

July 2025

## Description

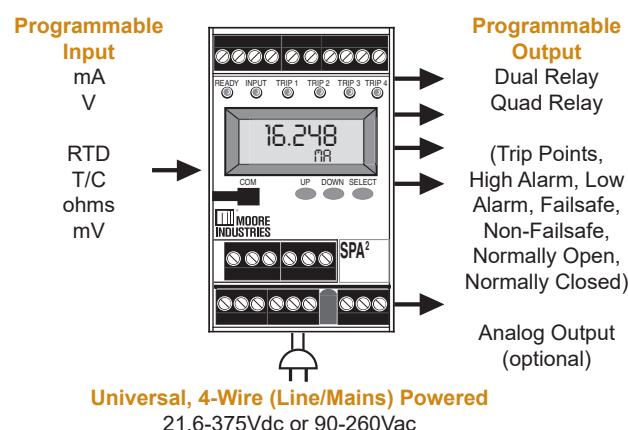
The universal SPA<sup>2</sup> Programmable Limit Alarm Trips provide on/off control, warn of unwanted process conditions, alarm on rate-of-change and provide emergency shutdown. Very versatile, they accept a signal input from transmitters, temperature sensors and a wide array of other monitoring and control instruments:

- **Current and Voltage Signals**
- **23 RTD Types**
- **9 Thermocouple Types**
- **Resistance and Potentiometer Devices**
- **Direct Millivolt Sources**

## Dual and Quad Alarm Trip Outputs

The 4-wire (line/mains-powered) SPA<sup>2</sup> provides two or four independent and individually-configurable alarm relay outputs when a monitored process variable falls outside of user-set high and/or low limits. This is typically used to activate a warning light, annunciator, bell, pump, motor or shutdown system.

**Figure 1.** Available SPA<sup>2</sup> models deliver versatile and programmable input and output choices.



### Certifications



**Factory Mutual – FM Approvals –**  
**cFMus (US/Canada), Non-Incendive –**  
 Class I, Division 2, Groups A, B, C, D  
 Suitable for use in General Locations and  
 Hazardous 'Classified' Locations when mounted in  
 suitable protective enclosures



**CE Conformance – EMC Directive 2014/30/EU**  
 EN 61326; Low Voltage Directive 2014/35/EU  
 EN 61010-1



*The SPA<sup>2</sup> features a metal, RFI resistant housing with display that snaps onto standard DIN-style rails.*

## Features

- **Universal plant standard.** With programmable input/output parameters, and "Universal" DC or AC power input, there's no need to stock dozens of different alarm trips.
- **20-bit input resolution.** Delivers industry-best digital accuracy for both sensor (RTD and thermocouple) and analog (current/voltage) inputs.
- **Site- and PC-Programmable.** Featuring security password protection, the SPA<sup>2</sup> offers the choice of using front panel pushbuttons or our FREE Windows®-based Intelligent PC Configuration Software for fast and simple set up.
- **Long-term stability.** Provides up to 5 years between scheduled calibrations.
- **Large 5-digit process and status readout.** A backlit display shows menu prompts during pushbutton configuration and, when the SPA<sup>2</sup> is in operation, shows the process variable, the output or toggles between the two in selectable engineering units.
- **Combined alarm trip and transmitter.** The analog output (-AO) option reduces costs and installation time when both alarm and transmitter functions are needed at the same location.
- **Isolated and RFI/EMI protection.** Delivers superior protection against the effects of ground loops and plant noise.

# SPA<sup>2</sup>

Programmable Current/Voltage  
and RTD/Thermocouple Limit Alarm Trips

## Site- and PC-Programmable

Operating parameters configure quickly and easily using front panel pushbuttons or our Intelligent PC Configuration Software. Programmable functions include:

- Security password protection on/off and password
- Input type and measurement range (zero and full scale values)
- Input and output trimming
- Multiple alarm options - high or low trip, out of band, rate of change, stuck input fault alarm
- Failsafe or non-failsafe, latching/non-latching and normally open or normally closed alarm relays
- Alarm deadband (0-100%) and alarm time delay
- T/C reference junction compensation (on/off)
- Display parameters (scale, engineering units, and set number of digits after the decimal point)
- Differential or averaging of RTD inputs
- Standard and custom linearization curves (up to 128 points)\*
- Analog output range\*\*
- On input failure, upscale or downscale drive, fail to last value or fail to selected value\*\*
- Analog signal output damping (0-30 seconds)\*\*

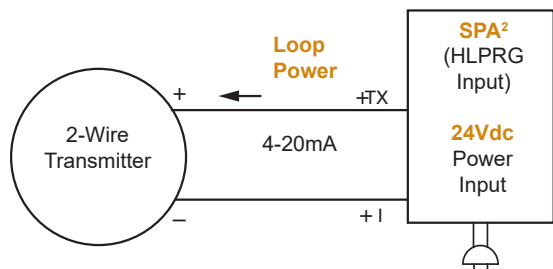
\*Programmable via the PC Configuration Software only.

\*\*Models with Analog Output (-AO) option.

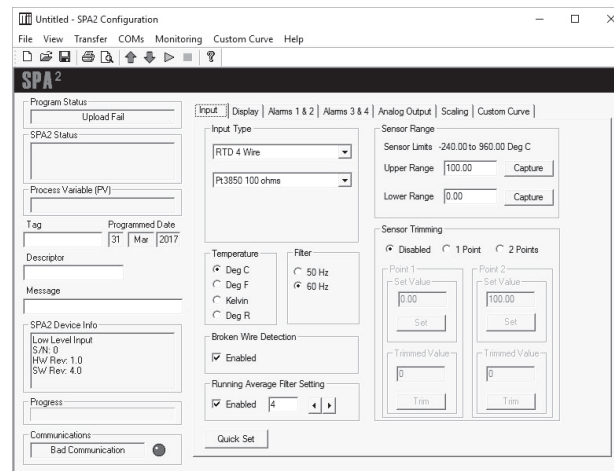
## Powers a 2-Wire Transmitter

The SPA<sup>2</sup> (HLPRG: current/voltage input model) comes standard with 2-wire transmitter excitation that provides 24Vdc to power the loop. This saves the cost of specifying and installing an additional instrument power supply to power a 2-wire transmitter on the input loop.

**Figure 2.** The SPA<sup>2</sup> provides transmitter excitation to power a 2-wire transmitter.



**Figure 3.** In addition to pushbutton configuration, the SPA<sup>2</sup> programs quickly from a single software window.



## Versatile Alarm Options

Each individually-configurable SPA<sup>2</sup> alarm trip relay programs via the PC software as a:

**High or Low Limit Process Alarm**—Monitor a temperature, pressure, level, flow, position or status variable, and use to warn of unwanted process conditions (Figure 4), provide emergency shutdown or provide on/off control (Figure 5).

**Rate-of-Change Alarm**—Monitor an input for a change in value with respect to time (Figure 6). The alarm trips when the input rate-of-change exceeds a user-selected rate (Delta) over a user selected time period (Delta Time); alarm can be configured for increasing or decreasing PV rate-of-change, or both.

