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### High Performance Signal Conditioners

## DSCA

# DSCA47

# Linearized Thermocouple Input Signal Conditioners

### Description

Each DSCA47 thermocouple input module provides a single channel of thermocouple input which is filtered, isolated, amplified, linearized, and converted to a high-level voltage output (Figure 1). Signal filtering is accomplished with a fivepole filter which provides 85dB of normal-mode rejection at 60Hz and 80dB at 50Hz. An anti-aliasing pole is located on the field side of the isolation barrier, and the other four poles are on the system 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 DSCA47 can interface to eight industry standard thermocouple types: J, K, T, E, R, S, B and N. Each module has cold junction compensation to correct for parasitic thermocouples formed by the thermocouple wire and input screw terminals on the module. Upscale open thermocouple detection is provided by internal circuitry. Downscale indication can be implemented by installing a 47MW, ±20% resistor between screw terminals 6 and 8 on the input terminal block.

Module output is either voltage or current. For current output models a dedicated loop supply is provided at terminal 3 (+OUT) with loop return located at terminal 4 (-OUT). The system-side load may be either floating or grounded.

Special input circuits provide protection against accidental connection of powerline voltages up to 240VAC and against transient events as defined by ANSI/ IEEE C37.90.1. Protection circuits are also present on the signal output and power input terminals to guard against transient events and power reversal. Power lines are secured to the module using screw terminals which are in pluggable terminal blocks for ease of system assembly and reconfiguration.

The modules have excellent stability over time and do not require recalibration, however, zero and span settings are adjustable up to  $\pm 3\%$  to accommodate situations where fine-tuning is desired. The adjustments



### **Features**

- Interfaces to Types J, K, T, E, R, S, B, and N Thermocouples
- · Linearizes Thermocouple Signal
- Industry Standard Output of 0 to +10V, 0 to 20mA, or 4 to 20mA
- 1500Vrms Transformer Isolation
- ANSI/IEEE C37.90.1 Transient Protection
- Input Protected to 240VAC Continuous
- True 3-Way Isolation
- Wide Range of Supply Voltage
- 160dB CMR
- 85dB NMR at 60Hz, 80dB at 50Hz
- ±0.08% Accuracy
- · Easily Mounts on Standard DIN Rail
- C-UL-US Listed
- CE and ATEX Compliant

are made using potentiometers located under the front panel label and are non-interactive for ease of use.

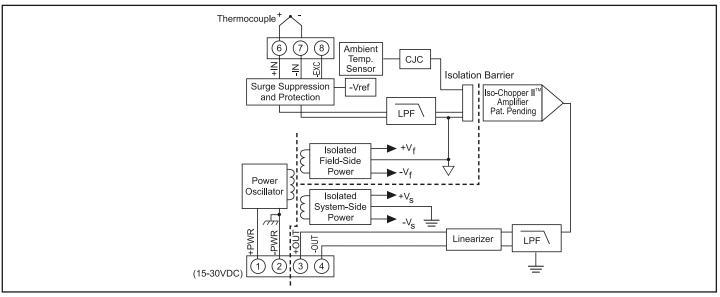


Figure 1: DSCA47 Block Diagram

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# **DATAFORTH**<sup>®</sup>

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#### **Specifications** Typical\* at T<sub>A</sub> = +25°C and +24VDC supply voltage

