MOORE INDUSTRIES WORLDWIDE

SPA²

Programmable Current/Voltage and RTD/Thermocouple Limit Alarm Trips

May 2017

Description

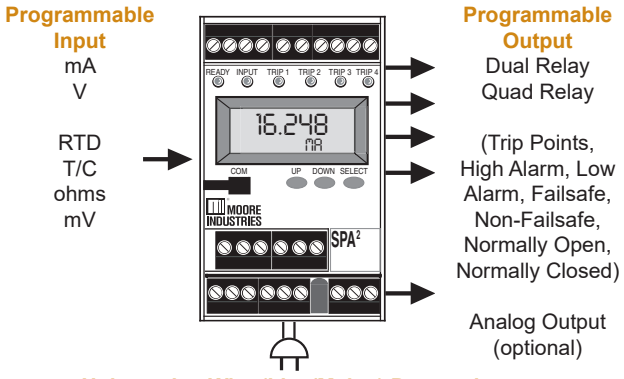
The universal SPA² Programmable Limit Alarm Trips provide on/off control, warn of unwanted process conditions, alarm on rate-of-change and provide emergency shutdown. Very versatile, they accept a signal input from transmitters, temperature sensors and a wide array of other monitoring and control instruments:

- **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.*



Universal, 4-Wire (Line/Mains) Powered
21.6-375Vdc or 90-260Vac

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

The SPA² 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 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.

SPA²

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, 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 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.

Figure 2. *The SPA² provides transmitter excitation to power a 2-wire transmitter.*

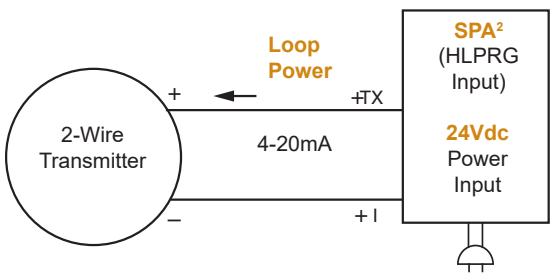
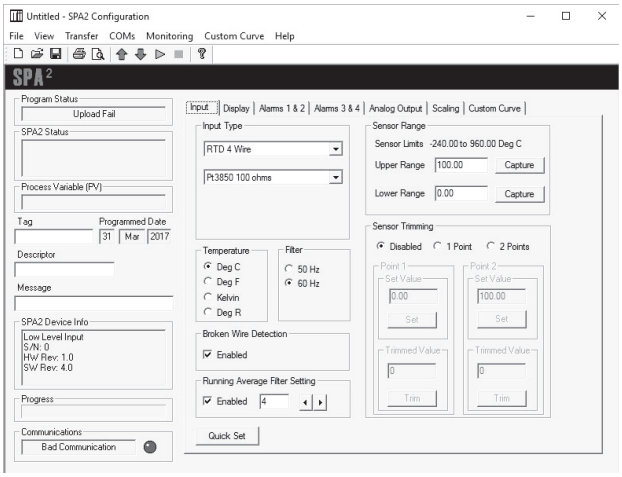


Figure 3. *In addition to pushbutton configuration, the SPA² programs quickly from a single software window.*



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.

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.*

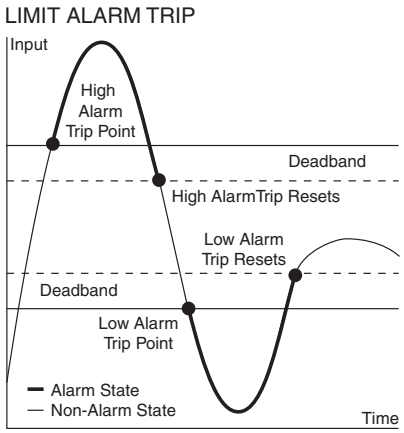


Figure 5. *The SPA² can be used as a simple on/off controller such as those required in level applications (pump/valve control) when filling or emptying a container or tank.*