**Band Alarm**—Combines the High and the Low Trip Alarms into one. It can be used to warn of a process that has left its normal operating conditions. Alternatively a midpoint PV value and a +/- variance can be set to alarm when it breaches the upper or lower variance setting.

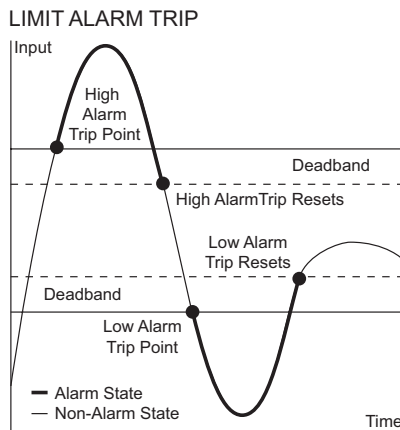
**Stuck Alarm**—Monitors the input with respect to time and trips when that input hasn't changed by a user-selected rate (Delta) over a user selected time period (Delta Time).

**Fault Alarm**—Provides an alarm (without affecting the other relay being used to monitor the process) when the SPA2 identifies a self-diagnostic issue, input saturation, sensor failure or input out-of-range failure.

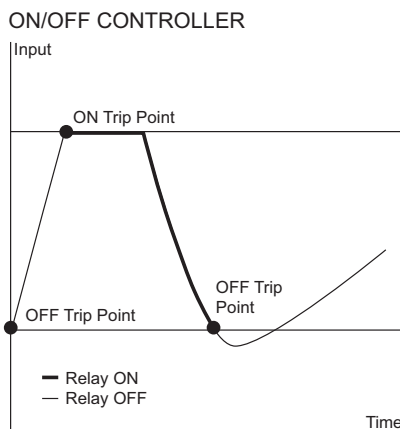
## Quick Ranging Calibration

Using the front panel pushbuttons or the PC Configuration Software (instead of potentiometers which can drift), precise zero and span settings can be made in seconds. Just select the zero and span values, and the push of a button locks the values into the alarm trip's memory.

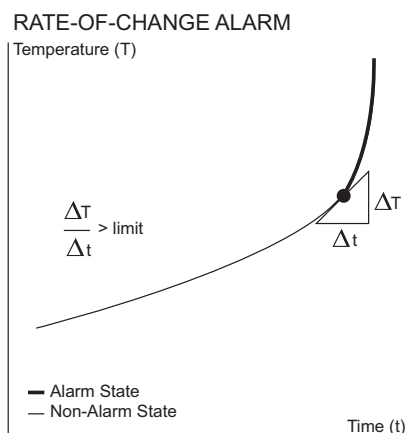
**Figure 4.** High and/or low limit alarms, with a selectable deadband to reduce false alarms, can be used to warn of unwanted process conditions or to provide emergency shutdown.



**Figure 5.** The SPA<sup>2</sup> can be used as a simple on/off controller such as those required in level applications (pump/valve control) when filling or emptying a container or tank.



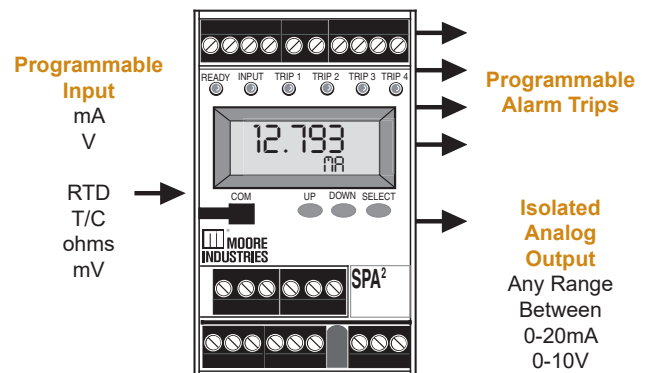
**Figure 6.** The SPA<sup>2</sup> can be set to trip when the input rate-of-change exceeds a user-selected rate (Delta) over a user-selected time period (Delta Time).



### Combination Alarm and Isolated Transmitter

When ordered with the Analog Output (-AO) option, the SPA<sup>2</sup> provides a proportional and isolated analog retransmission of the input signal that can be sent to remote monitoring/control devices like a DCS, PLC, PC, indicator or data recorder (Figure 7). All analog parameters can be selected using the SPA<sup>2</sup> push buttons or the Intelligent PC Configuration Software. Upon input failure, the analog output can be user-set for upscale or downscale drive or fail to last value.

**Figure 7.** When ordered with the Analog Output (-AO) option, the SPA<sup>2</sup> is a combination alarm trip and signal transmitter.



### Superior Reference Junction Compensation

Uncompensated plastic terminals are very susceptible to ambient temperature changes that may result in readings that are "off" by several degrees. SPA<sup>2</sup> models that accept temperature inputs (TPRG input) feature metal terminals and advanced electronic compensation techniques that provide a stable measurement in fluctuating ambient temperature conditions.

### Continuous Self-Diagnostics

Incorporating advanced self-diagnostics, the SPA<sup>2</sup> checks its own operation and configuration upon start up and then continuously monitors its status during operation. If it senses that it is not operating properly, it displays an error message on its display indicating what condition has occurred. In addition, one or more of the alarm trip outputs can be set as a fault alarm which will trip when an unwanted diagnostic condition occurs.

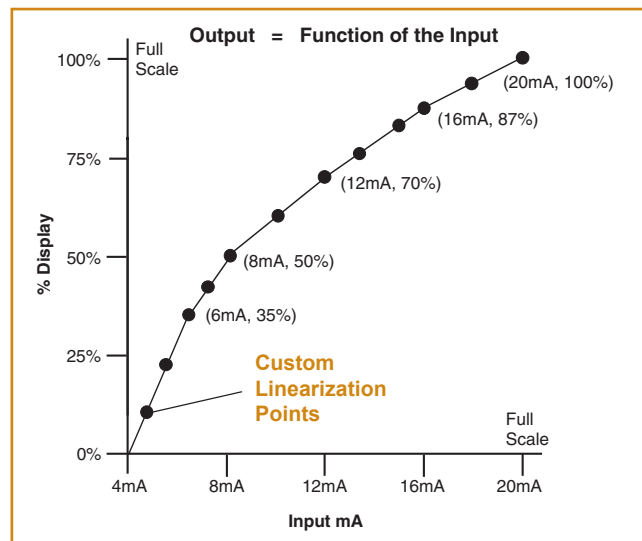
# SPA<sup>2</sup>

Programmable Current/Voltage  
and RTD/Thermocouple Limit Alarm Trips

## Custom 128-Point Linearization Curves

The ability to plot a custom linearization curve is beneficial when non-linear input signals must be converted to linear output representations (Figure 8). Typical applications include monitoring a non-linear transducer, the level of odd-shaped tanks and flow meter linearization.

