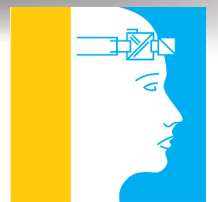


FS FUNCTIONAL
SAFETY SERIES



Functional Safety
Programmable Loop Display

SLD



PACTware Consortium e. V.

MEMBER

PACTware

User's Manual



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.

Locations

World Headquarters

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91343-6196, **U.S.A.**
Tel: (818) 894-7111
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Perth, WA
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North Perth, Western Australia
6006
Australia
Tel: (08) 9228-4435
Fax: (08) 9228-4436
sales@mooreind.com.au



www.miinet.com

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 web site at 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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SLD Quick Start Guide

The SLD is ready to install and is either set up with your specified configuration or the default configuration below.

After programming your loop display, install the unit into your application using the connection diagrams and terminal designation table located in this manual.

If you are using the SLD in a safety instrumented system, then you must read and follow the safety section 6 in this user manual

Default Configuration

Input Settings: 4-20mA

Filter: 60Hz

Damping Time: 0.0

Display Settings: 0-100 PCT

Display Resolution: AUTO

Linearization Mode: Normal

Section 1 - Introduction

The Moore Industries' Safety Programmable Display (SLD) is part of Moore Industries' **FS FUNCTIONAL SAFETY SERIES** products. It is a Type A non-interfering device to be used in a safety loop. It is not assessed or certified to be used as part of the safety function.

This manual contains information needed to install, operate and maintain this product. When the SLD is used in a SIL rated safety application, please refer to the Safety Instrumented Systems section of this manual.

Description

The Moore Industries' SLD Safety Programmable Loop Display features a large integral display that shows real-time process status in mA, percent, or any designated 5-character Engineering Units (EGU).

Designed to meet SIL3 systematic capability when installed in a safety loop (not assessed or certified to be used as part of the safety function).

Superior Accuracy—The loop-powered SLD reads any 4-20mA signal and displays the information with phenomenal accuracy of $\pm 0.012\%$ of input scale and because it requires less than 2.3 Volts, it won't burden most loops.

Loop Maintenance Zener Diode (-LMD) option allows the SLD to be removed from the loop without interrupting loop continuity.

DTM Programmable with simple configuration for fast and accurate setup. The SLD can either be custom scaled to display in a percent or scaled directly into engineering units for indicating process measurements such as pressure, temperature, level, or flow. Span, zero, input range, display range, and filtering frequency can also be easily programmed. Our software will even capture the input range limits of the loop to provide you with the most accurate display available.

Easy Calibration— A single button on the front of the unit allows you to easily calibrate your loop by displaying the loop current in mA with three-decimal place accuracy.

Features

- Easy-to-read, customizable display. The SLD's independently configured display features two rows of large characters that can be clearly read in the field and set to display any EGU.
- 360°, flexible mounting. When placed into one of our rugged enclosures, the SLD can be mounted at any angle in nearly any environment.
- Low voltage drop. Loop-powered by less than 2.3 Volts, the SLD can even be installed on burdened loops.
- Custom and square root curves. Select a square root or linear curve from the library, or create your own. Use our software to input a table in one EGU and have the PC program convert it into a different EGU for display.
- RFI/EMI immunity. The SLD is resistant to the harmful, unpredictable effects of radio frequency and electromagnetic interference.

Model Numbers and Options

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

Moore Industries uses the model and serial numbers of our instruments to track information regarding each unit that we sell and service. If a problem occurs with your instrument, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

Moore Industries model numbers for SRM are structured as follows:

SLD / 4-20mA / PRG / 2.3VLP / -LMD [BH2NG]

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

Refer to **Section 9 Ordering Information** for a quick reference table of ordering information.

INPUTS

4-20mA

OUTPUTS

PRG

Programmable with supplied configuration software to display a percent or any other EGU of up to 5 characters in length.

POWER

2.3VLP

Input loop powered

OPTIONS

-LMD

Loop Maintenance Zener Diode provided at input terminals allowing the SLD to be removed from the loop without interrupting loop continuity (Burden: increases from <2.3 to <5.1VLP when SLD is removed from the loop).

-ISE

ATEX Approved Intrinsically-Safe

HOUSING

[HP]

The HP unit can also be ordered in an explosion proof or protective enclosure e.g., BH, SB etc. or with a clip for DIN-rail or track mounting.

Please refer to Section 9 Ordering Information for all housing options.

Section 2 - Calibration and Bench Check

We highly recommend that you perform a bench check of the SLD prior to installing it in the field. Doing this will ensure that it is operating within your expectations or requirements. See Figure 2.1 for the power supply and loop connections.

Calibration

Every SLD is calibrated to our specifications prior to delivery to our customers. We recommend that you check the calibration every year and re-calibrate only when necessary. Please refer to the Long Term Stability Table in Section 8 of this manual. Calibration by the end user can be performed in the field by capturing or trimming the input.

Input trimming increases the measurement accuracy of your instrument by matching the reading of its actual input to its scaling. The SLD offers the use of a trimming feature that can be accessed using an FDT Host (such as PACTware).

Calibration using FDT/DTM Software

For users who already have an FDT Frame Application, all the following information is still relevant. For more information on FDT/DTM please refer to www.fdtgroup.org.

For instructions on installation and setup of the SLD DTM with PACTware or another FDT frame, please refer to section 4. See Figure 2.1 for loop connections.

To perform the Input Trimming you will need to install the SLD in the loop (as shown in Figure 2.1) to capture the full and zero input values.



Caution: *Unplugging the programming cable or resetting power while downloading to the unit may result in a corrupt configuration / calibration and the unit may have to be returned to the factory.*

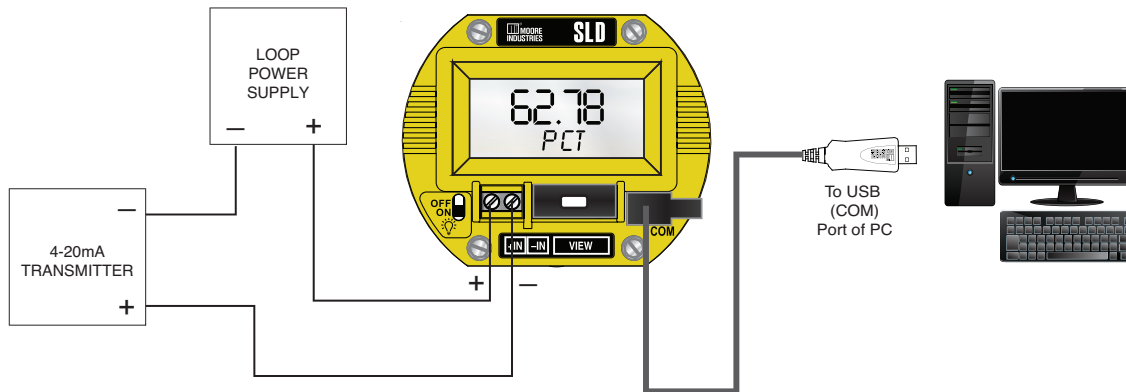
Table 2.1. Assembling the Necessary Equipment

Device	Specifications
2 wire 4-20mA transmitter	Accuracy per the intended application
Power Supply	24Vdc, $\pm 10\%$
PC Software with PACTware or FDT frame application	PACTware version 4.1 SP3 or newer
Personal Computer	Microsoft Windows-based PC; 16Mb free RAM; 20Mb free disk space on drive Microsoft Windows version 7, 10, or later; 1 serial port or USB port
Communications Cable	Moore Industries Non-isolated cable P/N: 803-040-26, Isolated cable P/N: 803-039-26, or USB cable P/N: 804-030-26

Input Range

For additional information on calibration, see Section 4, Input Range.

Figure 2.1. Power Supply and Loop connections (4-20mA Loop)



Caution: Do not connect the loop power supply directly to the SLD. A current limiting device such as a transmitter must be in the loop.

Bench Check Procedure

We highly recommend that you perform a bench check of your SLD prior to installing it in the field. Doing this will ensure it is operating within your expectations or requirements.

