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Site-Programmable  
HART® Alarm

# SPA

**SPA**  
Site-Programmable  
HART® Alarm



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## Introduction

Congratulations on your purchase of Moore Industries' Site-Programmable Alarm (SPA) for instruments using the HART data communications protocol. This is the Users' Reference Manual for the SPA with HART<sup>1</sup>. Here we have tried to provide you with all the information you might need—from specifications to installation and operation instructions, from maintenance and troubleshooting data, to a simple how-to on ordering additional or replacement SPAs.

We are recognized the world over as the industry leader in providing dependable, highly utilitarian instruments, and backing them up with award-winning customer service. If you ever experience any problems with the SPA, or with any Moore Industries product, you can contact one of our corporate Customer Service STAR<sup>2</sup> Centers, your local Moore Industries Interface Solution Sales Representatives, or our corporate headquarters. You'll find telephone and FAX numbers inside of the front cover of this booklet, and on the inside and outside of the back cover. You can also email us anytime at

[info@miinet.com](mailto:info@miinet.com), [cservice@miinet.com](mailto:cservice@miinet.com), or [techpubs@miinet.com](mailto:techpubs@miinet.com).

If you find any errors in this manual, or if you feel that there are things that could be clarified in any way, please contact us immediately. If you find any errors or areas that could be improved upon when dealing with any of Moore Industries' products, services, or people—*especially* if the attention you receive either before or after purchase is not *completely* satisfactory, please contact the corporate headquarters immediately.

Part of providing solutions is making sure that they are the *right* solutions for *you*. Our commitment to doing things right is more than cliché, it's the principle tenet of our corporate philosophy.

## About this Booklet

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

- A "*Note*" provides information to help you in avoiding minor inconveniences during calibration, installation, or operation of the SPA.
- A "*Caution*" provides information on steps to take in avoiding procedures and practices that could risk damage to the SPA or other equipment.
- A "*WARNING*" provides information on steps to take in avoiding procedures and practices that could pose safety risks to personnel.

If you are not familiar with the HART protocol, or with how to use HART field instruments in a process loop, we strongly recommend referring to any of the documents available on the subject of digital field communications protocols available from:

The HART Communications Foundation  
9390 Research Boulevard, Suite I-350  
Austin, Texas 78759-6540 U.S.A.  
Telephone: (512) 794-0369  
[www.ccsi.com/hart](http://www.ccsi.com/hart)

Copies of *A HART Protocol Introduction* and *A HART Technical Overview* are also available directly from Moore Industries.

You can also get some information on process control alarm trips in a brief synopsis of function and terminology in the appendix of this manual. The best place to get more information is from your local Moore Industries Interface Solutions Sales Representative. Ask him or her for a copy of our comprehensive technical bulletin, *Alarm Trips: The Ups and Downs*. This easy-to-read flier gives all sorts of useful details on how process alarm trips work, and how they can be used to add multiple levels of safety and increased return on investment for many types of instruments that you may already have installed and working in your applications.

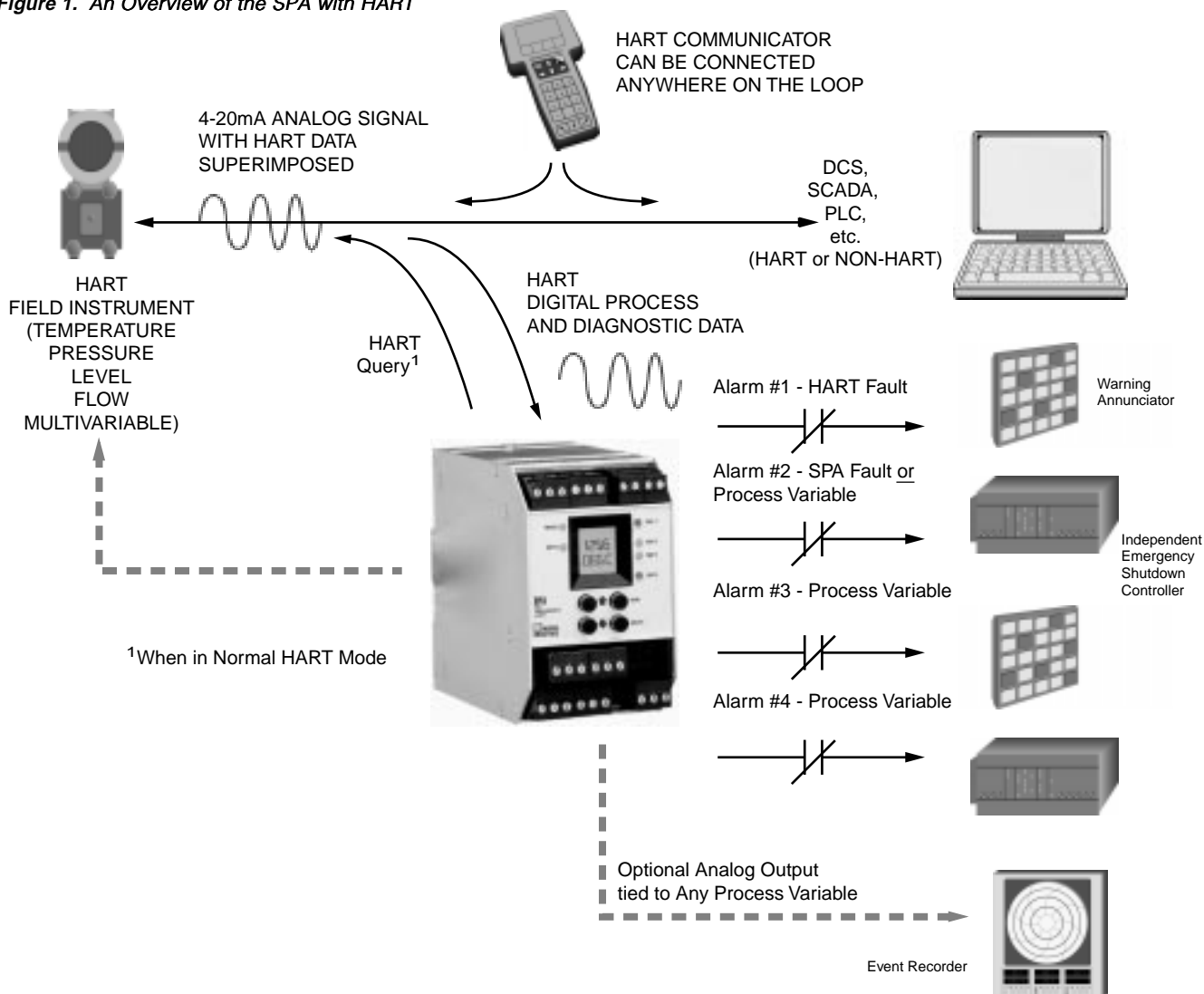
# SPA WITH HART

## Description

The SPA with HART is a 4-wire (line or mains powered), site-programmable, digital process alarm. It connects to a standard HART field device, and provides up to four, fully-configurable, contact-closure outputs based on "readings" of the HART digital data. See Figure 1.

The SPA can be user-set as either the Primary or Secondary HART Master in the process loop. It can provide transmitter excitation for the HART transmitter it is monitoring; provide an auxiliary analog output based on the HART-encoded digital input from the Smart device; and can be used as an "on-site" indicator of trouble by virtue of its programmable LCD and front panel multi-color LEDs.

Figure 1. An Overview of the SPA with HART



## Inputs

The SPA with HART reads and can display:

- The Primary, Secondary, Third (tertiary), Fourth (quartic), and Fifth (quintic) HART Variable
- The Current (0-20mA) of the Primary HART Variable  
and
- The scaling (zero and span) of the Primary Variable

Additionally, the SPA with HART monitors its own “health”. It constantly checks to make sure that internal programming is correct, and that it is receiving the correct HART signal from the transmitter.

## Outputs

The SPA with HART can be ordered with either 2, or 4 alarm outputs.

In both the 2- and 4-alarm configuration, Alarm #1 is a contact closure output that “trips” whenever there is a problem with HART communications. (More on this in the section of this manual that explains the SPA’s monitoring of the HART Status Byte information, pages 18 and 19.) Alarm #2 can be user set to trip either when the SPA itself is malfunctioning (Refer to “SPA Setup—Relay #2, page 14), when any one of the HART variables varies outside a user-defined range, or if the Primary Variable current is too high or too low.

Alarms #3 and #4 of the 4-alarm SPA variant, are process variable alarms that are configured by the user to trip when any one of the HART variables varies outside a user-defined range, or if the Primary Variable current is too high or too low.

Each of the SPA alarms can be configured for high, low, failsafe, non-failsafe, latching, or non-latching function. Each can also be programmed with a delay, and a deadband.

## Analog Output Option

The SPA also provides an isolated, scalable 0-20mA or 0-10V output proportional to the monitored process variable.

### Custom, 22-Point Linearization

The SPA input can be programmed from the front panel keypad with up to 22, custom linearization points for linearizing its display and/or its optional analog output.

## The SPA with HART is a DIGITAL Alarm

The other, non-HART alarm trips that Moore Industries makes base their alarm functioning on an *analog* signal from the field device. Even the other members of the SPA family of alarms use inputs from either current or voltage sources (the HLPRG variant), or from temperature sensors (the TPRG variant).

The SPA with HART bases all alarm functioning on its reading of the *digital* data received from the Smart device. Even its display (and its analog output, when equipped with its –AO option) is based on the digital information it processes.

## So...?

So in addition to the added flexibility and functionality that it gets from its HART capabilities, the SPA with HART is relatively immune to the kinds of problems that can plague other alarms when their inputs are exposed to ambient noise, electromagnetic and/or radio interference.

# SPA WITH HART

## Specifications

The table below lists the specifications for the SPA with HART Site Programmable Alarm. Consult the factory or your local Moore Industries Interface Solutions Sales professional for information on any aspect of unit performance or operation not listed here.

Moore Industries reserves the right to make specifications changes. When possible or urgent, past customers may be notified of changes.

## Ordering Additional SPAs

To order additional or replacement SPAs, use the information printed in bold in the Ordering Information table. "Build" the appropriate model number based on the examples at the bottom of the table.

For more help, call your local Moore Industries Interface Solutions Sales professional, or the factory directly.

**Table 1.** SPA with HART Specifications

<p><b>Performance</b></p> <p><b>Input Accuracy:</b> Depends upon the accuracy of the HART field instrument</p> <p><b>Display Accuracy:</b> ±1 digit</p> <p><b>Deadband:</b> Full display range available; equal to max input range in user-set engineering units</p> <p><b>Digital Response Time:</b> Defined by HART protocol as 500 milliseconds (ms) in normal mode, 333ms in burst mode</p> <p><b>Alarm Response Time:</b> Digital response time + 150ms, max (defined as the time from filed instrument reporting a fault until the SPA relay trips)</p> <p><b>Alarm Trip Delay:</b> Programmable from 0-120 seconds</p> <p><b>Line Voltage Effect:</b> ±0.005% of output span for a 1% change in the line voltage (ac or dc)</p> <p>Isolation: 1000Vrms between case, input, output<sup>1</sup>, and power terminals</p> <p><b>Power Consumption:</b> 2-4W, nominal; 6W, max</p> <p><b>Input Over-Range Protection:</b> ±5Vdc</p>	<p><b>Analog Output Performance (Requires -AO Option)</b></p> <p><b>Output Accuracy:</b> ±0.03% of output span (includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution)</p> <p><b>Output Stability:</b> ±0.1% of calibrated span, max, over 6 months</p> <p><b>Output Response Time:</b> 500ms, max</p> <p><b>Ripple (up to 1200Hz):</b> Current output - 10mV, peak-to-peak (p-p), when measured across a 250Ω resistor; Voltage output - 50mV, p-p, max</p> <p><b>Output Limiting:</b> 110% of span, max; 105% of span, typical</p> <p><b>Load Effect:</b> ±0.01% of span from 0 to max load resistance on current output</p> <p><b>Ambient Conditions</b></p> <p><b>Operating Range:</b> -25 to +65 °C (-13 to +149 °F)</p> <p><b>Storage Range:</b> -40 to +80 °C (-40 to +175 °F)</p> <p><b>Ambient Temperature Effect:</b> ±0.005% of output span, max, per °C</p> <p><b>Relative Humidity:</b> 0-95%, non-condensing</p> <p><b>RFI/EMI Protection:</b> 30V/m – ABC ≤ 0.5% reading error, when tested according to SAMA standard PMC 33.1</p>	<p><b>Adjustments</b> Front panel push buttons control settings for zero, span, alarm trip points, HART parameters, etc.; Easy-access internal controls select current source or sink or voltage output<sup>1</sup>, failsafe or non-failsafe, and high or low alarm functions; Internal jumper setting and menu password protect access to settings</p> <p><b>Indicators</b> <b>LCD:</b> 2 x 4 character, backlit, alphanumeric; range from -9999 to 9999; Auto-decimal positioning</p> <p><b>LEDs:</b> Dual-color TRIP light (one for each relay) shows green for non-alarm, red for alarm; READY light indicates normal operation, goes out in the event of any internal SPA failure; Dual-color INPUT light shows green for input with HART communications, red for communications failure; Dual-color TRIP1 light shows green for HART in non-alarm, red for HART failure</p> <p><b>Weight</b> 456 to 513 g (16.1 to 18.1 oz)</p>
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<sup>1</sup> When unit is equipped with its -AO Analog Output option.

**Table 2. SPA with HART Ordering Information**

Unit	Input	Output	Power	Options	Housing
SPA Site-Programmable HART Alarm	HART Accepts a HART digital protocol input directly from a HART temperature, pressure, level, flow or multivariable transmitter (HART version 5.4 and earlier)	<p><b>2PRG Dual Relays</b> RELAY #1 is a HART instrument fault alarm RELAY #2 configures as either a SPA instrument fault alarm or as a process variable alarm</p> <p><b>4PRG Quad Relays</b> RELAY #1 is a HART instrument fault alarm RELAY #2 configures as either a SPA instrument fault alarm or as a process variable alarm RELAY #3 is a process variable alarm RELAY #4 is a process variable alarm</p> <p>Process variable alarm relays configure independently for: High or Low Trip Normally Open or Normally Closed Failsafe or Non-Failsafe Latching or Non-Latching</p> <p>(Relays are single-pole/double-throw (SPDT), 1 form C, rated 5A @ 250Vac, 50/60Hz, non-inductive)</p>	<p>U Universal, 4-wire (line) power; accepts any power input range between 22-300Vdc or 90-260Vac</p> <p>For CE approved units, specify one of the following: <b>24DC ±10%</b> <b>117AC ±10%</b> <b>230AC ±10%</b></p>	<p>-AO Analog output scaleable for any range between 0-20mA (4mA span, min.) into 1200Ω or 0-10V (1V span, min.) into 10KΩ</p> <p>-DPDT Double-pole/double-throw relays, 2 form C relays, rated 5A @ 250Vac, 50/60Hz, non-inductive (2PRG output types only)</p> <p>-HS Hermetically sealed relays, rated 0.5A @ 117Vac and 2A @ 28Vdc (2PRG output type only)</p>	DIN Universal DIN-style housing mounts on 32mm (EN50035) G-type and 35mm (EN50022) Top Hat DIN rails

When ordering, specify: Unit / Input / Output / Power / Options [Housing]

Model number example: SPA / HART / 4PRG / U / -AO [DIN]

## SPA with HART Factory Defaults

If you have placed or are going to place an order for an SPA with HART without specifying any particular model number, the unit you receive will be shipped with the following “default” parameters:

- Alarm #2 functions as a Process Variable Alarm trip (as opposed to a SPA “Health” alarm)
- The unit functions as a HART Primary Master
- The unit functions in Normal Mode (as opposed to Burst Mode)
- The unit executes 3 retries in attempting to establish communications with the connected HART device, before returning a HART Fault
- The unit distinguishes the start of a polling message with 5 preambles
- The unit’s Alarm #1 trips on any HART Fault bit
- Input scaling is 0-100%
- Input Linearization is OFF

All of these parameters can be changed by the user with the instructions in this manual.

## SPA Options

The following list gives details for the options shown in the Ordering Information table. For information on the availability of any options not listed here, or for help in equipping the SPA with the options best suited for your application, call the factory, or your local Interface Solutions professional.

