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Site-Programmable
Temperature Transmitter
SPT

SPT *Site-Programmable Temperature Transmitter*

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Introduction

This is the Users' Manual for Moore Industries' SPT, Site-Programmable Temperature Transmitter. The SPT accepts inputs from thermocouples, RTDs, or millivolt or resistance (ý) sources in a host of sensor types and connection schemes. It provides isolated, linearized (or, selectably, non-linearized), process-ready output in several common ranges, and can be readily switched to operate as either a current or voltage source, or as a current sink.

The SPT's configurability makes it practical for use as a "generic" transmitter — a single unit that can be stocked, and set on-site to fulfill the requirements of several different signal conditioning applications within a process or plant. SPTs can also serve as replacements for installed transmitters from other manufacturers.

Unit setup is quick, intuitive, and flexible. Most operation settings can be viewed and/or changed using push buttons and a series of simple menus displayed on the unit's front panel LCD. Source/sink output settings, as well as failsafe or non-failsafe alarm function (with the optional alarm output) are controlled by a set of DIP switches that are located with a security jumper inside the housing behind a sliding panel. This makes disassembly of the unit unnecessary.

The following guidelines are used throughout the manual:

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.

Total Sensor Diagnostics

The SPT incorporates a patented input circuit that eliminates much of the time consuming, trial-and-error work of troubleshooting sensor networks. Total Sensor Diagnostics (TSD) continuously monitors the status of both the input sensor (or sensors) and wiring.

If a wire breaks, or the sensor fails, a front panel LED changes color to flag the problem, and the LCD displays a message telling *where* the failure has occurred. In multiple RTD or direct ohms input applications, the SPT messages indicate which sensor has failed, or if a wire is broken.

These diagnostic messages allow the user to distinguish between failures of one of the wires or in the sensor itself. In multiple sensor applications, the SPT can even differentiate between one wire and another.

In addition to these indications, the C option enables the SPT to provide a contact-closure alarm output that trips in the event of a sensor failure.

Universal Mounting Capability

The unit 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 unit dimensions.

Programmable Features

No hand-held configurator or sophisticated bench equipment is needed to get the SPT up and running. Unit control is done with four push buttons on the front panel. The standard SPT handles a variety of inputs, outputs, and multi-sensor applications:

- **Inputs –** RTD type and number of wires, T/C type, direct mV or resistance (ohms); reference junction compensation on/off, linearization on/off.
- **Outputs –** 4-20mA (source or sink), or 1-5V, configurable to drive upscale or downscale on sensor failure. Optional SPDT relay is configurable as failsafe or non-failsafe, with high or low alarm function.
- **Differential or Averaging –** Multiple sensors (direct ý or RTDs) can be connected to provide output based on differential inputs, or the averaging of two or more sensors.
- **Smart-Ranging –** An innovative operating feature allows the user to "program in" zero and full scale values. This eliminates the need for elaborate calibration setups.

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Specifications

Performance	**Maximum Unit Error:** Output Accuracy + Cold Junction Reference Accuracy + Input Accuracy (See Table 1, Accuracy) **Output Accuracy:** ±0.03% of output span **Cold Junction Reference Accuracy:** ±0.25°C **Stability:** ±0.1% of calibrated span, max. over six months **Output Response:** 800 milliseconds (msec) max., for output to reach full scale in response to a full scale input step change **Alarm Response:** 700 msec, max., from input change to alarm output for step change on input with trip point at midpoint of step **Ripple:** 15mV*, peak-to-peak, max., for voltage output; 10mV*, peak-to-peak, max., when measured across a 250Ω resistor for current; *Specified at frequencies up to 120Hz **Sensor Excitation Current:** 0.25mA, nominal **Power Consumption:** 3.5W nominal; 8.25W, maximum; 110mA @24Vdc power; 38mA at 115Vac power; 27mA @ 250Vac power; 123mA @24Vdc power; 42mA @115Vac power; 30mA @ 250Vac power
Performance (continued)	**Burnout Protection:** User-programmable. Front panel push buttons select upscale or downscale drive **Output Protection:** Transient protection on output **Output Limiting Capability:** 117% of span, max.; 115% typical **Load Capability:** 1200Ω, max. for current outputs (4-20mA) when configured as internally powered (source mode); 2000Ω, max. for current outputs when configured as externally powered (sink mode) **Input Impedance:** 10MΩ, min. (T/C and mV inputs) **Load Effect::** ±0.01% of span from 0 to max. load resistance on current output **Line Voltage Effect:** ±0.001% of span for a 1V change in line voltage (ac or dc) **Isolation:** 1000Vrms between case, input, output, and power terminals Note: High voltage effect of ±0.001% of span/V when unit is subjected to prolonged voltages above 200Vac **Input Over-Voltage Protection:** ±5.0Vdc **RFI/EMI Protection:** 30V/M – ABC ≤ 0.5% error in reading, when tested according to SAMA standard PMC 33.1 **Noise Rejection:** Common Mode, 120dB @ 60Hz Normal Mode, 30dB @ 60Hz
Ambient Conditions Ratings	**Operating Temperature Range:** –25°C to +65°C (–13°F to +149°F) **Storage Temperature Range:** –40°C to +80°C (–40°F to +176°F) **Humidity Range:** 0-95%, non-condensing
Effect of Ambient Temperature	**On Maximum Unit Error:** (refer to Table 1, Accuracy): ±0.005% of span per °C, ±15ppm of input signal **On Reference Junction Compensation:** ±0.5% per 50°C change in ambient temperature
Adjustments	Four, front panel push buttons control settings for Zero, Span, Alarm Trip point, etc. Easy-access, internal settings select current or voltage output and high/low alarm function; Internal jumper and menu password protect parameter settings **Display:** 2x4 character, backlit, alphanumeric LCD **LEDs:** Dual-color TRIP light shows green for non-alarm, red for alarm; Dual-color INPUT light shows green for input within rated range, red for sensor/wire failure or overrange; READY light indicates normal operation, extinguishes in the event of any internal failure
Weight	383 g (13.5 oz)

Table 1. *SPT Input Codes and Accuracy Ratings*

RTD Input*	α**	Ω (@0°C)	Range	Input Accuracy	Minimum Span**
R1	PT 3750	1000	–185°C to +540°C (–301°F to +1004°F)	±0.2°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
R2	Pt 3850	100, 200, 300, 400, 500, 1000	–200°C to +850°C (–328°F to +1562°F)	100Ω: ±0.2°C; 200, 300, &400Ω: ±0.15°C; 500 & 1000Ω: ±0.1°C	
R3	Pt 3902	100, 200, 400, 500, 1000	–100°C to +650°C (–148°F to +1202°F)	100Ω: ±0.2°C; 200 & 400Ω: ±0.15°C; 500 & 1000Ω: ±0.1°C	
R4	Pt 3911	100, 500	–200°C to +630°C (–328°F to +1166°F)	100Ω: ±0.2°C 500Ω: ±0.1°C	
R5	Pt 3916	100	–200°C to +510°C (–328°F to +950°F)	±0.2°C	
R6	Pt 3923	98.129	–200°C to +600°C (–328°F to +1112°F)	±0.2°C	
R7	Pt 3926	100, 200, 470, 500	–200°C to +630°C (–328°F to +1166°F)	100Ω: ±0.2°C 200 to 470Ω: ±0.15°C; 500Ω: ±0.1°C	
R8	Pt 3928	100	–200°C to +850°C (–328°F to +1562°F)	±0.2°C	
Consult factory for other available types and ranges					
R21	Ni 672	120	–80°C to +320°C (–112°F to +608°F)	±0.14°C	Single Sensor: 10°C Averaging Sensors: 10°C Differential of Multiple Sensors: 20°C
R22	Cu 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

Direct Ω Input*	Range	Input Accuracy	Minimum Span***
RO	0-4000Ω	±0.01% of reading, ±0.8Ω	30Ω

T/C Input*	Range	Linearization Conformance Range	Input Accuracy	Minimum Span***
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
K	–270°C to +1390°C (–54°F to +2534°F)	–150°C to +1370°C (–238°F to +2498°F)	±0.3°C	40°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	–270°C to +407°C (–54°F to +764.6°F)	–200°C to +400°C (–328°F to +752°F)	±0.25°C	35°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
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
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
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

Direct mV Input*	Range	Input Accuracy	Minimum Span***
MV	–10 to +120mV	±15µV	4mV

* All input types retain site programmability.
** Actual α is 0.003750, 0.003850, 0.003902, etc.
*** Recommended Minimum Span. Tighter spans, while available, may result in output outside of rated accuracy.

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Ordering Information

Unit	Input	Output	Power	Option	Housing
SPT	**TPRG** Programmable (Temperature). User-set, via integral LCD and menus, for input from RTD, T/C, mV or direct Ω RTD Range: 100 to 1000Ω, –200 to +850°C (–328 to +1562°F) T/C Range: –270 to + 1836°C (–454 to +3308°F) Millivolts Range: –10 to 120mV Ohms Range: 0 to 4000Ω Menus provide the following selections*: Pt RTD, with α 3916, 3928, 3926, 3923, 3911, 3902, 3850, or 3750 Ni with α 672; Cu with μ 427; 2-, 3-, or 4-wire inputs, multiple sensor averaging and dual sensor differential *Factory calibration available ISA T/C Types J, E, T, R, S, N and B	**PRG** Programmable. User-set via easy-access internal controls for either 4-20mA or 1-5V, internally or externally powered (source/sink) (Other ranges available. Consult factory for availability.)	**U** Universal Power. Power Auto-sensing automatically switches for safe power input from 22-300Vdc or 90-260Vac	**–C** Contact Closure Relay output **–EP** Externally Powered	**DIN** Universal DIN-style housing mounts on both 32 mm, G-type (EN50035) and 35 mm, Top Hat (EN50022) rail

Options

The following list gives details on the options in the Ordering Information table. For information on the availability of options not listed here, or for help in selecting the type of SPT best suited to your application, always consult with your Moore Industries Sales Representative, or call the factory.

C Option — *Contact Closure Output.* SPDT form 1C relay output, rated 5A @ 250Vac or 24Vdc, or 0.5A @ 125Vdc,non-inductive,50/60 Hz. 700msec max. response time for step change on input with trip point at midpoint of step. Field-selectable normally open/normally closed terminals and high/low and failsafe/non-failsafe selections provided.

EP Option — *Externally Powered.* For user convenience, units with this option are configured at the factory to sink 4-20mA current, 40Vdc, max. This is typically called for if other equipment in the application is to supply power to the SPT. EP-equipped units retain the capability to be switched from sink to source.

SPT Model Numbers

To order additional or replacement modules for your system, use the information shown in bold text in the Ordering Information Table. Specify the following in order:

Product / Input / Output / Power / Option / [Housing]

- For the standard SPT:

  SPT / TPRG / 4-20MA / U [DIN]

This is a programmable temperature T/C input unit. It sources 4-20mA output. Other defaults on this unit include upscale drive burn-out protection. This is the standard SPT that is shipped when the configurations are not specified. This unit, like all SPTs, retains its field configurability, regardless of any factory setup.