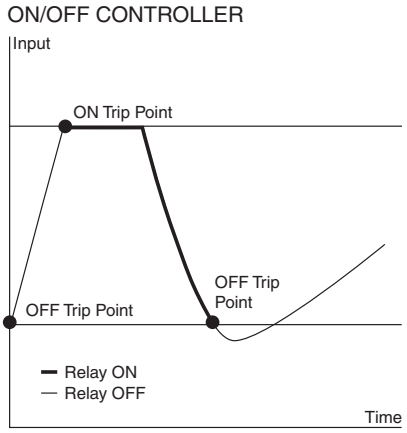
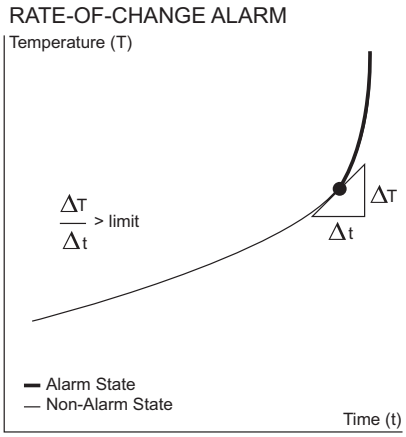


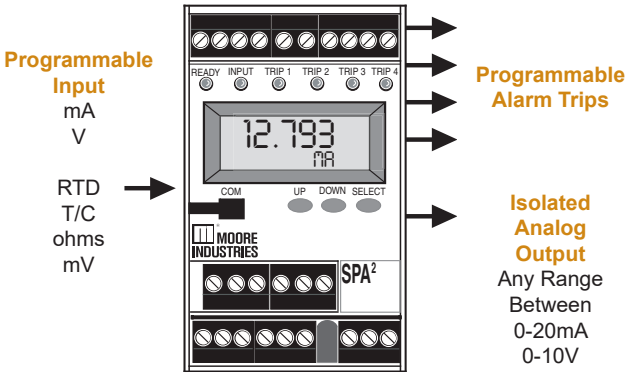
Figure 6. *The SPA² can be set to trip when the input rate-of-change exceeds a user-selected rate (Delta) over a user-selected time period (Delta Time).*



Combination Alarm and Isolated Transmitter

When ordered with the Analog Output (-AO) option, the SPA² 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 SPA² 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 SPA² 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. SPA² 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.

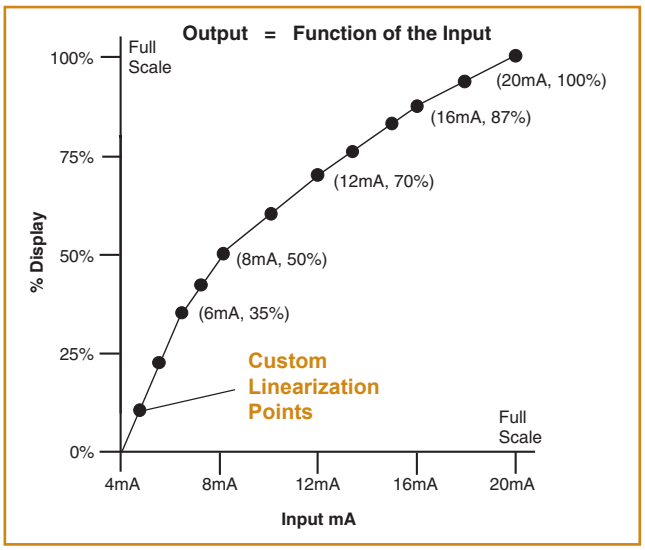
Continuous Self-Diagnostics

Incorporating advanced self-diagnostics, the SPA² 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 SPA²'s memory to compensate for non-linear input signals.*



Total Sensor Diagnostics for RTD Inputs

Our SPA² 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 SPA² 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 SPA² can be set to measure the segment most critical to the process.*