### **Ordering Information**

ModuleDSCA47Input RangeStandard thermocouple temperature limits as per NIST monograph 175, ITS-90 -30nAInput Resistance Normal Power Off Overload50MQ 65kQ 66kQInput Protection Continuous Transient240Vmms max 4NSI/IEEE C37.90.1Cold Junction Compensation Accuracy, +5°C to +45°C Accuracy, +5°C to +45°C Accuracy, +5°C to +45°C Accuracy, +5°C to +45°C Accuracy, +5°C to +45°COutput Range Load Resistance (I <sub>our</sub> ) Current Limit Output Protection TransientSee Ordering Information 600Q 8mA (V <sub>our</sub> ), 30mA (I <sub>our</sub> )Current Limit Continuous TransientContinuous ANSI/IEEE C37.90.1Current Limit Continuous TransientSee Ordering Information 600Q 8mA (V <sub>our</sub> ), 30mA (I <sub>our</sub> )CWV, Input to Output, Input to Power Continuous Continuous Continuous CMR (50Hz or 60Hz)See Ordering Information Below ±3% Zero and Span 160dBAccuracy Adjustability Stability Stability Input Offset Gain Output Offset GainSee Ordering Information Below ±3% Zero and Span 160dBBandwidth, -3dB NR Response Time, 90% Span Open Input Response Open Input Response Open Input Response Open Input Response Open Input Response Open Input Response Continuous Reverse Polarity Transient25mA (V <sub>our</sub> ), 55mA (I <sub>our</sub> ) ±0.0001%/%MontingDIN EN 50022-35x7.5 or -35x15 rail Chinuous Ansil/IEEE C37.90.1MountingDIN EN 50022-35x7.5 or -35x15 rail Chinuous Ansil/IEEE C37.90.1MountingDIN EN 50022-35x7.5 or -35x15 rail Chinuous Ansil/IEEE C37.90.1MountingDIN EN 5	• , , , , , , , , , , , , , , , , , , ,	11,5 0			
Imput Bias Current Input Bias Current Normal Power Off Overload Input Protection Continuous TransientSimilar Similar Similar Cold Junction Compensation Accuracy, +5°C to +45°C Accuracy, -40°C to +80°CSolMQ 65kQ 65kQ 15°C 41.25°COutput Protection Continuous Transient240Vtms max ANSI/IEEE C37.90.1Output Range Load Resistance (Iour) Output Protection Short to Ground TransientSee Ordering Information 600Q 8mA (Vour), 30mA (Iour)Output Range Load Resistance (Iour) Output Protection Short to Ground Transient Continuous<	Module	DSCA47			
Input Resistance Normal50MQ 65KQPower Off Overload240Vrms max 65KQInput Protection Continuous Transient240Vrms max ANSI/IEEE C37.90.1Cold Junction Compensation Accuracy, +5°C to +45°C Accuracy, -40°C to +80°C240Vrms max ANSI/IEEE C37.90.1Output Range Load Resistance (Iour)See Ordering Information 600Q 8mA (Vour), 30mA (Iour)Output Range Load Resistance (Iour)See Ordering Information 600Q 8mA (Vour), 30mA (Iour)Output Range Load Resistance (Iour)See Ordering Information 600Q 8mA (Vour), 30mA (Iour)Output Protection Short to Ground TransientSee Ordering Information Below 43% Zero and SpanAccuracy AdjustabilitySee Ordering Information Below ±3% Zero and SpanStability Input Offset Gain±0.5µ/°C ±0.5µ/°C ±0.5µ/VrC 250µVrms (Vour), ±20ppm/°C (Iour) ±3% Zero and SpanStability Input Offset Gain3Hz 195dB at 60Hz, 85dB at 50Hz 165ms UpscaleBandwidth, -3dB NMR Response Time, 90% Span Open Input Response Open Input Detection Time3Hz 255Power Supply Voltage Current Sensitivity Protection Reverse Polarity Transient15 to 30VDC 25mA (Vour), 55mA (Iour) ±0.0001%/%MountingDIN EN 50022-35x7.5 or -35x15 railEnvironmental Operating Temperature Range Relative Humidity Emissions EN61000-6.4 Radiated, Conducted Immunity EN61000-6.2-40°C to +80°C -40°C to +80°C<		limits as per NIST monograph 175, ITS-90			
Input Protection Continuous Transient240Vmms max ANSI/IEEE C37.90.1Cold Junction Compensation 	Input Resistance Normal Power Off	65kΩ			
Accuracy, $+5^{\circ}$ C to $+45^{\circ}$ C $\pm 0.5 C$ Accuracy, $-40^{\circ}$ C to $+80^{\circ}$ C $\pm 1.25^{\circ}$ COutput Range Load Resistance (I <sub>our</sub> )See Ordering Information $600\Omega$ $8mA (V_{our}), 30mA (I_{our})$ Output Protection Short to Ground TransientSee Ordering Information $4NSI/IEEE C37.90.1$ CMV, Input to Output, Input to Power 	Input Protection Continuous Transient	ANSI/IEEE C37.90.1			
Load Resistance (I_our) Current Limit Output Protection Short to Ground Transient $8mA(V_{out})$ , $30mA(I_{out})$ CMV, Input to Output, Input to Power Continuous TransientContinuous 	Accuracy, +5°C to +45°C				
Output Protection Short to Ground TransientContinuous ANSI/IEEE C37.90.1CMV, Input to Output, Input to Power Continuous Transient1500Vrms max ANSI/IEEE C37.90.1CMV, Output to Power Continuous CMR (50Hz or 60Hz)50VDC max 160dBAccuracy Adjustability Input Offset Gain Output Noise, 100kHz BandwidthSee Ordering Information Below ±3% Zero and Span ±0.5µV/°CBandwidth, -3dB NMR Response Time, 90% Span Open Input Desconse Open Input Desconse Open Input Desconse Open Input Desconse Open Input Desconse Open Input Desconse Open Supply Voltage Current Sensitivity Protection Reverse Polarity Transient3Hz 95dB at 60Hz, 85dB at 50Hz 15 to 30VDC 25mA (V <sub>out</sub> ), 1µArms (I <sub>out</sub> ) ±0.0001%/% Continuous ANSI/IEEE C37.90.1Mechanical Dimensions (h)(w)(d)2.95" x 0.89" x 4.13" (75mm x 22.5mm x 105mm)MountingDIN EN 50022 -35x7.5 or -35x15 railEnvironmental Operating Temperature Range Storage Temperature Range Relative Humidity Emissions EN61000-6-4 Radiated, Conducted Immunity EN61000-6-2-40°C to +80°C -40°C to +80°C<	Load Resistance (I <sub>OUT</sub> )	600Ω			
