

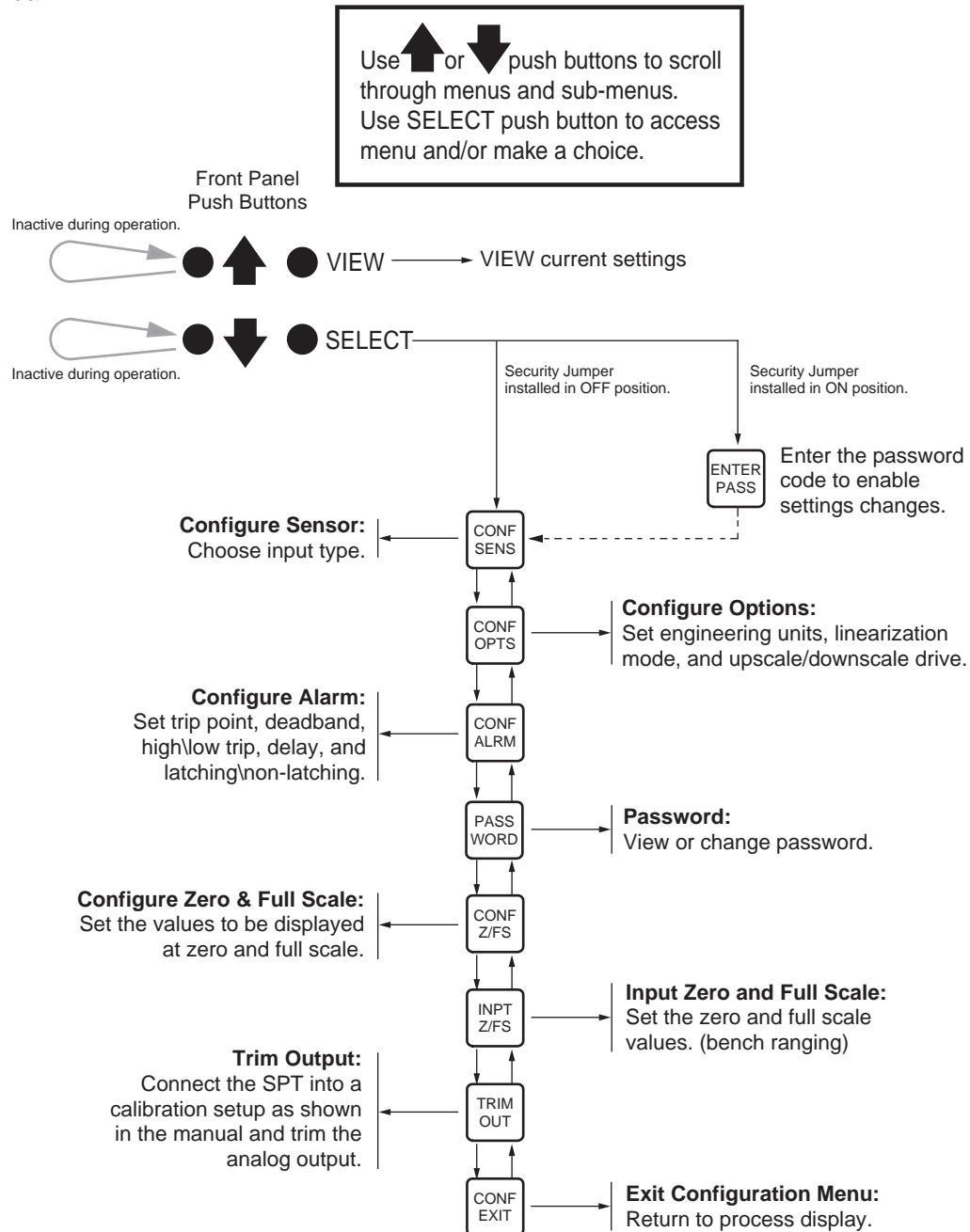
# SPA

Site-Programmable RTD &  
Thermocouple Limit Alarm Trips



## SPA TPRG Quickstart Guide

Use the front push-buttons to quickly and easily setup the SPA for your application. After programming your alarm using the diagram below, install the unit into your application using the connection diagram and terminal designation table on pages 28 and 29 of this manual.



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### SPA Temperature Inputs

This is the users' manual for the Temperature Input model of the Moore Industries' Site-Programmable Process Alarms (SPA). The SPA monitors a process variable and provides up to four, fully user configurable, contact closure outputs whenever the input falls outside a user-set, high or low trip point. SPAs are typically used to activate a warning light, bell, or buzzer; or to initiate a system shutdown, thus acting as a simple, but highly reliable and effective means of safe-guarding a process.

### Programmable Inputs

The Programmable RTD & Thermocouple unit, or SPA TPRG (for Temperature input **P**rogrammable) handles inputs from RTDs, thermocouples, direct resistance and millivolt sources.

### Programmable Outputs

The SPA TPRG can be equipped with an analog output option to provide either a 1-5V or 4-20mA output (-AO), or zero-based, 0-5V or 0-20mA, output (-AOZ). Both AO and AOZ equipped units are set by the user to provide either current (switchable between source or sink modes), or voltage.

The source/sink setting for the optional analog output is controlled by DIP switches that are located behind an easy-to-remove access panel inside the unit's housing.

### Programmable Display

With the RTD and Thermocouple Input SPA, the display is directly proportional to the input. The user can program the unit's display to show either °C or °F – with a simple push of a button.

### Programmable Alarms

The SPA can be ordered with 1, 2, 3, or 4 contact closure alarms. Each alarm can be individually programmed for a different trip point, deadband, delay, high or low alarming, latching or non-latching, and failsafe or non-failsafe operation.

The SPA also provides two ways to set the alarm trip point. If an input source is either unavailable or inconvenient, the unit's front panel push buttons and integral liquid crystal display (LCD) can be used to enter the desired trip point.

When a source is available, the SPA can capture trip points by setting the input to the desired trip and pressing the appropriate button.

Failsafe or Non-failsafe alarm functioning is controlled by DIP switches that are located behind an easy-to-remove access panel inside the unit's housing.

### Total Sensor Diagnostics

The standard SPA TPRG features a patented input circuit that eliminates much of the time consuming trial-and-error work of troubleshooting sensor networks. Total Sensor Diagnostics (TSD) is the SPA's continuous monitoring of the status of both the input sensor and its wiring.

If a wire breaks, or if the sensor fails, a front panel LED corresponding to the input changes color to flag the problem, and the LCD displays a message telling exactly where the failure has occurred.

In multiple RTD, or ohms input applications, messages on the front panel indicate which sensor has failed or which wire has broken. The unit distinguishes between failures on one of the wires or the sensor itself, or between one wire and another.

The SPA also allows the user to program the unit alarms to change state (trip) in the event of an input (sensor) failure. When equipped with one of the analog output options, the user can also program the unit's current or voltage output to drive upscale or downscale in the event of a failure.

An optional single alarm failure configuration (-SF3) freezes all but one of the alarms upon a sensor failure, tripping only relay #3.

### Universal Mounting

The SPA is housed in a "universal" DIN case that can be mounted on both 32mm G-type (EN50035) and 35mm Top-Hat (EN50022) DIN-rail. The Installation section of this manual gives the dimensions of the housings for the various SPA configurations.

## Specifications

<p><b>Performance</b> <b>Repeatability:</b> Trip point repeats within <math>\pm 0.05\%</math> of input span  <b>Display Accuracy:</b> <math>\pm 1</math> digit  <b>Input Accuracy:</b> See Table 1 on following page  <b>Cold Junction Compensation Accuracy (T/C inputs only):</b> <math>\pm 0.25^\circ\text{C}</math>  <b>Stability:</b> <math>\pm 0.1\%</math> of calibrated span, maximum, over 6 months  <b>Deadband:</b> User set within selected input range; fully scaleable and set in user-selected engineering units  <b>Response Time:</b> 700 milliseconds (Defined as time from step change on input to alarm state change when alarm is set to trip mid-point)  <b>Alarm Trip Delay:</b> Programmable from 0-60 seconds  <b>Line Voltage Effect:</b> <math>\pm 0.005\%</math> of span for a 1% change in line voltage (ac or dc)  <b>Isolation:</b> 1000Vrms between case, input, output (units with -AO or -AOZ option) and power terminals (NOTE: High voltage effect of <math>\pm 0.001\%</math> of output span/V possible with prolonged exposure to ac voltage above 200Vac)  <b>Power Consumption:</b> 2-3.5W, nominal; 4.3W, maximum</p>	<p><b>Performance (continued)</b> <b>Input Failure (Burn-out) Protection:</b> On detected input failure, all relays switch to alarm state (unless -SF3 option is specified, then only relay #3 trips); front panel push buttons select HI/LO alarms and upscale or downscale drive if equipped with -AO or -AOZ option  <b>Input Impedance:</b> <math>10\text{M}\Omega</math> for T/C and mV inputs  <b>Input Over-Range Protection:</b> <math>\pm 5\text{Vdc}</math>; 180% of maximum input span</p> <p><b>Performance with Analog Output (-AO Option)</b> <b>WITH ANALOG OUTPUT</b>  <b>Output Accuracy:</b> <math>\pm 0.03\%</math> of output span (includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution)  <b>Response Time:</b> 400ms maximum time for output to go from 10% to 90% for step change on input  <b>Ripple (up to 120Hz):</b> Current output, 10mV peak-to-peak max. when measured across a <math>250\Omega</math> resistor; Voltage output, 15mV peak-to-peak max.  <b>Output Limiting:</b> 117% of span max.; 115% of span typical  <b>Load Effect:</b> <math>\pm 0.01\%</math> of span from 0 to maximum load resistance on current output</p> <p><b>Ambient Conditions</b> <b>Operating Range:</b> <math>-25^\circ\text{C}</math> to <math>+65^\circ\text{C}</math> (<math>-13^\circ\text{F}</math> to <math>+149^\circ\text{F}</math>)  <b>Storage Range:</b> <math>-40^\circ\text{C}</math> to <math>+80^\circ\text{C}</math> (<math>-40^\circ\text{F}</math> to <math>+176^\circ\text{F}</math>)  <b>Relative Humidity:</b> 0-95% non-condensing</p>	<p><b>Ambient Conditions (continued)</b> <b>Ambient Temperature Effect:</b> <math>\pm 0.005\%</math> of output span per <math>^\circ\text{C}</math> max.; <math>\pm 15\text{ppm}</math> of input signal  <b>Effect of Ambient Temperature on Cold Junction Compensation (T/C inputs only):</b> <math>\pm 0.05\%</math> per <math>50^\circ\text{C}</math> change in ambient temperature  <b>RFI/EMI Protection:</b> 30V/m - ABC <math>\leq 0.5\%</math> error in reading when tested according to SAMA standard PMC 33.1  <b>Common Mode Rejection:</b> 100dB @ 60Hz  <b>Normal Mode Rejection:</b> 40dB @ 60Hz</p> <p><b>Adjustments</b> Front panel push buttons control settings for zero, span, alarm trip points, high/low alarms, etc.; Easy access internal settings select current (source or sink) or voltage output, and failsafe or non-failsafe alarm functions; Internal jumper and menu password protect parameter settings</p> <p><b>Indicators</b> <b>LCD:</b> 2x4 character, backlit, alphanumeric readout accurate to the nearest digit.  <b>Range:</b> -9999 to 9999  <b>LED's:</b> Dual-color TRIP light (one for each relay) shows green for non-alarm, red for alarm; READY light indicates normal operation, extinguishes in the event of any internal failure; Dual-color INPUT light shows green for input with rated range, red for over range and sensor/wire failure</p> <p><b>Weight</b> 456 to 513 g (16.1 to 18.1 oz)</p>
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Specifications and information subject to change without notice.

