Description
The universal SPA² 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) SPA² 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 SPA² models deliver versatile and programmable input and output choices.

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 SPA² 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 SPA² 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.

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


The SPA² features a metal, RFI resistant housing with display that snaps onto standard DIN-style rails.
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, 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)*

*Programmable via the PC Configuration Software only.

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

Powers a 2-Wire Transmitter

The SPA² (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.

Versatile Alarm Options

Each individually-configurable SPA² 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.
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.

When ordered with the Analog Output (-AO) option, the SPA\(^2\) 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\(^2\) 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.

The SPA\(^2\) 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.

The SPA\(^2\) can be set to trip when the input rate-of-change exceeds a user-selected rate (\(\Delta t\)) over a user-selected time period (\(\Delta t_{\text{time}}\)).

Uncompensated plastic terminals are very susceptible to ambient temperature changes that may result in readings that are “off” by several degrees. SPA\(^2\) 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.

Incorporating advanced self-diagnostics, the SPA\(^2\) 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.
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’s memory to compensate for non-linear input signals.

Total Sensor Diagnostics for RTD Inputs
Our SPA 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 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 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)

### Performance
- **Input Range**: Current Input 0-50mA (1mA minimum span); Voltage Input 0-11V (250mV minimum).
- **Input Accuracy and Alarm Trip Repeatability**: Current inputs, ±2 microamps (0.01% of 20mA span); Voltage inputs, ±1mV (0.01% of max. span).
- **Stability**: Refer to Table 1.

### Dead Band
- 11.5V or 50mA, maximum in Linear Mode; equivalent of maximum input range in user-set engineering units in Scaling/Custom Mode.

### Alarm Trip Delay
- Programmable from 0-120 seconds.

### Power Supply Effect
- ±0.002% of span for a 1% change in line voltage (AC or DC).

### Isolation
- 500Vrms between case, input, output (units with -AO option) and power, continuous.

### Dielectric Strength
- Will withstand a 1966Vdc dielectric strength test for 2 seconds (with no breakdown).

### Power Supply
- Universal 21.6-375Vdc or 90-260Vac;
- **Power Consumption**: 3.5W typical, 5.5W maximum.

### Input Over-Range Protection
- Voltage inputs, ±30Vdc; Current inputs, ±100mA.

### Output Failure Limits

### Performance with Analog Output (-AO Option)

### WITH ANALOG OUTPUT
- **Output Accuracy**: Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1mV).
- **Response Time**: 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%.
- **Ripple (up to 120Hz)**: Current output, 10mVp-p when measured across a 250 ohm resistor; Voltage output, 50mVp-p maximum.
- **Output Limiting**: Current outputs, 0-20mA, 4-20mA, X-20mA (90% of X), 0-1000 ohms for current output; greater than or equal to 2000 ohms resistance on current output.
- **Load Effect (current outputs)**: ±0.01% of span from 0 to 1000 ohms resistance on current output.

### Ambient Conditions
- **Temperature**: -40°C to +85°C;
- **Storage**: -40°C to +85°C;
- **Weight**: 544 g to 601 g.

### Weight
- 544 g to 601 g.

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**Table 1. Long-Term Stability**

<table>
<thead>
<tr>
<th>Stability (% of Maximum Span)</th>
<th>Input-to-Output (Years)</th>
<th>Input-to-Relay (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Current Inputs</td>
<td>0.081</td>
<td>0.14</td>
</tr>
<tr>
<td>Voltage Inputs</td>
<td>0.093</td>
<td>0.16</td>
</tr>
</tbody>
</table>
Specifications (TPRG: RTD, T/C, Ohm, mV and Potentiometer Input Model)