**-AO Analog Output** - When equipped with this option, the SPA with HART provides an isolated analog output proportional to its processing of its digital, HART input. Settings for the SPA analog output include:

- Current (0-20mA) or Voltage (0-10V); Also programmable for narrower spans
- Source or Sink (Current)
- Reflect Primary, Secondary, Tertiary, Quartic, or Quintic HART Variable, or Current of Primary Variable; Reverse or direct relationship
- Fully scalable, independent of any display or input scaling

Maximum Load: 1200W when sourcing current;  
10kW when sourcing voltage

Compliance Voltage: 40Vdc, max

Minimum Spans: 4mA, 1V

Factory Default: Current Sourcing, 0-20mA

# SPA WITH HART

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-DPDT Double-Pole/Double-Throw Relays - Equips the SPA with DPDT relays rated for 5A @250Vac, noninductive, 50/60Hz. This option is available only on units that have been factory-configured for 2PRG input.

-HS Hermetically-Sealed Relays - Standard SPA relays are replaced with hermetically-sealed components rated for 0.5A @ 117Vac, and 2A @ 28Vdc, noninductive, 50/60Hz.

## Accessories

Moore Industries offers a complete line of standard and specialty enclosures, non-HART alarms, site-programmable transmitters, PC-programmable devices, sensors, mounting hardware, thermowell connection heads, fittings, and complete, turnkey systems for use with the SPA and our other instruments. For more information, or to get a catalog of our products, contact your local Sales Representative, the factory, or log on to our website at [www.miinet.com](http://www.miinet.com).

## Calibration

In this manual, the term “calibration” is used to refer to the following, four procedures:

- 1. Verifying that the unit’s internal jumpers are set to provide Password Security for operational settings**
- 2. Setting the internal DIP switches to provide either failsafe of non-failsafe alarm functioning (and current or voltage output, if the SPA is equipped with its -AO option)**
- 3. Hooking up the SPA in a simple test setup that enables the user to view unit settings in memory, and to make whatever changes may be needed according to the requirements of the intended application**
- 4. Making sure that the SPA “synchs up” properly with a HART transmitter or calibrator, that it reads all the variables of the digital signal correctly, and that it provides the prescribed alarm(s) and/or analog output and display, based on changes on the input**

**Note:**

Prior to its shipment, every SPA is subjected to a battery of rigorous tests by our team of highly skilled technicians. Every product we sell and/or service is guaranteed to meet the strict quality standards that have become synonymous with our company name.

Before placing the SPA into service, however, Moore Industries recommends a basic bench-check of operations using the procedures in this section. Doing this will allow the user to become familiar with the unit in an environment separate from the actual application. It also will help to uncover any damage that may have been sustained during shipment.

We test all of the instruments we sell on equipment that is checked at least every six months for accuracy. All our test equipment is accurate on the order of 5:1, minimum. Every effort should be made to use the most accurate equipment available to calibrate your SPA prior to placing it into service.

**Caution:**

The internal circuitry of the SPA is vulnerable to damage from electrostatic discharge. Make sure to abide by all static safeguarding (ESD) practices any time the SPA housing is to be opened; especially when making changes to the jumper settings or DIP switches inside the SPA.

## Calibration Equipment

To configure and bench check the SPA with HART, the following items will be needed (note that these materials are not supplied by Moore Industries, but should be readily available in those environments otherwise appropriate for instrument calibration.):

**Table 3.** Equipment for Calibrating the SPA with HART

Equipment	Specifications
Power Source	22-300Vdc, ±10%; or 90-260Vdc, ±10%
Multimeter	Calibrated, Fluke Model 87 or equivalent, accurate to ±0.025%. It is best to have 2 of these; one to check for continuity (testing contact-closure), and one to calibrate SPA analog output when -AO option is installed.
Needle-nose-d pliers	Technicians pliers or tweezers for positioning internal jumpers (links)
Slave HART Fied Device or Field Device Simulator (optional)	Rosemount model 1151 Pressure Transmitter, or model 275 HART Communicator. HART input can be useful in calibrating the SPA, but it is not required.
Secondary Power Source (optional)	As required for powering the HART Slave device, if used. Consult manufacturer's specifications.

## Setting Jumpers and DIP Switches

The following SPA with HART functions are governed by the positioning of of the internal jumper and DIP switches:

- **Password** - To “protect” the operational settings of the SPA, make sure the Password Jumper shown in Figure 2 is in the “ON” position. With password protection ON, making changes to the SPA configuration can only take place after entering a two-digit, user-defined code (refer to the Password menu explanation, page 35). With password protection OFF, the user can make changes freely to the SPA settings, including the Password code itself.
- **Failsafe/Non-failsafe** - Set the appropriate DIP switch to FAILSAFE in order to configure it to *de-energize* when in an alarm condition. Non-failsafe alarms *energize* when tripped.
- **Current Source/Sink or Voltage** - If the SPA is equipped with its -AO option, this DIP switch setting determines whether the analog output is current or voltage. If the output is to be current, this switch setting also determines whether the unit sinks or sources that current.

# SPA WITH HART

To make changes to, or to view the settings of the SPA DIP switches and/or Password jumper, open the access panel in the bottom of the SPA housing. Figures 2, 3, and 4 show the access panel and locations of the jumpers and switches.

**Caution:**

*The procedures in the Calibration section should always be carried out in an environment considered appropriate for general testing of electronic equipment, such as a technicians' bench area or lab—as opposed to the field.*

**Note:**

*Jumpers are referred to as "links" in some countries. "DIP" is dual, in-line positioned switch.*

**Figure 2.** Accessing and Setting the SPA Password Jumper

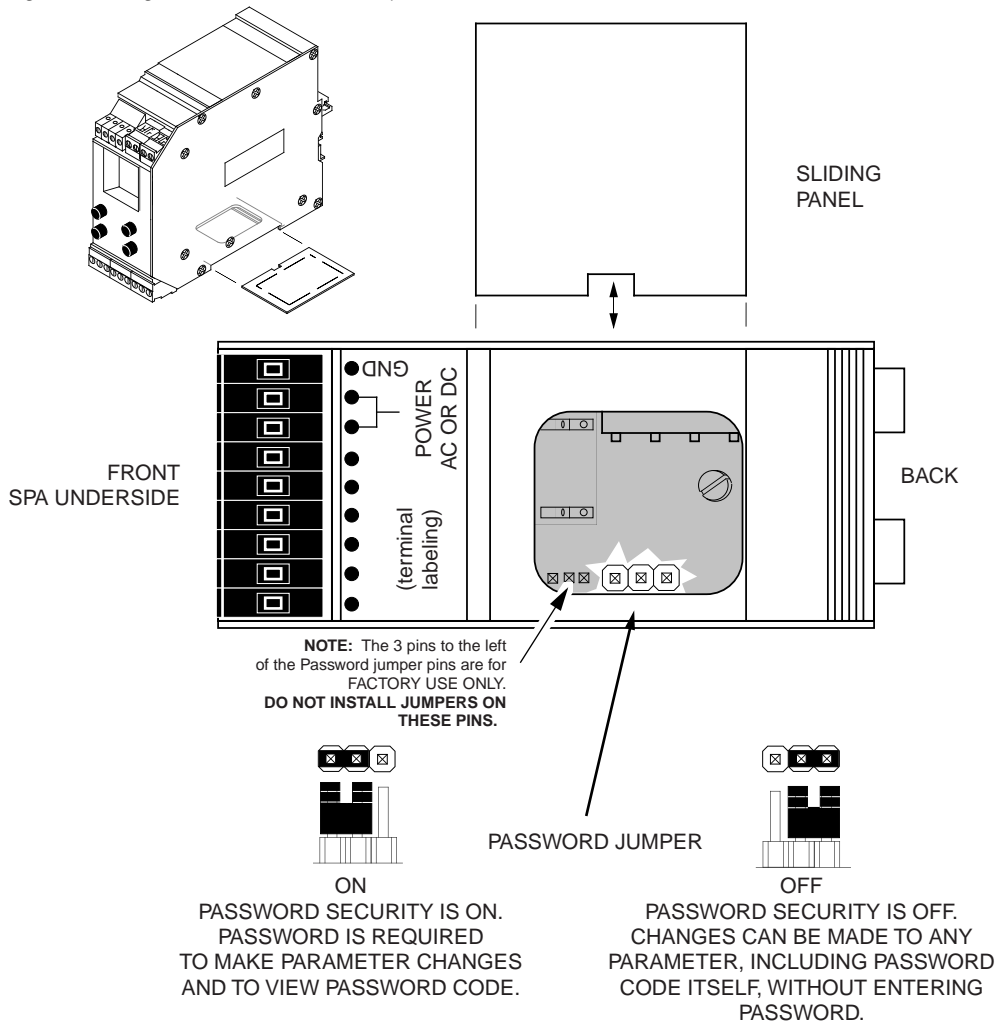
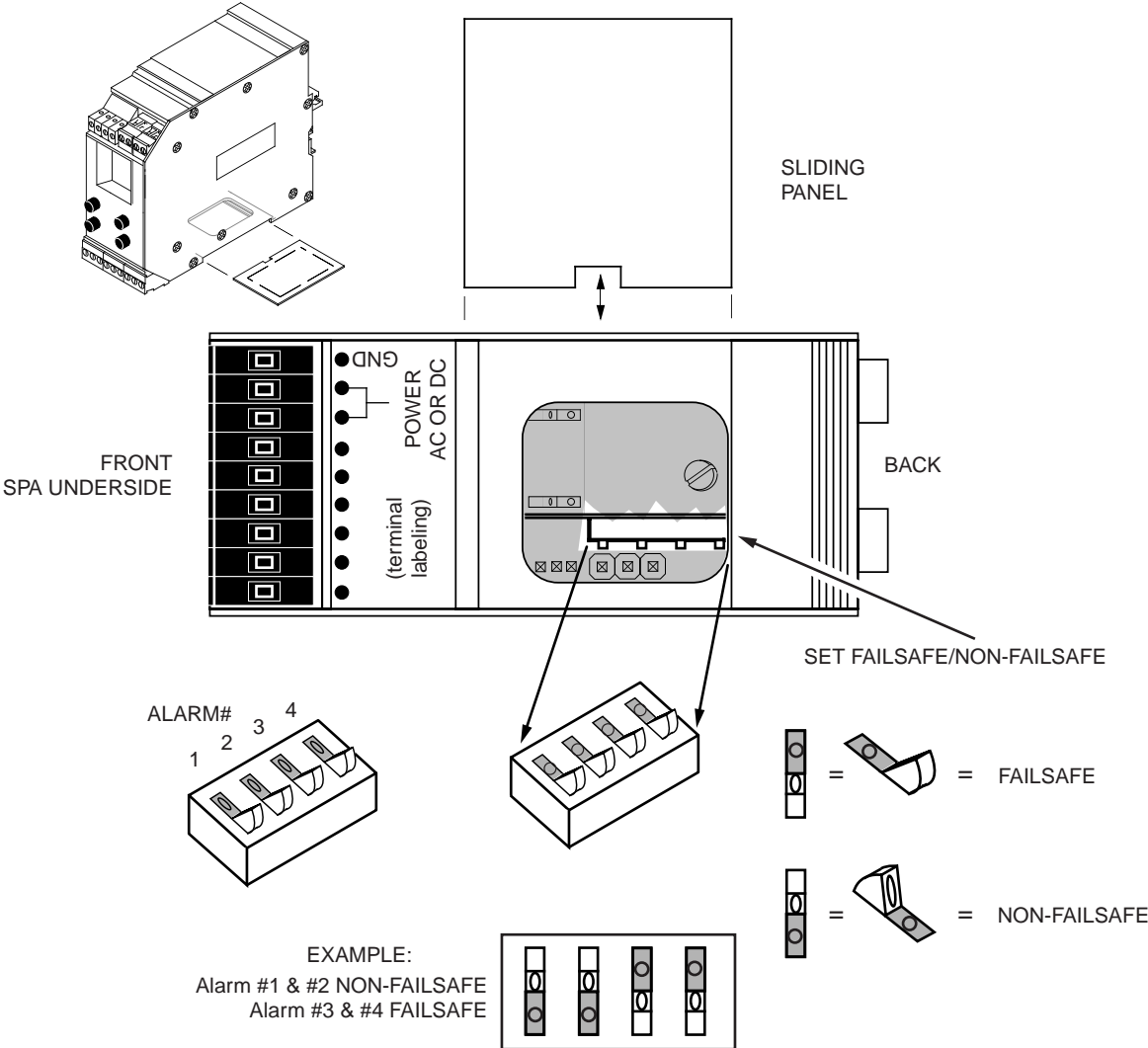


Figure 3. Accessing and Setting the SPA Failsafe/Non-Failsafe DIP Switches



# SPA WITH HART

**Note:**

Refer to the Appendix of this manual for an explanation of process alarms and terms like "failsafe", non-failsafe", etc.

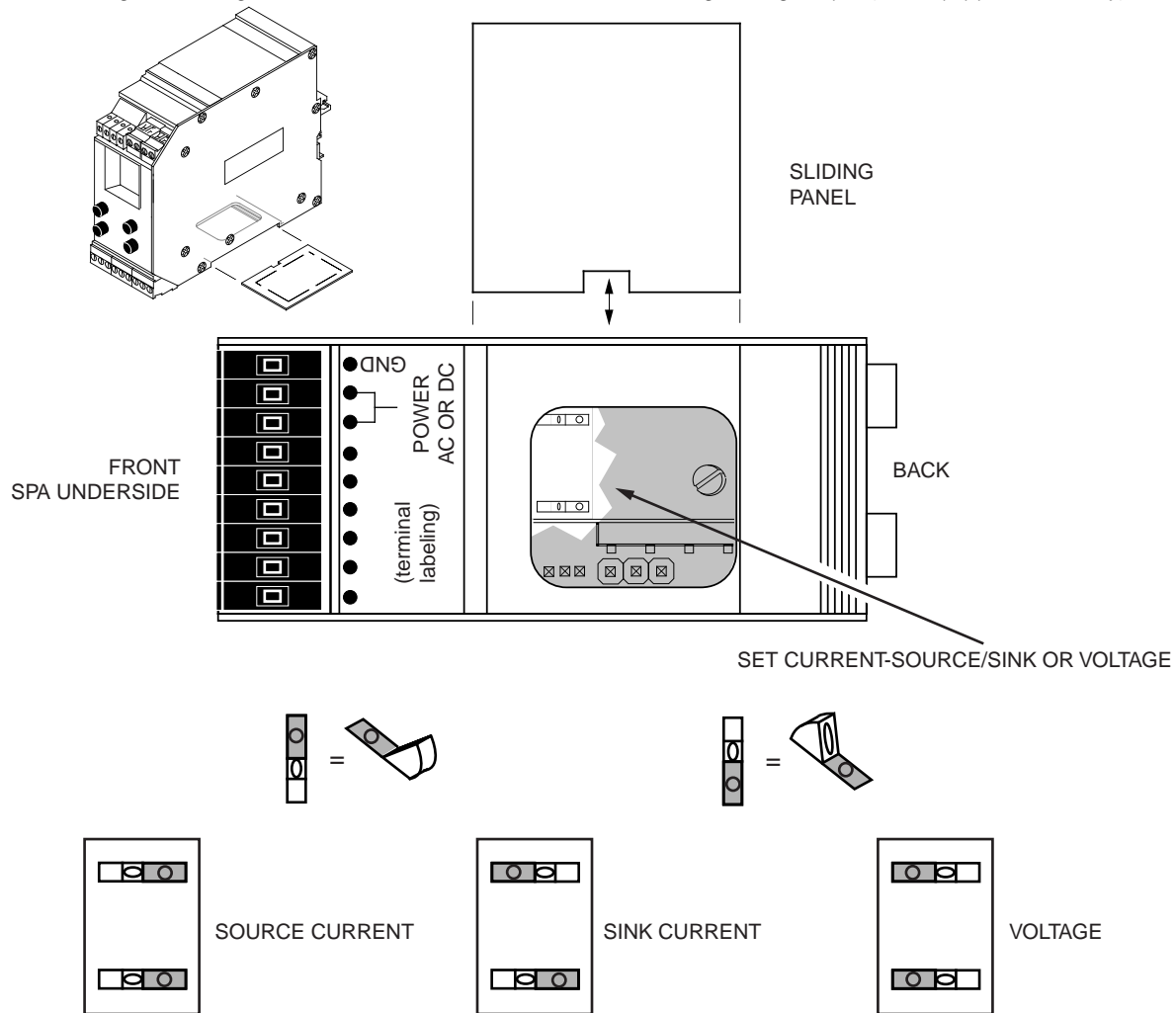
## Calibration Setup

After verifying that all the internal jumper and DIP switch settings are correct or otherwise set as needed, use Figure 5 to hook up the SPA with the calibration equipment listed in Table 3 (page 7). To use the SPA's transmitter excitation to power the HART transmitter or simulator in the hookup, refer to Figure 6 for the hook-ups.