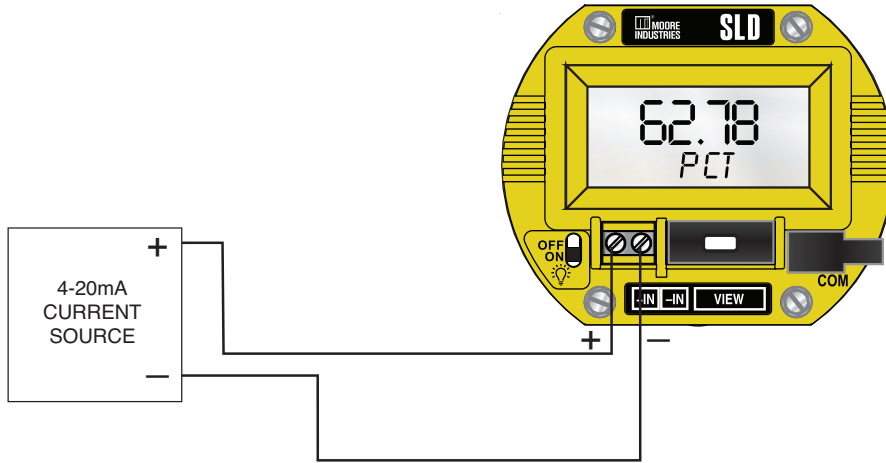
To perform the bench check of your SLD, you will need a 4-20mA current source with an accuracy of +/-0.01% of span. Set up the equipment as shown in Figure 2.2. If you do not have a current source then use the same setup as in figure 2.1.

If you need to make changes to your unit configuration, then you will also need to connect a PC with the FDT/DTM software (see section 4 for detailed instructions).

Use the View button to check your input zero and full (see Figure 5.1).

- 1) Use the View button to select meter mode.
- 2) Set the current source to input zero value and check the SLD displays 4mA.
- 3) Set the current source to input full value and check the SLD displays 20mA.
- 4) Set the current source to midpoint value and check the SLD displays 12mA.
- 5) Use the View button to exit View mode
- 6) Set the current source to zero, mid point and full values and check the output reading is configured correctly for scaling and engineering units.

Figure 2.2. Bench Check Setup



Section 3 - Installation and Wiring

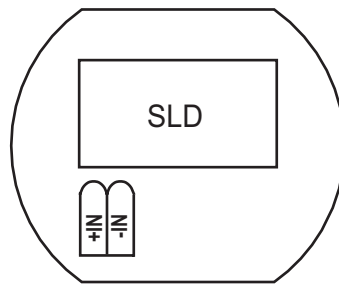
Instructions in this section and others may require special precautions to ensure the safety of the personnel performing the operations. Notes, Cautions and Warnings that may cause potential safety issues are indicated throughout this manual by symbols, please refer to Page 3 of this manual to view and familiarize yourself with these safety message symbols. See Figure 2.1 for the power supply and loop connections.



Note: Make sure to bench check the instruments prior to installation. Also, install all instruments in their intended application before making any electrical connections.

Terminal Designations

Figure 3.1. Terminal Designations



Caution: The SLD accepts 4-20mA input power only! Do NOT connect the SLD directly to a voltage power supply, as the mA inrush may damage the unit.