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Continuous Transient1500Vrms max ANSI/IEEE C37.90.1CMV, Output to Power Continuous CMR (50Hz or 60Hz)50VDC max 160dBAccuracy AdjustabilitySee Ordering Information Below ±3% Zero and SpanStability Input Offset Gain Output Noise, 100kHz BandwidthSee Ordering Information Below ±3% Zero and SpanBandwidth, -3dB NMR Response Time, 90% Span Open Input Response Open Input Detection Time3Hz 95dB at 60Hz, 85dB at 50Hz 165ms Upscale <5s	Transient				
Continuous50VDC max 160dBAccuracy AdjustabilitySee Ordering Information Below ±3% Zero and SpanStability Input Offset Output Offset Gain±0.5µV/°C ±6ppm/°C (V <sub>out</sub> ), ±20ppm/°C (I <sub>out</sub> ) ±40ppm/°COutput Offset Gain±0.5µV/°C ±6ppm/°C (V <sub>out</sub> ), ±20ppm/°C (I <sub>out</sub> ) ±40ppm/°CDutput Noise, 100kHz Bandwidth3Hz 95dB at 60Hz, 85dB at 50Hz 165ms UpscaleBandwidth, -3dB NMR Response Time, 90% Span Open Input Response Open Input Detection Time3Hz 95dB at 60Hz, 85dB at 50Hz 165ms UpscalePower Supply Voltage Current Sensitivity Protection Reverse Polarity Transient15 to 30VDC 25mA (I <sub>out</sub> ), 55mA (I <sub>out</sub> ) ±0.0001%/%Mechanical Dimensions (h(w)(d)2.95" x 0.89" x 4.13" (75mm x 22.5mm x 105mm)MountingDIN EN 50022 -35x7.5 or -35x15 railEnvironmental Operating Temperature Range Relative Humidity-40°C to +80°C -40°C to +80°C 0 to 95% Noncondensing ISM, Group 1 Class A ISM, Group 1 Class A ISM, Group 1	Continuous Transient				
Adjustability±3% Zero and SpanStabilityInput OffsetOutput Offset±0.5µV/°CGain±0.5µV/°C (V <sub>out</sub> ), ±20pm/°C (I <sub>out</sub> )Dutput Noise, 100kHz Bandwidth±350 Zero and SpanBandwidth, -3dB3HzNMR95dB at 60Hz, 85dB at 50HzResponse Time, 90% Span95dB at 60Hz, 85dB at 50HzOpen Input Response165msOpen Input Detection Time<5s	Continuous				
Input Offset Output Offset Gain±0.5µV/°C ±6ppm/°C (V_{OUT}), ±20ppm/°C (I_{OUT}) 	Adjustability				
Bandwidth, -3dB NMR3Hz 95dB at 60Hz, 85dB at 50Hz 165ms Upscale   Spen Input Response Open Input Detection Time3Hz 95dB at 60Hz, 85dB at 50Hz 165ms Upscale        	Input Offset Output Offset Gain	±6ppm/°C (V <sub>out</sub> ), ±20ppm/°C (I <sub>out</sub> ) ±40ppm/°C			
Voltage15 to 30VDCCurrent25mA (V_{Out}), 55mA (I_{Out})Sensitivity±0.0001%/%ProtectionContinuousReverse PolarityContinuousTransientANSI/IEEE C37.90.1Mechanical Dimensions2.95" x 0.89" x 4.13"(h)(w)(d)ContinuousMountingDIN EN 50022 -35x7.5 or -35x15 railEnvironmentalOperating Temperature RangeOperating Temperature Range-40°C to +80°CStorage Temperature Range-40°C to +80°CRelative Humidity0 to 95% NoncondensingEmissions EN61000-6-4ISM, Group 1RefISM, Group 1Performance A ±0.5% Span Error	NMR Response Time, 90% Span Open Input Response	3Hz 95dB at 60Hz, 85dB at 50Hz 165ms Upscale			
TransientANSI/IEEE C37.90.1Mechanical Dimensions (h)(w)(d)2.95" x 0.89" x 4.13" (75mm x 22.5mm x 105mm)MountingDIN EN 50022 -35x7.5 or -35x15 railEnvironmental Operating Temperature Range Storage Temperature Range Relative Humidity-40°C to +80°C -40°C to +80°C 0 to 95% Noncondensing ISM, Group 1 Class A ISM, Group 1 Performance A ±0.5% Span Error	Voltage Current Sensitivity	25mA (V <sub>оит</sub> ), 55mA (I <sub>оит</sub> )			
(h)(w)(d)(75mm x 22.5mm x 105mm)MountingDIN EN 50022 -35x7.5 or -35x15 railEnvironmental Operating Temperature Range Storage Temperature Range Relative Humidity-40°C to +80°C -40°C to +80°C 0 to 95% Noncondensing ISM, Group 1 					
Environmental Operating Temperature Range Storage Temperature Range Relative Humidity Emissions EN61000-6-4 Radiated, Conducted Immunity EN61000-6-2 RF Conducted ISM, Group 1 Performance A ±0.5% Span Error					
Operating Temperature Range Storage Temperature Range Relative Humidity-40°C to +80°C -40°C to +80°CRelative Humidity0 to 95% NoncondensingEmissions EN61000-6-4 Radiated, ConductedISM, Group 1 Class AImmunity EN61000-6-2 RFISM, Group 1 Performance A ±0.5% Span Error	Mounting	DIN EN 50022 -35x7.5 or -35x15 rail			
ESD, EFT Performance B	Operating Temperature Range Storage Temperature Range Relative Humidity Emissions EN61000-6-4 Radiated, Conducted Immunity EN61000-6-2	-40°C to +80°C 0 to 95% Noncondensing ISM, Group 1 Class A ISM, Group 1			

