

### ISOLATED SIGNAL CONDITIONING can significantly increase your system reliability... here's how:

#### Linearizes Thermocouple and RTD signals

- Reduces the demands on the software to linearize the signal
- Produces a voltage or current that is directly usable by a display device

#### Provides sensor excitation for RTD's, strain gages and transmitters

- Simplifies system design and reduces parts and cost
- Increases reliability

#### Eliminates ground loops

- More accurate data acquisition
- Shortens system start up time

#### Isolates the field from the computer

- Protects operators
- Protects the data acquisition hardware and the computer
- Minimizes errors caused by common mode voltage

#### Amplifies the low level sensor signal outside of the electrically noisy computer chassis

- Minimizes or eliminates errors caused by electro-magnetic interference

#### Provides over-voltage protection

- Protects equipment and personnel from improper wiring, power surges and other faults

#### Provides convenient screw terminals for field wiring

- Simplifies installation
- Reduces troubleshooting and repair time

#### Filters out unwanted noise

- Reduces noise from AC power lines, florescent lights, motors, etc.

#### Mixes and matches many sensor types on one back-plane

- Minimizes initial outlay
- Facilitates future expansion

#### Customizes the full range of the module to match the sensor signal range

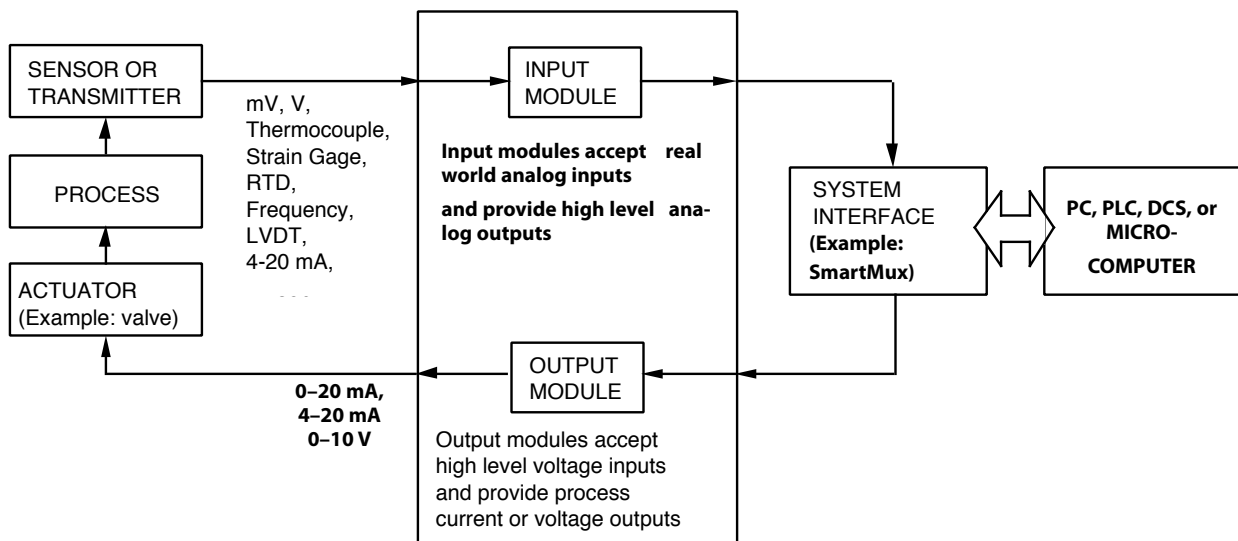
- Maximizes the resolution and accuracy of the reading over small signal spans

