

**FS** FUNCTIONAL  
SAFETY SERIES



Safety Series Isolator and Splitter

# SSX/SST

## User's Manual

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*Demand Moore Reliability*

## Customer Support

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

There are several pieces of information that can be gathered before you call the factory that will help our staff get the answers you need in the shortest time possible. For fastest service, gather the complete model and serial number(s) of the problem unit(s) and the job number of the original sale.

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## Safety Messages

Please read this manual in its entirety. It should answer most of your questions. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product. Should you still have questions please visit our website at [www.miinet.com](http://www.miinet.com) or contact any of our sales/support offices nearest you.

Your safety and the safety of others is very important. We have provided many important safety messages in this manual. Please read these messages carefully. These safety messages alert you to potential hazards that could hurt you or others or render damage to units.

All Moore Industries instrumentation should only be used for the purpose and in the manner described in this manual. If you use this product in a manner other than that for which it was intended, unpredictable behavior could ensue with possible hazardous consequences.

Each safety message is associated with a safety alert symbol. These symbols are found in the throughout the manual. The definition of these symbols is described below:

Pay particular attention wherever you see the following symbols:



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



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



**Warning** – Hazardous procedure or condition that could injure the operator.

### Qualified Personnel

The Moore Industries' product/systems described in this manual may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these Moore Industries' products/systems.

### Proper use of Moore Industries products

Moore Industries' products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Moore Industries'. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

We have reviewed the contents of this publication to ensure consistency with the hardware and/or software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions. Specifications and information are subject to change without notice.

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## Section 1 - Introduction

The Moore Industries' Safety Series Isolators (SSX and SST) are designed and manufactured to provide a high level of availability for safety critical applications and for use as a component part of a safety instrumented system.

This manual contains information needed to install, operate and maintain this product. When the SSX or SST are used in a SIL rated safety application, please refer to Section 6 SSX/SST in Safety Instrumented Systems. Safety and failure rate data for the SSX and SST are in the SSX/SST FMEDA report (Moore Industries' Document No: 700-702-36), which is available upon request.

### Overview

As part of the Moore Industries' **FS Functional Safety Series**, the *exida*® approved, SIL 3 capable 2-wire (loop powered) SSX and 4-wire (line/mains powered) SST Safety Isolators and Splitters provide galvanic isolation and signal conversion for your SIS (Safety Instrumented System) needs. These units protect and enhance loops and also pass valuable HART® data from the field transmitter to host systems and vice-versa.

### Description

#### 2-Wire, Loop Powered SSX

The SSX is a 2-wire isolator /signal convertor, drawing power from the output side of the loop. Typically, this is from a secondary receiving device such as a DCS or PLC. The SSX will also pass through a HART signal on its input or optionally can block the signal on its output.

#### 4-Wire Line/Mains Powered SST and SST Splitter

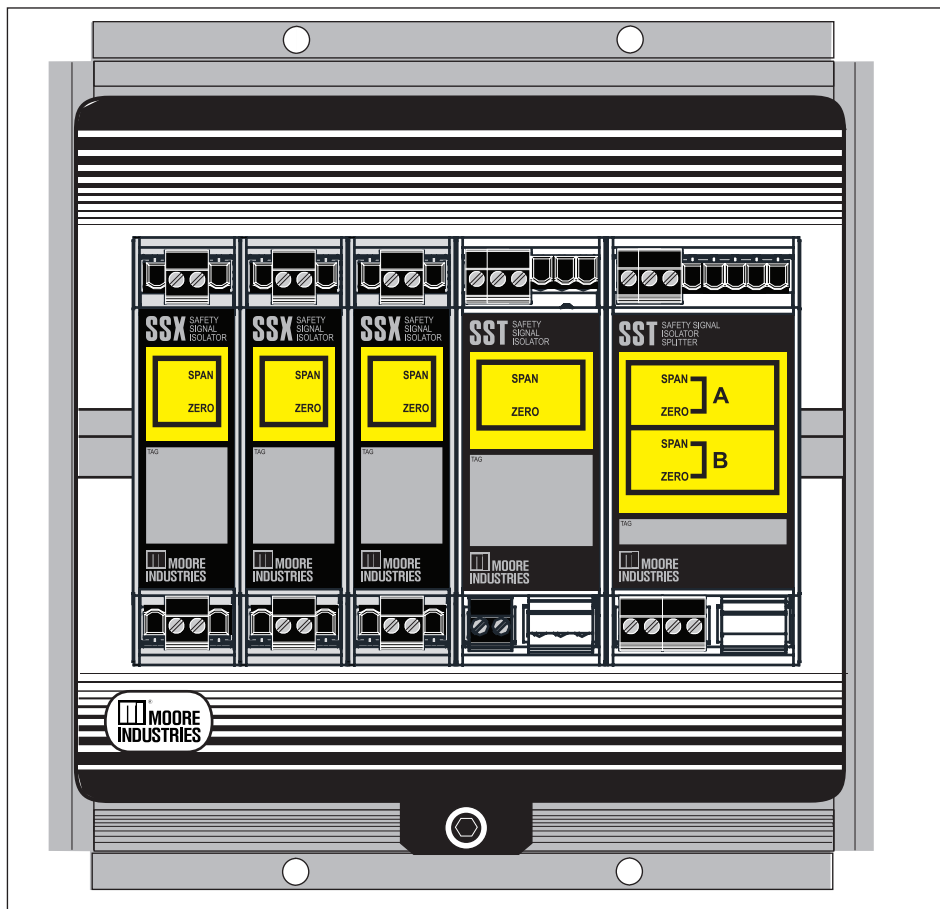
The SST is a 4-wire unit powered by 24DC, 117AC or 230AC. It is designed for applications where line/mains power is readily available, such as the back of a panel or inside of a control room. It passes through a HART signal on its input or optionally can block the signal on its output. The SST can also provide 24V power to a 2-wire, output-loop powered instrument which eliminates the need for an additional power supply.

The SST Splitter takes one input and creates two identical, completely isolated outputs. Additionally, the SST can function as a HART splitter that passes valuable HART data to one or both of the SST's independent outputs. This is especially important when asset management systems need to maintain a digital HART connection with critical valves or instruments for diagnostic monitoring or calibration record keeping.

## Single- and Multiple-Unit Instrument Enclosures

Designed to meet NEMA 4X and IP66 ratings, the R-BOX is the perfect solution for protecting the SST/SSX in field and control room applications. Rugged and versatile, it delivers a high impact structure and resistance to ultraviolet rays and chemicals. The R-BOX mounts on a pipe, panel or surface, and comes in a variety of widths to economically accommodate several SSTs or SSXs. It features a pre-installed mounting rail; customizable conduit entry options; a clear cover and a secure locking mechanism (See Figure 1.1). For more information, see the R-BOX Field-Mount Enclosure datasheet.

**Figure 1.1.** Available in a variety of widths, our R-BOX field-mount instrument enclosure is designed to protect DIN-rail instruments in even the most rugged environments



## SSX and SST Applications

Please refer to **Section 5: Applications** for examples of typical SSX and SST applications

### Model Numbers and Options

The following section provides details of the Moore Industries model number and the available options for the SSX and SST.

Moore Industries model numbers or SSX/SST are structured as follows:

SSX / 4-20MA / 4-20MA / 12-42DC / -IZ250 [DIN]

Unit / Input / Output / Power / -Options [Housing]

Refer to **Section 8 Ordering Information** for a quick reference table of ordering information. Further details are provided for each model starting on next page.

### SSX 2-Wire Loop Powered Safety Isolator / Signal Convertor

#### INPUT

##### 4-20MA

The standard input of the SSX is 4-20mA into 100 ohms.

There are two options available that will change the input resistance. The – IZ250 option will increase the input resistance to 250 ohms and the -0HART option (no HART pass-through) will change the input resistance to 65 ohms.

##### 1-5V

The SSX can also be ordered for use with a 1-5Vdc input (non-HART). The input impedance for this application is 1 Megohm.

**Note:** *Input resistance specifies the resistance seen by the DC signal. Since the HART signal is AC, it will see the input resistance plus the internal HART transformer (70 ohms) plus any termination resistance in the loop.*



#### OUTPUT

##### 4-20MA

Isolated 4-20mA into 0-600 ohms (with 24Vdc series loop voltage), with HART digital data pass-through.

**Note:** *There is no HART digital data pass-through at the output when the -0HART option is chosen or when the 1-5V Input is chosen.*





## POWER

### 12-42DC

The SSX is a 2-wire, loop powered instrument. It is powered either by an external 12-42Vdc power supply, or by a DCS (or PLC) input channel that provides power (12-42Vdc) to the loop.

## OPTIONS

### -IZ250

This option increases the input resistance to 250 ohms. (4-20mA input units only)

### -0HART

With this option the instrument is configured for no HART pass-through. (4-20mA input units only)

### -[LMD]

Loop Maintenance Diode provided at input terminals (for current input only). Allows removal of SSX from the loop without interrupting loop continuity. (This option increases the loop burden to 8.2V when the SSX is removed).

## HOUSING

### [DIN]

Universal DIN-style housing mounts on a 32mm G-type rail (EN 50035) or on 35mm Top Hat rail (EN50022).

### [FLB]

Flange mount bracket provides a secure mount for high vibration applications.

## SST 4-Wire Line/Mains Powered Safety Isolator/Signal Converter (Single Output Channel)

## INPUT

### 4-20MA

The standard input of the SST is 4-20mA into 100 ohms.

There are two options available that will change the input resistance. The -IZ250 option will increase the input resistance to 250 ohms and the -0HART option (no HART pass-through) will change the input resistance to 65 ohms.

**Note:** Input resistance specifies the resistance seen by the DC signal. Since the HART signal is AC, it will see the input resistance plus the internal HART transformer (70ohms) plus any termination resistance in the loop.

### 1-5V

The SST can also be ordered for use with a 1-5Vdc input (non-HART). The input impedance for this application is 1 Megohm.



### OUTPUT

#### 4-20MA

Isolated 4-20mA into 0-1000 ohms, with HART digital data pass-through.



**Note:** There is no HART digital data pass-through at the output when the -0HART option is chosen or when the 1-5V Input is chosen.

### POWER

#### 24DC

#### 117AC

#### 230AC

The SST is a 4-wire, line/mains powered instrument. The voltage choice should be specified at the time that the instrument is ordered. It can be powered by either 24Vdc (+/- 10%), 117Vac, 50/60Hz (+/- 10%) or 230Vac, 50/60Hz (+/- 10%). The SST with one output channel consumes 3 watts maximum.

### OPTIONS

#### -IZ250

This option increases the input resistance to 250 ohms. (4-20mA input units only)

#### -0HART

With this option the instrument is configured for no HART pass-through. (4-20mA input units only)

#### -LMD

Loop Maintenance Diode (for Current Input Only). Allows removal of SST from the loop without interrupting loop continuity. (This option increases the loop burden to 8.2V when the SST is removed).

### HOUSING

#### [DIN]

Universal DIN-style housing mounts on a 32mm G-type rail (EN 50035) or on 35mm Top Hat rail (EN50022).

#### [FLB]

Flange mount bracket provides a secure mount for high vibration applications.

## SST 4-Wire Line/Mains Powered Safety Isolator Splitter (Two Output Channels)

### INPUT

#### 4-20MA

The standard input of the SST is 4-20mA into 100 ohms.

There are three options available that will change the input resistance. The -IZ250 option will increase the input resistance to 250 ohms, the -0HART option (no HART pass-through) will change the input resistance to 65 ohms, and the -2HART option (HART pass-through for both output channels) will change the input resistance to 135 ohms

**Note:** Input resistance specifies the resistance seen by the DC signal. Since the HART signal is AC, it will see the input resistance plus the internal HART transformer (70 ohms) plus any termination resistance in the loop. For -2HART option this will be the input resistance plus 140 ohms plus the termination resistances in both output loops.



