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*Programmable Current/Voltage  
Limit Alarm Trips*

# SPA<sup>2</sup>

## HLPRG

# SPA<sup>2</sup> Programmable Current/Voltage Limit Alarm Trips



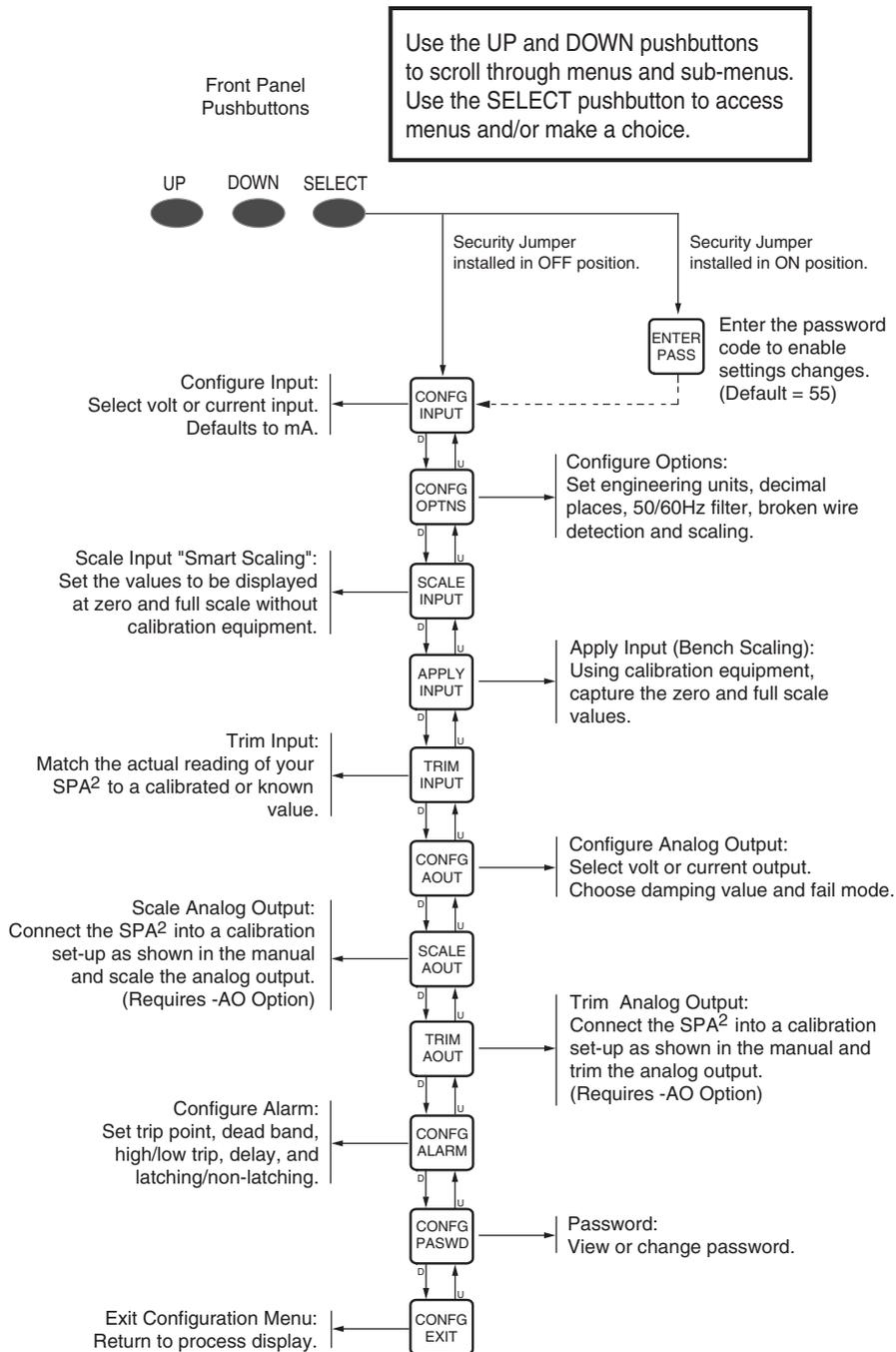
# SPA<sup>2</sup> (HLPRG) Quickstart Guide

Use the front pushbuttons to quickly and easily set-up the SPA<sup>2</sup> for your application. After programming your alarm using the diagram below, install the unit into your application using the connection diagrams and terminal designation table located in this manual.

## Default/Factory Configuration

The following are the default factory settings for your unit.

Input mA, 4-20mA  
 Display Normal Mode, PV  
 60Hz Filter  
 Broken wire enabled, level set to 0.1  
 Running Average Filter set to 4  
 All alarms set to Trip High at 12mA with Deadband set to 0  
 All alarms range set to 4-20mA  
 All alarms have OOR & Input Failure disabled  
 All alarms are configured as Fail Safe, latching disabled, 0 delay  
 AO(if fitted) : Current 4-20mA, fail high, hold duration of 1 second



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## Introduction

This is the user's manual for Moore Industries' SPA<sup>2</sup> (HLPRG): Programmable Current/Voltage Limit Alarm. The instrument is configured using a combination of front panel pushbuttons and a dedicated PC Configuration Program. The SPA<sup>2</sup> monitors a process variable and provides up to four, fully user configurable contact closure outputs that can be individually programmed to trip whenever the input falls outside a user-set, high or low trip point. The SPA<sup>2</sup> is typically used to activate a warning light, bell or buzzer; or to initiate a system shutdown. Thus, the instrument acts as a simple, but highly reliable and effective means of monitoring and safe-guarding a process.

## About this Manual

Wherever you see a "**Note**", "**Caution**" or "**WARNING**" pay particular attention.

**WARNING** - Hazardous procedure or condition that could injure the operator.

**Caution** - Hazardous procedure or condition that could damage or destroy the unit.

**Note** - Information that is helpful for a procedure, condition, or operation of the unit.

## Model and Serial Numbers

Moore Industries uses a system of model and serial numbers to keep track of all of the information on every unit it sells and services. If a problem occurs with your SPA<sup>2</sup>, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

## Inputs

The SPA<sup>2</sup> (HLPRG) ("High Level" Programmable input), handles either current inputs from 0-50mA (1mA minimum span) or voltage inputs from 0-10V (250mV minimum span).

## Outputs

### Alarms

The SPA<sup>2</sup> can be ordered with two (-2PRG) or four (-4PRG) contact closure alarms. Each alarm can be individually programmed.

### 2PRG

This is a two relay output with 5A@250Vac or 24Vdc, 50/60Hz non-inductive contact rating. The contact arrangement is SPDT; however, the -2PRG output is also available in a DPDT contact arrangement. All relay contacts (NO, NC and COM) are available for use. No jumpers are required.

### 4PRG

This is a four relay output with 5A@250Vac or 24Vdc, 50/60Hz non-inductive contact rating. The contact arrangement is SPDT. All relay contacts (NO, NC and COM) are available for use. No jumpers are required.

### TX Power

A transmitter excitation power supply (24Vdc  $\pm 10\%$ @24mA) is standard on the SPA<sup>2</sup> (HLPRG). You may access this externally at the terminals shown in Figure 3.

## Options

### Analog Output (-AO)

The SPA<sup>2</sup> can be equipped with a scaleable output option to provide a 0-20mA or 0-10V output. -AO equipped units are set by the user to provide either current (user-configurable between source or sink) or voltage.

## Internal Settings

The password security function of the SPA<sup>2</sup> is controlled by a single jumper inside the top of the unit housing. You will need to remove the top cover in order to access the jumper. Refer to Figure 2 for location and jumper settings.

# SPA<sup>2</sup>

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### Alarm Terminology

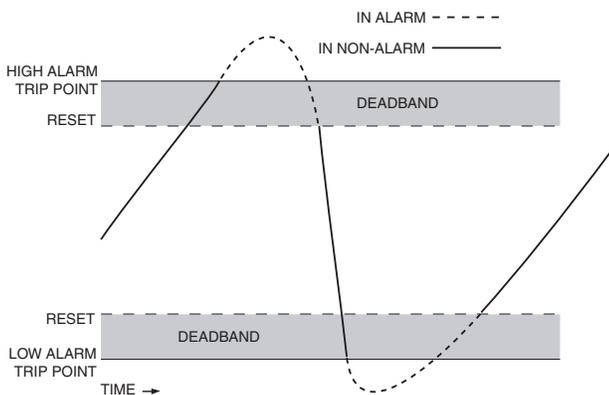
Before setting up the SPA<sup>2</sup>, or incorporating the unit in your application, Moore Industries suggests that all users take a few moments to become familiar with some of the terms associated with the use of process instrumentation alarms. The figure below illustrates the way the SPA<sup>2</sup> alarms operate.

The **Trip Point** is the process input level at which the user wants an alarm relay to change state, typically going into an alarm condition, or “tripping”. In the SPA<sup>2</sup>, the user sets the trip point for each installed relay.

**High/Low Alarms;** High Alarms trip when the process input goes above the trip point. Low Alarms trip when the process input drops below the trip point. Each of the SPA<sup>2</sup> outputs can be set by the user to function independently as either high or low alarms.

**Latching and Non-latching Alarms;** once tripped, a latching alarm remains in alarm until the input returns to a non-alarm level *AND* is manually reset. Non-latching alarms return to a non-alarm state whenever the process input returns to the Reset Point. The SPA<sup>2</sup> relays can be set by the user to function as either latching or non-latching.

How Alarms Work with the Process Input



The **Reset Point** is the process input level at which the user wants an alarm relay to change state, typically going from alarm to non-alarm. The reset point is not necessarily the same as the trip point, because most applications call for a buffer zone or “*Deadband*” around the trip point to allow for minute fluctuations in the process input. In the SPA<sup>2</sup>, the reset point is determined by the deadband setting. Latching SPA<sup>2</sup> alarms will not “clear” unless the reset point has been reached or passed *AND* the manual reset contacts have been shorted.

The **Deadband** is the range in which an alarm remains tripped even after the process input has returned to or passed the trip point. Deadband is not required. When it is not incorporated into an alarm application, the trip point and reset point are the same. The deadband of the SPA<sup>2</sup> is set by the user.

**Failsafe Alarms** are de-energized when tripped, energized when the process input is at a non-alarm level. Non-failsafe Alarms are energized whenever tripped, de-energized when the process input is at a non-alarm level. The relays in the SPA<sup>2</sup> can be switched from failsafe to non-failsafe at any time by the user.

**Normal** is the term used to describe the “shelf-state” of relay contacts. The contacts of a *Normally Open* relay are open (infinite resistance) when the relay is not energized. The contacts of a *Normally Closed* relay are open when the relay is energized (closed when not energized).

#### **NOTE:**

*Sometimes a non-alarm input level is referred to as being in a “normal” condition. This practice is intentionally avoided in this manual. Do not confuse the term “normal”, as in Normally Open or Normally Closed, with a non-alarm input condition. In this manual, “normal” is an exclusive reference to the shelf state or quiescent state of an alarm’s relay contacts, whether open or closed.*

### Specifications

<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, <math>\pm 2</math> microamps (0.01% of 20mA span); Voltage inputs, <math>\pm 1</math>mV (0.01% of max. span)</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 at mid-point)</p> <p><b>Alarm Trip Delay:</b> Programmable from 0-120 seconds</p> <p><b>Power Supply Effect:</b> <math>\pm 0.002\%</math> 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 two seconds (with no breakdown)</p> <p><b>Power Supply:</b> Universal 21.6-375Vdc or 90-260Vac; 24DC range, 18-30Vdc; UAC range, 90-260Vdc; 110DC range, 75-150Vdc;</p> <p><b>Power Consumption:</b> 3.5W typical, 6W max</p> <p><b>Input Impedance:</b> Current inputs, 20ohms; Voltage inputs, 1Mohm</p> <p><b>Input Over-Range Protection:</b> Voltage inputs, <math>\pm 30</math>Vdc of max. input span; Current inputs, <math>\pm 100</math>mA of max. input span</p>	<p><b>Performance (continued)</b> <b>TX Power Supply:</b> 24Vdc, <math>\pm 10\%</math>@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, <math>\pm 0.01\%</math> of max. span (<math>\pm 2</math> microamps); Voltage, <math>\pm 0.01\%</math> of max. span (<math>\pm 1</math>mV)</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 max.</p> <p><b>Output Limiting:</b> Current outputs, <table border="1" style="display: inline-table; vertical-align: middle;"> <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 (0&lt;X&lt;4)</td> <td>(90% of X), 23.6mA</td> </tr> </table> Voltage output, -0.5-11V</p> <p><b>Load Capability:</b> Source mode (internal power supply), 0-1000 ohms for current output; greater then or equal to 2000 ohms resistance on current output</p> <p><b>Load Effect (current outputs):</b> <math>\pm 0.01\%</math> 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> <p><b>Ambient Temperature Effect:</b> Current, 2 microamps/°C; Voltage, 1mV/°C; Output, <math>\pm 0.009\%</math> of max. span/°C</p> <p><b>Relative Humidity:</b> 0-95% non-condensing</p>	Output	Failure Limits	0-20mA	0, 23.6mA	4-20mA	3.6, 23.6mA	X-20mA (0<X<4)	(90% of X), 23.6mA	<p><b>Ambient Conditions (continued)</b> <b>RFI/EMI Protection:</b> With Universal Power Supply or -RF Option: 80% AM at 1Khz 20V/m @ 20-1000Mhz per IEC61000-4-3. All other units: 80% AM at 1Khz 10V/m @ 20-1000Mhz per IEC61000-4-3.</p> <p><b>Noise Rejection:</b> Common Mode, 100dB@50/60Hz Normal Mode, Current Input, 70dB typical@50mAp-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. <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 READY LED: Green LED indicates unit is operating properly ALARM 1, 2, 3 and 4 LED: Dual color LED per relay indicates alarm status</p> <p><b>Display Accuracy:</b> <math>\pm 1</math> 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>
Output	Failure Limits									
0-20mA	0, 23.6mA									
4-20mA	3.6, 23.6mA									
X-20mA (0<X<4)	(90% of X), 23.6mA									

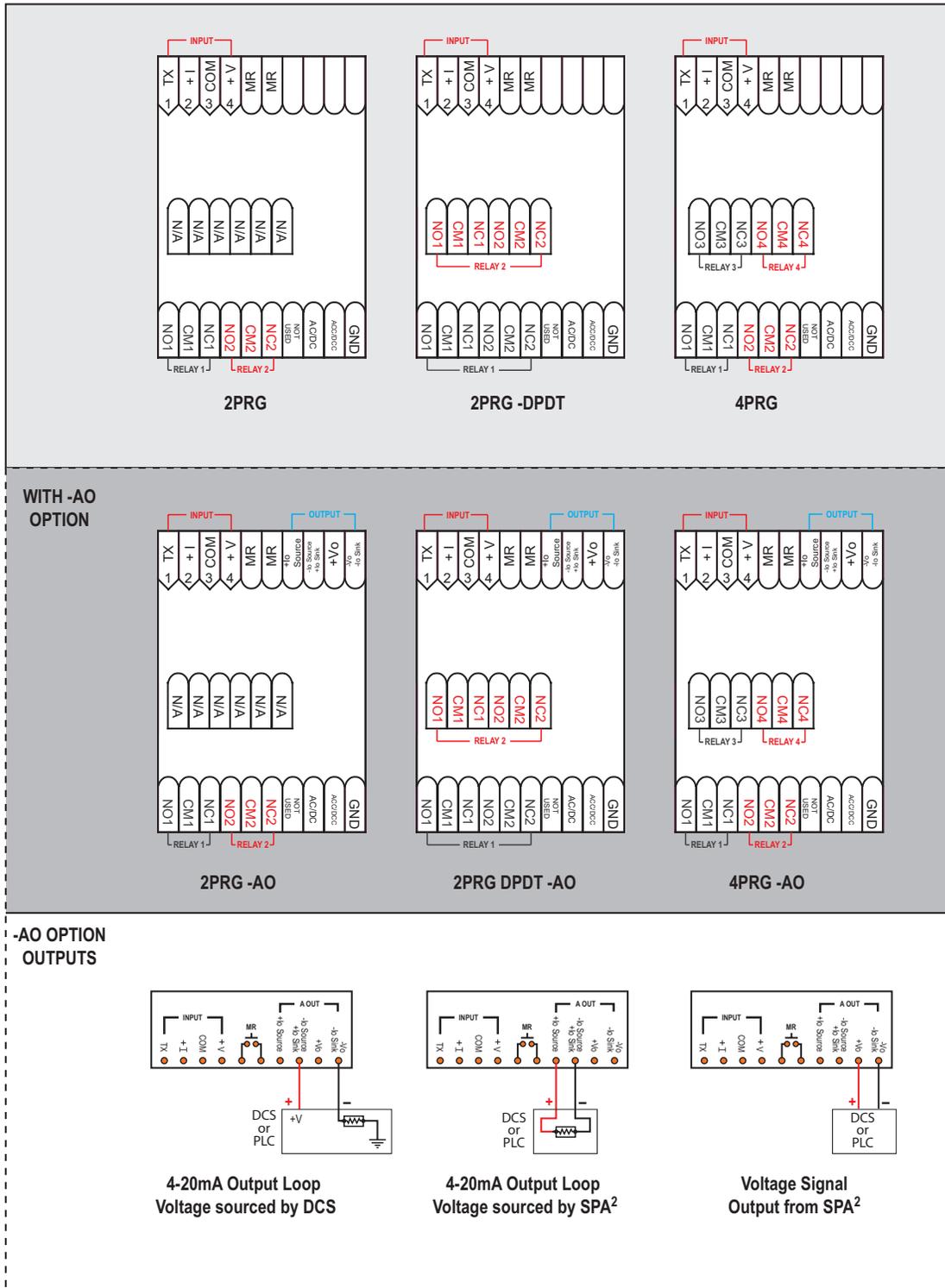
Specifications and information subject to change without notice.

**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	0.81	0.105
Voltage Inputs	0.093	0.16	0.21	0.066	0.114	0.147



**Table 2.** SPA<sup>2</sup> (HLPRG) Terminal Designations



**NOTES:**

1. Terminal blocks can accommodate 14-22 AWG solid wiring.
2. ±I/±Vo labeling is present only when the unit is equipped with the Analog Output (-AO) option.
3. Your input power requirement (AC or DC / ACC or DCC) will depend upon your unit's power need.