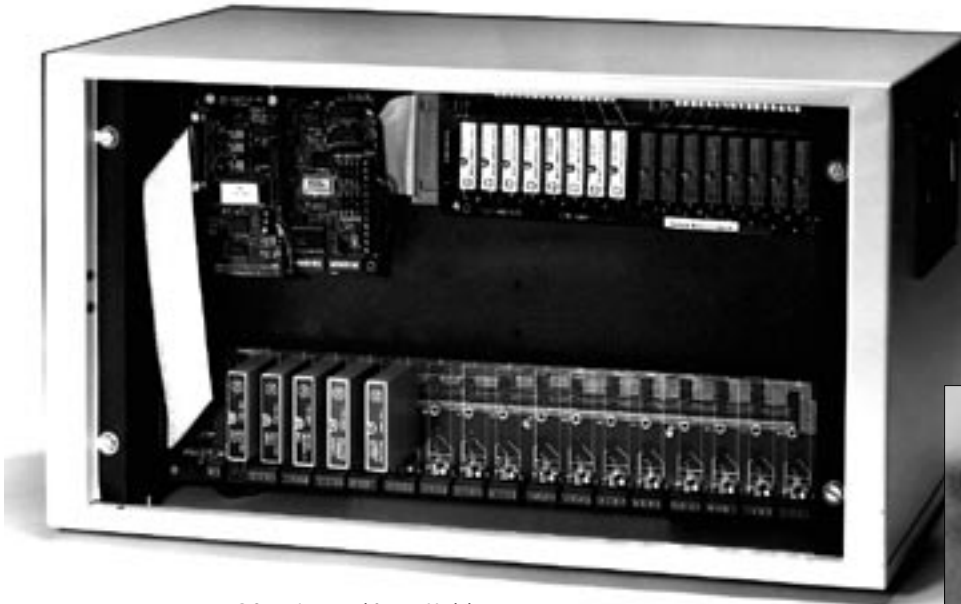
Whether your analog application calls for maximum flexibility, low cost, or high performance, you'll find it in the WRC's broad line of analog signal conditioners. Each offers a unique signal conditioning solution.

The **1781-7B Series** is optimized for use in the process control industry. Features including redundant +24 V dc power, and 1500 V rms isolation facilitate system design. High channel density applications are easily accommodated by the small size of the 7B Series' module. Flexibility is a keynote of the 7B series... these signal conditioners are the system designer's drop-in solution for interfacing to real-world signals.

The **WRC7 Series** provides low-cost, low-isolation signal conditioning using the same pin-out and foot-print as the 1781-7B Series. Modules operate from regulated +24Vdc power supplies and provide nominal 60 V isolation.

Functional Block Diagram of a typical measurement and control loop using signal conditioning subsystems.





1781-7B Series Input and Output Modules



#### Features

- Accepts most process control input signals
- Powered current input provides +24 V for a transmitter
- Analog current output module
- Complete signal conditioning function: 120 V rms field wiring protection, filtering, amplification, 1500 V rms galvanic isolation
- Pin compatible to industry standard solid-state relays
- Operates from 24 V dc (+14 V dc to +35 V dc) power
- Factory-calibrated accuracy to  $\pm 0.1\%$
- Mix-and-match modularity

#### 1781-7B Series Input and Output Modules

The 1781-7B Series represents Western Reserve Control's ongoing commitment to provide cost-effective, isolation-based signal conditioning solutions for the process control industries. The 1781-7B Series is a family of modular, single-channel, plug-in signal conditioning modules that accept inputs from a wide range of process control transducers and signals while providing high-level output voltages or process control currents.

#### Performance Optimized for Process Control

Featuring a maximum nonlinearity of  $\pm 0.02\%$  and factory calibration that guarantees an initial accuracy specification of  $\pm 0.1\%$ , the 1781-7B Series offers superior performance at a lower cost than existing multipurpose signal conditioners or in-house designs. Other family features include 160 dB of common-mode rejection, 60 dB of normal-mode rejection, up to 1500 V rms of isolation, and 120 V rms of field wiring protection. Short circuit and input overvoltage protection are built-in and the proprietary isolation transformer circuit design of

the 1781-7B Series provides for true channel-to-channel isolation.

#### CSA Approval

1781-7B Series modules are approved by the Canadian Standards Association (CSA) for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. These approvals certify that the 7B Series is suitable for use in locations where a hazardous concentration of flammable gas may exist under fault conditions of operation. Equipment of this category is classified as being "Nonincendive" and needs no special enclosure or other physical safeguards.