- For a unit with a specific factory-set input and range (100ý Platinum RTD with a 3916, –200 to 500°C, for example) specify:

  SPT / R5 - (–200) - 500C / 4-20MA / U [DIN]

Unit Setup

Operationally, the SPT is a very flexible device. Most of its operating parameters can be set by the user, and Moore Industries has made every effort to make setup quick and intuitive. Bear in mind, however, that because there is so much about the SPT that can be controlled or set by the user, it may take a few runs through the setup routine to become comfortable with the procedure.

It is possible to order the SPT pre-configured according to specification, directly from the factory. Even if factory settings have been ordered, however, it is a good idea to run through the setup routine in order to verify that parameters have been set according to preference. It is easier to take a few minutes to check settings prior to starting up your process than it is to dismantle that process because something was inadvertently overlooked.

Internal Settings

The password security and voltage and current sink/source selections of the standard SPT are controlled by means of simple DIP switches and a single jumper inside the unit housing.

If the unit is equipped with the C option for an alarm output, the alarm's failsafe/non-failsafe function is also controlled by internal DIP switches.

The SPT housing is fitted with a sliding access door in its bottom panel. Figures 1, 2, and 3 show the panel and the location of each of the controls for setting:

- Password Security ON/OFF (Figure 1)
- Current Source/Sink or Voltage (Figure 2)
- Failsafe/Non-failsafe Alarm Function (Figure 3) Available with C-equipped units only.

Figure 1. *Setting the Internal Jumper for Password Security ON/OFF*

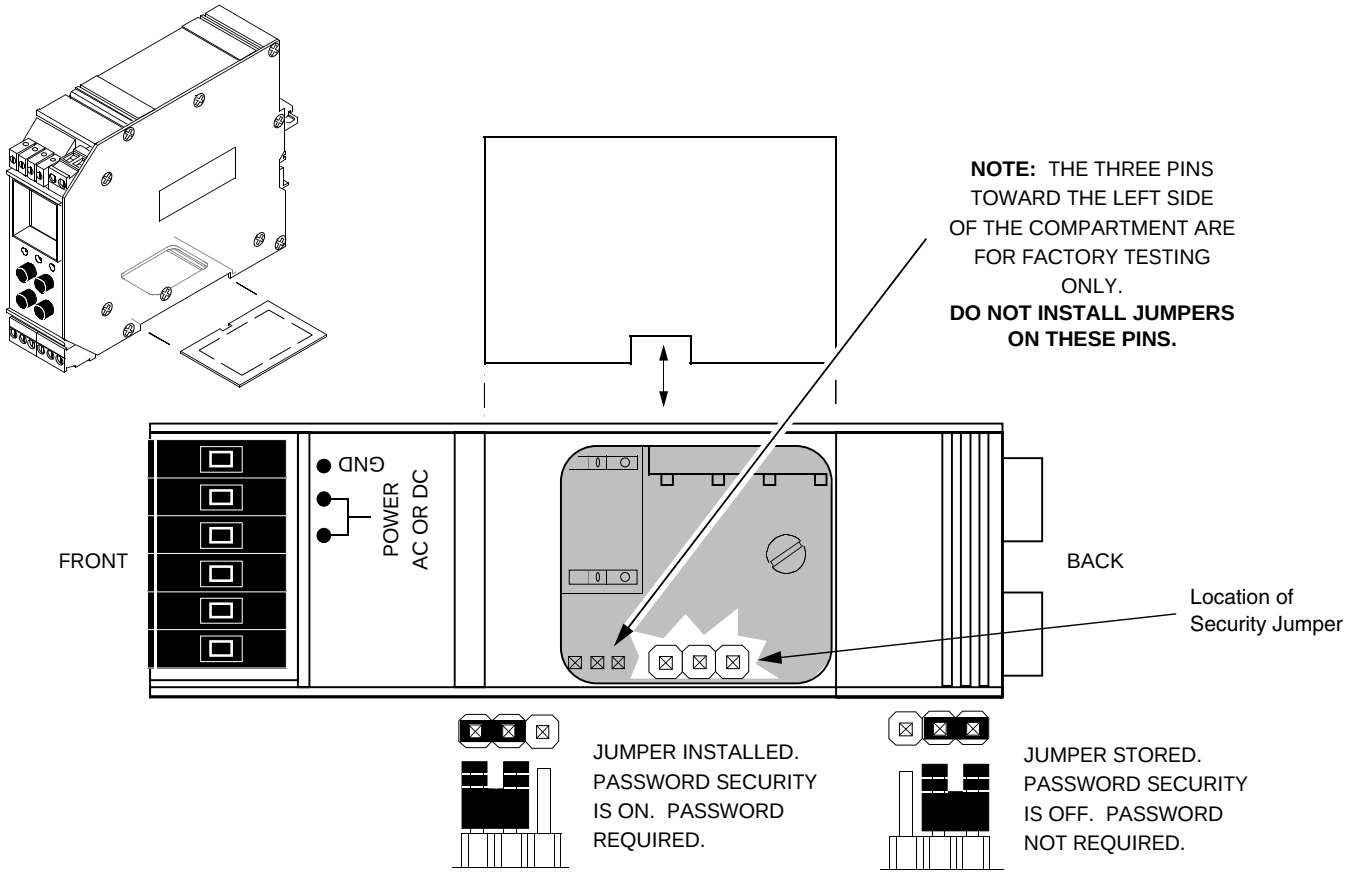

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Figure 2. *Setting the Internal DIP Switches to Source or Sink Current, or to Provide Voltage*

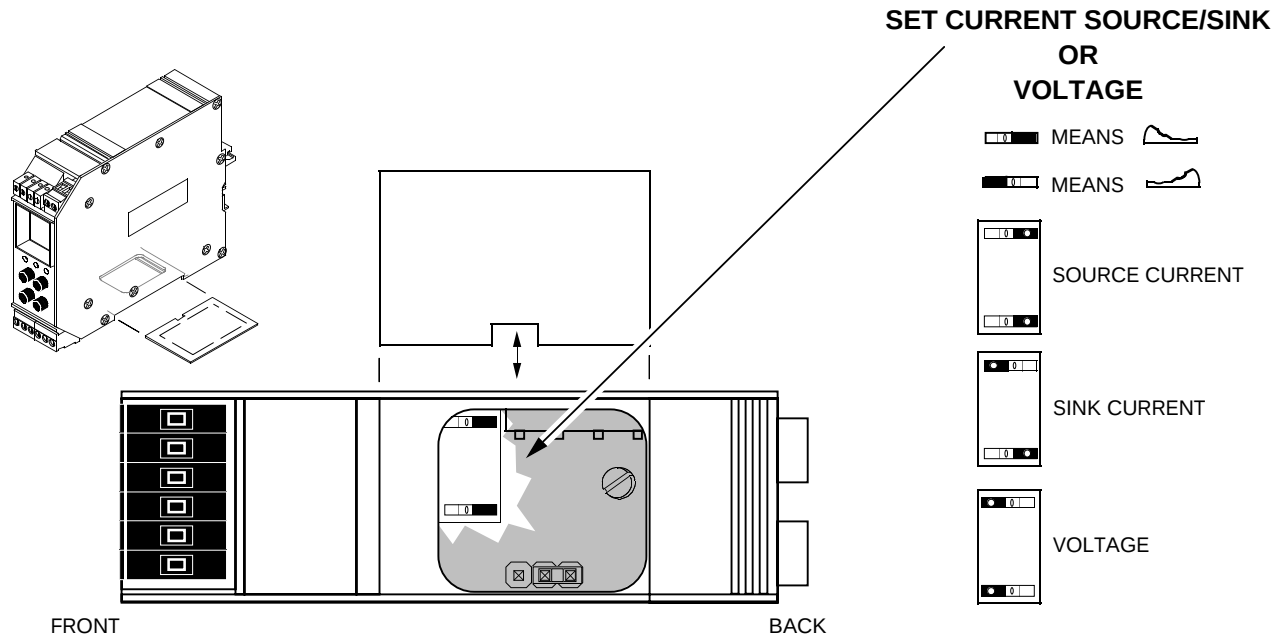
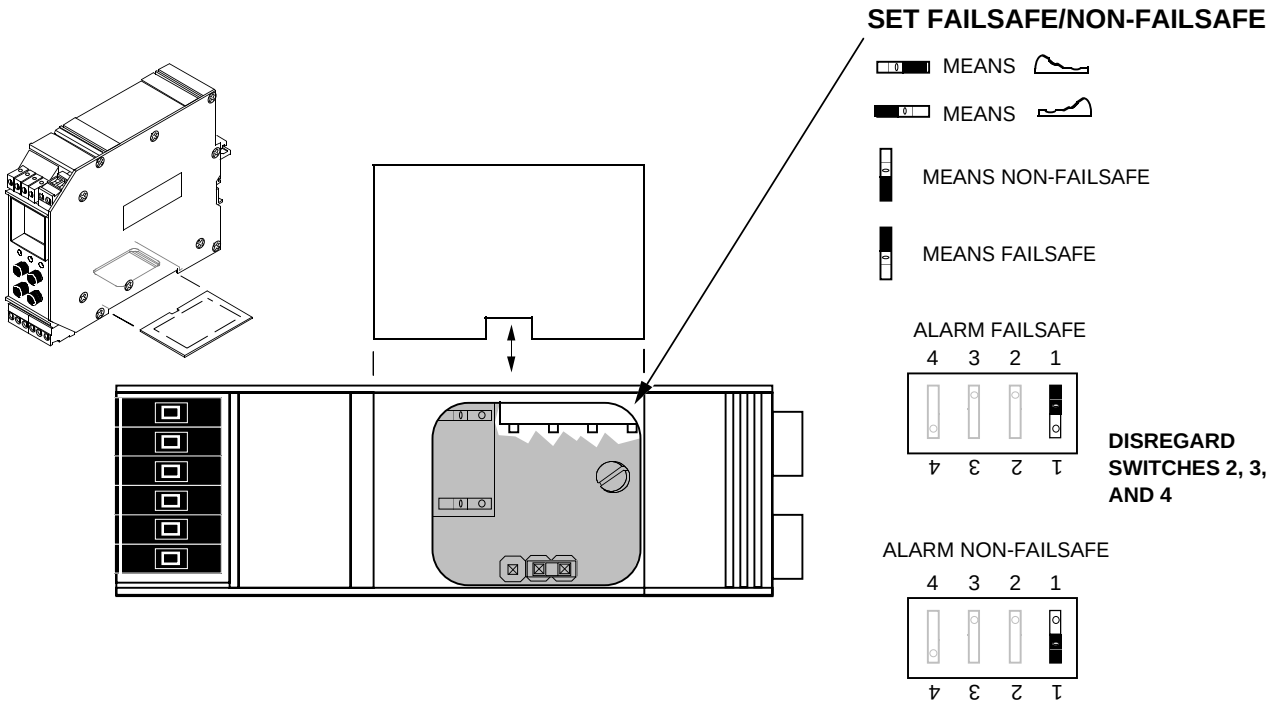


Figure 3. *Setting the Internal DIP Switches for Failsafe or Non-failsafe Alarm Function (C-equipped SPTs Only)*



The SPT Menus

SPT operating parameters are set, and their settings stored in on-board, non-volatile memory. There are four push buttons on the unit front panel. Together with the messages displayed on the LCD, these are used to access menus and effect changes to the settings for:

- Input Sensor Type and Range
- Engineering Units Displayed, and other Options
- Alarm Functions (C-equipped units only)
- Password (Menus/Settings Security)
- “Smart Ranged” Zero and Full Scale
- Standard Ranged Zero and Full Scale
- Actual Output Trim

Main Menu/View Settings

When first powered up, the SPT defaults to a display of measured value. Pressing VIEW accesses a series of displays that show, in succession, the settings currently stored in unit memory for Zero, Span, Alarm Setpoint and High/Low operational setting, if equipped with the alarm option.