Dimensions

Figure 3.2. The SLD Dimensions

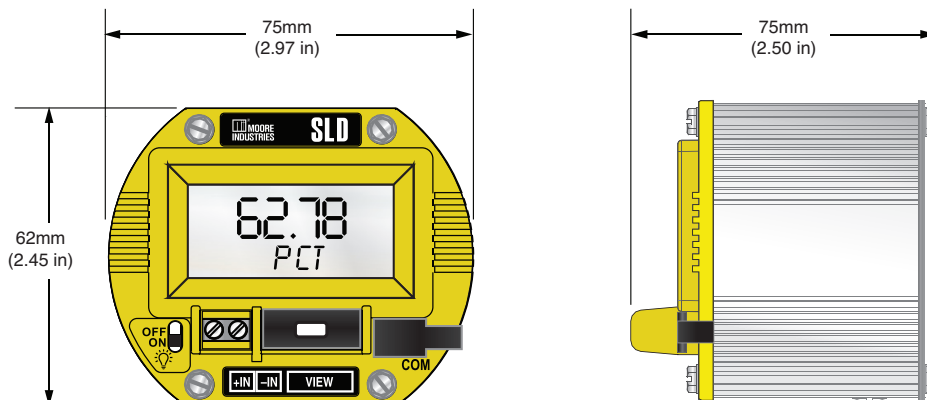


Figure 3.3. Dimensions of BH2 Housing

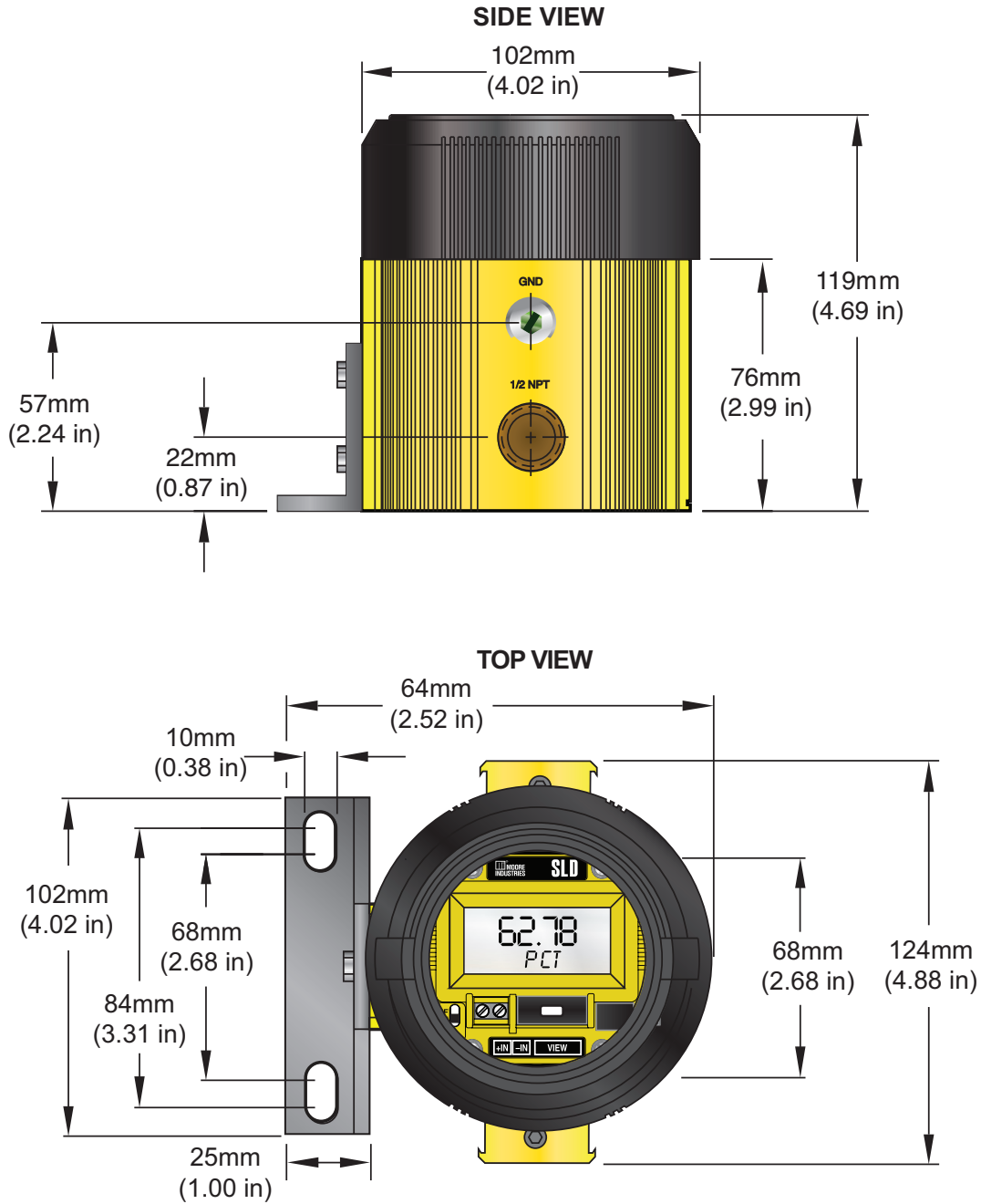
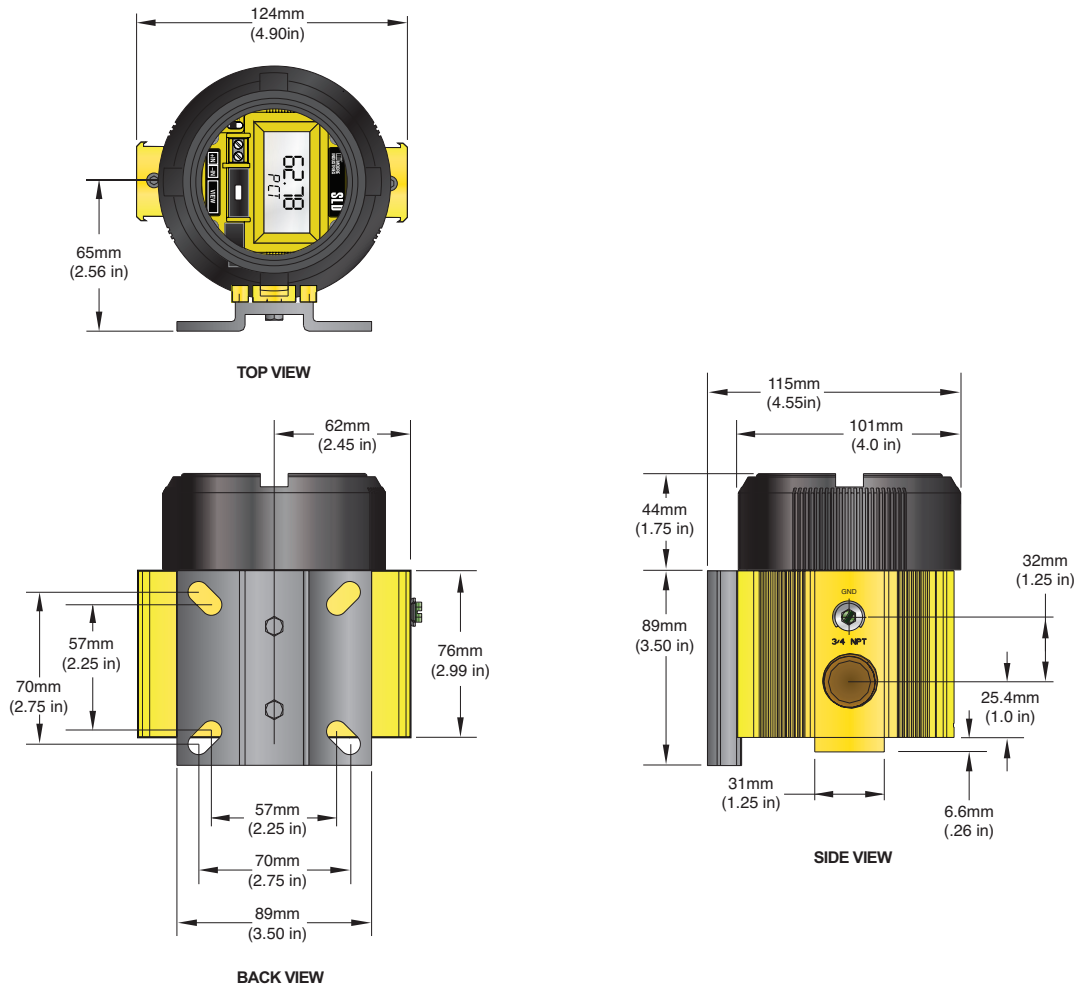


Figure 3.4. Dimensions of BH3 Housing



Electrical Connections

When installing any Moore Industries product, always follow all local regulations and standards for grounding, shielding, and safety. Refer to Figure 3.1 for Terminal Designations. Use +90°C suitable wiring for all connections



Warning: *The SLD accepts 4-20mA input power only! Do NOT connect the SLD directly to a voltage power supply, as the mA inrush may damage the unit.*

Installation Category

All terminals are rated CAT I.

Equipment Ratings

The SLD does not generate hazardous voltages, it accepts a 4-20mA input and accepts no output.



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

Input Wiring

The Input connections can be made with 14 to 22 AWG (2.0mm² or 0.33mm²) 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 Conformity

Installation of any Moore Industries' products that bare the CE mark must adhere to the guidelines in the Recommended Ground Wiring Practices section in order to meet the requirements set forth in the applicable European Union EMC (Electromagnetic Compatibility) Directive.

Installation in Hazardous Locations

This section contains important information regarding installation of SLD in Hazardous Area Locations.



Warning: *Static/Explosion Hazard. Do not rub with dry cloth. Do not disconnect equipment when a flammable or combustible atmosphere is present.*

Specific Conditions of Use

The following instructions must be adhered to when the SLD is used in hazardous locations and potentially explosive atmospheres.

FMus Installations

Class 1, Division 2, Groups A-D

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

No connections shall be made to the communications "COM" port in Hazardous (Classified) Locations.

Maximum operating parameters of the "COM" port for use in Non-Hazardous areas shall not exceed 3.0V, 300mA and 240mW.

European Union Installations

ATEX 2014/34/EU Directive

Intrinsically Safe Applications - Zone 0

II 1 G Ex ia IIC

Install per I.S. Control Drawing 100-100-85

The apparatus is intrinsically safe. It can be used in potentially explosive atmospheres. The equipment must only be associated with certified intrinsically safe associated apparatus and these combinations must be compatible as regards to intrinsic safety.

The electrical parameters of the certified associated intrinsically safe apparatus must not exceed any of the following values : (terminals +ps, -ps)

$U_o \leq 29.1V$; $I_o \leq 109mA$; $P_o \leq 0.793W$

The COM port must not be used in hazardous areas.

Operating ambient temperature : $-40^{\circ}C$ to $+85^{\circ}C$

The equipment must not be submitted to mechanical impacts or friction. The display window must not be submitted to mechanical impacts.

Section 4 - Configuration

This section provides information on configuring the SLD using a PC with PACTware (an FDT frame application). For users who already have an FDT Frame Application, all the following information is still relevant except for the PACTware installation. For more information on FDT/DTM please refer to www.fdtgroup.org.

FDT Frame Application

Moore Industries has always provided manufacturer-specific programs to operate our field instruments to the full extent. The SLD will require the use of an FDT frame application, which allows configuration and adjustment of any and all field instruments, which have a DTM. For users who do not already have an FDT frame application, Moore Industries provides PACTware.

An FDT frame application, such as PACTware, is a PC program which interfaces with individual software modules for instrument operation. This interface is regarded as the FDT; the individual software modules for instrument adjustment are called DTMs (Device Type Manager). This configuration makes user-friendly adjustments possible because the interface for instrument adjustment is optimally adapted to each instrument.

You can communicate with an FDT frame application not only via HART but also via any standard field bus system. Moore Industries provides a proprietary serial communication DTM named MISP, which allows faster device configuration using our USB communication cable. The MISP DTM will be provided in addition to the SLD specific DTM. In the FDT frame application, these individual instrument DTMs and communication DTMs are installed as required.

FDT/DTM Software Installation

In order to get started you will need to either install the PACTware software and DTMs or just install the DTMs (if you already have an FDT frame application installed). All the files you need can be found on our website www.miinet.com.

The PACTware installer file will install PACTware and all required communication DTMs. The SLD and other device DTMs need to be installed separately (see below).