European CE approvals EMC directive compliant. Low voltage directive is not applicable. Products comply with ENG1010-1 (IEC1010.)

#### Rated to Operate in the Industrial Environment

All 1781-7B Series modules are packaged in compact, rugged, 2.1" x 1.7" x 0.6" (54 mm x 42 mm x 14 mm) plastic cases that readily accommodate high channel density applications. The modules are rated over the extended -40°C to +85°C industrial temperature range; and they

may be operated in noncondensing, high humidity environments. 1781-7B Series modules can be removed and/or inserted into the backplane without damage to the modules when the power supplies are energized.

### Unregulated 24 V dc Linear Power Supplies

The 1781-7B Series is rated for a nominal power supply input of +24 V dc; and, for maximum flexibility, it will accept supply voltages in the +14 V dc to +35 V dc range. Consequently, system performance will not degrade with the use of unregulated supplies. Linear supplies are recommended for better noise rejection. Redundant power supply configurations are available.

### Hardware

The 1781-7B Series is complemented by a full line of backplanes (1, 4-, 8-, 16-channel) and rackmount hardware. Each backplane contains screw terminals for field wiring connections, and a miniature cold junction compensation thermistor is installed under the screw terminal blocks for each channel. The 1781-7B Series' simplified pinout ensures that this thermistor compensates the input signals for the thermocouple modules only. Consequently, any module type may be used in any channel on the backplane.

Model	Sensor Type
1781-7B21	dc V input
1781-7B22	dc V output
1781-7B30	dc mV/V input
1781-7B31	dc V input
1781-7B32	dc mA input
1781-7B33	dc V input
1781-7B34/34N	100 $\Omega$ platinum or nickle RTD
1781-7B35	dc mA with loop power: two-wire transmitter
1781-7B37	Isolated J, K, T, E, R, S, B, N thermocouple
1781-7B39	dc mA output
1781-7B47	Isolated J, K, T, E, R, S, B thermocouple

### 1781-7B Series

Accuracy	$\pm 0.1\%$
Power Supply Requirements	+14 V dc to +35 V dc
Configurability	Factory Configured and Trimmed
CSA Approval	Yes
FM Approval	No
Field Wiring Protection	Up to 120 V rms, continuous
Isolation Voltage	1500 V rms
Common-Mode Rejection @ 50 or 60Hz	120 dB or better (3 Hz modules only)
Normal-Mode Rejection @ 50 or 60Hz	60 dB
Backplanes	1, 4, 8, and 16 channel with built-in CJC sensor
Rated Temperature Range	-40°C to +85°C
Gain Adjustment	None Available to the User
Offset Adjustment	None Available to the User
Package Size	1.663" x 2.11" x 0.563" (42.24mm x 53.6mm x 14.3mm)
Packaging Style	Module
Special Features	Simple pinout, compact package
Short Circuit Protection (Voltage Outputs)	Continuous short to ground

### 1781-7B21 Isolated Analog Input Modules

Module	Input Range
1781-7B21	±10 V

#### General Specifications

Input Resistance - Normal      2 MΩ minimum  
 Bandwidth, -3 dB 300 Hz

### 1781-7B30 Isolated Analog Input Modules

Module	Input Range
1781-7B30-01	0 to +10 mV
1781-7B30-02	0 to +100 mV
1781-7B30-03	0 to +1 V
1781-7B30-05	+1 to +5 V
1781-7B30-06	±10 mV
1781-7B30-07	±100 mV
1781-7B30-08	±1 V

#### General Specifications

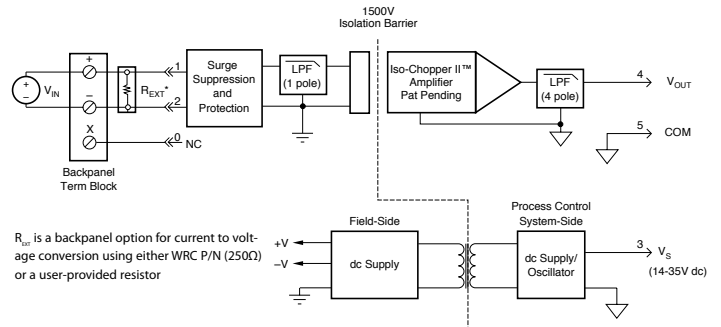
Input Resistance - Normal      50 MΩ minimum  
 Bandwidth, -3 dB                3 Hz