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**Table 1. SPA Input Accuracy**

Input Type Selection	$\alpha$	$\Omega$	Range	Accuracy	Minimum Span <sub>2</sub>
Pt RTD	3750	1000	-185°C to +540°C (-301°F to +1004°F)	±0.1°C	Single, 100Ω Sensor: 15°C Averaging 100Ω Sensors: 15°C Differential of 100Ω Sensors: 30°C  Single, 200Ω Sensor: 10°C Averaging 200Ω Sensors: 10°C Differential of 200Ω Sensors: 20°C  Single, 500 or 1000Ω Sensor: 7.5°C Averaging 500 or 1000Ω Sensors: 7.5°C Differential of 500 or 1000Ω Sensors: 15°C
	3850	100, 200, 300, 400, 500, 1000	-200°C to +850°C (-328°F to +1742°F)	100Ω: ±0.2°C; 200, 300, & 400Ω: ±0.15°C; 500, & 1000Ω: ±0.1°C;	
	3902	100, 200, 400, 500, 1000	-100°C to +650°C (-148°F to +1201°F)	100Ω: ±0.2°C; 200, & 400Ω: ±0.15°C; 500, & 1000Ω: ±0.1°C;	
	3911	100, 500	-200°C to +630°C (-328°F to +1166°F)	100Ω: ±0.2°C; 500Ω: ±0.1°C;	
	3916	100	-200°C to +510°C (-328°F to +950°F)	±0.2°C	
	3923	98.129	-200°C to +600°C (-328°F to +1112°F)	±0.2°C	
	3926	100, 200, 470, 500	-200°C to +630°C (-328°F to +1166°F)	200 to 470Ω ±0.15°C; 500Ω: ±0.1°C	
	3928	100	-200°C to +850°C (-328°F to +1742°F)	±0.2°C	
Ni RTD	672	120	-80°C to +320°C (-112°F to +608°F)	±0.14°C	
Cu RTD	427	9.035	-50°C to +250°C (-58°F to +482°F)	±1.6°C	Single Sensor: 100°C Averaging Sensors: 100°C Differential of Multiple Sensors: 200°C
$\Omega$			0-4000Ω	±0.4Ω	30Ω
		Range	Linear Conformance Range	Accuracy	Minimum Span <sub>2</sub>
T/C J		-210°C to +770°C (-346°F to +1418°F)	-180°C to +760°C (-292°F to +1400°F)	±0.25°C	35°C
T/C K		-270°C to +1390°C (-454°F to +2534°F)	-150°C to +1370°C (-238°F to +2498°F)	±0.3°C	40°C
T/C E		-270°C to +1013°C (-454°F to +1855.4°F)	-170°C to +1000°C (-274°F to +1832°F)	±0.25°C	35°C
T/C T		-270°C to +407°C (-454°F to +764.6°F)	-200°C to +400°C (-328°F to +752°F)	±0.25°C	35°C
T/C R		-50°C to +1786°C (-58°F to +3246.8°F)	0°C to +1760°C (-32°F to +3200°F)	±0.5°C	50°C
T/C S		-50°C to +1786°C (-58°F to +3246.8°F)	0°C to +1760°C (-32°F to +3200°F)	±0.5°C	50°C
T/C N		-270°C to +1316°C (-454°F to +2400.8°F)	-130°C to +1300°C (-202°F to +2372°F)	±0.4°C	45°C
T/C B		+200°C to +1836°C (+392°F to +3336.8°F)	+400°C to +1820°C (+752°F to +3308°F)	±0.8°C	75°C
Voltage - mV		-10 to +120mV		±15μV	4mV

1. Actual  $\alpha$  is 0.003750, 0.003850, etc.

2. Recommended Minimum Span. Tighter spans may result in output inaccuracies.

## Alarm Terminology

Before setting up the SPA, 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. Figure 1 illustrates the way the SPA 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, 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 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 relays can be set by the user to function as either latching or non-latching.

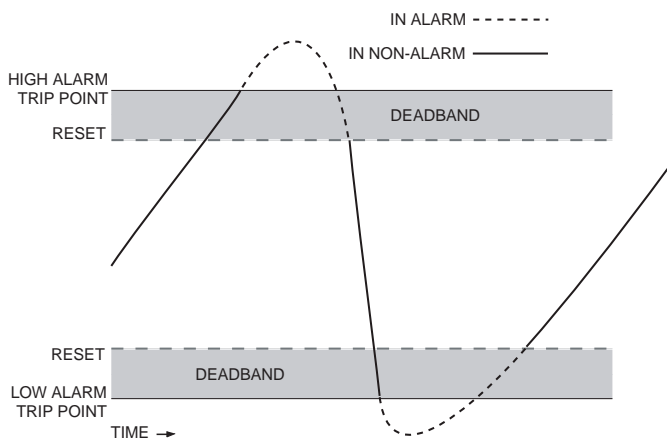
The **Reset Point** is the process input level at which the user wants an alarm relay to change state, typically going from alarm to non-alarm. The reset point is not necessarily the same as the trip point, because most applications call for a buffer zone or “*Deadband*” around the trip point to allow for minute fluctuations in the process input. In the SPA, the reset point is determined by the deadband setting. Latching SPA 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 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 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).

**Figure 1.** How Alarms Work with the Process Input



### **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.

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### Internal Settings

The Failsafe/Non-failsafe relay and the password security functions of the SPA are controlled by means of simple DIP switches and a single jumper inside the unit housing.

If the unit is equipped with the AO or AOZ options, voltage and current sink/source selection is also inside.

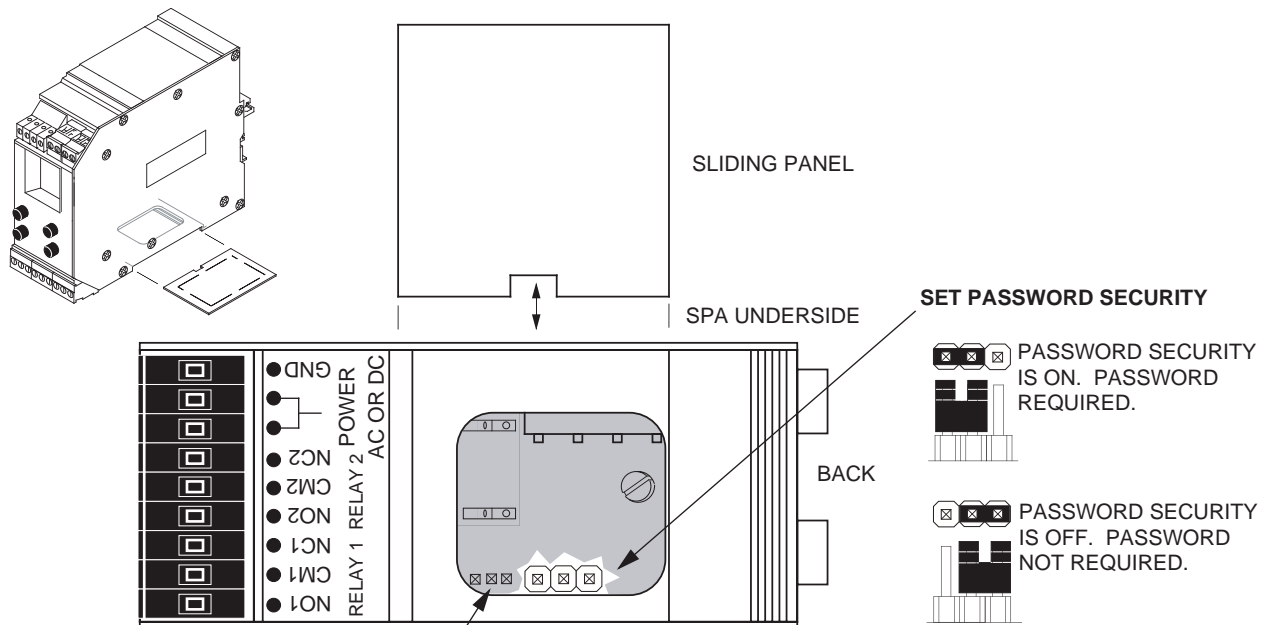
The SPA housing is fitted with a sliding access door in its bottom panel. Figures 2, 3, and 4 show the panel and the location of each of the controls for setting:

- Password Security ON/OFF (**Figure 2**)
- Failsafe/Non-failsafe Alarm Function (**Figure 3**)
- Current Source/Sink or Voltage (**Figure 4**)  
(Available in AO-equipped SPAs only)

**NOTE:**

SPAs equipped with the DPDT option make use of switches 1 and 2 only (see Figure 3).