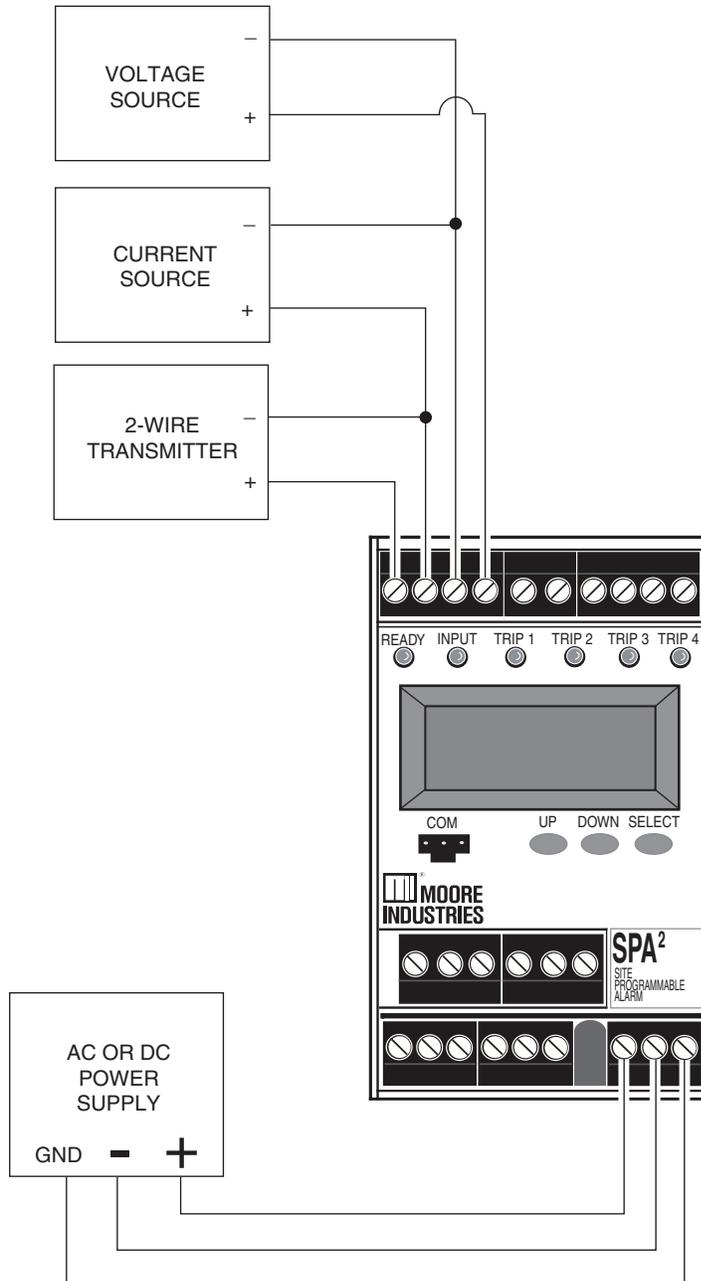
**KEY:**

- |                                 |                      |                                   |
|---------------------------------|----------------------|-----------------------------------|
| AC/DC = Power Input             | I = Current Input    | Source = Current Source           |
| ACC/DCC = Power Input           | Io = Current Output  | SPDT = Single-Pole/Double-Throw   |
| CM = Relay Common               | NO = Normally Open   | MR = Manual Reset                 |
| COM = Analog Common             | NC = Normally Closed | TX = Power for 2-wire transmitter |
| DPDT = Double-Pole/Double-Throw | GND = Ground         | V = Voltage Input                 |
|                                 |                      | Vo = Voltage Output               |
|                                 |                      | Sink = Current Sink               |

# SPA<sup>2</sup>

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Figure 3. SPA<sup>2</sup> (HLPRG) Hook-Up Diagram For Front Panel Configuration



## SPA<sup>2</sup> Configuration: Front Panel Pushbuttons

The SPA<sup>2</sup> (HLPRG) operating parameters may be set using front panel pushbuttons and/or Moore Industries' PC Configuration Software. This section describes configuration via the front panel pushbuttons.

There are three pushbuttons on the unit's front panel; *UP*, *DOWN* and *SELECT*. Together with the prompting messages displayed on the LCD, these are used to access menus, and to view and change the settings.

Use *SELECT* as your "Enter" button, to make your selections.

Use the *UP* and *DOWN* buttons to navigate within the menus.

**Note:**

*Refer to the SPA<sup>2</sup> HLPRG QuickStart Guide to see the default factory settings for your unit. All parameters, except the Custom Curve Table feature, can be configured using the front panel pushbuttons. The Custom Curve table can only be configured using the PC Configuration Software Program.*

## Main Menu/View Settings

Figure 4 gives an overview of the Main menu; the View menu is shown in Figure 5.

Upon power-up, the SPA<sup>2</sup> defaults to a display of the measured value. Pressing the *DOWN* button accesses a series of displays that show, in succession, the settings currently stored in unit memory.

Depending upon whether or not the Security Jumper has been installed (Figure 2), pressing *SELECT* will access either the first screen in the main configuration menu, "CONFIG INPUT", or the password code query screen, "ENTER PASS".

Once the Main Menu has been accessed, the *DOWN* button is used to move through all of the sub-menus in a loop. Pressing the *SELECT* button accesses the first screen of the sub-menu shown on the LCD.

## Password

This menu is bypassed if the Password Security Jumper is not installed. If the jumper is installed, the menu comes up when *SELECT* is pressed from the display of the process variable input. To access the security jumpers, you must remove the top cover (refer to Figure 2). The menu is shown as part of Figure 4. Refer to the *Password Configuration* section of this manual for a more detailed description of the password feature.

1. If the jumper is installed, pressing *SELECT* from the display of the process variable input will bring up the "ENTER PASS" screen.
2. Press *SELECT* again to enter the "PASS" screen. Use the *UP* and *DOWN* buttons to enter "55", the default screen for this point in the menu.
3. If a password has been set (four characters, maximum), use the *UP* or *DOWN* buttons to display the correct password.

When the correct password number is displayed, press *SELECT*.

**Note:**

*If the correct password is not known, the unit settings can be viewed, but not changed.*

4. If you have entered the correct password, the input configuration menu, "CONFIG INPUT", will be accessed. If not, the display will show a "VIEW ONLY" message.
5. From "VIEW ONLY", press *SELECT* to go back to the process variable input. Use the *UP* and *DOWN* buttons to view the settings in the various menus. The "VIEW ONLY" mode locks out any attempt to make changes to the settings.

**Note:**

*The menu to set or change the password stored in SPA<sup>2</sup> memory is presented in the Password Configuration section of the manual.*

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Figure 4. Main Menu and Password Menu

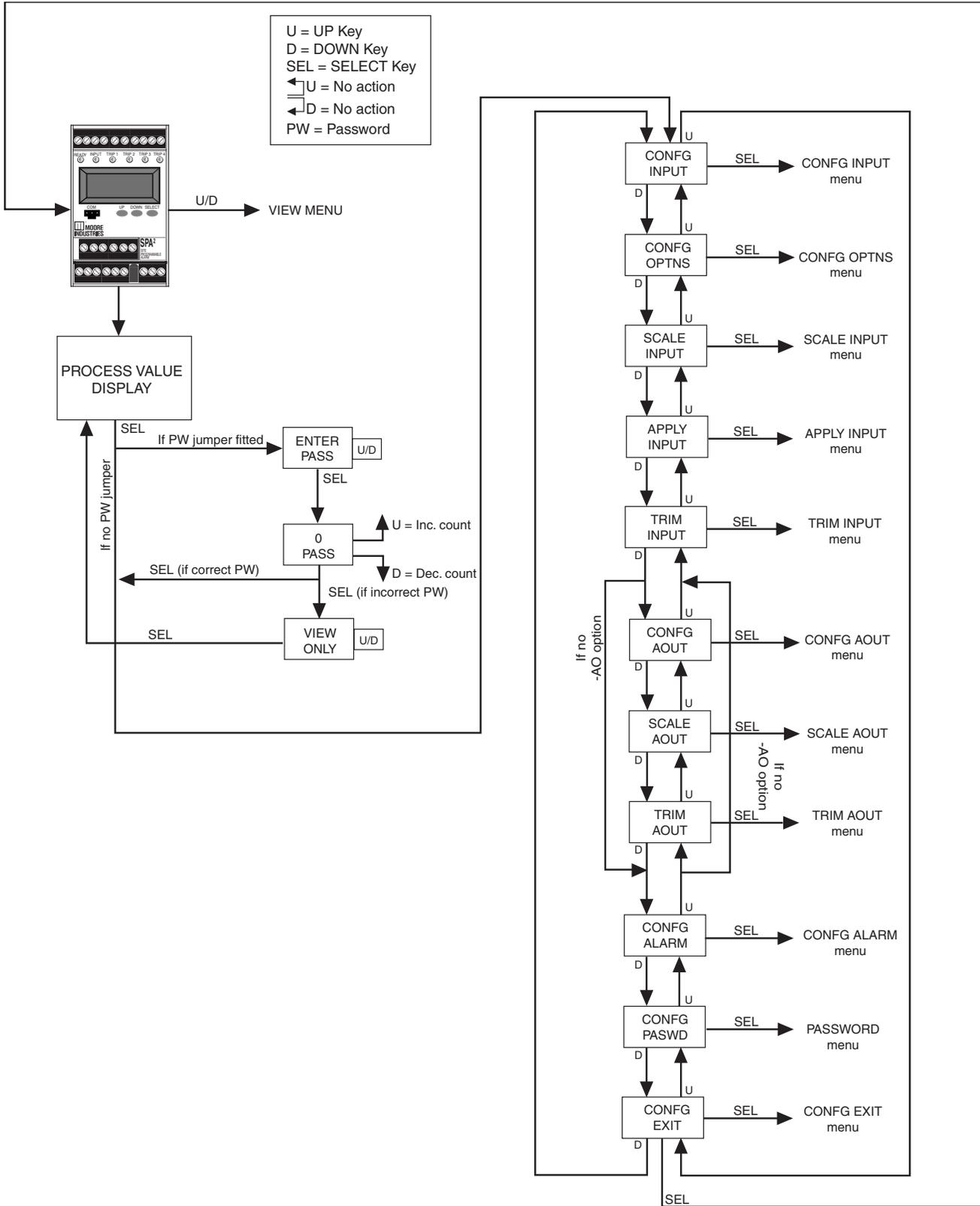
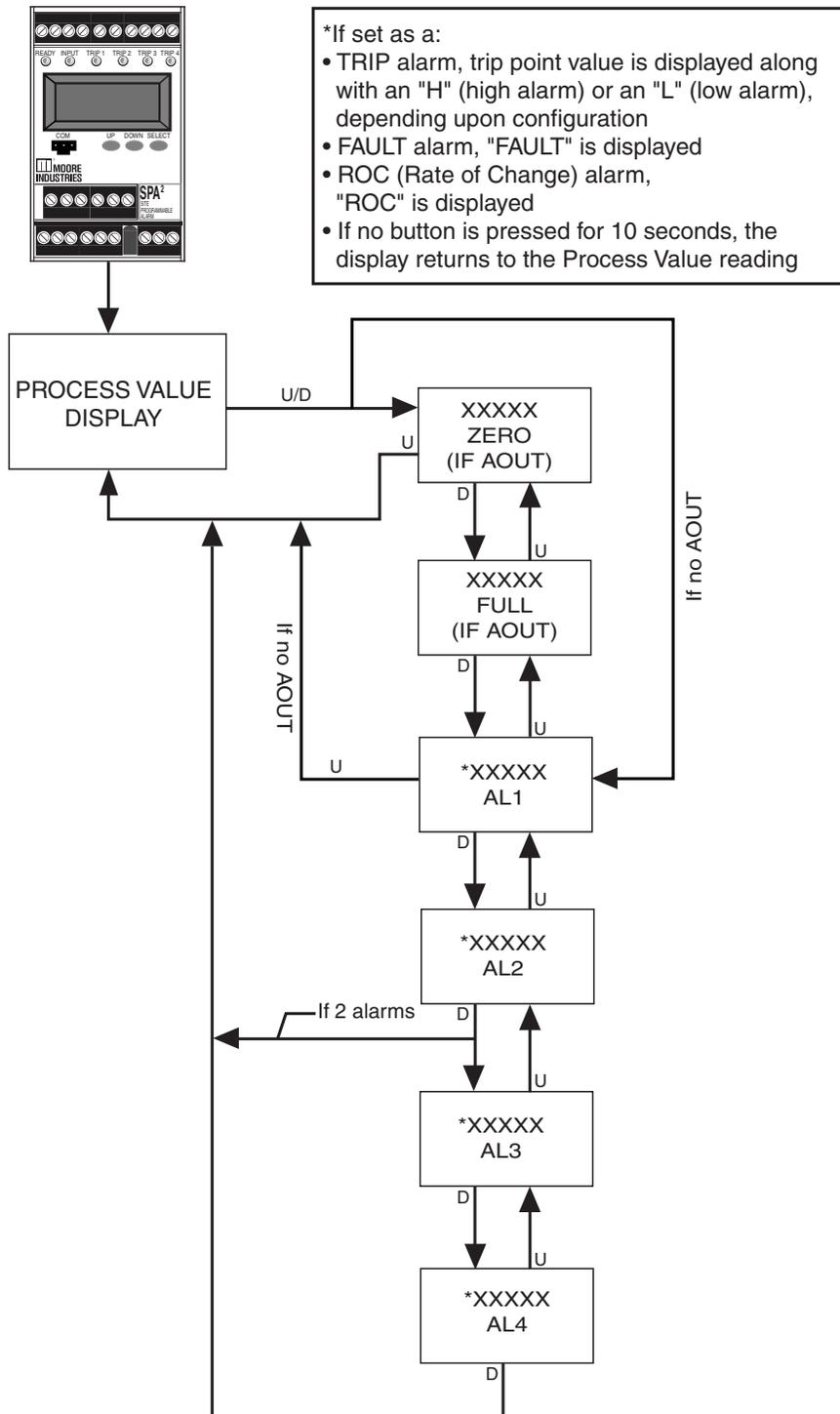


Figure 5. View Menu



- \*If set as a:
- TRIP alarm, trip point value is displayed along with an "H" (high alarm) or an "L" (low alarm), depending upon configuration
  - FAULT alarm, "FAULT" is displayed
  - ROC (Rate of Change) alarm, "ROC" is displayed
  - If no button is pressed for 10 seconds, the display returns to the Process Value reading

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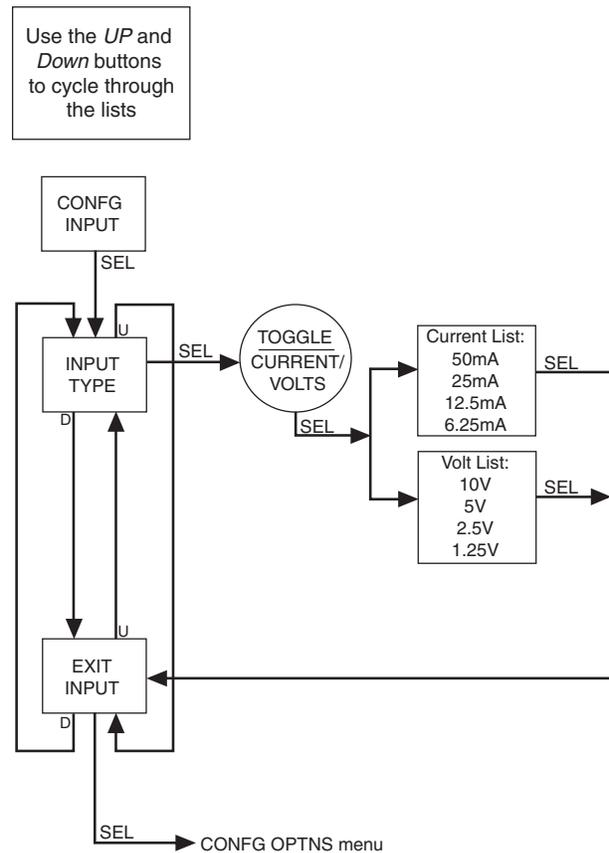
### Configuring the Input

Figure 6 gives an overview of the Input Configuration menu.

If the Password Jumper is not installed, the password sub-menu is bypassed, and the "CONFIG INPUT" menu is accessed by pressing *SELECT* from the process variable display.

1. From the "CONFIG INPUT" display, press *SELECT*.
2. At "INPUT TYPE" press *SELECT*. The display shows, "CURNT" or "VOLTS" (current or voltage parameter). Use the *UP* or *DOWN* arrow buttons to scroll through the two options for input type. The default display for this menu is always the last setting.
3. When the display shows the type of input, current or voltage, that you choose to use, press *SELECT*.
4. Next, the available input values are displayed. Use the *UP* or *DOWN* buttons to scroll through the selections, choose a value that is greater than or equal to the maximum value for the input you will be monitoring and press *SELECT* when the value has been displayed.
5. "EXIT INPUT" appears. If all values in this parameter have been set, press *SELECT*. If not, return to the menu and set your values.
6. The next display is the menu for the selection of functional options, "CONFIG OPTNS". To skip the rest of the configuration menus and return to the process variable display, press the *UP* button twice (to "CONFIG EXIT"), and press *SELECT*.

Figure 6. CONFIG INPUT Menu



### Configuring the Options

Figure 7 gives an overview of the Options Configuration menu.

You may configure the process variable display, decimal places, 50/60Hz filter selection, broken wire detection and the scaling mode from this menu.

To configure the options of the the SPA<sup>2</sup>:

1. At the "CONFIG OPTNS" screen, press *SELECT*.
2. "DSPLY MODE" appears. Press *SELECT* to enter the menu. Choose between "NORM MODE" and "TOGGLE MODE" by using the *UP* and *DOWN* buttons. Press *SELECT*.

**NORM MODE**– Displays only your PV or AOUT value, whichever you select.

**TOGGLE MODE**– Every four seconds your display will toggle between two displays that you choose.

3. Next, "DSPLY SRC 1" appears. Press *SELECT* and choose between "AOUT" (if your unit is equipped with the -AO option) or "PV" by using the *UP* and *DOWN* buttons. Press *SELECT*.  
If you selected "TOGGLE MODE", you will next be asked to enter your "DSPLY SRC 2" value.
4. The "DSPLY EGU 1" prompt is brought up. Press *SELECT* and choose the desired appearance of your display. Press *SELECT*.  
If you selected "TOGGLE MODE", you will next be asked to enter your "DSPLY EGU 2" value.
5. Next, the "SET DPS" display appears. Press *SELECT*. Scroll through the available choices by using the *UP* and *DOWN* buttons and press *SELECT* once you have made your selection.
6. "SET FILTR" appears; press *SELECT*. Here, you must select the proper line frequency of your AC source—50Hz or 60Hz or you can choose the FAST\* option; press *SELECT*.