**Figure 8.** Using the Intelligent PC Configuration Software, up to 128 custom linearization points can be selected and saved in the SPA<sup>2</sup>'s memory to compensate for non-linear input signals.



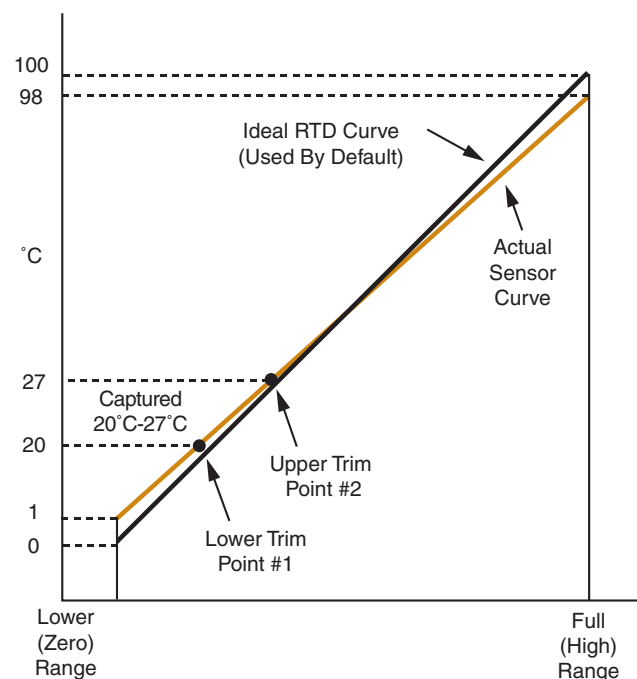
## Total Sensor Diagnostics for RTD Inputs

Our SPA<sup>2</sup> Programmable Limit Alarm Trip (TPRG input model) performs continuous sensor diagnostics (Figure 10). This industry-first and patented Moore Industries feature saves you time and money by letting you know when a problem occurs, and its type and location. If the RTD input breaks, the user can decide whether or not to trip one or more alarms to indicate trouble. A plain-English error message on the display, as well as on the PC Configuration Software, indicates exactly which RTD wire has broken. Specific error messages eliminate the work of removing the sensor or checking all lead wires to diagnose a problem. If equipped with the Analog Output (-AO) option, the user has the option of driving the analog output either upscale or downscale on sensor failure.

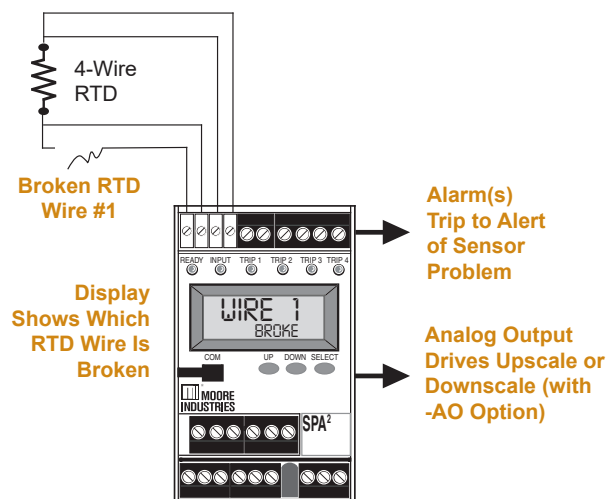
## Trim to Specific Curve Segments

The SPA<sup>2</sup> can be trimmed with two data points within the selected zero and span measurement range (Figure 9). This allows a complete process range to be monitored while placing measurement emphasis on a critical segment of the range. This provides incredible precision over a limited portion of the span while measuring the remainder of the span with outstanding accuracy.

**Figure 9.** The SPA<sup>2</sup> can be set to measure the segment most critical to the process.



**Figure 10.** Patented "Total Sensor Diagnostics" saves troubleshooting time by identifying which sensor wire has broken.



## Specifications (HLPRG: mA and V Input Model)

| <p><b>Performance</b> <b>Input Range:</b> Current Input 0-50mA (1mA minimum span); Voltage Input 0-11V (250mV minimum)</p> <p><b>Input Accuracy and Alarm Trip Repeatability:</b> Current inputs, ±2 microamps (0.01% of 20mA span); Voltage inputs, ±1mV (0.01% of max. span)</p> <p><b>Overall Accuracy:</b> The overall accuracy of the unit is the combined input and output accuracies. It includes the combined effects of linearity, hysteresis, repeatability and adjustment resolution. It does not include ambient temperature effect.</p> <p><b>Stability:</b> Refer to Table 1</p> <p><b>Dead Band:</b> 11.5V or 50mA, maximum in Linear Mode; equivalent of maximum input range in user-set engineering units in Scaling/Custom Mode</p> <p><b>Response Time:</b> 256msec maximum (Defined as the time from step change on input to alarm state change when alarm is set to trip mid-point)</p> <p><b>Alarm Trip Delay:</b> Programmable from 0-120 seconds</p> <p><b>Power Supply Effect:</b> ±0.002% of span for a 1% change in line voltage (AC or DC)</p> <p><b>Isolation:</b> 500Vrms between case, input, output (units with -AO option) and power, continuous.</p> <p><b>Dielectric Strength:</b> Will withstand a 1966Vdc dielectric strength test for 2 seconds (with no breakdown)</p> <p><b>Power Supply:</b> Universal 21.6-375Vdc or 90-260Vac;</p> <p><b>Power Consumption:</b> 3.5W typical, 5.5W maximum</p> <p><b>Input Impedance:</b> Current inputs, 20 ohms; Voltage inputs, 1 Mohm</p> | <p><b>Performance (continued)</b> <b>Input Over-Range Protection:</b> Voltage inputs, ±30Vdc; Current inputs, ±100mA</p> <p><b>TX Power Supply:</b> 24Vdc, ±10%@24mA (regulated)</p> <p><b>Relay Outputs:</b> Single-pole/double-throw (SPDT), 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive -DPDT option: Double-pole/double-throw (DPDT), 2 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, noninductive</p> <p><b>Performance with Analog Output (-AO Option)</b> <b>WITH ANALOG OUTPUT</b></p> <p><b>Output Accuracy:</b> Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1mV)</p> <p><b>Response Time:</b> 256msec maximum (128msec typical) for the output to change from 10% to 90% of its scale for an input step change of 0 to 100%</p> <p><b>Ripple (up to 120Hz):</b> Current output, 10mVp-p when measured across a 250 ohm resistor; Voltage output, 50mVp-p maximum</p> <p><b>Output Limiting:</b> Current outputs,</p> <table><tr><th>Output</th><th>Failure Limits</th></tr><tr><td>0-20mA</td><td>0, 23.6mA</td></tr><tr><td>4-20mA</td><td>3.6, 23.6mA</td></tr><tr><td>X-20mA</td><td>(90% of X), 23.6mA</td></tr></table> <p>Voltage output, -0.5-11V</p> <p><b>Load Capability:</b> Source mode (internal power supply), 0-1000 ohms for current output; greater than or equal to 2000 ohms resistance on current output</p> <p><b>Load Effect (current outputs):</b> ±0.01% of span from 0 to 1000 ohms resistance on current output</p> <p><b>Ambient Conditions</b> <b>Operating Range:</b> -40°C to +85°C (-40°F to +185°F)</p> <p><b>Storage Range:</b> -40°C to +85°C (-40°F to +185°F)</p> | Output | Failure Limits | 0-20mA | 0, 23.6mA | 4-20mA | 3.6, 23.6mA | X-20mA | (90% of X), 23.6mA | <p><b>Ambient Conditions (continued)</b> <b>Ambient Temperature Effect:</b> Current, 2 microamps/°C; Voltage, 1mV/°C; Output, ±0.009% of maximum span/°C; Ambient Temperature Reference Conditions for Specifications: 25°C</p> <p><b>Relative Humidity:</b> 0-95%, non-condensing</p> <p><b>RFI/EMI Protection:</b> 80% AM at 1Khz 20V/m @ 20-1000Mhz per IEC61000-4-3.</p> <p><b>Noise Rejection:</b> Common Mode, 100dB@50/60Hz Normal Mode, Current Input, 70dB typical@50mA p-p@ 50/60Hz; Voltage Input, 70dB typical@1Vp-p@ 50/60Hz</p> <p><b>Adjustments</b> Front panel pushbuttons parameter configurations; Internal jumper and menu password protect parameter settings</p> <p><b>Indicators</b> <b>LCD:</b> 2x5 14-segment characters, backlit, alphanumeric readout accurate to the nearest digit.</p> <p><b>Range:</b> -99999 to 99999; Decimal point can be user-set</p> <p><b>LED Type:</b> INPUT LED: Dual color LED indicates input failure</p> <p>READY LED: Green LED indicates unit is operating properly</p> <p>ALARM 1, 2, 3 and 4 LED: Dual color LED per relay indicates alarm status</p> <p><b>Display Accuracy:</b> ±1 digit; when scaling the display (or in Custom Mode), high input-to-display span ratios decrease display accuracy</p> <p><b>Weight</b> 544 g to 601 g (19.2 oz to 21.2 oz)</p> |
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| Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Failure Limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 0-20mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0, 23.6mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 4-20mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3.6, 23.6mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| X-20mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (90% of X), 23.6mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