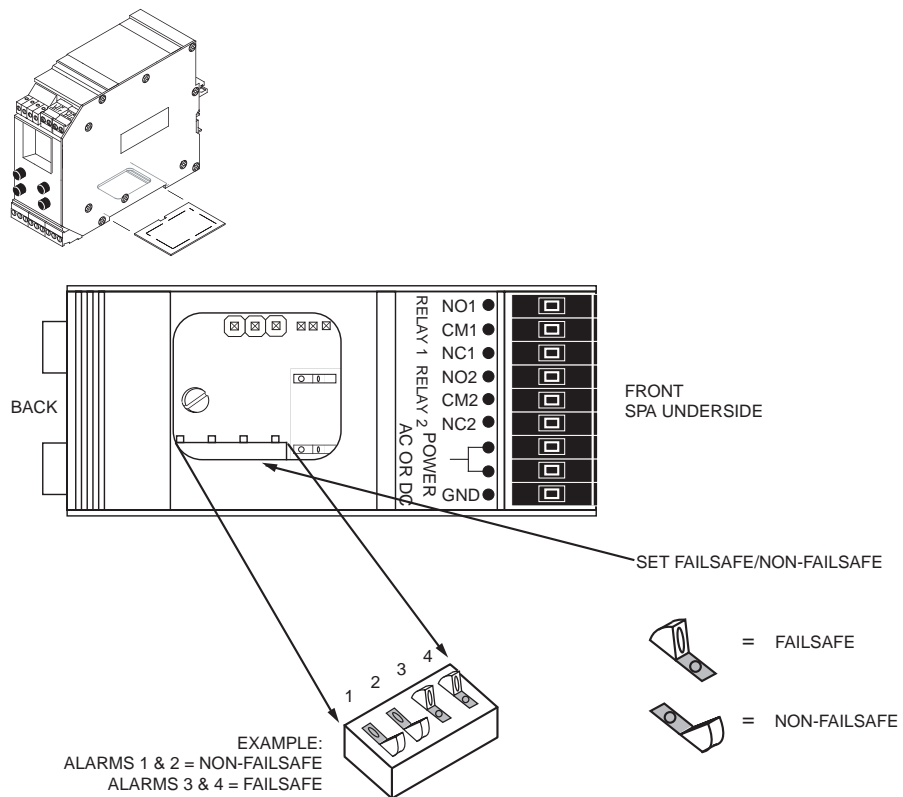
Figure 2. Setting the Internal Jumper for Password Security ON or OFF



**NOTE:** THE THREE PINS TOWARD THE LEFT SIDE OF THE COMPARTMENT ARE FOR FACTORY TESTING ONLY.  
**DO NOT INSTALL JUMPERS ON THESE PINS!**

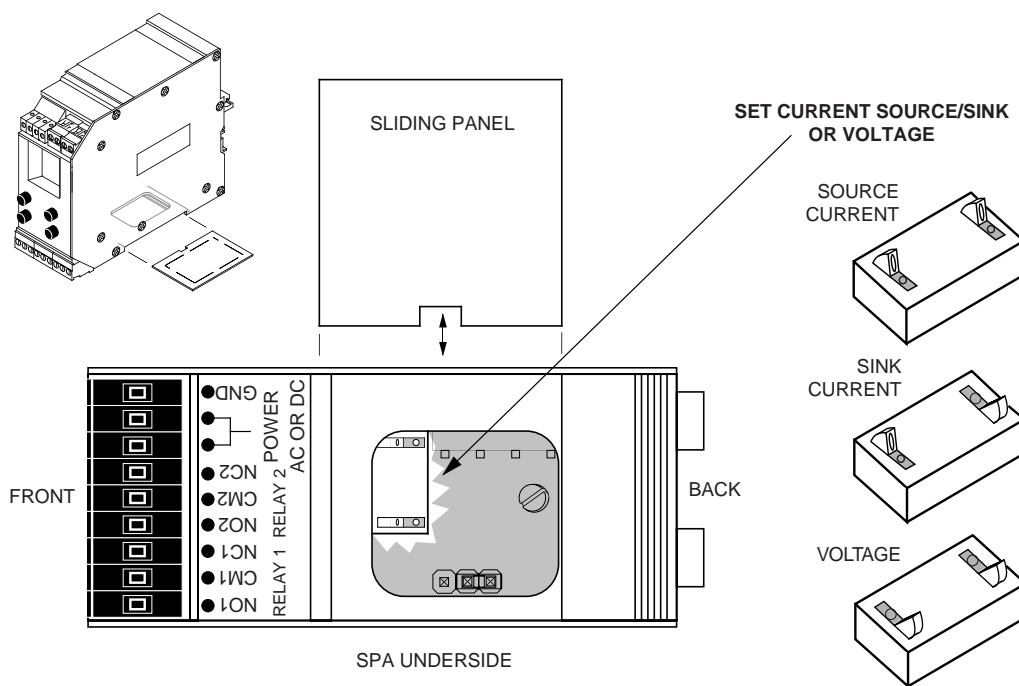


**Figure 3.** Setting the Internal DIP Switches for Failsafe or Non-Failsafe Alarm Function



NOTE: THIS 4-POSITION SIP SWITCH MAY VARY IN LOCATION BASED ON THE TYPE OF SPA USED

**Figure 4.** Setting the Internal DIP Switches for Current Source/Sink or Voltage (AO-equipped SPAs only)



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### Programming the TPRG SPA

The Temperature Input SPA operating parameters are set, and the settings stored in on-board, non-volatile EEPROM. There are four push buttons on the unit front panel; VIEW, SELECT, an UP arrow, and a DOWN arrow. Together with the prompting messages displayed on the LCD, these are used to access menus, and to view and change the settings for:

- **Input Sensor Type and Range**
- **Engineering Units Displayed, and other Options**
- **Alarm Functions (Trip points, etc.)**
- **Password (Menus/Settings Security)**
- **“Smart Ranged” Zero and Full Scale (AO/AOZ-equipped units only)**
- **Standard Ranged Zero and Full Scale (AO/AOZ-equipped units only)**
- **Analog Output Trim (AO/AOZ-equipped units only)**

### Main Menu/View Settings

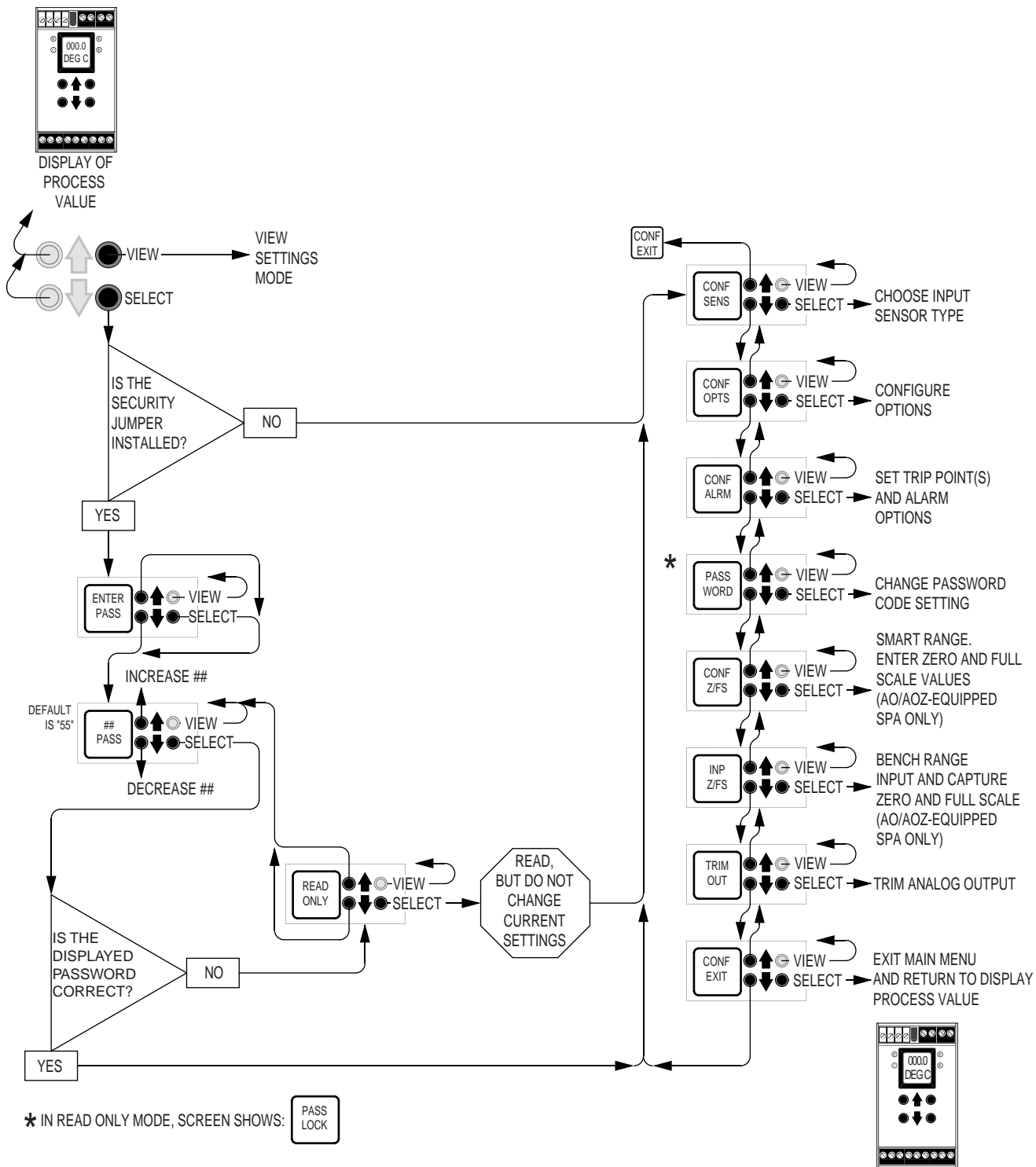
Figure 5 gives an overview of the first level of menus used to configure the TPRG SPA.

On power-up, the SPA defaults to a display of the measured value. Pressing the VIEW button accesses a series of displays that show, in succession, the settings currently stored in unit memory (see Figure 6).

Depending upon whether or not the Security Jumper has been installed (see Figure 2), SELECT will access either the first screen in the main configuration menu, “CONF SENS”, or the password code query screen, “ENTR PASS”.

Once the Main Menu has been accessed, the up and down arrow buttons are 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.

Figure 5. The TPRG SPA Main Menu and Password Menu (Temperature, mV, or Ω Inputs)



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### Password

This menu is bypassed if the Password Security Jumper is not installed (see Figure 2). If the jumper is installed, the menu comes up when SELECT is pressed from the display of the process variable input. The flow chart is shown as part of Figure 5.