Figure 4 shows the location of the DIP switches for setting the parameters of the SPA analog output. This output is present only in those units equipped with the -AO option.

Once hooked up and supplied with the appropriate power, allow a few minutes for stabilization.

**Figure 4.** Accessing and Setting the SPA with HART DIP Switches for Controlling Analog Output (-AO-equipped SPAs only)



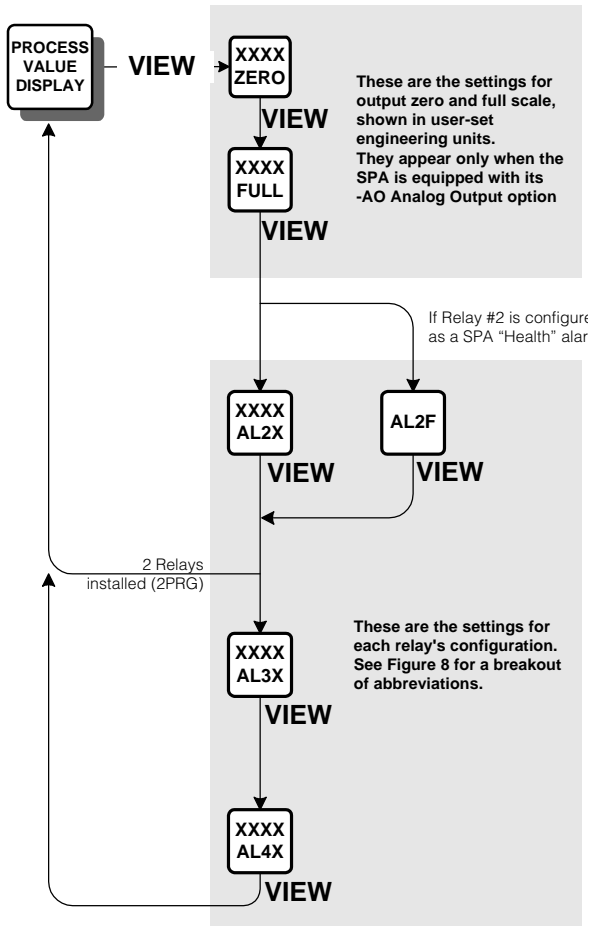


# SPA WITH HART

## SPA Setup — Viewing What You Have

With the SPA set up as shown in Figure 5 (or 6), you can run through the View Menu to check the settings already present in unit memory. See Figure 7.

Figure 7. Viewing the Settings in SPA Memory



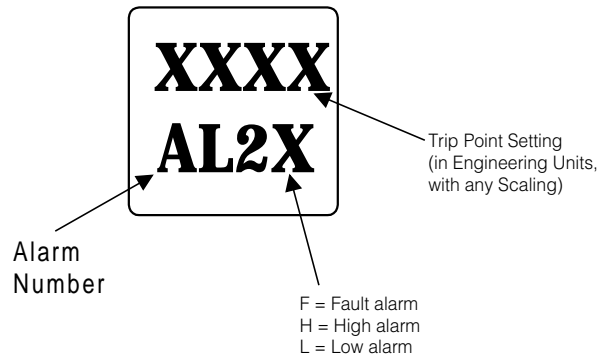
### Notes:

The UP, DOWN, and SELECT push buttons are inactive in the VIEW menu.

No password is needed to view the settings in SPA memory.

Figure 8 gives the breakout for the abbreviations used in the SPA View Menu.

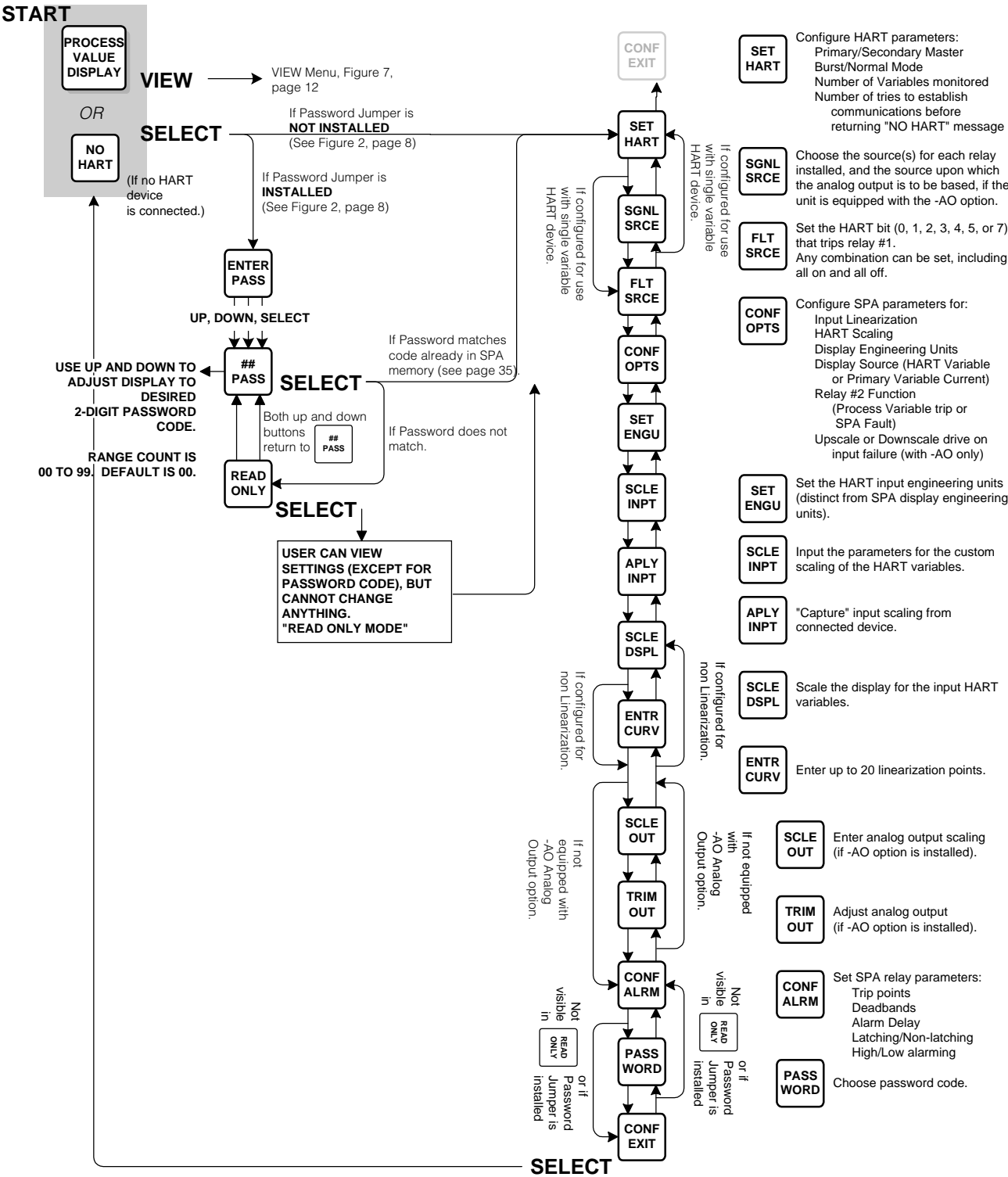
Figure 8. Understanding the SPA Relays' LCD



## SPA Setup — The Main Configuration Menu

Figure 9 gives an overview of the uppermost level of the SPA menu system. All user-set operating parameters are arranged in hierarchical fashion, stemming from somewhere on this ladder. To enter the sub-menus, scroll through the Main Menu, and press the SELECT button when the display shows the desired sub-menu title.

Figure 9. Moving Around in the SPA Main Configuration Menu



# SPA WITH HART

---

## SPA Setup — Relay #1

Relay #1 on the SPA with HART is factory-set to “trip” whenever the unit detects a fault in the connected HART device. The relay provides a contact-closure output based on the status of the HART device, monitoring the HART “Status Byte” several times a second.

*Note:*

*The function of Relay #1 on the SPA with HART cannot be changed.*

*The user can, however, set several operating parameters that affect its function.*

*See Figure 10, page 15.*

## SPA Setup — Relay #2

Relay #2 on the SPA with HART can be user-configured to trip under one of two conditions. First, it can be configured as a SPA “health” alarm, providing contact-closure output if there is a communications failure, or if the unit detects an error in its own memory or processing.

Alternatively, it can be configured as a standard, digital process variable alarm. In the case of the SPA with HART, this configuration brings the number of available process alarms to 3 in 4PRG output SPA model variants.

The SPA is configured at the factory with its Relay #2 as a Process Variable alarm.



## SPA Setup — HART Configuration

The first thing to set up in the SPA with HART are the parameters that control how the unit “talks” to the HART device it will be monitoring. Accordingly, this is the first sub-menu accessible from the Main Configuration menu (see Figure 9, page 13).

Figure 10 shows the sub-menu for setting the HART parameters.



## Primary/Secondary Master

The HART protocol is designed to take advantage of a dual-master networking topology. That means that it allows for two communications masters on the loop, a Primary and a Secondary.

The factory sets the SPA to function as the Primary HART master by default.

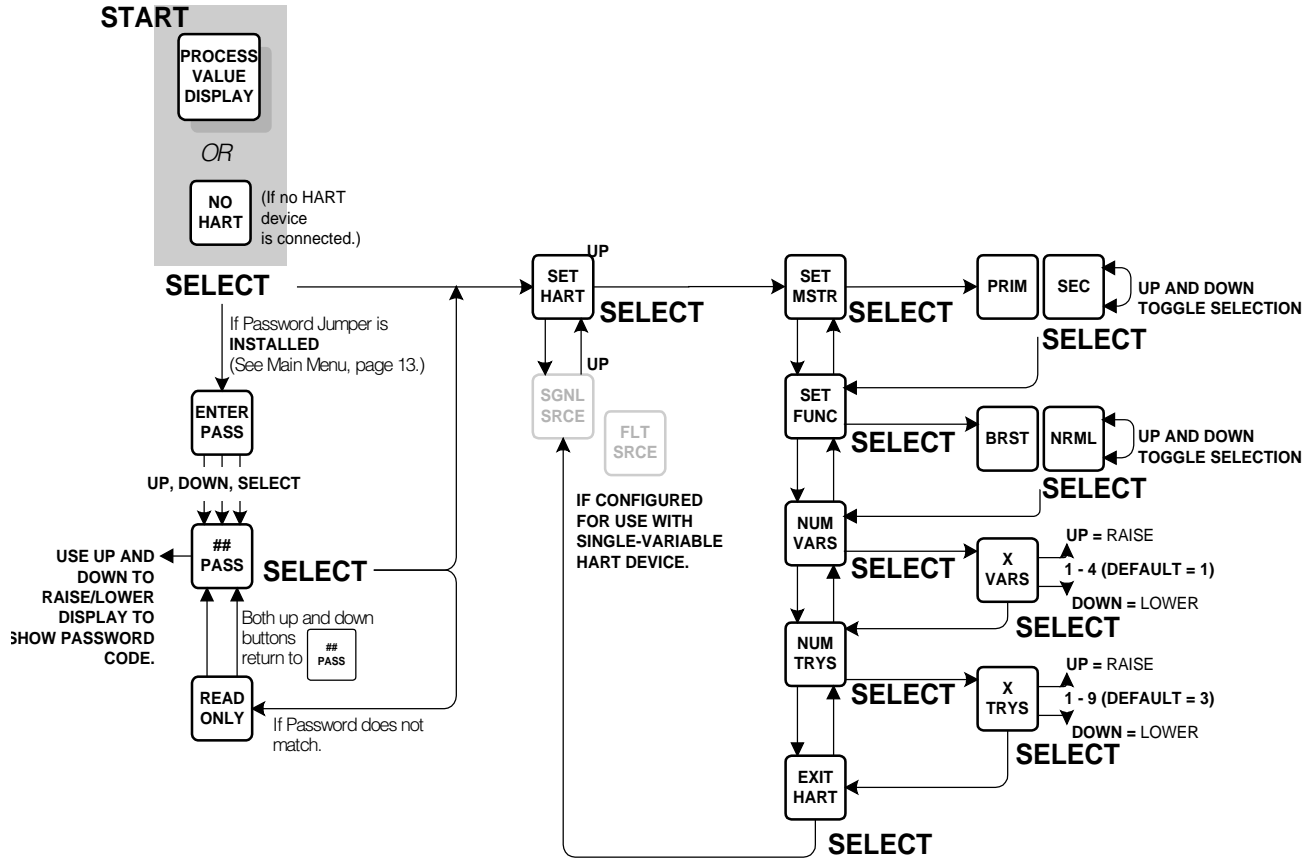
*Note:*

*Setting the SPA to function as the Primary HART Master in the application means that any other HART device in the loop **MUST** be configured either as a HART Secondary Master (1 per loop), or as a HART Slave (up to 15 per loop).*

*Conversely, setting the SPA to function as the Secondary Master allows other HART devices to function either as a Primary Master (1 per loop), or as Slaves (15 per loop).*

**Configuring more than one device on a single loop as a Primary or Secondary HART Master will cause a communications failure.**

Figure 10. Configured the HART Alarm Parameters for the SPA



**SET FUNC Normal/Burst Mode**

The SPA can be user-configured to operate either in Normal HART mode, or in Burst HART mode.

In Normal mode, the SPA (once supplied with power) begins an automatic scan through HART addresses 1 through 15. Once communications have been established with a HART device, the SPA queries that device twice per second, acting according to its setting either as the Primary or Secondary HART Master.

In Burst mode, once communications between the SPA and the connected field device have been established, the SPA continuously “listens” for incoming data from the field device without ever issuing a query. In this mode, the SPA reads incoming data 3 times per second.

The factory default is Normal mode.

# SPA WITH HART

---

NUM  
VARS

## Number of Variables

The SPA is capable of monitoring the first 4 digital process variables from the connected HART device.

Factory default is 1; the Primary HART variable only.

**Note:**

*The setting for Number of Variables has an affect on the number of selections available in the Signal Source menu.*

*Choices in that menu for Secondary, Tertiary, and Fourth (Quartic) variables as sources for SPA Alarms (and analog output) are shown only if the Number of Variables selection in the Set HART menu is 2, 3, or 4, respectively.*

NUM  
TRYS

## Number of TRYS (Tries)

This setting allows the user to configure the SPA to “poll” the communications bus, attempting to connect to a field device from 1 to 9 times before returning the “NO HART” message on the SPA, and issuing an alarm from Relay #2 (if configured as a SPA “health” alarm).

The factory default for the Number of Tries is 3.

SGNL  
SRCE

## SPA Setup — Alarm Source

This is the sub-menu with which Alarms 2 (if configured as a Process Variable Alarm, refer to page 14), 3, and 4 are assigned those aspects of the HART input data upon which to base their functioning. Additionally, if the SPA is equipped with its -AO Analog Output option, this sub-menu sets the HART variable upon which it will be based.

This menu is only accessible on those SPAs that are to process more than one HART variable. It is also only accessible on SPAs with more than 2 relays (4PRG output model variant).

Figure 11 shows the sub-menu for configuring the Signal Source for each SPA input and output available.

**AOUT SRCE** Analog Output Source

This is the setting that determines which of the available HART parameters the SPA will base its analog output upon.

If the -AO Analog Output option is not installed, this section of the sub-menu is skipped, and the first selection will be for AL2 or AL3.