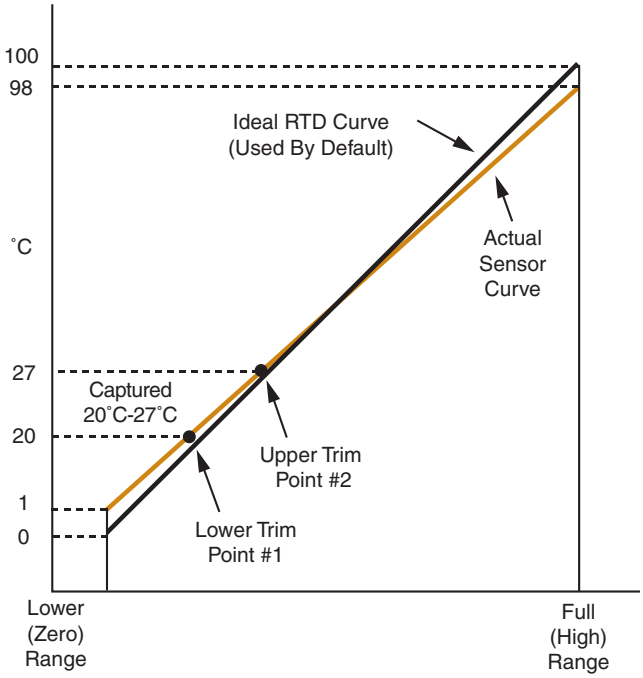
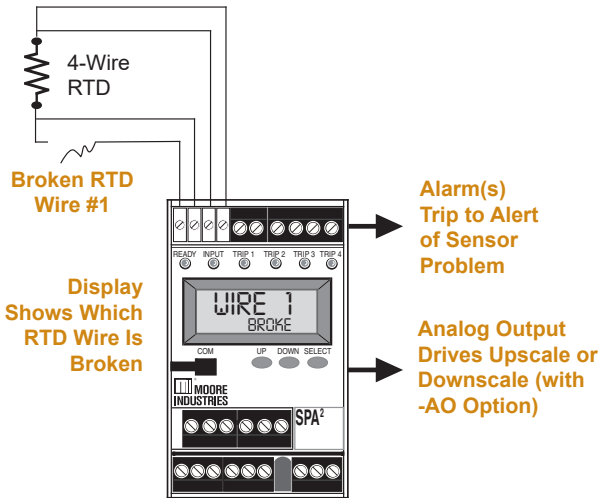


Figure 10. *Patented "Total Sensor Diagnostics" saves troubleshooting time by identifying which sensor wire has broken.*



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
Response Time: 256msec maximum (Defined as the time from step change on input to alarm state change when alarm is set to trip mid-point)
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 Impedance: Current inputs, 20 ohms; Voltage inputs, 1 Mohm
Input Over-Range Protection: Voltage inputs, ±30Vdc; Current inputs, ±100mA

Performance (continued)

TX Power Supply: 24Vdc, ±10%@24mA (regulated)
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

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,

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
Load Capability: Source mode (internal power supply), 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

Operating Range: -40°C to +85°C (-40°F to +185°F)
Storage Range: -40°C to +85°C (-40°F to +185°F)

Ambient Conditions (continued)

Ambient Temperature Effect: Current, 2 microamps/°C; Voltage, 1mV/°C; Output, ±0.009% of maximum span/°C
Relative Humidity: 0-95%, non-condensing
RFI/EMI Protection: 80% AM at 1Khz 20V/m @ 20-1000Mhz per IEC61000-4-3.
Noise Rejection: Common Mode, 100dB@50/60Hz Normal Mode, Current Input, 70dB typical@50mAp-p@ 50/60Hz; Voltage Input, 70dB typical@1Vp-p@ 50/60Hz

Adjustments

Front panel pushbuttons parameter configurations; Internal jumper and menu password protect parameter settings

Indicators

LCD: 2x5 14-segment characters, backlit, alphanumeric readout accurate to the nearest digit.
Range: -99999 to 99999; Decimal point can be user-set
LED Type: INPUT LED: Dual color LED indicates input failure
READY LED: Green LED indicates unit is operating properly
ALARM 1, 2, 3 and 4 LED: Dual color LED per relay indicates alarm status
Display Accuracy: ±1 digit; when scaling the display (or in Custom Mode), high input-to-display span ratios decrease display accuracy

Weight

544 g to 601 g (19.2 oz to 21.2 oz)

Table 1. *Long-Term Stability*

Stability (% of Maximum Span)	Input-to-Output (Years)			Input-to-Relay (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

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

Performance

Input Accuracy and Alarm Trip Repeatability: Refer to Table 2
Reference Junction Compensation Accuracy (T/C inputs only): ±0.45°C
Stability: Refer to Table 3
Dead Band: User set within selected input range; fully scaleable and set in user-selected engineering units
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 mid-point)
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: 3W typical, 5.5W maximum
Input Over-Range Protection: ±5Vdc
Input Impedance: T/C inputs, 40 Mohms, nominal
Input Over-Range Protection: ±5Vdc
Excitation Current: (RTD and Ohms) 250 microamps, ±10%

Performance (continued)

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

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 250ohm resistor; Voltage output, 50mVp-p maximum
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
Load Capability: Source mode (internal power supply), 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

Operating Range: -40°C to +85°C (-40°F to +185°F)
Storage Range: -40°C to +85°C (-40°F to +185°F)
Ambient Temperature Effect: Refer to Table 4
Effect of Ambient