If the security password jumper is not installed, (the jumper is stored) pressing SELECT accesses the first configure menu, CONFIGURE SENSOR (see figure 4). If the jumper is installed, the SPT asks for a password with the ENTER PASSWORD menu (see Figure 5). Then with the password correctly entered, returns to the main menu at CONFIGURE SENSOR.

Once inside the main menu level, the up and down arrow buttons are used to move through the various menus in a loop. The SELECT button accesses the associated sub-menu.

Hitting SELECT from the “CONF EXIT” screen returns to the display of the measured process variable.

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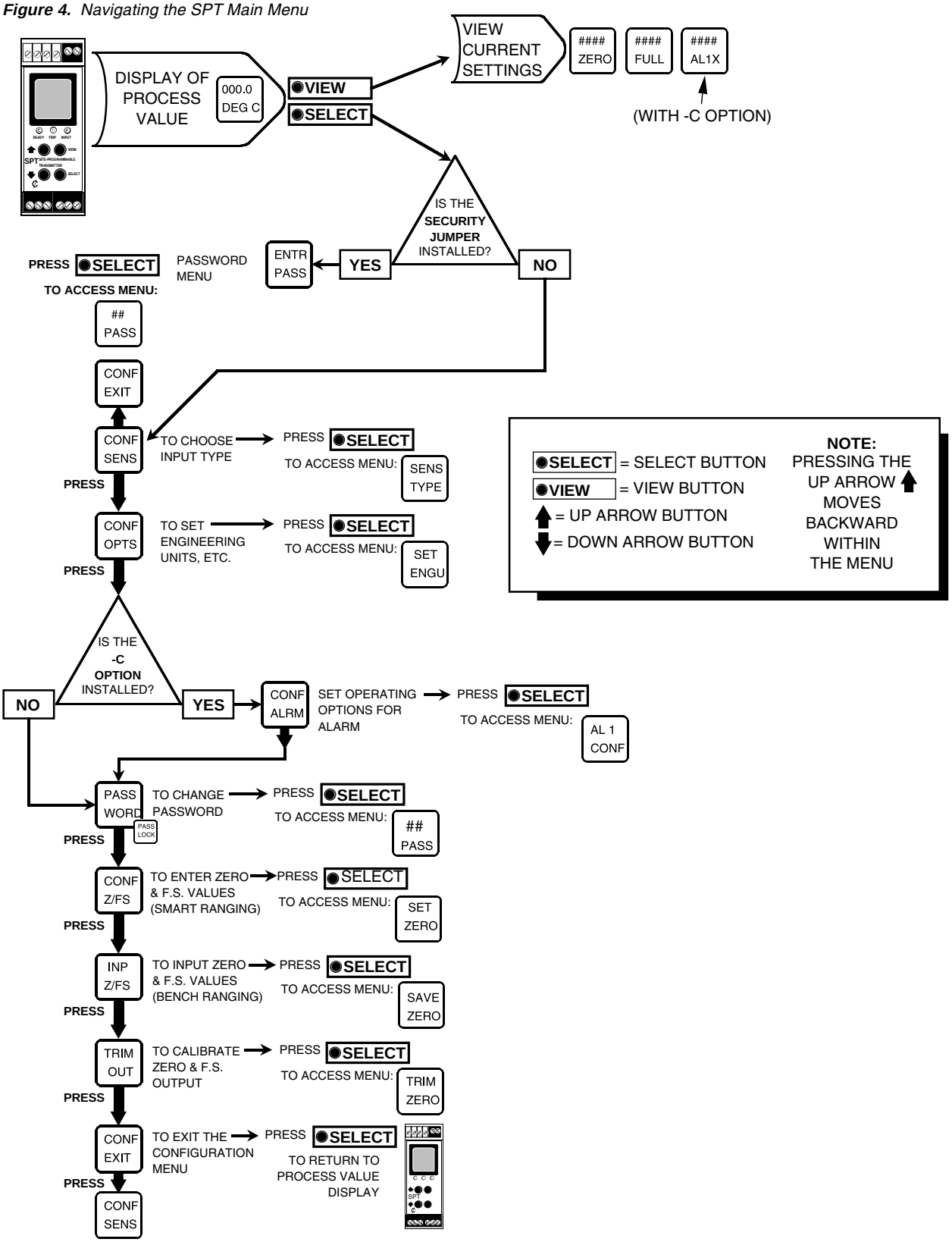
Figure 4. *Navigating the SPT Main Menu*

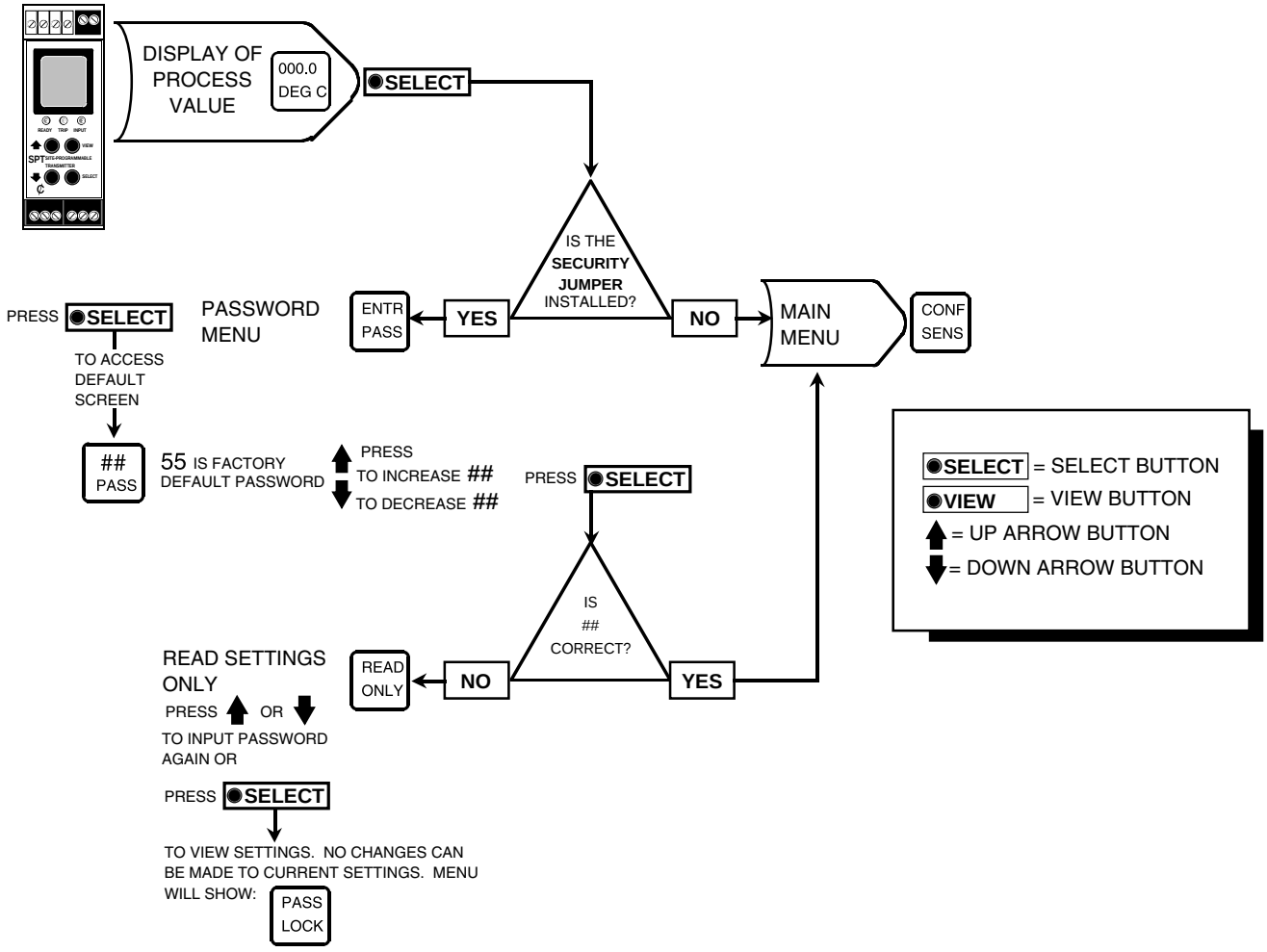


Entering Password

This menu is accessed if the Password Jumper is installed (see Figure 1). Figure 5 shows how to enter a password.

Note:
To change the password, remove the internal password jumper, or (with the jumper in) enter the correct password, then refer to the procedure/menu shown in Figure 11.

Figure 5. *Entering a Password*



To enter password:

1. **If the jumper is installed, press SELECT from the display of the measured value to bring up the "ENTR PASS" screen.**

2. **Use the arrow buttons, or press SELECT to access "55 PASS", the default screen for this point in the menu.**

3. **Use the arrow buttons to display the correct password. When the correct password number is displayed, press SELECT.**

Note:
If the correct password is not entered, unit settings can be viewed ("READ ONLY"), 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 read "READ ONLY".**

5. **From "READ ONLY", press SELECT to view the settings in the menus. READ ONLY mode blocks any attempt to make changes to the settings, and prevents the user from viewing the current password.**

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 SPT memory is presented later in this manual. See Figure 11.

Choosing the Sensor Input Type

This is the first menu accessed after the correct password has been entered.

Figure 6 shows the menu.

If the Password Jumper is not installed, the password menu is bypassed, and the Configure Sensor (CONF SENS) menu is accessed by pressing SELECT from the display of the measured value.

To configure the sensor:

1. **From the "CONF SENS" display, press SELECT.**

2. **Use the 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 the last setting. For Example, if a J-type thermocouple was last selected as the sensor type, "TC J" will be displayed when this menu is accessed.