<table>
<thead>
<tr>
<th>Performance</th>
<th>Input Accuracy and Alarm Trip Repeatability: Refer to Table 2</th>
<th>Relay Outputs: 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</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Junction Compensation Accuracy (T/C inputs only):</td>
<td>±0.45°C</td>
<td>WITH ANALOG OUTPUT Output Accuracy: Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1mV)</td>
</tr>
<tr>
<td>Stability: Refer to Table 3</td>
<td></td>
<td>Response Time: 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%</td>
</tr>
<tr>
<td>Dead Band: User set within selected input range; fully scaleable and set in user-selected engineering units</td>
<td></td>
<td>Ripple (up to 120Hz): Current output, 10mVp-p when measured across a 250ohm resistor; Voltage output, 50mVp-p maximum</td>
</tr>
<tr>
<td>Input to Output Response Time: 256msec typical (Defined as the time from step change on input to alarm state change when alarm is set to trip midpoint)</td>
<td></td>
<td>Output Limiting: Current outputs, Output Failure Limits 0-20mA 0, 23.6mA 4-20mA 3.6, 23.6mA X-20mA (90% of X), 23.6mA Voltage output, -0.5-11V</td>
</tr>
<tr>
<td>Alarm Trip Delay: Programmable from 0-120 seconds</td>
<td></td>
<td>Load Capability: Source mode (internal power supply), 0-1000 ohms for current output; greater than or equal to 2000 ohms resistance on current output</td>
</tr>
<tr>
<td>Power Supply Effect: ±0.002% of span for a 1% change in line voltage (AC or DC)</td>
<td></td>
<td>Load Effect (current outputs): ±0.01% of span from 0 to 1000 ohms resistance on current output</td>
</tr>
<tr>
<td>Isolation: 500Vrms between case, input, output (units with -AO option) and power, continuous.</td>
<td></td>
<td>Display Accuracy: ±1 digit; when scaling the display (or in custom mode), high input-to-display span ratios decrease display accuracy</td>
</tr>
<tr>
<td>Dielectric Strength: Will withstand a 1966Vdc dielectric strength test for 2 seconds (with no breakdown)</td>
<td></td>
<td>Temperature on Reference Junction Compensation (T/C inputs only): ±0.005% per °C change of ambient temperature</td>
</tr>
<tr>
<td>Power Supply: Universal 21.6-375Vdc or 90-260Vac</td>
<td></td>
<td>Relative Humidity: 0-95%, non-condensing</td>
</tr>
<tr>
<td>Power Consumption: 3W typical, 5.5W maximum</td>
<td></td>
<td>RFI/EMI Protection: 80% AM at 1Khz 20V/m @ 20-1000Mhz per IEC61000-4-3</td>
</tr>
<tr>
<td>Input Over-Range Protection: ±5Vdc</td>
<td></td>
<td>Noise Rejection: Common Mode, 100dB@50/60Hz Normal Mode, refer to Table 5</td>
</tr>
<tr>
<td>Input Impedance: T/C inputs, 40 Mohms, nominal</td>
<td></td>
<td>Adjustment: Front panel pushbuttons parameter configurations; Internal jumper and menu password protect parameter settings</td>
</tr>
<tr>
<td>Input Over-Range Protection: ±5Vdc</td>
<td></td>
<td>Indicators LCD: 2x5 14-segment characters, backlit, alphanumeric readout accurate to the nearest digit.</td>
</tr>
<tr>
<td>Excitation Current: (RTD and Ohms) 250 microamps, ±10%</td>
<td></td>
<td>Range: -99999 to 99999; Decimal point can be user-set</td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td>Operating Range: -40°C to +85°C (-40°F to +185°F)</td>
<td>LED Type: INPUT LED: Dual color LED indicates input failure</td>
</tr>
<tr>
<td>Storage Range:</td>
<td></td>
<td>READY LED: Green LED indicates unit is operating properly</td>
</tr>
<tr>
<td>Weatherproof ALARM 1, 2, 3 and 4 LED:</td>
<td></td>
<td>Display Status: ALARM 1, 2, 3 and 4 LED: Dual color LED per relay indicates alarm status</td>
</tr>
<tr>
<td>Display Accuracy: ±1 digit; when scaling the display (or in custom mode), high input-to-display span ratios decrease display accuracy</td>
<td></td>
<td>Weight: 544 g to 601 g (19.2 oz to 21.2 oz)</td>
</tr>
</tbody>
</table>
Table 2. Accuracy with RTD, Thermocouple, Ohms, and Millivolt Inputs (Models with TPRG Input)