#### 1-5V

The SST can also be ordered for use with a 1-5Vdc input (non-HART). The input impedance for this application is 1 Megohm.

### OUTPUT

#### 2X4-20MA

Two isolated 4-20mA channels into 0-600 ohms, with HART digital data pass through on one output channel only (Output "A").

The -2HART option will provide isolated two isolated 4-20mA channels into 0-600 ohms, with HART digital data pass-through on both output channels.

If the -EP (External Power) option is selected both outputs will be powered by external voltage sources connected in series.

**Note:** There is no HART digital data available at the output when the -0HART option is chosen or when the 1-5V Input is chosen.



### POWER

#### 24DC

#### 117AC

#### 230AC

The SST is a 4-wire, line/mains powered instrument. The voltage choice should be specified at the time that the instrument is ordered. It can be powered by either 24Vdc (+/- 10%), 117Vac, 50/60Hz (+/- 10%) or 230Vac, 50/60Hz (+/- 10%). The SST with two output channels consumes 5 watts maximum.

## OPTIONS

### **-IZ250**

This option increases the input resistance to 250 ohms. (4-20mA input units only)

### **-0HART**

With this option the instrument is configured for no HART pass-through. (4-20mA input units only)

### **-2HART**

With this option the instrument is configured for HART pass-through on both output channels. (4-20mA input units only)

### **-EP**

With this option both output channels will be powered by an external source.

### **-RO**

With this option both output channels will be the reverse of the input eg. 4mA input would be represented as 20mA on both outputs.

### **-LMD**

Loop Maintenance Diode (for Current Input Only). Allows removal of SST from the loop without interrupting loop continuity. (This option increases the loop burden to 8.2V when the SST is removed).

## HOUSING

### **[DIN]**

Universal DIN-style housing mounts on a 32mm G-type rail (EN 50035) or on 35mm Top Hat rail (EN50022).

### **[FLB]**

Flange mount bracket provides a secure mount for high vibration applications.

## Section 2 - Calibration and Bench Check

It is recommended that you perform a bench check on your instruments prior to installing them in your application.

### Calibration

We recommend that you check the calibration every year and re-calibrate only when necessary.

To calibrate the SSX or the SST, set up the equipment listed in Table 1 as shown in Figures 2.2 thru 2.4, as appropriate.

**Table 1.** Calibration Equipment for the SSX and SST

Device	Specifications
<b>Current/Voltage Calibrator</b>	Adjustable, calibrated to an accuracy of $\pm 0.025\%$ (Fluke Model 725, or similar)
<b>Power Supply</b>	Calibrated, regulated 24Vdc ( $\pm 10\%$ ) source, nominal, for SSX or dc-powered SST; calibrated, regulated 117Vac or 230Vac ( $\pm 10\%$ ) source, nominal, for ac-powered SST
<b>Load Resistor</b>	250 ohm with $\pm 0.01\%$ precision; required only if using a Voltmeter to calibrate the analog output from the SST/SSX (voltage drop across the precision resistor; 4-20mA=1-5V)
<b>Multimeter</b>	Calibrated to an accuracy of $\pm 0.025\%$ , or better; such as Fluke Model 725, or similar
<b>Screwdriver</b>	Standard (blade) head; head width 2.5mm (0.1in), maximum width

All referenced product names are the sole property of their respective manufacturers.

## Calibration Procedure - SSX and SST Single Output Channel

### Current Input Units

1. Apply the appropriate power to the unit being calibrated.
2. Set the INPUT simulator to 4mA.
3. Adjust the ZERO potentiometer (pot) on the SSX or SST front panel until the meter in the calibration setup reads 1V,  $\pm 0.02V$ .
4. Adjust the INPUT to 20mA.
5. Adjust the SPAN pot on the SSX or SST front panel until the meter in the calibration setup reads 5V,  $\pm 0.02V$ .

**Note:** SPAN and ZERO adjustments are non-interactive as long as zero is set first.



### Voltage Input Units

1. Apply the appropriate power to the unit being calibrated.
2. Set the INPUT simulator to 1V.
3. Adjust the ZERO potentiometer (pot) on the SSX or SST front panel until the meter in the calibration setup reads 1V,  $\pm 0.02V$ .
4. Adjust the INPUT to 5V.
5. Adjust the SPAN pot on the SSX or SST front panel until the meter in the calibration setup reads 5V,  $\pm 0.02V$ .

## SPAN and ZERO Adjustments - SSX and SST Single Output Channel

Figure 2.1. SPAN and ZERO adjustments - SSX and SST Single Output Channel

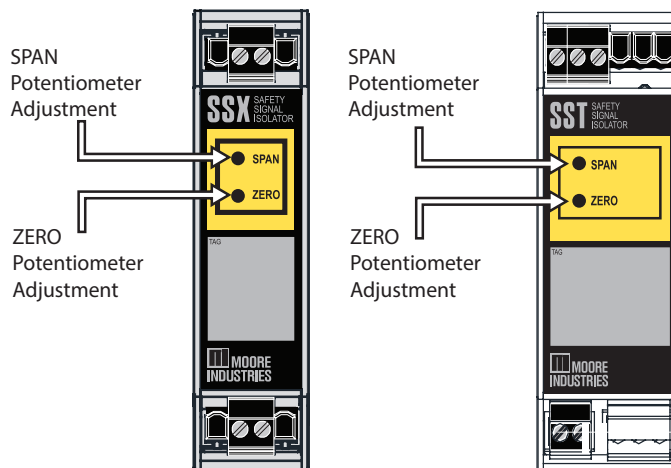


Figure 2.2. Setting up to Calibrate the SSX

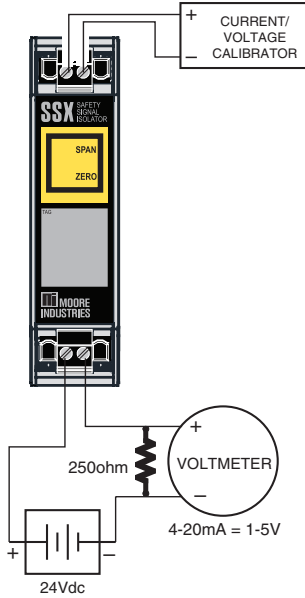
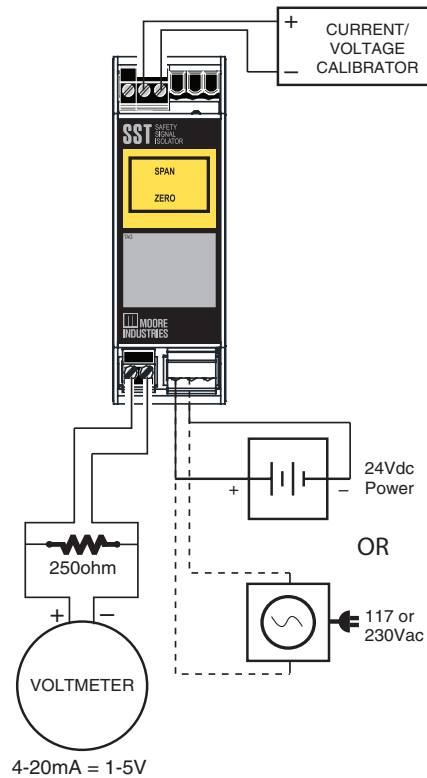


Figure 2.3. Setting up to Calibrate the SST (Single Output Channel)



## Calibration Procedure - SST Splitter (Two Output channels)

### Current Input Units

1. Apply the appropriate power to the unit being calibrated.
2. Set the INPUT simulator to 20mA.
3. Adjust the SPAN pot on the SST Splitter front panel until the meter in the calibration setup reads 5V,  $\pm 0.02V$  (1V,  $\pm 0.02V$  for -RO option units).
4. Adjust the INPUT to 4mA.
5. Adjust the ZERO potentiometer (pot) on the SST Splitter front panel until the meter in the calibration setup reads 1V,  $\pm 0.02V$  (5V,  $\pm 0.02V$  for -RO option units).
6. Re-check SPAN at 20mA, adjust if needed; re-check ZERO.
7. Repeat steps 2 to 6 for the second output channel.

**Note:** SST Splitter SPAN and ZERO adjustments are non-interactive as long as span is set first.



### Voltage Input Units

1. Apply the appropriate power to the unit being calibrated.
2. Set the INPUT simulator to 5V.
3. Adjust the SPAN pot on the SST Splitter front panel until the meter in the calibration setup reads 5V,  $\pm 0.02V$  (1V,  $\pm 0.02V$  , for -RO option units).
4. Adjust the INPUT to 1V.
5. Adjust the ZERO potentiometer (pot) on the SST Splitter front panel until the meter in the calibration setup reads 1V,  $\pm 0.02V$  (5V,  $\pm 0.02V$  for -RO option units).
6. Re-check SPAN at 20mA, adjust if needed; re-check ZERO.
7. Repeat steps 2 to 6 for the second output channel.

## SPAN and ZERO Adjustments - SST Splitter

Figure 2.4. SPAN and ZERO adjustments - SST Splitter

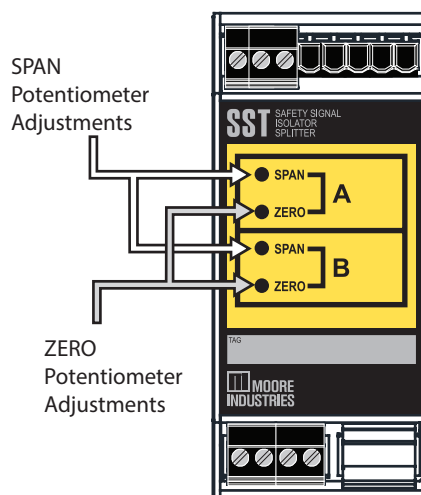
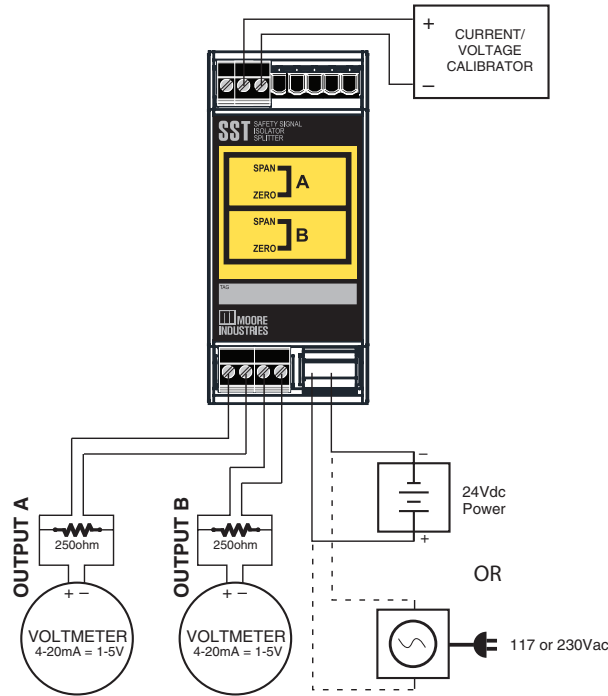
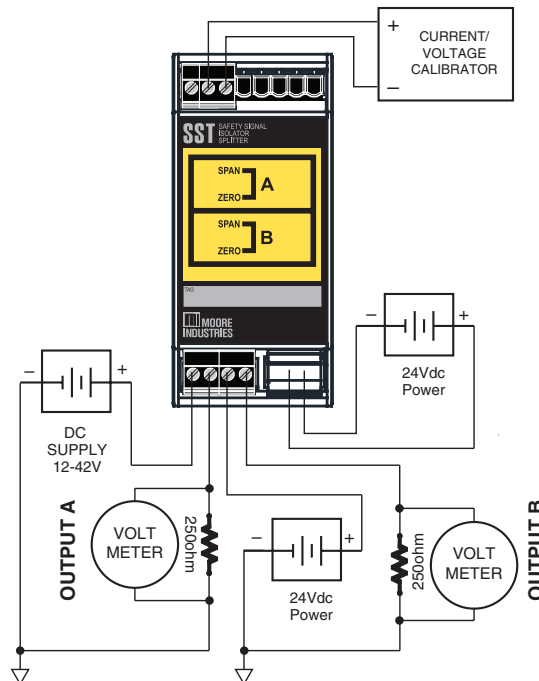




Figure 2.5. Setting up to Calibrate the SST Splitter (Two Output Channels)



### -EP Option Wiring



### Bench Check

If you are using HART devices in conjunction with your SSX or SST we highly recommend that you perform a bench check of the devices prior to installing them in the field. Doing this will ensure that they are operating within your expectations or requirements.