NOTES:

\*Contact factory or your local Dataforth sales office for maximum values. (1) Includes conformity, hysteresis, repeatability, and CJC error.

(JDYX/JDYX2) Rated 6A Max.

Model	TC Type‡	Input Range	Output Range	Accuracy <sup>(1)</sup>	
DSCA47J-01	J	0°C to +760°C (+32°F to +1400°F)	2, 3, 4	±0.08%	±0.61°C
DSCA47J-02	J	–100°C to +300°C (–148°F to +572°F)	2, 3, 4	±0.08%	±0.32°C
DSCA47J-03	J	0°C to +500°C (+32°F to +932°F)	2, 3, 4	±0.07%	±0.35°C
DSCA47K-04	К	0°C to +1000°C (+32°F to +1832°F)	2, 3, 4	±0.08%	±0.80°C
DSCA47K-05	K	0°C to +500°C (+32°F to +932°F)	2, 3, 4	±0.08%	±0.40°C
DSCA47K-13	K	–100°C to +1350°C (–148°F to +2462°F)	2, 3, 4	±0.08%	±1.16°C
DSCA47K-14	K	0°C to +1200°C (+32°F to +2192°F)	2, 3, 4	±0.08%	±0.96°C
DSCA47T-06	Т	–100°C to +400°C (–148°F to +752°F)	2, 3, 4	±0.16%	±0.80°C
DSCA47T-07	Т	0°C to +200°C (+32°F to +392°F)	2, 3, 4	±0.13%	±0.26°C
DSCA47E-08	Е	0°C to +1000°C (+32°F to +1832°F)	2, 3, 4	±0.10%	±1.00°C
DSCA47R-09	R	+500°C to +1750°C (+932°F to +3182°F)	2, 3, 4	±0.10%	±1.25°C
DSCA47S-10	S	+500°C to +1750°C (+932°F to +3182°F)	2, 3, 4	±0.10%	±1.25°C
DSCA47B-11	В	+500°C to +1800°C (+932°F to +3272°F)	2, 3, 4	±0.15%	±1.95°C
DSCA47N-15	Ν	–100°C to +1300°C (–148°F to +2372°F)	2, 3, 4	±0.08%	±1.12°C

#### <sup>†</sup>Output Ranges Available

Output Range	Part No. Suffix	Example
110V to +10V 2. 0V to +10V 3. 4 to 20mA	NONE NONE C	N/A DSCA47J-01 DSCA47J-01C
4. 0 to 20mA	E	DSCA47J-01E

#### <sup>‡</sup>Thermocouple Alloy Combinations

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

Туре	Material
J	Iron vs. Copper-Nickel
K	Nickel-Chromium vs. Nickel-Aluminum
Т	Copper vs. Copper-Nickel
E	Nickel-Chromium vs. Copper-Nickel
R	Platinum-13% Rhodium vs. Platinum
S	Platinum-10% Rhodium vs. Platinum
В	Platinum-30% Rhodium vs. Platinum-6% Rhodium
Ν	Nickel-14.2% Chromium-1.4% Silicon vs. Nickel-4.4%
	Silicon- 0.1% Magnesium

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