**Note:**

*A faster respond time can be achieved when selecting the Fast option, but this will also produce a reduced accuracy and increase the possibility of mains-induced noise. \* FAST option available only for units with software V2.11 or greater.*

7. When "SET BWIRE" appears, press *SELECT* to enter the menu. You must choose whether or not to enable Broken Wire Detection. Press *SELECT*.

**Broken Wire Detection**— The SPA<sup>2</sup> monitors your process variable. If the monitored value falls equal to or below a set value, then a state of Broken Wire is declared.

**Caution:**

*Moore Industries does not recommend use of broken wire detecton if using a voltage input on the SPA<sup>2</sup>. Various factors may hinder the unit's performance and greatly slow the broken wire response time. If broken wire detection is used on a voltage input, testing must be done on a regularly scheduled basis, both with near-end and far-end open circuits on each of the wires.*

*Leakage current into a broken wire can prevent the voltage from dropping to the broken wire threshold. For example, on a 1-5V input, with a broken wire threshold of 0.6V, a leakage current of 1microamp into the broken wire will hold the input voltage at approximately 1.1V indefinitely. No alarm results under these conditions.*

*If the external wiring is long and has significant capacitance, broken wire response time is slowed by the RC time constant of the SPA<sup>2</sup> input resistance and the external wire capacitance. For example, 1 km of wire with 100pf/m capacitance and a far-end break, has a capacitance of 0.1microfarad. The time constant will be 0.11 seconds. Using a starting voltage of 3V and a broken wire threshold of 0.6V, the threshold is reached in approximately 0.18 seconds. The instrument response time must be added to this time.*

*If both leakage and capacitance exist, the time to threshold can extend greatly. Using a 5V starting voltage, 0.6V threshold voltage, 1 km of wire and 0.5 microamps leakage current, the threshold is reached in 0.42 seconds. The instrument response time must then be added to this time.*

8. "SCALE MODE" appears; press *SELECT*. Choose whether or not to enable scaling. This will be configured in the next menu. Select "SCALE OFF" or "SCALE ON" and press *SELECT*.

**Caution:**

*Turning on scaling will disable custom-curve and turning off scaling will not restore custom-curve. The custom-curve can only be restored using the PC configuration Software. The custom data points will remain unchanged.*

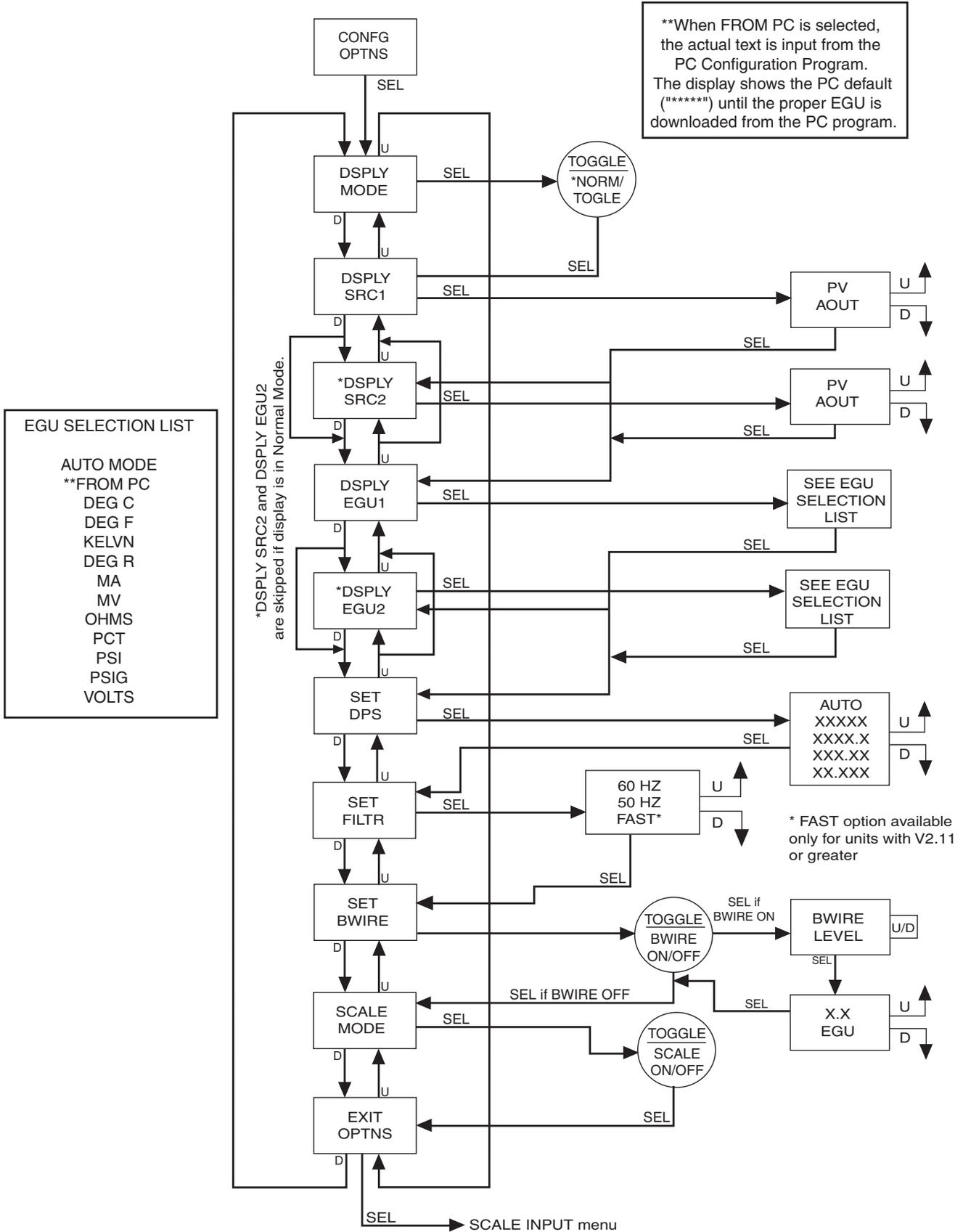
**Scale Mode**— This allows you to customize your display for your application. By example: if your process is sending a 4-20mA signal to the SPA<sup>2</sup> and you wish to view the input as 0-100% then this can be accomplished with the Scale Mode feature.

9. "EXIT OPTNS" appears. Press *SELECT*. Proceed to the "SCALE INPUT" menu.

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Figure 7. CONFIG OPTNS Menu



## Scaling the Input

Figure 8 gives an overview of the Input Scaling menu.

Scaling allows you to take your PV (Process Variable) reading and manipulate it to a more customized display range. PV is the unit read after selecting your input type. For example, choosing a Current input would then produce a PV displayed in mA.

Also known as “Smart Ranging”, scaling of the SPA<sup>2</sup> (HLPRG) allows the user to set the zero and full scale values of the input from the intended application, without having to connect the unit to any calibration equipment.

Continue with the “SCALE INPUT” if you enabled scaling in the previous menu. To proceed, follow the steps below.

### Note:

*When using the front panel push buttons to enter your scaling values, you may enter only whole number increments. To adjust your value past the decimal point, you must use the PC Configuration Program.*

1. At the “SCALE INPUT” display, press **SELECT**.
2. Press **SELECT** at the “INPUT ZERO” parameter and enter the value you want displayed when your input is at zero. Press **SELECT**.
3. Press **SELECT** at the “INPUT FULL” screen. Enter the value you wish displayed when your input is at full scale. Press **SELECT**.

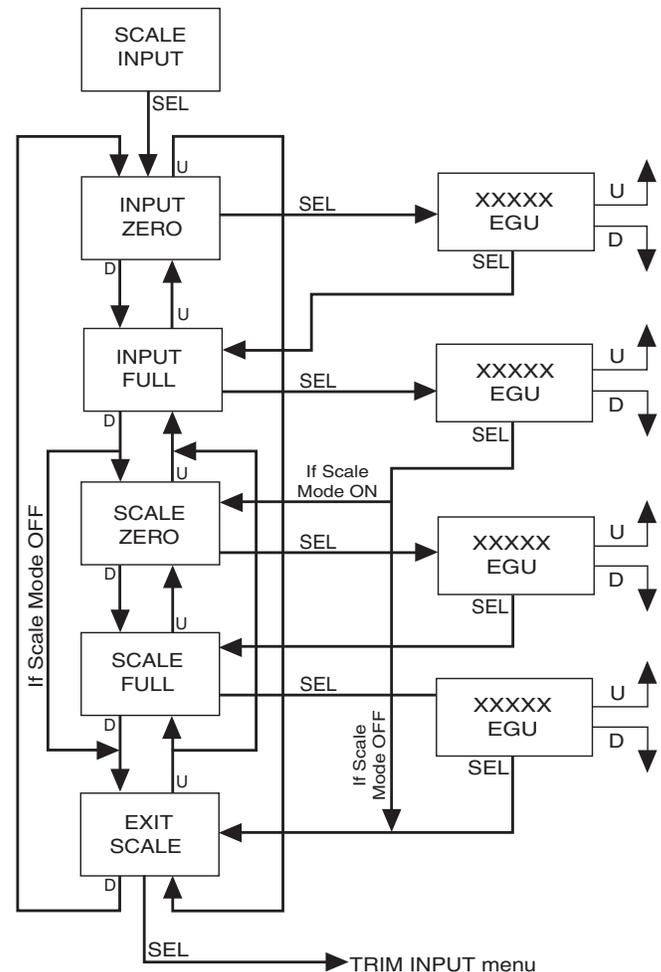
If you selected “SCALE OFF” in the “CONFIG OPTNS” menu, the menu skips to Step 6. If you selected “SCALE ON”, proceed to Step 4.

4. Next, “SCALE ZERO” is displayed. Use the **UP** and **DOWN** buttons to adjust your scaled zero value. This is the value that will be displayed when you are at the zero end of your display range. Press **SELECT**.
5. “SCALE FULL” appears. Press **SELECT** to enter the menu. Enter the value you wish as your full scaled range– the value displayed when you are at the full end of your range. Press **SELECT**.
6. “EXIT SCALE” appears. If all scaling parameters have been set, press **SELECT**. The next menu selection to appear is “TRIM INPUT”.

Figure 8. SCALE INPUT Menu

**NOTES:**

1. When scaling the input, the value displayed represents the actual input.
2. When the SCALE INPUT menu is accessed, the APPLY INPUT menu is skipped and the TRIM INPUT menu appears.



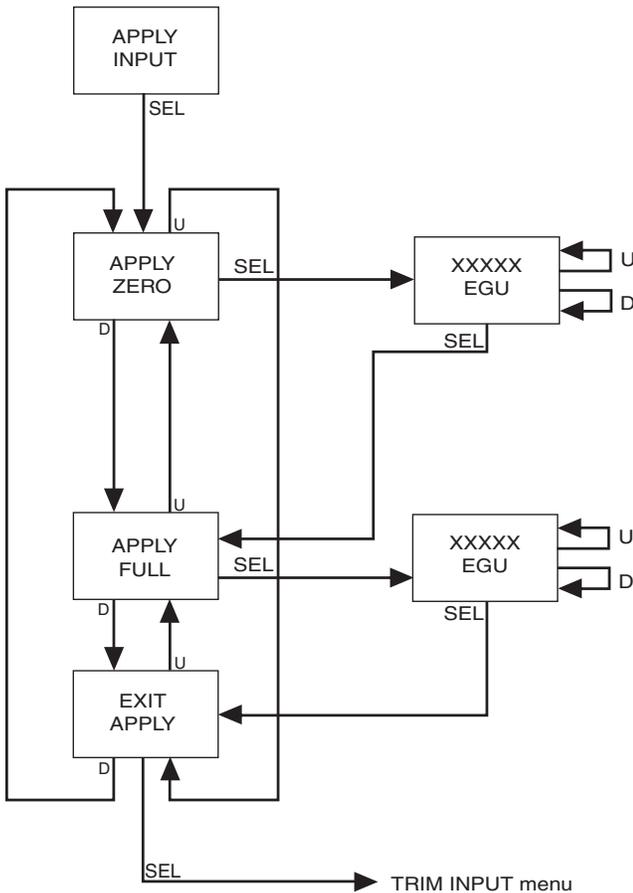
## Applying Input (Bench Scaling)

Figure 9 gives an overview of the Apply Input menu.

With Bench Scaling, also called “Standard Ranging”, inputs are “captured” at their zero and full scale levels using external, calibrated equipment.

1. At the “APPLY INPUT” screen, press *SELECT*.
2. “APPLY ZERO” appears. Apply the input you wish as your zero and press *SELECT*. Wait until it is flashed on the display and press *SELECT* to capture.
3. Next, “APPLY FULL” is displayed. Apply the value of your full range and press *SELECT*. When this is flashed, press *SELECT* to capture.
4. Press *SELECT* at “EXIT APPLY” and exit the menu.

Figure 9. APPLY INPUT Menu



## Input Trimming

Figure 10 gives an overview of the Input Trimming menu.

Input trimming increases the measurement accuracy of the parameter you are trimming by matching the reading of its actual input to its scaling. The SPA<sup>2</sup> offers the use of a factory-configured trimming feature (“FCTRY TRIM”) or user-set, one-point or two-point (“USER 1PNT” OR “USER 2PNT”) trimming.

Unit default is “FCTRY TRIM”. If another trimming selection had been made and you wish to return to the “FCTRY TRIM” feature, follow the instructions below.

1. Press *SELECT* at the “TRIM INPUT” SCREEN. Once the “TRIM MODE” appears, press *SELECT*.
2. “FCTRY TRIM” is displayed, press *SELECT*. This takes you to the “EXIT TRIM” screen.
3. To exit, press *SELECT*.

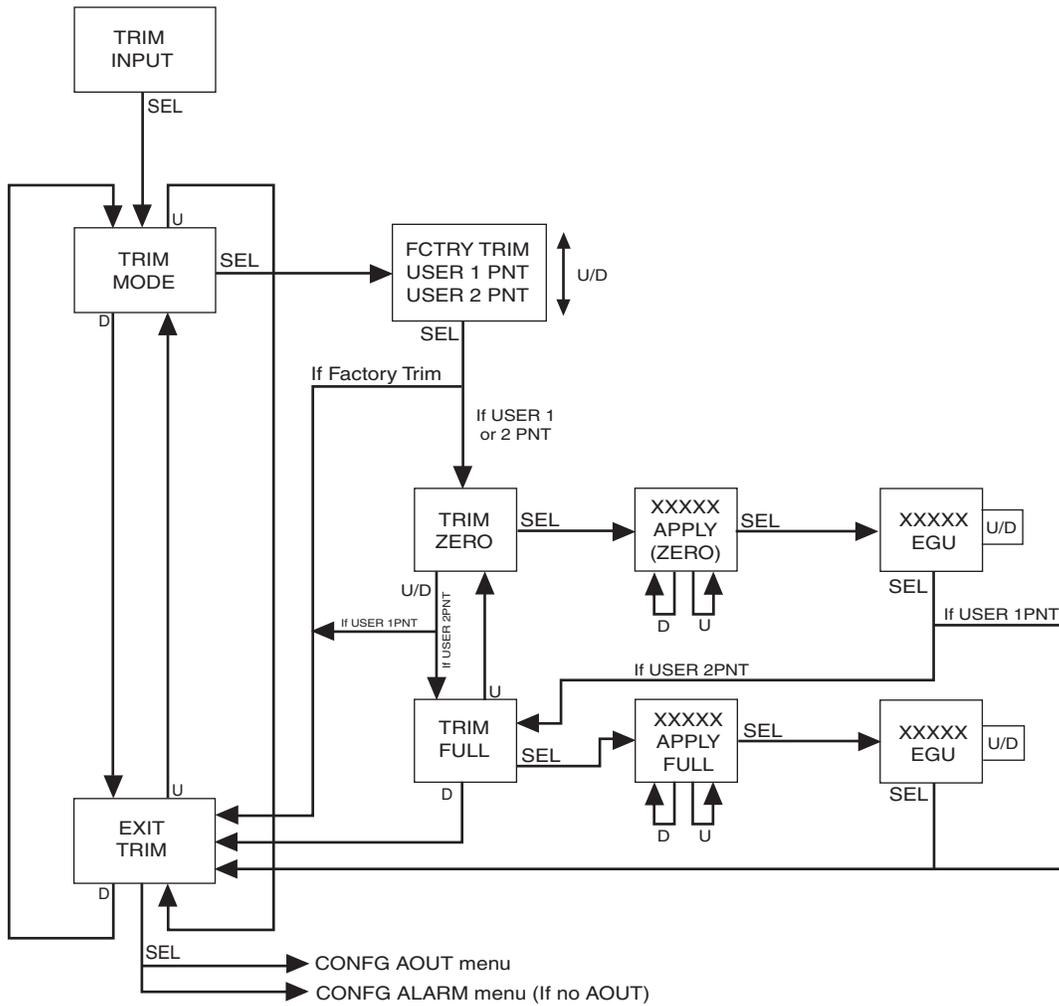
To input user-specific trim values, perform the following steps:

1. At the “TRIM INPUT” display, press *SELECT*. When “TRIM MODE” appears, press *SELECT* again. Use the *UP* and *DOWN* buttons to reach the user-set trimming menus. Press *SELECT* once the desired parameter is displayed—“USER 1PNT” or “USER 2PNT”.
2. “TRIM ZERO” appears. To program, press *SELECT*. Your present zero scaling value is shown and prompts you to “APPLY” your value. Press *SELECT*, once your value is present and flashing at the appropriate input terminals, press *SELECT* again. If you selected “USER 1PNT” trimming, “EXIT TRIM” appears. Press *SELECT* to reach the “CONFIG AOUT” menu (or “CONFIG ALARM” menu if the -AO option is not enabled). Proceed to Step 3 for “USER 2PNT” trimming.
3. If you selected “USER 2PNT” trimming, repeat the instructions in Step 2 for the “TRIM FULL” setting. Press *SELECT* when “EXIT TRIM” is displayed to reach the “CONFIG AOUT” menu (or “CONFIG ALARM” menu if the -AO option is not enabled).

### Note:

Trim only the zero and full values entered in the “SCALE INPUT” menu through the front panel pushbuttons. To trim values other than those specified in the “SCALE INPUT” menu, you must use the PC Configuration Software program.