Table 1. Long-Term Stability

| Stability<br>(% of Maximum<br>Span) | Input-to-Output<br>(Years) |      |      | Input-to-Relay<br>(Years) |       |       |
|-------------------------------------|----------------------------|------|------|---------------------------|-------|-------|
|                                     | 1                          | 3    | 5    | 1                         | 3     | 5     |
| Current Inputs                      | 0.081                      | 0.14 | 0.18 | 0.047                     | 0.081 | 0.105 |
| Voltage Inputs                      | 0.093                      | 0.16 | 0.21 | 0.066                     | 0.114 | 0.147 |

## Specifications (TPRG: RTD, T/C, Ohm, mV and Potentiometer Input Model)

| <p><b>Performance</b></p> <p><b>Input Accuracy and Alarm Trip Repeatability:</b> Refer to Table 2</p> <p><b>Overall Accuracy:</b> The overall accuracy of the unit is the combined input and output accuracies. It includes the combined effects of linearity, hysteresis, repeatability and adjustment resolution. It does not include ambient temperature effect. For T/C input, add the RJC error.</p> <p><b>Reference Junction Compensation Accuracy (T/C inputs only):</b> ±0.45°C</p> <p><b>Stability:</b> Refer to Table 3</p> <p><b>Dead Band:</b> User set within selected input range; fully scalable and set in user-selected engineering units</p> <p><b>Input to Output Response Time:</b> 256msec typical (Defined as the time from step change on input to alarm state change when alarm is set to trip mid-point)</p> <p><b>Alarm Trip Delay:</b> Programmable from 0-120 seconds</p> <p><b>Power Supply Effect:</b> ±0.002% of span for a 1% change in line voltage (AC or DC)</p> <p><b>Isolation:</b> 500Vrms between case, input, output (units with -AO option) and power, continuous.</p> <p><b>Dielectric Strength:</b> Will withstand a 1966Vdc dielectric strength test for 2 seconds (with no breakdown)</p> <p><b>Power Supply:</b> Universal 21.6-375Vdc or 90-260Vac</p> <p><b>Power Consumption:</b> 3W typical, 5.5W maximum</p> <p><b>Input Over-Range Protection:</b> ±5Vdc</p> <p><b>Input Impedance:</b> T/C inputs, 40 Mohms, nominal</p> | <p><b>Performance (continued)</b></p> <p><b>Input Over-Range Protection:</b> ±5Vdc</p> <p><b>Excitation Current:</b> (RTD and Ohms) 250 microamps, ±10%</p> <p><b>Relay Outputs:</b> Single-pole/double-throw (SPDT), 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive</p> <p>-DPDT option: Double-pole/double-throw (DPDT), 2 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, noninductive</p> <p><b>WITH ANALOG OUTPUT</b></p> <p><b>Output Accuracy:</b> Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1mV)</p> <p><b>Response Time:</b> 256msec maximum (128msec typical) for the output to change from 10% to 90% of its scale for an input step change of 0 to 100%</p> <p><b>Ripple (up to 120Hz):</b> Current output, 10mVp-p when measured across a 250ohm resistor; Voltage output, 50mVp-p maximum</p> <p><b>Output Limiting:</b> Current outputs,</p> <table><tr><th>Output</th><th>Failure Limits</th></tr><tr><td>0-20mA</td><td>0, 23.6mA</td></tr><tr><td>4-20mA</td><td>3.6, 23.6mA</td></tr><tr><td>X-20mA</td><td>(90% of X), 23.6mA</td></tr></table> <p>Voltage output, -0.5-11V</p> <p><b>Load Capability:</b> Source mode (internal power supply), 0-1000 ohms for current output; greater than or equal to 2000 ohms resistance on current output</p> <p><b>Load Effect (current outputs):</b> ±0.01% of span from 0 to 1000 ohms resistance on current output</p> <p><b>Ambient Conditions</b></p> <p><b>Operating Range:</b> -40°C to +85°C (-40°F to +185°F)</p> | Output | Failure Limits | 0-20mA | 0, 23.6mA | 4-20mA | 3.6, 23.6mA | X-20mA | (90% of X), 23.6mA | <p><b>Ambient Conditions (continued)</b></p> <p><b>Storage Range:</b> -40°C to +85°C (-40°F to +185°F)</p> <p><b>Ambient Temperature Effect:</b> Refer to Table 4</p> <p><b>Effect of Ambient Temperature on Reference Junction Compensation (T/C inputs only):</b> ±0.005% per °C change of ambient temperature</p> <p><b>Relative Humidity:</b> 0-95%, non-condensing</p> <p><b>RFI/EMI Protection:</b> 80% AM at 1KHz 20V/m @ 20-1000Mhz per IEC61000-4-3</p> <p><b>Noise Rejection:</b> Common Mode, 100dB@50/60Hz Normal Mode, refer to Table 5</p> <p><b>Adjustments</b> Front panel pushbuttons parameter configurations; Internal jumper and menu password protect parameter settings</p> <p><b>Indicators</b></p> <p><b>LCD:</b> 2x5 14-segment characters, backlight, alphanumeric readout accurate to the nearest digit.</p> <p><b>Range:</b> -99999 to 99999; Decimal point can be user-set</p> <p><b>LED Type:</b> INPUT LED: Dual color LED indicates input failure</p> <p>READY LED: Green LED indicates unit is operating properly</p> <p>ALARM 1, 2, 3 and 4 LED: Dual color LED per relay indicates alarm status</p> <p><b>Display Accuracy:</b> ±1 digit; when scaling the display (or in custom mode), high input-to-display span ratios decrease display accuracy</p> <p><b>Weight</b> 544 g to 601 g (19.2 oz to 21.2 oz)</p> |
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| Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Failure Limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 0-20mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0, 23.6mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 4-20mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3.6, 23.6mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| X-20mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | (90% of X), 23.6mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |                |        |           |        |             |        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