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Ohms</th>
<th>Conformance Range</th>
<th>Minimum Span</th>
<th>Input Accuracy/Repeatability</th>
<th>Maximum Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTD</strong> (2-, 3-, 4-Wire)</td>
<td>100</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td>Dual (2-Wire, One 2-Wire and One 3-Wire)</td>
<td>100</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
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<tr>
<td></td>
<td>300</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
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<td></td>
<td>400</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>-20°C to 85°C (-292°F to 156°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td>Triple (2-Wire)</td>
<td>100</td>
<td>-10°C to 65°C (-14°F to 120°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>-10°C to 65°C (-14°F to 120°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>-10°C to 65°C (-14°F to 120°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>-10°C to 65°C (-14°F to 120°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>-10°C to 65°C (-14°F to 120°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>-10°C to 65°C (-14°F to 120°F)</td>
<td>10°C</td>
<td>±0.1°C (±0.18°F)</td>
<td>-240°C to 96°C (-400°F to 176°F)</td>
</tr>
<tr>
<td>Platinum</td>
<td>100</td>
<td>0-40°C (32-104°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-150°C to 72°C (-238°F to 132°F)</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>0-40°C (32-104°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-150°C to 72°C (-238°F to 132°F)</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>0-40°C (32-104°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-150°C to 72°C (-238°F to 132°F)</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>0-40°C (32-104°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-150°C to 72°C (-238°F to 132°F)</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>0-40°C (32-104°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-150°C to 72°C (-238°F to 132°F)</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>0-40°C (32-104°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-150°C to 72°C (-238°F to 132°F)</td>
</tr>
<tr>
<td>Nickel</td>
<td>100</td>
<td>-20°C to 51°C (-4°F to 125°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-100°C to 36°C (-148°F to 96°F)</td>
</tr>
<tr>
<td>Copper</td>
<td>100</td>
<td>-20°C to 51°C (-4°F to 125°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-100°C to 36°C (-148°F to 96°F)</td>
</tr>
<tr>
<td>Direct Resistance</td>
<td>9.035</td>
<td>-50°C to 25°C (-58°F to 77°F)</td>
<td>10°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>-65°C to 28°C (-85°F to 82°F)</td>
</tr>
<tr>
<td>Ohms</td>
<td>0-200 ohms</td>
<td>0-20 ohms</td>
<td>±0.4 ohms</td>
<td>0-200 ohms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-2000 ohms</td>
<td>10 ohms</td>
<td>±0.1%</td>
<td>0-1000 ohms</td>
<td></td>
</tr>
<tr>
<td>Potentiometer</td>
<td>0-4000 ohms</td>
<td>0-4000 ohms</td>
<td>±0.1%</td>
<td>0-1000 ohms</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>n/a</td>
<td>-180°C to 76°C (-292°F to 168°F)</td>
<td>35°C</td>
<td>±0.25°C (±0.45°F)</td>
<td>-210°C to 77°C (-346°F to 148°F)</td>
</tr>
<tr>
<td>K</td>
<td>n/a</td>
<td>-150°C to 137°C (-238°F to 278°F)</td>
<td>40°C</td>
<td>±0.3°C (±0.5°F)</td>
<td>-270°C to 139°C (-454°F to 253°C)</td>
</tr>
<tr>
<td>L</td>
<td>n/a</td>
<td>-170°C to 100°C (-274°F to 392°F)</td>
<td>35°C</td>
<td>±0.2°C (±0.36°F)</td>
<td>-270°C to 101°C (-454°F to 185°C)</td>
</tr>
<tr>
<td>T</td>
<td>n/a</td>
<td>-170°C to 400°C (-274°F to 752°F)</td>
<td>35°C</td>
<td>±0.25°C (±0.45°F)</td>
<td>-270°C to 407°C (-454°F to 752°C)</td>
</tr>
<tr>
<td>R</td>
<td>n/a</td>
<td>0°C to 760°C (32°F to 1400°F)</td>
<td>50°C</td>
<td>±0.55°C (±1.0°F)</td>
<td>-50°C to 178°C (-58°F to 346°F)</td>
</tr>
<tr>
<td>S</td>
<td>n/a</td>
<td>0°C to 1760°C (32°F to 3400°F)</td>
<td>50°C</td>
<td>±0.55°C (±1.0°F)</td>
<td>-50°C to 178°C (-58°F to 346°F)</td>
</tr>
<tr>
<td>B</td>
<td>n/a</td>
<td>-400°C to 182°C (-650°F to 332°F)</td>
<td>75°C</td>
<td>±0.7°C (±1.3°F)</td>
<td>200 to 1836°C (392 to 3336°F)</td>
</tr>
<tr>
<td>N</td>
<td>n/a</td>
<td>-130°C to 130°C (-202°F to 266°F)</td>
<td>45°C</td>
<td>±0.4°C (±0.72°F)</td>
<td>-270°C to 131°C (-454°F to 266°F)</td>
</tr>
<tr>
<td>C</td>
<td>n/a</td>
<td>0°C to 2300°C (32°F to 4172°F)</td>
<td>100°C</td>
<td>±0.8°C (±1.4°F)</td>
<td>0 to 2338°C (32°F to 4204°F)</td>
</tr>
<tr>
<td>mV</td>
<td>DC</td>
<td>n/a</td>
<td>n/a</td>
<td>±50 microvolts</td>
<td>-50 to 1000mV</td>
</tr>
</tbody>
</table>
### Ordering Information