**Table 2.** Bench Check Equipment for the SSX and SST

Device	Specifications
HART Slave Device	Use your HART slave device(s) that will be used for your final installation.
HART Communicator	HART Communicator Model 275 or equivalent. Device used should be capable of reading a valid HART signal (and 4-20mA analog signal).
Power Supply	Calibrated, regulated 24Vdc ( $\pm 10\%$ ) source, nominal, for SSX or dc-powered SST; calibrated, regulated 117Vac or 230Vac ( $\pm 10\%$ ) source, nominal, for ac-powered SST
Load Resistor	250 ohm with $\pm 0.01\%$ precision; required only if using a Voltmeter to calibrate the analog output from the SST/SSX (voltage drop across the precision resistor; 4-20mA=1-5V)
Multimeter	Calibrated to an accuracy of $\pm 0.025\%$ , or better; such as Fluke Model 725, or similar
Screwdriver	Standard (blade) head; head width 2.5mm (0.1in), maximum width

All referenced product names are the sole property of their respective manufacturers.

## Bench Check Procedure

### SSX Bench Check

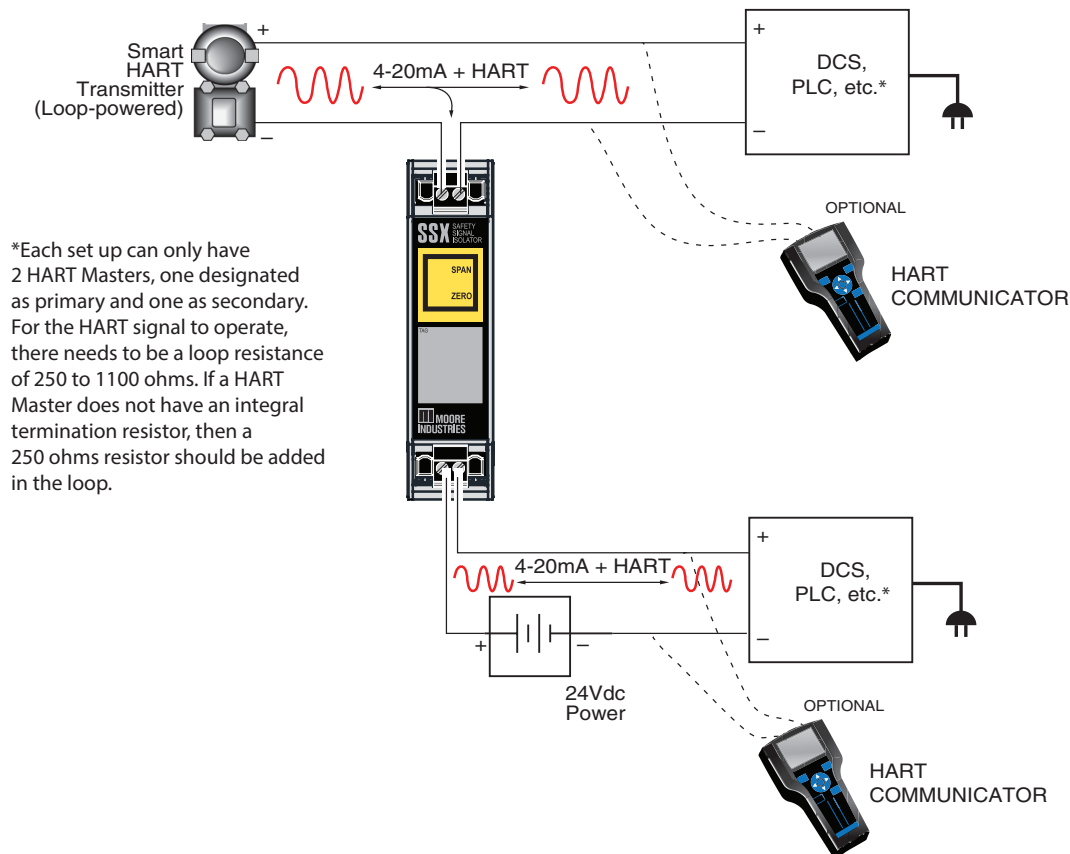
1. Connect your SSX as shown in Figure 2.6.
2. Using your HART Communicator verify that you can read HART data on the Input side of the SSX.
3. Using your HART Communicator verify that you can read HART data on the Output side of the SSX.

**Note:** If your SSX has the -0HART option verify that there is no HART data on the Output side of the SSX.



4. With your HART Communicator connected to the Output side of the SSX send a HART command to your HART slave device to verify that the HART signal will pass from the SSX's Output side to the SSX's Input side (except units with the -0HART option).
5. Remove the power supply from the Output side of the SSX and verify that the HART signal is still active on the Input side.

Figure 2.6. Bench Check setup for the SSX



### SST (Single Output Channel) Bench Check

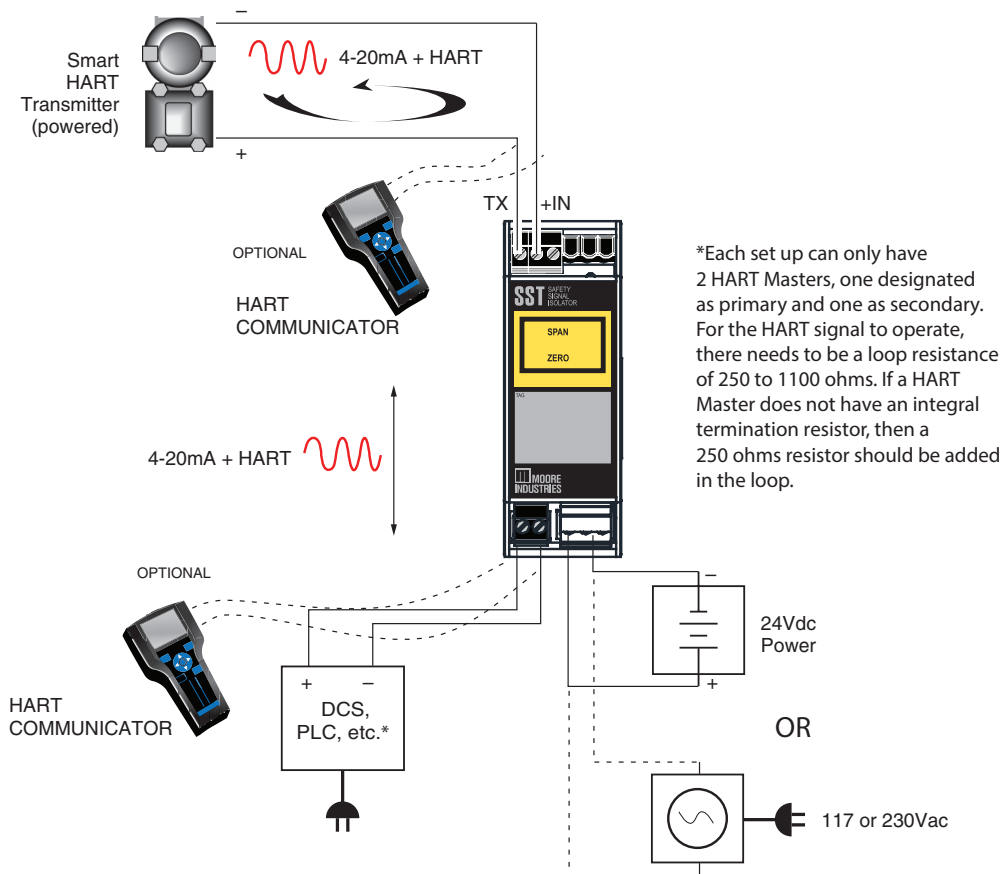
1. Connect your SST (Single Output Channel) as shown in Figure 2.7, 2.8 or 2.9.
2. Using your HART Communicator verify that you can read HART data on the Input side of the SST.
3. Using your HART Communicator verify that you can read HART data on the Output side of the SST.

**Note:** If your SST (Single Output Channel) has the -0HART option verify that there is no HART data on the Output side of the SST.

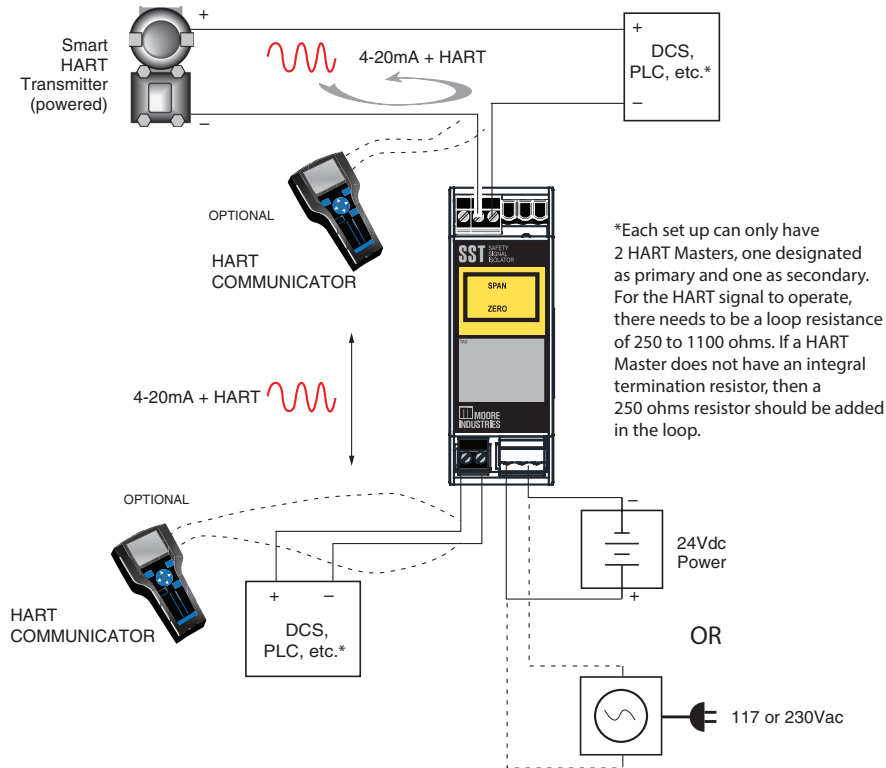


4. With your HART Communicator connected to the Output side of the SST send a HART command to your HART slave device to verify that the HART signal will pass from the SST's Output side to the SST's Input side (except units with the -0HART option).
5. Remove the power supply from the SST and verify that the HART signal is still active on the Input side (except when using the TX terminal to power your HART slave device).

