## FLEX I/O Analog, Thermocouple and RTD Modules

Choose analog, thermocouple, or RTD I/O modules when you need:

- **Individually configurable channels** allow the module to be used with a variety of sensors.
- **On-line configuration**. Modules can be configured in RUN mode using programming software or the control program. This allows you to change configuration while the system is operating.
- **Selectable input filters** on many modules allow you to select from several different filter frequencies for each channel that best meets the performance needs of your application. Lower filter settings provide greater noise rejection and resolution. Higher filter settings provide faster performance. *Note: Isolated analog modules have four filter selections; the thermocouple module has ten; and the combined RTD/thermocouple module has eight.*
- **Ability to direct output device operation during an abnormal condition.**
  Each channel of the output module can be individually configured to hold its last value or assume a user-defined value on either a run-to-program or run-to-fault condition. This feature allows you to set the condition of your analog devices, and therefore your control process, which may help to ensure a reliable shutdown.
- **Selectable response to broken input sensor.** This feature provides feedback to the controller that a field device is not connected. This allows you to specify corrective action based on the channel condition.
- **Single-ended or differential inputs depending on module.** Analog modules have single-ended inputs while isolated analog and temperature modules have differential inputs. Single-ended voltage sensors reduce costs. Differential inputs are more expensive, but are typically more noise immune.
- **Over- and under-range detection and indication** are available with most modules. This eliminates the need to test values in the control program. While standard analog modules have limited diagnostics, temperature and isolated analog modules provide over-range, under-range, and wire-off diagnostics with alarm bits.
- **On-board scaling** is performed by the temperature modules and is user configurable for either °C, °F, °K, Ohms, or mV. This eliminates the need to scale the data in the user program.
- **Accuracy and resolution varies by module** and the associated application. Specifications are given for each module at it's operational conditions.
- **Internal calibration is performed** in the analog modules (1794-IE8, 1794-OE4, and 1794-IE4XOE2). User calibration is recommended (yearly) for isolated analog and temperature modules. All modules come factory calibrated.

### Analog I/O Module Summary

| Catalog Number | Inputs | Outputs | Terminal Base Unit | Module Type |
|---|---|---|---|---|
| 1794-IE8 | 8 | — | 1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS, 1794-TB3K, 1794-TB3SK, 1794-TB3TK, 1794-TB3TSK | Selectable, non-isolated inputs |
| 1794-IE8XT | | | | Selectable, non-isolated inputs, Extended temperatures |
| 1794-IE8H | | | 1794-TB3G, 1794-TB3GS, 1794-TB3GK, 1794-TB3GSK | Single-ended, non-isolated, HART-enabled inputs |
| 1794-IE12 | 12 | | | Single-ended inputs |
| 1794-IF4I | 4 | — | 1794-TBN, 1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS, 1794-TBNK, 1794-TB3K, 1794-TB3SK, 1794-TB3TK, 1794-TB3TSK | Single-ended, isolated inputs |
| 1794-IF4IXT | | | | Single-ended inputs, Isolated, Extended temperatures |
| 1794-IF8IH | 8 | — | 1794-TB3, 1794-TB3S, 1794-TB3K, 1794-TB3SK | Single-ended, isolated, HART-enabled inputs |
| 1794-IR8 | | | 1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS, 1794-TBKD, 1794-TB3K, 1794-TB3SK, 1794-TB3TK, 1794-TB3TSK | Non-isolated relay inputs |
| 1794-IRT8 | | | 1794-TB3G, 1794-TB3GS, 1794-TB3GK, 1794-TB3GSK | Non-isolated RTD/Thermocouple inputs |
| 1794-IRT8XT | | | | Non-isolated RTD/Thermocouple inputs, Extended temperatures |
| 1794-IT8 | | | 1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS, 1794-TB3K, 1794-TB3SK, 1794-TB3TK, 1794-TB3TSK[3] | Non-isolated, Thermocouple, Millivolt inputs |
| 1794-IE4XOE2 | 4 | 2 | | Single-ended, non-isolated I/O |
| 1794-IE4XOE2XT | | | | Single-ended, non-isolated I/O, Extended temperatures |
| 1794-IE8XOE4 | 8 | 4 | 1794-TB3G, 1794-TB3GS, 1794-TB3GK, 1794-TB3GSK | Single-ended, non-isolated I/O |
| 1794-IF2XOF2I | 2 | 2 | 1794-TBN, 1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS, 1794-TBNK, 1794-TB3K, 1794-TB3SK, 1794-TB3TK, 1794-TB3TSK | |
| 1794-IF2XOF2IXT | | | | Single-ended, non-isolated I/O, Extended temperatures |
| 1794-OE4 | — | 4 | | Selectable, non-isolated outputs |
| 1794-OE4XT | | | | Selectable, non-isolated outputs, Extended temperatures |
| 1794-OE8H[1] | | 8 | 1794-TB3G, 1794-TB3GS, 1794-TB3GK, 1794-TB3GSK | Single-ended, non-isolated, HART-enabled outputs |
| 1794-OE12[2] | | 12 | | Single-ended, non-isolated outputs |
| 1794-OF4I | | 4 | 1794-TBN, 1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS, 1794-TBNK, 1794-TB3K, 1794-TB3SK, 1794-TB3TK, 1794-TB3TSK | Source isolated outputs |
| 1794-OF4IXT | | | | Source isolated outputs, Extended temperatures |
| 1794-OF8IH | | 8 | 1794-TB3, 1794-TB3S, 1794-TB3K, 1794-TB3SK | Single-ended, isolated, HART-enabled outputs |

