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.

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

![Functional Block Diagram](https://example.com/diagram.png)
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 ±0.02% and factory calibration that guarantees an initial accuracy specification of ±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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B21</td>
<td>dc V input</td>
</tr>
<tr>
<td>1781-7B22</td>
<td>dc V output</td>
</tr>
<tr>
<td>1781-7B30</td>
<td>dc mV/V input</td>
</tr>
<tr>
<td>1781-7B31</td>
<td>dc V input</td>
</tr>
<tr>
<td>1781-7B32</td>
<td>dc mA input</td>
</tr>
<tr>
<td>1781-7B33</td>
<td>dc V input</td>
</tr>
<tr>
<td>1781-7B34/34N</td>
<td>100 Ω platinum or nickle RTD</td>
</tr>
<tr>
<td>1781-7B35</td>
<td>dc mA with loop power: two-wire transmitter</td>
</tr>
<tr>
<td>1781-7B37</td>
<td>Isolated J, K, T, E, R, S, B, N thermocouple</td>
</tr>
<tr>
<td>1781-7B39</td>
<td>dc mA output</td>
</tr>
</tbody>
</table>

**1781-7B Series**

- **Accuracy**: ±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

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Range</th>
<th>Output Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B21</td>
<td>±10 V</td>
<td>±10 V</td>
</tr>
</tbody>
</table>

#### General Specifications
- Input Resistance - Normal: 2 MΩ minimum
- Bandwidth, -3 dB: 300 Hz

### 1781-7B30 Isolated Analog Input Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Range</th>
<th>Output Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B30-01</td>
<td>0 to +10 mV</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B30-02</td>
<td>0 to +100 mV</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B30-03</td>
<td>0 to +1 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B30-05</td>
<td>+1 to +5 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B30-06</td>
<td>±10 mV</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B30-07</td>
<td>±100 mV</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B30-08</td>
<td>±1 V</td>
<td>±10 V</td>
</tr>
</tbody>
</table>

#### General Specifications
- Input Resistance - Normal: 50 MΩ minimum
- Bandwidth, -3 dB: 3 Hz

### 1781-7B31 Isolated Analog Input Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Range</th>
<th>Output Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B31-01</td>
<td>0 to +10 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B31-02</td>
<td>±10 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B31-03</td>
<td>±10 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>1781-7B31-04</td>
<td>0 to +5 V</td>
<td>±10 V</td>
</tr>
</tbody>
</table>

#### General Specifications
- Input Resistance - Normal: 500 kΩ minimum
- Bandwidth, -3 dB: 30 Hz

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

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Range</th>
<th>Output Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B22</td>
<td>±10 V</td>
<td>±10 V</td>
</tr>
</tbody>
</table>

#### 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 \( \frac{V_{OUT}}{P_E} \) where \( P_E \) is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.
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 | 4 to 20 mA
1781-7B33-02 | 0 to 20 mA

**Output Ranges Available**
- **Range** | **Part #** | **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 \( \frac{V_{OUT}}{P_E} \), where \( P_E \) is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.

1781-7B34/34N RTD Input Modules

Module | Input Range | Accuracy* | Non-** conformity
--- | --- | --- | ---
100Ω Pt (alpha = 0.00385) | 1781-7B34-01 | ±0.15°C | ±0.05%
| 1781-7B34-02 | ±0.2°C | ±0.05%
| 1781-7B34-03 | ±0.15°C | ±0.05%
| 1781-7B34-04 | ±0.1°C | ±0.05%
| 1781-7B34-05 | ±0.1°C | ±0.05%

100Ω Ni (alpha = 0.00672)
- 1781-7B34-01N | ±0.3°C | ±0.12%
- 1781-7B34-02N | ±0.3°C | ±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 #** | **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 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 \( \frac{V_{OUT}}{P_E} \), where \( P_E \) 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)

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Range</th>
<th>Output Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B35-01D</td>
<td>4 to 20 mA</td>
<td>+1 to +5 V</td>
</tr>
<tr>
<td>1781-7B35-01</td>
<td>4 to 20 mA</td>
<td>0 to +10 V</td>
</tr>
</tbody>
</table>

General Specifications

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

Output Ranges Available

<table>
<thead>
<tr>
<th>Range</th>
<th>Part # modifier</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to +10 V</td>
<td>none</td>
<td>1781-7B30-01</td>
</tr>
<tr>
<td>+1 to +5 V</td>
<td>D</td>
<td>1781-7B30-01D</td>
</tr>
</tbody>
</table>

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 current specifications are based on minimum output load resistance. Minimum output load resistance is calculated by VOUT/P, where P is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.