Ambient Conditions (continued)

Temperature on Reference Junction Compensation (T/C inputs only): ±0.005% per °C change of ambient temperature
Relative Humidity: 0-95%, non-condensing
RFI/EMI Protection: 80% AM at 1Khz 20V/m @ 20-1000Mhz per IEC61000-4-3
Noise Rejection: Common Mode, 100dB@50/60Hz Normal Mode, refer to Table 5

Adjustments

Front panel pushbuttons parameter configurations; Internal jumper and menu password protect parameter settings

Indicators

LCD: 2x5 14-segment characters, backlit, alphanumeric readout accurate to the nearest digit.
Range: -99999 to 99999; Decimal point can be user-set
LED Type: INPUT LED: Dual color LED indicates input failure
READY LED: Green LED indicates unit is operating properly
ALARM 1, 2, 3 and 4 LED: Dual color LED per relay indicates alarm status
Display Accuracy: ±1 digit; when scaling the display (or in custom mode), high input-to-display span ratios decrease display accuracy

Weight

544 g to 601 g (19.2 oz to 21.2 oz)

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

Input	Type	α	Ohms	Conformance Range	Minimum Span	Input Accuracy/ Repeatability	Maximum Range
RTD (2-, 3-, 4-Wire) **Dual** (2-Wire, One 2-Wire and One 3-Wire) **Triple** (2-Wire)	**Platinum**	0.003850	100	-200 to 850°C (-328 to 1562°F)	10°C (18°F)	±0.1°C (±0.18°F)	-240 to 960°C (-400 to 1760°F)
			200				
			300				
			400				
			500				
			1000				
			Dual 500				
			Dual 1000	-200 to 260°C (-328 to 500°F)			-200 to 260°C (-328 to 500°F)
			Triple 500	-200 to 440°C (-328 to 824°F)			-200 to 440°C (-328 to 824°F)
			Triple 1000	-200 to 80°C (-328 to 176°F)			-200 to 80°C (-328 to 176°F)
		0.003902	100	-100 to 650°C (-148 to 1202°F)			-150 to 720°C (-238 to 1328°F)
			200				
			400				
			500				
			1000				
			Dual 500				
			Dual 1000	-100 to 260°C (-148 to 500°F)			-100 to 260°C (-148 to 500°F)
			Triple 500	-100 to 440°C (-148 to 824°F)			-100 to 440°C (-148 to 824°F)
			Triple 1000	-100 to 80°C (-148 to 176°F)			-100 to 80°C (-148 to 176°F)
		0.003916	100	-200 to 510°C (-328 to 950°F)			-240 to 580°C (-400 to 1076°F)
	Nickel	0.00672	120	-80 to 320°C (-112 to 608°F)			-100 to 360°C (-148 to 680°F)
	Copper	0.00427	9.035	-50 to 250°C (-58 to 482°F)		±0.85°C (±1.53°F)	-65 to 280°C (-85 to 536°F)
Ohms	**Direct Resistance**	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
	Potentiometer		4000 maximum	0-100%	10%	±0.1%	0-100%
T/C	**J**	n/a	n/a	-180 to 760°C (-292 to 1400°F)	35°C (63°F)	±0.25°C (±0.45°F)	-210 to 770°C (-346 to 1418°F)
	K	n/a	n/a	-150 to 1370°C (-238 to 2498°F)	40°C (72°F)	±0.3°C (±0.54°F)	-270 to 1390°C (-454 to 2534°F)
	E	n/a	n/a	-170 to 1000°C (-274 to 1832°F)	35°C (63°F)	±0.2°C (±0.36°F)	-270 to 1013°C (-454 to 1855.4°F)
	T	n/a	n/a	-170 to 400°C (-274 to 752°F)	35°C (63°F)	±0.25°C (±0.45°F)	-270 to 407°C (-454 to 764.6°F)
	R	n/a	n/a	0 to 1760°C (32 to 3200°F)	50°C (90°F)	±0.55°C (±0.99°F)	-50 to 1786°C (-58 to 3246.8°F)
	S	n/a	n/a	0 to 1760°C (32 to 3200°F)	50°C (90°F)	±0.55°C (±0.99°F)	-50 to 1786°C (-58 to 3246.8°F)
	B	n/a	n/a	400 to 1820°C (752 to 3308°F)	75°C (135°F)	±0.75°C (±1.35°F)	200 to 1836°C (392 to 3336.8°F)
	N	n/a	n/a	-130 to 1300°C (-202 to 2372°F)	45°C (81°F)	±0.4°C (±0.72°F)	-270 to 1316°C (-454 to 2400.8°F)
	C	n/a	n/a	0 to 2300°C (32 to 4172°F)	100°C (180°F)	±0.8°C (±1.44°F)	0 to 2338°C (32 to 4240.4°F)
mV	**DC**	n/a	n/a	n/a	4mV	±30 microvolts	-50 to 1000mV