3. **When the display shows the type of sensor to be used with the SPT, press SELECT.**

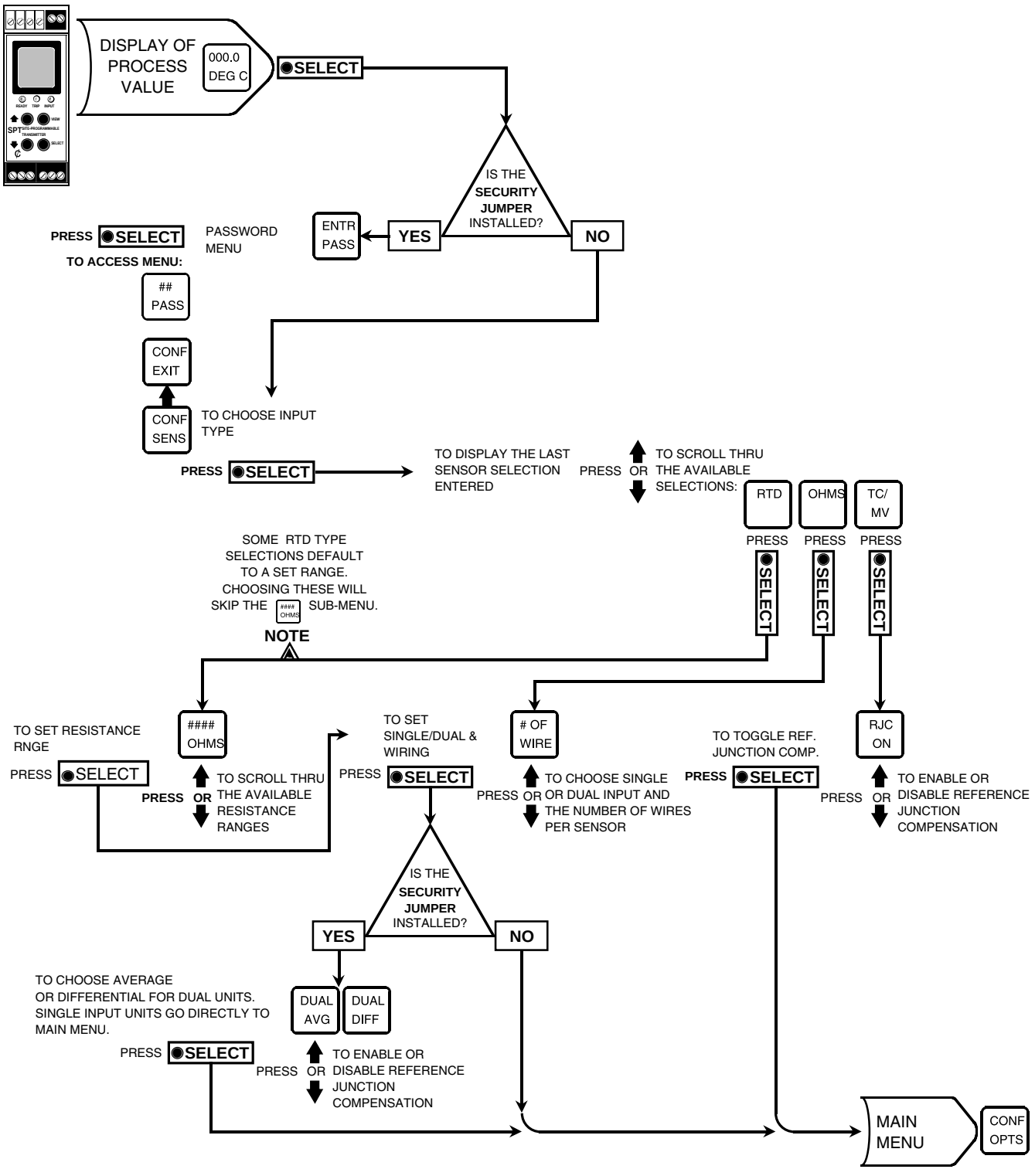
4. **If an RTD or direct resistance source was selected in step 3, skip to step 6.**

   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.

   If a millivolt source was selected in step 3, RJC is automatically set to OFF, and cannot be changed.

Figure 6. *Choosing the Sensor Input Type*



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". Not all RTD selections (step 3) have ranges available, as some default to a factory-set range. In those cases the next screen displayed will be the selection of the wiring configuration to be used. If "# OF WIRES" is displayed, go to step 7.**

   From the "XXXX OHMS" display, use the arrow buttons to scroll through the available ranges and press SELECT.

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 value, press the up arrow button 2 times (to "CONF EXIT"), and press SELECT.**

Configuring Unit Function Options

This menu is for selecting miscellaneous options associated with unit function.

Figure 7 gives an overview.

To select unit function options:

1. **From the "CONF OPTS" screen of the main menu, press SELECT.**

2. **Use the arrow buttons to scroll through the options:**

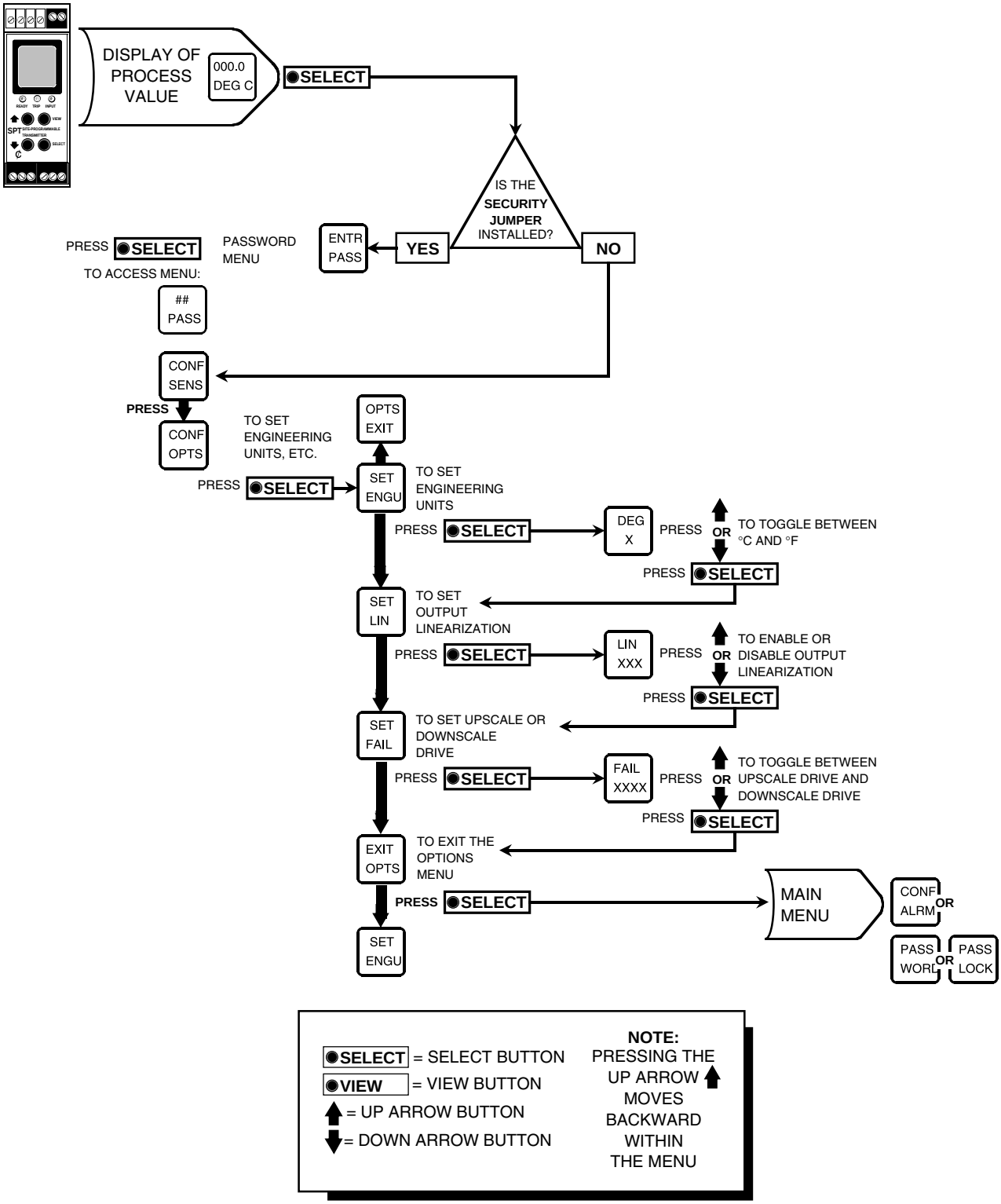
- **Set the engineering units of the display of the measured value (°C or °F)**
- **Toggle the linearization of the input ON or OFF**
- **Determine how the unit behaves in the event of a sensor failure (Upscale/downscale drive and (optional) alarm output).**

3. **Press SELECT when the display shows any of these options, then use the arrow buttons to toggle the choices.**

4. **When the display shows the option set as desired, press SELECT. The next option will be displayed, or "OPTS EXIT".**

5. **Repeat step 2, or from "OPTS EXIT" press SELECT to return to the main menu.**

Figure 7. *Configuring Unit Function Options*



"SET FAIL" and the "C" option

The SPT's standard Total Sensor Diagnostics distinguishes between sensor failure and an alarm condition on the measured process variable. If a sensor fails, the unit output will drive in the direction specified in the "SET FAIL" menu, and if equipped with the C option, can also produce an alarm output.

To produce a sensor failure alarm, set both the unit "SET FAIL" and "ALRM HI LO" parameters high or low. The procedure for choosing high or low alarm can be found under the explanation of the Configure Alarm menu, "CONF ALRM", following this section. Table 2 shows how the C option works with the SPT during sensor failure.

To set failure sensor alarm and alarm output:

1. **From the "SET FAIL" screen, press SELECT.**
2. **Use the up or down arrow to toggle the display between "FAIL HIGH" and "FAIL LOW".**
3. **Press SELECT to enter the setting into memory. Choosing "FAIL HIGH" configures the unit's output to drive to full scale in the event of an open input. With "FAIL LOW", the output is driven downscale to zero.**

   If equipped with the Alarm option, the optional unit relay will also trip if configured for:

- **High alarm with "FAIL HIGH"**
- **Low alarm with "FAIL LOW"**

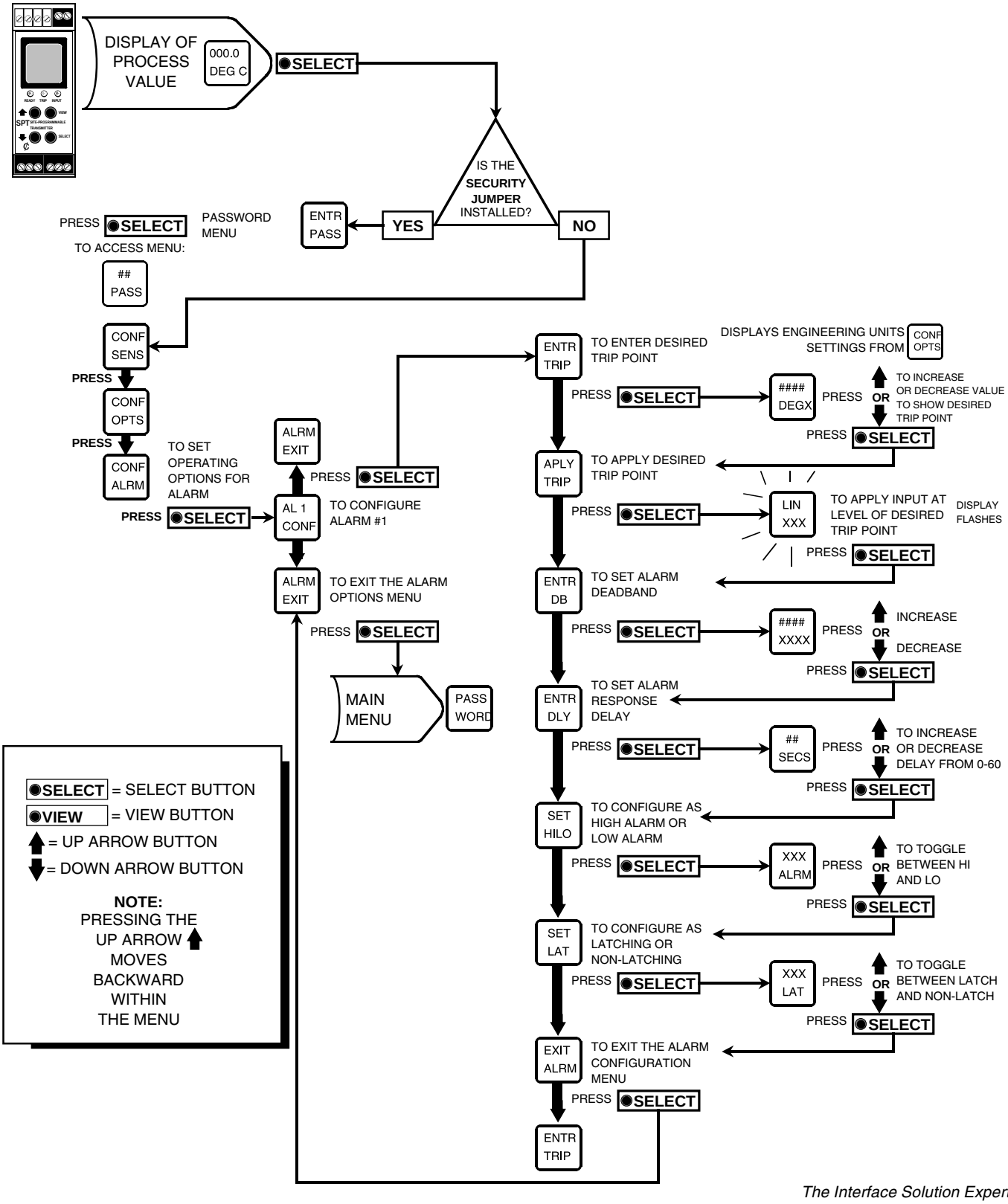
Configure Alarm

This menu sets the parameters of the SPT alarm, which is present only when the unit is equipped with the C option. Selections for trip point, deadband, delay, and high/low function are made in this menu. If the C option is not present, the SPT will automatically bypass this menu. Figure 8 gives an overview.

Table 2. *How the C Option Works with the SPT if the Sensor Fails*

	Which "SET FAIL" selection is chosen?	Does Alarm Trip on Sensor Failure?	How does the Analog Ouptut respond to sensor failure?
Standard SPT (No Options)	"FAIL HIGH"	n/a	Drives ouput to full scale
	"FAIL LOW"	n/a	Drives output to zero
C-equipped	"FAIL HIGH"	YES if configured as "HI" NO if configured as "LO" (CONF ALRM menu)	Drives output to full scale
	"FAIL LOW"	YES if configured as "LO" NO if configured as "HI" (CONF ALRM menu)	Drives output to Zero

Figure 8. *Configuring the Alarm Parameters (C Option-equipped units ONLY)*



Alarm Terminology

If the SPT to be installed is equipped with the alarm option, 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 9 illustrates the way the SPT alarm operates. For more in depth information, contact the factory for a copy of the publication "*Alarm Trips: The Ups and Downs*".

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*". The SPT alarm trip point is set by the user.

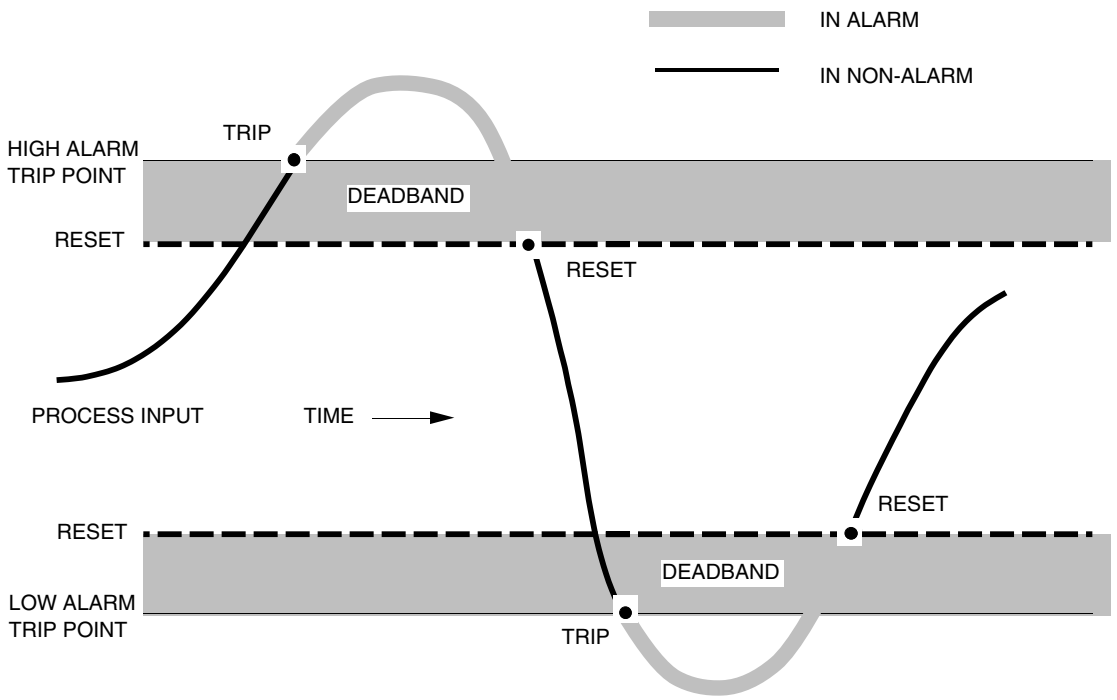
High Alarms trip when the process input goes above the trip point. **Low Alarms** trip when the process input drops below the trip point. The SPT alarm output can be set by the user to function as either a high or low alarm.

Reset Point is the process input level at which the user wants an alarm relay to change state, 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.

Deadband 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. Deadband is not required, but remember that when an alarm is configured without one, its trip point and reset point are the same. The deadband of the SPT is set by the user.

The relays of a **Failsafe Alarm** are de-energized when tripped, energized when the process input is at a non-alarm level. **Non-failsafe Alarm** relays are energized when tripped, de-energized when the process input is at a non-alarm level. The SPT alarm option can be switched from failsafe to non-failsafe at any time by the user.

Figure 9. *How Alarms Work with the Process Input*



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.

TSD, the C Option and the SPT Alarm

Total Sensor Diagnostics, TSD, is standard on all SPTs. This innovative, embedded feature monitors input continuously, and displays messages on the front panel LCD to let the user know not only *if* there is a problem with the input(s), but ***where*** the problem has occurred. The INPUT LED also changes color (from green to red) if there is an input problem.

Sensor Failure and Alarm Output. To complement TSD, the C option enables the SPT to provide alarm output on sensor failure.

Note:
Without the C option, the SPT cannot provide an alarm output on sensor failure. But, the analog output does react to sensor failure.

Assuming the appropriate options are present, to provide a sensor failure alarm, the SPT's HI/LO alarm setting and its upscale/downscale drive selection ("SET FAIL") must be configured to work in concert. The settings for both parameters must agree.

Table 2 summarizes the way the C-equipped SPT functions in response to sensor failures.

To set the parameters of the SPT alarm:

1. **From the "CONF ALRM" screen of the main menu, press SELECT.**
2. **Press SELECT to access the settings for the alarm, or use the arrow buttons to access the "ALRM EXIT" screen, and press SELECT to return to the main menu at "PASS WORD".**
3. **After pressing SELECT in step 2, use the arrow buttons to scroll through the alarm parameters:**
   - **Enter trip point**
   - **Input trip point**
   - **Enter deadband**
   - **Enter delay**
   - **Set high/low function**

   Press SELECT to access the settings for the displayed parameter. It is recommended that the parameter settings be entered into SPT memory in the order that they come up in this step (shown above). This is not required, however.

Note:
There are two options for setting the trip points of the alarm on the C-equipped SPT, "ENTR TRIP" and "INP TRIP".

"ENTR TRIP" allows the user to use the front panel push buttons to enter the desired trip point value into unit memory.

"INP TRIP" requires that the user incorporate the SPT into a calibration setup to "capture" the trip point value using an adjustable input source.

Entering the Alarm Trip

If the actual value of the trip point is known, the user can use “ENTR TRIP” to program the trip point. If the trip point is not known, skip to INPUT TRIP.

To program the trip point:

1. **From “ENTR TRIP”, press SELECT.**
2. **Use the arrow buttons to ramp the display to the trip point value, and press SELECT. This enters the displayed value into SPT memory.**

   The next screen shown will be “ENTR DB” (enter deadband).
3. **Use the arrow buttons to scroll through the alarm parameters, and press select to access the settings for the parameter displayed, or scroll to “EXIT ALARM” and press SELECT twice to return to the main menu at “PASS WORD”.**

Inputting Trip Point

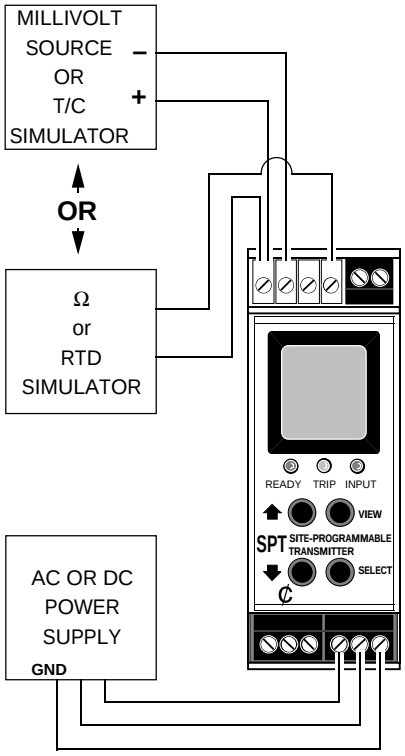
An input signal can be applied to the input terminals of the SPT, using the setup shown in Figure 10, and the unit can “capture” the trip point value.