Figure 10. TRIM INPUT Menu



# SPA<sup>2</sup>

Programmable Current/Voltage  
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## Configuring the Analog Output (-AO Option)

Figure 11 gives an overview of the Analog Output Configuration menu.

If your unit is equipped with the -AO option, use this menu for configuration.

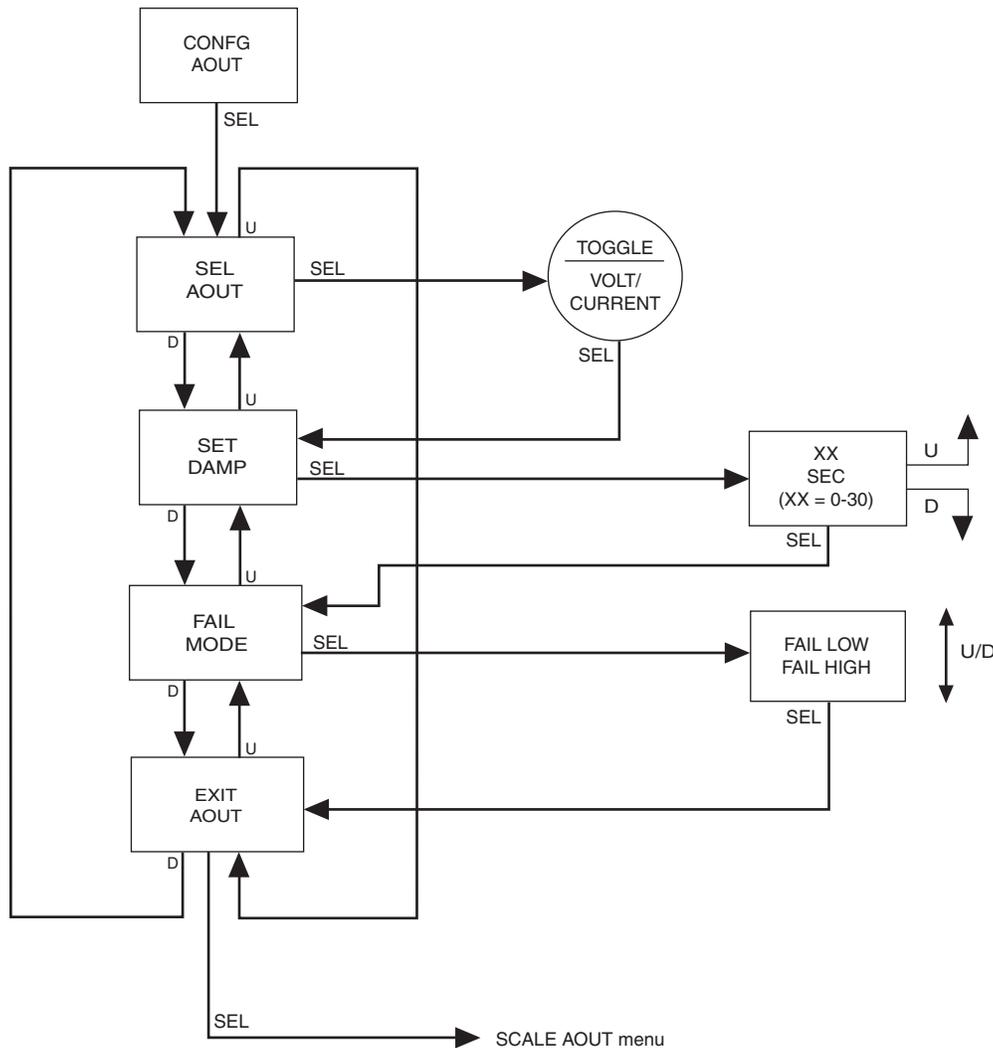
1. Press *SELECT* at the “CONFIG AOUT” display. This sends you to the “SEL AOUT” section. Press *SELECT* and use the *UP* and *DOWN* buttons to toggle between current and voltage. When the selection you desire is displayed, press *SELECT*.
2. Once you reach the “SET DAMP” field, you may skip the damping parameter, by using the *Down* button to reach the next field. To set damping, proceed to Step 3.

**Damping**– Output Damping allows you to introduce a delay (0-30sec) into the response of your unit in order to stop momentary input variations from setting off alarms.

3. To set damping, press *SELECT* at the “SET DAMP” display. Use the *UP* and *DOWN* buttons to enter a value between 0 and 30 seconds; press *SELECT*.
4. Press *SELECT* at “FAIL MODE” to program the setting. Choose “FAIL HIGH” or “FAIL LOW”. This sends you to “EXIT AOUT”.

**HIGH/LOW**– Choosing either of these options will send the output to a High (23.6mA for current; 11.0V for voltage) or Low (3.6mA for current; -0.5V for voltage), respectively.

Figure 11. CONFIG AOUT Menu



## Scaling the Analog Output (-AO Option)

Figure 12 gives an overview of the Analog Output Scaling menu.

Follow these instructions to scale the analog output after you have performed the configuration.

**Note:**

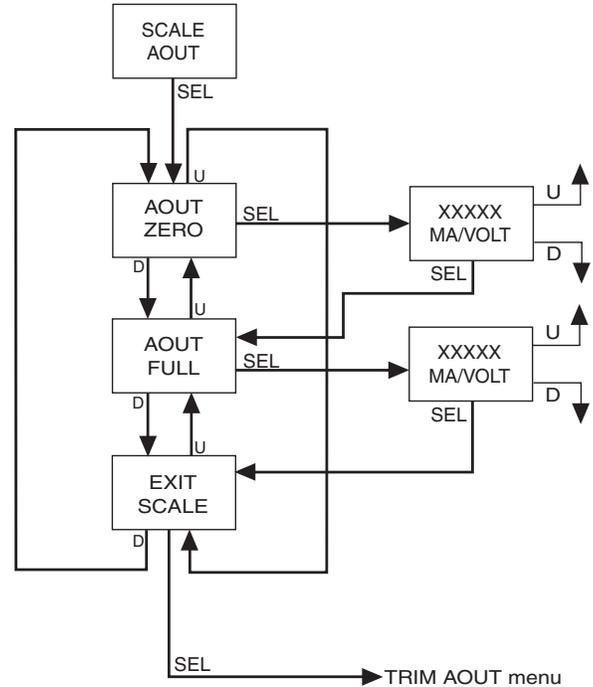
*When using the front panel pushbuttons to enter your scaling values, you may enter only values to one decimal place (tenths). To adjust your value past one decimal place, you must use the PC Configuration Program.*

1. At the "SCALE AOUT" display, press *SELECT*.
2. Press *SELECT* at the "AOUT ZERO" parameter and enter the value you want to output when your input is at zero. Press *SELECT*.
3. Press *SELECT* at the "AOUT FULL" screen. Enter the value you want to output when your input is at full scale. Press *SELECT*.
4. "EXIT SCALE" appears. If all scaling parameters have been set, press *SELECT*.

Figure 12. SCALE AOUT Menu

**NOTES:**

1. When setting zero and full values, the values displayed are the analog output. Zero and full in mA or Volts (depending upon the output configuration).
2. Update your analog output during -AO scaling.
3. Rearranging values nulls your trim value.
4. Implement "auto increment" when incrementing and decrementing zero and full counts.



## Trimming the Analog Output

### (-AO Option)

Figure 13 gives an overview of the Analog Output Trimming menu.

Output trimming increases the measurement accuracy of the SPA<sup>2</sup> by calibrating its analog output to the device that is receiving the output. This ensures that the instrument is being correctly interpreted.

Connect the unit as shown in Figure 14 and allow five minutes for warm up and stabilization.

1. At the “TRIM AOUT” display, press *SELECT*.
2. “TRIM ZERO” appears. Press *SELECT*. The value 0.000 (mA or V depending on the set up) is shown. While monitoring your reading on the meter, use the *UP* and *DOWN* buttons to adjust the output to the desired level. Use the meter in the set up to monitor the output as it is adjusted. When the output is set as desired, press *SELECT*.

**Note:**

*The value on the LCD is the value that must be trimmed in order to adjust to the desired level.*

3. Press *SELECT* at “TRIM FULL” and repeat Step 2. Press *SELECT*. “FCTRY TRIM” is shown on the display.
  4. If you wish to **disable** the user-configured trimming values and use factory trimming, press *SELECT* at the “FCTRY TRIM” screen. Use the *UP* and *DOWN* buttons to choose “YES”; press *SELECT*. “TEST AOUT” is brought up on the display.
- By selecting “NO” at the “FCTRY TRIM” screen, the user-configured trim values will be used.
5. In order to check output performance and accuracy, you may want to perform an output test. If you choose to enable this test, follow the instructions in Step 6. To bypass this feature, use the *DOWN* button and scroll to “EXIT TRIM”.
  6. To enable the analog output test, press *SELECT* at the “TEST AOUT” display. Use the *UP* and *DOWN* buttons to set your output test value (this figure must fall within your sensor configuration range value) and press *SELECT*. “EXIT TRIM” appears; press *SELECT*.

Figure 13. TRIM AOUT Menu

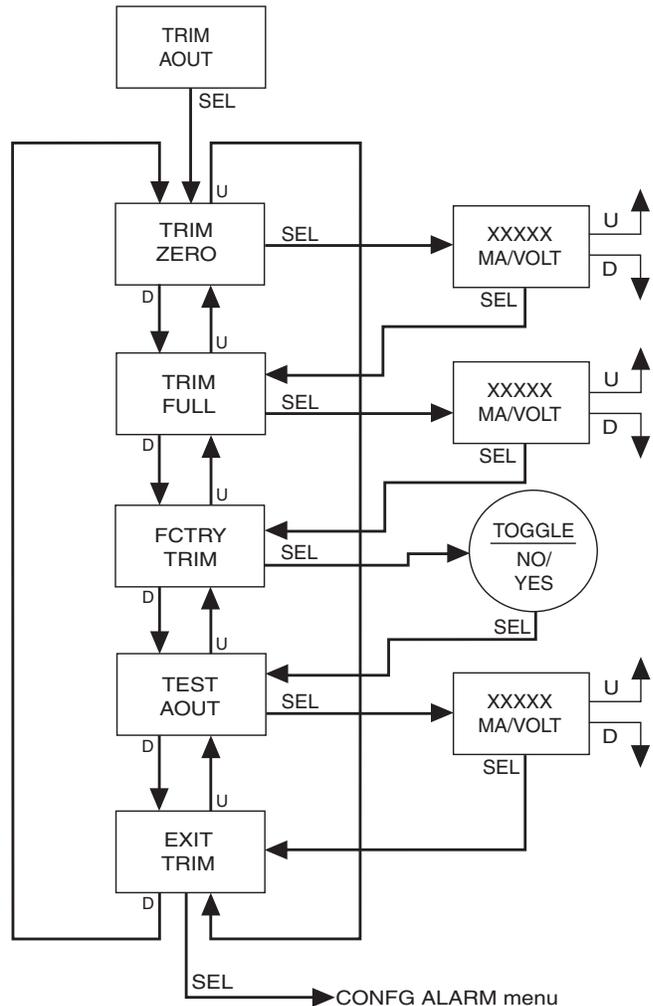
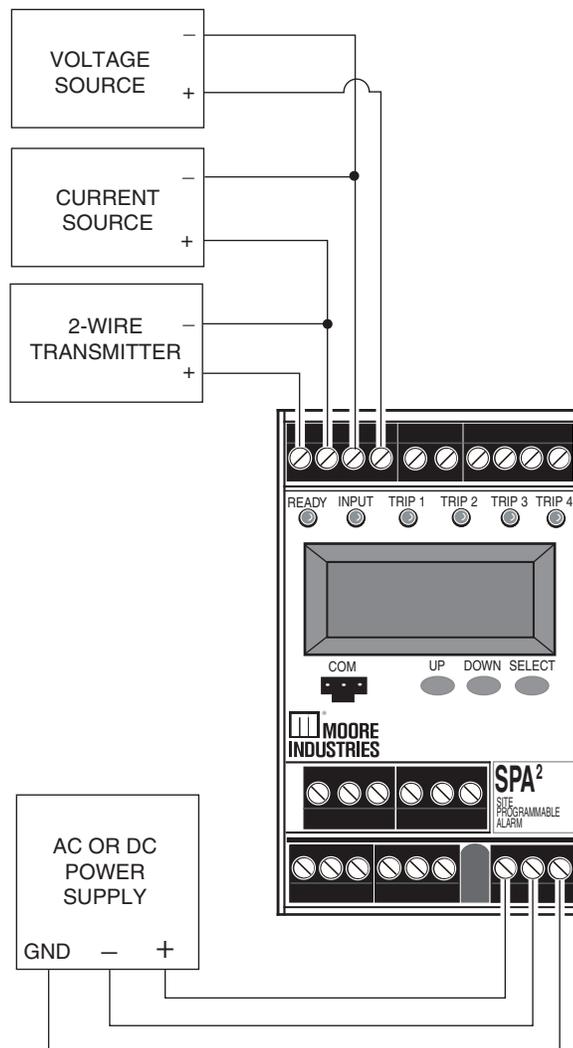
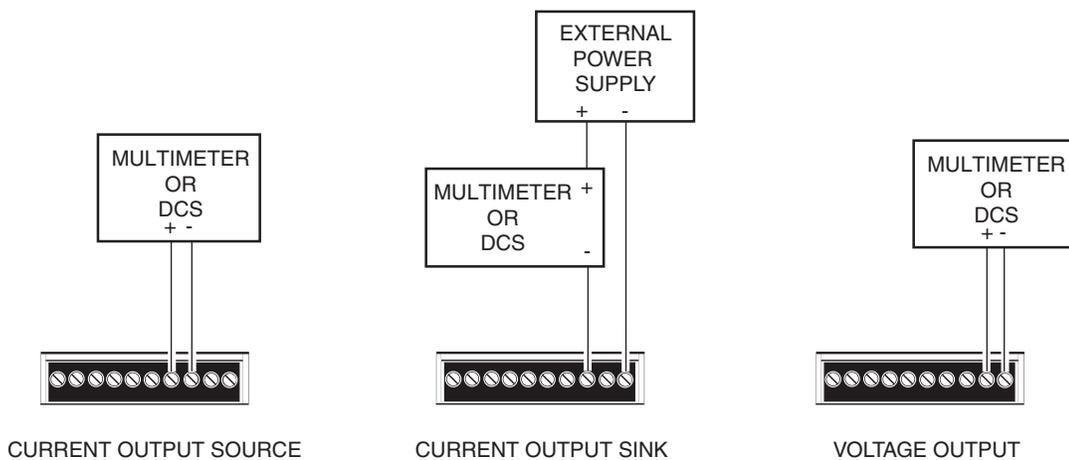


Figure 14. SPA<sup>2</sup> (HLPRG) Trimming Hook-Up Diagram For Front Panel Configuration



### HOOK-UPS FOR OUTPUT TRIMMING



# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

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### Configuring the Alarm(s)

The SPA<sup>2</sup> offers you four alarms. Each of these alarms may be configured as trip, fault or rate of change alarms. The instructions below will explain the steps to follow in order to set each type of alarm. This section will be divided into three sub-sections: "Trip Alarm Configuration", "Fault Alarm Configuration" and "Rate of Change Alarm Configuration". Depending upon the type of alarm you are setting, you may refer to the section specific to your need at the time.

### Trip Alarm Configuration

Figure 15 gives an overview of the Trip Alarm Configuration menu.

Trip alarms are used if the user desires an alarm condition if a process value deviates from a set trip point.

1. At the "CONFIG ALARM" menu, press *SELECT*. Use the *UP* and *DOWN* buttons to toggle between the four alarms. When the desired alarm appears, press *SELECT*.
2. At the "ALARM TYPE" menu press *SELECT*. From here you will choose your alarm type. Use the *UP* and *DOWN* buttons to scroll through the selections. Press *SELECT* once "ALARM TRIP" is displayed.
3. At "ENTER TRIP", press *SELECT* and enter your alarm trip value. Use the *UP* and *DOWN* buttons to select your trip value; press *SELECT*.
4. Press *SELECT* at "ENTER DBAND" and enter your dead band value if using dead band. Press *SELECT* once your desired setting appears.

**Dead Band**– The Dead Band is the range within which an alarm relay remains in an alarm condition even after the monitored process variable input has returned to a safe level, at or below/above the trip point setting.

5. Press *SELECT* at "ENTER DELAY" and input your desired delay time by using the *UP* and *DOWN* buttons.

**Delay**– When your unit is in an alarm condition, the delay is the amount of time you set (0-120sec) to elapse before a relay trip.

6. Pressing *SELECT* at the "SET HI/LO" menu directs you to configure the alarm as an "ALARM HI" or "ALARM LO". Use the *UP* and *DOWN* buttons to reach your selection and press *SELECT*.

**ALARM LO**– You are notified if your process input drops below your trip point setting.

**ALARM HI**– You are notified if your process input exceeds your trip point setting.

7. At the "SET LATCH" display, press *SELECT* and choose "LATCH ON" or "LATCH OFF" using the *UP* and *DOWN* buttons; press *SELECT*.

**Latching Alarm**– When a SPA<sup>2</sup> is configured with latching alarms, an alarm condition will not "clear" (the relay will not change state) until the input returns to a non-alarm state **AND** manual reset terminals are shorted.

**Note:**

*If manual reset terminals remain shorted, this will disable the alarm latching function.*

These manual reset terminals, labeled "MR" are located on the top row of the SPA<sup>2</sup>.

8. Press *SELECT* at "SET FSAFE" to enter the menu. Then use the *UP* and *DOWN* buttons to switch from "ALARM FSAFE" to "ALARM NONFS". Make your selection and press *SELECT*.

**Fail Safe (ALARM FSAFE)**– Will remain in an alarm condition even if power to the unit is removed. Its alarm trip relays are energized whenever the process input is in a non-alarm condition (including any dead band setting). These relays de-energize when the process input trips the alarm.

**Non Fail Safe (ALARM NONFS)**– With this type of alarm relays are energized whenever the process input is in an alarm condition. These relays de-energize when the process input returns to the reset point (including any dead band).

9. "INPUT FAULT" appears. Select whether or not to enable the input failure alarm by using the *UP* and *DOWN* buttons; press *SELECT*.

**Input Fault Alarm (INPUT FAULT)**– If enabled, this alarm will notify the user upon a breakdown of input .

10. "RANGE ALARM" appears. Select whether or not to enable the range alarm by using the *UP* and *DOWN* buttons; press *SELECT*. If enabled "LOWER POINT" appears, then use the *UP* and *DOWN* buttons to set your lower point value, press *SELECT*. "UPPER POINT" appears, then use the *UP* and *DOWN* buttons to set your upper point value, press *SELECT*. "EXIT RANGE" appears. Press *SELECT*. "EXIT ALRM\*" appears. If range alarm not enabled "EXIT ALRM\*" appears.