PACTware_vxxx_FDT_DTM_Installation_Moore_Industries.exe

When you run the installer you will have the option to select which components you want to install:

PACTware 4.1 SP4

ICS Generic HART FDT DTM - This is for HART instruments which do not have a DTM

HART Communication FDT DTM - This is for using a HART modem with HART devices

MII MISP Communications DTM - This is for using a Moore Industries serial or USB cable (required for the SLD)

Figure 4.1. PACTware Installer

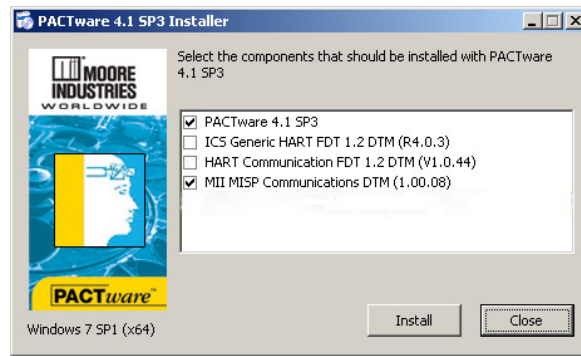
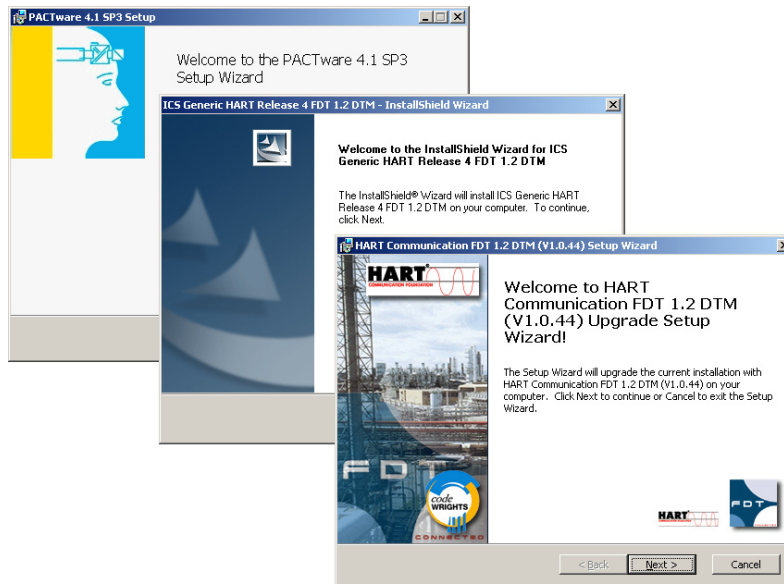


Figure 4.2. PACTware Installer Prompts



You will find individual DTM installers on the website and Moore Tools CD in Comms and Device folders. Use these to install or update the Moore Industries DTMs.

DTM Comms Folder: MISP_vxxx_CommsDTM_Moore_Industries.exe

SLD Configuration Tools Folder: SLD_vxxx_DeviceDTM_Moore_Industries.exe

The USB cable driver is also available in the Comms folder on the CD if you need to install the Moore Industries USB cable on your PC for the first time.

USB Cable Utility Software Folder: MIIUSBCable_vxxx_PC_Configuration_Software_Moore_Industries.exe

Moore Industries MISP DTM Installation

To communicate with the SLD using the USB communications cable, you will need to install the MISP DTM. The MISP DTM can be found on the Moore Industries Configuration Tools CD, or from our website www.miinet.com.

File is named: MISP_DTM_Configuration_Software_Moore_Industries.exe

To install simply locate file, double click file and follow on screen instructions to install.

Figure 4.4A Installation Software.

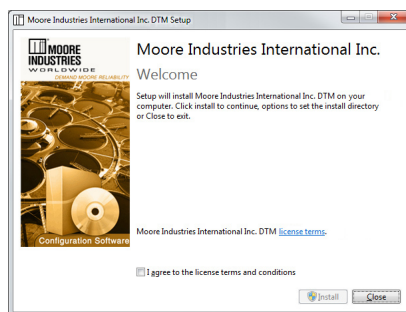


Moore Industries SLD DTM Installation

File is named: SLD_PC_Configuration_Software_Moore_Industries

To install simply locate file, double click file and follow on screen instructions to install.

Figure 4.4B. Run the Setup



Using DTM's with FDT Frame Application (PACTware)

Once you have installed all the necessary DTMs on your system, you are now ready to launch the FDT frame application (PACTware) and configure your device.



Note: When loading a new DTM you may need to update the device catalog. To do that launch the PACTware:

1. From the View Menu, select "Add DTM"
2. Select "Device Catalog"
3. Select "Update Device Catalog"
4. You will get a prompt "Create New PACTware Device Catalog?"
5. Select "Yes"

Figure 4.5. PACTware Device Catalog

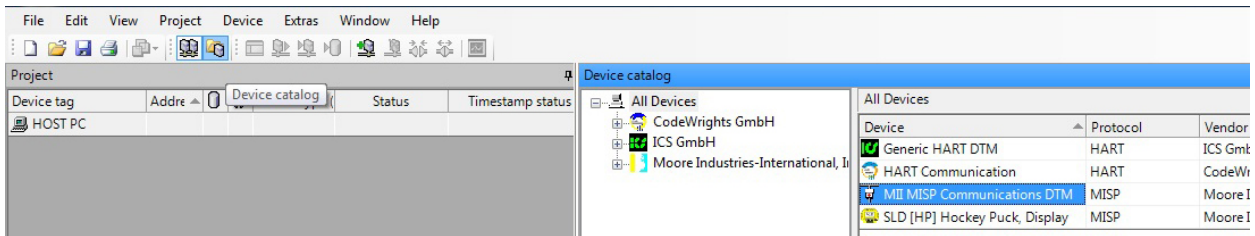
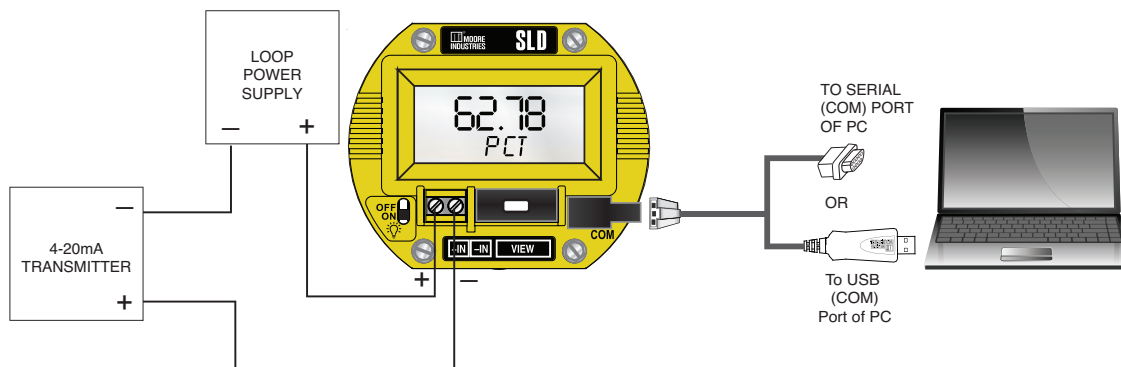


Figure 4.6. Connecting the SLD to a 4-20mA Loop



Caution: Do not connect the loop power supply directly to the SLD! A current limiting device such as a transmitter must be in the loop.

Connecting to SLD

Once you have installed all the necessary DTMs on your system, you are now ready to launch the FDT frame application (PACTware) and configure your device.

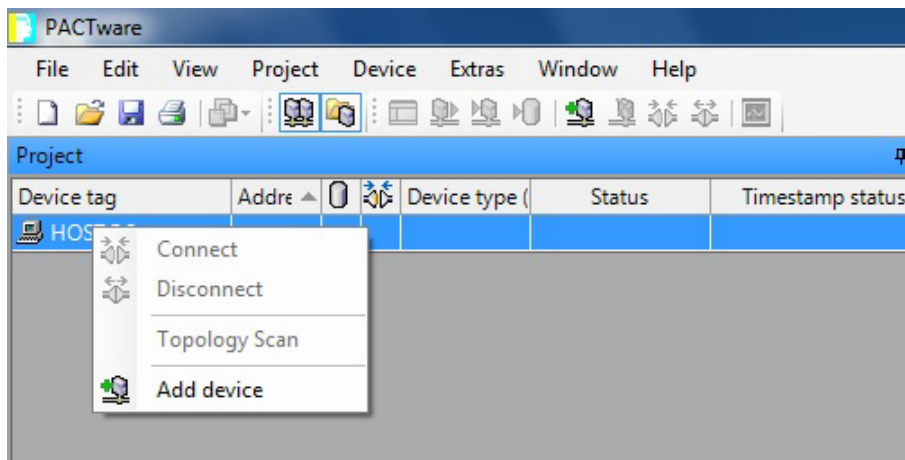
You will also need to have a Moore Industries Fuse Protected USB Communications Cable (sold separately P/N:804-030-26 USB cable or 803-040-26 serial cable). Refer to Fuse Protected USB Communications Cable documentation for installation of USB Communications Utility and configuration. Follow steps below to connect and configuration your device.