**Table 2.** Accuracy with RTD, Thermocouple, Ohms, and Millivolt Inputs (Models with TPRG Input)

| Input                                                                                                                     | Type                     | $\alpha$    | Ohms                             | Conformance Range                  | Minimum Span     | Input Accuracy/<br>Repeatability* | Maximum Range                     |                                   |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------|----------------------------------|------------------------------------|------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| <b>RTD</b><br>(2-, 3-, 4-Wire)<br><br><b>Dual</b><br>(2-Wire, One 2-Wire and One 3-Wire)<br><br><b>Triple</b><br>(2-Wire) | <b>Platinum</b>          | 0.003850    | 100                              | -200 to 850°C<br>(-328 to 1562°F)  | 10°C<br>(18°F)   | ±0.1°C<br>(±0.18°F)               | -240 to 960°C<br>(-400 to 1760°F) |                                   |
|                                                                                                                           |                          |             | 200                              |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | 300                              |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | 400                              |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | 500                              |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | 1000                             |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | Dual 500                         |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | Dual 1000                        | -200 to 260°C<br>(-328 to 500°F)   |                  |                                   | -200 to 260°C<br>(-328 to 500°F)  |                                   |
|                                                                                                                           |                          | Triple 500  | -200 to 440°C<br>(-328 to 824°F) | -200 to 440°C<br>(-328 to 824°F)   |                  |                                   |                                   |                                   |
|                                                                                                                           |                          | Triple 1000 | -200 to 80°C<br>(-328 to 176°F)  | -200 to 80°C<br>(-328 to 176°F)    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          | 0.003902    | 100                              | -100 to 650°C<br>(-148 to 1202°F)  |                  |                                   |                                   | -150 to 720°C<br>(-238 to 1328°F) |
|                                                                                                                           |                          |             | 200                              |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | 400                              |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | 500                              |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | 1000                             |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | Dual 500                         |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | Dual 1000                        |                                    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          |             | Triple 500                       | -100 to 440°C<br>(-148 to 824°F)   |                  |                                   |                                   | -100 to 440°C<br>(-148 to 824°F)  |
|                                                                                                                           |                          | Triple 1000 | -100 to 80°C<br>(-148 to 176°F)  | -100 to 80°C<br>(-148 to 176°F)    |                  |                                   |                                   |                                   |
|                                                                                                                           |                          | 0.003916    | 100                              | -200 to 510°C<br>(-328 to 950°F)   |                  |                                   |                                   | -240 to 580°C<br>(-400 to 1076°F) |
|                                                                                                                           | <b>Nickel</b>            | 0.00672     | 120                              | -80 to 320°C<br>(-112 to 608°F)    |                  |                                   | -100 to 360°C<br>(-148 to 680°F)  |                                   |
|                                                                                                                           | <b>Copper</b>            | 0.00427     | 9.035                            | -50 to 250°C<br>(-58 to 482°F)     |                  | ±0.85°C<br>(±1.53°F)              | -65 to 280°C<br>(-85 to 536°F)    |                                   |
| <b>Ohms</b>                                                                                                               | <b>Direct Resistance</b> | n/a         | 0-4000                           | 0-4000 ohms                        | 10 ohms          | ±0.4 ohms                         | 0-4095 ohms                       |                                   |
|                                                                                                                           |                          |             | Dual 0-2000 ohms                 | 0-2000 ohms                        |                  |                                   | 0-2000 ohms                       |                                   |
|                                                                                                                           |                          |             | Triple 0-1300 ohms               | 0-1300 ohms                        |                  |                                   | 0-1300 ohms                       |                                   |
|                                                                                                                           | <b>Potentiometer</b>     |             | 4000 maximum                     | 0-100%                             | 10%              | ±0.1%                             | 0-100%                            |                                   |
| <b>T/C</b>                                                                                                                | <b>J</b>                 | n/a         | n/a                              | -180 to 760°C<br>(-292 to 1400°F)  | 35°C<br>(63°F)   | ±0.25°C<br>(±0.45°F)              | -210 to 760°C<br>-346 to 1400°F   |                                   |
|                                                                                                                           | <b>K</b>                 | n/a         | n/a                              | -150 to 1370°C<br>(-238 to 2498°F) | 40°C<br>(72°F)   | ±0.3°C<br>(±0.54°F)               | -270 to 1372°C<br>-454 to 2501°F  |                                   |
|                                                                                                                           | <b>E</b>                 | n/a         | n/a                              | -170 to 1000°C<br>(-274 to 1832°F) | 35°C<br>(63°F)   | ±0.2°C<br>(±0.36°F)               | -270 to 1000°C<br>-454 to 1832°F  |                                   |
|                                                                                                                           | <b>T</b>                 | n/a         | n/a                              | -170 to 400°C<br>(-274 to 752°F)   | 35°C<br>(63°F)   | ±0.25°C<br>(±0.45°F)              | -270 to 400°C<br>-454 to 752°F    |                                   |
|                                                                                                                           | <b>R</b>                 | n/a         | n/a                              | 0 to 1760°C<br>(32 to 3200°F)      | 50°C<br>(90°F)   | ±0.55°C<br>(±0.99°F)              | -50 to 1768°C<br>-58 to 3214°F    |                                   |
|                                                                                                                           | <b>S</b>                 | n/a         | n/a                              | 0 to 1760°C<br>(32 to 3200°F)      | 50°C<br>(90°F)   | ±0.55°C<br>(±0.99°F)              | -50 to 1768°C<br>-58 to 3214°F    |                                   |
|                                                                                                                           | <b>B</b>                 | n/a         | n/a                              | 400 to 1820°C<br>(752 to 3308°F)   | 75°C<br>(135°F)  | ±0.75°C<br>(±1.35°F)              | 0 to 1820°C<br>32 to 3308°F       |                                   |
|                                                                                                                           | <b>N</b>                 | n/a         | n/a                              | -130 to 1300°C<br>(-202 to 2372°F) | 45°C<br>(81°F)   | ±0.4°C<br>(±0.72°F)               | -270 to 1300°C<br>-454 to 2372°F  |                                   |
|                                                                                                                           | <b>C</b>                 | n/a         | n/a                              | 0 to 2300°C<br>(32 to 4172°F)      | 100°C<br>(180°F) | ±0.8°C<br>(±1.44°F)               | 0 to 2315°C<br>32 to 4200°F       |                                   |
| <b>mV</b>                                                                                                                 | <b>DC</b>                | n/a         | n/a                              | n/a                                | 4mV              | ±30 microvolts                    | -50 to 1000mV                     |                                   |