### 1781-7B31 Isolated Analog Input Modules

Module	Input Range
1781-7B31-01	0 to +10 V
1781-7B31-02	±5 V
1781-7B31-03	±10 V
1781-7B31-04	0 to +5 V

#### General Specifications

Input Resistance - Normal      500 kΩ minimum  
 Bandwidth, -3 dB                30 Hz



$R_{ext}$  is a backpanel option for current to voltage conversion using either WRC P/N (250Ω) or a user-provided resistor

#### Common Specifications

Accuracy†                                ±0.1% span max., ±0.05% span typical  
 Supply Voltage                        14 to 35 Vdc  
 Current‡                                    30 mA maximum

#### Output Ranges Available

Range	Part # modifier	Example
0 to +10 V	none	1781-7B30-01
+1 to +5 V	D	1781-7B30-01D

#### Notes:

- † Includes the effects of repeatability, hysteresis and linearity
- ‡ Output range and supply current specifications are based on minimum output load resistance. Minimum output load resistance is calculated by  $V_{out}^2/P_i$  where  $P_i$  is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.

### 1781-7B22 Isolated Output (bipolar)

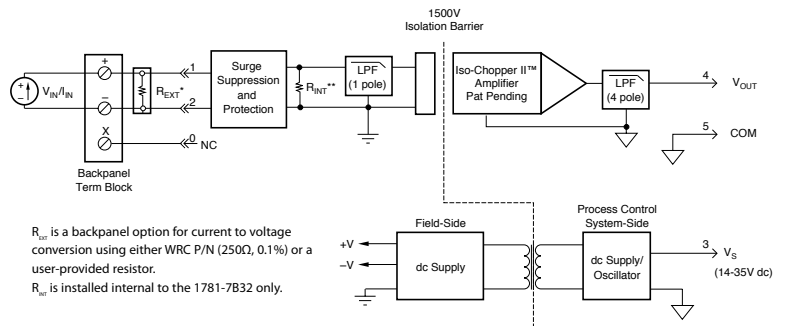
Module	Input Range	Output Range
1781-7B22	±10 V	±10 V

#### General Specifications

Output Resistance                    <1 Ω  
 Input Resistance                    2 MΩ minimum  
 Accuracy\*                            ±0.1% span max.  
                                               ±0.05% span typical  
 Bandwidth, -3 dB                    400 Hz  
 Supply Voltage                        19 to 29 Vdc  
 Current\*\*                                30 mA maximum

#### Notes:

- \* Includes the effects of repeatability, hysteresis and linearity
- \*\* Output range and supply current specifications are based on minimum output load resistance. Minimum output load resistance is calculated by  $V_{out}^2/P_i$  where  $P_i$  is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.



$R_{ext}$  is a backpanel option for current to voltage conversion using either WRC P/N (250Ω, 0.1%) or a user-provided resistor.  
 $R_{int}$  is installed internal to the 1781-7B32 only.

**1781-7B32 Process Current Input**

**Module Input Range**

1781-7B32-01	4 to 20 mA
1781-7B32-02	0 to 20 mA

**General Specifications**

Input Resistance - Normal <100 Ω

**1781-7B33 Process Voltage Input**

**Module Input Range**

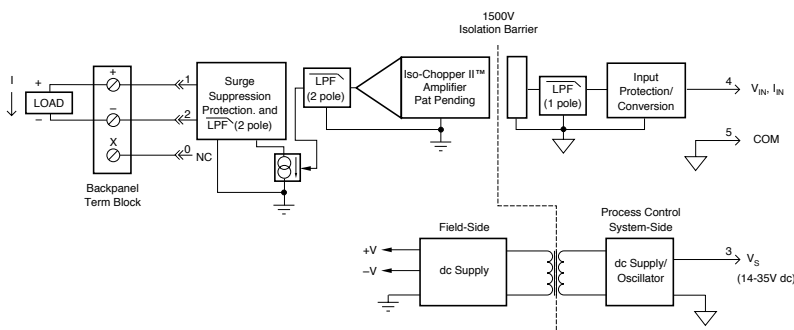
1781-7B33-01	+1 to +5 V
1781-7B33-02	0 to +5 V