**Note:**

*When setting the Range Alarm, the values in Lower Point must be greater than those of the Sensor Lower Limit, and less than those set in Lower Range. When setting the Upper Point, the value must be less than the Sensor Upper Limit, and greater than those set in Upper Range.*

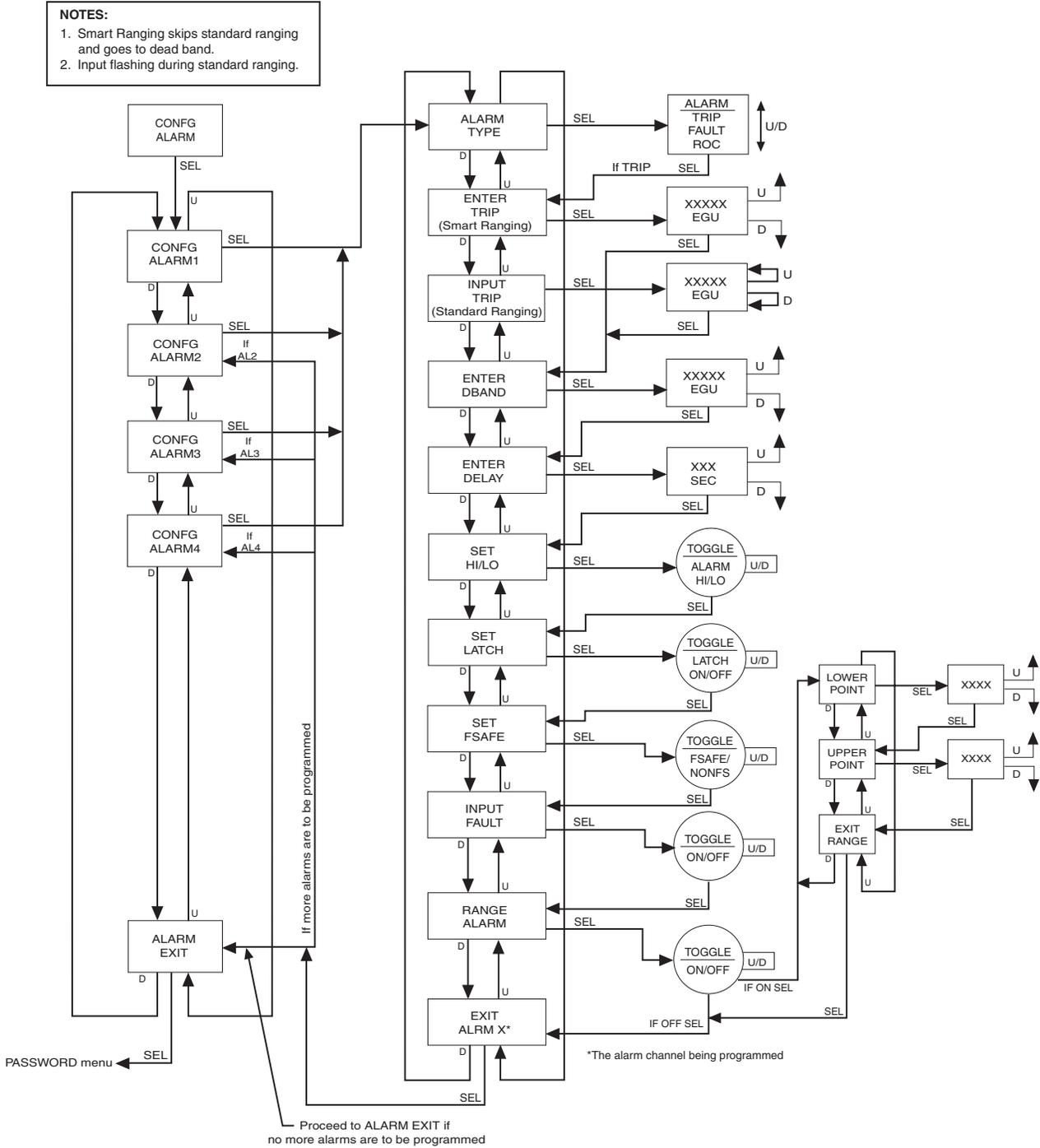
11. If you are to program other alarms, use the *UP* and *DOWN* buttons to reach your next alarm and follow the steps described in the appropriate alarm configuration section.

If you have completed your alarm configurations, use the *UP* and *DOWN* buttons to bypass the alarm menu. To exit, press *SELECT* at the "ALARM EXIT" display.

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

Figure 15. CONFIG ALARM MENU (Trip Alarm)



## Fault Alarm Configuration

Figure 16 gives an overview of the Fault Alarm Configuration menu.

Fault alarms are set in order to notify you of any fault conditions during your process. If you wish an alarm condition when a malfunction occurs, use the Fault Alarm

1. At the "CONFIG ALARM" menu, press *SELECT*. Use the *UP* and *DOWN* buttons to toggle between the four alarms. When the desired alarm appears, press *SELECT*.
2. At the "ALARM TYPE" menu press *SELECT*. From here you will choose your alarm type. Use the *UP* and *DOWN* buttons to scroll through the selections. Press *SELECT* once "ALARM FAULT" is displayed.

Below are the configuration options you are given in setting up the fault alarm. You may choose any combination of alarms including all three.

**INPUT FAULT**– You are notified upon breakdown of your input.

**INPUT SAT**– Should the input become overloaded or saturated, your alarm would activate.

**SPA FAULT**– Choosing this parameter activates the alarm at any failure that occurs in the SPA<sup>2</sup> itself.

### **Note:**

*Enabling all fault alarm configurations will activate the alarm at any failure that occurs (refer to Table 4 in the Error Codes section of this manual).*

3. "INPUT FAULT" appears. Press *SELECT* at "INPUT FAULT". Dependent upon whether you wish the alarm activated due to an input fault, use the *UP* and *DOWN* buttons to scroll through the "ALARM ON" and "ALARM OFF" options. Once you have made a selection, press *SELECT*.
4. Press *SELECT* at the "INPUT SAT" display. You are given the choice of "ALARM ON" or "ALARM OFF" by using the *UP* and *DOWN* buttons. Choose your setting and press *SELECT*.
5. Next, the "SPA FAULT" menu is displayed. Press *SELECT*. Toggle between "ALARM ON" and "ALARM OFF" by using the *UP* and

*DOWN* buttons and press *SELECT* when the setting you desire is displayed.

6. Press *SELECT* at "ENTER DELAY" and enter your desired delay time by using the *UP* and *DOWN* buttons.
7. At the "SET LATCH" display, press *SELECT* and choose "LATCH ON" or "LATCH OFF" using the *UP* and *DOWN* buttons; press *SELECT*.

Refer to the "Trip Alarm Configuration" section for a description of delay and latching alarms.

8. Press *SELECT* at "SET FSAFE" to enter the menu. Then use the *UP* and *DOWN* buttons to switch from "ALARM FSAFE" to "ALARM NONFS". Make your selection and press *SELECT*.

Refer to the "Trip Alarm Configuration" section for a description of fail safe and non fail safe alarms.

9. "RANGE ALARM" appears. Select whether or not to enable the range alarm by using the *UP* and *DOWN* buttons; press *SELECT*. If enabled "LOWER POINT" appears, then use the *UP* and *DOWN* buttons to set your lower point value, press *SELECT*. "UPPER POINT" appears, then use the *UP* and *DOWN* buttons to set your upper point value, press *SELECT*. "EXIT RANGE" appears. Press *SELECT*. "EXIT ALRM\*" appears. If range alarm not enabled "EXIT ALRM\*" appears.

### **Note:**

*When setting the Range Alarm, the values in Lower Point must be greater than those of the Sensor Lower Limit, and less than those set in Lower Range. When setting the Upper Point, the value must be less than the Sensor Upper Limit, and greater than those set in Upper Range.*

10. If you are to program other alarms use the *UP* and *DOWN* buttons to reach your next alarm and follow the steps described in the appropriate alarm configuration section.

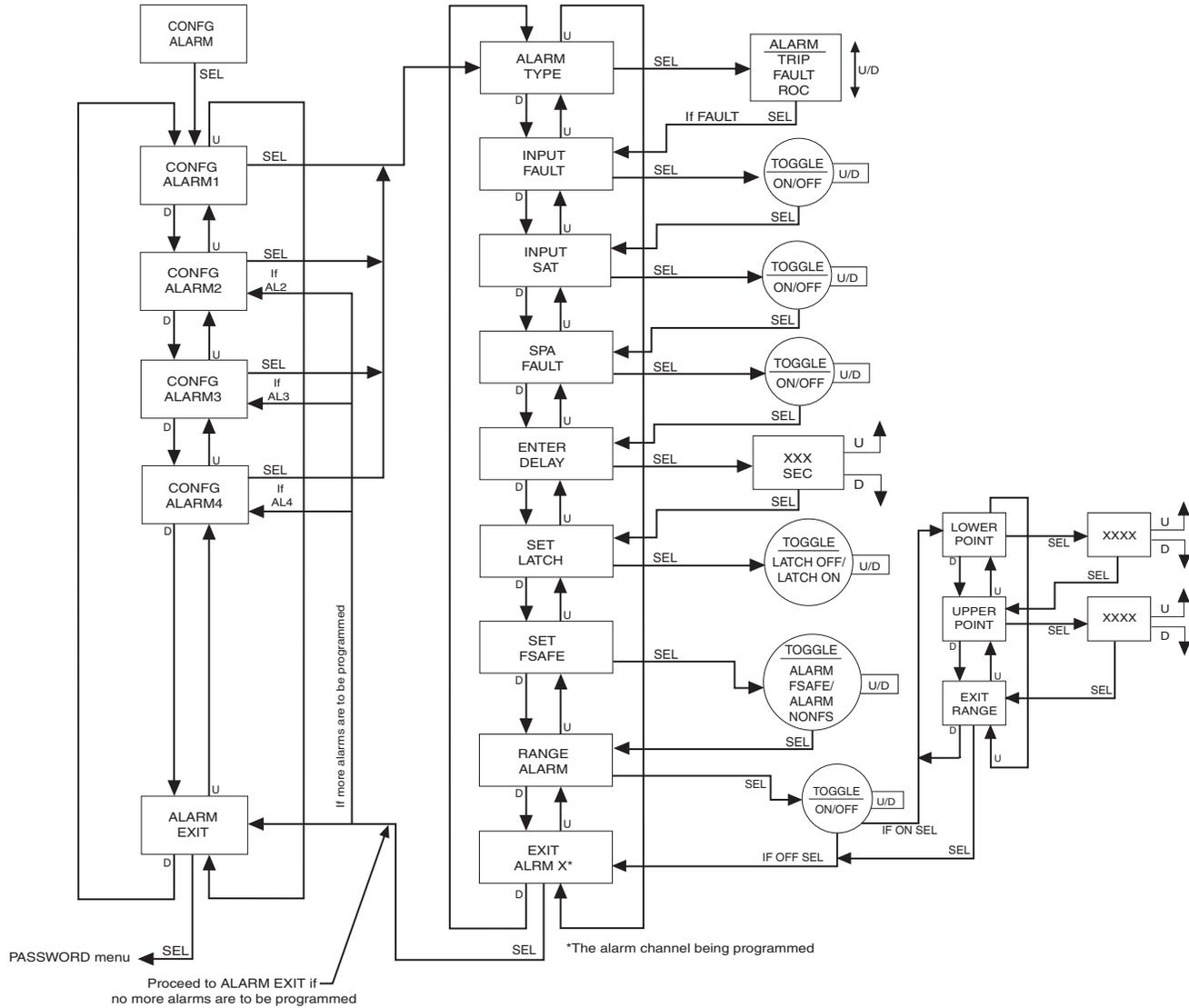
If you have completed your alarm configurations, use the *UP* and *DOWN* buttons to bypass the alarm menu. To exit, press *SELECT* at the "ALARM EXIT" display.

\*ALARM X denotes the alarm (1, 2, 3 or 4) that you are currently configuring.

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

Figure 16. CONFIG ALARM Menu (Fault Alarm)



## Rate of Change Alarm Configuration

Figure 17 gives an overview of the Rate of Change Alarm configuration menu.

If you wish to be notified when deviations outside of ranges you have set occur, use the Rate of Change Alarm. The alarm will be set according to the rate of change of the process variable over a set time period.

1. At the "CONFIG ALARM" menu, press **SELECT**. Use the **UP** and **DOWN** buttons to toggle between the four alarms. When the desired alarm appears, press **SELECT**.
2. At the "ALARM TYPE" menu, press **SELECT**. From here you will choose your alarm type. Use the **UP** and **DOWN** buttons to scroll through the selections. Press **SELECT** once "ALARM ROC" is displayed.
3. At "ENTER DELTA" press **SELECT** and use the **UP** and **DOWN** buttons to set your delta value. Press **SELECT**.

**DELTA**– This is the amount by which the process variable must change. You may enter a value less than one through the PC Configuration Program **only**.

4. At the "ENTER TIME" menu, press **SELECT**. Using the **UP** and **DOWN** buttons, set the time and press **SELECT**.

**TIME**– The span (1-60sec) in which the delta must change before the alarm is set.

### **Note:**

*When configuring a Rate of Change alarm, "LATCH ON" must be selected in the "SET LATCH" menu.*

5. At the "SET LATCH" display, press **SELECT** and choose "LATCH ON" using the **UP** and **DOWN** buttons; press **SELECT**.  
Refer to the "Trip Alarm Configuration" section for a description of latching alarms.
6. Press **SELECT** at "SET FSAFE" to enter the menu. Then use the **UP** and **DOWN** buttons to switch from "ALARM FSAFE" to "ALARM NONFS". Make your selection and press **SELECT**.

Refer to the "Trip Alarm Configuration" section for a description of fail safe and non fail safe alarms.

7. "INPUT FAULT" appears. Select whether or not to enable the input failure alarm by using the **UP** and **DOWN** buttons; press **SELECT**.

**INPUT FAULT Alarm**– If enabled, this alarm will notify the user upon a breakdown of input.

8. "RANGE ALARM" appears. Select whether or not to enable the range alarm by using the **UP** and **DOWN** buttons; press **SELECT**. If enabled "LOWER POINT" appears, then use the **UP** and **DOWN** buttons to set your lower point value, press **SELECT**. "UPPER POINT" appears, then use the **UP** and **DOWN** buttons to set your upper point value, press **SELECT**. "EXIT RANGE" appears. Press **SELECT**. "EXIT ALRM\*" appears. If range alarm not enabled "EXIT ALRM\*" appears.

### **Note:**

*When setting the Range Alarm, the values in Lower Point must be greater than those of the Sensor Lower Limit, and less than those set in Lower Range. When setting the Upper Point, the value must be less than the Sensor Upper Limit, and greater than those set in Upper Range.*

9. If you are to program other alarms, use the **UP** and **DOWN** buttons to reach your next alarm and follow the steps described in the appropriate alarm configuration section.

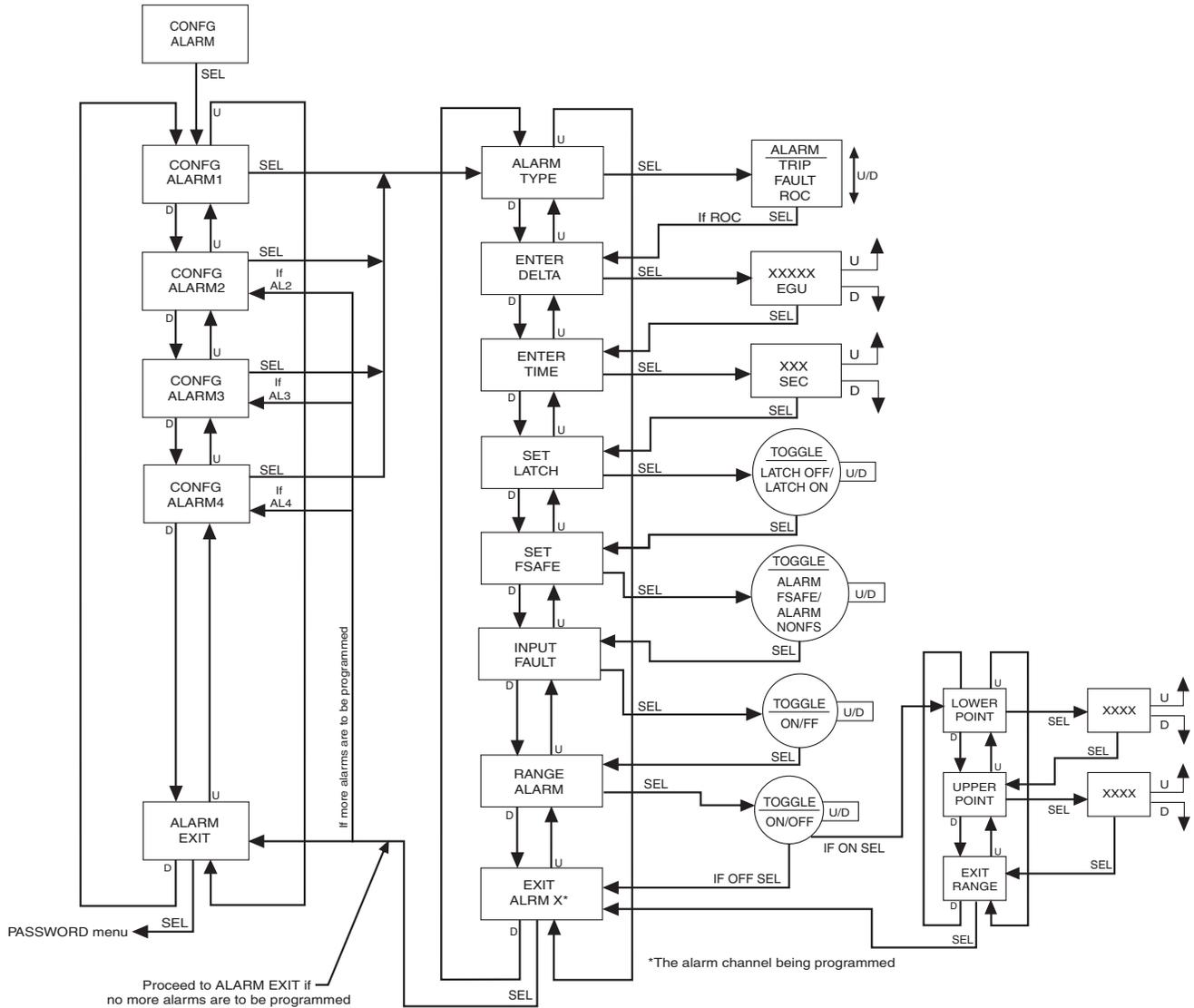
If you have completed your alarm configurations, use the **UP** and **DOWN** buttons to bypass the alarm menu. To exit, press **SELECT** at the "ALARM EXIT" display.