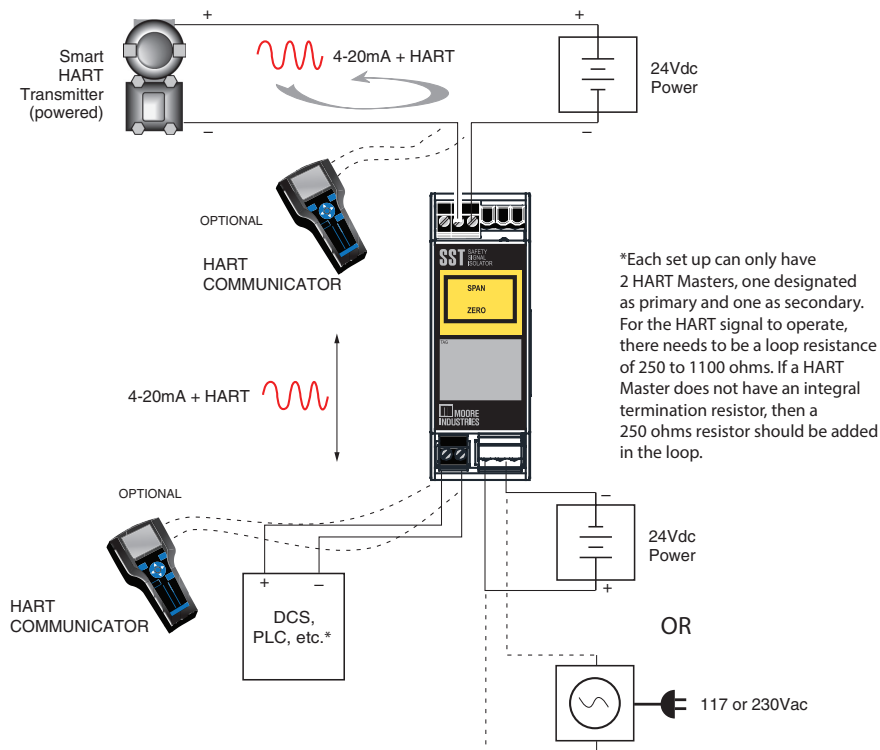
**Figure 2.7.** Bench Check Setup for SST (when using the SST -TX terminal to power your HART transmitter)



**Figure 2.8. Bench Check Setup for SST (HART transmitter powered by PLC)**



**Figure 2.9. Bench Check Setup for SST (HART transmitter powered by an external power supply)**



### SST Splitter (Two Output Channel) Bench Check

1. Connect your SST Splitter (Two Output Channels) as shown in Figure 2.10, 2.11 or 2.12.
2. Using your HART Communicator verify that you can read HART data on the Input side of the SST.
3. Using your HART Communicator verify that you can read HART data on Output A of the SST.

**Note:** If your SST (Two Output Channels) has the -0HART option verify that there is no HART data on either Output channel of the SST Splitter. Conversely, if your SST (Two Output Channels) has the -2HART option verify that you can read the HART data on Output A and Output B.



4. With your HART Communicator connected to the Output side of the SST send a HART command to your HART slave device to verify that the HART signal will pass from the SST's Output side to the SST's Input side (except units with the -0HART option).
5. Remove the power supply from the SST and verify that the HART signal is still active on the Input side (except when using the TX terminal to power your HART slave device).

**Figure 2.10.** Bench Check Setup for SST Splitter with TX (when using the SST -TX terminal to power your HART transmitter)

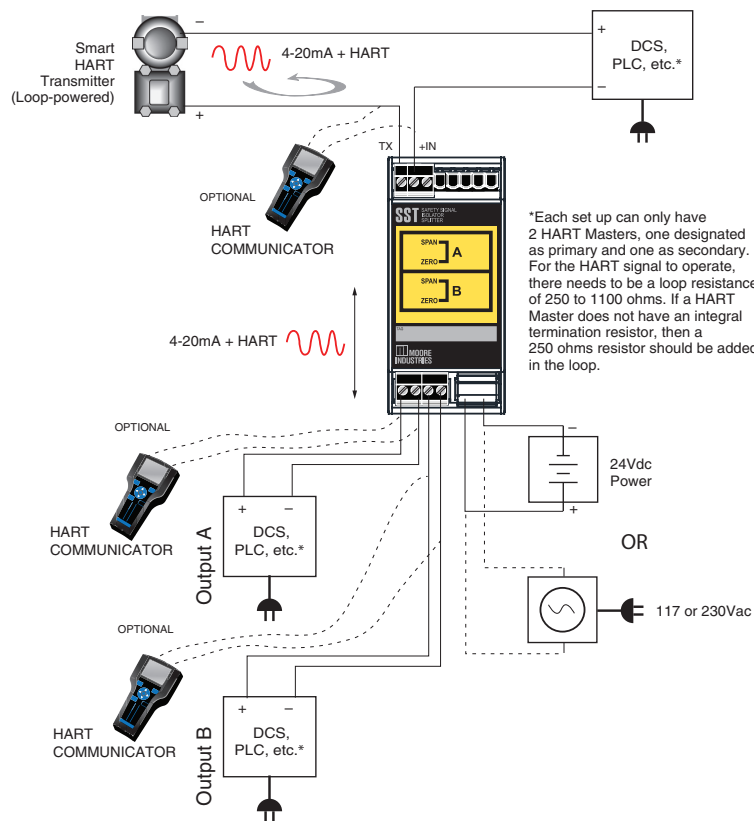


Figure 2.11. Bench Check Setup for SST Splitter (HART transmitter powered by PLC)

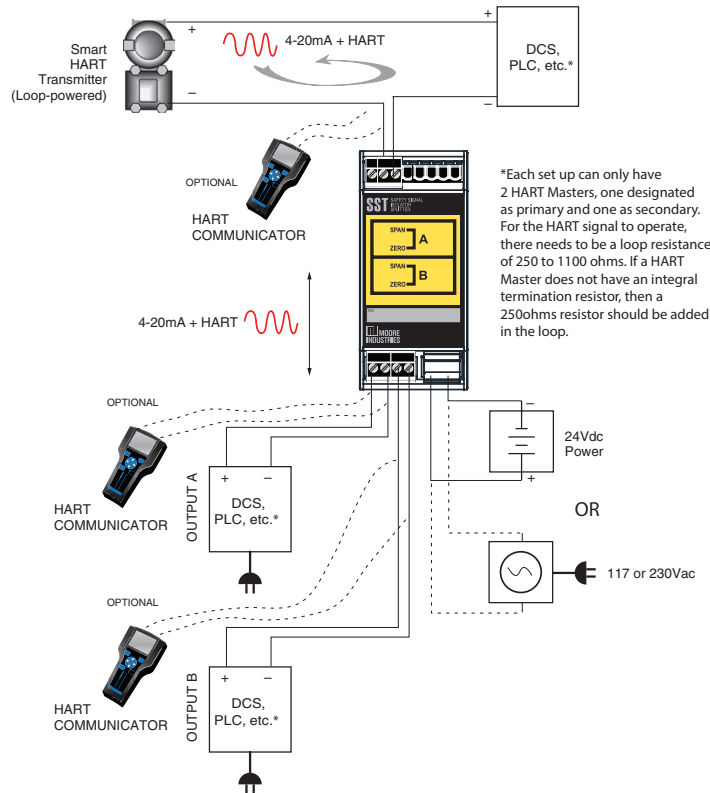
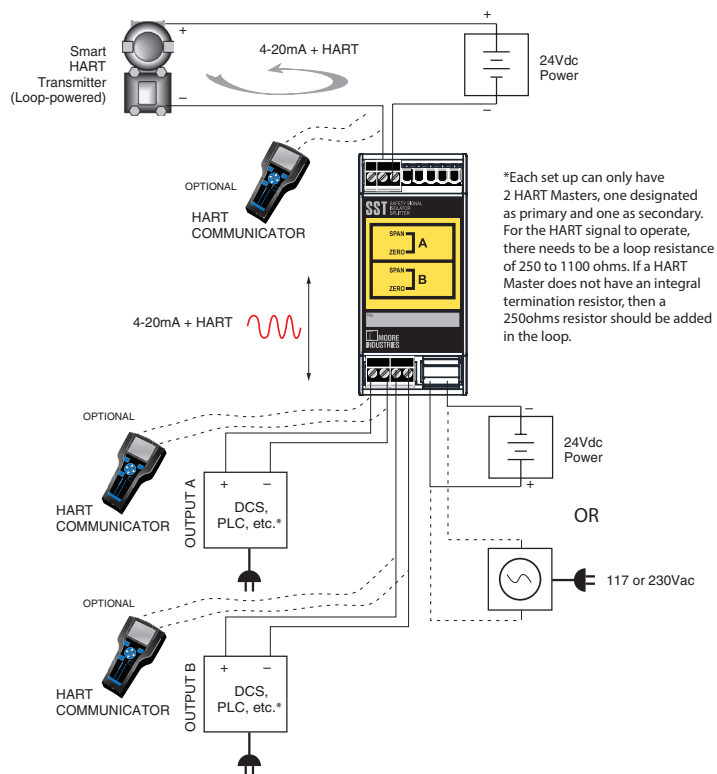


Figure 2.12. Bench Check Setup for SST Splitter (HART transmitter powered by an external power supply)



## Section 3 - Installation and Wiring

Instructions in this section and others may require special precautions to ensure the safety of the personnel performing the operations. Notes, Cautions and Warnings that may cause potential safety issues are indicated throughout this manual by symbols, please refer to Page 3 of this manual to view and familiarize yourself with these safety message symbols.

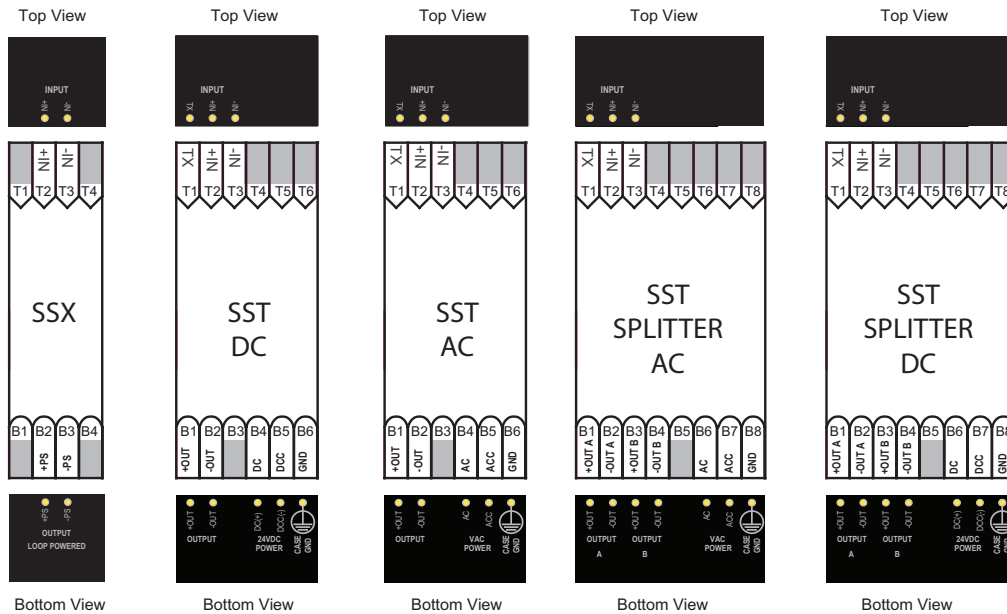
The SSX and SST housings accommodate both 32mm, DIN-style G-rail (EN50035) and 35mm Top Hat rail(EN50022). Figure 3.2, Figure 3.3, and Figure 3.4 show the dimensions of the housing for each type of isolator.

**Note:** Make sure to calibrate and bench check the instruments prior to installation. Also, install all instruments in their intended application and on their rail before making any electrical connections. Allow enough room for pivoting instruments vertically on the rail for removal in applications involving multiple banks of SSXs and/or SSTs.