**AL 2 SRCE** **AL 3 SRCE** **AL 4 SRCE** Relay Sources

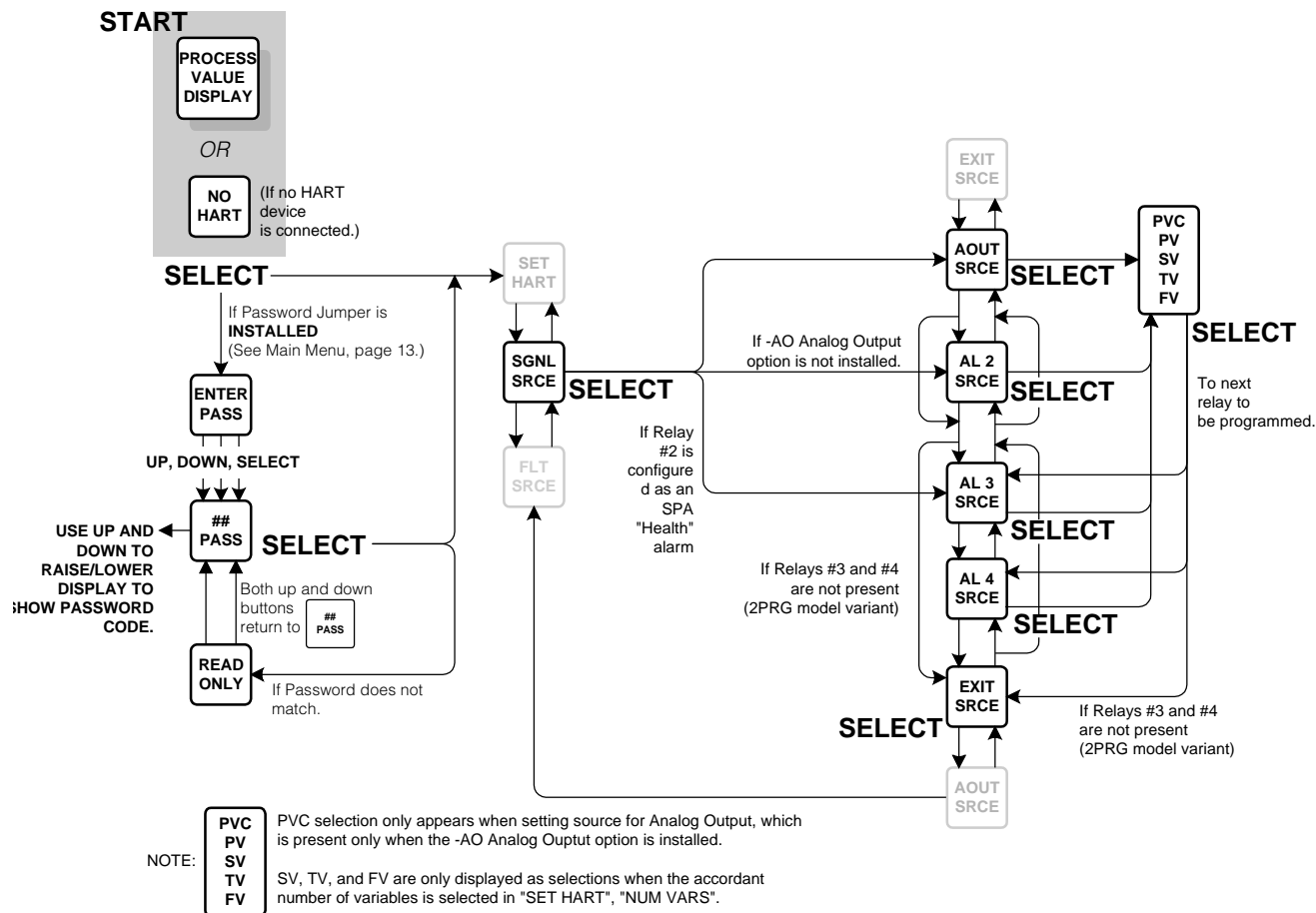
These menus permit the user to configure the available SPA relays to respond to changes in any combination of the first 4 variables of the HART input.

“PV” signifies the Primary HART variable, “SV” the secondary variable, “TV” the third or tertiary variable, and “FV” the fourth or quartic variable.

**Note:**

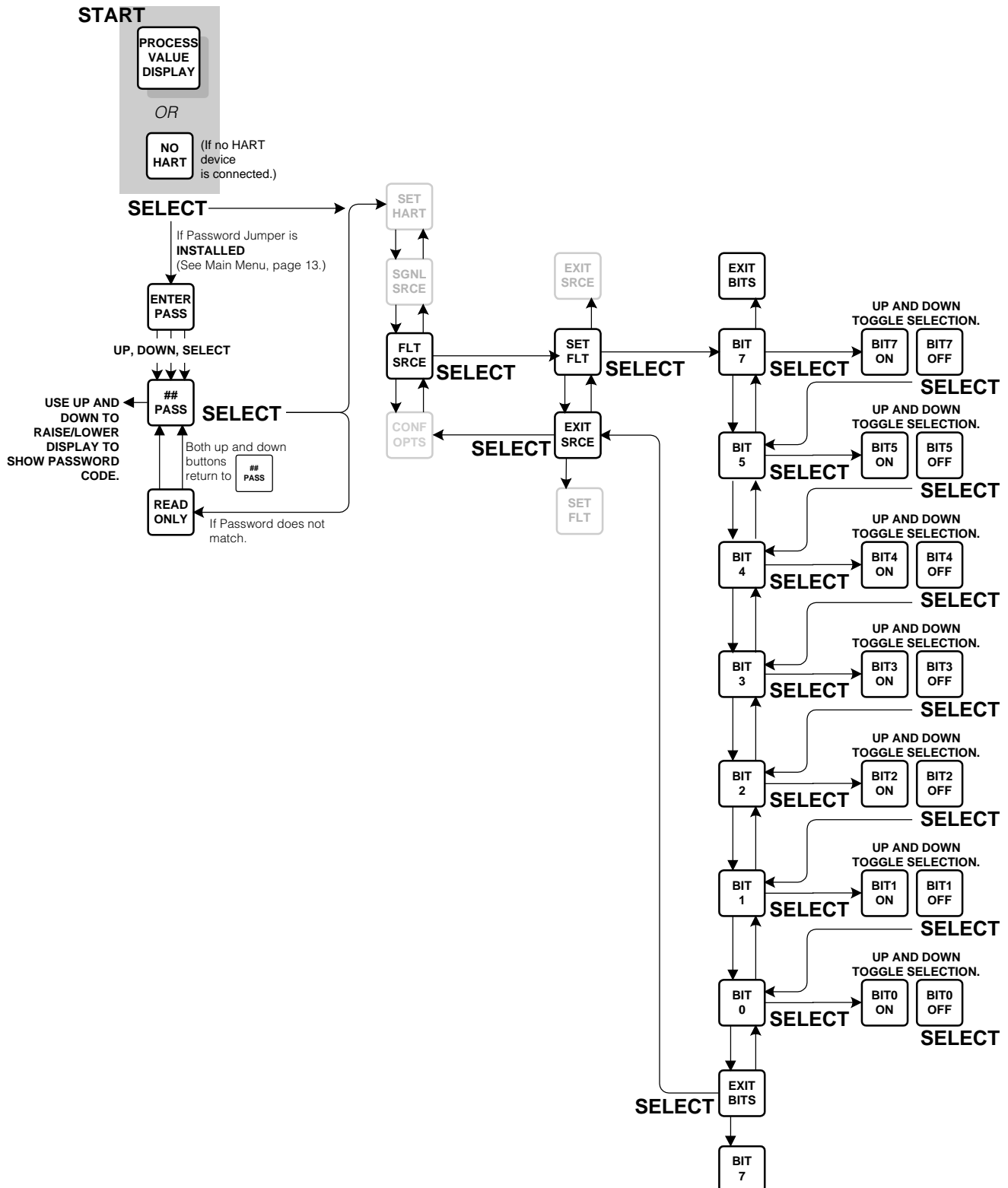
*The selection for Primary Variable Current is available only when configuring the signal source for the analog output, and is only shown when the SPA -AO option is present.*

Figure 11. Choosing the Sources for the SPA Relays



# SPA WITH HART

Figure 12. Choosing the HART Source for SPA Relay #1



**Note:**

The selections for Secondary, Tertiary, and Fourth (Quartic) variables as signal sources appear only if the Number of Variables selection in the Set HART menu is 2, 3, or 4, respectively (see Figure 10, page 15).

## **FLT SRCE** SPA Setup — Fault Source

The settings in this sub-menu control the function of the SPA relay #1, the HART monitor. The SPA's first relay, Alarm #1, is permanently dedicated to monitoring the function of the HART device and communications.

The user can choose among 7 HART conditions to produce an alarm. Figure 12, on the following page, is a map of this sub-menu. Any combination, including all bits or no bits may be set.

### **BIT 7** Bit 7 — Field Device Malfunction

Set this bit ON to configure the SPA Relay #1 to trip whenever it detects that a hardware error or failure has occurred in the connected HART device.

### **BIT 5** Bit 5 — Cold Start

Set this bit to ON to configure the SPA Relay #1 to trip whenever power to the HART device is interrupted. If ON, this bit will also trip the alarm following a HART Master Reset or Self Test command.

### **BIT 4** Bit 4 — More Status Available

Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device reports a condition requiring HART Command #48, which is "Read Additional Information". That is, if ON, this bit trips the alarm to indicate that the HART device requires attention from a diagnostic tool with full HART command capability.

### **BIT 3** Bit 3 — Primary Variable Analog Output

#### **Fixed**

Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device detects that its Primary Variable (typically the analog output) is no longer responding to changes on its input, and is, in fact being held at a predefined level.

### **BIT 2** Bit 2 — Primary Variable Analog Output

#### **Saturated**

Set this bit to ON to configure the SPA Relay #1 to trip whenever the HART device detects that both its analog and digital representations of the Primary Variable are outside rated operating limits, and no longer reflect the true sensor input.



CONF  
OPTS

## SPA Setup — Configuring Miscellaneous Options

This sub-menu comprises the settings for input linearization, Primary HART Variable scaling, engineering units for the SPA display, the which HART variable is to be shown on the SPA display, how Relay #2 functions (Process Trip, or SPA malfunction alarm), and how the SPA analog output (if present) behaves in the event of input failure.

Figure 13 shows the menu.

SET  
LINR

## Toggle Linearization On/Off

This setting determines whether the SPA will linearize the input from the HART device. The SPA is capable of 20-point linearization, with customizable curves. Refer to the Enter Curve sub-menu, explained on page 27.

**Note:**

*If Linearization is set to OFF, the Enter Curve sub-menu (see page 27) is not accessible on the Main Configuration menu (page 15).*

PV  
SCLE

## Customizing the Primary Variable Scaling

Toggle this setting to “CSTM” (Custom) to enable the SPA’s capability to perform additional offset and span scaling—beyond those otherwise the HART device itself—on the Primary Variable.

Toggle this setting to “AUTO” (Automatic) to enable the SPA to “capture” the zero and full scale values for the Primary HART variable automatically.

DSPLE  
EGU

## Setting the SPA Display Engineering Units

This setting determines how SPA will display the selected process variable input. Choices are:

- DEGC - Degrees Centigrade (Celsius)
- DEGF - Degrees Fahrenheit
- PCT - Percent of Span
- MA - Current in Milliamps
- PSI - Pounds per Square Inch
- CSTM - 4-place, alphanumeric display set by the user

DSPLE  
SRCE

## Choosing the Source for the SPA Display

This setting selects which of the available HART Variables will be shown as the Process Value during normal SPA operation.

**Note:**

*The number of selections available in this sub-menu is determined by the “NUM VARS” setting in the SET HART sub-menu. Refer to Figure 12 on page 15.*

# SPA WITH HART

## AL 2 SEL Setting the Function of SPA Relay #2

This is where the user sets whether the SPA Relay #2 functions as a Process Variable Alarm or as a SPA "health" alarm. Choose the "TRIP" selection for Process Variable Alarm functionality, "FALT" for SPA health alarm.

## SET FAIL Upscale/Downscale Drive

If the SPA is equipped with its -AO Analog Output option, this setting determines how that output will behave in the event of an input failure. Choose "HIGH" for output to ramp to 20mA on input failure, "LOW" for output to ramp downward to 0mA on input failure.

## SET ENGU SPA Setup — Setting Engineering Units

This sub-menu allows the user to assign engineering units to the display of any of the HART Variables that are input to the SPA.

Figure 14 shows the menu.

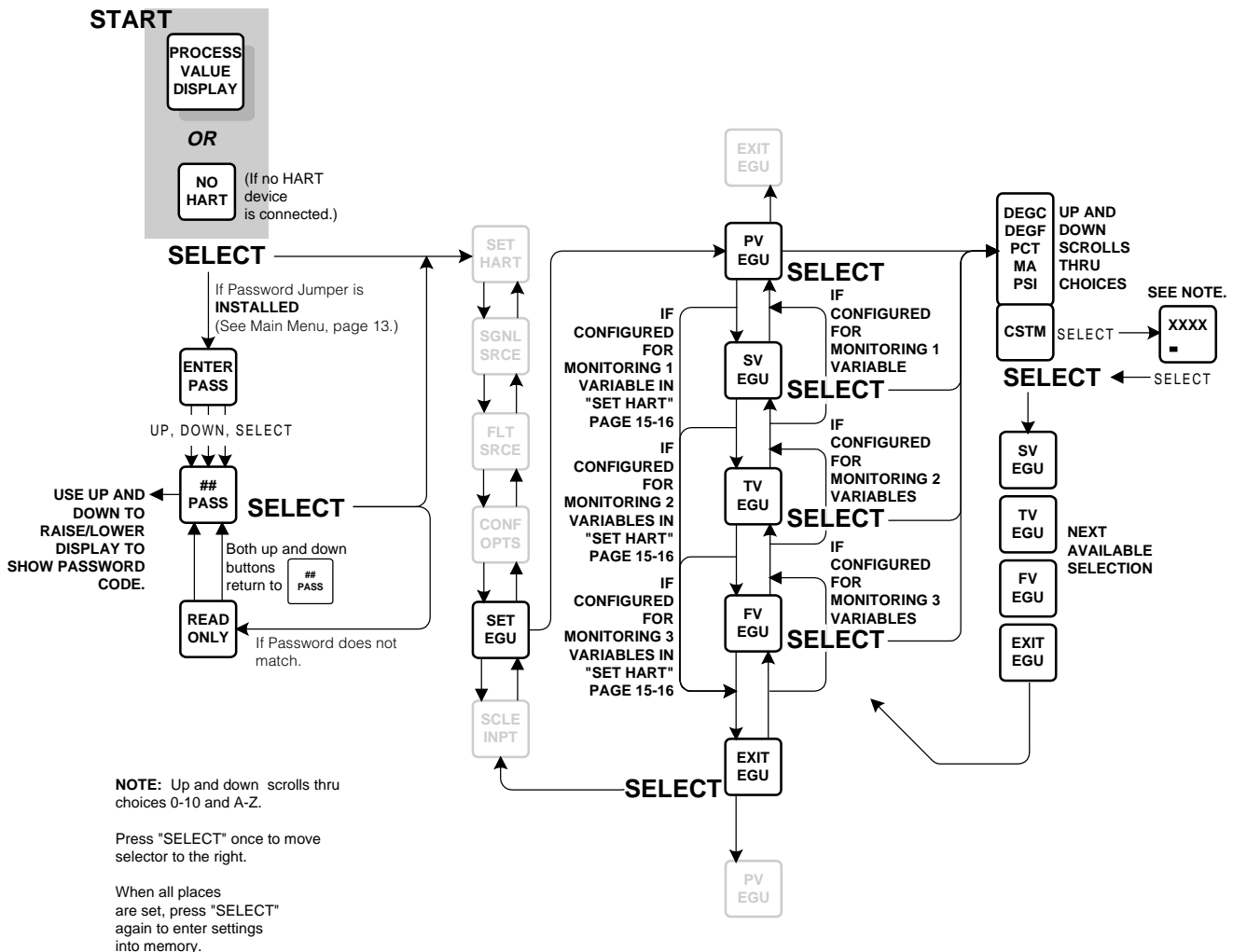
In addition to the standard units for:

- DEGC - Degrees Centigrade (Celsius)
- DEGF - Degrees Fahrenheit
- PCT - Percent of Span
- MA - Current in Milliamps
- PSI - Pounds per Square Inch

If desired, a 4-place, alphanumeric display can also be entered:

- CSTM

Figure 14. Setting the HART Display Engineering Units



**SCLE INPT** SPA Setup —  
**Smart Scaling the HART Input**

The SPA with HART can read the zero and full scale settings for the Primary Variable directly from a connected HART device. Alternatively, the user can enter values into SPA memory for zero and full scale (for all measured variables). This is called “smart” scaling, because the numeric values are entered directly into memory, without having to connect the SPA to HART input (unless reading zero and full scale automatically).