**Output Ranges Available**

Range	Part # modifier	Example
0 to +10 V	none	1781-7B30-01
+1 to +5 V	D	1781-7B30-01D

**General Specifications**

Input Resistance - Normal 2 MΩ



**Common Specifications**

Accuracy*	±0.1% span max., ±0.05% span typical
Bandwidth, -3 dB	100 Hz
Supply Voltage	14 to 35 Vdc
Current**	30 mA maximum

**Notes:** \* Includes the effects of repeatability, hysteresis and linearity  
 \*\* Output range and supply current specifications are based on minimum output load resistance. Minimum output load resistance is calculated by  $V_{out}^2/P$ , where P is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.

**1781-7B34/34N RTD Input Modules**

**Module Input Accuracy\* Non-\*\* conformity**

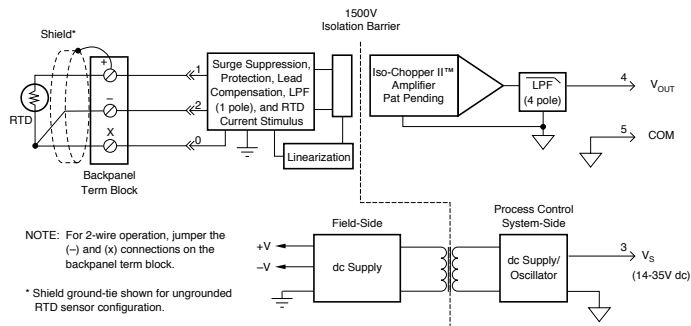
Module Range	Input	Accuracy*	Non-** conformity
<b>100Ω Pt (alpha = 0.00385)</b>			
1781-7B34-01	±100°C	±0.15%	±0.05%
1781-7B34-02	0 to +100°C	±0.2%	±0.05%
1781-7B34-03	0 to +200°C	±0.15%	±0.05%
1781-7B34-04	0 to +100°C	±0.1%	±0.05%
1781-7B34-05	-50°C to +350°C	±0.1%	±0.05%
<b>100Ω Ni (alpha = 0.00672)</b>			
1781-7B34-01N	0 to +300°C	±0.3%	±0.12%
1781-7B34-02N	0 to +200°C	±0.3%	±0.14%

**General Specifications**

Lead Resistance Effect	±0.02°C/Ω
Sensor Excitation Current	.250 μA
Bandwidth, -3 dB	3 Hz
Supply Voltage	14 to 35 Vdc
Current†	30 mA maximum

**Output Ranges Available**

Range	Part # modifier	Example
0 to +10 V	none	1781-7B30-01
+1 to +5 V	D	1781-7B30-01D



NOTE: For 2-wire operation, jumper the (-) and (x) connections on the backpanel term block.

\* Shield ground-tie shown for ungrounded RTD sensor configuration.

**Notes:**  
 \* Includes the effects of repeatability, hysteresis and conformity. Accuracy is given as a maximum. The typical value is half the maximum.  
 \*\* Nonconformity is calculated using the best-fit straight-line method. Nonconformity is given as a maximum. The typical value is half the maximum.  
 † Output range and supply current specifications are based on minimum output load resistance. Minimum output load resistance is calculated by  $V_{out}^2/P$ , where P is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.