\*Ambient Temperature Reference Conditions for Specifications: 25°C

# SPA<sup>2</sup>

Programmable Current/Voltage  
and RTD/Thermocouple Limit Alarm Trips

## Ordering Information

| Unit                                            | Input                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Output                                                                                                                                                                                                                                                                                                                                                                                                                                        | Power                                                                           | Options                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Housing                                                                                                                                                                                        |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SPA2</b><br>Programmable<br>Limit Alarm Trip | <b>HLPRG</b><br>Programs to accept:<br><br>Current: Any range between 0-50mA including:<br>0-20mA<br>4-20mA<br>10-50mA<br><br>Voltage: Any range between 0-10Vdc including:<br>0-5Vdc<br>1-5Vdc<br>0-10Vdc<br><br><b>TPRG</b> Programs to accept (see Table 2 for details):<br><br>RTD: 2-, 3- and 4-wire; platinum, copper, and nickel<br><br>Thermocouple: J, K, E, T, R, S, N, C, B<br><br>Ohms: 0-4000ohms (Potentiometer, 4000ohms maximum)<br><br>Millivolts: -50 to +1000mV | <b>2PRG</b> Dual Relays<br>(Relays are single-pole/double-throw (SPDT), 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive)<br><br><b>4PRG</b> Quad Relays<br>(Relays are single-pole/double-throw (SPDT), 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive)<br><br>Each relay individually configures for:<br>High or Low Trip<br>Normally Open or Normally Closed<br>Failsafe or Non-Failsafe<br>Latching or Non-Latching | <b>U</b> Universal<br>accepts any power input range of 21.6-375Vdc or 90-260Vac | <b>-AO</b> Analog output (isolated and linearized) scalable for any range between 0-20mA into 1000 ohms or 0-10V into 10 kohms (see "Specifications" for additional information)<br>Voltage output, -0.5-11V<br>NOTE: Current output can be user-set for internal or external power (source or sink)<br><br><b>-DPDT</b> Relays are double-pole/double-throw (DPDT), 2 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive (2PRG output model only)<br><br><b>-FMEDA</b> Unit comes with Failure Modes, Effects and Diagnostic Analysis (FMEDA) data for evaluating the instrument for suitability of use in a safety-related application<br><br><b>-VTD</b> Standard Factory Calibration with NIST Test Data Report<br><br><b>-EMP EMPHASIS</b><br>Version with keyed terminals and locked firmware version | <b>DIN</b><br>DIN-style housing mounts on 35mm (EN50022) Top Hat DIN-rails<br><br><b>FLB</b><br>Flange mount bracket for wall mounting provides a secure mount for high vibration applications |

When ordering, specify: Unit / Input / Output / Power / Options [Housing]

Model number example: SPA2 / TPRG / 2PRG / U / - AO [DIN]

**Table 3. Long-Term Stability**

| Stability<br>(% of Maximum Span) | Input-to-Output<br>(Years) |      |      | Input-to-Relay<br>(Years) |       |       |
|----------------------------------|----------------------------|------|------|---------------------------|-------|-------|
|                                  | 1                          | 3    | 5    | 1                         | 3     | 5     |
| RTD, Ohm & Pot Inputs            | 0.09                       | 0.16 | 0.21 | 0.047                     | 0.081 | 0.104 |
| T/C & mV Inputs                  | 0.08                       | 0.14 | 0.18 | 0.008                     | 0.014 | 0.019 |

**Table 5. Normal Mode Rejection Ratio**

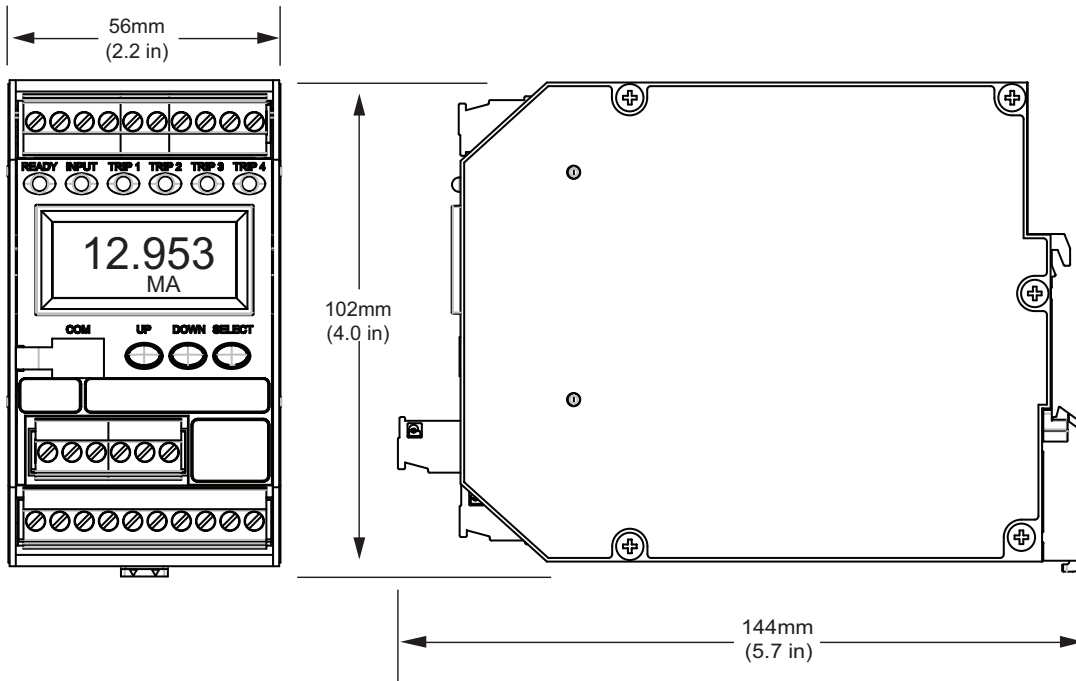
| Sensor Type                 | Max. p-p Voltage Injection for 100dB at 50/60Hz |       |
|-----------------------------|-------------------------------------------------|-------|
| T/C: J, K, N, C, E          | 150mV                                           |       |
| T/C: T, R, S, B             | 80mV                                            |       |
| Pt RTD: 100, 200, 300 ohms  | 250mV                                           |       |
| Pt RTD: 400, 500, 1000 ohms | 1V                                              |       |
| Ni: 120 ohms                | 500mV                                           |       |
| Cu: 9.03 ohms               | 100mV                                           |       |
| Resistance                  | mV                                              |       |
| 1-4 kohms                   | 250-1000                                        | 1V    |
| 0.25-1 kohms                | 62.5-250                                        | 250mV |
| 0.125-0.25 kohms            | 31.25-62.5                                      | 100mV |