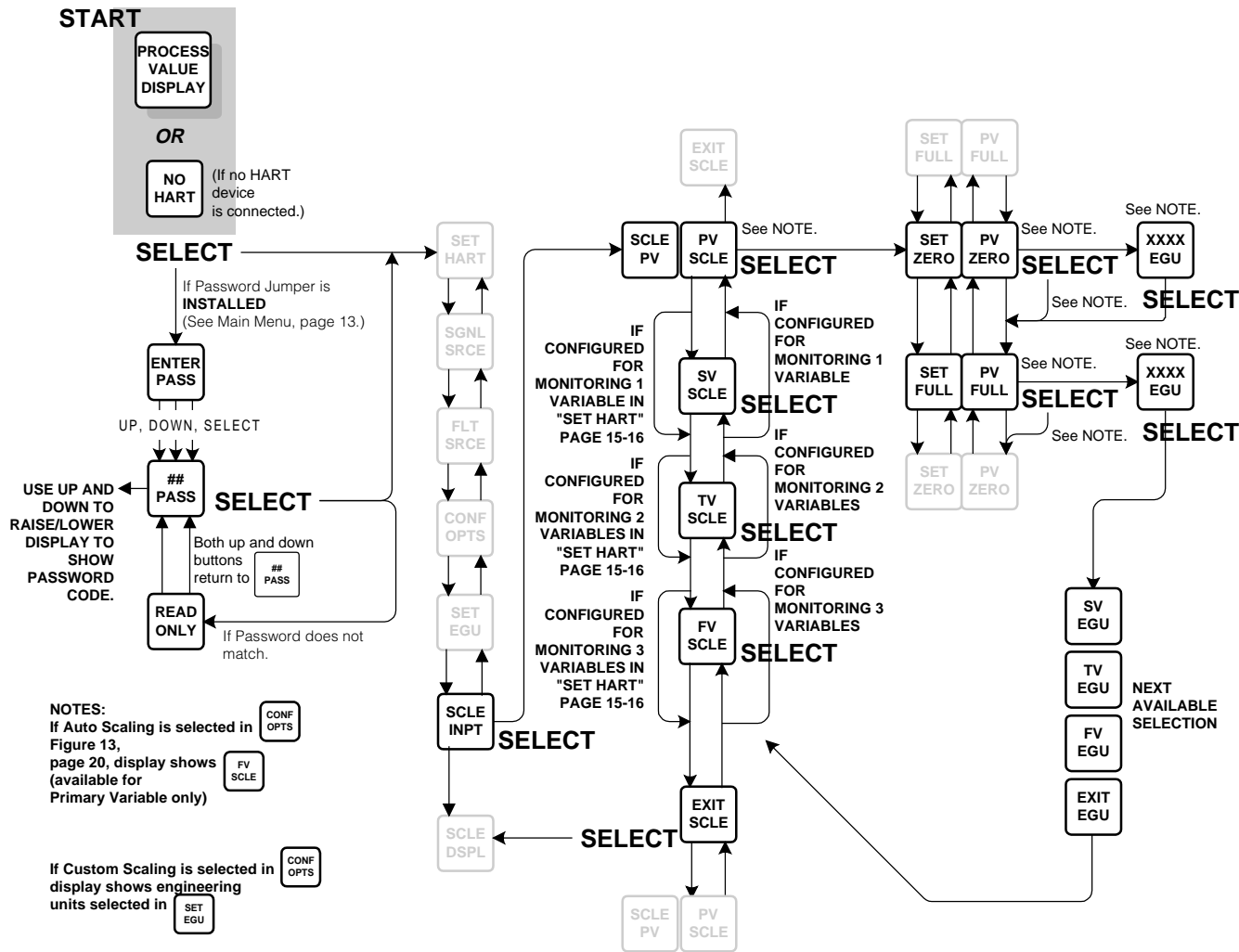
*Note:*

Refer to *Configuring Miscellaneous Options*, pages 20-21, to set the SPA to automatically read the Primary Variable Zero and Full Scale settings.

The Smart Scaling sub-menu comprises the settings with which the user can scale the input from the HART device. This scaling is applied to all trip point settings and displays.

Figure 15 shows the menu.

**Figure 15.** Scaling the HART Variables Input to the SPA



**NOTES:**  
 If Auto Scaling is selected in Figure 13, page 20, display shows (available for Primary Variable only)

If Custom Scaling is selected in display shows engineering units selected in

- in Custom Scaling, UP and DOWN buttons ramp display up or down. "SELECT" enters displayed value into SPA memory.
- If Auto Scaling for Primary Variable is enabled, display simply shows zero and full scale in setting already in SPA memory. "SELECT" goes to next step in submenu.
- Next available selection. depends on number of variables enabled in "SET HART", pages 15 and 16.

# SPA WITH HART

---

Note that there are two options for setting the scaling of the Primary HART Variable; Auto and Custom. If the SPA is set in the “CONF OPTS” menu (Figure 13, page 20) for Auto Primary Variable scaling, the zero and full scale setting is entered into SPA memory automatically.

If, in the “CONF OPTS” sub-menu, the Primary Variable scaling was set to Custom, the user can, in this sub-menu, use the up and down push buttons to enter custom scaling for the Primary Variable.

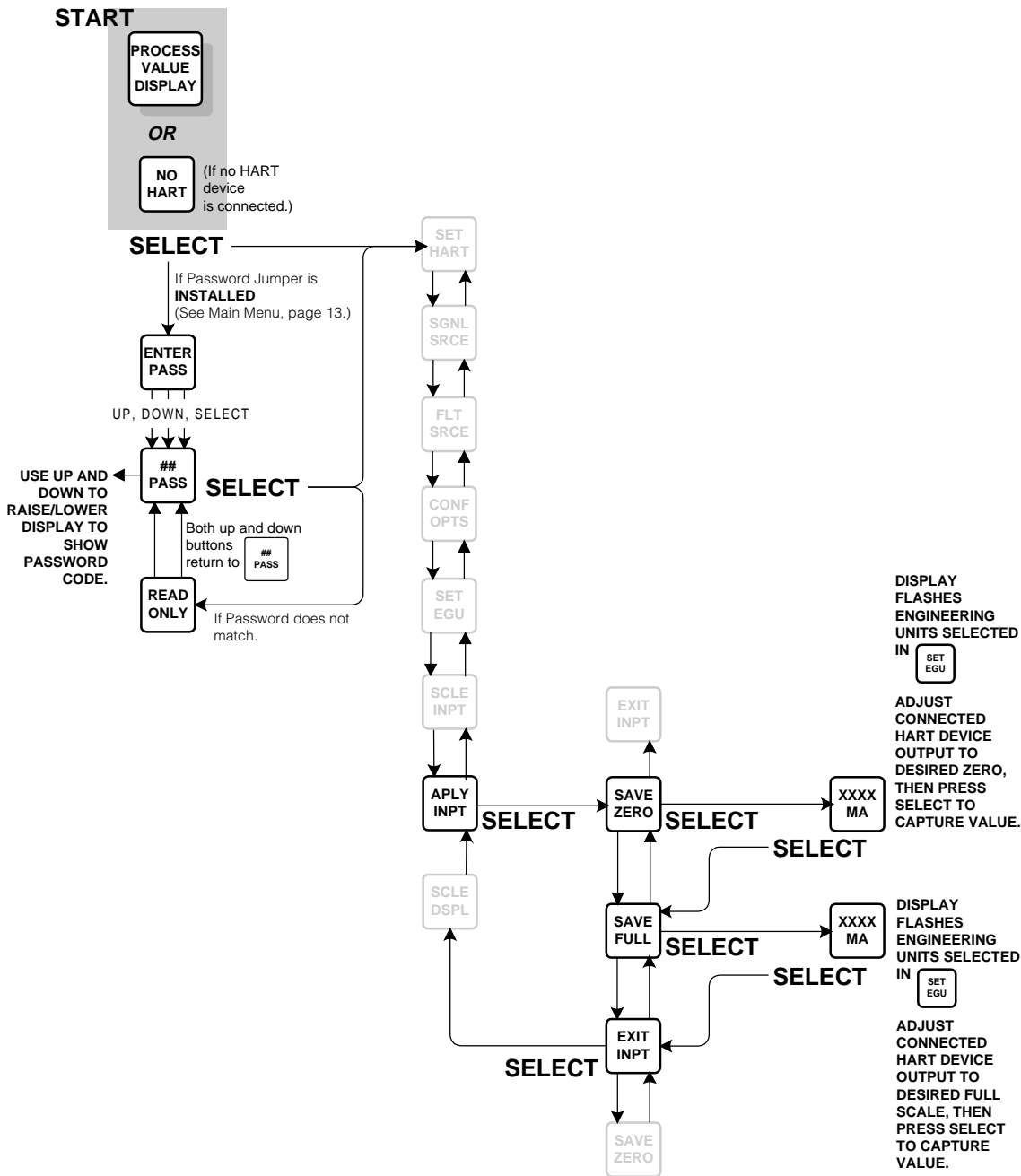
**APLY INPT** SPA Setup —  
**Bench Scaling HART Input**

*Note:*  
 Bench Scaling requires that a HART device be connected to the SPA.

This method of scaling the input to the SPA involves “capturing” the actual zero and full scale from a connected HART device. See Figures 5 or 6 on page 11 for help in connecting an instrument to the SPA.

Figure 16 shows the menu, including instructions for when to “apply” the zero and full scale inputs to the calibration setup.

**Figure 16.** Bench Scaling the HART Input to the SPA





**ENTR CURV** **SPA Setup — Customizing Input Linearization**

The SPA can incorporate up to 20 points of linearization in its processing of the HART input. This sub-menu is used to enter those points into memory.

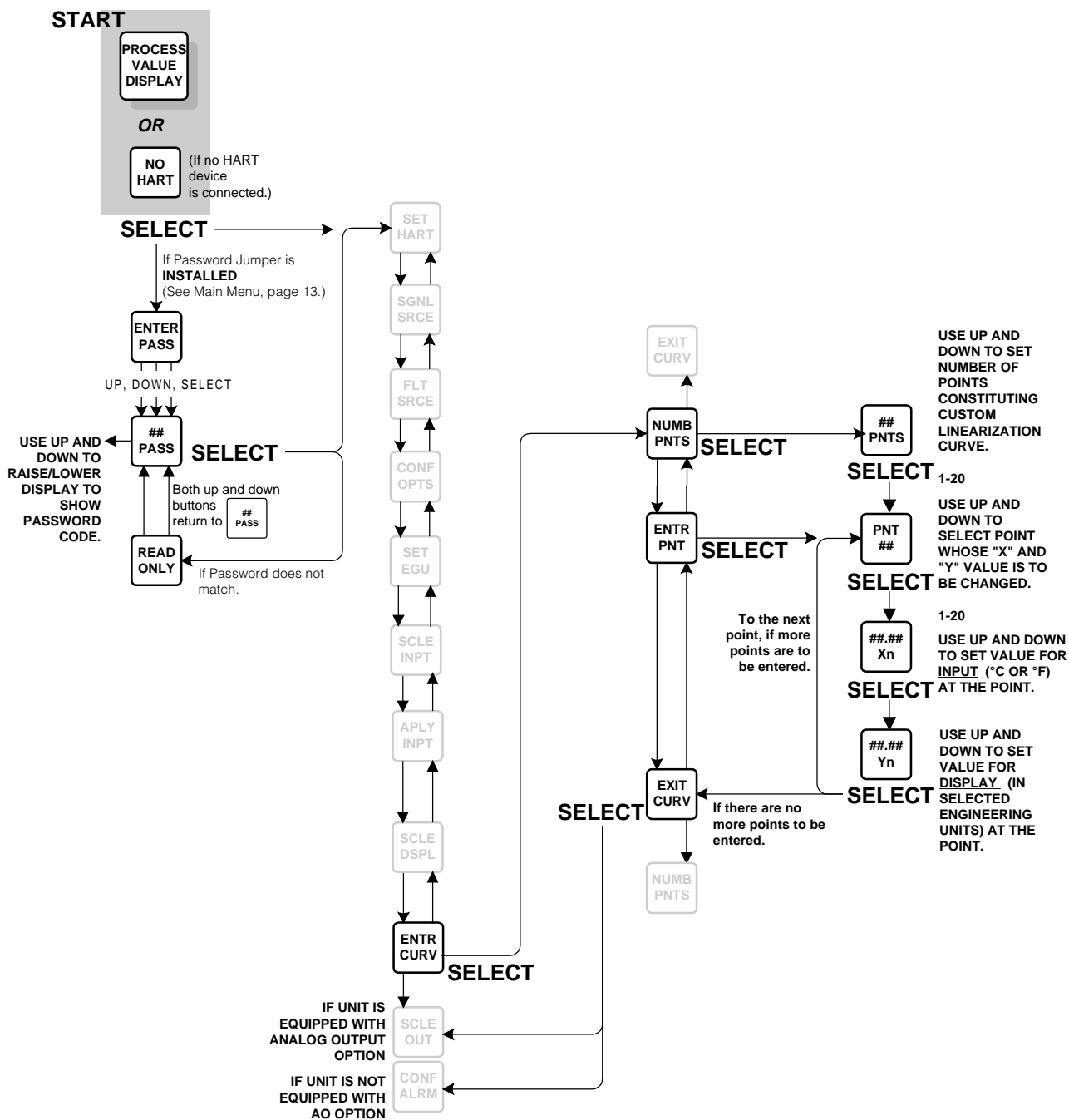
Figure 18 shows the sub-menu.

**NUMB PNTS** **Enter the Number of Points to be used to Linearize the Input**

The SPA can accommodate up to 20 points to linearize input. The more points entered, the more accurate the SPA display, alarm, and output (with -AO), but the longer it takes to program.

*Continued on page 28...*

**Figure 18.** Entering Custom Linearization Points for the SPA



Continued from page 27

**ENTR  
PNT** **Go Directly to a Particular Point for Adjustment**

If a custom linearization curve is already entered, use this sub-menu to access a particular point and make changes.

**##.##  
Xn** **Set the Value for the INPUT at Point ##**

The display shows the number of the linearization point, and allows the user to set a value, presumably from the connected HART transmitter output, for which a linearization value will be entered.

**##.##  
Yn** **Set the Value for the DISPLAY at Point ##**

The display shows the number of the linearization point, and allows the user to set a SPA value for the input at that point.

**RULES:**

**Where  $X_z$  = Input Zero, and  
 $X_f$  = Input Full Scale, the following **MUST**  
be true for all entered points:**

$$X_z < X_n < X_{n+1} < X_{n+2} < \dots < X_f$$

**AND**

**Where  $Y_z$  = Display Zero, and  
 $Y_f$  = Display Full Scale, the following  
**MUST** be true for all entered points:**

$$Y_z < Y_n < Y_{n+1} < Y_{n+2} < \dots < Y_f$$

**In other words, all the linearizing points entered must fall within a range defined by the zero and full scale settings for both Input and Display.**

## Applications for Custom Linearization

This SPA capability is quite useful for producing a display and output curve in an applications such as providing alarm trips for transmitters monitoring the amount of fluid in a tank shaped like this:



or this:



Because of their non-cylindrical shape, transmitters monitoring level of fluid in tanks such as these tend to produce nonlinear output. The SPA can be used to linearize that output and base its alarms and displays on the true level of the fluid in the tank, relative to the percent full or empty.

The SPA linearization function is implemented in a 3-step procedure.

First:

- 1. The number of points (20, max) that are to constitute the desired linearization curve are determined,**

then:

- 2. The input at each point is specified,**

and then finally:

- 3. The corresponding display value for each point is set.**

**Note:**

Input zero and full scale, as well as display zero and full scale must be programmed prior to programming the linearization curve.

Input zero and full scale, Figure 15, page 23.

Display zero and full scale, Figure 17, page 26.

**Linearization Example**

Here is an example of how to configure the SPA with HART to linearize nonlinear input:

**1. Always make sure that zero and full scale have been entered into SPA memory for:**

- Input (page 23)
- Display (page 26)
- Output (page 30)

**2. Access the “ENTR CURV” sub-menu (see Figure 18, page 27).**

**3. Refer to Figure 19 to determine:**

- The number of points needed to express the desired, custom curve (NUMB PNTS)
- The value at each point for the X axis (input)
- The value at each point for the Y axis (display)

**Notes:**

When entering the linearization points, the LCD will begin flashing if an attempt is made to enter an “illegal” point (i.e., one that doesn’t follow the RULES as outlined).

Also, it is not possible to exit the Linearization Configuring sub-menu until all linearizing points are entered. That is, if 6 points are entered in “NUMB PNTS”, it will not be possible to exit from “ENTR CURV” or otherwise return to the Main Menu until values for all 6 of those points, both X (input) and Y (display), have been entered.