### 1781-7B35 Transmitter Input Modules (2-Wire with Loop Power and Sense Resistor)

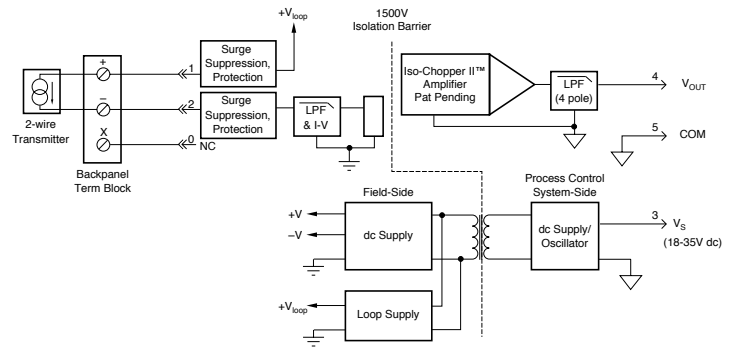
Module	Input Range	Output Range
1781-7B35-01D	4 to 20 mA	+1 to +5 V
1781-7B35-01	4 to 20 mA	0 to +10 V

#### General Specifications

Loop Voltage	+24 Vdc*
Bandwidth, -3 dB	100 Hz
Supply Voltage	18 to 35 Vdc
Current**	70 mA

#### Output Ranges Available

Range	Part # modifier	Example
0 to +10 V	<i>none</i>	1781-7B30-01
+1 to +5 V	D	1781-7B30-01D



#### Notes:

\* +24 Vdc will be supplied to the loop for an open loop condition. Approximately +22 V to +16 V will be supplied for a corresponding 4 mA to 20 mA input. Loop voltage is independent of supply voltage.

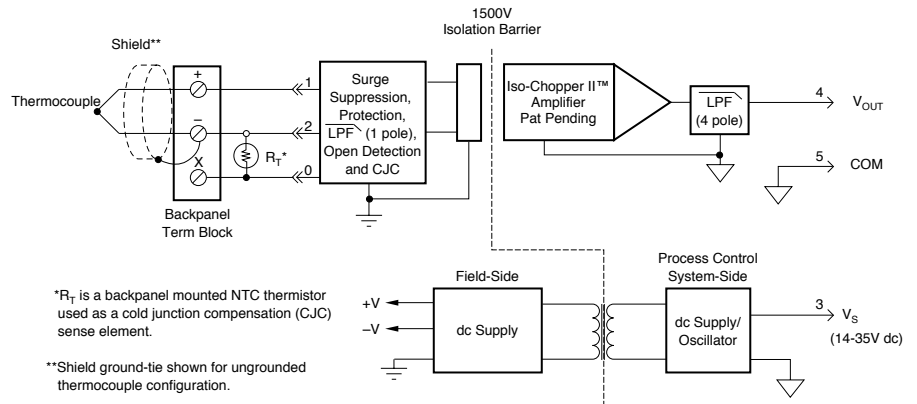
\*\* Output range and supply current specifications are based on minimum output load resistance.

Minimum output load resistance is calculated by

$V_{out}^2/P$ , where  $P$  is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.

### 1781-7B37 Thermocouple Input Modules

Model Number	Input Range
1781-7B37-J-01	-100°C to +760°C
1781-7B37-J-10	0°C to +200°C
1781-7B37-J-11	0°C to +400°C
1781-7B37-J-12	0°C to +600°C
1781-7B37-J-13	+300°C to +600°C
1781-7B37-K-02	-100°C to +1350°C
1781-7B37-K-20	0°C to +300°C
1781-7B37-K-21	0°C to +600°C
1781-7B37-K-22	0°C to +1200°C
1781-7B37-K-23	+500°C to +1800°C
1781-7B37-T-03	-100°C to +400°C
1781-7B37-E-04	0°C to +900°C
1781-7B37-R-05	0°C to +1750°C
1781-7B37-S-06	0°C to +1750°C
1781-7B37-B-07	-100°C to +1800°C



#### General Specifications

Input Resistance - normal	50 MΩ
Accuracy*	±0.1% span max, ±0.05% span typical
Open Input Response	Upscale
Open Input Detection Time	10 s maximum
Bandwidth, -3dB	3 Hz
Supply Voltage	14 to 35 Vdc
Current**	30 mA maximum