1. If the jumper is installed, pressing SELECT from the display of the process variable input will bring up the "ENTR PASS" screen.
2. Use the up or down arrow buttons, or press SELECT again to access "55 PASS", the default screen for this point in the menu.
3. Use the up or down arrow 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.*

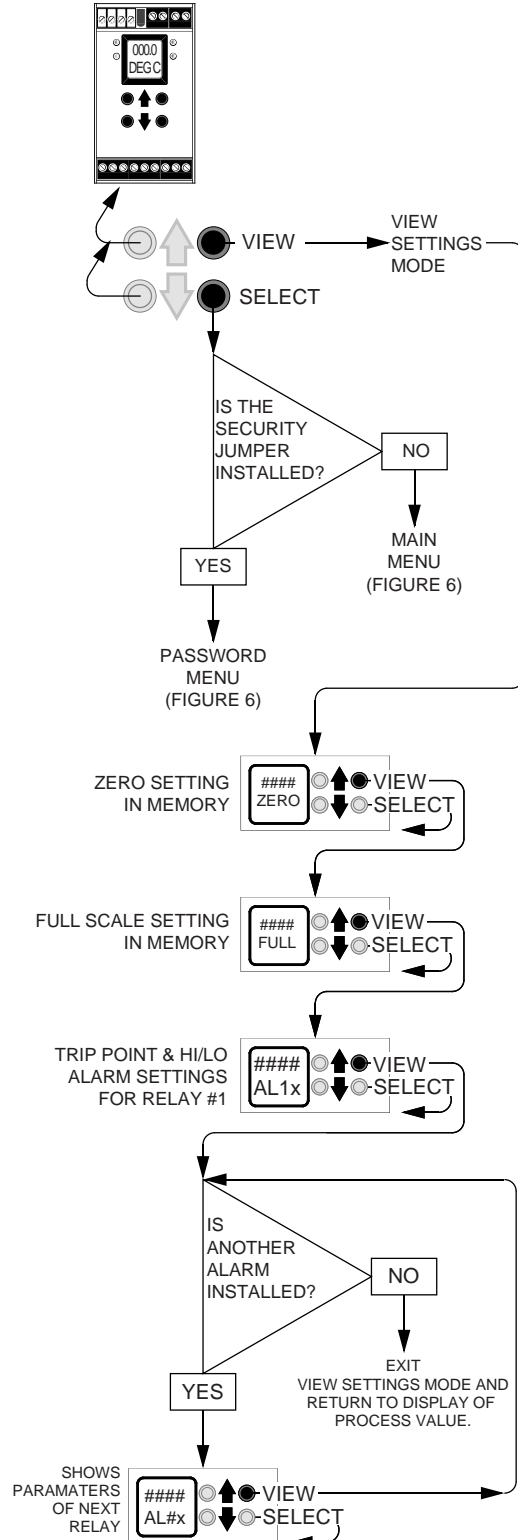
4. If you have entered the correct password, the Configure Sensor menu, "CONF SENS", will be accessed. If not, the display will show a "READ ONLY" message.
5. From "READ ONLY", press SELECT to view the settings in the various menus. READ ONLY mode locks out any attempt to make changes to the settings.

Press the up or down arrow buttons to return to "55 PASS" from "READ ONLY".

**NOTE:**

*The menu to set or change the Password stored in SPA memory is presented later in this section of the manual.*

Figure 6. The TPRG SPA View Settings Mode



## Configure Sensor

In the TPRG, if the security jumper is not installed (see Figure 2), the password sub-menu is bypassed, and the Configure Sensor menu is accessed when SELECT is pressed from the display of the measured input value. Figure 7 shows the Configure Sensor menu.

The Configure Sensor menu sets:

- RTD, TC or mV, or  $\Omega$
- Range (for  $\Omega$  or RTD)
- # of input wires (for RTD or  $\Omega$ )
- Reference Junction Compensation (RJC) enable/disable, and dual sensor input differential or averaging

To configure the sensor of the TPRG SPA:

1. Press SELECT from the "CONF SENS" display of the Main Menu (see Figure 5).
2. Use the up or down arrow buttons to scroll through the options for sensor/inputs. There are several types of RTDs and Thermocouples, as well as direct millivolt source and resistance inputs available.  
  
The default display for this menu is always the last setting. For example, if a J-type thermocouple was selected as the sensor type last, "TC J" will be displayed when this menu is accessed.
3. When the display shows the type of sensor to be used with the SPA, press SELECT.
4. If an RTD or direct resistance source was selected in step 3, skip to step 6.

If a thermocouple or millivolt source was selected in step 3, the next screen will be the choice of reference junction compensation ON or OFF.

Use the arrow buttons to toggle the display, turning RJC ON or OFF, and press SELECT.

5. Skip to step 10.
6. If an RTD was selected in step 3, the next screen displayed may offer selections for a resistance range, "XXXX OHMS".

If a direct ohms source ( $\Omega$ ) was selected as sensor type, skip to step 7.

Note that some RTD selections (from step 3) automatically default to a standard range, and where this occurs, the next screen displayed will be the selection of the wiring configuration to be used, "# OF WIRES". If "# OF WIRES" is displayed after selecting sensor type in step 3, go directly to step 7.

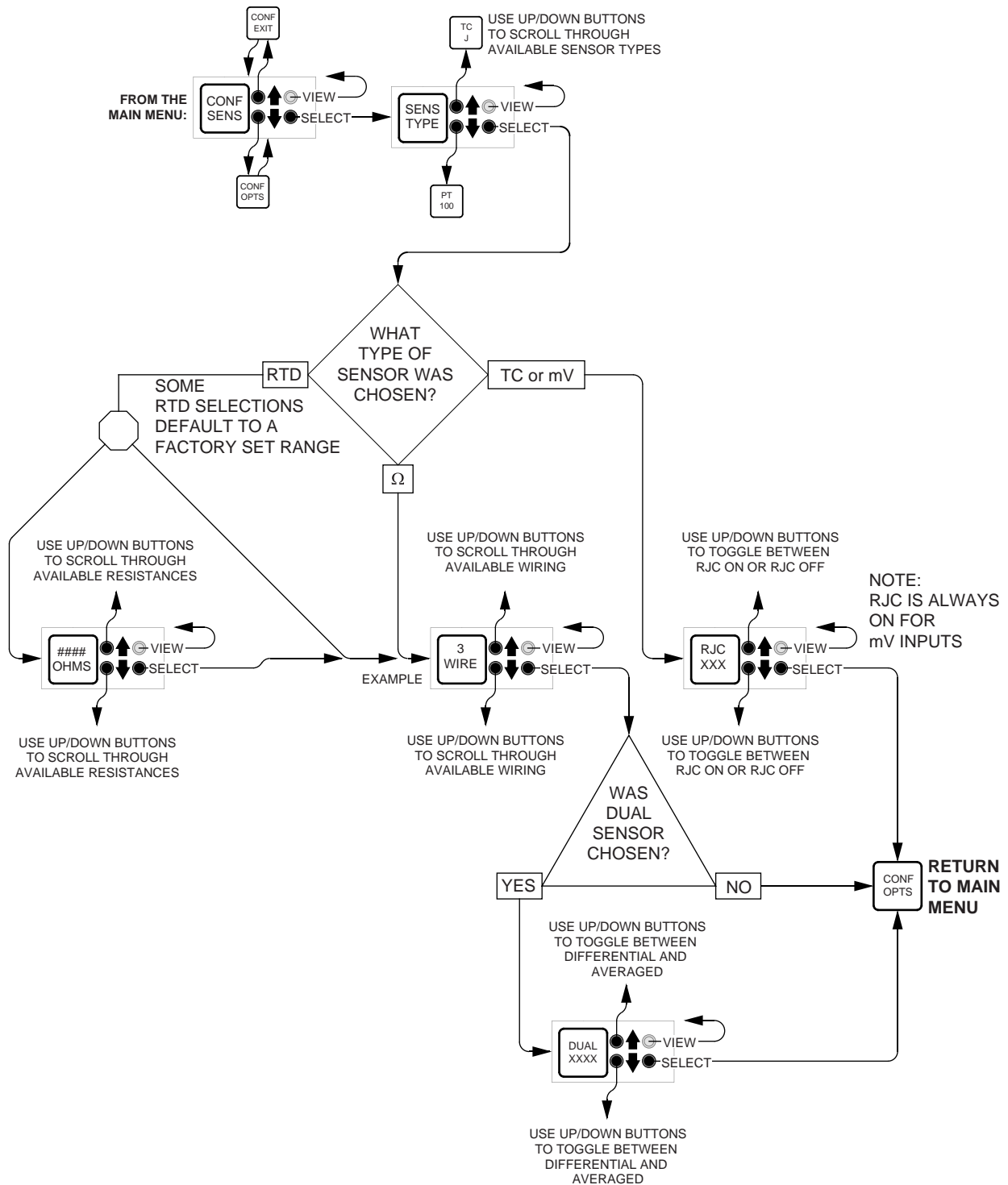
From the "XXXX OHMS" screen, use the arrow buttons to scroll through the available ranges. Choose the desired range by pressing SELECT, which brings up the "# OF WIRES" screen.

7. From "# OF WIRES" use the arrow buttons to choose the type of RTD sensor to be used, or the number of RTD sensors to be used. When the display shows the setup desired, press SELECT.
8. If a single sensor (2-, 3-, or 4-wire) selection was made in step 7, skip to step 10.
9. If "DUAL 2W" or "DUAL 3W" was selected in step 7, the next display allows you to choose between differential or averaged inputs. Use the arrow buttons to choose the desired setup and press SELECT.
10. The next display is the menu for the selection of functional options, "CONF OPTS". To skip the rest of the configuration menus and return to the display of the measured input value, press the up arrow button 2 times (to "CONF EXIT"), and press SELECT.

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Figure 7. The TPRG SPA Configure Sensor Menu



## Configure Options

This menu is for selecting display of °C or °F, linearization on or off, and how the TPRG SPA behaves in the event of sensor input failure

Figure 8 gives an overview of the menu. To configure the options of the the TPRG SPA:

1. From the “CONF OPTS” screen of the Main Menu, press SELECT.
2. Use the arrow buttons to scroll through the options.
3. Press SELECT when the display shows the operating parameter that is to be set, then use the arrow buttons to toggle between the available settings for each.
4. When the display shows the parameter set as desired, press SELECT. The next option or “OPTS EXIT” will be displayed.
5. Repeat step 2, or from “OPTS EXIT” press SELECT to return to the Main Menu.

## “SET FAIL” and the SF3 and AO/AOZ options

The selection made in “SET FAIL” determines how the SPA functions in the event of a sensor failure. The SPA’s Total Sensor Diagnostics package distinguishes between a sensor failure and an alarm condition on the input, and depending upon which of the available SPA options is installed, the “SET FAIL” menu can be used to set the following operating parameters:

- Upscale or Downscale Drive (when AO or AOZ is installed)
- High Alarms Trip
- Low Alarms Trip
- Relay #3 Trips (when SF3 is installed)

Table 2 summarizes the effect of the SET FAIL setting.