To input the trip point:

1. **Incorporate the SPT into the setup shown in the figure, apply appropriate power, and allow 5 minutes for stabilization/warm-up.**
2. **Access the configuration menus, and use the down arrow to access the “CONF ALRM” menu.**
3. **Press SELECT.**
4. **Use the arrow buttons to access “INP TRIP”.**
5. **Press SELECT. The display will flash the input level present at the terminals.**
6. **Adjust the input to the desired trip point level.**
7. **Press SELECT when the flashing value on the display reaches the desired trip point value. This stores the value in SPT memory and returns the unit to the “AL1 CONF” menu at the “ENTR DB” screen.**

   Disconnect the SPT from the input.
8. **Use the arrow buttons to scroll through the alarm parameters, and press SELECT to access the settings for the parameter displayed, or scroll to “EXIT ALRM” and press SELECT twice to return to the main menu at “PASS WORD”.**

Figure 10. *Setting Up the SPT for “Capturing” Alarm Trip Point (C Option-equipped units ONLY)*



Entering Deadband

To enter the deadband:

1. **From the "ENTR DB" screen, press SELECT.**
2. **Use the arrows to increase or decrease the deadband. The display will show the value in the engineering units selected in the "CONF OPTS" menu.**
3. **Press SELECT when the display shows the desired value. This returns the unit to the "AL1 CONF" menu at the "ENTR DLY" screen.**
4. **Use the arrows to scroll through the alarm parameters. Press SELECT to access the settings or scroll to "EXIT ALRM" and press SELECT twice to return to the main menu.**

Entering Alarm Delay Time

To input the alarm delay time:

1. **From the "ENTR DLY" screen, press SELECT.**
2. **Use the arrows to change the time between the input exceeding the trip point and the response of the alarm. Settings from 0 to 60 seconds are available in 1 second increments.**
3. **Press SELECT when the display shows the desired delay settings. This returns the unit to the "AL1 CONF" menu at "SET HILO".**
4. **Use the arrows to scroll through the alarm parameters, and press SELECT to access the parameter settings, or scroll to "EXIT ALRM" and press SELECT twice to return to the main menu at "PASSWORD".**

Setting HI/LO Alarms

If the SPT is equipped with the C option, this parameter effects how the unit behaves in the event of a sensor failure. Selecting:

- High alarm ("HI ALRM") with a "FAIL HIGH" setting in "SET FAIL" ("CONF OPTS", described in the preceding section) will cause the SPT relay to trip if the sensor opens (output will be driven upscale)
- Low alarm ("LO ALRM") with a "FAIL LOW" setting in "SET FAIL" ("CONF OPTS" in the preceding section) will cause the SPT relay to trip if the sensor opens (output will be driven downscale).

To set alarm function:

1. **From the "SET HILO" screen, press SELECT.**
2. **Use the arrows to toggle the alarm function between high alarm (trips when input rises to, and exceeds the trip point setting) and low alarm (drops to, and falls below the trip point setting).**

Note:
The SPT will not provide an alarm indication of sensor failure unless equipped with the C option, and configured as described in these instructions.

"HI ALRM" must be set with a "FAIL HIGH" setting and "LO ALRM" must be set with a "FAIL LOW" setting. If they are not set in this manner, ***the alarm will not trip in the event of sensor failure.*** *Instead, the alarm holds its final state until the sensor input is restored.*

3. **Press SELECT to enter the desired alarm function into SPT memory. This returns the unit to the "AL1 CONF" menu at "SET LAT".**
4. **Use the arrow buttons to scroll through the alarm parameters, and press SELECT to access the settings for the parameter displayed, or scroll to "EXIT ALRM" and press SELECT twice to return to the main menu at "PASS WORD".**

Setting Latching/Non-Latching Functions

For C-equipped SPTs, the alarm is factory-set for non-latching function. From "SET LAT" press the down arrow to access the exit screen.

To review inputs, use the arrows to scroll through the alarm parameters and then press SELECT to access the settings for the parameter displayed. To exit the system, scroll to "EXIT ALRM" and press SELECT twice to return to the main menu at "PASS WORD".

Changing the Security Password

The following menu is active only when the Security Jumper shown in Figure 1 is NOT INSTALLED or when the jumper *is* installed and the correct password has been entered. (see figure 5) With the jumper installed, attempts to access this menu without the correct password, cause "PASS LOCK" to appear on the LCD. Attempts to make changes are blocked (READ ONLY mode).

Figure 11 shows the menu.

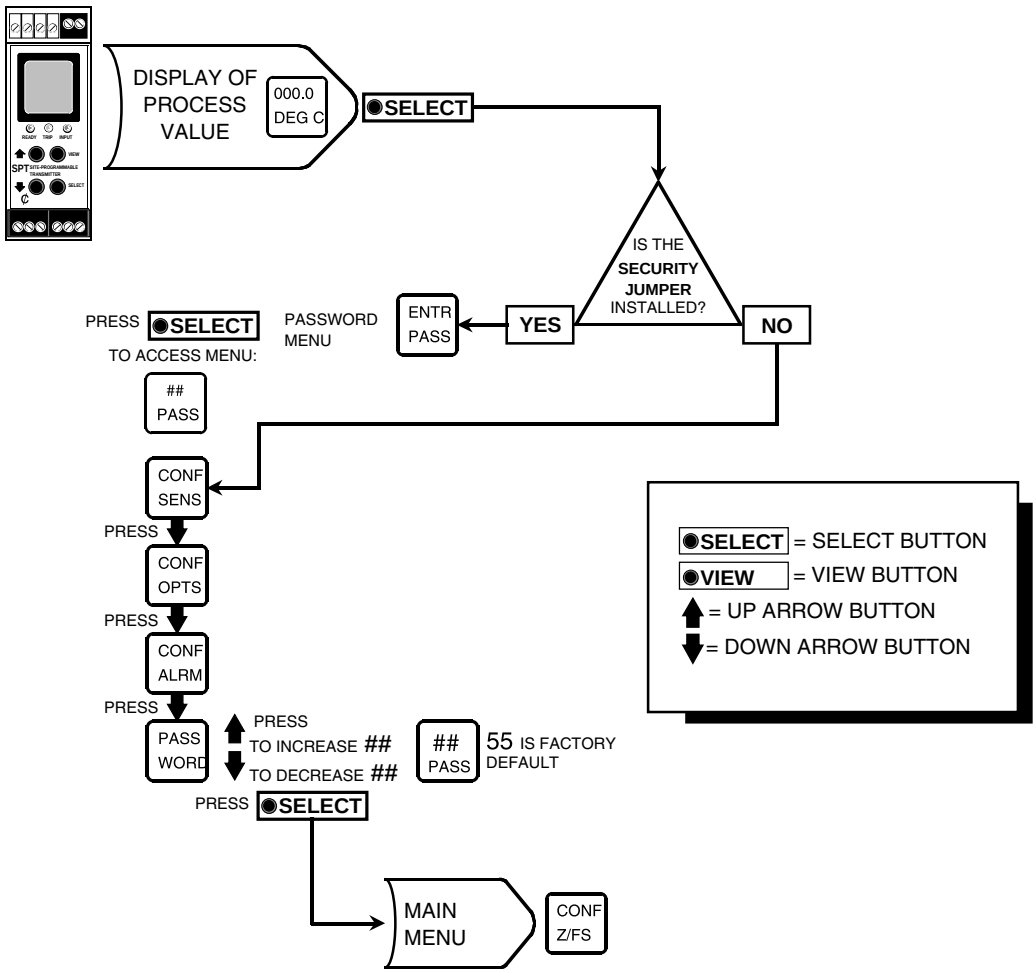
To change the security password:

1. **From the "CONF PASS" screen, press SELECT to access "## PASS".**
2. **Use the arrows to increase or decrease 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.**

Note:
The SPT password can be any number between 00 and 99.

When the security jumper is NOT installed, pressing SELECT from "PASSWORD" shows the current password setting.

Figure 11. *Changing the Security Password*



Configuring Zero and Full Scale — Smart Ranging

This menu allows the user to "program in" the values for the analog output 0 and 100% output without having to incorporate the SPT into any calibration setup.

Figure 12 shows the menu.

To configure zero and full scale:

1. **From the "CONF Z/FS" screen displayed, press SELECT.**
2. **Use the arrows to choose either "SET ZERO" or "SET FULL", and press SELECT.**
3. **Use the arrows 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 (see Figure 6).

4. **Press SELECT to enter the value into SPT memory.**

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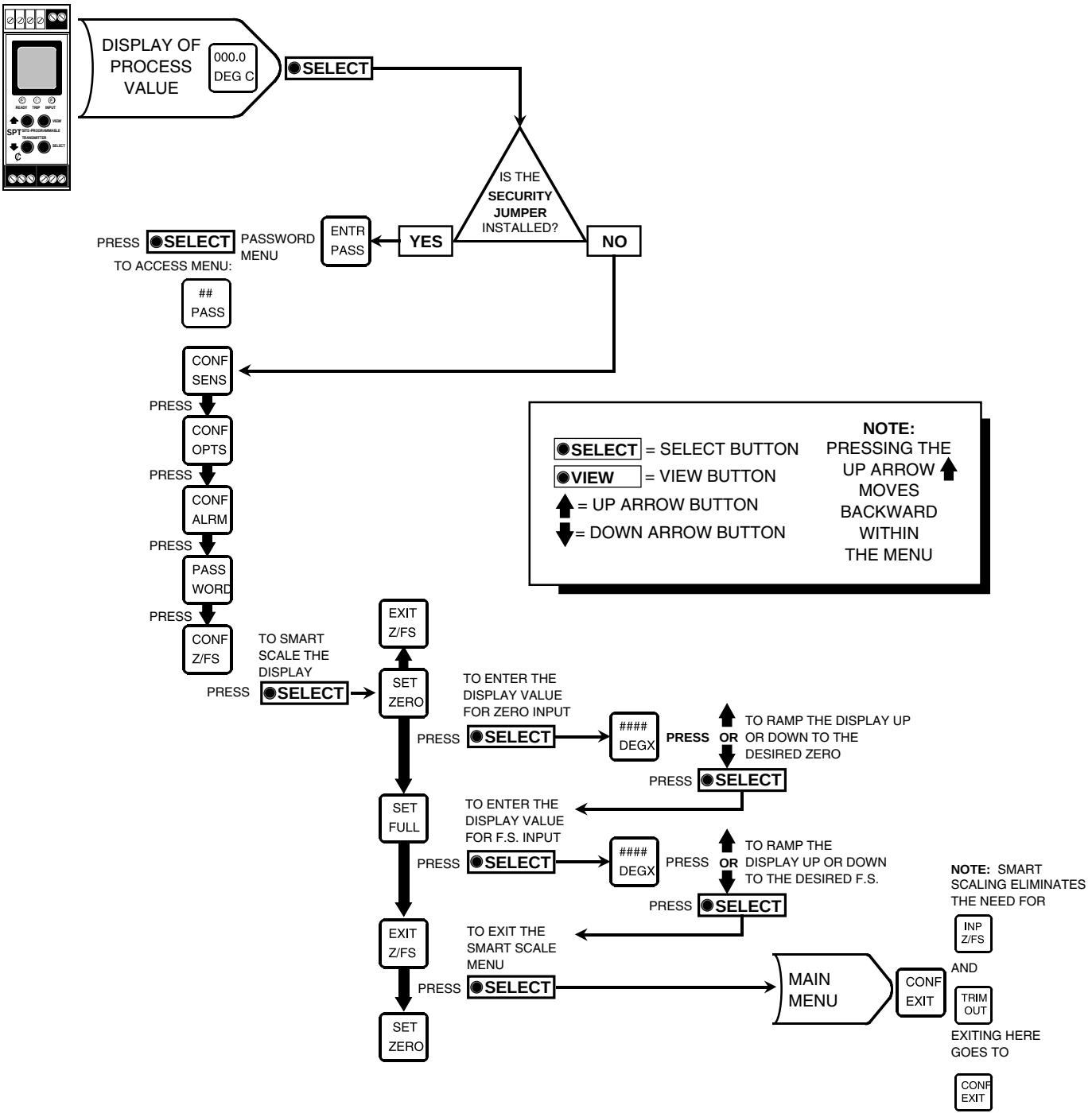
Figure 12. *Configuring Zero and Full scale*



5. **Repeat steps 2-4 to set the complimentary value. Once both have been set, the "EXIT Z/FS" screen will be displayed.**

6. **Press SELECT to return 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".