## Terminal Designations

Figure 3.1. Terminal Designations





## Dimensions

Figure 3.2. Dimensions of Aluminum DIN-Housed SSX Isolator

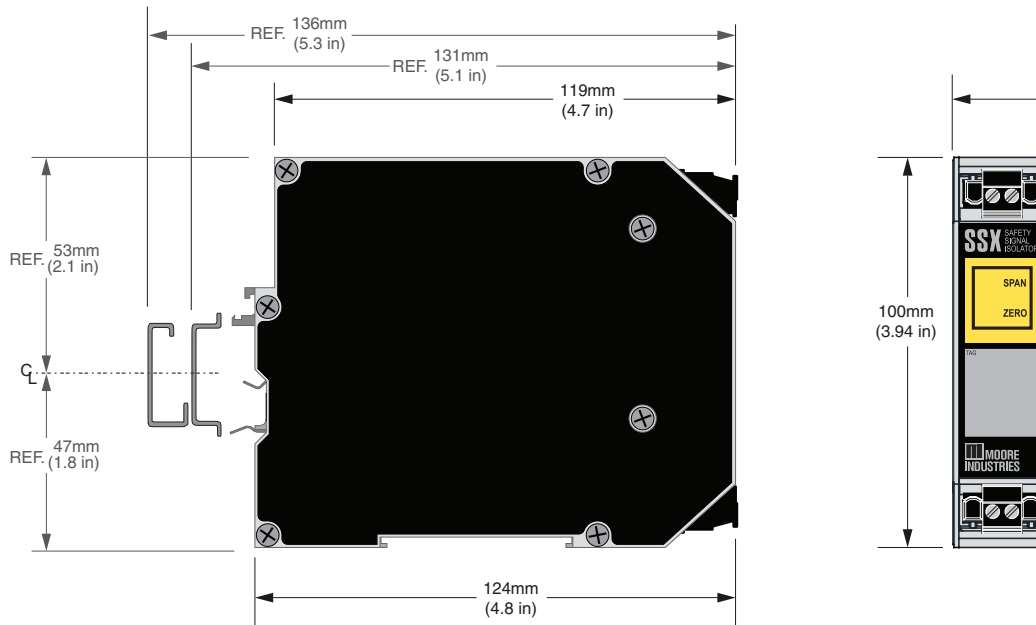
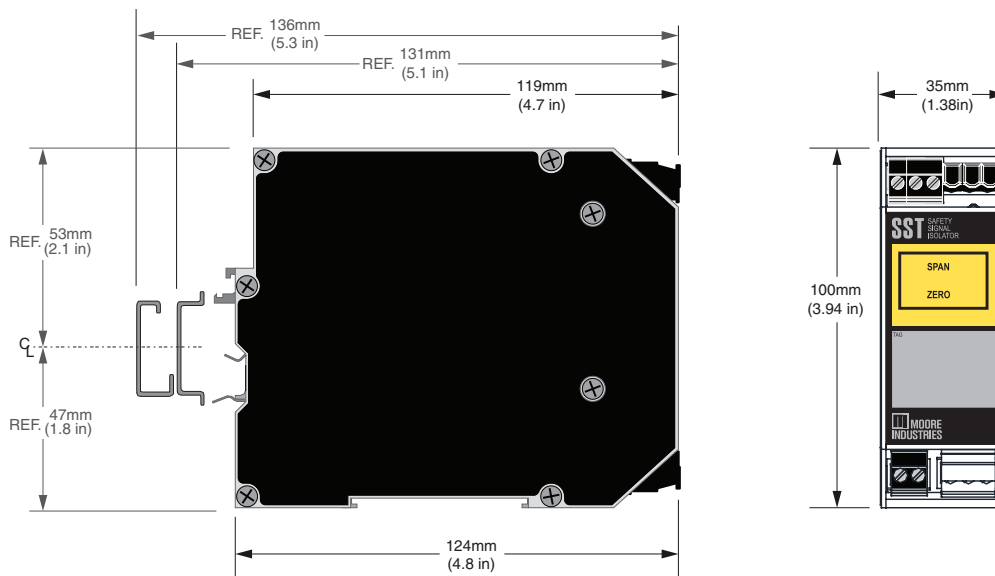
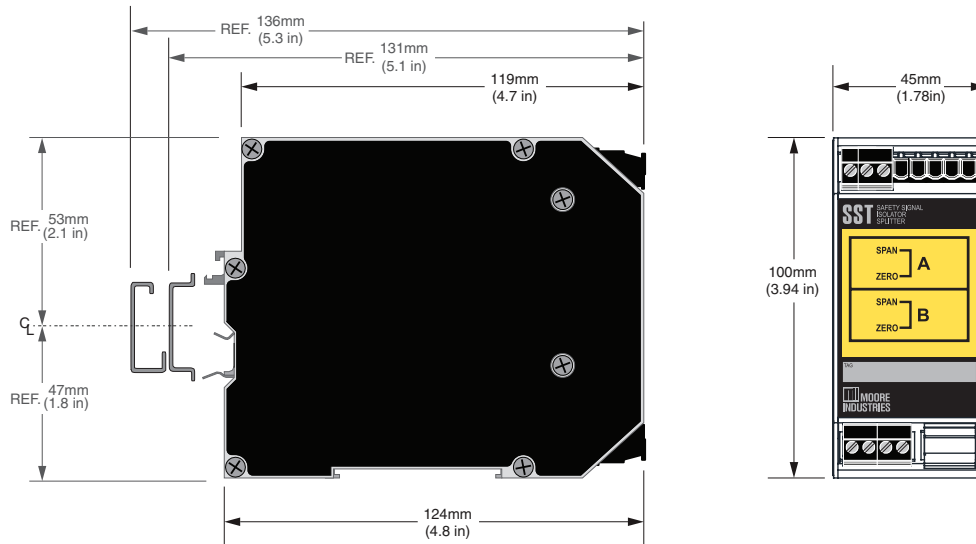


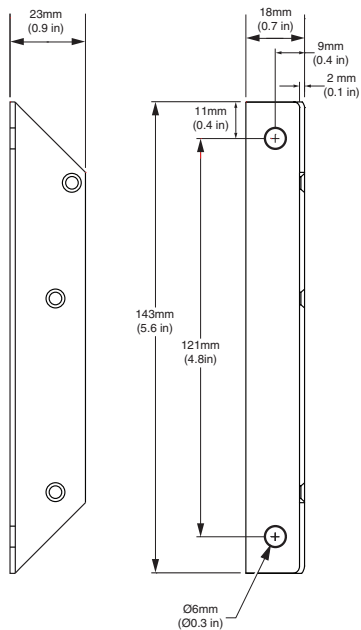
Figure 3.3. Dimensions of Aluminum DIN-Housed SST Isolator



**Figure 3.4.** Dimensions of Aluminum DIN-Housed SST Splitter



**Figure 3.5.** The SST Splitter and the SST and SSX Isolators mounted with the FLB flange bracket and the bracket's dimensions.



## Electrical Connections

When installing any Moore Industries product, always follow all local regulations and standards for grounding, shielding, and safety.

***WARNING:*** Terminals on this unit may be connected to hazardous voltages. Before making ANY connections to this unit, always remove power from the loop or instrument power terminals.



## Installation Category

All terminals are rated CAT I.

## Equipment Ratings

The SSX and SST do not generate hazardous voltages, they provide a low current (4-20mA) or voltage (1-5V) input and a 4-20mA output. Products connected to the SSX or SST should be designed to receive this type of input.

***WARNING:*** If this unit is used in a manner not specified by Moore Industries, the protection provided by the equipment may be impaired.



## Switches and Circuit Breakers

For SST AC powered units, a switch or circuit breaker must be wired in series with the AC power conductors. The switch or circuit breaker used must be located within three meters of the unit.

The circuit breaker or switch will only remove power to the unit, hazardous voltages may still be connected to other terminals on the unit.

## 117Vac, 230Vac, and 24Vdc Supply Wiring

All power connections should be made with 14 or 16 AWG (2mm<sup>2</sup> or 1.3mm<sup>2</sup>) wire.

The end of each conductor should be stripped no more than 0.25in (7mm). The end of the stripped wire should be tinned with solder, or inserted into a ferrule and crimped before being placed into a terminal block.

Tighten the screws on the terminal block to 4.4 - 5.3 lbf·in (0.5 - 0.6 N·m).

## Input/Output Wiring

The Input/Output connections can be made with 14 to 24 AWG (2.5mm<sup>2</sup> to 0.2mm<sup>2</sup>) wire.

The end of each conductor should be stripped no more than 0.25in (7mm).

Tighten the screws on the terminal block to 4.4 - 5.3 lbf·in (0.5 - 0.6 N·m).

## Protective Earth Conductor

The Protective Earth Conductor shall be of equal or larger size wire than the other two power conductors.

The Protective Earth Conductor shall be the first conductor connected to the unit when the unit is being wired. It shall be the last conductor removed when the unit is being un-wired.

### Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

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

**Note:** *Some of Moore Industries' instruments can be classified as receivers (IPT2, IPX2, etc.) and some can be classified as transmitters (TRX, TRY, etc.) while some are both a receiver and a transmitter (SPA2, HIM, etc). Hence, your shield ground connections should be appropriate for the type of signal line being shielded. The shield should be grounded at the receiver and not at the signal source.*



### CE Certification-related Guidelines

The grounding and wiring practices described above must be followed in order for the unit(s) to meet the requirements set forth in EMC standard EN61326.

The Low Voltage Directive also applies to AC powered versions of the SST. In order to comply with EN61010-1 (Low Voltage Directive) all guidelines in this section must be followed.

## Installation in Hazardous Locations

This section contains important information regarding installation of the SSX/SST in Hazardous Area Locations.

*This equipment is suitable for use in Class I, Division 2, Groups A, B, C & D or non-hazardous locations only. Field wiring shall be rated for 85°C.*

**WARNING:**

*Explosion Hazard. Do not disconnect while circuit is live unless area is known to be non-hazardous.*

**AVERTISSEMENT:**

*Risque d'explosion. Ne pas débrancher tant que le circuit est sous tension, à moins qu'il ne s'agisse d'un emplacement non dangereux.*

**WARNING:**

*Explosion Hazard. Substitution of components may impair suitability for Class I, Division 2.*

**AVERTISSEMENT:**

*Risque d'explosion. La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.*

## Special Conditions of Use

### cFMus Installations

#### Nonincendive Applications

#### Class I, Division 2, Groups A-D

The SST shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

The SSX shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

## **Section 4 - Operation and Maintenance**

When the SSX or SST are used in a SIL rated safety application, please refer to the Safety Instrumented Systems section of this manual before operating your unit.

### **Operation**

Once calibrated, installed, and supplied with the correct power, the SSX/SST begins to operate immediately. Depending upon environmental conditions, it can be expected to operate unattended for extended periods of time.

### **Maintenance**

Moore Industries recommends that the calibration of this instrument should be checked every year and re-calibrated only when necessary. In addition, we suggest a quick check for terminal tightness and general unit condition. Always adhere to any site requirements for programmed maintenance.

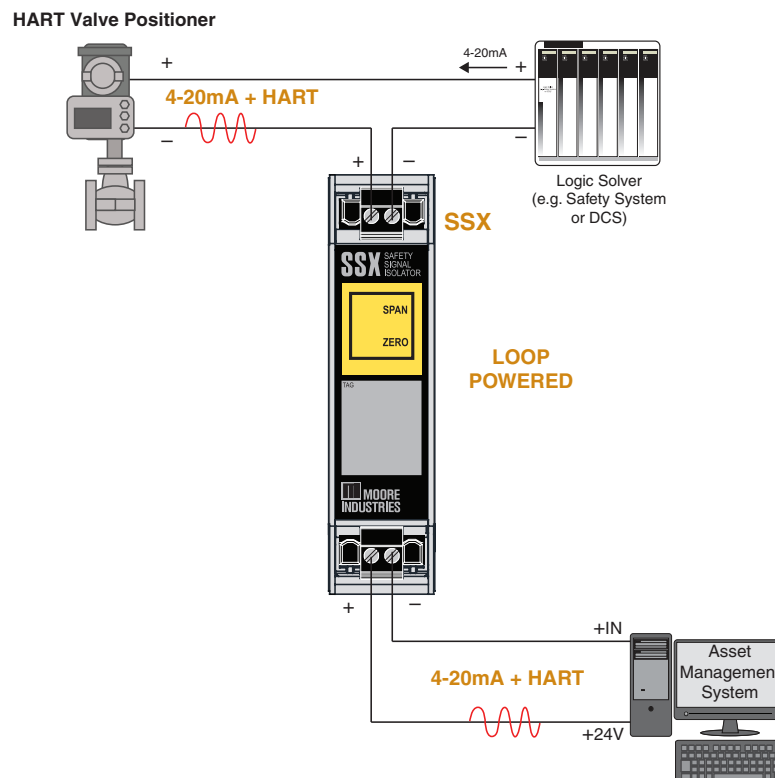
## Section 5 - Applications

This section provides some examples of typical applications for the SSX and SST.