**Changing Linearization with using Display Scaling**

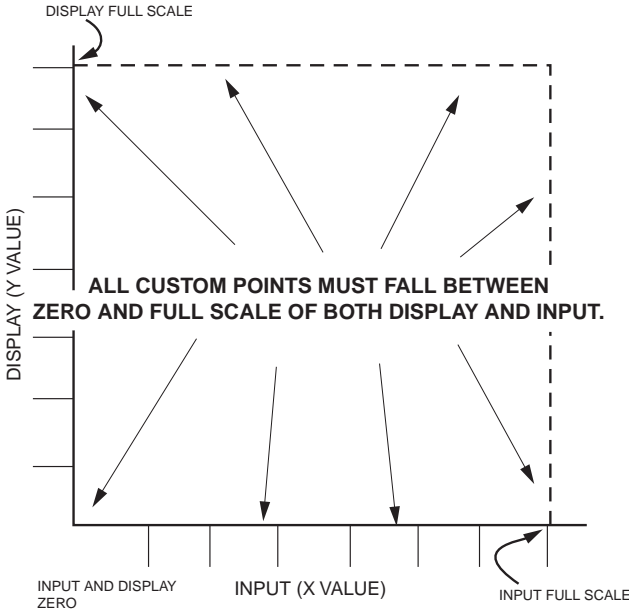
It is possible to change the absolute linearization values by changing the display zero and full scale (see page 26). DO NOT, however, CHANGE THE INPUT SCALING once linearization values have been entered.

**Note:**

If INPUT SCALING is changed (sub-menu on page 23) at any time AFTER linearization is entered (sub-menu on page 27), a “TABL ERR” message will be returned upon SPA startup.

To reset after a “TABL ERR” message, change any INPUT SCALING so that it follows all RULES (shown at left), then either exit the Configuration Menu, or cycle power to the SPA.

**Figure 19.** Plotting Custom Linearization Points for the SPA



It is possible to change the display scaling of the SPA (sub-menu on page 26) at any time. Effecting a display scale change automatically changes the values of the Y axis in the linearization curve. It is not necessary to re-configure the linearization curve.

**Note:**

Remember! Though the SPA trip points, deadbands, and any output scaling setting are based on the display of the process value input, changing the Display Scaling DOES NOT AUTOMATICALLY CHANGE THE OTHER SPA SETTINGS (other than the linearization curve points’ Y axis).





# SPA WITH HART

Continued from page 31

To trim SPA output, compare the SPA's output display to the actual output shown by the meter reading. Then use the SPA UP or DOWN push buttons to raise or lower the output of the SPA until it matches that shown on the LCD.

Press the SELECT push button to capture the output setting.

## CONF ALRM SPA Setup — Configuring the SPA Relays

This is the sub-menu whose settings control Trip Point(s), Delay, Hi/Lo Functioning, and Latching/Non-latching operation of the SPA relays. Figure 22 shows the first part of the sub-menu.

Continued on page 34

Figure 22. Configuring SPA Relays #1 and #2 (when #2 is configured as a SPA "Health" Alarm)

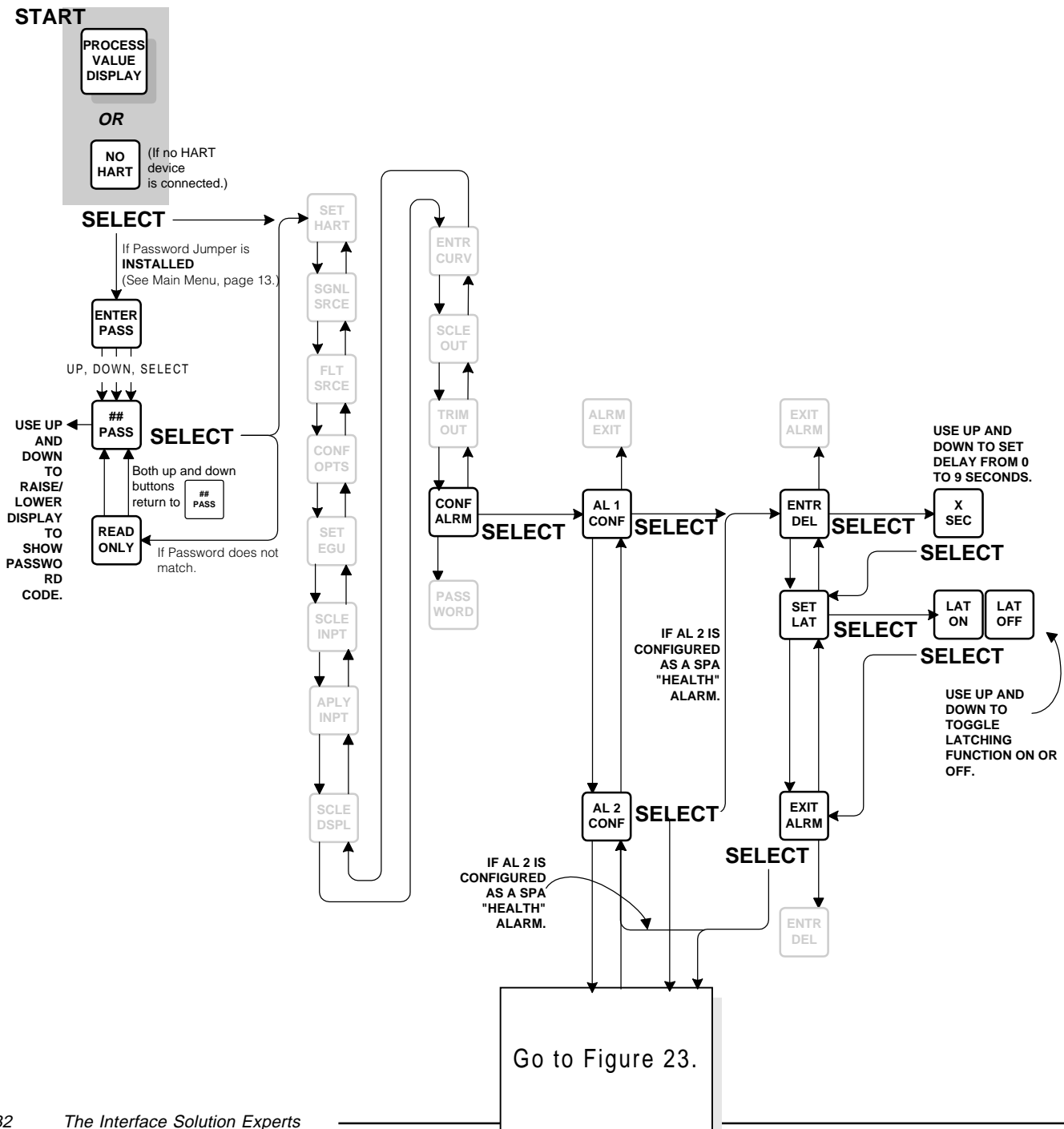
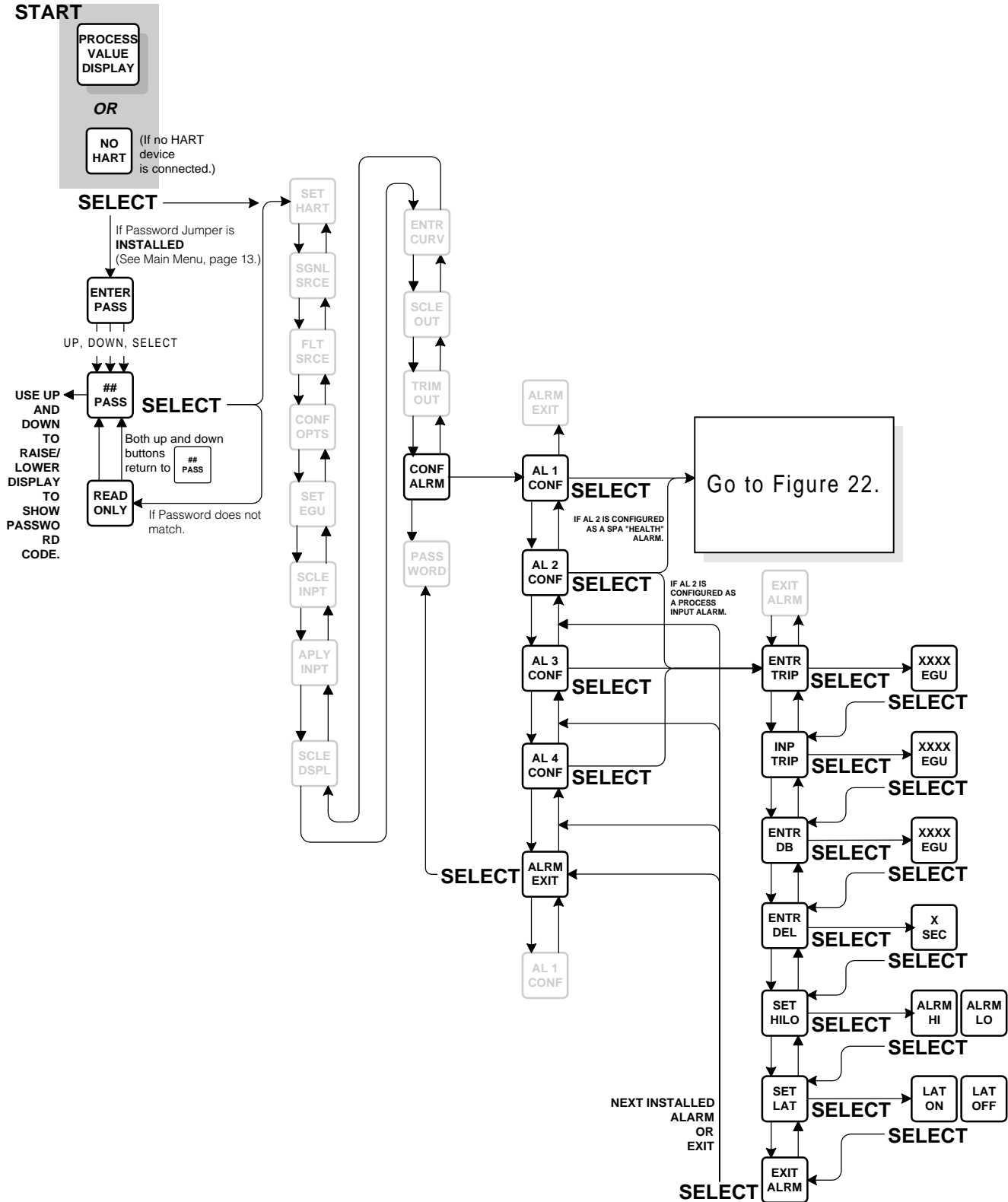


Figure 23. Configuring SPA Relays #2, #3, and #4 (when #2 is configured as a Process Input Alarm)



# SPA WITH HART

Continued from page 32

If Relay #2 is configured as a SPA “Health” alarm (refer to page 20, Figure 13), use this part of the sub-menu to enter the parameters for Relays #1 and #2. If Relay #2 is set to trip on a Process Input value, refer to Figure 23 when configuring the operating parameters.

Refer to Figure 23 to configure the parameters of relays #3 and #4 too.

The appendix of this manual comprises a basic description of how process control alarm trips work, and an informal glossary of alarm trip terminology. Contact your local Moore Industries Interface Solutions Salesperson for a copy of *Alarm Trips: The Ups and Downs*, and any of the other technical bulletins from Moore Industries designed to help you specify and configure the correct Moore Industries instrument for your application.



## AL 1 & AL 2 Config — Setting Alarm Delay

With this parameter, the user can set delays from 0 to 9 seconds. This is the delay from the time the SPA detects a fault until it changes the state of the relay(s).



## AL 1 & AL 2 Config — Setting Latching/Non-Latching Alarm Function

Both latching and non-latching alarms change state when an alarm condition is detected. The difference between the two types of alarm is how they are *reset*.

Assuming that the monitored input returns to a non-alarm condition (including deadband), a Latching alarm relay requires that the Manual Reset Terminals be shorted **and released** before returning to a non-alarm state. The SPA has two labeled reset contacts on the top row of terminals. These can be connected to a switch or push button (not supplied).

A Non-Latching alarm relay, on the other hand, returns to a non-alarm state as soon as the alarm condition on the input is cleared. No manual reset is required.



## AL 2, 3, & 4 Config — Entering Trip Points

**Smart Ranging.** This part of the sub-menu is used to enter the relay trip point(s) into SPA memory. Pressing the SELECT button from this point brings up a display of showing a value with the engineering units for the relay being configured, as selected in the “SET EGU” sub-menu, page 22.

Use the UP and DOWN arrow push buttons to change the display to the value required for the relay being configured. Press SELECT to enter the value into SPA memory.

### Note:

*It is not necessary to provide a source of HART input to the SPA when using the Smart Ranging capability.*

*If the trip point for a relay is entered into memory using Smart Ranging, the sub-menu for Standard or Bench Ranging is skipped.*



## AL 2, 3, & 4 Config — Capturing Trip Points

**Bench or Standard Ranging.** This part of the sub-menu is used to capture (vs. enter) relay trip point(s) into SPA memory. If using this procedure, a source of HART input is required.

To use Bench Ranging, the HART input device is adjusted to the desired trip point, and the SPA SELECT push button is pressed to capture the reading.

### Note:

*The UP and DOWN push buttons are inactive at this point in the sub-menu.*



## AL 2, 3, & 4 Config — Entering Alarm Deadband

This part of the sub-menu is used to enter a deadband around a trip point setting. The SPA displays the value in the engineering units selected for the relay being configured, and the UP and DOWN push buttons are used to raise and lower the value as desired.

Press SELECT to enter the displayed value into SPA memory.

*Note:*

Relays configured with latching ON require Manual Reset. Manual Reset does not work until the process input has passed out of the deadband.

**ENTR DEL AL 2, 3, & 4 Config — Entering Alarm Delay**

With this parameter, the user can set delays from 0 to 9 seconds. This is the delay from the time the SPA detects a fault until it changes the state of the relay(s).

**SET HILO AL 2, 3, & 4 Config — Set High/Low Alarm Function**

Use the UP or DOWN push buttons to toggle this parameter either HI or LO.

HI-configured relays change state whenever the process input reaches or exceeds the trip point setting.

LO-configured relays change state whenever the process input reaches or drops below the trip point setting.

**SET LAT AL 2, 3, & 4 Config — Set Latching/Non-Latching Alarm Function**

Both latching and non-latching alarms change state when an alarm condition is detected. The difference between the two types of alarm is how they are reset.

Assuming that the monitored input returns to a non-alarm condition, a Latching alarm relay requires that the Manual Reset Terminals be shorted **and released** before returning to a non-alarm state. The SPA has two labeled reset contacts on the top row of terminals. These can be connected to a switch or push button (not supplied).

A Non-Latching alarm relay, on the other hand, returns to a non-alarm state as soon as the alarm condition on the input is cleared. No manual reset is required.

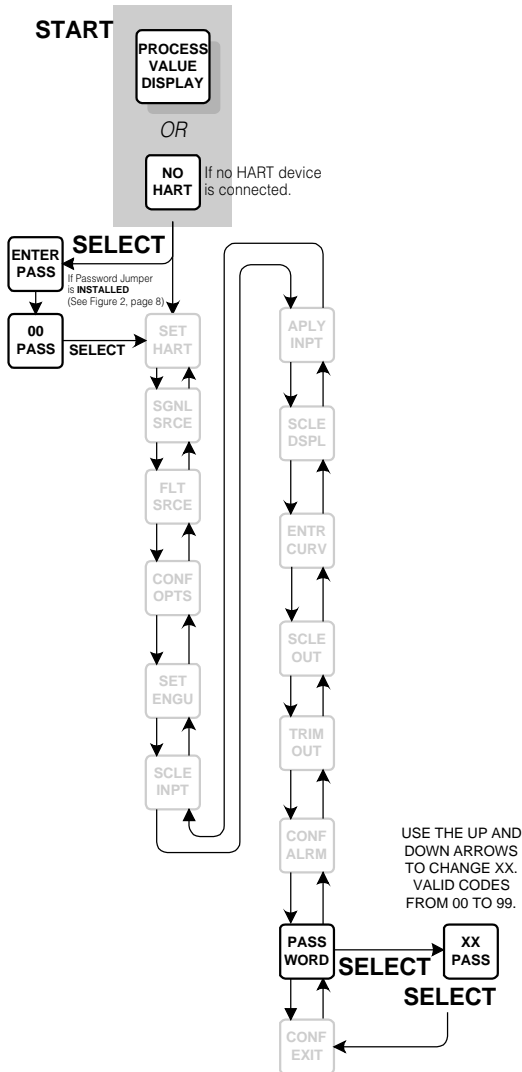
**PASS WORD SPA Setup — Setting or Changing the SPA Password Code**

This sub-menu is only accessible when the internal Password Jumper is in the OFF or STORED position (refer to Figure 2 on page 9), or when the correct password code is entered in the Main Configuration menu when prompted at:

**ENTER PASS**

Figure 24 shows the sub-menu. The Password sub-menu works with the internal Password Jumper to allow the user to set up “protection” for operating parameter settings against inadvertent tampering once the SPA is installed.