\*ALARM X denotes the alarm (1, 2, 3 or 4) that you are currently configuring.

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

Figure 17. CONFIG ALARM Menu (Rate of Change Alarm)



## Password Configuration

Figure 18 gives an overview of the Password Configuration menu.

The password menu is accessible only when the security jumper is not installed (Figure 2) or when the password is entered correctly.

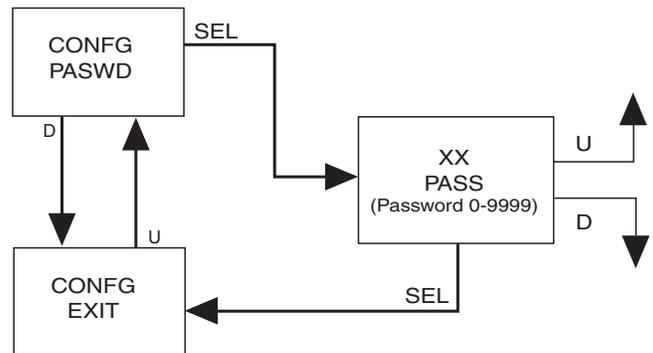
The last of your menus, “CONFIG PASWD”, is for password configuration.

1. At “CONFIG PASWD”, press *SELECT*. This puts you in the “PASS” menu. The previously saved password appears.
2. Use the *UP* and *DOWN* buttons to set a new password to any number between 0 and 9999. Press *SELECT*.
3. The “CONFIG EXIT” option appears. Press *SELECT* to return to the process variable display.

Figure 18. CONFIG PASWD Menu

### NOTES:

1. The Password menu is accessible only when the security jumper is not installed or when the password is entered correctly.



# SPA<sup>2</sup>

Programmable Current/Voltage  
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## SPA<sup>2</sup> Configuration: PC Configuration Software

One of the benefits of the SPA<sup>2</sup> is that you may either use the external push button controls to set up the instrument, or use a PC and Moore Industries' Intelligent PC Configuration software.

In using the software program, settings are downloaded to the instrument in the form of a Configuration File and stored in the instrument's memory. You can save a backup copy of the file on your PC hard drive or disk. The SPA<sup>2</sup> communicates with the PC through an RS-232 connection to the PC's serial port, USB Communications Cable, or Fuse Protected USB Communications Cable.

**Note:**

Refer to the SPA<sup>2</sup> HLPRG QuickStart Guide to see the default factory settings for your unit.

## Installing the Configuration Software

Refer to Table 3 for the equipment needed.

1. Insert the *Moore Industries Interface Solution PC Configuration Software* CD into the CD drive of the PC. Access the CD and open the "SPA<sup>2</sup> PC Configuration Software" folder.
2. Double-click the installation program located in the folder. Follow the prompts to correctly install the program.

Once the Configuration Program is installed onto your PC, the SPA<sup>2</sup> can be connected to equipment to simulate input and monitor output. You can then change the operating parameters of the alarm.

### No Alarm Needed

It is not necessary to connect the SPA<sup>2</sup> to a PC to create configuration files using the software. The Configuration Program can be run without connecting an alarm, and **most** parameters can be set without benefit of input from a sensor or SPA<sup>2</sup>.

This makes it easy to create a set of operating parameters, save them to disk, and download them to one or more instruments at a later time.

The SPA<sup>2</sup> **must** be connected to the PC in order to: trim input, trim output, assign a tag, perform a loop test, receive (via download) a configuration file, and save the configuration file (via upload) from the SPA<sup>2</sup>'s memory.

## Connecting the SPA<sup>2</sup> to the PC

Connect the RS-232 end of the cable to the PC's COM port.

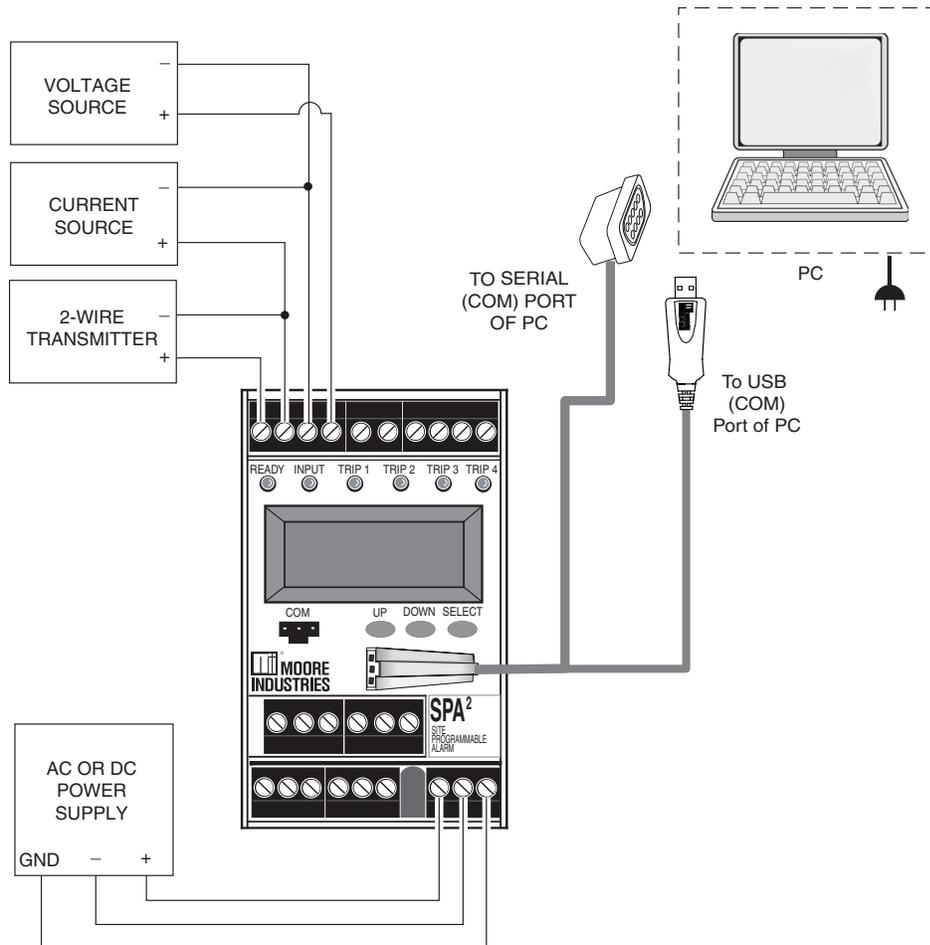
See Table 3 for information on the necessary equipment.

## Selecting Model Type

User must select model type when the software is opened without a unit connected as shown below. Unit type is determined by software version and input type. When a unit is connected the software will select the correct type automatically.



**Figure 19.** SPA<sup>2</sup> (HLPRG) Hook-Up Diagram For PC Configuration



**Table 3.** Necessary Equipment to Configure the SPA<sup>2</sup> (HLPRG)

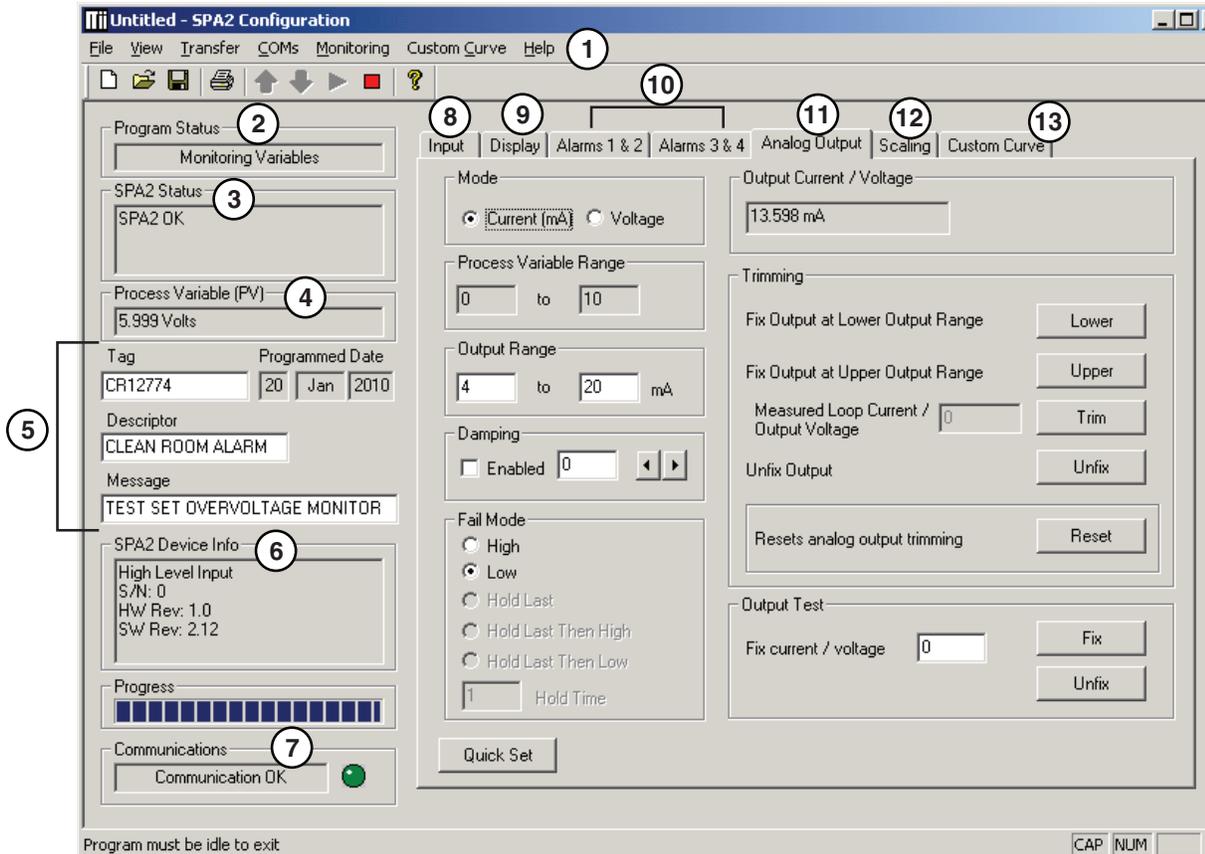
Device	Specifications
Current or Voltage Source (optional)	Accurate to 0.05% of span for the intended application
Power Supply	24Vdc, $\pm 10\%$ or 117/230Vac, 110Vdc (depending on model)
Multimeter (optional)	Accurate to $\pm 0.009\%$ of span; e.g., HP Model 3478A
Personal Computer	Microsoft Windows based PC; 16Mb free RAM; 20MB free disk space on hard drive Microsoft Windows XP, Vista or 7 1 (one) serial port or one available USB port
Moore Industries PC Configuration Software	Version 1.0 or greater, successfully installed to the hard drive
Communication Cable or USB Cable)	Part# Communications Cable 803-053-26A, USB Cable Part# 208-236-00A, or Fuse Protected USB Cable 804-030-26A

# SPA<sup>2</sup>

Programmable Current/Voltage  
Limit Alarm Trips

## PC Configuration Software Summary

Figure 20. SPA<sup>2</sup> (HLPRG) Main PC Screen



Once the default configuration has been saved to disk, it is safe to program other parameters. The PC Software is made up of these sections:

**1. Tool Bar/Status Bar**– Dropdown menus and corresponding icons allow you to perform various functions throughout the PC Configuration Program. Refer to the *Status and Tool Bar Legend* for a complete description.

**2. Program Status**– This portion of the program displays the activity of the connected unit. It will display such messages as: Reading SPA Info, Idle, Monitoring Variables and Monitor Fail.

**3. SPA<sup>2</sup> Status**– Indicates if there are problems or faults with the instrument.

**4. Process Variable (PV)**– Displays the selected Process Variable.

**5. Identification Parameters**– Use this parameter to place an identifying “Tag” (12 alphanumeric characters max.), “Descriptor” (16 alphanumeric characters max.) or “Message” (32 alphanumeric characters max.).

You may also use the *Quick Set* feature to set these features and download them.

**6. SPA<sup>2</sup> Device Info**– This “read-only” display indicates instrument configuration, device identification, hardware revision and software revision.

**7. Communications**– Notifies user of current PC connection/communications status.

**8. Input Tab**– Use this tab to set your input parameters. Refer to the *Input* section for a complete description.

**9. Display Tab**– Used to set up the appearance of the SPA<sup>2</sup>'s LCD screen. Refer to the *Display* section for a complete description.

**10. Alarms Tab (1 & 2 and 3 & 4)**– Alarm parameters are configured using these windows. Alarms 1 & 2 are located in the same window. Alarms 3 & 4 are grouped together in another window. Refer to the *Alarms* section for a complete description.

**11. Analog Output Tab**– Configuration of the analog output (if your instrument is equipped with the -AO option) is performed here. Refer to the *Analog Output* section for a complete description.

**12. Scaling Tab**– If you choose to enable the scaling feature, the parameter would be configured at this window. Refer to the *Scaling* section for a complete description.

**13. Custom Curve Tab**– The SPA<sup>2</sup> has two modes of operation: linear mode and custom mode. In linear mode, the scaled output is proportional to the scaled input. In custom mode, reached by selecting the *Custom Curve* tab, you define a special linearization function. Refer to the *Custom Curve* section for a complete description.

**Note:**

*The Custom Curve parameter can ONLY be configured using your PC and PC Configuration Software Program. It cannot be configured using the front panel push buttons.*

## Status and Tool Bar Legend

<div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;">File</div> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;">View</div> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;">Transfer</div> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;">Comms</div> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;">Monitoring</div> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;">Custom Curve</div> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;">Help</div>	<p>Allows such functions as New, Open, Save and Print</p> <p>Controls whether Tool and Status Bars are viewed on the screen</p> <p>Allows you to Upload and Download configurations</p> <p>Select the PC Port (Com Port) that you will use</p> <p>Allows you to Monitor and Stop monitoring processes</p> <p>Provides functions specific to your Custom Curve table</p> <p>Displays the version of the SPA<sup>2</sup> Configuration Program</p>
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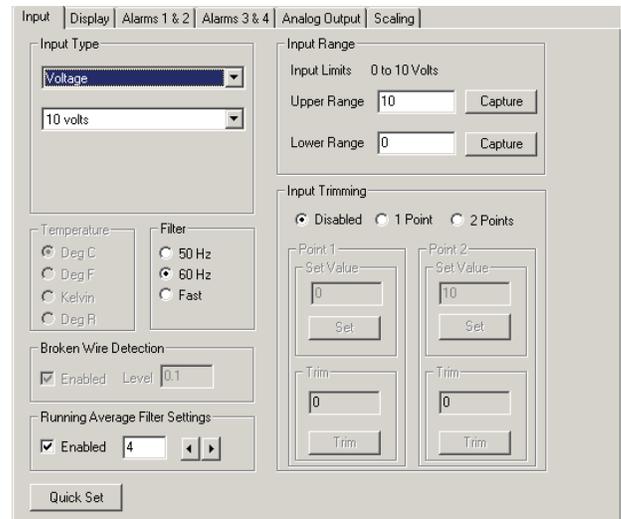
## Configuration Screens

**Note:**

*Unless otherwise noted, ensure that the PC Program is idle before making any selections or configuration changes to the parameters and windows of the program. Also, when attempting to download, upload or Quick Set, monitoring must be stopped. To do this, click “Stop” in the Monitoring dropdown menu, or click the “Stop Monitoring” icon.*

## Input

Figure 21. Input Tab



**Input Type**– Select your input configuration (Current or Voltage) and the respective range of your input.

**Filter**– This setting is used to configure the input filter. This filter is designed to reduce the effects of mains-induced noise. The input filter frequency value should be set to the frequency of the local AC supply– either 50Hz or 60Hz. For units with software V2.11 or greater there is a FAST option, which allows for a faster response time to be achieved.

**Note:**

*A faster response time can be achieved when selecting the Fast option, but this also will produce a reduced accuracy and increase the possibility of mains-induced noise. Selecting FAST option will also disable the Running Average Filter Setting automatically.*

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

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**Broken Wire Detection**— Refer to the “**Caution**” on Page 14 regarding Broken Wire Detection. The SPA<sup>2</sup> monitors your process variable. If the monitored value falls equal to or below a set value, then a state of Broken Wire is declared.

1. Check the “Enabled” box in order to activate Broken Wire Detection.
2. In the “Level” textbox, enter the set value you choose as your limit. The value that you enter must be greater than zero and less than your “Lower Range” value (see *Input Range*).

**Running Average Filter Settings**— This function is for filtering the input signal. The SPA<sup>2</sup> provides this filter with a user-selected range between 1 and 64 for units with software V2.11 or greater and between 1 and 16 for units with software V2.8 or lower. Factory default is 4. This setting is only available through the PC Configuration Software, and cannot be set using push-button menus on the SPA2 unit.

**Note:**

*A higher Running Average Filter setting provides smoother output transitions; however, reduces response time. Conversely, a lower setting provides a faster response time, but may seem more unstable. Typical Alarm Response time for Running Average Filter equal to 1 is 256ms.*

**Input Range**— Allows you to set your upper and lower range values within the range chosen in the *Input Type* section.

The desired Upper and Lower Range settings can be entered via your PC keyboard or captured. To capture an input, follow the steps below.

1. Apply the desired Upper Range input and press the corresponding “Capture” button.
2. Repeat Step 1 to configure the Lower Range value.

**Input Trimming**— Input Trimming increases the measurement accuracy of your instrument by matching the reading of its actual input to either a calibrated source or the device to which it is connected. This verifies that the input to the transmitter is being interpreted correctly.

You may trim any point between 0% and 100% along the scale. Note that one-point trimming applies an offset to the input reading, while two-point trimming applies both an offset and a gain.

Follow the steps below in order to perform input trimming.