### Isolate and Pass Critical HART Data

When HART data is required for diagnostics, maintenance or calibration the SSX is able to isolate and pass HART data from the transmitter to the host system (See Figure 5.1).

**Figure 5.1.** The SSX passes HART data to asset management systems or other host control and monitoring systems.



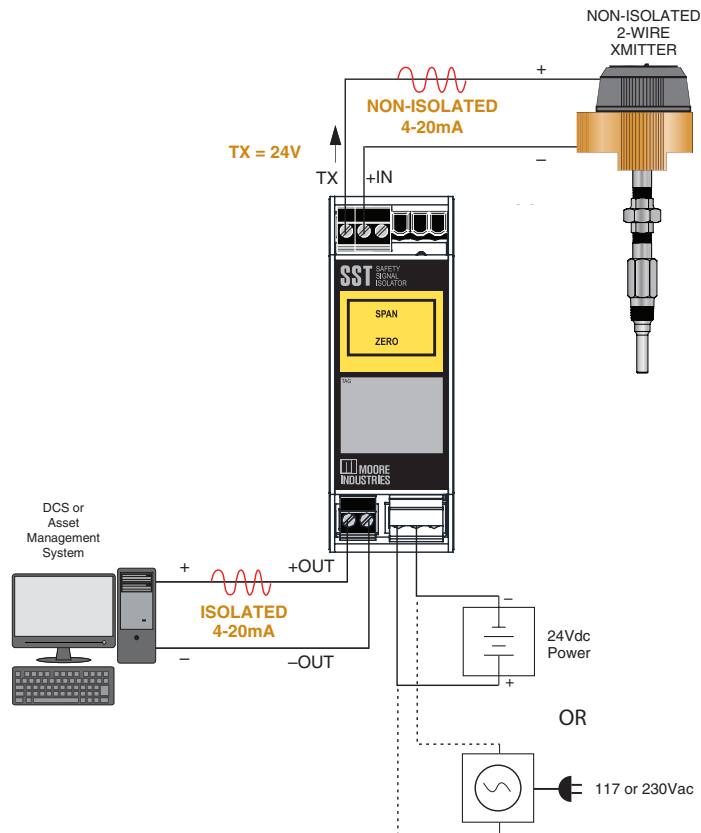
**Note:** For the HART signal to operate, there needs to be a loop resistance of 250 to 1100 ohms. If a HART Master does not have an integral termination resistor, then a 250 ohms resistor should be added in the loop.



### Isolate and Power a 2-Wire Transmitter

In addition to isolation, the SST can also provide 24V power to a 2-wire, output-loop powered instrument. This eliminates the need for an additional power supply (See Figure 5.2).

Figure 5.2. The standard -TX Transmitter Excitation of the SST allows it to supply loop power to a 2-wire transmitter.



**Note:** For the HART signal to operate, there needs to be a loop resistance of 250 to 1100 ohms. If a HART Master does not have an integral termination resistor, then a 250 ohms resistor should be added in the loop.



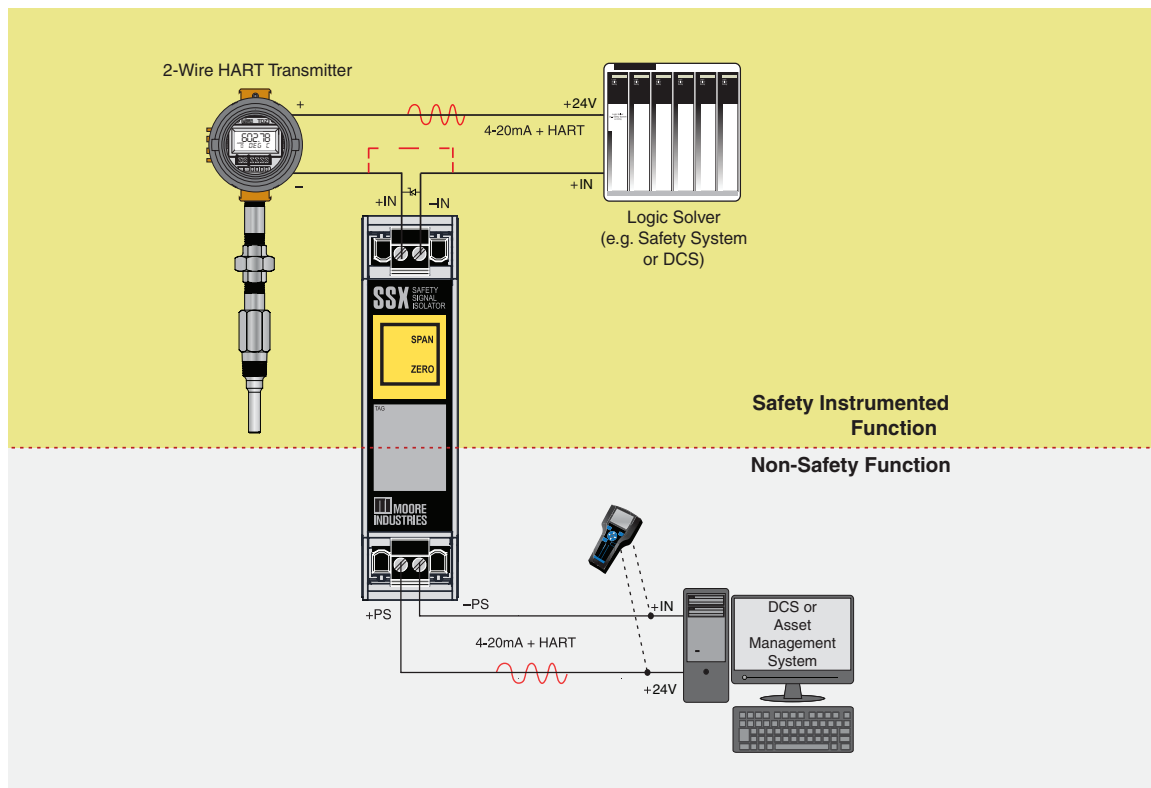


## Isolation of Safety Systems

Use the SSX to isolate your SIF (Safety Instrumented Function) from your basic process control system. While power for the SSX is derived from the output side of the loop, disconnection or loss of power will not affect the input loop's signal integrity. This allows maintenance to be performed on the non-critical side of the loop (See Figure 5.3).

The SSX has a negligible impact on the SIF since only the input circuit failures need to be considered. Dangerous failures for the SSX in this application are <5FITS (See FMEDA report for specific failure rates of all models and configurations).

**Figure 5.3.** The SSX with -LMD option provides area isolation for your safety system and still allows maintenance of the SSX and the output side of the loop.



**Caution:** Sensor for the Safety System shall not be the same sensor for controlling the non safety process. Thus the DCS or Asset Management System can only be used for monitoring the Safety System Sensor.



**Note:** If the -LMD option is used, confirm that the loop can reach full current with the compliance voltage of the loop maintenance diode (8.2V) in the loop. (i.e. set the instrument output to full, disconnect the SSX or SST from the loop and check that the loop current is still full).

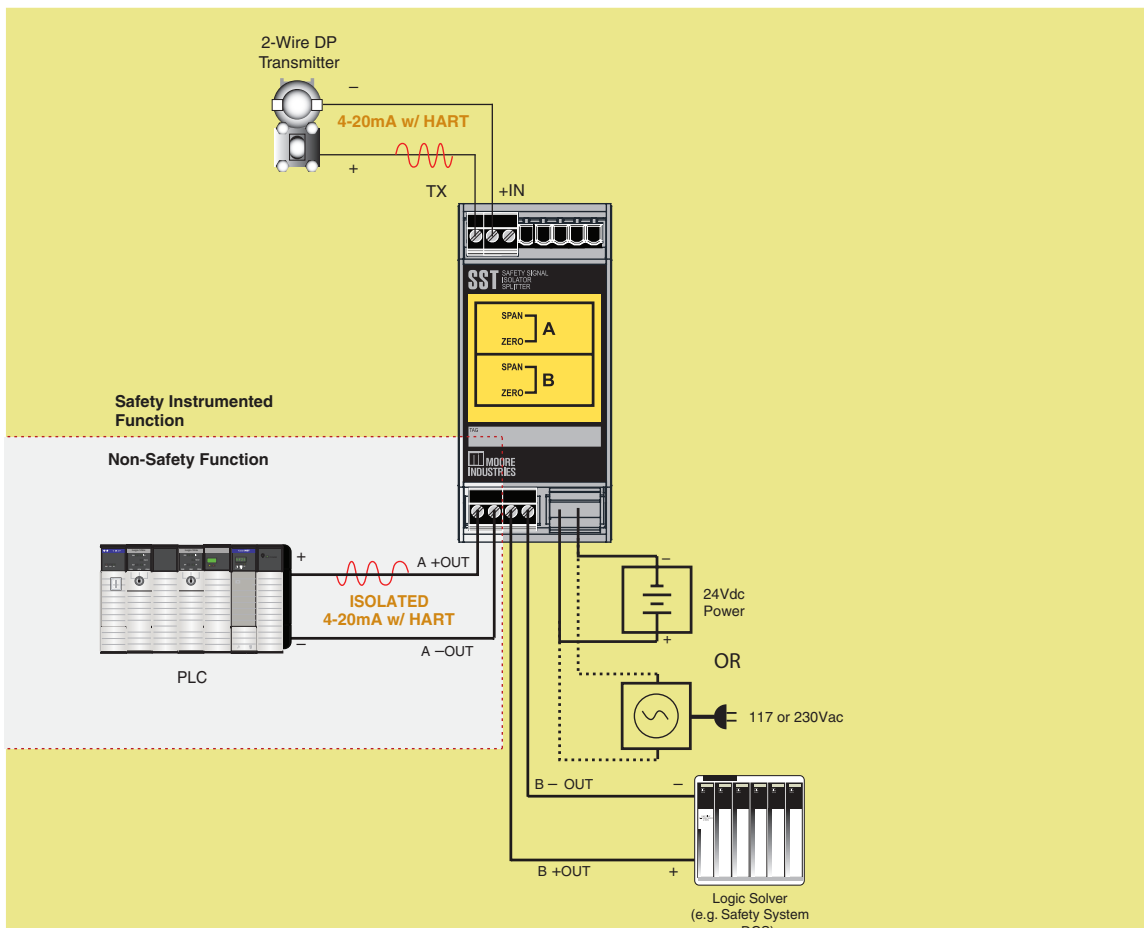


### “Sharing” or “Splitting” Process Signals

When isolation is also required in the safety loop, an SST splitter can be used. The SST Splitter takes one input and creates two identical, completely isolated outputs to two separate monitoring or control devices. Additionally, the SST functions as a HART splitter that passes valuable HART data to one or both of the SST's independent outputs. This is especially important when asset management systems need to maintain a digital HART connection with critical valves or instruments for diagnostic monitoring or calibration record keeping. This also makes it very convenient when using HART handhelds, modems or programming devices to configure remote field transmitters from control rooms (See Figure 5.4).

In this example HART is blocked in the SIF on output B (default). If HART pass-through is required on both outputs, the -2HART option needs to be ordered.

**Figure 5.4.** The SST Splitter takes one process signal and delivers two completely isolated signal outputs. HART data can be passed to one or both outputs.