(1) Do not exceed length of 30 m (100 ft) for signal cabling.

(2) Not supported by 1747-SN or 1747-BSN for use on RIO with SLC controllers.

(3) 1794-TB2, 1794-TB3, 1794-TB3S for mV inputs only.

### 2 Input/2 Output Isolated Combination Module

| Specification | 1794-IF2XOF2I, 1794-IF2XOF2IXT |
|---|---|
| Normal mode rejection ratio | -3 dB @ 12 Hz (300 Hz conversion rate)<br>-80.0 dB @ 50 Hz (300 Hz conversion rate)<br>-3 dB at 6 Hz (150 Hz conversion rate)<br>-80 dB at 60 Hz (150 Hz conversion rate) |
| Accuracy(1) | Current input or output: 0.1% Full Scale @ 25 °C<br>Voltage input or output: 0.1% Full Scale @ 25 °C |
| Accuracy drift with temperature | Current input: 0.0038% Full Scale/°C<br>Voltage input: 0.0028% Full Scale /°C<br>Current output: 0.0025% Full Scale /°C<br>Voltage output: 0.0012% Full Scale /°C |
| Input impedance | Current input: <100 Ω<br>Voltage input: >1 MΩ(3) |
| Voltage input, overload, max | 30V, single channel, continuous |
| Output resolution | 15 bit + sign<br>0.656 μA/cnt<br>0.320 mV/cnt |
| Output conversion type | Digital-to-analog converter |
| Output conversion rate | 2.5/5.0 ms |
| Current load on voltage output, max | 3 mA |
| Resistive load on current output | 0…750 Ω |
| Dimensions (HxWxD), approx | **1794-IF2XOF2I:**<br>46 x 94 x 53 mm (1.8 x 3.7 x 2.1 in.)<br>94 x 94 x 69 mm (3.7 x 3.7 x 2.7 in.) installed<br>**1794-IF2XOF2IXT:**<br>46 x 94 x 75 mm (1.8 x 3.7 x 2.9 in.)<br>94 x 94 x 91 mm (3.7 x 3.7 x 3.6 in.) installed |
| Temperature, operating | **1794-IF2XOF2I:** 0…55 °C (32…131 °F)<br>**1794-IF2XOF2IXT:** -20…70 °C (-4…185 °F) |

(1) Includes offset, gain, non-linearity and repeatability error terms.

(2) Can be calibrated in field when necessary.

(3) If 24V DC is removed from the module, input resistance = 10 KΩ.

## FLEX I/O Analog Output Modules

### Analog Output Comparison

| Catalog Number | Output Signal Range | External DC Supply Current, Nom | Power Dissipation, Max | Thermal Dissipation, Max |
|---|---|---|---|---|
| 1794-OE4(1) | 4…20 mA<br>0…20 mA<br>±10V<br>0…10V | 70 mA @ 24V DC(2) | 4.5 W @ 31.2V DC | 15.3 BTU/hr @ 31.2V DC |
| 1794-OE4XT | | 180 mA @ 10.5V DC | | 13.6 BTU/hr @ 31.2V DC |
| 1794-OE8H | 4…20 mA (user configurable)<br>0…20 mA (user configurable) | 255 mA @ 24V DC | 6.1 W | 20.8 BTU/hr |
| 1794-OE12 | 0 mA output until module is configured<br>4…20 mA (user configurable)<br>0…20 mA (user configurable) | 320 mA @ 24V DC;<br>720 mA @ 10.0V DC | 40 W @ 31.2V DC;<br>4.3 W @ 24V DC;<br>10.0 W @ 10.0V DC | 14.7 BTU/hr @ 24V DC |

