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VENDOR TECHNICAL MANUAL

Number:	25203-002-002
For:	**AI-2000 REVISION 4.3 SMART TEMPERATURE TRANSMITTER OPERATING INFORMATION**
From:	ACCUTECH
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sensor excitation current and the open sensor detection threshold, 180mV, the maximum allowable lead wire resistance can be determined for any application.

7.1.1 Maximum lead Resistance for RTD

The maximum total resistance including the RTD and the two lead wires that carry the RTD excitation current is:

$$\frac{180mV}{0.3mA} = \frac{0.180}{0.0003} = 600 \text{ Ohms}$$

If a 100ΩPt RTD is used to measure a maximum temperature of 700°C, then the RTD resistance is 345 ohms and the maximum lead wire resistance for both leads combined is 600-345 = 255 Ohms. Similarly, the permissible maximum lead wire resistance can be calculated for other RTD applications.

7.1.1 Maximum lead Resistance for Thermocouples

Assuming the resistance of the thermocouple junction is negligible, the total resistance of the two lead wires is:

$$\frac{180mV - (T/C\ mV\ Output)}{0.005mA} = \frac{0.180 - (T/C\ mV) \times 0.001}{0.000005}$$

Consider a type J thermocouple to be operated up to a temperature of 1200 °F. The approximate output of this thermocouple is 36mV (reference junction at 32°F). The maximum lead resistance (both leads combined) is:

$$\frac{.180 - 0.036}{0.000005mA} = 28{,}800 \text{ Ohms}$$

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REV. 1

9.0 SPECIFICATIONS

THERMOCOUPLE SENSORS:
NIST Types B, E, J, K, N, R, S, T.

RTD Resistance Sensors:

100 Ω PT US SAMA curve (α = 0.00392)	2, 3 or 4 Wire
100 Ω PT DIN curve (α = 0.00385)	2, 3 or 4 Wire
120 Ω Ni	2, 3 or 4 Wire
10 Ω Cu, Consult Factory	2, 3 or 4 Wire

MILLIVOLT INPUT RANGE: -15 to 160mVDC

THERMOCOUPLE AND RTD LINEARIZATION: Linearization with temperature conforms to NIST & DIN curves within ±0.05°C. Custom linearization user programmable at 21 points.

OUTPUT: Analog, Two wire 4 to 20mA

OUTPUT RANGING ADJUSTMENTS:

Analog Zero	} (100% of sensor range, non interacting
Full Scale	} (Normal or reverse acting
Digital Mode	°C, °F, °K, °R, mV (No ranging required)

MINIMUM OUTPUT RANGE: None

OUTPUT RESOLUTION: Analog, 2.1μA; Digital 0.01°, 0.001mV

TRANSMITTER ACCURACY: Includes repeatability, hysteresis, load and ambient temperature effect. For detailed analysis, refer to Accutech Application Note #203. Enhanced accuracy calibrations available from the factory. Refer to the AI-2000UP, Ultra Precision transmitter.

Digital Output Accuracy:
± 0.04% of the millivolt or ohm equivalent reading, or the accuracy from the table below, whichever is greater; plus the effect of cold junction measurement error or ± 0.25°C (±0.45°F), if using a thermocouple sensor.

Sensor Type		Accuracy
E, J, K, N, T	T/C's	± 0.2°C (± 0.36°F)
R, S	T/C's	± 0.6°C (± 1.08°F)
B	T/C's	± 0.8°C (± 1.44°F)
mV		± 0.008mV
100Ω Pt DIN RTD		± 0.10°C (± 0.18°F)
100Ω Pt US RTD		± 0.10°C (± 0.18°F)
120Ω Ni RTD		± 0.10°C (± 0.18°F)
10Ω CU RTD		Consult Factory
Ohms		± 0.06 Ohm

Analog Accuracy:
Digital Accuracy plus ± 4μA

TRANSMITTER REPEATABILITY: One half of accuracy.