**Caution:** Sensor for the Safety System shall not be the same sensor for controlling the non safety process. Thus the DCS or Asset Management System can only be used for monitoring the Safety System Sensor.

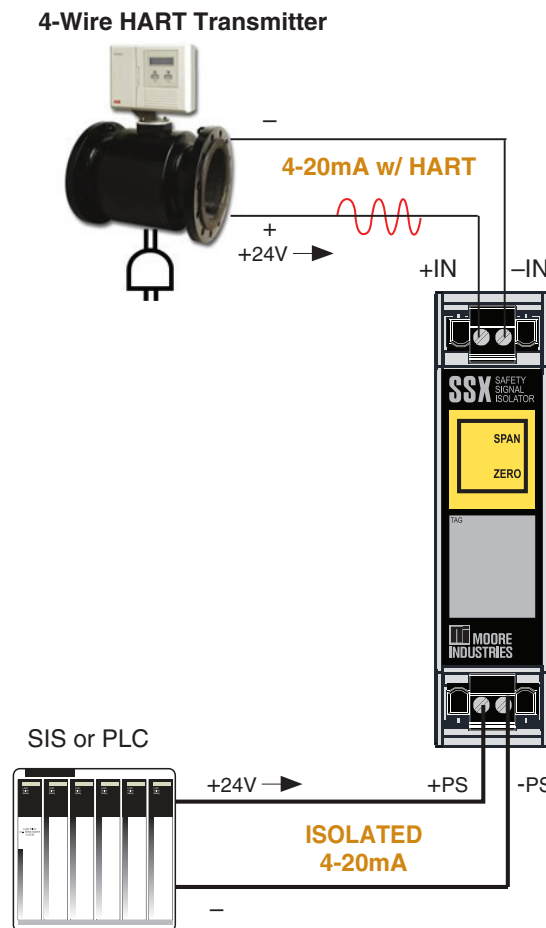
**Note:** For the HART signal to operate, there needs to be a loop resistance of 250 to 1100 ohms. If a HART Master does not have an integral termination resistor, then a 250 ohms resistor should be added in the loop.



## Solve “Bucking” Power Supplies and Filter HART

When two devices (such as a 4-wire HART transmitter and a DCS) are trying to source power to the same loop, the result is a non-functioning loop. When neither of the devices can be eliminated, the solution is an SSX. It can operate with powered inputs from both sides, thus restoring normal operations to the loop while also passing any HART signals. Sometimes older DCS and PLC input cards have trouble with HART signals. When this problem arises you can order the SSX with option code -0HART and the SSX will filter the HART signal (See Figure 5.5).

**Figure 5.5.** The SSX solves bucking power supplies. Also, when used with the -0HART option, the SSX acts as a current isolator that stops a HART signal from reaching a PLC, DCS or other receiving device.



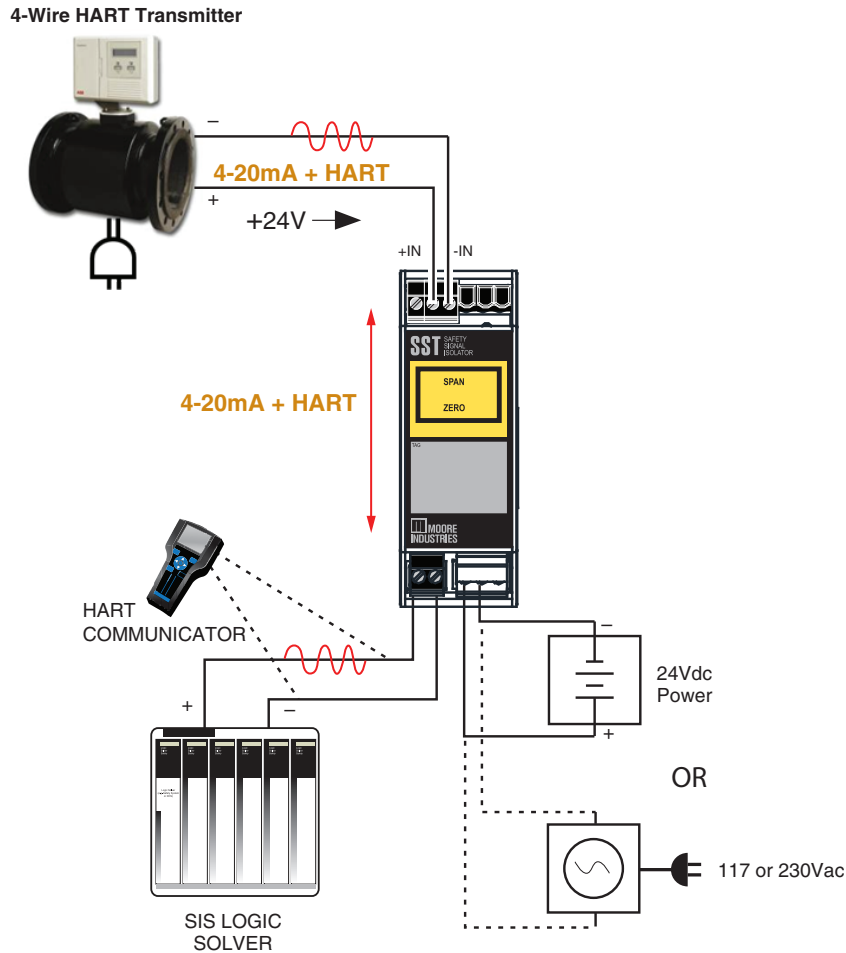
**Note:** For the HART signal to operate, there needs to be a loop resistance of 250 to 1100 ohms. If a HART Master does not have an integral termination resistor, then a 250 ohms resistor should be added in the loop.



### Solving 4-Wire Transmitter Problems

Figure 5.6 shows how to use the 4-Wire SST to provide the same kind of power supply isolation in applications that call for the use of 4-wire transmitters.

**Figure 5.6.** Connecting the SST to provide power supply isolation for 4-wire transmitters



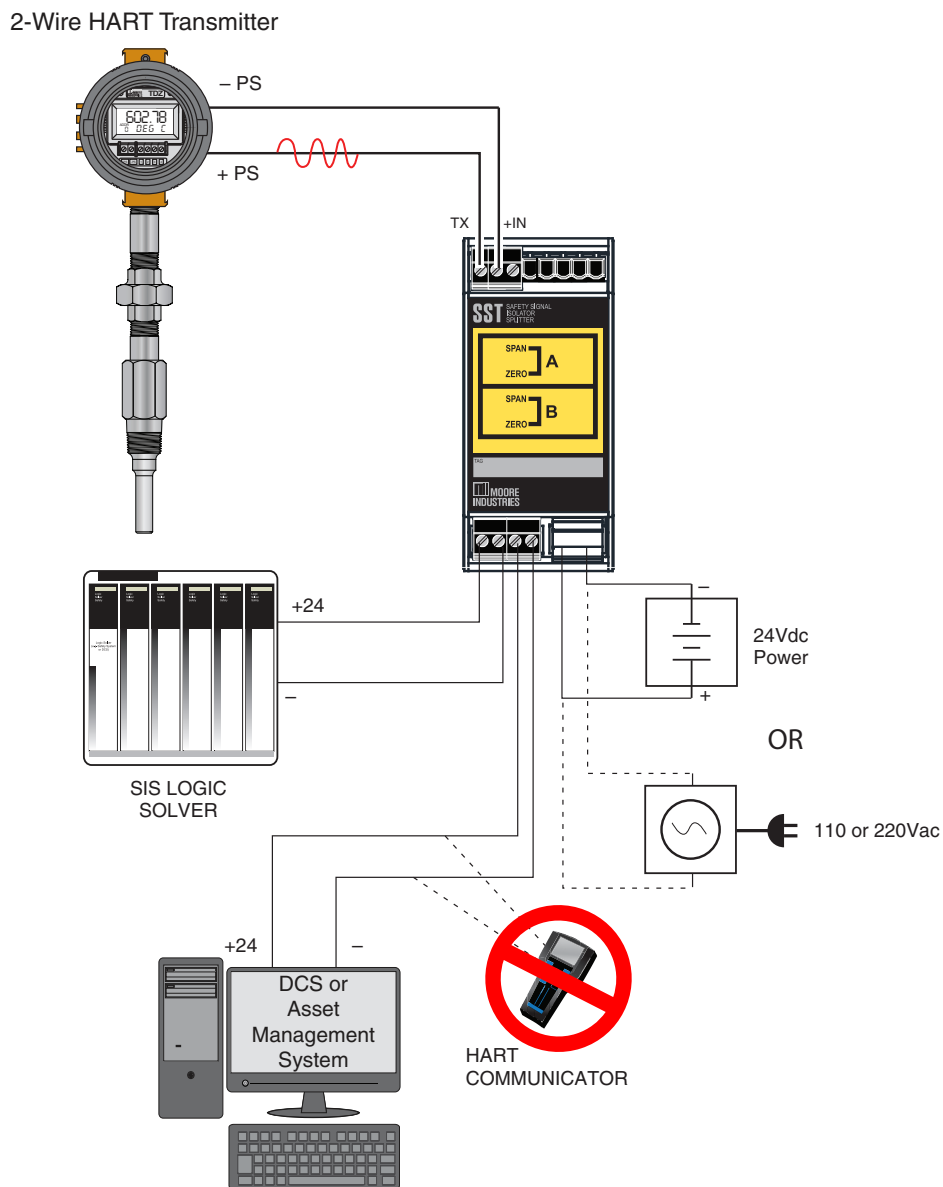
**Note:** For the HART signal to operate, there needs to be a loop resistance of 250 to 1100 ohms. If a HART Master does not have an integral termination resistor, then a 250ohms resistor should be added in the loop.



## Duplicate Signal to Two Legacy Systems

When there are two systems which need to read the same analog signal from an instrument, the SST Splitter can be used. Sometimes older systems want to source power to the instrument and also have trouble with HART signals. In this case, the SST splitter can be used with -EP and -0HART options. The SST can power a HART instrument using TX power, reads the input and provides duplicate 4-20mA signals on each of its outputs. Each output sinks power and filters out the HART signal.(See Figure 5.7).

Figure 5.7. Connecting the SST Splitter with -EP and -0HART options



## Section 6 - SSX/SST in Safety Instrumented Systems

The SSX/SST is designed for use as an element of a safety instrumented system as defined by IEC61508-4 para 3.4.1 as a Type A device.

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

### Functional Safety Description

The SSX/SST has been certified, by *exida*® to IEC61508:2010 for systemic integrity up to SIL 3 and random integrity up to SIL2 in a low demand application. This means that the SST and SSX are approved for single use in Safety Instrumented Systems (SIS) up to SIL2 for Hardware Fault Tolerance (HFT) of zero (0).

**Note:** When used in monitor mode, where only the input circuit is part of the safety function (see Figure 5.3), the SST and SSX may be used in SIS up to SIL3.



### Failure Rate Data

The SSX/SST FMEDA report (Moore Industries' Document No: 700-702-36) provides the failure data (including PFD and SFF) required for calculations to use the SSX/SST as part of a Safety Instrumented System.

### Product life

The product life of the SSX/SST is 50 years (based on worst case component life data).

However, IEC 61508-2, section 7.4 states that a useful lifetime based on experience has more weight than the calculated figures; Note 3 in the section comments that the useful lifetime of a transmitter is most often within 8 to 12 years.

### Installation

The SSX or SST can be connected in 2 ways:

- a. SSX/SST is part of the safety function (see Fig 5.2 as an example)
- b. SSX/SST is inserted into a safety loop but the output is used for monitoring purposes only and is not part of the safety function (see Fig 5.1 as an example)

In addition a Loop Maintenance Zener Diode (-LMD option) provided at input terminals, allows the SSX or SST to be removed from the loop without interrupting loop continuity (see Fig 5.3 as an example).