1. Connect SLD unit to your computer as per Figure 4.6

2. Launch PACTware software by clicking on the PACTware icon. 

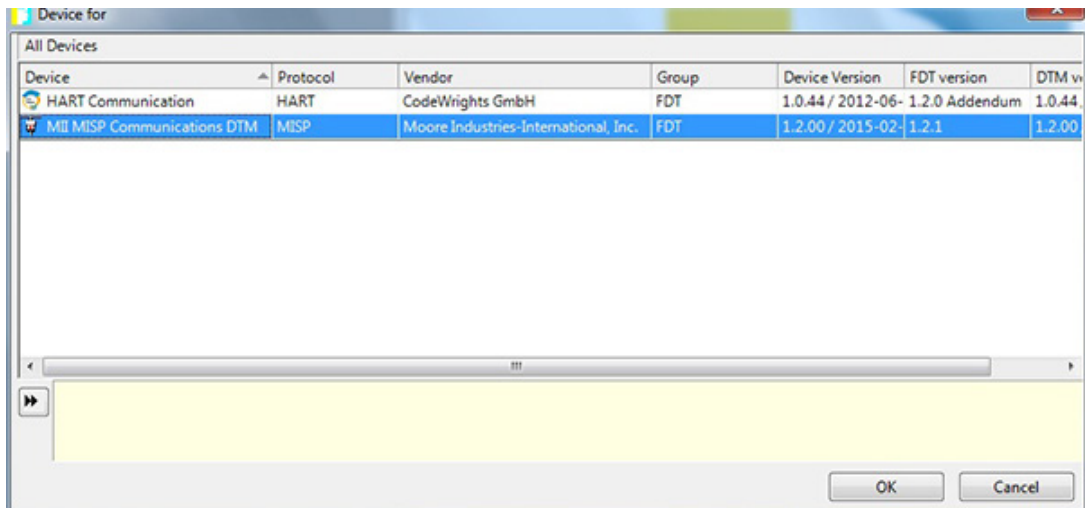
3. Once open, Right click on the Device Tag named "HOST PC" and select "Add device"

Figure 4.7. Connecting to the SLD Using PACTware



4. Select the MISP Communications DTM and click "OK"

Figure 4.8. Connecting to the SLD Using PACTware



5. Right Click on MISP:COM1 and select "Parameter"
6. In the Communications Port drop-down menu select the actual COM port which your Fuse Protected USB Communications Cable is connected to and click "Apply" then "Ok".

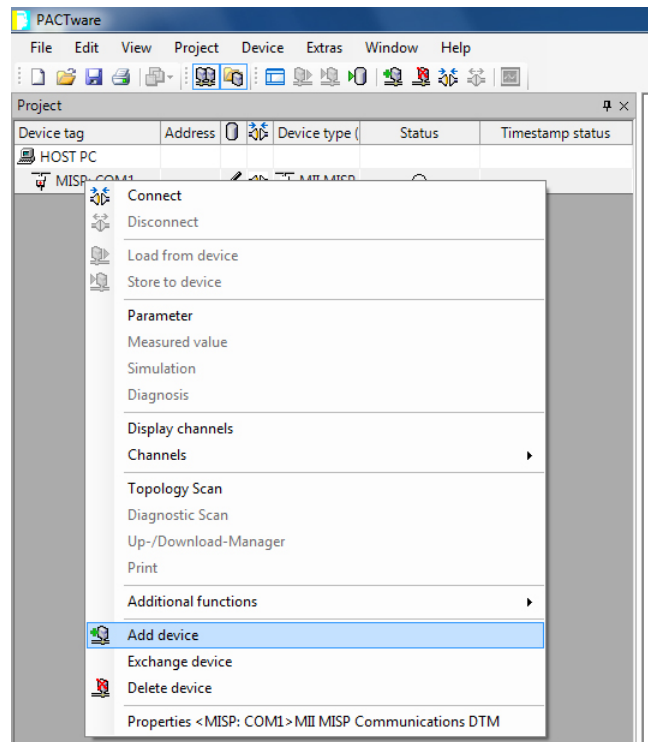


Note: You need to be certain to click apply when making these changes. Once the correct COM Port is selected and you have applied it to parameters the small Pencil icon will disappear. If Pencil icon is still visible, it indicates that the change has not been applied to device.



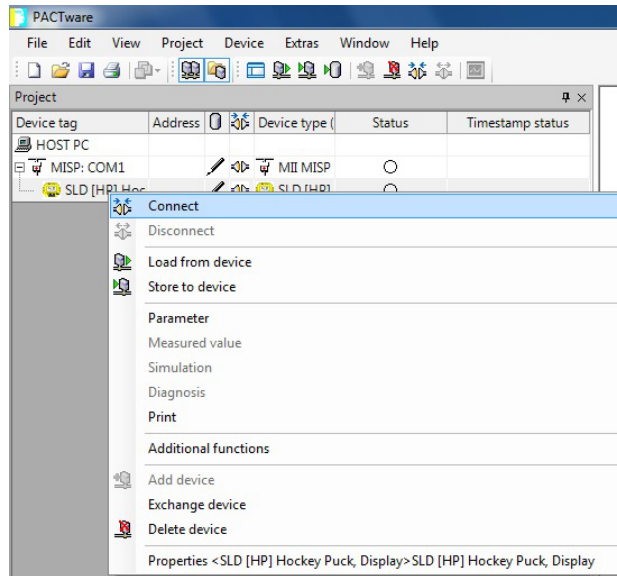
7. Return to Device Tag Menu. The MISP COM port you selected should now appear i.e. "MISP:COM2" hover over it, right click and select "Connect." You will now see the "online state" turn green to indicate you have a connection.
8. Next you will right click on "MISP:COM2" and select "Add device". Select SLD from list and click "Ok".

Figure 4.9. Adding a device (SLD) Using PACTware



9. Right click on selected DTM in the Device Tag menu and select “Connect.” You will now see the “online state” turn green to indicate you have a connection.

Figure 4.10. Connecting to the SLD Using PACTware



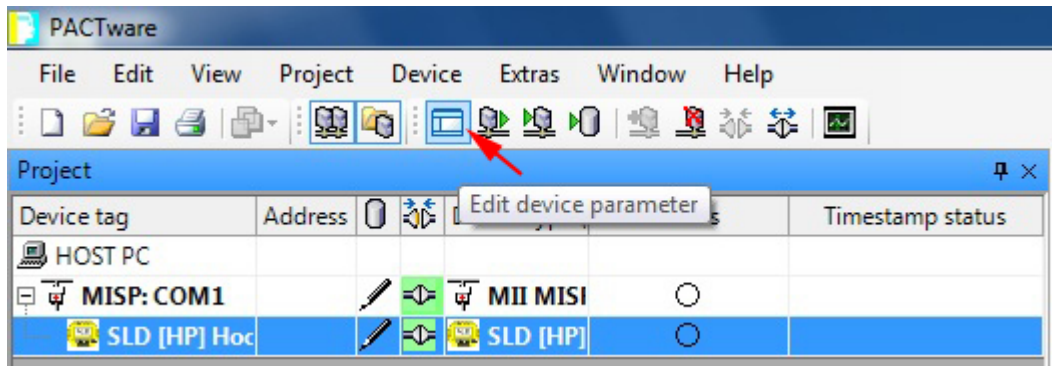
10. Right click on DTM (SLD) in the Device Tag menu and select “Parameters”. This will bring up screen for the SLD parameters. You are now ready to start your configuration of the device. You may also access the factory default settings directly from device by right clicking on DTM in the Device Tag menu and selecting “Load from device”.

