Output Ranges Available

| Output Range | Part No. Suffix | Example |
|--------------|-----------------|-------------|
| 3.0V to +5V | NONE | SCM5B35-01 |
| 4.0V to +10V | D | SCM5B35-01D |

NOTES:

*Contact factory or your local Dataforth sales office for maximum values.

(1) "Ω" refers to the resistance in one lead.

(2) Includes conformity, hysteresis and repeatability.

 (3) Conformity error is $\pm 0.05\%$ Span for SCM5B35N-01.