Figure 24. Viewing or Changing the SPA Password Code



# SPA WITH HART

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Note:

*The internal Password Jumper  
must be in the OFF or STORED position,*

**or**

*The correct, existing Password Code must be  
entered in the Main Configuration menu in order to  
view or change the Password Code.*

*Failure to enter the correct code automatically puts  
the SPA menu system into "READ ONLY" mode,  
wherein settings (except for the Password Code)  
can be viewed, but not changed.*

## Installation

When all of the internal and menu settings for the SPA have been checked and/or changed as needed, the unit is ready to be installed. The installation of Moore Industries products generally consists of physically mounting the unit(s) then making connections to other instruments and power.

**Note:**

Moore Industries recommends that the SPA be physically installed in its intended application **before** making any electrical and/or signal connections.

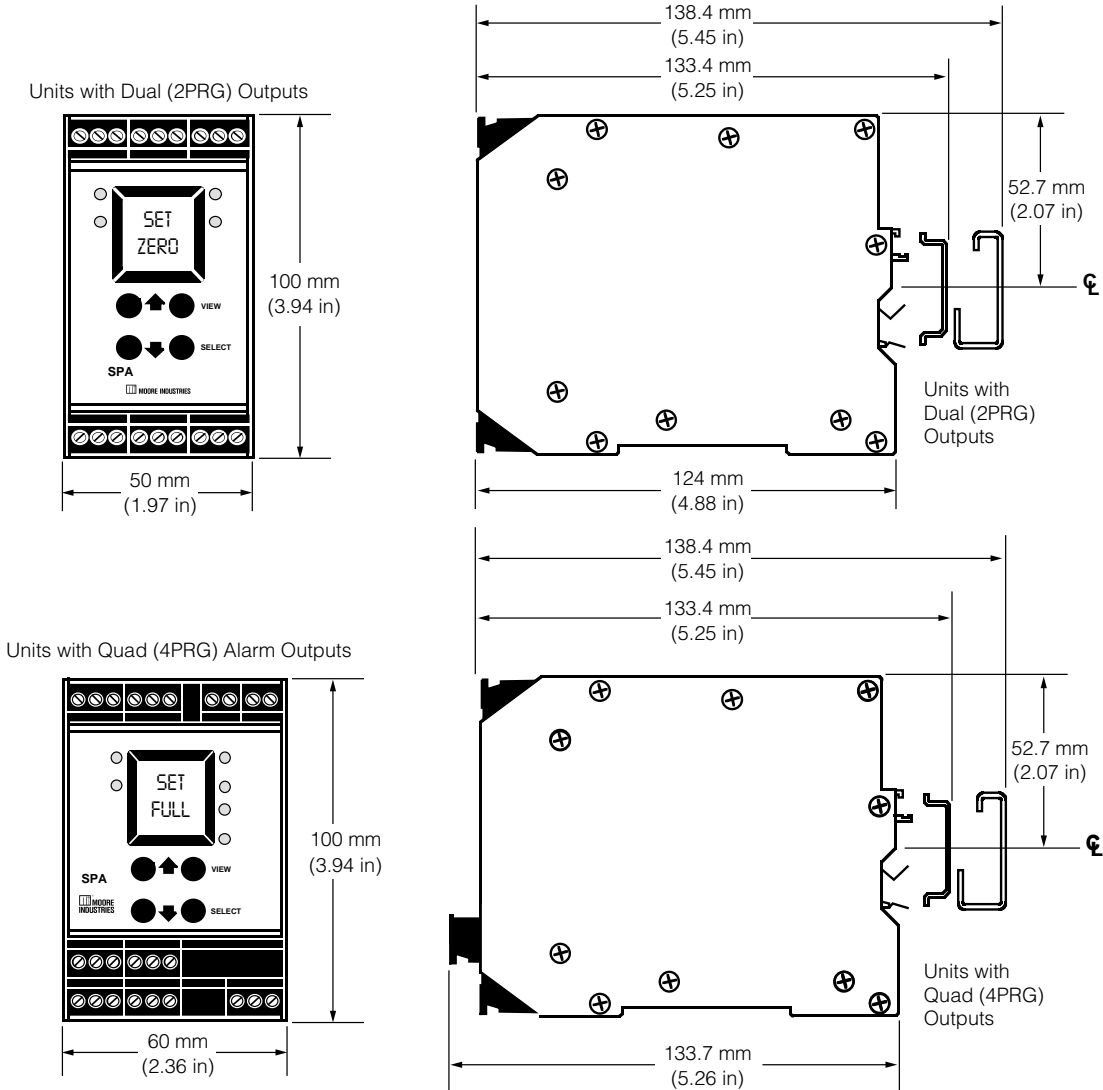
Make sure to follow any local regulations regarding the installation of electronic equipment, especially in hazardous or intrinsically safe applications.

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 either 32mm, G-type (EN50035) or 35mm Top Hat (EN50022) DIN rails.

Figure 25 shows the unit dimensions, including those for the both the 2PRG dual relay and the 4PRG quad relay variants.

Continued on page 38

Figure 25. SPA with HART Dimensions



# SPA WITH HART

**Note:**

To physically mount the SPA, it is necessary to pivot the unit upward, around the mounting clips on the back. When mounting more than one SPA in a cabinet or on a rack, make sure to allow adequate vertical spacing for pivoting the units to install and/or remove them.

Figure 27 shows how to hook up the SPA in an application where the HART field device is powered by the excitation capability of the SPA.

Refer to Table 4 for a summary of SPA terminal designations.

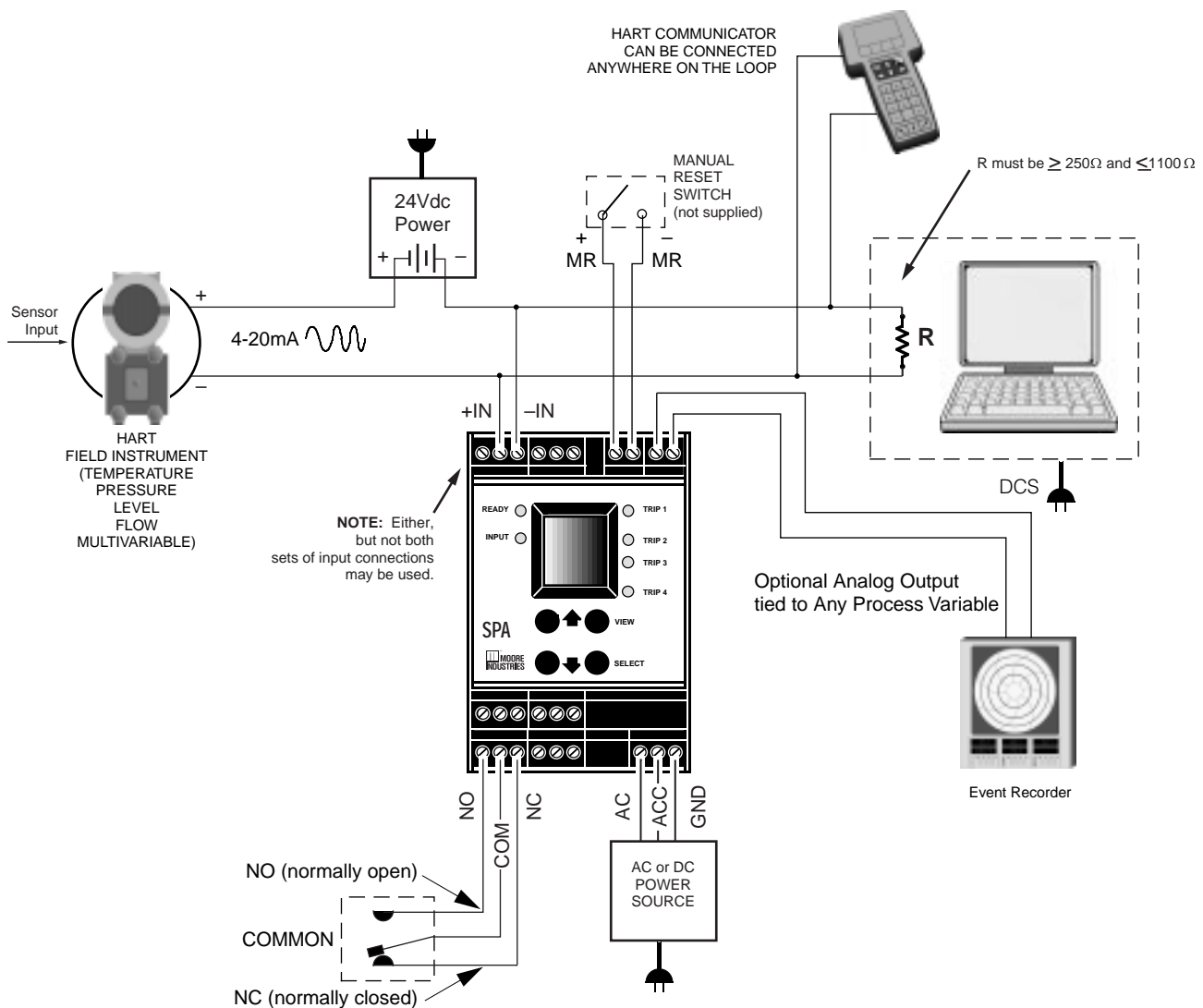
## Connecting the SPA

Figure 26 shows the SPA connected to a field device that is drawing power from the loop Primary Master, generically represented as a DCS.

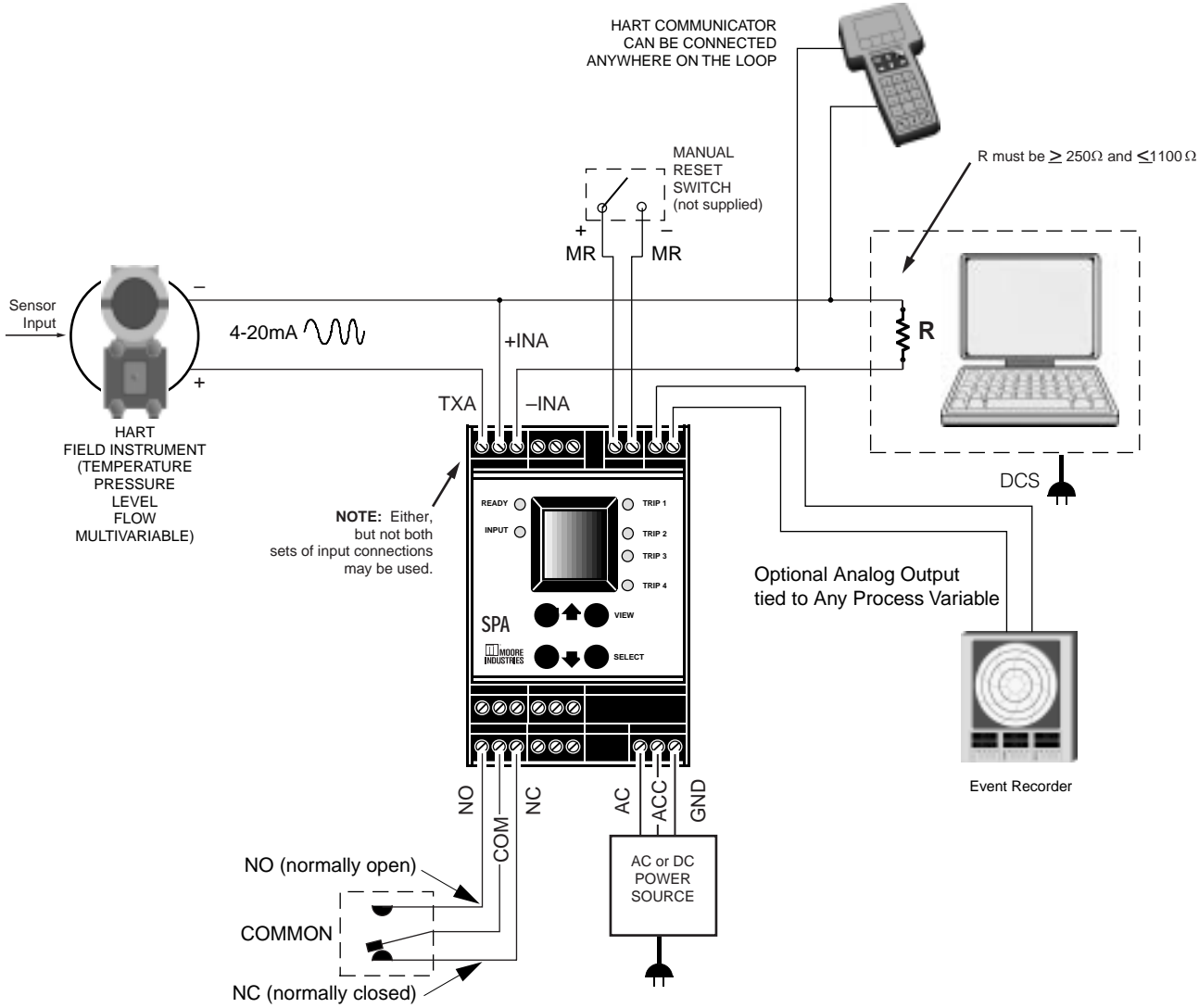
## Grounding the SPA

Moore Industries provides the following guidelines for grounding the SPA in an applications. Further, the CE certification of the SPA in an application requires that these guidelines be followed in order for the unit to meet the specifications in EMC Directives EN50082-2 and EN55011.

**Figure 26.** Connecting the SPA with HART to an Externally Powered Field Device



**Figure 27.** Connecting the SPA with HART to a Field Device using the SPA's Transmitter Excitation Feature



### Housing

The metallic case of the SPA must be grounded. This can be achieved by mounting the unit on a grounded DIN-style rail.

A protective earth conductor should be supplied for each installation of SPAs. It should be of equal or larger size wire than any power-conducting wires in use.

### Wiring

Twisted pair, shielded wiring should be used for all inputs and output signals. Shields should be grounded at the unit to earth (safety ground). Any unshielded part of input/output wiring should be no longer than 51 mm (approximately 2 inches).

The protective earth conductor should be the first thing connected to the SPA as part of the installation, and the last thing removed if the unit is being taken out of service for any reason.

# SPA WITH HART

**Table 4.** SPA with HART Terminal Designations

Input	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11
<b>HART</b>	TXA	+INA	-INA	TXB	+INB	-INB	not present	MR+	MR-	+AO	-AO
Output	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11
<b>DUAL Alarm (2PRG) with -DPDT Option</b>	NO2	CM2	NC2	NO2	CM2	NC2	not present				
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							
<b>QUAD Alarm (4PRG)</b>	NO3	CM3	NC3	NO4	CM4	NC4					
	↑ RELAY #3 ↑			↑ RELAY #4 ↑							
Output/Power	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
<b>DUAL Alarm (2PRG) with or without -DPDT Option</b>	NO1	CM1	NC1	NO2	CM2	NC2	not present		POWER AC DC	POWER AC DC	GND
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							
<b>QUAD Alarm (4PRG)</b>	NO1	CM1	NC1	NO2	CM2	NC2	not present		POWER AC DC	POWER AC DC	GND
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							

**KEY:**

MR = Manual Reset

GND = Ground

TXA, TXB = Excitation for 2-wire HART Transmitter

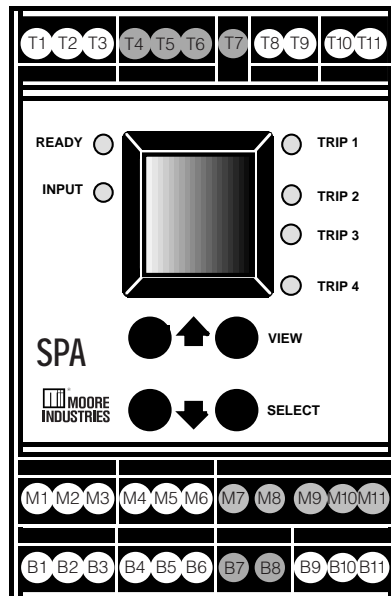
AO = Analog Output

NO# = Normally Open

CM# = Common

INA, INB = Input from HART Transmitter

NC# = Normally Closed



## Other Notes on Connecting the SPA

The SPA must be configured to function as the Primary/Secondary HART master compliment to the other HART master in the loop; that is, if the DCS or HART Communicator in an application is configured as the Primary Master, then the SPA must be configured as the Secondary. If the DCS or Communicator is configured as the Secondary, then the SPA must be the Primary.

The total resistance in the loop must always be maintained between 250 and 1100 $\Omega$  for optimum HART communication performance. Remember too that the SPA can be connected to only one HART field instrument. Do not use the SPA in a multidrop scenario.