1. Select either “1 Point” (one-point trimming) or “2 Points” (two-point trimming) by clicking the appropriate button. Each pair consists of “Set Value” and “Trim” fields.
2. Enter the values that require trimming into the “Set Value” field and click “Set”.
3. Apply the targeted signal to the input, wait until it settles and click “Trim” to capture the measured value. If you chose “2 Points”, repeat the step above for the second point.

**Note:**

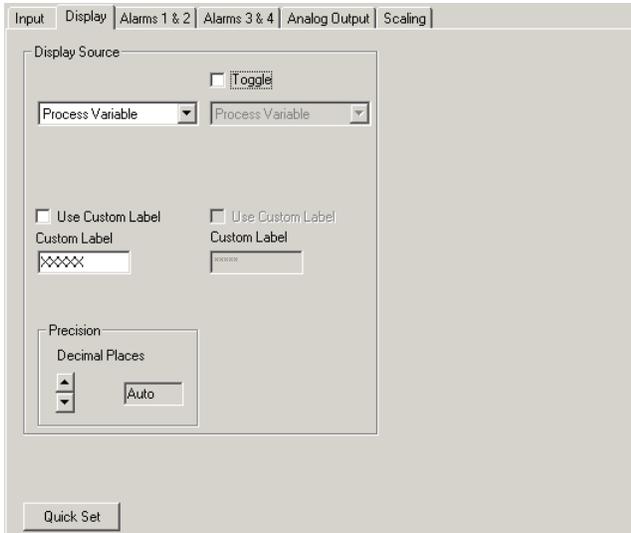
*Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. Or, click the  button in the Tool Bar.*

You may also use the *Quick Set* feature to configure your *Input* parameters and download the settings.

Configure your parameters and click the *Quick Set* button in the window. The settings you have chosen will be applied and downloaded to your unit.

## Display

**Figure 22.** Display Tab



**Display Source**– By selecting the “Toggle” check box, you can choose to view multiple forms of your display. Your selections will toggle every few seconds to display each setting.

**Toggle Mode**– Every four seconds your display will toggle between two displays that you choose.

**Normal Mode**– Displays only your PV or AOOUT value, whichever you select.

**Use Custom Label**– You can choose to assign a specific label, or EGU (Engineering Unit).

1. Check the “Use Custom Label” box.
2. Enter the value you wish viewed into the “Custom Label” text box.

**Precision**– Select the number of decimal places/ resolution of your display.

**Note:**

Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. Or, click the



You may also use the *Quick Set* feature to configure your *Display* parameters and download the settings.

Configure your parameters and click the *Quick Set* button in the window. The settings you have chosen will be applied and downloaded to your unit.

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

### Alarms

Figure 23. Alarms Tab

The screenshot shows the 'Alarms Tab' configuration interface for SPA2. It is divided into two columns for 'Alarm 1' and 'Alarm 2'. Each column has a 'Mode' section with radio buttons for 'Trip', 'Fault', and 'Rate of Change'. Below this are sections for 'Input Failure', 'Out Of Range' (with 'Lower Point' and 'Upper Point' input fields), 'Input Saturation', and 'SPA2 Failure'. There are also 'Trip Point', 'Dead Band', and 'Delta' (with 'Delta Time' in seconds) settings. At the bottom of each column are 'Delay' (in seconds) and 'Fail Safe' options (radio buttons for 'Fail Safe' and 'Non Fail Safe'), along with a 'Latching' checkbox. A 'Quick Set' button is located at the bottom left of the interface.

These instructions apply to Alarms 1 through 4.

**Mode**– Click the appropriate button to configure your alarm as a Trip, Fault or Rate of Change alarm.

**Trip**– Notifies you if your process input drops below or exceeds your trip point setting.

**Fault**– Alerts the user of a fault whenever one has been sensed.

**Rate of Change**– Used if you wish to be notified when deviations occur outside of ranges you have set.

#### Common Alarm Features:

When selecting Trip, Fault, or Rate of Change Modes you can additionally select one or both of the following alarm features:

**Sensor Failure** – You are notified upon breakdown of your input.

**Out of Range** – When selected, you can specify the lower point and upper point in which you want to be notified when readings occur outside of upper or lower range points you have set.

#### **Note:**

When setting **Out of Range Lower Point** the Lower Point must be less than Lower Range Value (set in the Sensor Range section in Input Tab) and greater than the Lower Sensor Limit. Additionally when setting the **Out of Range Upper Point** the Upper Point must be greater than the Upper Range Value (set in the Sensor Range section in Input Tab) and less than the Upper Sensor Limit.

**Delay**– When your unit is in an alarm condition, the delay is the amount of time you set (0-120sec) to elapse before a relay trip. Enter your delay time into the “Delay” text box.

**Fail Safe/Non Fail Safe**– A Fail Safe alarm, if in the alarm condition, will remain in the alarm condition even if power to the unit is removed. Its alarm trip relays are energized whenever the process input is in a non-alarm condition (including any dead band setting). These relays de-energize when the process input trips the alarm.

Non Fail Safe alarm trip relays are energized whenever the process input is in an alarm condition. These relays de-energize when the process input returns to the reset point (including any dead band). To Select a Fail Safe or Non Fail Safe alarm, and click the corresponding button.

**Latching**– The alarm will latch after being activated and requires a manual reset. Select the “Latching” check box if you choose this alarm type.

#### Manual Reset

A latching alarm requires a manual reset. There are two connections labeled “MR” on the SPA<sup>2</sup> top terminal block. These terminals work in conjunction with the latching alarm function.

When a SPA<sup>2</sup> is configured with latching alarms, an alarm condition will not “clear”, that is, the relay will not change state, until the input returns to a non-alarm state **AND** these manual reset terminals are shorted.

#### **Note:**

If manual reset terminals remain shorted, this will disable the alarm latching function.

### Trip Alarm

Choosing the Trip Alarm, you are prompted to complete the following fields:

**Input Failure**– Select this box if you choose to be notified upon breakdown of your input.

**Trip Point**– The reference value used for notification.

In choosing your limits you are setting the parameters for your unit to notify you if your process input drops below (Low Alarm) or exceeds (High Alarm) your trip point setting.

1. Select the “High Alarm” or “Low Alarm” button.
2. Enter the value you wish set as the trip point in the “Trip Point” text box.

**Dead Band**– The Dead Band is the range in which an alarm relay remains in an alarm condition even after the monitored process variable input has returned to a safe level, at or below/above the trip point setting.

3. If choosing to use a dead band value, enter it into the “Dead Band” text box

### Fault Alarm

The Fault Alarm enables the fields outlined below. Select the type of Fault Alarm you require in your application.

**Input Failure**– You are notified upon breakdown of your input.

**Input Saturation**– Should the input become overloaded, or saturated, your alarm would activate.

**SPA<sup>2</sup> Failure**– Choosing this parameter activates the alarm at any internal failure that occurs.

**Note:**

*Enabling all fault alarm configurations will activate the alarm at any failure that occurs (refer to Table 4 in the Error Codes section of this manual).*

### Rate of Change Alarm

The fields below must be configured in order to set up your Rate of Change Alarm properly. The alarm will be set according to the rate of change of the process variable over a set time period.

**Input Failure**– Select this box if you choose to be notified upon breakdown of your input.

**Delta**– This is the amount by which the process variable must change. You may enter a value less than one through the PC Configuration Program **only**. Enter your delta value in the “Delta” text box.

**Delta Time**– The span (1-60sec) in which the delta must change before the alarm is set. Enter your time in the “Delta Time” text box.

**Note:**

*Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. Or, click the  button in the Tool Bar.*

You may also use the *Quick Set* feature to configure your *Alarm* parameters and download the settings. The settings you have chosen will be applied and downloaded to your unit.

**Note:**

*If both alarms have been set with one configured to trip in the case of a broken wire and the other to trip due to another selected parameter and an actual Broken Wire failure occurs, both the **Out of Range** and **Broken Wire** alarms may trip.*

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

### Analog Output

Figure 24. Analog Output (-AO) Tab

If your instrument is equipped with the -AO option, proceed with the following instructions:

**Mode**– Your desired output mode.

1. Select your mode, Current or Voltage.

**Process Variable Range**– Displays the selected process variable range in the “Measurement Mode” section of the *Input* screen.

**Output Range**– Sets your output limits.

2. Set your Output Range. Enter a low and high value .

**Damping**– Output Damping allows you to introduce a delay (0-30sec) into the response of your unit in order to stop short-lived spikes from setting off alarms.

3. Select “Enabled” if you choose to use Damping.
4. Enter your damping time into the “Damping” text box.

**Fail Mode**– In the case of an input failure, you have the ability to set a mode you choose to alert of the failure.

**High/Low**– Choosing either of these options will send the output to a High (23.6mA for current; 11.0V for voltage) or Low (3.6mA for current; -0.5V for voltage) fail mode, respectively.

5. Select your Fail Mode.

**Note:**

Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. Or, click the  button in the Tool Bar.

You may also use the *Quick Set* feature to configure your *Analog Output* parameters and download the settings.

Configure your parameters and click the *Quick Set* button in the window. The settings you have chosen will be applied and downloaded to your unit.

**Output Current / Voltage**– Displays the value presently at your output.

**Trimming**– Output Trimming increases the accuracy of your instrument by calibrating its analog output to the device that is receiving the output. This ensures that the instrument is being correctly interpreted. Refer to Figure 25 for hook-up.

1. Click the “Lower” button to trim the Lower Output Range.
2. To “fine tune” trimmed values, place the value read on the external multimeter, connected to your instrument for trimming, in the “Measured Loop Current / Output Voltage” text box and click “Trim”.
3. Click the “Upper” button and repeat Step 2 to trim the Upper Output Range.
4. Once you have performed your output trimming, click “Unfix”.

**Note:**

Do not click the “Reset” button in the Trimming menu unless you want to disregard your trimmed values and return to the manufacturer’s trim values.

**Output Test**– This test may be performed in order to check output performance and accuracy and to trim other instruments in your setup. Your output will be a current value, in mA, or a voltage equal to the value you enter into the text box. You can check the other devices on the system and calibrate them to this signal.

This feature is independent of the input. If you find that the output requires adjustment, you may perform the Trimming function.

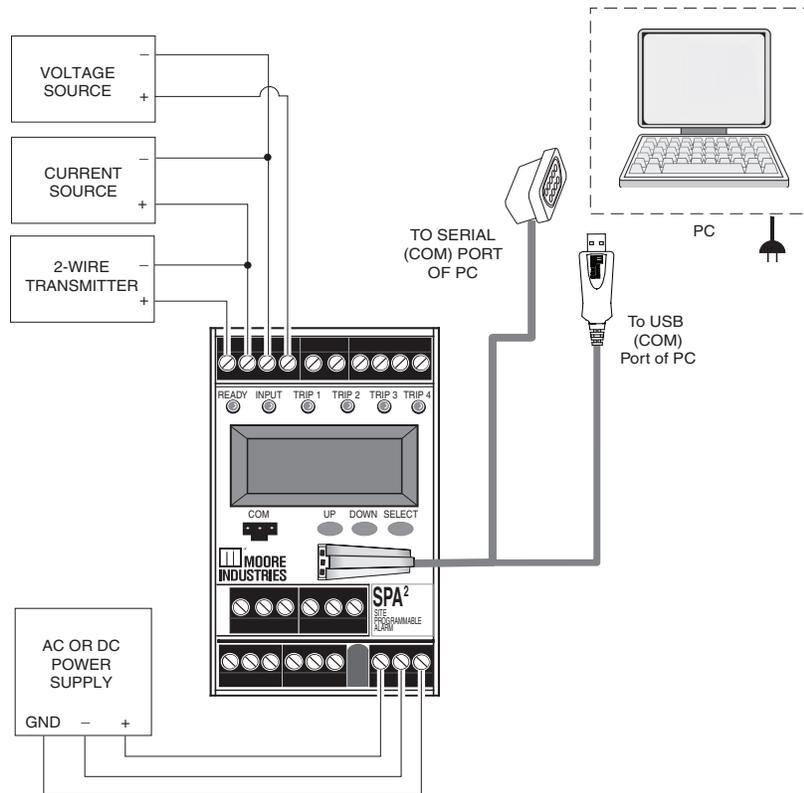
1. Ensure that SPA<sup>2</sup> monitoring is stopped. In the “Fix current / voltage” text box, enter a value between 0-20mA (for current) or 0-10V (for voltage) and click the “Fix” button.

2. Return to monitoring the SPA<sup>2</sup>. You will see the “fixed” value in the “Output Current / Voltage” display and on the external multimeter.
3. Once you have finished, click “Unfix”.

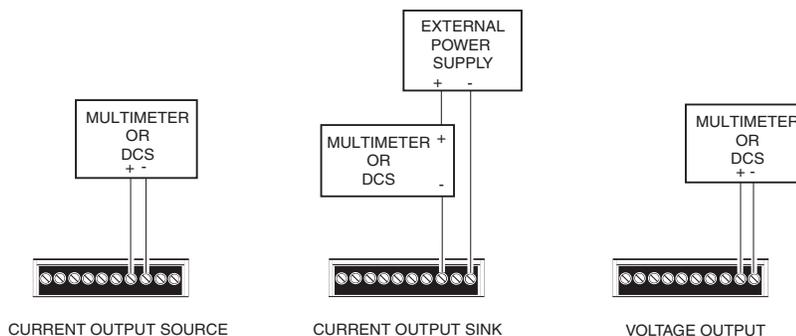
**Note:**

While performing Analog Output Trimming functions, you may notice a message in the “SPA 2 Status” display reading “\*\*\*OUTPUT FIXED\*\*\*”. Clicking the “Unfix” button will clear this message.

Figure 25. SPA<sup>2</sup> (HLPRG) Trimming Hook-Up Diagram For PC Configuration



HOOK-UPS FOR OUTPUT TRIMMING



# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

### Scaling

Figure 26. Scaling Tab

The screenshot shows the 'Scaling' configuration window. At the top, there are tabs for 'Input', 'Display', 'Alarms 1 & 2', 'Alarms 3 & 4', 'Analog Output', and 'Scaling'. The 'Scaling' tab is selected. Inside the window, there is a 'Scaling' section with a checked 'Enabled' checkbox. Below this are two columns of input fields: 'Zero' and 'Full'. Under 'Zero', the 'Input Range' is set to '0' and the 'Process Variable' is '4'. Under 'Full', the 'Input Range' is set to '10' and the 'Process Variable' is '20'. A 'Quick Set' button is located at the bottom left of the window.

#### **Note:**

Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. Or, click the  button in the Tool Bar.

You may also use the *Quick Set* feature to configure your *Scaling* parameters and download the settings.

Configure your parameters and click the *Quick Set* button in the window. The settings you have chosen will be applied and downloaded to your unit.

#### **Note:**

Using the *Scaling* feature will disable the *Custom Curve* capability. Since both are scaling features used to manipulate the appearance of your process variable, only one of these functions may be used at a time.

**Scaling**– This allows you to customize your display for your application. By example: if your process is sending a 4-20mA signal to the SPA<sup>2</sup> and you wish to view the input as 0-100% then this can be accomplished with the *Scaling* feature.

To scale your instrument, perform the following steps.

1. Click the “Enabled” check box.
2. The “Input Range” boxes (in the *Scaling Tab*) will display the range selected in the “Input Range” section of the *Input* screen.
3. In the “Process Variable” text boxes, enter the values you wish displayed when your input is at its Lower Range and Upper Range.

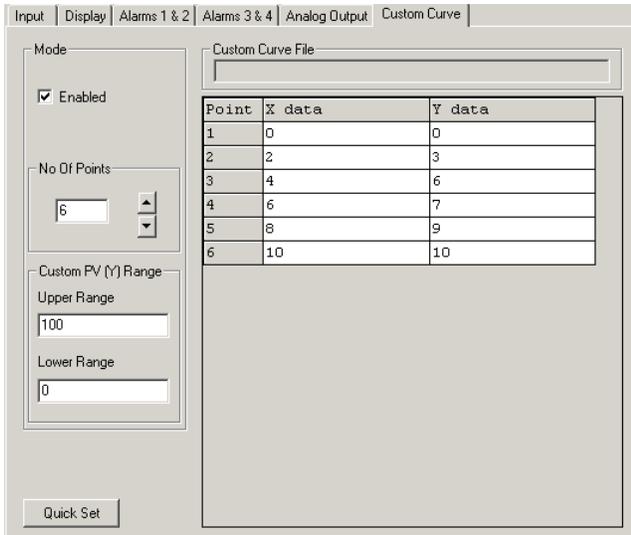
Once downloaded, your unit will display the scaled values on its LCD.

#### **Note:**

In our above example, you may also wish to go to the *Display* screen and click on “Use Custom Label” and enter “PCT” (percent) as your new label.

## Custom Curve

Figure 27. Custom Curve Tab



Point	X data	Y data
1	0	0
2	2	3
3	4	6
4	6	7
5	8	9
6	10	10

**Note:**

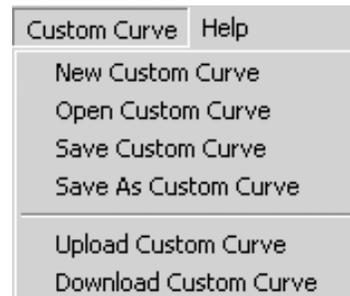
Using the Custom Curve feature will disable the Scaling capability. Since both are scaling features used to manipulate the appearance of your process variable, only one of these functions may be used at a time.

**Custom Curve**—The Custom Curve feature allows you to set up your own custom curve table. This allows you to tell the transmitter what it should output when it receives a certain input. This feature also allows you the ability to write a table in Microsoft® Excel, save it in a .csv format, and import it into the Configuration Software. This makes it simple to save the custom table for downloading to multiple units or for backup purposes.

To create a custom curve:

1. Click the “Enabled” box .
2. Select the number of points for your curve (128 points maximum) and enter it into the “No Of Points” text box.
3. In the “Custom PV (Y) Range” text boxes, enter the values you wish displayed when your input is at its upper and lower ranges.
4. Type your individual values in the X and Y columns. Source variables are inserted into the X Column while the corresponding data is inserted into the Y Column.
5. After all of your data has been entered, you must use the *Custom Curve* dropdown menu to save your newly created custom table (“Save Custom Curve”) and to download it to your SPA<sup>2</sup> (“Download Custom Curve”). See Figure 28.

Figure 28. Custom Curve Dropdown Menu



**Note:**

Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. Or, click the  button in the Tool Bar.

You may also use the *Quick Set* feature to configure your *Custom Curve* parameters and download the settings.

Configure your parameters and click the *Quick Set* button in the window.

**Note:**

When the Custom Curve feature is enabled for your unit, the SPA<sup>2</sup> will display “CC” in the lower left corner of its LCD.