<table>
<thead>
<tr>
<th>Unit</th>
<th>Input</th>
<th>Output</th>
<th>Power</th>
<th>Options</th>
<th>Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPA2 Programmable Limit Alarm Trip</td>
<td>HLPRG</td>
<td>2PRG Dual Relays (Relays are single-pole/double-throw (SPDT, 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive))</td>
<td>U Universal accepts any power input range of 21.6-375Vdc or 90-260Vac</td>
<td>-AO 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) Voltage output, -0.5-11V</td>
<td>DIN DIN-style housing mounts on 35mm (EN50022) Top Hat DIN-rails</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4PRG Quad Relays (Relays are single-pole/double-throw (SPDT), 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive)</td>
<td></td>
<td></td>
<td>FLB Flange mount bracket for wall mounting provides a secure mount for high vibration applications</td>
</tr>
<tr>
<td>TPRG Programs to accept:</td>
<td>RTD 2-, 3- and 4-wire; platinum, copper, and nickel</td>
<td>Each relay individually configures for: High or Low Trip Normally Open or Normally Closed Failsafe or Non-Failsafe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermocouple: J, K, E, T, R, S, N, C, B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ohms: 0-4000ohms (Potentiometer, 4000ohms maximum)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Millivolts: –50 to +1000mV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: SPA2 / TPRG / 2PRG / U / - AO [DIN]

### Table 3. Long-Term Stability

<table>
<thead>
<tr>
<th>Stability (% of Maximum Span)</th>
<th>Input-to-Output (Years)</th>
<th>Input-to-Relay (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>RTD, Ohm &amp; Pot Inputs</td>
<td>0.09</td>
<td>0.16</td>
</tr>
<tr>
<td>T/C &amp; mV Inputs</td>
<td>0.08</td>
<td>0.14</td>
</tr>
</tbody>
</table>

### Table 4. Ambient Temperature Effect

#### RTD

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Accuracy per 1°C (1.8°F) Change in Ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RTD*</td>
</tr>
<tr>
<td>T/C, J, K, N, C, E</td>
<td>0.0035°C</td>
</tr>
<tr>
<td>T/C, T, R, S, B</td>
<td></td>
</tr>
<tr>
<td>Pt RTD: 100, 200, 300 ohms</td>
<td></td>
</tr>
<tr>
<td>Pt RTD: 400, 500, 1000 ohms</td>
<td></td>
</tr>
<tr>
<td>Ni: 120 ohms</td>
<td></td>
</tr>
<tr>
<td>Cu: 9.03 ohms</td>
<td></td>
</tr>
</tbody>
</table>

#### Millivolt

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Accuracy per 1°C (1.8°F) Change in Ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>0.00016°C + 0.005% of reading</td>
</tr>
<tr>
<td>K</td>
<td>0.0002°C + 0.005% of reading</td>
</tr>
<tr>
<td>E</td>
<td>0.00026°C + 0.005% of reading</td>
</tr>
<tr>
<td>T</td>
<td>0.0001°C + 0.005% of reading</td>
</tr>
<tr>
<td>R, S</td>
<td>0.00075°C + 0.005% of reading</td>
</tr>
<tr>
<td>B</td>
<td>0.0038°C + 0.005% of reading</td>
</tr>
<tr>
<td>N</td>
<td>0.003°C + 0.005% of reading</td>
</tr>
<tr>
<td>C</td>
<td>0.00043°C + 0.005% of reading</td>
</tr>
<tr>
<td>mV</td>
<td>0.5 microvolts + 0.005% of reading</td>
</tr>
</tbody>
</table>