**Table 4. Ambient Temperature Effect**

|              | Accuracy per 1°C (1.8°F) Change in Ambient |
|--------------|--------------------------------------------|
| RTD*         | 0.0035°C                                   |
| Millivolt    | 0.5 microvolts + 0.005% of reading         |
| Ohm          | 0.002 ohms + 0.005% of reading             |
| Thermocouple |                                            |
|              | Accuracy per 1°C (1.8°F) Change in Ambient |
| J            | 0.00016°C + 0.005% of reading              |
| K            | 0.0002°C + 0.005% of reading               |
| E            | 0.00026°C + 0.005% of reading              |
| T            | 0.0001°C + 0.005% of reading               |
| R, S         | 0.00075°C + 0.005% of reading              |
| B            | 0.0038°C + 0.005% of reading               |
| N            | 0.003°C + 0.005% of reading                |
| C            | 0.00043°C + 0.005% of reading              |
| mV           | 0.5 microvolts + 0.005% of reading         |

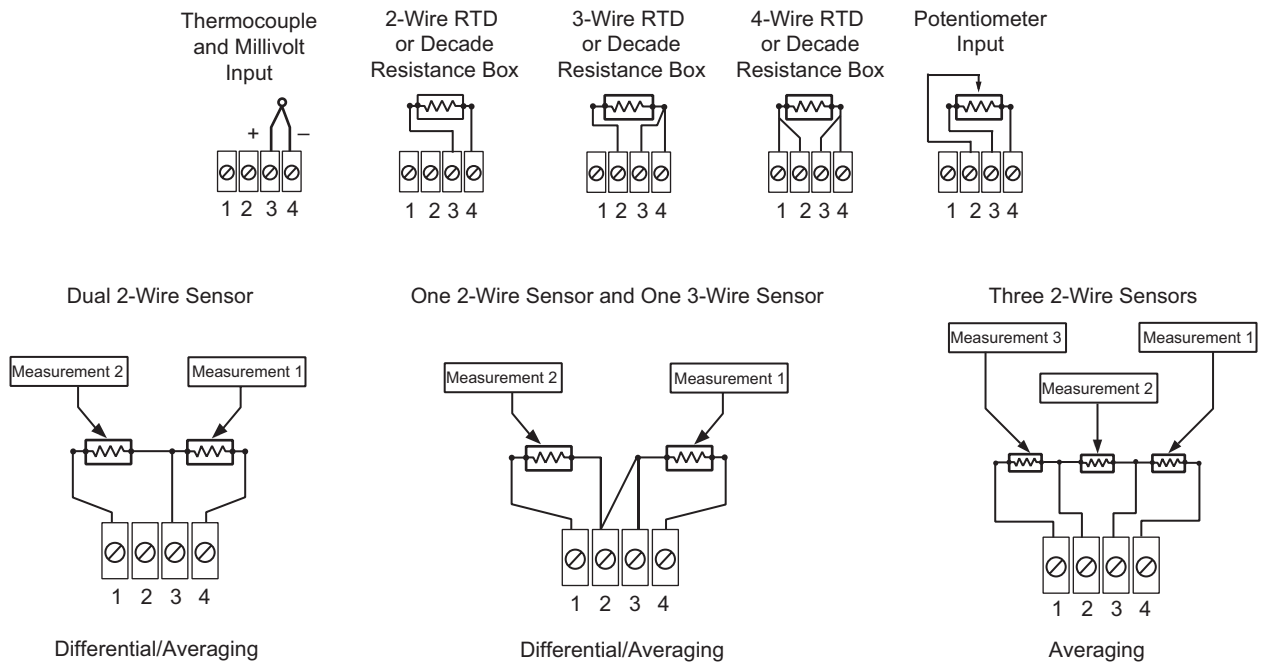
\*Accuracy of Ni672 is 0.002°C

**Figure 11. Installation Dimensions**



**NOTE:** While all SPA<sup>2</sup> models (model with HLPRG input shown) are dimensionally identical, the SPA<sup>2</sup> that accepts temperature inputs (TPRG input) features metal terminal blocks for enhanced reference junction compensation.

**Figure 12. Temperature Sensor Hook-Up Guide (Models with TPRG Input)**



# SPA<sup>2</sup>

Programmable Current/Voltage  
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**Table 6. Terminal Designations (Models with TPRG Input)**

| Input Type                                  | Top Terminals (Left to Right) |    |    |    |    |    |            |                        |     |                 |
|---------------------------------------------|-------------------------------|----|----|----|----|----|------------|------------------------|-----|-----------------|
|                                             | T1                            | T2 | T3 | T4 | T5 | T6 | T7         | T8                     | T9  | T10             |
| RTD, Ohm, Potentiometer,<br>T/C & mV Inputs | See Figure 12                 |    |    |    | MR | MR | +Io Source | -Io Source<br>+Io Sink | +Vo | -Vo<br>-Io Sink |

| Output Type           | Middle Terminals (Left to Right) |                |                |                |                |                |
|-----------------------|----------------------------------|----------------|----------------|----------------|----------------|----------------|
|                       | 11                               | 12             | 13             | 14             | 15             | 16             |
| 2PRG<br>(SPDT Relays) | N/A                              | N/A            | N/A            | N/A            | N/A            | N/A            |
| 4PRG<br>(SPDT Relays) | NO3                              | CM3            | NC3            | NO4            | CM4            | NC4            |
| 2 DPDT Relays         | Relay 2<br>NO1                   | Relay 2<br>CM1 | Relay 2<br>NC1 | Relay 2<br>NO2 | Relay 2<br>CM2 | Relay 2<br>NC2 |

| Output/Power Type     | Bottom Terminals (Left to Right) |                |                |                |                |                |             |                |                  |     |
|-----------------------|----------------------------------|----------------|----------------|----------------|----------------|----------------|-------------|----------------|------------------|-----|
|                       | B1                               | B2             | B3             | B4             | B5             | B6             | B7          | B8             | B9               | B10 |
| 2PRG<br>(SPDT Relays) | NO1                              | CM1            | NC1            | NO2            | CM2            | NC2            | Not<br>Used | AC<br>or<br>DC | ACC<br>or<br>DCC | GND |
| 4PRG<br>(SPDT Relays) | NO1                              | CM1            | NC1            | NO2            | CM2            | NC2            | Not<br>Used | AC<br>or<br>DC | ACC<br>or<br>DCC | GND |
| 2 DPDT Relays         | Relay 1<br>NO1                   | Relay 1<br>CM1 | Relay 1<br>NC1 | Relay 1<br>NO2 | Relay 1<br>CM2 | Relay 1<br>NC2 | Not<br>Used | AC<br>or<br>DC | ACC<br>or<br>DCC | GND |

**NOTES:**

- Terminal blocks can accommodate 14-22 AWG solid wiring, tighten to four inch-pounds (maximum).
- $\pm I_o/\pm V_o$  labeling is present only when the unit is equipped with the Analog Output (-AO) option.