SPA²

Programmable Current/Voltage
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Ordering Information

Unit	Input	Output	Power	Options	Housing
SPA2 Programmable Limit Alarm Trip	**HLPRG** Programs to accept: Current: Any range between 0-50mA including: 0-20mA 4-20mA 10-50mA Voltage: Any range between 0-10Vdc including: 0-5Vdc 1-5Vdc 0-10Vdc **TPRG** Programs to accept (see Table 2 for details): RTD: 2-, 3- and 4-wire; platinum, copper, and nickel Thermocouple: J, K, E, T, R, S, N, C, B Ohms: 0-4000ohms (Potentiometer, 4000ohms maximum) Millivolts: –50 to +1000mV	**2PRG** Dual Relays (Relays are single-pole/double-throw (SPDT, 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive) **4PRG** Quad Relays (Relays are single-pole/double-throw (SPDT), 1 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive) Each relay individually configures for: High or Low Trip Normally Open or Normally Closed Failsafe or Non-Failsafe	**U** Universal accepts any power input range of 21.6-375Vdc or 90-260Vac	**-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 NOTE: Current output can be user-set for internal or external power (source or sink) **-DPDT** Relays are double-pole/double-throw (DPDT), 2 form C, rated 5A@250Vac, 50/60Hz or 24Vdc, non-inductive (2PRG output model only) **-FMEDA** Unit comes with Failure Modes, Effects and Diagnostic Analysis (FMEDA) data for evaluating the instrument for suitability of use in a safety-related application **-VTD** Standard Factory Calibration with NIST Test Data Report	**DIN** DIN-style housing mounts on 35mm (EN50022) Top Hat DIN-rails **FLB** 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 (% of Maximum Span)	Input-to-Output (Years)			Input-to-Relay (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*

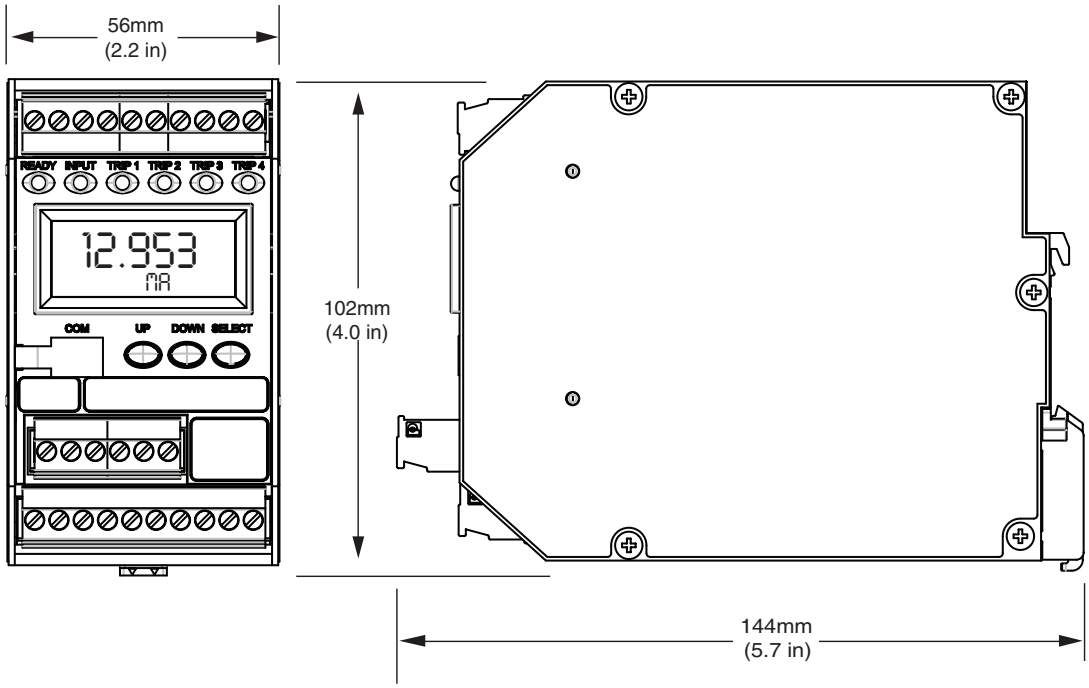
Sensor Type		Max. p-p Voltage Injection for 100dB at 50/60Hz
T/C: J, K, N, C, E		150mV
T/C: T, R, S, B		80mV
Pt RTD: 100, 200, 300 ohms		250mV
Pt RTD: 400, 500, 1000 ohms		1V
Ni: 120 ohms		500mV
Cu: 9.03 ohms		100mV
Resistance	**mV**	
1-4 kohms	250-1000	1V
0.25-1 kohms	62.5-250	250mV
0.125-0.25 kohms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