REFERENCE CONDITION ACCURACY:
Equal to transmitter repeatability, when set-up under reference conditions in the "Tap" mode to an external source. The transmitter is then referenced to the prevailing conditions and transmitter accuracy at this reference condition will include repeatability, linearity, and hysteresis effects. If using a thermocouple add 0.05°F for reference condition accuracy cold junction effect. Reference condition accuracy is comparable in scope to the accuracy generally specified for analog based transmitters and is consistent with the ANSI/ISAS51.1-1979 definition of "Accuracy".

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REV. 1

SPECIFICATIONS (CONTINUED)

DYNAMIC RESPONSE:
Turn On Time: Less than 5 seconds after power up
Ambient Temperature Gradient: Automatic compensation to 20°C/Hour Change
Update Time: 0.15 Seconds; Digital, 1 second
Response to Step Input: 0.25 Seconds, Typical

COLD JUNCTION COMPENSATION:
Self-correction to ±0.25°C

OPERATING TEMPERATURE RANGE:
-40°F to +167°F (-40°C to +75°C) Electronics
-4°F to +158°F (-20°C to +70°C) Display

STORAGE TEMPERATURE RANGE:
-58°F to +185°F (-50°C to +85°C)

AMBIENT TEMPERATURE STABILITY: Self-correcting over the operating temperature range. Refer to Accutech Application Note #203 for full discussion.

LONG TERM STABILITY: Less than 0.05% of reading plus ±2.1µA per year.

AUTOMATIC DIAGNOSTICS: Every 3 seconds the AI-2000 transmitter performs self-checks for zero, span, cold-junction temperature, open T/C, open RTD element, shorted RTD element, each open RTD lead and transmitter malfunction.

FAILSAFE: User settable 21.0mA, 3.9mA, or OFF

INTERCHANGEABILITY: All units interchangeable without field calibration.

EMI/RFI IMMUNITY: Less than 0.5% of reading (SAMA PMC 33.1c test method) 20KHz to 1000MHz, 10 V/meter.

ISOLATION: 250 VAC rms or 800VDC

COMMON MODE REJECTION: 120dB

REVERSE POLARITY PROTECTION:
42 VDC applied with either polarity

POWER AND LOAD:
Supply voltage (no load resistance): 12 to 42VDC;
Supply voltage (with load resistance):
Vsupply=(12)+(R_{load} in Kohm) x (21mA)
for Digital operation, R_{load} = 250Ω minimum
Supply Voltage Effect: < +/-0.005% of Span per Volt

WEIGHT: 12 oz. (340g)

STANDARD CONFIGURATION:
Factory configured for Type J thermocouple, 40°F=4.0mA, 200°F=20mA, with HI failsafes. Special configurations are available to suit your requirements. See Price List.

OPTIONS: LD-2, Local Display; KB-2 Local Keyboard, Sensors, Probes, and Thermowells. See Price List.

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REV. 1

2.3.1 Output Terminals

The output terminals, 9 & 10, are connected generally to a power supply having a nominal 24 Volt DC voltage and capable of supplying 100mA for the SC-2000. Although in the analog mode these signal conditioners require a maximum of only 24mA, for digital communications with the SC-2000 the power supply capacity should be 100mA. The +OUT and -OUT terminals of the signal conditioner are connected to the corresponding polarity terminals of the power supply. Optionally a load resistor, typically 250 ohms, may be connected in series with either terminal of the signal conditioner (for digital communications with the SC-2000 this 250 ohm resistor is required). The maximum series resistance in the circuit (including wiring lead resistance) can be calculated using the formula:

$$Rs = \frac{Vs - 12}{0.023} \quad \text{in ohms}$$

The following chart gives maximum series resistances:

Supply Voltage Vs	Max. Series Resistance Rs
42.0 Volts	1300 ohms
24.0 Volts	520 ohms
21.6 Volts	417 ohms
18.0 Volts	250 ohms
12.0 Volts	0 ohms

2.3.2 Case Ground

Terminal 8 provides a connection to the metal enclosure of the signal conditioner. For safety, optimum performance and EMI immunity the case of the instrument should be connected to a good local earth ground. When using grounded sensors which are connected to the local electrical ground, then the signal conditioner case should be connected to that same ground point.

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