Inputting Zero and Full Scale

Referred to as "Standard Ranging", this menu 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.

To input zero and full scale:

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

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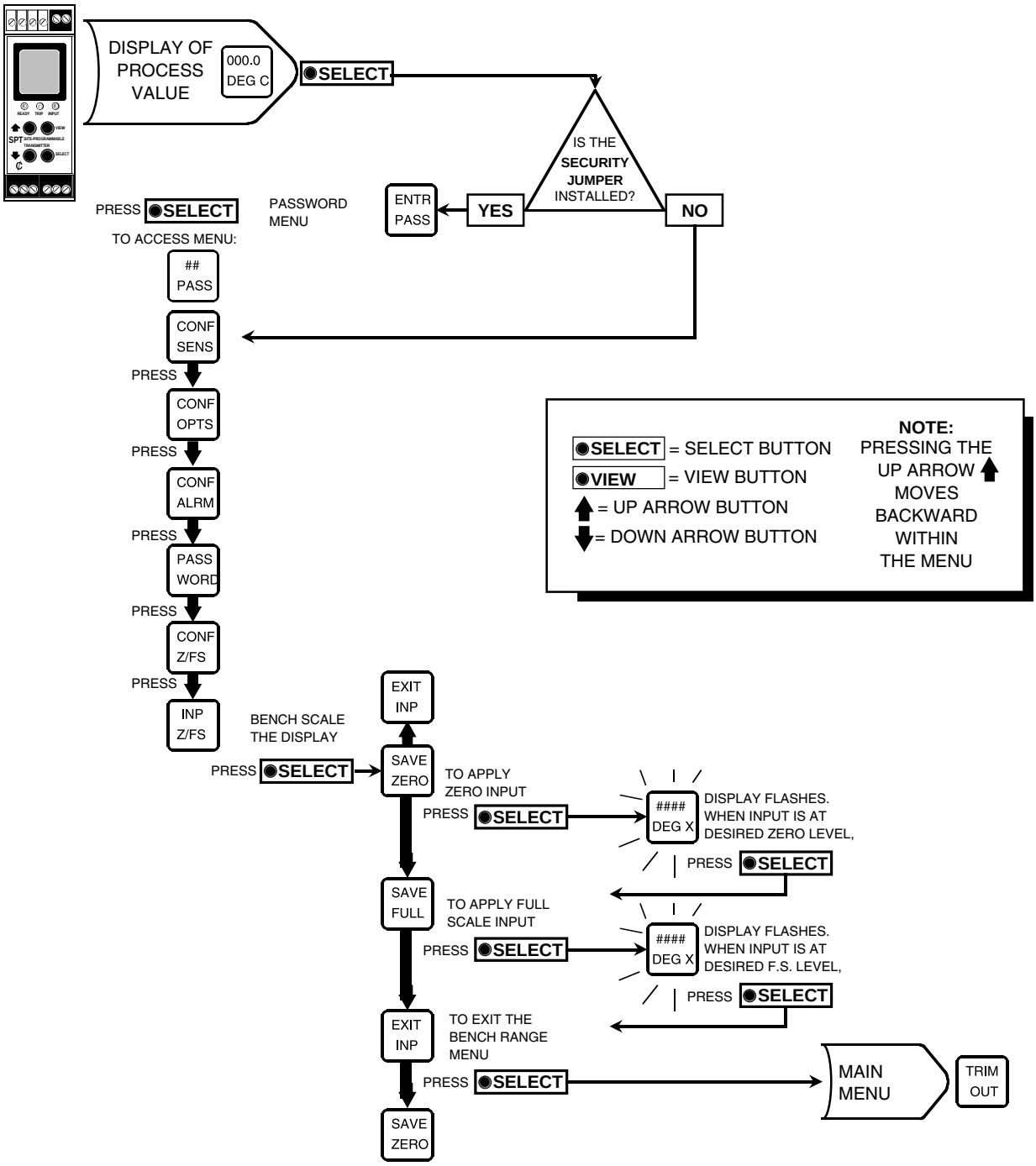
Figure 13. *Inputting Zero and Full Scale*

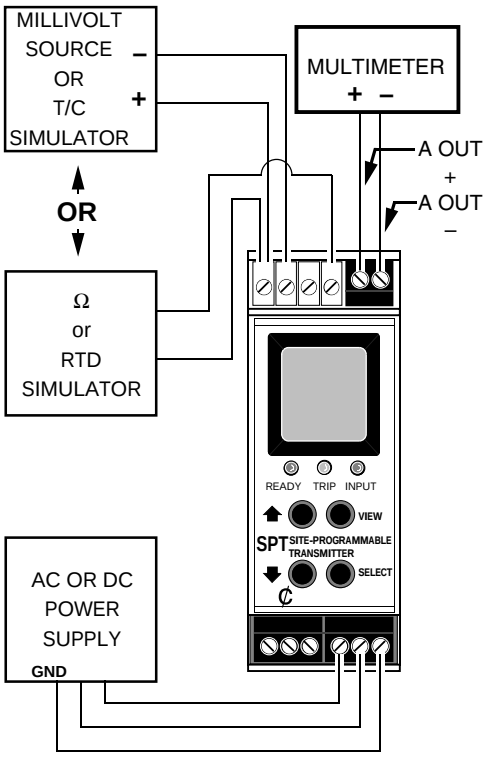


Trimming Output

Figure 14 shows the setup needed for performing this operation. Figure 15 shows the menu.

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

Figure 14. *Setting Up for Trimming the SPT Output*



To trim output:

1. **From the configuration menu, use the arrow button 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. The display will flash either "TRIM ZERO" or "TRIM FULL", depending upon the selection made in step 3.**
5. **While monitoring the reading on the meter, use the arrow buttons to adjust the output.**
6. **When the output is set , press SELECT. This sets the adjustment into memory, and brings up the next level to be adjusted, or "EXIT TRIM" if both outputs have been adjusted.**
7. **To exit the menu, press SELECT when "EXIT TRIM" is displayed. The unit will return to the main menu at "CONF EXIT".**

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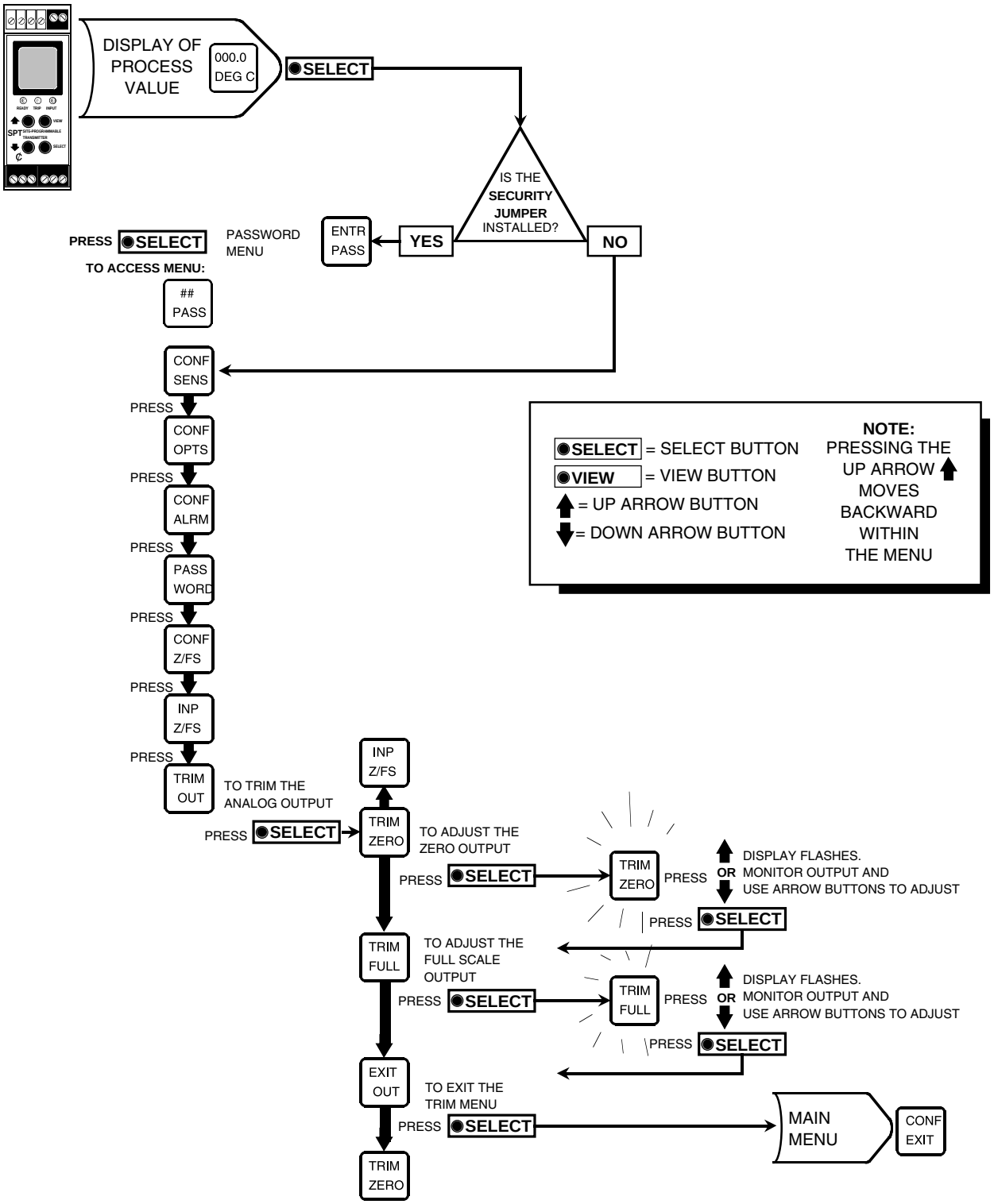
Figure 15. *Trimming Output*



Installation

The SPT is housed in a universal DIN-style case that mounts easily on both G-type and Top Hat rails.

Mounting the SPT

To mount the SPT on Top Hat DIN rail, seat the upper extrusion on the back panel over the top 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 pivot downward.