Edit Device Parameter

To edit device parameters such as Input, Display, Device Settings, or create a custom curve. The type of engineering units and damping can be set using the Edit Device Parameter window.

1. Click on the Device (SLD) to highlight
2. Click on "Parameter" and then "Load from device"
3. In the Parameter Window, select the parameter you want to edit

Figure 4.12. Editing the SLD Parameters Using PACTware



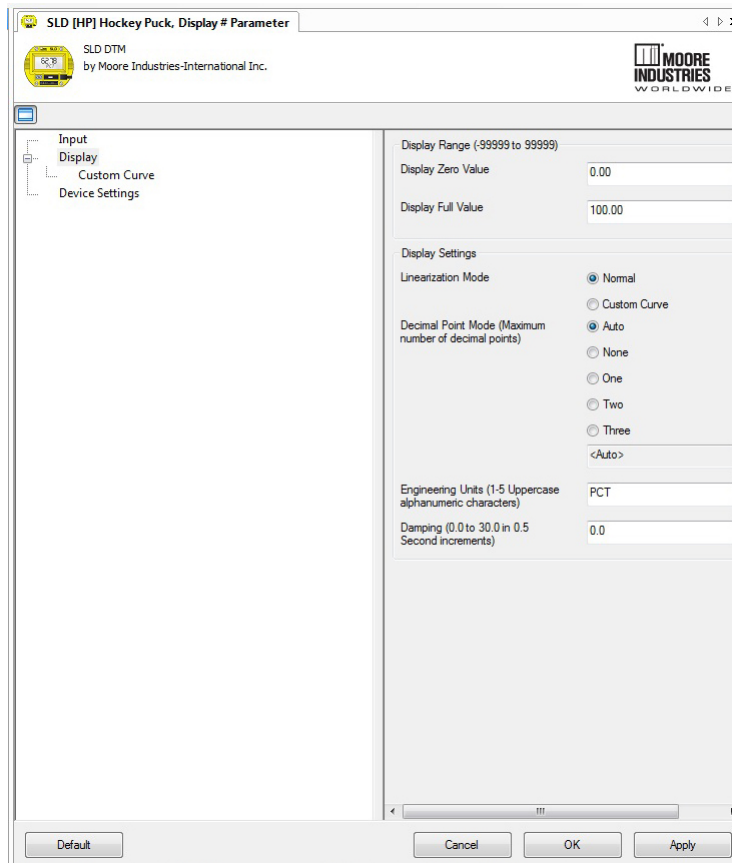
Display

The Display Range can be set between -99999 to 99999 for the Display Zero Value (factory default 0.00 and the Display Full Value (default 100.00). Linearization mode selections are Normal and Custom Curve. You can input your own custom curve from a CSV.

The “Decimal Point Mode” allows the maximum number of decimal points to be set, with none, one, two, or three places. The default is “Auto”.

You can use the “Display” window to set the type of engineering units to display and the damping (in 0 to 30 in, 0.5 second increments).

Figure 4.13. Editing the SLD Parameters



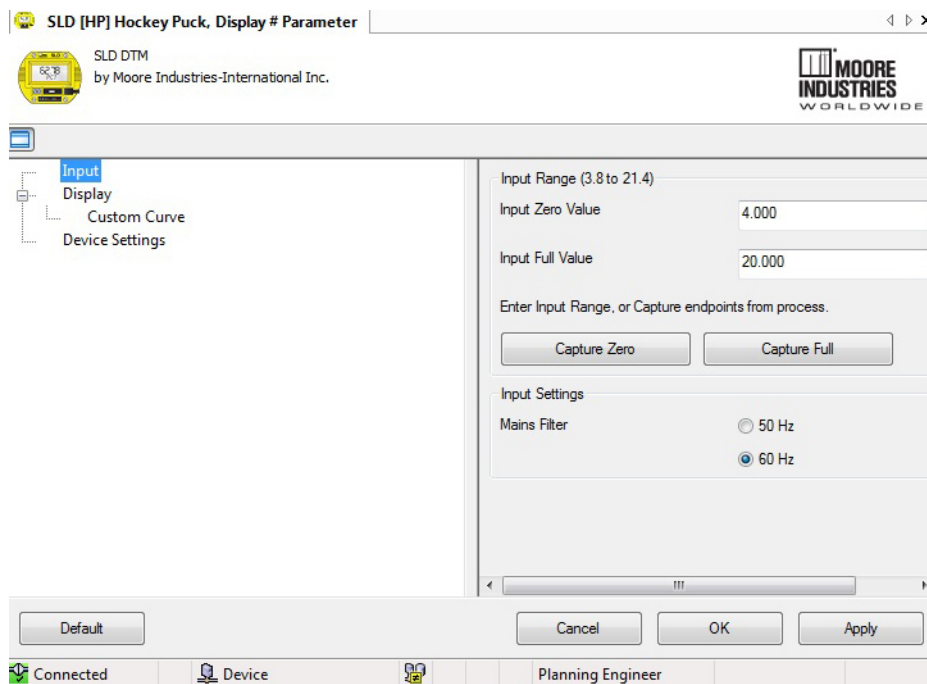
Input Range

The Input Range can be set between 3.8 to 21.4. The default Input Zero Value is 4.000 mA and the Input Full Value default is 20.000 mA. The range can also be captured using the “Capture Zero” or “Capture Full” buttons.

The Mains filter can be set to either 50Hz or 60Hz.

Once input parameters are set, click Apply then OK to add changes.

Figure 4.14. Input Parameters

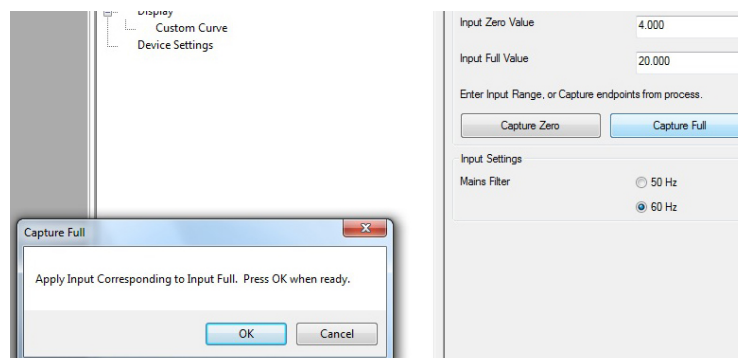


Capturing Input Parameter

Capturing endpoints from a process is easy and will automatically send the captured value to the SLD. Capturing the Input Zero Value and the Input Full Value is the same.

1. Click on the “Capture Full” or the “Capture Zero” button
2. A prompt will popup, see Figure 4.x
3. Click “OK” when you are ready to capture

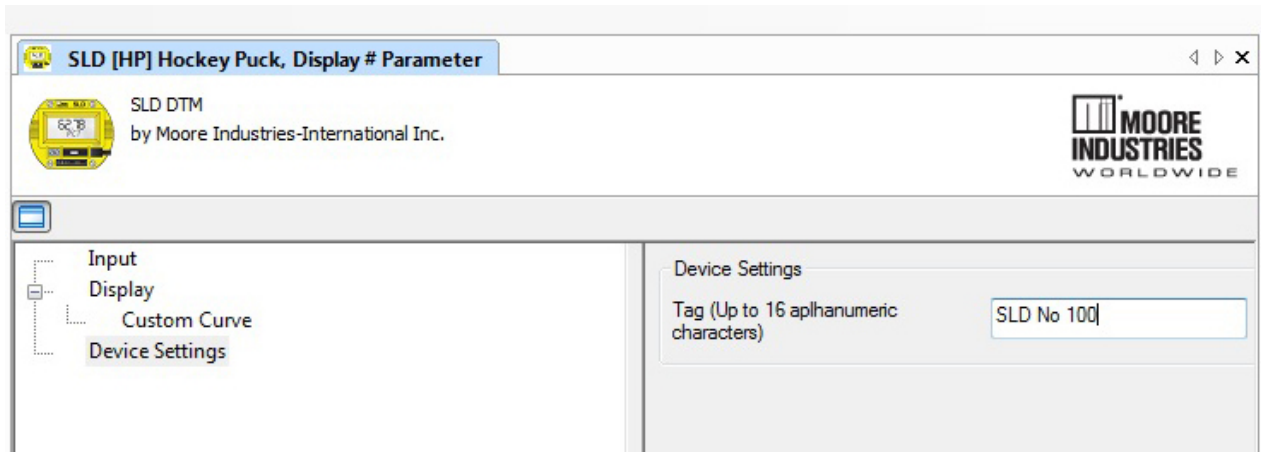
Figure 4.15. Capturing Input Parameters



Device Settings

Click on the “Device Settings” to name the SLD. Use up to 16 alphanumeric characters.