**NOTE:**

*When equipped with the SF3 option, relays #1, #2, and #4 (if present) freeze in their respective states (open or closed) in the event of sensor failure. Only relay #3 responds to the failure with a state change.*

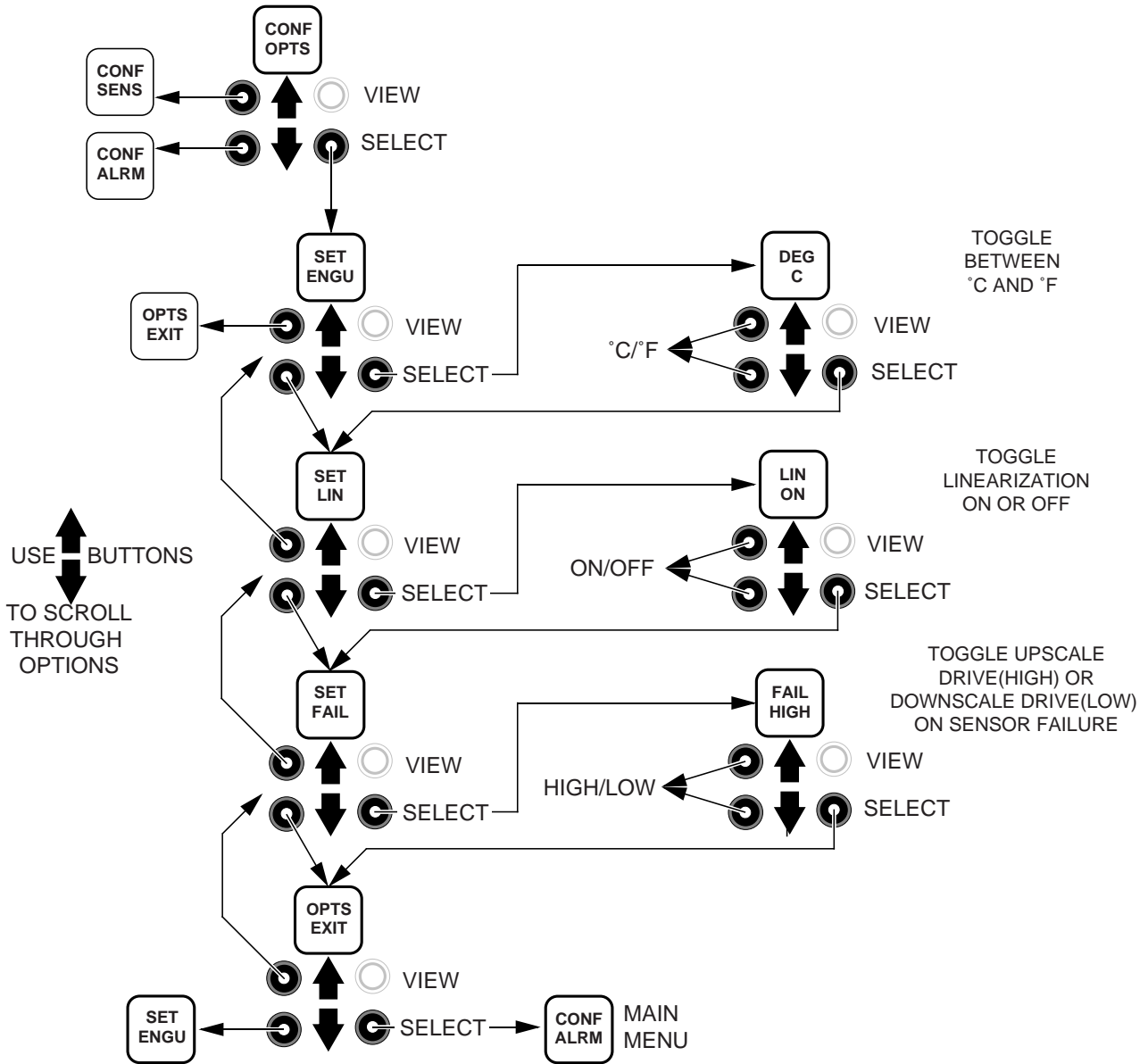
**Table 2.** TPRG SPA Function in the Event of Sensor Failure

	What is the “Set Fail” Setting?	Which Alarms trip on sensor failure?	How does the Analog Output re- spon to densor failure?
<b>Standard SPA (No Options)</b>	“Fail High” (CONF OPTS menu)	All High Alarms (CONF ALRM menu)	n/a
	“Fail Low” (CONF OPTS menu)	All Low Alarms (CONF ALRM menu)	n/a
<b>SF3-Equipped SPA</b>	“Fail High”	Alarm #3 if configured as “Hi” (CONF ALRM menu)	n/a
	“Fail Low”	Alarm #3 if configured as “Lo” (CONF ALRM menu)	n/a
<b>AO/AOZ-Equipped SPA</b>	“Fail High”	All High Alarms (CONF ALRM menu)	Drives output to full scale
	“Fail Low”	All Low Alarms (CONF ALRM menu)	Drives output to zero

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Figure 8. The TPRG SPA Configure Options Menu





## Configure Alarm(s)

This menu sets:

- Trip point(s)
- Deadband(s)
- Trip delay(s)
- High alarm or Low alarm function
- Latching or Non-latching operation

Figure 9 gives the menu overview.

1. From the “CONF ALRM” screen of the Main Menu, press SELECT.
2. Press SELECT again to access the settings for the first installed alarm, or use the arrow buttons to access the “ALRM EXIT” screen. Pressing SELECT from “ALRM EXIT” returns to the Main Menu at “PASS WORD”.
3. Use the arrow buttons to scroll through the alarm operation parameters. Press SELECT to access the settings for the displayed parameter.

For convenience, it is recommended that the settings be entered into SPA memory in the order that they come up in this step (shown in Figure 10 from top to bottom).

### **NOTES:**

*There are two options for setting the trip points of the installed alarms, “ENTR TRIP” and “INP TRIP”. In the “ENTR TRIP” menu, the user employs the Smart Ranging feature of the SPA, entering the desired trip point with the front panel push buttons. (Steps 4 through 6)*

*In the “INP TRIP” menu, the SPA must be set up with calibration equipment (see Figure 10). In this, the Standard Ranging procedure, the unit “captures” its trip point from the input of an adjustable source. (Steps 7 through 14)*

## ENTER TRIP

If the value of the trip point is known, use the Smart Ranging feature of the SPA to program the value into SPA memory. If the trip point is unknown, skip to step 7, INPUT TRIP.

4. From “ENTR TRIP” in step 3, press SELECT.
5. Use the arrow buttons to ramp the display to the trip point value, and press SELECT. This enters the displayed value into SPA memory, and brings up the “ENTR DB” (enter deadband) display.
6. Skip to step 14.

## INPUT TRIP

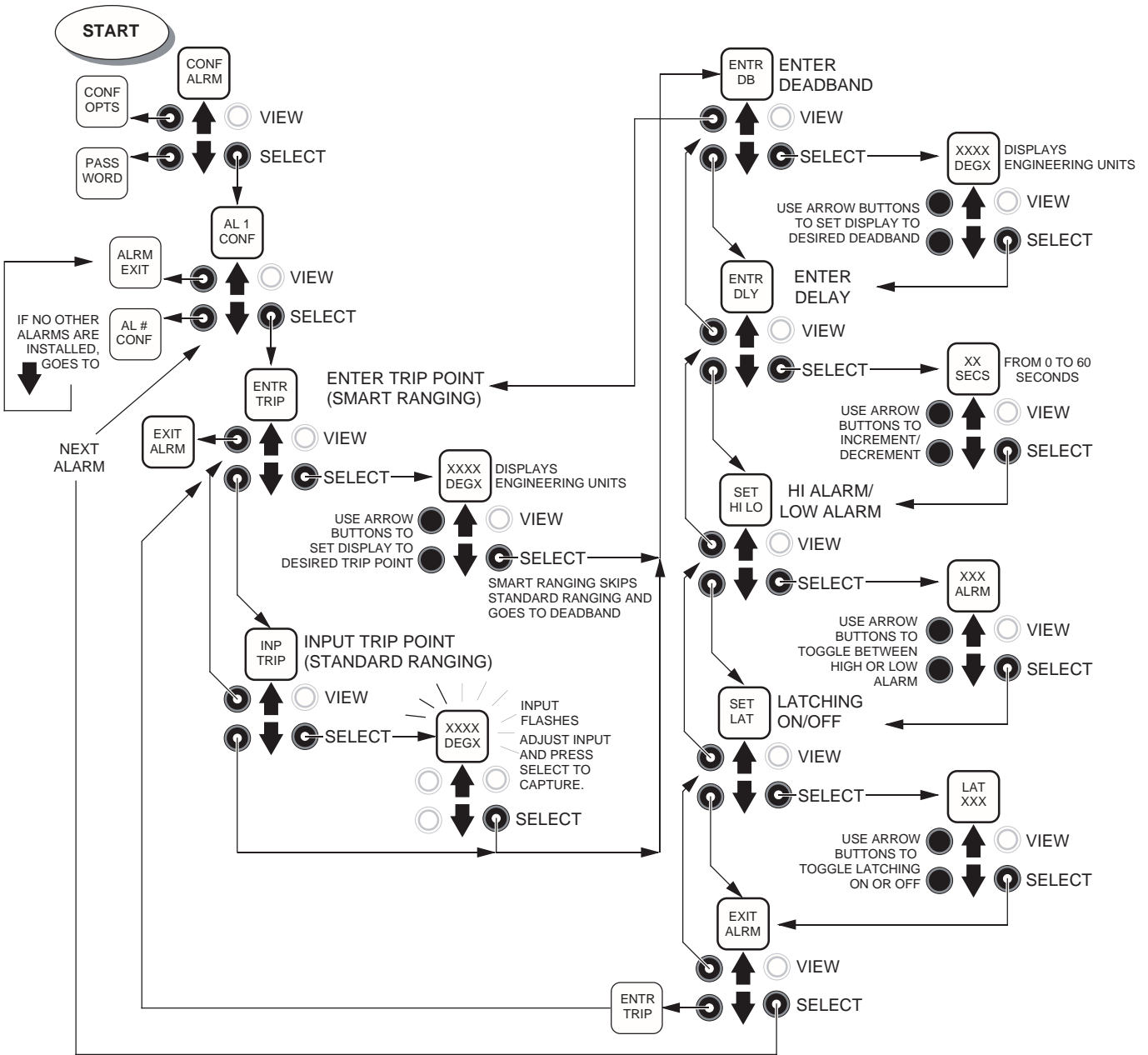
A signal can be applied to the input terminals of the SPA, using the setup shown in Figure 10. With this setup and the following procedure, the unit can “capture” the desired trip point.