1781-7B37 Thermocouple Input Modules

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Input Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B37-J-01</td>
<td>-100°C to +760°C</td>
</tr>
<tr>
<td>1781-7B37-J-10</td>
<td>0°C to +200°C</td>
</tr>
<tr>
<td>1781-7B37-J-11</td>
<td>0°C to +400°C</td>
</tr>
<tr>
<td>1781-7B37-J-12</td>
<td>0°C to +600°C</td>
</tr>
<tr>
<td>1781-7B37-J-13</td>
<td>+300°C to +600°C</td>
</tr>
<tr>
<td>1781-7B37-K-02</td>
<td>-100°C to +1350°C</td>
</tr>
<tr>
<td>1781-7B37-K-20</td>
<td>0°C to +300°C</td>
</tr>
<tr>
<td>1781-7B37-K-21</td>
<td>0°C to +600°C</td>
</tr>
<tr>
<td>1781-7B37-K-22</td>
<td>0°C to +1200°C</td>
</tr>
<tr>
<td>1781-7B37-K-23</td>
<td>+500°C to +1800°C</td>
</tr>
<tr>
<td>1781-7B37-S-03</td>
<td>-100°C to +400°C</td>
</tr>
<tr>
<td>1781-7B37-S-04</td>
<td>0°C to +900°C</td>
</tr>
<tr>
<td>1781-7B37-S-05</td>
<td>0°C to +1750°C</td>
</tr>
<tr>
<td>1781-7B37-S-06</td>
<td>0°C to +1750°C</td>
</tr>
<tr>
<td>1781-7B37-B-07</td>
<td>-100°C to +1800°C</td>
</tr>
</tbody>
</table>

General Specifications

- Input Resistance: 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

<table>
<thead>
<tr>
<th>Range</th>
<th>Part # modifier</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>to +10 V</td>
<td>none</td>
<td>1781-7B30-01</td>
</tr>
<tr>
<td>+1 to +5 V</td>
<td>D</td>
<td>1781-7B30-01D</td>
</tr>
</tbody>
</table>

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 current specifications are based on minimum output load resistance. Minimum output load resistance is calculated by VOUT/P, where P is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.
1781-7B39 Process Current Output

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Range</th>
<th>Output Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B39-02</td>
<td>0 to +10 V</td>
<td>0 to 20 mA</td>
</tr>
<tr>
<td>1781-7B39-02D</td>
<td>+1 to +5 V</td>
<td>4 to 20 mA</td>
</tr>
<tr>
<td>1781-7B39-01</td>
<td>0 to 10 V</td>
<td>4-20 mA</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781-7B47-J-01</td>
<td>0°C to +760°C</td>
<td>±0.52% span</td>
</tr>
<tr>
<td>1781-7B47-J-02</td>
<td>-100°C to +300°C</td>
<td>±0.50% span</td>
</tr>
<tr>
<td>1781-7B47-K-03</td>
<td>0°C to +1300°C</td>
<td>±0.52% span</td>
</tr>
<tr>
<td>1781-7B47-K-04</td>
<td>0°C to +600°C</td>
<td>±0.18% span</td>
</tr>
<tr>
<td>1781-7B47-T-05</td>
<td>0°C to +400°C</td>
<td>±0.38% span</td>
</tr>
<tr>
<td>1781-7B47-T-06</td>
<td>-100°C to +200°C</td>
<td>±0.47% span</td>
</tr>
<tr>
<td>1781-7B47-T-07</td>
<td>0°C to +900°C</td>
<td>±0.54% span</td>
</tr>
<tr>
<td>1781-7B47-R-08</td>
<td>+500°C to +1750°C</td>
<td>±0.50% span</td>
</tr>
<tr>
<td>1781-7B47-S-09</td>
<td>+700°C to +1750°C</td>
<td>±0.25% span</td>
</tr>
<tr>
<td>1781-7B47-B-10</td>
<td>+800°C to +1800°C</td>
<td>±0.55% span</td>
</tr>
<tr>
<td>1781-7B47-N-11</td>
<td>+200°C to +1300°C</td>
<td>±0.27% span</td>
</tr>
</tbody>
</table>

**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, -3 dB: 3 Hz
- Supply Voltage: 14 to 35 Vdc
- Current **: 30 mA maximum

* 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 \( \frac{V_{OUT}}{P_{E}} \) where \( P_{E} \) is the Output Effective Available Power that guarantees output range, accuracy and linearity specifications.