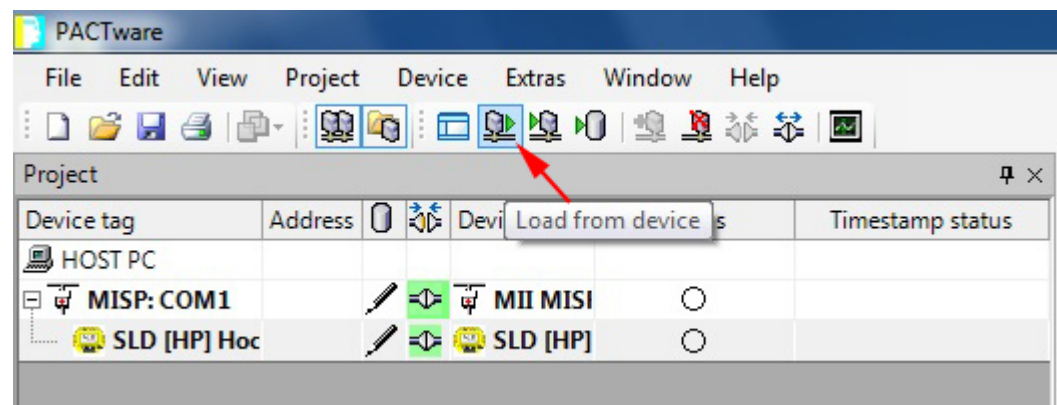
Figure 4.16. Device Settings



Load Settings from the SLD to Your Desktop

1. Click on the Load from Device Button on the Menubar
2. Click OK

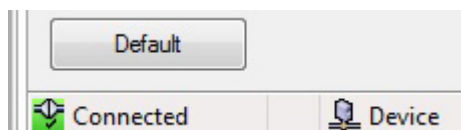
Figure 4.17. Load Parameters Button



Reset Settings

Click on the “Default” button to set the SLD back to factory defaults.

Figure 4.18. Factory Default Parameters

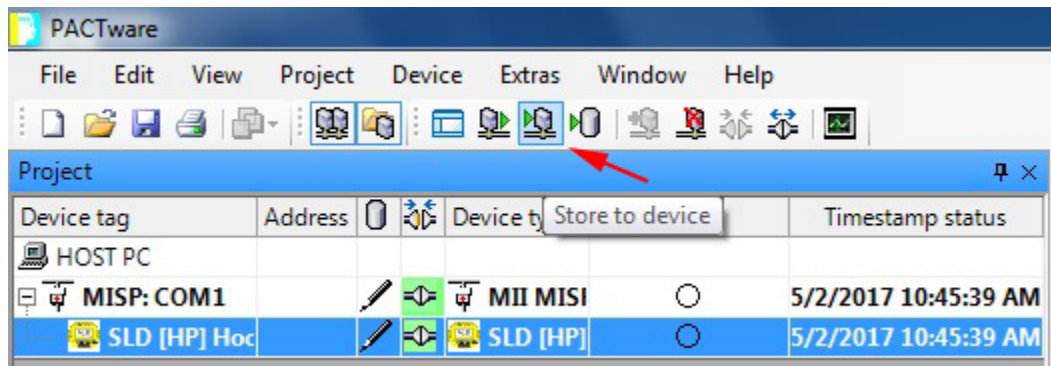


Downloading New Settings to the SLD

Once settings are changed in the software, they need to be written to the SLD. To write to the SLD:

1. Click on the “Store to device” Button on the Menubar
2. Click OK

Figure 4.19. Store Parameters to Device



Write SLD Data to File

Once settings are changed in the software and saved to the SLD, you can save the configuration to a file on your computer

1. Click on the “Save Project” Button on the Menubar
2. Click OK

Custom Curve

Moore Industries provides two options for customers who require a custom square root linearization table. You add a pre-made curve by typing it in the field.

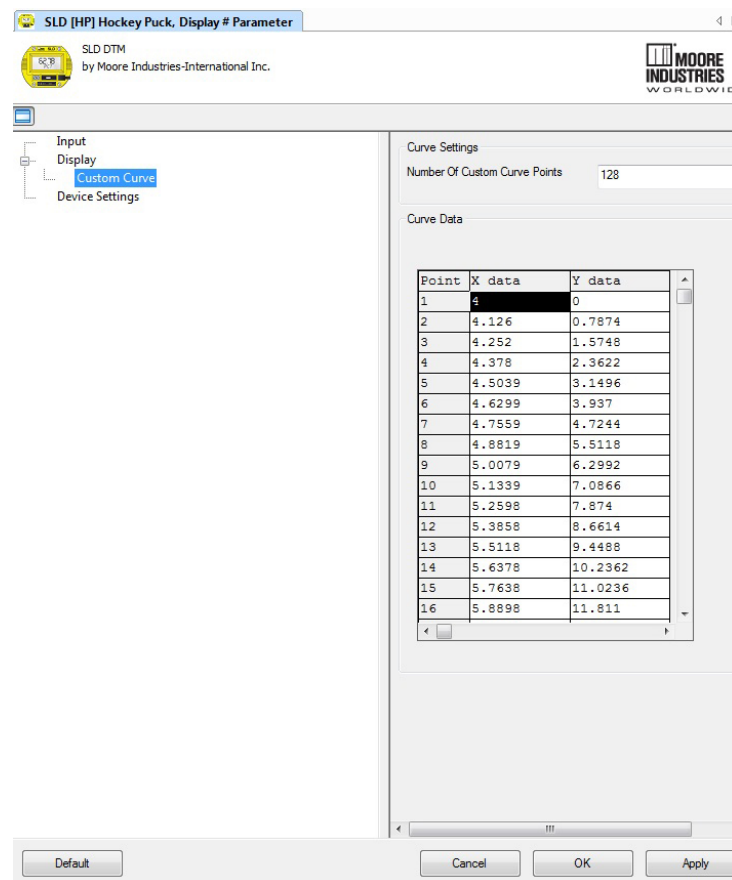
In the Device Window:

1. Click on the "-" by "Display"
2. Click on "Custom Curve," the "Curve Settings" and "Curve Data" graph will appear

The panel for the custom curve opens and allows you to enter custom curve numbers and define the number of points in the curve.

3. Click "Apply" to add your changes, you can also click "OK" to accept the curve and exit menu

Figure 4.20. Input Parameters



Delete Device

The SLD can be deleted from the listing of devices. This is useful if you remove the SLD from your loop. You will need to add the SLD you removed to see it again, see Configuring the SLD using DTM (Section 4)

1. You must disconnect before deleting device
2. Select the device you want to delete in the Project window
3. Click "Delete device"
4. Click OK

Figure 4.21 Delete the SLD from the Project Menu

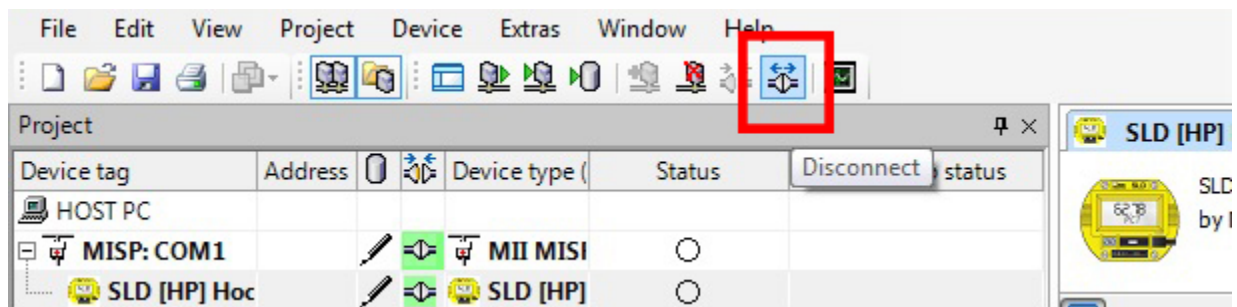


Disconnect from Device

Disconnect the SLD when you have completed and saved your custom settings.