7. Install the SPA being configured into the setup shown in the figure, apply appropriate power, and allow approximately 5 minutes for stabilization/warm-up.
8. Access the configuration menus, and use the down arrow to access the “CONF ALRM” menu.
9. Press SELECT.
10. Use the arrow buttons to access “INP TRIP”.
11. Press SELECT. The display will flash the input level present at the terminals.
12. Adjust the input to the desired trip point level.

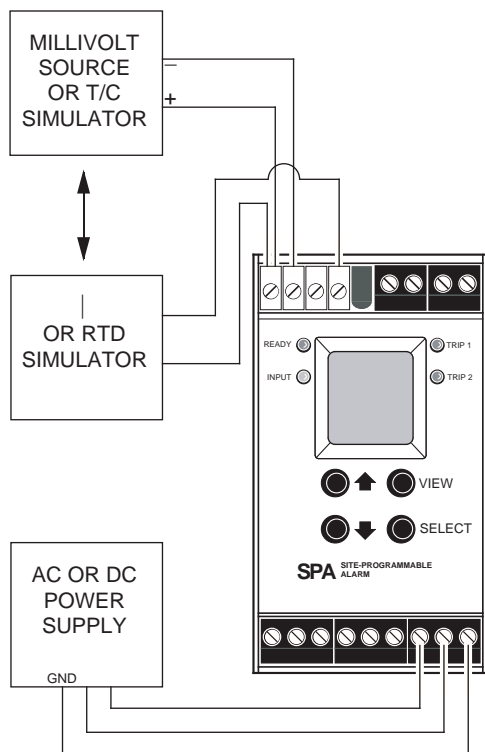
# SPA

## Site-Programmable RTD & Thermocouple Limit Alarm Trips

Figure 9. The TPRG SPA Configure Alarms Menu



**Figure 10.** Setting Up for “Capturing” Alarm Trip Points  
(Standard Ranging)



13. Press SELECT when the flashing value on the display reaches the desired trip point value. This stores the value in SPA memory and returns the unit to the Alarm Configuration menu at the “ENTR DB” (enter deadband) screen.

Disconnect the SPA from the input.

14. Press SELECT to access the deadband setting screen, or use the arrow buttons to scroll through the other alarm operating parameters. Press SELECT to access the screen(s) for the parameter displayed, or scroll to “EXIT ALRM” and press SELECT to access the menus for another alarm (if installed), or to return to the Main Menu.

## ENTER DEADBAND

15. From the “ENTR DB” screen, press SELECT.
16. Use the arrow buttons to change the deadband around the trip point in SPA memory. The display will show the value in the engineering units selected in the “CONF OPTS” menu, discussed earlier.
17. Press SELECT when the display shows the desired deadband value. This returns the unit to the Alarm Configuration menu at the “ENTR DLY” (enter response delay) screen.
18. Press SELECT to access the delay setting screen, or use the arrow buttons to scroll through the other alarm operating parameters. Press SELECT to access the screen(s) for the parameter displayed, or scroll to “EXIT ALRM” and press SELECT to access the menus for another alarm (if installed), or to return to the Main Menu.

## ENTER DELAY

19. From the “ENTR DLY” screen, press SELECT.
20. Use the arrow buttons to change the amount of delay time between the input’s exceeding the trip point setting and the actual state change of the alarm. Settings from 0 to 60 seconds are available in 1 second increments.
21. Press SELECT when the display shows the desired delay setting. This returns the unit to the Alarm Configuration menu at “SET HILO” (choose high or low alarm function).
22. Press SELECT to access the high/low setting screen, or use the arrow buttons to scroll through the other alarm operating parameters. Press SELECT to access the screen(s) for the parameter displayed, or scroll to “EXIT ALRM” and press SELECT to access the menus for another alarm (if installed), or to return to the Main Menu.

# SPA

## Site-Programmable RTD & Thermocouple Limit Alarm Trips

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### SET HI/LO

23. From the “SET HILO” screen, press SELECT.
24. Use the arrow buttons to toggle the alarm function between high alarm operation (trips when input exceeds the trip point setting) and low alarm operation (trips when input drops below the trip point).
25. Press SELECT when the display shows the desired setting. This returns the unit to the Alarm Configuration menu at “SET LAT” (choose latching or non-latching alarm function).
26. Press SELECT to access the latch/no latch setting screen, or use the arrow buttons to scroll through the other alarm operating parameters. Press SELECT to access the screen(s) for the parameters displayed, or scroll to “EXIT ALRM” and press SELECT to access the menus for another alarm (if installed), or to return to the Main Menu.

**NOTE:**

*An alarm’s HI/LO setting can affect the way the SPA functions on sensor failure (when equipped with the –SF3 option). Refer to the Operation section under “Sensor Failure and Alarms” for more information.*

### SET LATCHING/NON-LATCHING

27. From the “SET LAT” screen, press SELECT.
28. Use the arrow buttons to toggle the alarm function between latching (alarm stays tripped until input returns to normal (allowing for any deadband) **AND** unit is manually reset) and non-latching (alarm returns to normal as soon as input returns to normal, allowing for any deadband) function.
29. Press SELECT when the display shows the desired setting. This returns the unit to the Alarm Configuration menu at “EXIT ALRM”.
30. Press SELECT to bring up the menu for the next installed alarm. If no additional alarms are installed, or to return to the Main Menu, press SELECT from “EXIT ALRM”.

To set the operating parameters for the next installed alarm, use the arrow buttons from the “EXIT ALRM” screen to display the next alarm, “AL2 CONF”, for example, and press SELECT, and return to step 3.

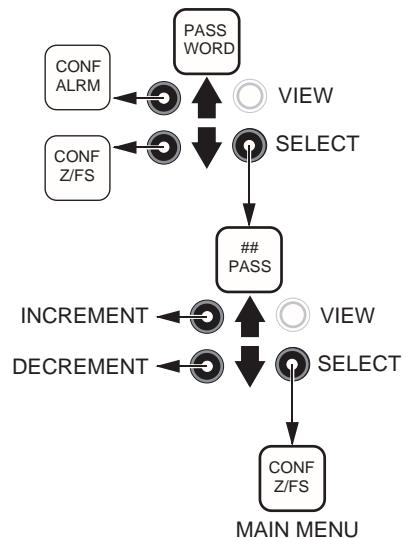
When all of the alarm parameters for all of the installed alarms have been set as desired, press SELECT from “EXIT ALRM”, and press SELECT again from “ALRM EXIT”. This returns the unit to the Main Menu at “PASS WORD”

## Change the Security Password Code

This menu is active when the Security Jumper is NOT installed, or when the jumper is installed and a correct password has been entered. When the jumper is installed, unless the correct password is entered, accessing this menu causes the “PASS LOCK” message to appear. Any attempt to make changes will be “locked out” (READ ONLY mode).

Figure 11 shows the menu.

Figure 11. Changing the TPRG SPA Password



1. From the “PASS WORD” screen, press SELECT to access “## PASS”.
2. Use the arrow buttons to increment or decrement the password number to be stored in unit memory.
3. Press SELECT when the desired password number is displayed. This returns the user to the Main Menu.

**NOTES:**

*The password can be any number between 00 AND 99.*

*When the security jumper (Figure 3) is NOT installed, pressing SELECT from “PASS WORD” shows the current password setting.*

# SPA

## Site-Programmable RTD & Thermocouple Limit Alarm Trips

### Configure Zero and Full Scale — Smart Ranging

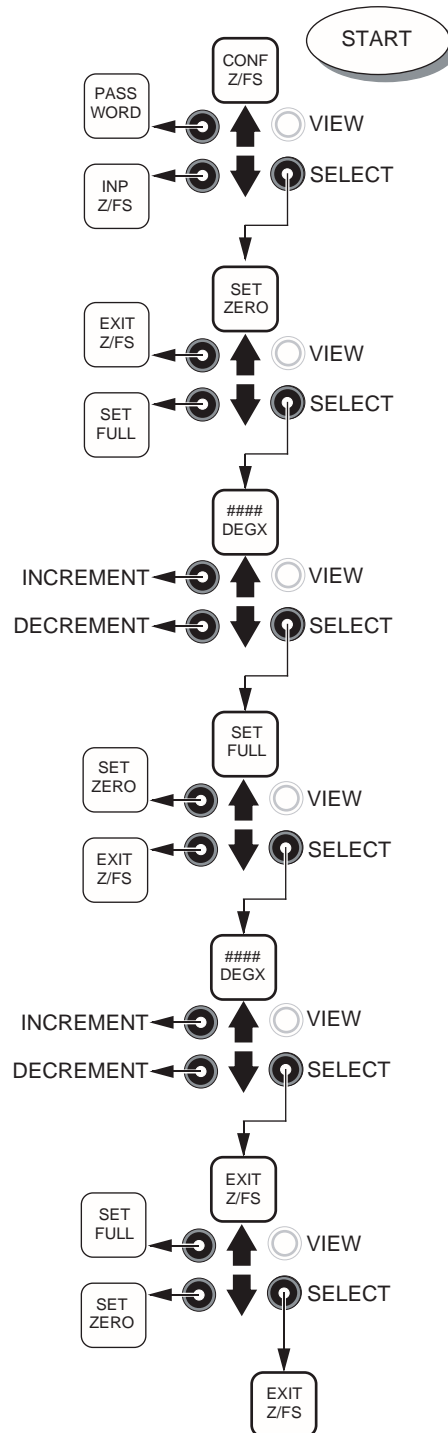
This set of menus is available only on those units equipped with one of the AO (Analog Output) options. Referred to as “Smart Ranging”, it allows the user to program in the values for the analog output’s 0 and 100% settings without having to incorporate the SPA into any calibration setup.

If a setup is available, the analog output range and trim can be calibrated using a meter and adjustable input source. Refer to “Inputting Zero and Full Scale”, later in this manual. Figure 12 shows the SPA analog output Smart Ranging menu.

1. From the “CONF Z/FS” screen displayed, press SELECT.
2. Use the arrow buttons to choose either “SET ZERO” or “SET FULL”, and press SELECT.
3. Use the arrow buttons to raise or lower the value displayed according to the requirements of the application.  
**NOTE:**  
*The engineering units displayed on this screen are determined by the setting entered in the “CONF OPTS” menu, explained earlier in this manual.*
4. Press SELECT to enter the value into SPA memory.
5. Repeat steps 2 and 3, if necessary, to set the complimentary value. Once both have been set, the “EXIT Z/FS” screen will be displayed.
6. Press SELECT to go to the Main Menu.

**NOTE:**  
*If Smart Ranging is used, the menus for inputting zero and full scale and the menu for trimming the output are by-passed. Pressing SELECT from “EXIT Z/FS” returns to the Main Menu at “CONF EXIT”.*

Figure 12. Smart Ranging the AO/AOZ-equipped TPRG SPA



## Input Zero and Full Scale — Bench Ranging

This set of menus is available only on those units equipped with one of the AO options. Referred to as “Standard Ranging”, it allows the user to enter the values for the analog output 0 and 100% based on actual input. It requires the same calibration setup shown in Figure 10.