If the -LMD option is used, confirm that the loop can reach full current with the compliance voltage of the loop maintenance diode (8.2V) in the loop. (i.e. set the instrument output to full, disconnect the SSX or SST from the loop and check that the loop current is still full).

The FMEDA report provides failure data to cover all these options.

## Configuration

The SSX/SST is a passive device that requires no user configuration. For SIL1 and SIL2 applications, it can be connected directly to the safety system to monitor the loop. The input circuit design is such that its failure will not compromise the safety function of the system.

The following considerations and restrictions will apply when using the SSX/SST in a safety application:

For non-safety systems, the accuracy of the SSX/SST is 0.1% of span. For safety systems, up to 3% of span is considered safe.

## Process Safety Time

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

The SSX/SST has a characteristic response time (end to end) of <100mSec.

## Input Types

The SSX/SST can be ordered to accept 4-20mA or 1-5V. It is the end user's responsibility to ensure that the chosen device connected to the SSX/SST's input is compatible.

## Broken Wire Detection

When the input to an SSX (2 Wire) is broken, the output is driven to <3mA. When the input to an SST (4 Wire) is broken, the output will be driven to <1mA.

## Proof Test Procedure

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

Calculation of the required proof test interval can be made using data in the FMEDA report (Moore Industries' Document No: 700-702-36).

A proof test interval of 3 years is recommended for a single SSX/SST used in a typical SIL 2 low demand application (15% of the SIL band being allocated to the SSX/SST). The proof tests described in Table 2 are designed to cover all possible dangerous undetected faults that can be detected without opening the unit. Proof Test coverage: SSX 71%, SST 88%, and SST Splitter 84%.

When using the product in a safety function, the proof test can be tailored to the specific SSX/SST configuration since any faults related to unused features/configurations will not affect the safety function. For example, the note in Step 6 in *Proofing Test Steps for 4-wire SST* can be modified to omit the TX (24V Transmitter Excitation) supply test if not used.

Periodically testing the SSX/SST, using the proof test steps outlined below, the cumulated PFDAVG value can be reduced to a smaller but non-zero value. To completely test for all possible dangerous undetected faults, the unit must be sent back to the factory for a comprehensive proof test inspection.

### Proofing test steps for 2-wire SSX

Step	Action
1	Bypass the safety DCS/PLC/Transmitter or take other appropriate action to avoid a false trip.
2	Disconnect all wires from the SSX. Using an ohmmeter, measure the resistance between the case and all exposed pins on the front. Verify that the measured resistance is greater 1M $\Omega$ . This test for shorts between the input or output to the case.
3	Connect SSX input in series to Calibrator. Be sure to use correct polarity.
4	Connect SSX output in series with 250 $\Omega$ resistor and 24Vdc power supply. Be sure to use correct polarity.
5	Connect DVM across 250 $\Omega$ Resistor.
6	Perform 5 point linearity test on input to output with input range of 4-20mA (or 1-5V for Voltage input configuration). Verify that accuracy is within +/-0.5% of span at each step.
7	Increase input current to 35mA. Verify that output remains under 30mA.
8	Open Input and verify that output drops below 3mA.
9	For -LMD Option: Disconnect SSX from LMD terminal plug and verify voltage across LMD terminal plug is 8.2v +/- 5%
10	Disconnect SSX from Test equipment and restore Safety System connections to state prior to testing.



## Proofing test steps for 4-wire SST

Step	Action
1	Bypass the safety DCS/PLC/Transmitter or take other appropriate action to avoid a false trip.
2	Disconnect all wires from the SST. Using an ohmmeter, measure the resistance between the case and all exposed pins on the front. Verify that the measured resistance is greater than 1 MΩ with the exception of the CASE GND pin which should have 0Ω resistance. This test for shorts between the power, input or output to the case and verifies that ground is connected to case.
3	Connect SST input in series to calibrator using SST +IN and -IN. Be sure to use correct polarity.
4	For NON-EP Option: Connect SST output to 250Ω resistor and be sure to use correct power supply (24Vdc, 117Vac or 230Vac).  For -EP Option: Connect SST output in series with 250Ω resistor and 24Vdc power supply. Be sure to use correct polarity.
5	Connect DVM across 250Ω Resistor.
6	Perform 5 point linearity test on input to output with input range of 4-20mA (or 1-5V for Voltage input configuration). Verify that accuracy is within +/-0.5% of span at each step.
7	Increase input current to 35mA. Verify that output remains under 30mA (drops below 1mA for units with -RO option)
8	Open Input and verify that output drops below 1mA (remains under 30mA for units with -RO option).
9	For Splitter, repeat steps 4-8 for second Output channel.
10	For -LMD Option: Disconnect SST from LMD terminal plug and verify voltage across LMD terminal plug is 8.2v +/- 5%
11	If TX is used, verify TX voltage is in spec with 22mA load
12	Disconnect SST from Test equipment and restore Safety System connections to state prior to testing.

## Repair and Replacement

The SSX/SST is not intended to be repaired on site and has no components needing maintenance or regular replacement. On device failure, the SSX/SST should be returned to Moore Industries World Headquarters in North Hills, CA USA for repair and refurbishment/ Refer to the return process described at the end of this manual.

**WARNING:** The SSX/SST is a certified Safety component. Repair or replacement of any component without authorization from Moore Industries will invalidate any remaining warranty and the IEC61508 certification.

## Section 7 - Specifications

### Performance

**Accuracy:** ±0.1% of span; Functional Safety Accuracy

**Stability:** ±0.2% of reading per year

**Isolation:** Continuous:

SSX: 500Vrms between Input, Output and Case; SST: 500Vrms Between Input, Output, Case and Power

**Tested To:** SSX: 1500Vrms between Input, Output and Case for 1 minute; SST: 1500Vrms between Input, Output, Case and DC Power for 1 minute (2300Vrms from AC Power to Input, Output and Case for 1 minute)

**Response Time (analog output):** 100msec max. to 99% of output

**Input Resistance:** 100 ohms standard; 250 ohms with -IZ250 option

**Input Overrange Protection:** 250% of full scale

**Ripple:** <10mV when measured across 250 ohm resistor

**Burden:** For Current Input, 2V for -IZ100 option; 5V for -IZ250 option; 8.2V for -LMD option; For Voltage Input, 1 Mega Ohm.

**Load Effect:**

0.01% of span from 0-100% of rated output (current only)

**Power Supply:** SST: 24DC ±10%; 117AC 50/60HZ, ±10%; 230AC 50/60HZ, ±10%; SSX: 12-42DC;

TX Supply 24V +/-15% @24mA (regulated)

**Power Consumption:**

SST: Single channel: 3 watts max.; Dual output channel: 5 watts max

**Power Supply Effect:**

<0.05% of Span

**Power Supply Rejection:**

Exceeds 90db for current input units

**Load Capability:**

**SSX:**

$$\frac{V_s - 12V_{dc}}{20mA}$$

**SST:** 1000 ohms

**SST-Splitter:** 600 ohms per channel

**Output Current Limiting:** 25mA typical; 30mA max

**Voltage Limit (for -EP only):** 30Vdc max

### Ambient Conditions

**Temperature Range:**

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

**Temperature Effect:** ±0.007% of span/°C typical; ±0.015% of span/°C max

**Relative Humidity:** 5-95% non-condensing

**RFI/EMI Protection:** Less than +/- 0.1% of span error when tested at 20V/m @ 20-1000MHz

**Common Mode Rejection:** Exceeds 95dB at 60Hz with a limit of 1500Vrms

### Adjustments

**Type:** Front panel pots

**Span:** ±2%

**Zero:** ±2%

### Weight

**SST:**

DC: 12oz (340g)

AC: 17oz (482g)

**SST Splitter:**

DC: 15oz (425g)

AC: 20oz (567g)

**SSX:**

8oz (227g)

## Section 8- Ordering Information

The SSX/SST ordering information is detailed below.

Unit	Input	Output	Power	Options	Housing
<b>SST</b> 4-wire, Line- (Mains) Powered, Safety Isolator and Splitter	<b>4-20MA</b> 4-20MA into 100 ohms with HART digital data superimposed <b>1-5V*</b> into 1 Mohm	<b>4-20MA</b> Isolated, 4-20MA into 1000 ohms (with 24Vdc, 117Vac, or 230Vac power); HART digital data superimposed  <b>2X4-20MA</b> into 600 ohms per channel (available with 4-20MA input only); on standard model HART digital data superimposed on Channel A	<b>24DC</b> ±10% <b>117AC</b> 50/60HZ, ±10% <b>230AC</b> 50/60HZ, ±10% 3 watts maximum for single channel models; 5 watts maximum for dual output channel models	<b>-IZ250**</b> (N/A with -0HART) Increases the input resistance to 250 ohms <b>-EP***</b> External power, output stage powered by external source (both Outputs) <b>-0HART</b> No HART signal pass-through <b>-2HART***</b> HART signal pass-through on both channels moved). <b>-RO***</b> Reverse Output (both channels) <b>-LMD**</b> Loop Maintenance Diode (for Current Input Only). Allows removal of SST from the loop without interrupting loop continuity. (This option increases the loop burden to 8.2V when the SST is removed).	<b>DIN</b> DIN-style housing mounts on 35mm (EN50022) Top Hat DIN-rails  <b>FLB</b> Flange bracket with top/bottom mounting holes
<b>SSX</b> 2-wire, Loop- Powered, Safety Isolator	<b>4-20MA</b> 4-20MA into 100 ohms with HART digital data superimposed <b>1-5V*</b> into 1 Mohm	<b>4-20MA</b> Isolated, 4-20MA into 600 ohms (with 24Vdc, power); HART digital data superimposed	<b>12-42DC</b>	<b>-IZ250**</b> (N/A with -0HART) Increases the input resistance to 250 ohms <b>-0HART</b> No HART signal pass-through <b>-LMD**</b> Loop Maintenance Diode (for Current Input Only). Allows removal of SSX from the loop without interrupting loop continuity (This increases the loop burden to 8.2V when the SSX is removed).	

**When ordering, specify:** Unit / Input / Output / Power / -Option [Housing]  
**Model number examples:** SST / 4-20MA / 2X4-20MA / 24DC / -EP [DIN]  
 SSX / 4-20MA / 4-20MA / 12-42DC / -IZ250 [DIN]

\*HART Pass Through not available for 1-5V Input models

\*\* -IZ250 and -LMD only available for 4-20mA Input models

\*\*\* -EP, -RO and -2HART only available for 2X4-20mA Output models

### Accessories

Part Number **700-702-35** **FMEDA Report** consistent with IEC 61508-2:2010 providing the information necessary to design a Safety Instrumented System (One copy provided free with each order Upon Request)

## Warranty Disclaimer

Moore Industries ("The Company") makes no express, implied or statutory warranties (including any warranty of merchantability or of fitness for a particular purpose) with respect to any goods or services sold by the company. The company disclaims all warranties arising from any course of dealing or trade usage, and any buyer of goods or services from the company acknowledges that there are no warranties implied by custom or usage in the trade of the buyer and of the company, and that any prior dealings of the buyer with the company do not imply that the company warrants the goods or services in any way.

Any buyer of goods or services from the company agrees with the company that the sole and exclusive remedies for breach of any warranty concerning the goods or services shall be for the company, at its option, to repair or replace the goods or services or refund the purchase price. The company shall in no event be liable for any consequential or incidental damages even if the company fails in any attempt to remedy defects in the goods or services, but in such case the buyer shall be entitled to no more than a refund of all monies paid to the company by the buyer for purchase of the goods or services.

Any cause of action for breach of any warranty by the company shall be barred unless the company receives from the buyer a written notice of the alleged defect or breach within ten days from the earliest date on which the buyer could reasonably have discovered the alleged defect or breach, and no action for the breach of any warranty shall be commenced by the buyer any later than twelve months from the earliest date on which the buyer could reasonably have discovered the alleged defect or breach.

## Return Policy

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

## 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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