#### Ohm

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Accuracy per 1°C (1.8°F) Change in Ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td></td>
</tr>
<tr>
<td>R, S</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>mV</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5. Normal Mode Rejection Ratio

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

*Accuracy of Ni672 is 0.002°C
NOTE: While all SPA² models (model with HLPRG input shown) are dimensionally identical, the SPA² that accepts temperature inputs (TPRG input) features metal terminal blocks for enhanced reference junction compensation.
### Table 6. Terminal Designations (Models with TPRG Input)

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Top Terminals (Left to Right)</th>
<th>Middle Terminals (Left to Right)</th>
<th>Bottom Terminals (Left to Right)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD, Ohm, Potentiometer, T/C &amp; mV Inputs</td>
<td>T1 T2 T3 T4 T5 T6 T7 T8 T9 T10</td>
<td>N/A N/A N/A N/A N/A N/A N/A N/A</td>
<td>N/A N/A N/A N/A N/A N/A N/A N/A</td>
</tr>
<tr>
<td></td>
<td>See Figure 12</td>
<td>CM3 NC3 NO4 CM4 NC4</td>
<td>CM1 NC1 NO2 CM2 NC2</td>
</tr>
<tr>
<td>Output Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2PRG (SPDT Relays)</td>
<td>11 12 13 14 15 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4PRG (SPDT Relays)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 DPDT Relays</td>
<td>Relay 2 NO1 Relay 2 CM1 Relay 2 NC1 Relay 2 NO2 Relay 2 CM2 Relay 2 NC2</td>
<td>Relay 1 NO1 Relay 1 CM1 Relay 1 NC1 Relay 1 NO2 Relay 1 CM2 Relay 1 NC2</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. Terminal blocks can accommodate 14-22 AWG solid wiring, tighten to four inch-pounds (maximum).
2. ±Io/±Vo 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)
- Io = Current Output
- MR = Manual Reset
- NC = Normally Closed
- AC or DC = Power Input
- ACC or DCC

### Accessories
Each SPA² order comes with one copy of our Intelligent PC Configuration Software. Use the chart below to order additional parts.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>750-75E05-01</td>
<td>Intelligent PC Configuration Software</td>
<td>(One copy provided free with each order)</td>
</tr>
<tr>
<td>803-053-26</td>
<td>Serial Configuration Cable for use in connecting the SPA² to a PC</td>
<td></td>
</tr>
<tr>
<td>804-030-26</td>
<td>Fuse Protected, Non-Isolated USB Communication Cable</td>
<td></td>
</tr>
</tbody>
</table>
### Table 7. Terminal Designations (Models with HLPRG Input)

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Top Terminals (Left to Right)</th>
<th>Middle Terminals (Left to Right)</th>
<th>Bottom Terminals (Left to Right)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td>Current Input</td>
<td>Tx</td>
<td>+I</td>
<td>COM</td>
</tr>
<tr>
<td>Voltage Input</td>
<td>Tx</td>
<td>Not Used</td>
<td>COM</td>
</tr>
<tr>
<td>Output Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output/Power Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2PRG (SPDT Relays)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4PRG (SPDT Relays)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 DPDT Relays</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. Terminal blocks can accommodate 14-22 AWG solid wiring, tighten to four inch-pounds (maximum).
2. ±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
- SPDT = Double-Pole/Double-Throw
- GND = Ground (case)
- I = Current Input
- Io = Current Output
- MR = Manual Reset
- NC = Normally Closed
- Sink = Current Sink
- Source = Current Source
- TX = Power for 2-wire transmitter
- V = Voltage Input
- Vo = Voltage Output
SPA² Programmable Current/Voltage
and RTD/Thermocouple Limit Alarm Trips

Do you Need an Intrinsically-Safe
Alarm Solution?

SPA²IS has Intrinsically-Safe Field Connections
For facilities that employ intrinsic safety measures, the SPA²IS 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 SPA²IS 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 SPA²IS 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 SPA²IS 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 SPA²IS
• 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 SPA²IS 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 SPA²IS 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.

Specifications and information subject to change without notice.