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

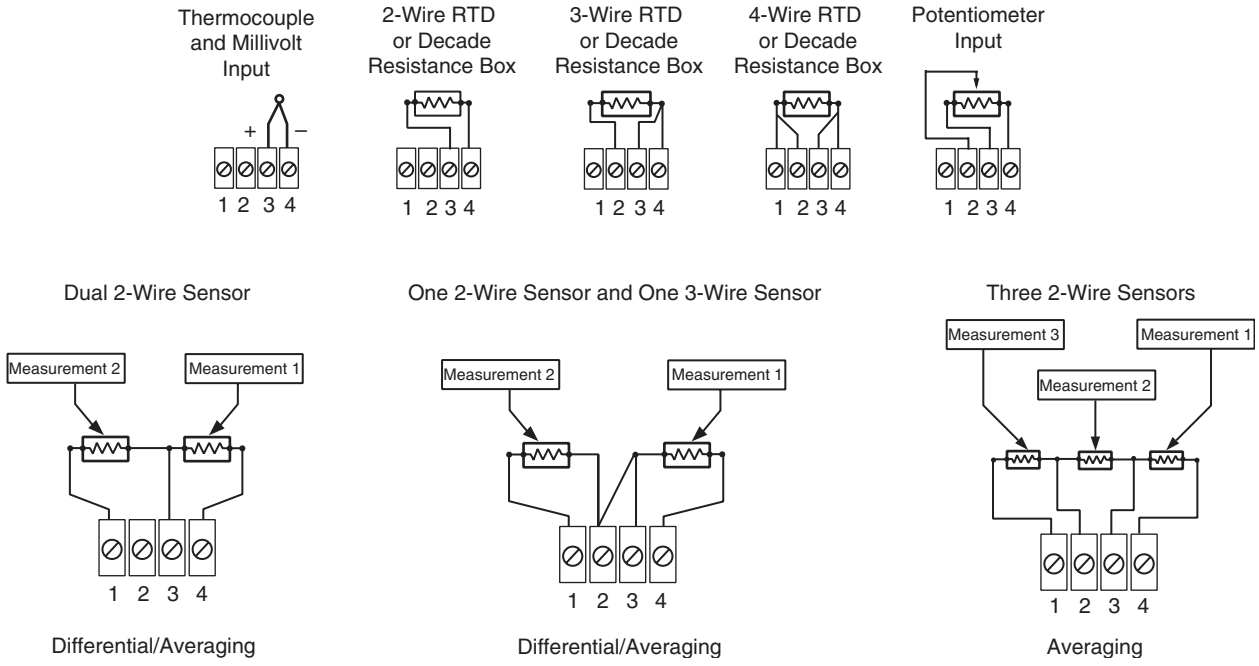


Table 6. *Terminal Designations (Models with TPRG Input)*

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

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

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

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
NO = Normally Open
NC = Normally Closed
Sink = Current Sink
Source = Current Source
SPDT = Single-Pole/Double-Throw
Vo = Voltage Output

Accessories

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

Part Number **750-75E05-01**	**Intelligent PC Configuration Software** (One copy provided free with each order)
Part Number **803-053-26**	**Serial Configuration Cable** for use in connecting the SPA² to a PC
Part Number **804-030-26**	**Fuse Protected, Non-Isolated USB Communication Cable**

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 +Io Sink	+Vo	-Vo -Io Sink
Voltage Input	Tx	Not Used	COM	+V	MR	MR	+Io Source	-Io Source +Io Sink	+Vo	-Vo -Io Sink

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

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

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
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