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

### Error Codes

Every SPA<sup>2</sup> is subjected to an exhaustive battery of operational checks and tests prior to its shipment. Occasionally, however, units can sustain damage getting from the factory to the user.

As a safeguard, your unit is equipped with a full set of internal diagnostics that check operation and configuration upon power-up. If there are problems with the microprocessor, or with conflicting operating parameter settings, the LCD will display an error code upon unit start-up.

Table 4 lists the error codes.

For most of these problems, it will be necessary to return the instrument to the factory.

Table 4. SPA<sup>2</sup> (HLPRG) LCD Error Codes

Error Message	What it Means	What to Do
*ERROR ADC	ADC watchdog failure	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
*ERROR RAM	EEPROM Error - The internal processor failed	
*ERROR CALIB	Calibration data bad - The factory-set calibration of the unit has failed to initialize	
*ERROR CKSUM	Configuration or calibration data checksum mismatch	
*ERROR BLANK	EEPROM blank	
*ERROR SPA2	Other or combination of errors	
*ERROR RJC	Reference Junction Compensation Resistor Burnout	
*ERROR WDOG	Watchdog failure	
*ERROR SWDOG	Software Watchdog failure	
ERROR OUT OF LIMIT	The input is out of the custom table or RTD/TC table limits	Check input signal to ensure that it is within table limits.
ERROR UNDER RANGE or ERROR OVER RANGE	Process variable out of range (<-99999 or >+99999)	Check input signal to ensure that it is within sensor limits.
ERROR INSAT	Input saturation condition (reaches 110% of calibrated range)	
ERROR INPUT	Input error condition	
*ERROR DZERO	Maths division by zero error	Cycle power and download configuration data. If the error occurs again, return the unit to the factory for service.
*ERROR CONFG	Configuration information bad	Cycle power to the unit, then run through the configuration menus to ensure that the technician made the correct sensor selections, range settings, etc.
WIRE 1 BROKE	Wire 1 broken	Check your system for a broken wire(s). Fasten any loose wiring; replace broken wires.
WIRE 2 BROKE	Wire 2 broken	
WIRE 3 BROKE	Wire 3 broken	
WIRES BROKE	Wire 4 broken or more than one wire broken	

\*This will induce a "SPA<sup>2</sup> Failure" condition in a configured Fault Alarm.

## Installation

Installation consists of physically mounting the unit and completing the electrical connections.

### Mounting

The SPA<sup>2</sup> is housed in a “universal” DIN case that can be mounted on both 35mm G-type (EN50035) and 35mm Top-Hat (EN50022) DIN-rail. To mount the SPA<sup>2</sup> on a Top-Hat DIN-rail, seat the upper extrusion on the unit back panel over the top lip of the rail and pivot downward until the housing locks into place. To mount the unit on a G-type rail, seat the extrusion under the top lip of the rail and again, pivot downward. When mounting multiple units, like a rack or cabinet, make sure to allow adequate vertical spacing for pivoting the units.

### Making the Electrical Connections

Refer to Figure 3 (SPA<sup>2</sup> Front Panel Configuration) or Figure 19 (SPA<sup>2</sup> PC Configuration) for electrical connections.

## Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

- Any Moore Industries product in a metal case or housing should be grounded.
- The protective earth conductor must be connected to a system safety earth ground before making other connections.
- All input signals to, and output signals from, Moore Industries’ products should be wired using a shielded, twisted pair wiring technique. Shields should be connected to an earth or safety ground.
- For the best shielding, the shield should be run all the way from the signal source to the receiving device. (see Note below)
- The maximum length of unshielded input and output signal wiring should be 2 inches.

**Note:**

*Some of Moore Industries’ instruments can be classified as receivers (IPT<sup>2</sup>, IPX<sup>2</sup>, etc.) and some can be classified as transmitters (TRX, TRY, etc.) while some are both a receiver and a transmitter (SPA<sup>2</sup>, HIM, etc). Hence, your shield ground connections should be appropriate for the type of signal line being shielded. The shield should be grounded at the receiver and not at the signal source.*

# SPA<sup>2</sup>

Programmable Current/Voltage  
Limit Alarm Trips

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## Contact/Load Suppression

When the instrument relays are used to switch external relay coil, contactor, solenoid or some other inductive load, large voltage spikes may be created in nearby cable harnesses. When excessive, these voltage spikes can disrupt the operation of all nearby electronics including this product. Please follow the external relay manufacturer instructions for their recommended relay coil suppression kits. Inductive loads should have suppression devices installed on the relay right across the relay coil itself. Usually this is a simple diode for dc circuits. AC circuits routinely use an R-C snubber.

## CE Conformity

Installation of any Moore Industries' products that carry the CE marking must adhere to the guidelines in the Recommended Ground Wiring Practices section in order to meet the EN 61326 requirements set forth in the applicable EMC directive.

## Operation

Once programmed, calibrated, installed, and supplied with the correct power, the SPA<sup>2</sup> alarm begins to operate immediately. Depending upon environmental conditions, it can be expected to operate unattended for extended periods of time.

## Maintenance

Moore Industries suggests a quick check for terminal tightness and general unit condition every 6-8 months. Always adhere to any site requirements for programmed maintenance.

## Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customers in products and services. We perform a battery of stringent quality assurance checks on every unit we ship. If any Moore Industries product fails to perform up to rated specifications, call us for help. Our highly skilled staff of trained technicians and engineers pride themselves on their ability to provide timely, accurate, and practical answers to your process instrumentation questions.

Factory phone numbers are listed on the back cover of this manual.

If problems involve a particular SPA<sup>2</sup>, there are several pieces of information that can be gathered ***before you call the factory*** that will help our staff get the answers you need ***in the shortest time possible***. For fastest service, gather the complete model and serial number(s) of the problem unit(s) and the job number of the original sale.

## SPA<sup>2</sup> in Safety Instrumented Systems

This user manual contains all of the information needed to configure, install, operate and maintain this product. For safety applications the SPA<sup>2</sup> must only be used in accordance with this information and the restrictions and limitations as detailed below.

The SPA<sup>2</sup> is classified as a Type B device, in accordance with IEC 61508 and has undergone a hardware assessment only. For full certification of the safety application, all requirements of IEC61508 must be considered.

### Failure Rate Data

Failure data (including PFD and SFF) required for calculations to use the SPA<sup>2</sup> as part of a Safety Instrumented System is provided in the SPA<sup>2</sup>U FMEDA Report (Moore Industries Document No: 700-702-34) for Universal Power Supply models and in the SPA<sup>2</sup> FMEDA report (Moore Industries' Document No: 700-702-19) for all other models.

An FMEDA option is available on the SPA<sup>2</sup> which provides a copy of the FMEDA report, Certificate of Conformance and ISO9001 certificate for each order. In addition test data is provided for each unit which is subjected to a 72 hour burn-in at 65°C and a commitment to perform root cause failure analysis in case of unit failure.

### Product life

The product life of the SPA<sup>2</sup> is 10-20 years (based on worst case component life data). However, IEC 61508-2, section 7.4 states that a useful lifetime based on experience has more weight than the calculated figures; Note 3 in the section comments that the useful lifetime of a transmitter is most often within 8 to 12 years.

### Installation

No special installation is required in addition to the standard installation practices in this user manual. Refer to the specifications table of this user manual for ambient conditions and required power input.

## Configuration

The unit can be configured using the front panel buttons or pc configuration software as described in this manual.

Do not attempt to connect the SPA<sup>2</sup> pc communication cable to the SPA<sup>2</sup> while the output relays are connected to a load.

### **WARNING:**

*While the system is in configuration mode the system should not be operational in the safety function.*

## Using Relays as Safety Output

The following considerations and restrictions will apply when using the SPA<sup>2</sup> in a safety application:

All relays which are used in the safety function must be configured as failsafe (de-energized on trip). The SPA<sup>2</sup> must have one relay that is configured as a fault alarm which detects input failure, input saturation and SPA<sup>2</sup> failure. In addition, at least one trip alarm must be connected to the actuator/equipment under control (EUC). The fault relay must either be connected in series with the trip alarm OR connected to a separate indicator or logic solver to provide notification that the SPA<sup>2</sup> is in a fault state. Separating the process and fault loads increases availability but its use must be authorized only after a careful hazard and operability study involving suitably qualified persons.

### **WARNING:**

*With this configuration, an internal SPA<sup>2</sup> fault would not trip the EUC.*

## Using Analog Output as Safety Output

The SPA<sup>2</sup> may optionally be provided with an analog output. Data is provided to use the AO in the safety path in the SPA<sup>2</sup>U FMEDA report with the following configuration: Universal Power Supply models using the AO set to 4-20mA . The logic solver connected to the AO must be either configured to detect a 'fail low' condition (anything less than 4.0mA is detected as a fault) or 'fail windowed' condition (anything outside the 4-20mA range is detected as a fault).

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

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### Process Safety Time

Process safety time is the minimum time from the initiation of a hazardous event to the point where the hazardous event is unavoidable. Any safety function designed to either prevent the event or at least mitigate its effect must be capable of performing its specified safety function in a time period very much less than the process safety time.

Please ensure that any configured delay (1-120secs) in the SPA<sup>2</sup> trip alarm is well within the process safety time.

### Sensor Types

The SPA<sup>2</sup> is designed for use with a wide variety of inputs (See Table 4 of this manual for valid inputs and ranges). It is the end user's responsibility to ensure that the chosen sensor is capable of achieving the required loop SIL.

### Broken Wire Detection

The SPA<sup>2</sup> is provided with the facility to detect both open circuit and short circuit input. This broken wire detection must always be enabled. This is essential to ensure that dangerous failure of the sensor or signal input is detected by the SPA<sup>2</sup> and consequently alarmed.

**WARNING:**

*For HIGH LEVEL INPUT, the Lower Range Value (LRV) must be set higher than zero. Broken Wire Detection will be disabled if LRV is set to zero and will invalidate the safety function.*

### Sensor Trimming Enable/Disable

Sensor trimming should be used with extreme care as this facility is allowed to trim the sensor accuracy by more than 2% of the trimming point value which could impair measurement accuracy. It is the user's responsibility to ensure that the safety application can tolerate this.

### Latching Mode Enable/Disable

The SPA<sup>2</sup> is provided with the capability to latch on a trip or fault, i.e. once the output process or fault alarm relays have de-energized they will remain de-energized until either the manual reset contact is closed or the unit is power cycled. The use of this facility will be determined by the application. It is recommended that if the output state is latched externally to the SPA<sup>2</sup>, the SPA<sup>2</sup> latching option is disabled.

### Remote Manual Reset Procedural Issues

The SPA<sup>2</sup> has a facility for the connection of a remote switch to release the latch on the outputs. This function is meaningful only when automatic latching of outputs is selected in the configuration. If the manual reset is made part of the safety procedure, it must only be used under strict supervisory and procedural control. The use of a key operated momentary contact is suggested.

## Operation and Maintenance

### Proof Test Procedure

It is normal practice with SIS that the components undergo periodic proof tests to expose dangerous faults that are not detected by internal diagnostic tests. Thus, this section specifies how the dangerous undetected faults determined during the FMEDA can be detected during proof testing.

Calculation of the required proof test interval can be made using data in the FMEDA report (Moore Industries' Document No: 700-702-34 or 700-702-19).

A proof test interval of 18 months is recommended for a single SPA<sup>2</sup> used in a typical SIL 2 low demand application (15% of the SIL band being allocated to the SPA<sup>2</sup> at 40°C ambient).

The proof tests described in Tables 5 and 6 are designed to cover all possible dangerous undetected faults that can be detected without opening the unit (98% coverage). The proof test steps in Table 6 are only applicable if the Analog Output is used as a in the safety path. Periodically testing the SPA<sup>2</sup>, using the proof test steps outlined below, the accumulated PFD<sub>AVG</sub> value can be reduced to a smaller but non-zero value. To completely test for all possible dangerous undetected faults, the unit must be sent back to the factory for a comprehensive proof test inspection.

## **Repair and Replacement**

The SPA2 is not intended to be repaired on site and has no components needing maintenance or regular replacement. On device failure, the SPA2 should be returned to Moore Industries World Headquarters in North Hills, CA U.S.A for repair and refurbishment (refer to Returns Procedures at the end of this manual).

Repair or replacement of any component without authorization from Moore Industries will invalidate any remaining warranty and FMEDA data.

## **Recording and Reporting of SPA2 Performance**

It is the end user's responsibility to maintain records of all safety component failures, especially those that might be classified as potentially dangerous.

This feedback data not only helps the supplier identify and rectify reliability issues but also to provide quantitative data to increase confidence in the FMEDA analysis of dangerous failure rates.

Please ensure that any components returned to Moore Industries are returned with a clear report identifying the fault experienced.

# SPA<sup>2</sup>

## Programmable Current/Voltage Limit Alarm Trips

Table 5. Proof Test Steps

Step	Action
1	Bypass the safety PLC or take other appropriate action to avoid a false trip
2	Connect the SPA2 to a PC running the SPA2 configuration program
3	Configure all alarm outputs such that: <ul style="list-style-type: none"><li>i. Each alarm is set to the midpoint of the configured range</li><li>ii. Alarm 1 is set to trip when the input is below the midpoint, Alarm 2 is set to trip when the input is above the midpoint, and so on</li></ul>
4	Run the SPA2 configuration program in monitoring mode
5	Apply a calibrated input near the high limit of the selected input configuration
6	Verify that the input as reported by the SPA2 configuration program matches what is expected <i>This tests for failures in the input connections to the A/D converter near the high limit operation</i>
7	Verify that for the configured alarms, the output is as expected <i>This test verifies signaling for the tested relay and for issues in the relay to the output connections</i>
8	Apply a calibrated input near the low limit of the selected input configuration
9	Verify that the input as reported by the SPA2 configuration program matches what is expected <i>This test completes the full test for failures in the input connections to the A/D converter near the low limit operation. This also covers the CPU and A/D clocks</i>
10	Verify that for the configured alarms, the output is as expected <i>This test ensures that there is no crosstalk between the relays</i>
11	Use the SPA2 configuration program to change the input to a different gain
12	Verify the gain change by: <ul style="list-style-type: none"><li>i. If the original input range was smaller: Verify by applying an input that is out of range for the original configuration and is in range for the new range being tested</li><li>ii. If the original input range was larger: Verify by applying an input that is in range for the original configuration and is out of range for the new range being tested</li></ul> <i>This tests all of the communication lines between the CPU and the A/D converter</i>
13	Restore the SPA2 to its original configuration
14	Restore the loop to full operation
15	Remove the bypass from the safety logic solver or otherwise restore normal operation
16	Confirm the configured logic solver complies with the system specification

**Table 6.** Additional Proof Test Steps for Analog Output

Step	Action
1	Bypass the safety PLC or take other appropriate action to avoid a false trip
2	Configure the SPA2 for 2-10V input with broken wire set at 2V
3	Provide an input of 4V. Verify that the analog output is within 2% of 8.0mA
	<i>This, in addition to the next step verifies that there are no failures that cause the AO to have more than 2% error as well as lose linearity</i>
4	Provide an input of 8V. Verify that the analog output is within 2% of 16.0mA
	<i>This, in addition to the previous step verifies that there are no failures that cause the AO to have more than 2% error as well as lose linearity</i>
5	Restore the SPA2 to its original configuration
6	Restore the loop to full operation
7	Remove the bypass from the safety logic solver or otherwise restore normal operation

# EC Declaration of Conformity

Moore Industries-International, Inc.  
16650 Schoenborn Street  
North Hills, CA 91343-6196 U.S.A.

Date Issued: 21 Feb. 2013  
No. 100-100-207 Rev. C  
Page 1 of 2

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Equipment Description:

**Site-Programmable Limit Alarm Trip**  
**Model SPA2 / \* / \* / \* / \* / \***

\* Indicates any input, output, power, options and housing as stated in the product data sheet.

Directive:

**2004/108/EC (EMC)**

Specifications Conformed To:

**EN 61326-1:2006** Electrical equipment for measurement, control and laboratory use - EMC requirements

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Equipment Description:

**Site-Programmable Limit Alarm Trip**  
**Model SPA2 / \* / \* / 110DC or UAC or U / \* / \***

\* Indicates any input, output, options and housing as stated in the product data sheet.

Directive:

**2006/95/EC (LVD)**

Specifications Conformed To:

**EN 61010-1:2001**  
**(C22.2 No. 1010-1:2004)**

Electrical Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

# EC Declaration of Conformity

Moore Industries-International, Inc.  
16650 Schoenborn Street  
North Hills, CA 91343-6196 U.S.A.

Date Issued: 21 Feb. 2013  
No. 100-100-207 Rev. C  
Page 2 of 2

Equipment Description:

**Site-Programmable Limit Alarm Trip  
Model SPA2 / \* / \* / \* / \* / \***

\* Indicates any input, output, power, options and housing as stated in the product data sheet.

Directive:

**94/9/EC (ATEX)**

Provisions of the Directive Fulfilled by the Equipment:

**Group II Category 3G Ex nA IIC T4 @ 85°C; T5 @ 50°C**

Conformity Assessment Procedure:

**Internal Control of Production - Annex VIII (Module A)**

Technical File:

**MII 13ATEX0220X**

Standards Referenced:

**EN 60079-0:2006** Explosive atmospheres Part 0: Equipment - General requirements

**EN 60079-15:2005** Explosive atmospheres Part 15: Equipment protection by type of protection "n"

Special Conditions of Use:

**When installed as Category 3 equipment, the apparatus shall be mounted within a tool-secured enclosure which meets the requirements of EN 60079-0 and EN 60079-15 and is capable of accepting the applicable wiring methods specified in EN 60079-14. The enclosure shall, at a minimum, meet the requirements of IP54.**

**On installation, the apparatus shall be provided with supply transient protection external to the apparatus such that the voltage at the supply terminals of the apparatus does not exceed 364V peak or 364Vdc.**

**The COM port shall not be used in Hazardous areas.**

On Behalf of Moore Industries-International, Inc., I declare that, on the date the equipment accompanied by this declaration is placed on the market, the equipment conforms with all technical and regulatory requirements of the above listed directives.

Signature:



Deanna Esterwold, Quality Manager

## RETURN PROCEDURES

**To return equipment to Moore Industries for repair, follow these four steps:**

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

### Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

### Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
  - a) A note listing the symptoms that indicate the unit needs repair
  - b) Complete shipping information for return of the equipment after repair
  - c) The name and phone number of the person to contact if questions arise at the factory
3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

#### WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES, BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

#### RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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