#### Output Ranges Available

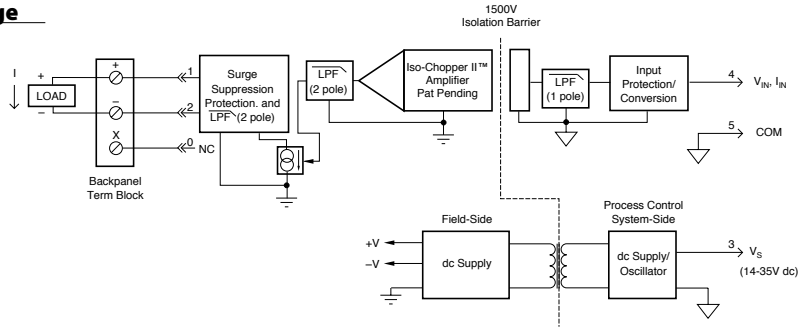
Range	Part # modifier	Example
to +10 V	<i>none</i>	1781-7B30-01
+1 to +5 V	D	1781-7B30-01D

### 1781-7B39 Process Current Output

Module	Input Range	Output Range
1781-7B39-02	0 to +10 V	0 to 20 mA
1781-7B39-02D	+1 to +5 V	4 to 20 mA
1781-7B39-01	0 to 10 V	4-20 mA

#### General Specifications

Output Effective Available Power	320 mW
Output Current Limit	32 mA
Accuracy *(see -7B47)	±0.1% span max. ±0.05% span typical
Bandwidth, -3 dB	100 Hz
Supply Voltage	18 to 35 Vdc
Current ** (see -7B47)	70 mA maximum

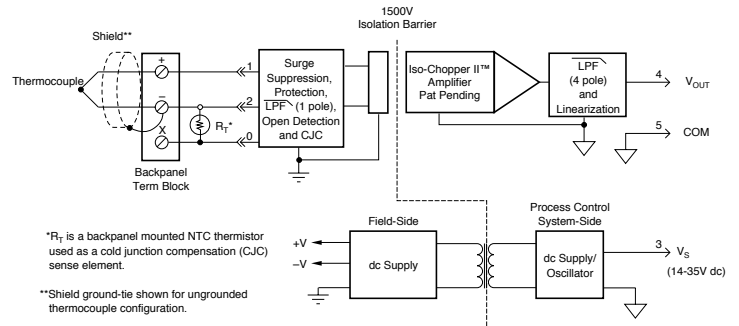


### 1781-7B47 Linearized Thermocouple Input

Module	Input Range	Accuracy
1781-7B47-J-01	0°C to +760°C	±0.32% span
1781-7B47-J-02	-100°C to +300°C	±0.30% span
1781-7B47-K-03	0°C to +1300°C	±0.32% span
1781-7B47-K-04	0°C to +600°C	±0.18% span
1781-7B47-T-05	0°C to +400°C	±0.38% span
1781-7B47-T-06	-100°C to +200°C	±0.47% span
1781-7B47-E-07	0°C to +900°C	±0.34% span
1781-7B47-R-08	+500°C to +1750°C	±0.30% span
1781-7B47-S-09	+700°C to +1750°C	±0.25% span
1781-7B47-B-10	+800°C to +1800°C	±0.35% span
1781-7B47-N-11	+200°C to +1300°C	±0.27% span

#### General Specifications

Input Resistance - normal	50 MΩ
Accuracy*	±0.1% span max, ±0.05% span typical
Open Input Response	Upscale
Open Input Detection Time	10 s maximum
Bandwidth, -3dB	3 Hz
Supply Voltage	14 to 35 Vdc
Current**	30 mA maximum



\*R<sub>T</sub> is a backpanel mounted NTC thermistor used as a cold junction compensation (CJC) sense element.

\*\*Shield ground-tie shown for ungrounded thermocouple configuration.

#### Output Ranges Available

Range	Part # modifier	Example
0 to +10 V	none	1781-7B30-01
+1 to +5 V	D	1781-7B30-01D

#### Notes:

\* Includes the effects of repeatability, hysteresis and linearity

\*\* Output range and supply current specifications are based on minimum output load resistance.

Minimum output load resistance is calculated by  $V_{out}^2/P_i$  where  $P_i$  is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.