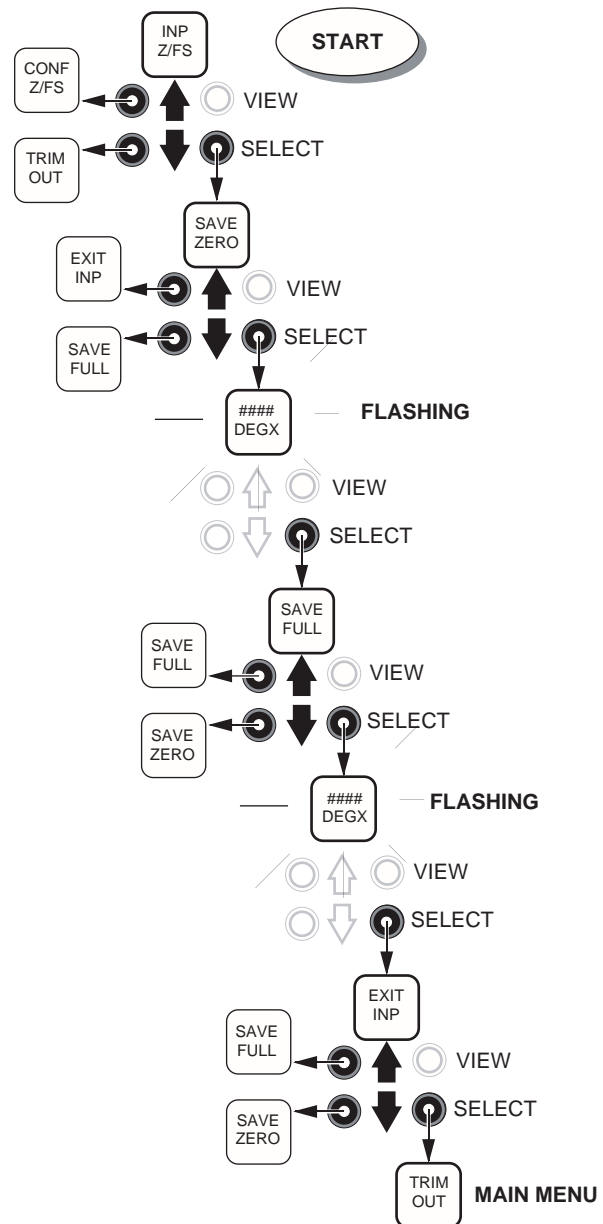
Figure 13 shows the menu.

1. From the Main Menu “INP Z/FS” screen, press SELECT. This will access “SAVE ZERO”.
2. Press SELECT. The screen will flash the input level.
3. Adjust input to the desired 0% level. The screen will flash the changing input level.
4. Press SELECT, storing the zero setting in SPA memory and accessing “SAVE FULL”.
5. Press SELECT again. The screen will flash the input level.
6. Adjust input to the desired 100% level. The screen will flash the changing input level.
7. Press SELECT, storing the full scale setting in SPA memory and bringing up “EXIT INP”.
8. Press SELECT to return to the Main Menu, or use the arrow keys to access “SAVE ZERO” or “SAVE FULL” again.

**NOTE:**

*SPA zero and full scale settings are non-interactive. It is not necessary to perform this setting more than once.*

Figure 13. Bench Ranging the AO/AOZ-equipped TPRG SPA



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## Site-Programmable RTD & Thermocouple Limit Alarm Trips

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### Trim Output

This procedure is only required on those SPAs equipped with one of the available AO options.

Figure 14 shows the setup needed. Figure 15 shows the menu.

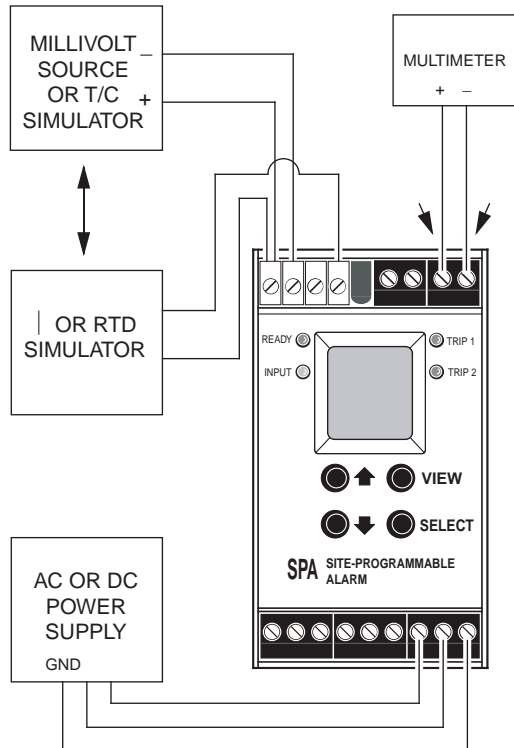
Connect the unit as shown, apply the appropriate power, and allow 5 minutes for stabilization/warm-up.

1. Access the configuration menus, and use the arrow buttons to scroll to "TRIM OUT".
2. Press SELECT to access the menu. The "TRIM ZERO" screen will be displayed.
3. Use the arrow buttons to choose the level, zero or full scale, that is to be trimmed.

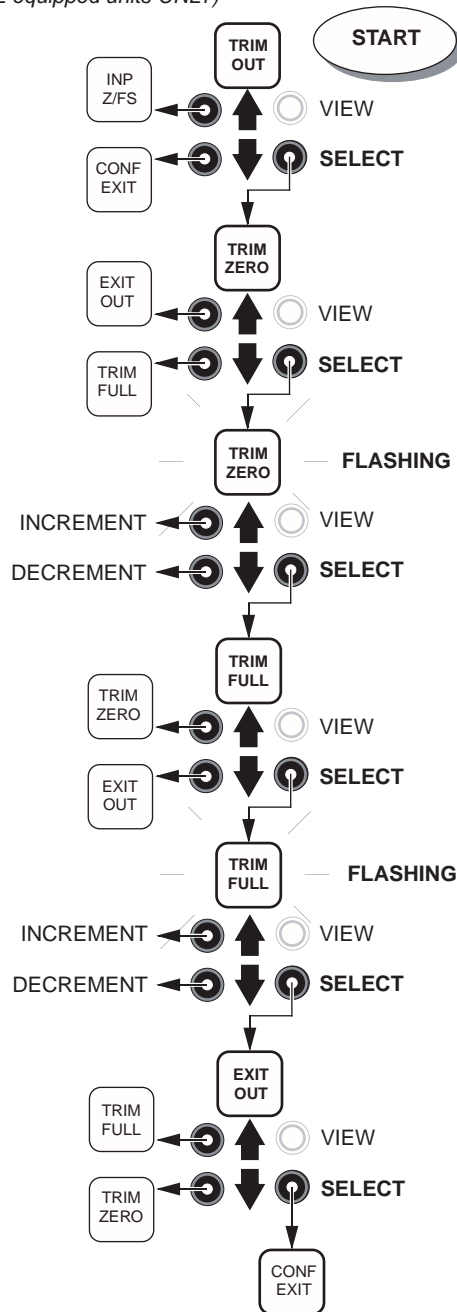
4. Press SELECT to begin the trim process. The display will begin to flash the "TRIM ZERO" or "TRIM FULL" screen, depending upon the option chosen in step 3.
5. While monitoring the reading on the meter, use the arrow buttons to adjust the output to the desired level. Use the meter in the setup to monitor the output as the output is adjusted.
6. When the output is set as desired, press SELECT. This sets the adjustment into SPA memory, and brings up either the next output level to be adjusted (repeat steps 3, 4, and 5), or "EXIT OUT" if both zero and full scale output have been adjusted.
7. To exit the menu, press SELECT when "EXIT OUT" is displayed. The unit will return to the Main Menu.



**Figure 14.** Setting Up for Trimming the TPRG SPA Output (AO/AOZ-equipped units only)



**Figure 15.** Trimming the TPRG SPA Analog Output (AO/AOZ-equipped units ONLY)



# SPA

## Site-Programmable RTD & Thermocouple Limit Alarm Trips

### Installation

The SPA is housed in a universal DIN-style case. Its back panel is equipped with fittings that make it possible to mount the unit on both G-type and Top Hat rails.

Figure 16 shows the unit dimensions, including the sizes for dual- and triple/quad-alarm SPAs.

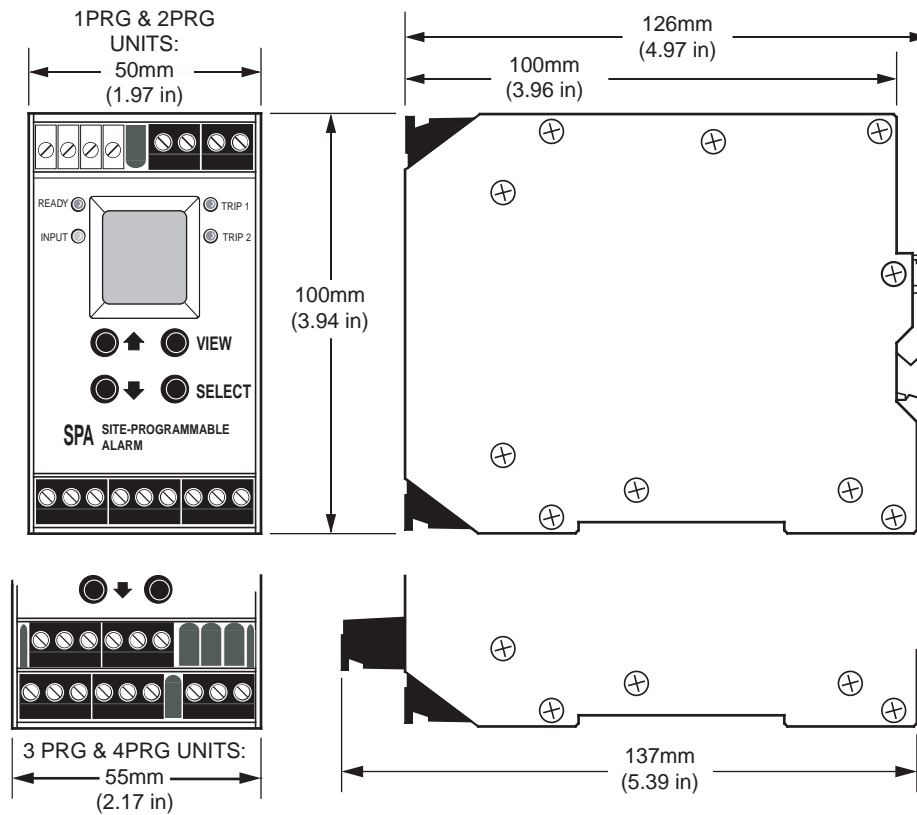
### Mounting

To mount the SPA on 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 G-type rail, seat the extrusion under the top lip of the rail and again, pivot downward.