**Analog Output Comparison**

| Catalog Number | Output Signal Range | External DC Supply Current, Nom | Power Dissipation, Max | Thermal Dissipation, Max |
|---|---|---|---|---|
| 1794-OF4I | 4…20 mA<br>0…20 mA<br>±10V<br>0…10V<br>±5V<br>0…5V | 210 mA @ 24V DC | 4.7 W @ 31.2V DC | 16 BTU/hr @ 31.2V DC |
| 1794-OF8IH | 4…20 mA (user configurable)<br>0…20 mA (user configurable) | 450 mA @ 24V DC | 5.0 W @ 31.2V DC | 6.8 BTU/hr @ 31.2V DC |
| 1794-IE8XOE4(1) | 4…20 mA<br>0…20 mA<br>±10V<br>0…10V | 140 mA @ 24V DC;<br>280 mA @ 10.0V DC | 3.0 W @ 31.2V DC;<br>2.3 W @ 24V DC;<br>2.0 W @ 10.0V DC | 10.3 BTU/hr @ 31.2V DC |
| 1794-IE4XOE2(1) | 4…20 mA<br>0…20 mA<br>±10V<br>0…10V | 70 mA @ 24V DC | 4.0 W @ 31.2V DC | 13.6 BTU/hr @ 31.2V DC |
| 1794-IF2XOF2I(1) | 4…20 mA<br>0…20 mA<br>±10V<br>0…10V<br>±5V<br>0…5V | 150 mA @ 24V DC | 3.3 W @ 31.2V DC | 11 BTU/hr @ 31.2V DC |

(1) Each module's channel is individually selectable or as a group of four.

(2) Not including outputs.

## 1794-OE4 and 1794-OE4XT Analog 4 Output Module

The 1794-OE4 module has 4 output, non-isolated, individually-configurable channels. Outputs are capable of driving the field devices that require a voltage of ±10V or a current of 0... 20 mA.

**Analog 4 Input Modules**

| Specification | 1794-OE4 | 1794-OE4XT |
|---|---|---|
| Output resolution | 12 bit + sign<br>2.56 mV/cnt<br>5.13 μA/cnt | 12 bits + sign<br>0.156 mV/cnt<br>0.320 μA/cnt |
| Data format | 16 bits, 2's complement, left-justified | |
| Output conversion type | Pulse width modulation | |
| Output conversion rate | 1.024 ms all channels | Outputs: PWM |
| Step response to 63% of FS, output | Voltage output: 24 ms | |
| Current load on voltage output, max | 3 mA | |
| Output current, resistive load | 15…750 Ω | |
| Accuracy | Current input:<br>0.425% Full Scale @ 25 °C (77 °F)<br>Voltage input:<br>0.133% Full Scale @ 25 °C (77 °F)(1) | |

**Analog 4 Input Modules**

| Specification | 1794-OE4 | 1794-OE4XT |
|---|---|---|
| Accuracy drift w/temp | Current input: 0.0069% Full Scale /°C<br>Voltage input: 0.0045% Full Scale/°C | |
| Calibration | None required | |
| Isolation voltage | 50 (continuous), I/O to system<br>Type tested at 850V DC for 1 s, I/O to system<br>Type tested at 850V DC for 60 s (for 1794-OE4XT only)<br>No isolation between individual channels | |
| Power dissipation, max | 4.5 W @ 31.2V DC | |
| Thermal dissipation, max | 15.3 BTU/hr @ 31.2V DC | 13.6 BTU/hr @ 31.2V DC |
| Wire size | 0.34... 2.5 $mm^2$ (22...12 AWG) solid or stranded shielded copper wire rated at 75 °C (167 °F) or greater 1.2 mm (3/64 in.) insulation max | |
| Wire category | 2 – on signal ports<br>2 – on power ports(2) | 2 - on signal ports |
| Dimensions (HxWxD), approx | 46 x 94 x 53 mm (1.8 x 3.7 x 3.1 in.)<br>94 x 94 x 69 mm (3.7 x 3.7 x 2.7 in.) installed | |
| Temperature, operating | 0…55 °C (32…131 °F) | -20…70 °C (-4…185 °F) |

(1) Includes offset, gain, non-linearity, and repeatability error terms

(2) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

## 1794-OE8H HART Enabled Analog 8 Output Module

The 1794-OE8H is a HART enabled analog output module that works with HART enabled field devices that use current in the 0 to 20 mA range. Use with 2 wire devices. This module provides wire-off detection on a per-channel basis.

This module can be used on ControlNet, EtherNet/IP or PROFIBUS DP networks. One HART field device per channel.

**HART Enabled Analog 8 Output Module**

| Specification | 1794-OE8H |
|---|---|
| Output resolution | 13 bit |
| Data format | Configurable |
| Output conversion type | — |
| Output conversion rate | 10 ms for all channels |
| Step response to 99% of FS, output | 13 ms to 99% of FS<br>115 ms during HART communication |
| Current load on voltage output, max | 0…22 mA @ > 15V |
| Output current, resistive load | 0…680 Ω @ 22 mA<br>0…770 Ω @ 20 mA |
| Accuracy | 0.1% Full Scale @ 20 °C (68 °F) |
| Accuracy drift with temperature | 0.010% Full Scale @ 20 °C (68 °F) |