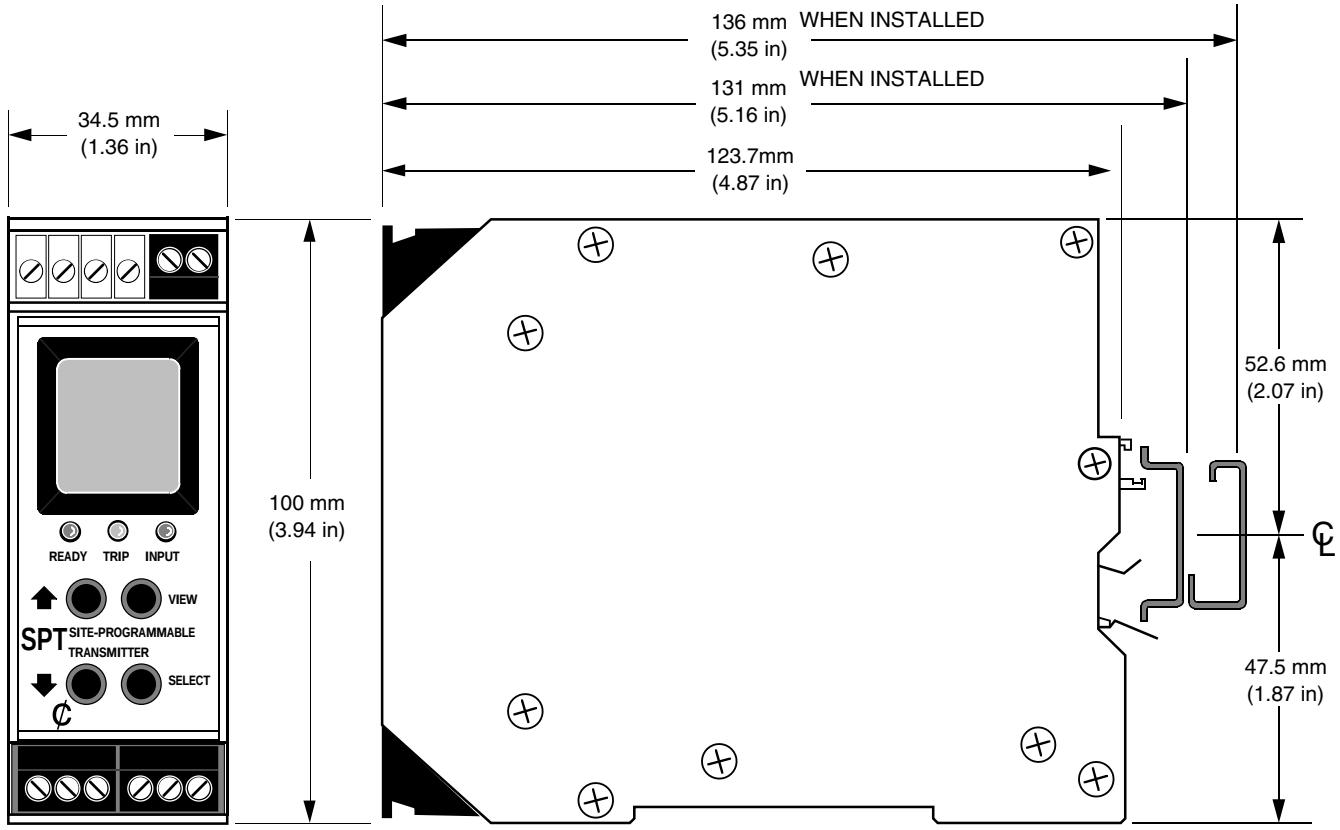
When mounting SPTs in multiple unit scenario like a rack or cabinet, make sure to allow adequate vertical spacing for pivoting the units. Figure 16 shows the unit's dimensions.

Recommended Ground Wiring Practices

The following ground wiring practices must be followed to ensure proper performance of the SPT:

- Any Moore Industries' product in a metal case, enclosure or housing should be grounded. Units in DIN housings, for example, should be mounted on a grounded rail.
- All input signals to, and output signals from Moore Industries' products should be wired using a shielded, twisted pair technique. Shields are to be connected to an earth or safety ground at the unit itself.
- The maximum length of any unshielded input and/or output signal wiring is 2 inches.

Figure 16. *Dimensions of the SPT*



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Connections

Figure 17 shows how to hook up the various sensor inputs, and Table 3 summarizes unit terminal designations.

Figure 17. *Connecting SPT Terminals and Input Hookups*

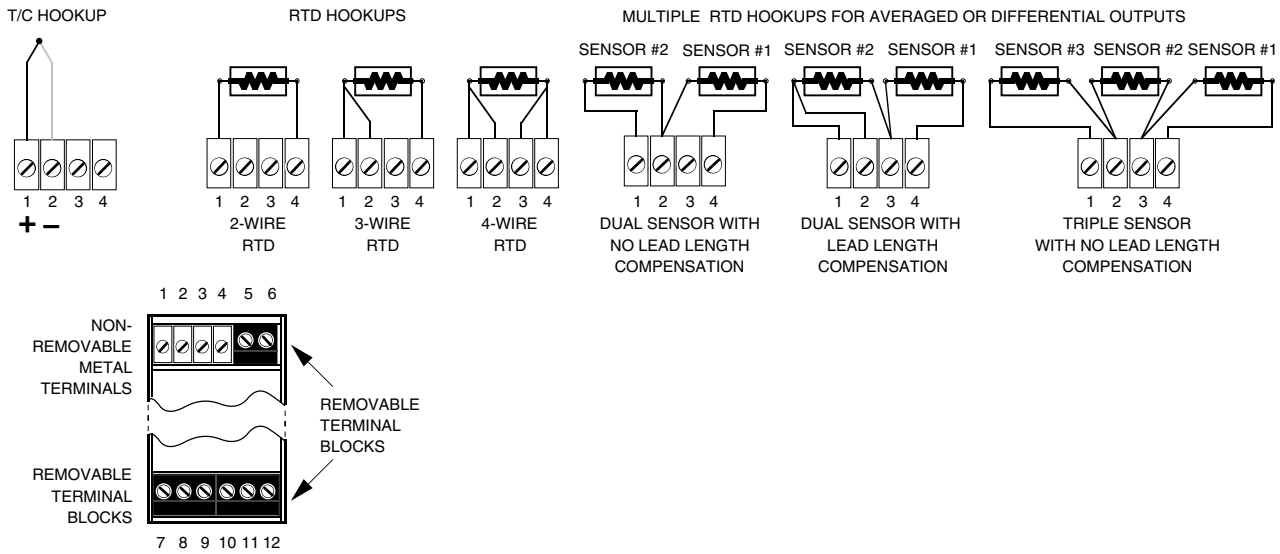

Table 3. *SPT Terminals*

1	2	3	4	5	6
+ (See Note 1)	– (See Note 1)	(See Note 2)	(See Note 2)	+ Analog OUT	– Analog OUT
7	**8**	**9**	**10**	**11**	**12**
Relay Normally OPEN (See Note 3)	Relay COMMON (See Note 3)	Relay Normally CLOSED (See Note 3)	POWER AC or DC	POWER AC or DC	GND

Notes: 1. Reference polarity when connecting T/C's or other mV sources only.
2. Not used with T/C inputs.
3. Requires -C option.

Operation

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

Unit configuration data, stored in memory, is monitored continuously. Any changes made to operating parameters controlled by choices made in the SPT menu system take effect immediately.

The settings of the internal DIP switches and security jumper may also be changed at any time. Changing the Security Jumper setting, however, requires that unit power be cycled off and on before taking effect. The settings for source/sink and failsafe/non-failsafe take effect right away.

LED's

The front panel of the SPT incorporates a set of LEDs that are labeled according to function. These indicators provide a quick reference for input condition during normal unit operations. Table 4 illustrates the different conditions of the LEDs.

Note:
The state of the SPT relay in alarm or non-alarm is determined by the failsafe/non-failsafe setting of the unit's internal DIP switch.
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). Failsafe relays are OFF (de-energized) when input is in alarm (red LED).

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

This design scheme means that, regardless of the relay state, the LEDs associated with the alarm output in the C-equipped SPT will always show red when the input is in alarm, and green in non-alarm.

Table 4. *LED Meanings*

LED	COLOR	INPUT CONDITION
Ready	Green	Normal operation. Indicated that the SPT has run its startup diagnostics and all internal circuitry is functioning properly.
	No color (LED OUT)	The LED goes out if internal error occurs.
Input	Green	Normal operation. Indicates that an input sensor or sensors has been connected, and they are functioning properly.
	Red	Problem with the sensor inputs. Sensor problems are accompanined by a message on the LCD diagnosing the specific problem. Sensor failures and individual wire breaks are all called out by the SPT's Total Sensor Diagnostics
Trip # (C option only)	Green	The connected input is is a non-alarm condition relative to the user-determined trip point setting.
	Red	Alarm is tripped. Changes back to green when the input returns to a non-alarm level relative to the user-determined trip point and deadband settings.

Error Codes

Every SPT 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.

The SPT is equipped with a full set of internal diagnostics that check unit operation and configuration on power-up. If there are problems with the unit's microprocessor, or with conflicting settings in memory, the LCD will show an error code.

For most problems, it will be necessary to return the unit to the factory. A quick call to Moore Industries will have a temporary replacement unit to you in as little as 24 hours, usually in even less time.

Table 5 lists the error codes, and the action to take if they are displayed on start-up.

Table 5. *SPT Error Codes*

LCD DISPLAY	Translation	What to Do
EE FLT	EEPROM Error – The internal processor has failed.	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
RAM ERR	RAM (memory) Error – The internal memory has failed.	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
ROM ERR	ROM Error – The internal, permanent memory has failed.	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
CAL ERR	Calibration Error – The factory-set calibration of the unit has failed to initialize.	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
DATA ERR	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 correct sensor selections have been made for the range settings, etc.
PACT ERR	Memory Packet Error – Internal memory failure.	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
CONF ERR	Configuration Error – There are conflicts in the settings entered into unit memory. This can be caused by power loss or fluctuation during configuration.	Cycle power to the unit, then run through the configuration menus to ensure that the correct sensor selections have been made for the range settings, etc.
RJC OPEN	Reference Junction Compensation Resistor Burnout.	Cycle power to the unit, and if the error occurs again, return the unit to the factory for service.
LD 1 OPEN	Lead # 1 is open.	Repair Lead # 1.
LD 2 OPEN	Lead # 2 is open.	Repair Lead # 2.
LD 3 OPEN	Lead # 3 is open.	Repair Lead # 3.
LD 4 OPEN	Lead # 4 is open.	Repair Lead # 4.
SEN1 OPEN	R1 is open (Sensor # 1)	Repair Sensor # 1.
SEN2 OPEN	R2 is open (Sensor # 2)	Repair Sensor # 2.
SEN3 OPEN	R3 is open (Sensor # 3)	Repair Sensor # 3.

Customer Service

Moore Industries is recognized as the industry leader in delivering top quality to its customer, both in products and services. We perform a battery of stringent quality asurance 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 on the back cover.

If problems involve a particular SPT , there are several pieces of information you can gather ***before*** you call the factory that will help our staff to get you answers more efficiently. When you call, please have:

- The model number of the unit in question.
- The serial number of the unit in question.
- The job number (if available).
- The purchase order under which the unit was shipped (if available).

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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.

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