When mounting SPAs in multiple unit scenario like a rack or cabinet, make sure to allow adequate vertical spacing for pivoting the units.

Figure 16. The Dimensions of the SPA



NOTE: All units with the -DPDT option will have the same dimensions as the 3PRG/4PRG units

## 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.*

## 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.

# SPA

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### Connections

Figure 17 shows how to hook up the various inputs accommodated by the TPRG SPA. Table 3 gives terminal designations.

### Operation

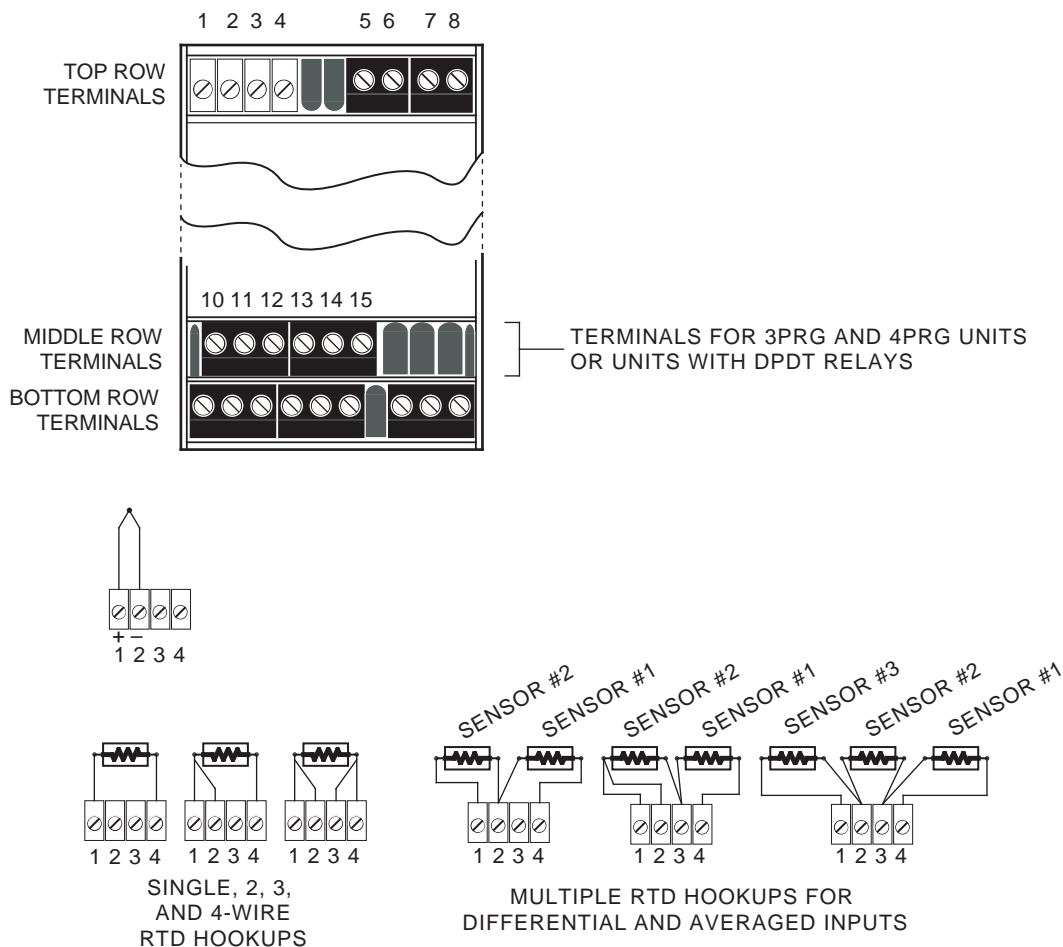
Once connected to sensors, annunciators (or other discrete devices), and appropriate power, the SPA begins to function according to its internal switch settings and the configuration stored in its non-volatile internal memory.

Configuration data, stored in memory, is monitored continuously. Changes can be made at any time. Any changes made to operating parameters controlled by choices made in the SPA menu system take effect immediately.

The settings of the internal DIP switches and security jumper may also be changed at any time. Changes to the security jumper setting, however, do not take effect until unit power is cycled off and on.

The settings for failsafe/non-failsafe and source/sink (see Figures 3 and 4, respectively), once made, take effect right away.

Figure 17. Connections for the TPRG SPA



**NOTE:** IN DIFFERENTIAL MEASUREMENT APPLICATIONS, ALWAYS CONNECT "HIGH" SENSOR TO TERMINALS DESIGNATED HERE AS "SENSOR #1"

**Table 3.** Terminals for the SPA

Top Row Terminals	T1	T2	T3	T4	T5	T6	T7	T8	T9						
<b>Low Level SPA</b>	+ (Note 1)	- (Note 1)	(Note 2)	(Note 2)	MR	MR	+Analog OUT (Note 3)	-Analog OUT (Note 3)	Not Present						
<b>Middle Row Terminals</b>	10	11	12	13	14	15									
<b>1 and 2 Relays (1PRG and 2PRG)</b>	Not Present														
<b>3 Relays (3PRG)</b>	NO3	CM3	NC3	Not Present											
<b>4 Relays (4PRG)</b>	NO3	CM3	NC3	NO4	CM4	NC4									
<b>1DPDT Relay</b>	NO2	CM2	NC2	Not Present			POWER AC or DC								
	Relay 1(above)														
<b>2 DPDT Relays</b>	NO2	CM2	NC2	NO2	CM2	NC2				POWER AC or DC					
	Relay 1(above)			Relay 2(above)											
<b>Bottom Row Terminals</b>	B1	B2	B3	B4	B5	B6							B7	B8	B9
<b>1 Relay (1PRG)</b>	NO	CM	NC	NA	NA	NA							POWER AC or DC		
<b>2 Relays (2PRG)</b>	NO1	CM1	NC1	NO2	CM2	NC2									
<b>3 Relays (3PRG)</b>	NO1	CM1	NC1	NO2	CM2	NC2									
<b>4 Relays (4PRG)</b>	NO1	CM1	NC1	NO2	CM2	NC2									
<b>1DPDT Relay</b>	NO1	CM1	NC1	Not Present			GND								
	Relay 1(above)														
<b>2 DPDT Relays</b>	NO1	CM1	NC1	NO1	CM1	NC1				GND					
	Relay 1(above)			Relay 2(above)											

**NOTES:**

1. Reference polarity when connecting TC's or other mV sources only.
2. Not used with TC inputs (Refer to RTD connections).
3. When AO or AOZ option is installed.

# SPA

## Site-Programmable RTD & Thermocouple Limit Alarm Trips

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### LEDs

There are at least three, and as many as six LEDs on the front panel of the SPA. Each is labeled, and provides a quick reference for input condition during normal unit operations.

- **READY** This LED shows green during normal operation. Green indicates that the SPA has run its startup diagnostic and that all internal circuitry is functioning properly.

The LED goes out if internal errors occur.

- **INPUT** This LED shows green during normal operation. Green indicates that an input sensor or sensors has/have been connected, and that they are functioning properly.

The LED turns red if there is a problem with the sensor inputs. On TPRG SPAs, sensor problems are also accompanied by a message on the LCD diagnosing the specific problem. Sensor failures and individual wire breaks are all called out by the TPRG SPA's Total Sensor Diagnostics.

- **TRIP #** These LEDs, one per installed relay, show green when the connected input is in a non-alarm condition relative to the trip point setting. A red LED indicates alarm.

### ***NOTE:***

*The state of the SPA relays in alarm or non-alarm is determined by the failsafe/non-failsafe setting of the unit's internal DIP switches (see Figure 3, earlier in this manual). Do not confuse the state of the LED with the state of its associated relay.*

*Failsafe relays are ON (energized) when input is in a non-alarm condition (green LED), OFF (de-energized) in alarm (red LED).*

*Non-failsafe relays are ON (energized) when input is in an alarm condition (red LED), OFF (de-energized) in non-alarm (green LED).*

This design scheme means that the LEDs associated with relays will always show red when the corresponding input is in an alarm condition, green in non-alarm.

### **Manual Reset**

There are two connections labeled "MR + -" on the SPA top terminal block. These terminals work in conjunction with the latching/non-latching alarm function.

When an SPA is configured with latching alarms (refer to the description of the "CONF ALRM" menu, earlier in this manual), 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.

Shorting the MR terminals "clears" all alarms.

### Error Codes

Every SPA 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, the unit is equipped with a full set of internal diagnostics that check operation and configuration on power-up. If there are problems with the microprocessor, or with conflicting operating parameter settings, the LCD will show 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 offending SPA to the factory.

**Table 4.** SPA LCD Error Codes

Error Message	What it Means	What to Do
<b>EE FLT</b>	EEPROM Error - The internal processor failed	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
<b>RAM ERR</b>	RAM(memory) Error - The internal processor failed	
<b>ROM ERR</b>		
<b>CAL ERR</b>	Calibration Error - The factory-set calibration of the unit has failed to initialize.	
<b>DATA ERR</b>	Data Error - There are conflicts in the settings entered into unit memory. This can be caused by power loss or fluctuation during power-up.	Cycle power to the unit, then run through the configuration menus to ensure that the technician made the correct sensor selections for the range settings, etc.
<b>PACT ERR</b>	Memory Packet Failure - Internal memory failure	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
<b>CONF ERR</b>	Data Error - There are conflicts in the settings entered into unit memory. This can be caused by power loss or fluctuation during power-up.	Cycle power to the unit, then run through the configuration menus to ensure that the technician made the correct sensor selections for the range settings, etc.
<b>RJC OPEN</b>	Reference Junction Compensation Resistor Burnout.	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
<b>TABL ERR</b>	Internal Table Error - The linearization curve programming is not correct.	Make sure that the endpoints of the programmed curve are within the selected INPUT SCALING.

### Customer Service

If service assistance is ever required for one of the SPAs in your application, refer to the inside of the back cover of this manual for the telephone numbers to Moore Industries STAR Center customer service department.

If possible, make a note of the model number of the offending unit before calling. For fastest assistance, try to gather information on the unit(s) serial number and the job and purchase order number under which it was shipped.

## 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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