**KEY:**

AC or DC = Power Input  
ACC or DCC = Power Input  
CM = Relay Common  
DPDT = Double-Pole/Double-Throw  
GND = Ground (case)

$I_o$  = Current Output  
MR = Manual Reset  
NO = Normally Open  
NC = Normally Closed

Sink = Current Sink  
Source = Current Source  
SPDT = Single-Pole/Double-Throw  
 $V_o$  = Voltage Output

## Accessories

Configuration software can be downloaded from our website. Use the chart below to order additional parts.

|                                  |                                                                                      |
|----------------------------------|--------------------------------------------------------------------------------------|
| Part Number<br><b>803-053-26</b> | <b>Serial Configuration Cable</b> for use in connecting the SPA <sup>2</sup> to a PC |
| Part Number<br><b>804-030-26</b> | <b>Fuse Protected, Non-Isolated USB Communication Cable</b>                          |

**Table 7. Terminal Designations (Models with HLPRG Input)**

| Input Type    | Top Terminals (Left to Right) |          |     |          |    |    |            |                        |     |                 |
|---------------|-------------------------------|----------|-----|----------|----|----|------------|------------------------|-----|-----------------|
|               | T1                            | T2       | T3  | T4       | T5 | T6 | T7         | T8                     | T9  | T10             |
| Current Input | Tx                            | +I       | COM | Not Used | MR | MR | +Io Source | -Io Source<br>+Io Sink | +Vo | -Vo<br>-Io Sink |
| Voltage Input | Tx                            | Not Used | COM | +V       | MR | MR | +Io Source | -Io Source<br>+Io Sink | +Vo | -Vo<br>-Io Sink |

| Output Type           | Middle Terminals (Left to Right) |                |                |                |                |                |
|-----------------------|----------------------------------|----------------|----------------|----------------|----------------|----------------|
|                       | 11                               | 12             | 13             | 14             | 15             | 16             |
| 2PRG<br>(SPDT Relays) | N/A                              | N/A            | N/A            | N/A            | N/A            | N/A            |
| 4PRG<br>(SPDT Relays) | NO3                              | CM3            | NC3            | NO4            | CM4            | NC4            |
| 2 DPDT Relays         | Relay 2<br>NO1                   | Relay 2<br>CM1 | Relay 2<br>NC1 | Relay 2<br>NO2 | Relay 2<br>CM2 | Relay 2<br>NC2 |

| Output/Power Type     | Bottom Terminals (Left to Right) |                |                |                |                |                |          |                |                  |     |
|-----------------------|----------------------------------|----------------|----------------|----------------|----------------|----------------|----------|----------------|------------------|-----|
|                       | B1                               | B2             | B3             | B4             | B5             | B6             | B7       | B8             | B9               | B10 |
| 2PRG<br>(SPDT Relays) | NO1                              | CM1            | NC1            | NO2            | CM2            | NC2            | Not Used | AC<br>or<br>DC | ACC<br>or<br>DCC | GND |
| 4PRG<br>(SPDT Relays) | NO1                              | CM1            | NC1            | NO2            | CM2            | NC2            | Not Used | AC<br>or<br>DC | ACC<br>or<br>DCC | GND |
| 2 DPDT Relays         | Relay 1<br>NO1                   | Relay 1<br>CM1 | Relay 1<br>NC1 | Relay 1<br>NO2 | Relay 1<br>CM2 | Relay 1<br>NC2 | Not Used | AC<br>or<br>DC | ACC<br>or<br>DCC | GND |

**NOTES:**

- Terminal blocks can accommodate 14-22 AWG solid wiring, tighten to four inch-pounds (maximum).
- ±Io/±Vo labeling is present only when the unit is equipped with the Analog Output (-AO) option.

**KEY:**

AC/DC = Power Input

ACC/DCC = Power Input

CM = Relay Common

COM = Analog Common

DPDT = Double-Pole/Double-Throw

GND = Ground (case)

I = Current Input

Io = Current Output

MR = Manual Reset

NO = Normally Open

NC = Normally Closed

Sink = Current Sink

Source = Current Source

SPDT = Single-Pole/Double-Throw

TX = Power for 2-wire transmitter

V = Voltage Input

Vo = Voltage Output

# SPA<sup>2</sup>

Programmable Current/Voltage  
and RTD/Thermocouple Limit Alarm Trips

## Do you Need an Intrinsically-Safe Alarm Solution?



### SPA<sup>2</sup>IS has Intrinsically-Safe Field Connections

For facilities that employ intrinsic safety measures, the SPA<sup>2</sup>IS is a cost effective and complete alarm solution. It includes intrinsically-safe field connections which accept current/voltage, resistance temperature detectors (RTDs), and thermocouple inputs and provides the necessary protection typically afforded by a separate galvanically isolated intrinsically-safe barrier. The SPA<sup>2</sup>IS cuts wiring and maintenance costs by enabling users to eliminate additional barriers and power supplies, which reduces space requirements and heat dissipation or cooling considerations in barrier marshalling cabinets.

The SPA<sup>2</sup>IS is powered by a universal AC/DC power supply and provides on/off control, warns of unwanted process conditions, alarms on rate of change, and assists with or performs emergency shutdowns. The SPA<sup>2</sup>IS provides dual and quad independent and individually-configurable alarm relay outputs when a monitored process variable falls outside of user-set high and/or low limits.

### Key features of the SPA<sup>2</sup>IS

- **Intrinsically-Safe Field Connections.** Apply inputs from temperature sensors or transmitters located in hazardous areas without the need of a costly intrinsically-safe barrier. Plus power an intrinsically-safe loop using the 2-wire transmitter excitation in the current/voltage input model.
- **20-bit input resolution.** Delivers industry-best digital accuracy for both sensor (RTD and thermocouple) and analog (current/voltage) inputs.
- **Site- and PC-Programmable.** The SPA<sup>2</sup>IS offers the choice of using front panel pushbuttons or our FREE Windows®-based Intelligent PC Configuration Software for fast and simple set up.
- **Large 5-digit process and status readout.** A display shows menu prompts and, when the SPA<sup>2</sup>IS is in operation, shows the process variable, the output or toggles between the two in programmable engineering units.
- **Combined alarm trip and transmitter.** The analog output (-AO) option reduces costs and installation time when both alarm and transmitter functions are needed at the same location.



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