Both Figure 26 and Figure 27 depict a hand-held HART Communicator. This is optional, and not supplied by Moore Industries, but may be used in the loop without affecting SPA operation. If a communicator is used in the loop, it should also be configured to operate in the "opposite" mode (with respect to Primary/Secondary HART Master) as the SPA.

## Other SPA Installation Information

- SPA terminals are rated CAT II.
- All supply wiring connections should be made with 14 or 16 AWG (0.083 mm or 0.064 mm) wire. The ends of power conductor connections should be stripped no more than 8 mm (0.32 in). The stripped end of each wire should be tinned with solder, or inserted into a ferrule and crimped before being placed into a terminal block.
- The SPA does not generate hazardous voltages. Alarm contacts are wired in series with power sources and their intended loads. The correct load should be selected for the power source.
- The maximum working voltage for the contact-closure outputs of the SPA is 30Vdc.

# SPA WITH HART

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## Operation

Once connected to the HART Field device, a power supply, and the annunciators or other contact-closure-driven device(s) in the application, the SPA with HART begins to function according to its internal switch settings and the configuration stored in its nonvolatile internal memory.

## Changing Settings

Configuration data stored in SPA memory is monitored continuously. Changes to settings can be made at any time, though extreme caution should be exercised whenever making changes to parameters that could affect the process being monitored.

### **Caution:**

*Any changes made to operating parameters controlled by the settings in the SPA menu system take effect immediately. It is not necessary to exit the Configuration menu, or to cycle power.*

Changes made to the SPA's internal DIP switch settings and security jumper do not take effect until power to the SPA is cycled off and on.

### **Caution:**

*Do not make changes to internal SPA settings when the unit is connected to power or to input.*

## LEDs

Each LED on the SPA front panel is labeled for a quick, visual reference for input condition and instrument "health" during normal operation. Here's what each LED means:

- **READY**

GREEN DURING NORMAL OPERATION. This indicates that the SPA has run its start-up diagnostic routine, and that all internal circuitry is functioning properly.

GOES OUT to indicate SPA FAULT. Relay #2 will parallel the state of this LED if configured to reflect SPA "health".

- **INPUT**

GREEN DURING NORMAL OPERATION. This indicates that the SPA has established valid communications with the connected HART device.

RED INDICATES HART FAULT. Typically, the loss of, or failure to establish communications with the connected HART device will result in this LED changing to RED state, and the LCD displaying a "NO HART" message.

- **TRIP #**

GREEN WHEN RELAY IS IN A NON-ALARM STATE.

RED INDICATES PROCESS INPUT FAULT (ALARM), relative to the trip point setting.

TRIP 1 always monitors the state of the SPA-to-HART-device communications. GREEN INDICATES GOOD HART COMMUNICATIONS, RED INDICATES HART FAULT.

## Important: Relays and LEDs—Working Together

It is important to note that the states of the Trip LEDs do not always indicate that their corresponding relay is energized or de-energized. The SPA LEDs are designed to indicate the state of the alarm, not the relay.

The state of SPA relays is determined by the settings for failsafe and non-failsafe operation.

Failsafe relays are ON (energized) whenever input is in a non-alarm condition. They are OFF (de-energized) whenever input is in an alarm condition.

LEDs complementing failsafe-configured relays will be GREEN whenever relays are energized (input is in NON-ALARM), and RED whenever relays are de-energized (input is in ALARM).

Non-failsafe relays are ON (energized) whenever input is in an alarm condition, OFF (de-energized) in non-alarm.

LEDs complementing non-failsafe-configured relays will be GREEN whenever relays are de-energized (input is in NON-ALARM), and RED whenever relays are energized (input is in 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 function set in the CONF ALRM sub-menu (page 32).

When the SPA is configured with latching alarms, an alarm condition will not “clear” or reset until:

- Input returns to non-alarm condition
- Manual Reset (MR) terminals are shorted and opened

Typically, some type of switch is connected to these terminals to facilitate quick alarm reset.

When the SPA is configured with non-latching alarm, an alarm condition “clears” or resets whenever the corresponding input returns to a non-alarm condition, as defined by the trip point, deadband, and alarm delay settings. No manual reset is needed.

**Note:**

*Manual Reset clears (resets) all alarms.*

## Error Codes

Every SPA is subjected to an exhaustive batter 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 SPA performs a full set of internal diagnostics that check operation and configuration upon power-up. If there are problems with the micro-processor, or with conflicting operating parameter settings, the unit LCD indicates a problem by displaying an error code. Table 5 lists those codes.

For most of these problems, it will be necessary to return the recalcitrant SPA to the factory. A quick call to the nearest Moore Industries STAR Center will have a temporary replacement unit en route right away.

**Table 5.** Troubleshooting—SPA Error Codes

Error Code	What it Means	What to Do
EE FLT	Erasable Electronic Programmable Read-Only Memory (EEPROM) fault. The unit's 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	Random Access Memory (RAM) Error. The unit's internal memory has failed. User-settings may be lost or corrupted.	Cycle power to the unit. If the error occurs again, return the unit to the factory for service. If the error clears, check all user-configurable operating parameters before placing the unit into service.
ROM ERR	Read-Only Memory (ROM) Error. The unit's internal memory has failed. User-settings may be lost or corrupted.	Cycle power to the unit. If the error occurs again, return the unit to the factory for service. If the error clears, check all user-configurable operating parameters before placing the unit into service.
CAL ERR	Calibration Error. The factory-set calibration of the unit has failed to initialize. Settings may be lost or corrupted.	Cycle power to the unit. If the error occurs again, return the unit to the factory for service. If the error clears, check all user-configurable operating parameters before placing the unit into 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 diagnostic.	Cycle power to the unit. If the error occurs again, return the unit to the factory for service. If the error clears, check all user-configurable operating parameters before placing the unit into service.
PACT ERR	The unit's internal memory has failed. User-settings may be lost or corrupted.	Cycle power to the unit. If the error occurs again, return the unit to the factory for service. If the error clears, check all user-configurable operating parameters before placing the unit into service.
CONF ERR	Configuration Error. There are conflicts in the settings entered into unit memory by the user. This can be caused by power loss or fluctuation during power-up diagnostic.	Cycle power to the unit. If the error occurs again, return the unit to the factory for service. If the error clears, check all user-configurable operating parameters before placing the unit into service.
TABL ERR	Linearization Error. Settings entered by the user for Custom Linearization do not follow the “RULES” (page xx).	Refer to the explanation of entering custom linearization curves, page xx, and make sure that all points entered follow the “RULES”.

## We Take Pride in Our Work

Our entire corporate structure is built upon the ideal that you, our customer, are always right. We work hard—from the time you first contact us for information or help, through supporting your installation after delivery of the instruments—to make sure that you are completely satisfied with our products and services.

Nevertheless, every once in a great while, we make a mistake. Please remember, if you are unhappy with our products or services for **any** reason, make sure to give us a call right away. It's the only way we can make sure you end up happy, and that mistakes don't recur.

We operate full-service Customer and Technical Assistance Centers at several corporate hubs. You will find our engineers accessible, professional, easy to talk to, and very eager to make sure that your experience with Moore Industries is as positive and rewarding as possible.

## ***Thank You...***

For purchasing an SPA with HART from Moore Industries. We appreciate your business. If you need anything else, please contact your local, Moore Industries Interface Solution Expert, or the factory directly. We are always glad to listen to any ideas for new products, or suggestions for improving our existing products, manuals, services, or sales materials.

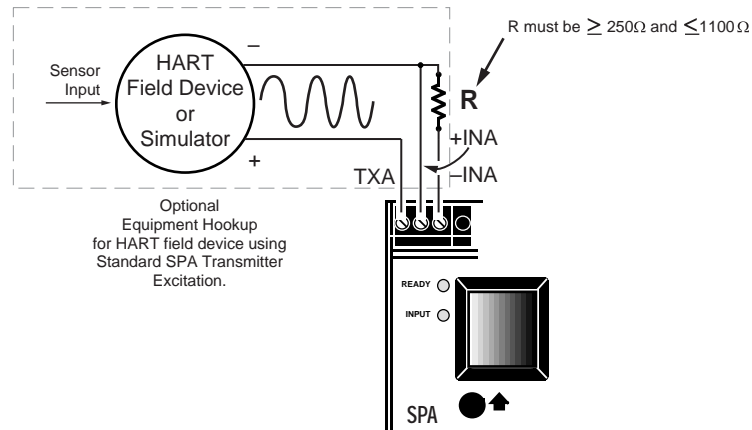
# Supplement - SPA WITH HART

## Correction

The drawing in Figure 6, page 11 of the SPA with HART Users' Manual, #224-741-00, version B, is incorrect.

Please refer to the following illustration when connecting the calibration equipment to the transmitter excitation of the SPA with HART.

**Corrected Figure 6.** Hooking up the Transmitter Excitation on the SPA with HART for Calibration



Continues...

# Supplement - SPA WITH HART

## Also...

The "B" set of input connection terminals has been removed from SPA with HART. There is only one set of input connections, and references to the "B" set should be ignored wherever they occur in the manual.

The following shows the ammended Terminal Designations Table (the original appears as Table 4 on page 40 of the manual).

**Corrected Table 4.** SPA with HART Terminal Designations

Input	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11
HART	TXA	+INA	-INA	not present	not present	not present	not present	MR+	MR-	+AO	-AO
Output	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11
DUAL Alarm (2PRG) with -DPDT Option	NO2	CM2	NC2	NO2	CM2	NC2	not present				
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							
QUAD Alarm (4PRG)	NO3	CM3	NC3	NO4	CM4	NC4					
	↑ RELAY #3 ↑			↑ RELAY #4 ↑							
Output/Power	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
DUAL Alarm (2PRG) with or without -DPDT Option	NO1	CM1	NC1	NO2	CM2	NC2	not present		POWER AC DC	POWER AC DC	GND
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							
QUAD Alarm (4PRG)	NO1	CM1	NC1	NO2	CM2	NC2	not present		POWER AC DC	POWER AC DC	GND
	↑ RELAY #1 ↑			↑ RELAY #2 ↑							

**KEY:**

MR = Manual Reset

GND = Ground

TXA, TXB = Excitation for 2-wire HART Transmitter

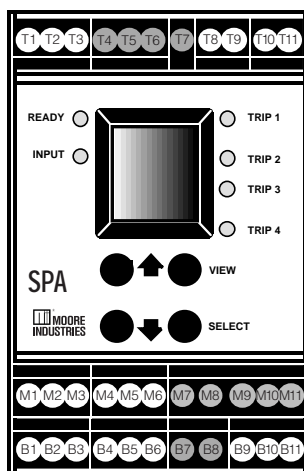
AO = Analog Output

NO# = Normally Open

CM# = Common

INA, INB = Input from HART Transmitter

NC# = Normally Closed

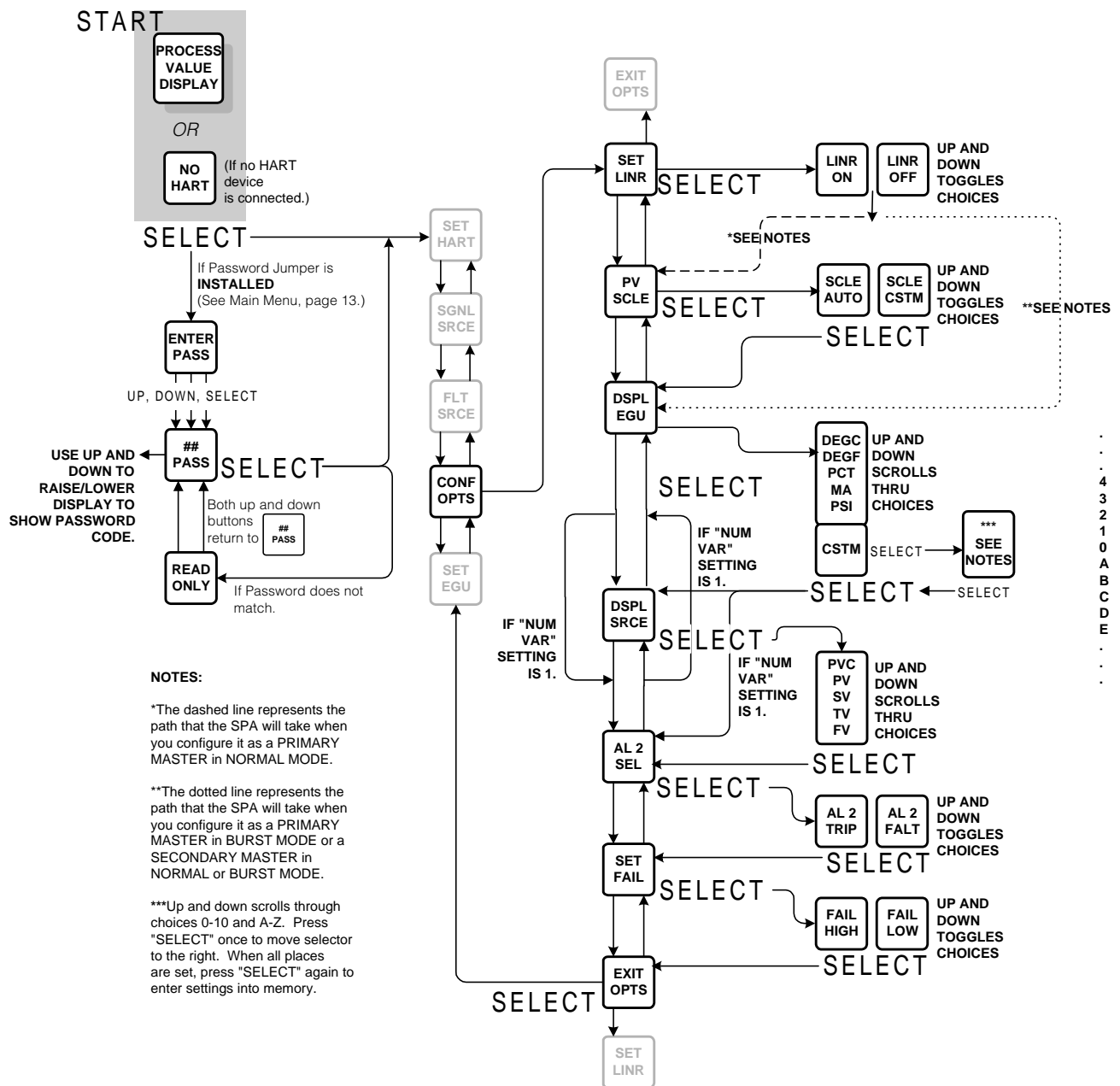


# Supplement - SPA WITH HART

## Correction

The drawing in Figure 13, page 20 of the SPA with HART Users' Manual, #224-741-00 B, is incorrect. It shows that the SPA will automatically take you to the Primary Variable Scaling Menu after you set the linearization curves. The only time this menu is actually enabled is when the SPA is set to PRIMARY MASTER and NORMAL MODE in the "Set Master" and "Set Function" menus. When the SPA is set to PRIMARY MASTER in BURST MODE or SECONDARY MASTER in NORMAL or BURST MODE, the Primary Variable Scaling Menu will be skipped. See the following figure for the corrected diagram.

Corrected Figure 13. Configuring Miscellaneous SPA Operating Options



## RETURN PROCEDURES

### To return equipment to Moore Industries for repair, perform the following:

1. Notify the local Moore Industries' Sales Representative or a factory Customer Service Representative that you are returning equipment for repair. Furnish the Moore Industries' representative with the model and serial number(s) of the equipment to be returned.
2. In a cover letter or note, describe completely the following:
  - a. the symptoms that indicate the equipment needs repair
  - b. the environment in which the equipment has been operating (vibration, temperature, etc.)
  - c. approximate number of operating hours or approximate installation date (if known)
  - d. complete shipping information for return of the equipment after repair
  - e. the name and phone number of the person to contact if questions arise at the factory
3. Enclose the cover letter, packing list, copies of rejection or discrepancy reports (if available), and purchase order or purchase order number with the equipment.
4. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
5. Ship the equipment to the Customer Service Department nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries' representative will contact the person designated in the cover letter if more information is needed.

In case of repair pursuant to Moore Industries' return policy, the defective equipment will be either replaced, or the purchase price refunded, at Moore Industries option. The equipment or its replacement will be returned to you in accordance with the shipping instructions furnished in your cover letter.

In other cases, the Moore Industries' representative will advise you of the repair cost and estimated return date, if requested in your letter. Repair in such instances must be authorized by a purchase order number before the equipment can be repaired and returned.

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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.

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### RETURN POLICY

For a period of twelve (12) 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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