1. Right click on Device (SLD)
2. Select Disconnect

Figure 4.22 Disconnect from SLD Device



Section 5 - Operation and Maintenance

When the SLD is installed in a safety loop, please refer to the SLD in Safety Instrumented Systems section of this manual before operating your unit.

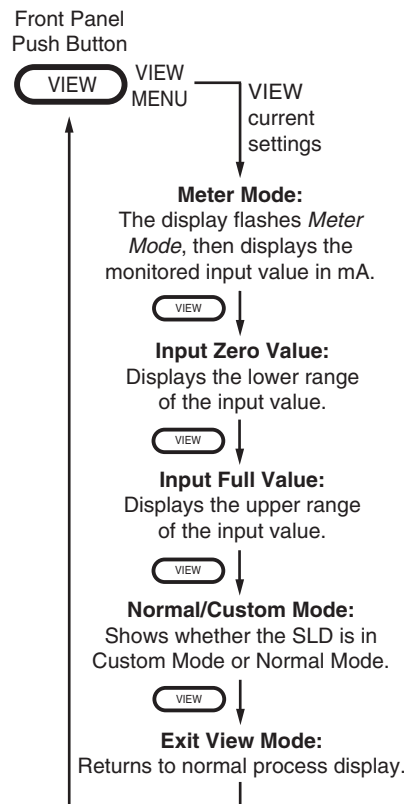
Operation

Once calibrated and installed in a 4-20mA loop the SLD begins to operate immediately. Depending upon environmental conditions, it can be expected to operate unattended for extended periods of time.

Site-Viewing the Configuration

Even after your SLD has been installed in the field, it is easy to verify its configuration using the front-mounted View button. Figure 5.1 describes the various displays controlled by the View button.

Figure 5.1. The View button on the front of the SLD allows you view the different SLD settings.



Maintenance

Moore Industries suggests a quick check for terminal tightness and general unit condition every year. Always adhere to any site requirements for programmed maintenance. The calibration of this instrument should be checked every year and re-calibrated only when necessary.

Section 6 - SLD in Safety Instrumented Systems

The SLD is not intended for use as part of a Safety Function but can be considered 'interference free' when added to a safety critical loop for monitoring purposes.

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

Functional Safety Description

The SLD has systematic integrity up to SIL3 as a Type A Non-interfering device. This means that an SLD is capable for use in a SIL3 loop and will not interfere with the safety instrumented function but cannot be used as part of that safety function.

The SLD is a programmable loop device which accepts a 4-20mA input and displays the reading which can be scaled to % or custom engineering units.

Installation

The SLD can be connected in 2 ways, either directly in the loop (Figure 6.1) or with a Loop Maintenance Zener Diode (-LMD option) provided at input terminals, allowing the SLD to be removed from the loop without interrupting loop continuity (Figure 6.2).

If the -LMD option is used, confirm that the loop can reach full current with the compliance voltage of the loop maintenance diode (5.1V) in the loop. (i.e. set the instrument output to full, disconnect the SLD from the loop and check that the loop current is still full).

The loop current must be monitored by the PLC for out of range values ie. outside normal operating range (4-20mA).

Figure 6.1. SLD Monitor in Safety Loops

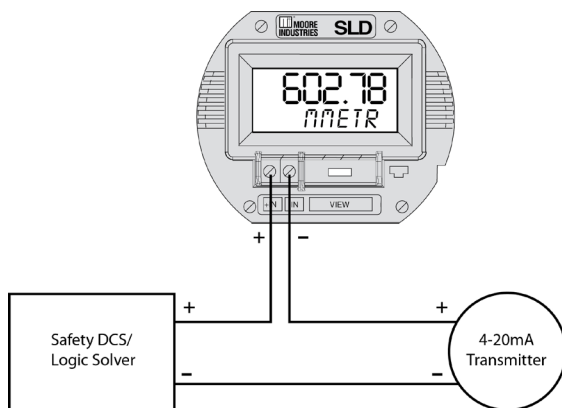
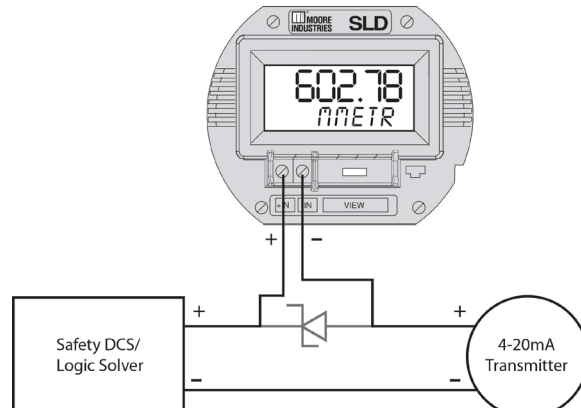


Figure 6.2. SLD Monitor with -LMD option in Safety Loop



Operation and Maintenance

Do not connect the USB communications cable to the SLD and do not attempt to configure the unit while the unit is in an active safety loop.

If the unit is ordered with the -LMD option, it can be removed from the safety loop for maintenance without interrupting the safety function.

Failure Rate Data

The FMEDA (Failure Mode, Effects and Diagnostic Analysis) process only considers components of which failures could be reasonably considered to impact the safety function. This FMEDA considers only the input circuit of the SLD and how it may affect the safety critical loop it is connected to. The failure rate of the SLD instrument and function is not considered here.

The SLD is internally redundant at the field terminals. The only internal single faults that could possibly open the loop are solder joints and connectors. These are taken care of by the **-LMD** option, which is a zener diode attached to the bottom of the field terminal block. The only faults it cannot eliminate are the field connections themselves, where the field wires attach to the terminal block.

Any shorts in the loop will make the SLD inoperable but will not affect the safety loop.

EMC filters between the loop terminals and chassis may create dangerous undetected failures. Since the relationship between the loop voltages and chassis potential is unknown, half the failure rate for the short circuit mode of these components are counted as dangerous undetected faults.

Profile 1	Profile 2
λ S (Fail Safe): 11.68 FITS λ DU (Dangerous Undetected): 2.19 FITS	λ S (Fail Safe): 21.28 FITS λ DU (Dangerous Undetected): 2.19 FITS
-LMD Option: λ S (Fail Safe): 5.84 FITS λ DU (Dangerous Undetected): 2.19 FITS	-LMD Option: λ S (Fail Safe): 10.64 FITS λ DU (Dangerous Undetected): 2.19 FITS

Profile 1 is defined for cabinet mounted equipment as having an average external temperature of 30° C, mean internal module temperature of 60° C with a temperature cycle of 5° C.

Profile 2 is defined for low power (2 wire) field products which have minimal self heating and are subject to daily temperature swings. An average external temperature of 25° C and mean internal module temperature of 30° C is assumed.

Failure Definitions

A FIT, Failure in Time, is a unit measure for failures, indicating one failure per 1,000,000,000 (109) hours. A device failure is defined as a failure which causes any of the following:

- The loop current to change by more than 2%
- The output current to change outside its normal 4-20mA operating range.

A safe (S) failure is defined as a failure which causes:

- The loop current to change outside its normal 4-20mA operating range.

A dangerous (D) failure is defined as a failure which causes:

- The loop current to change by more than 2% AND the output current remains in normal 4-20mA operating range.

Methodology and Assumptions

The failure rate and modes used in the analysis for the SLD were calculated using the Exida FMEDA database which is derived from Telcordia, SN29500, HRBD5, MIL HDBK-217F, among others. It is expected that the data used and calculations employed return a result that is conservative against actual field failure in environments with average stress.

The user is responsible for determining the fitness of the data provided in this manual to any specific environment. For industrial plant sites with high environment stress or environment profile that is different from the one given in the assumptions below, the user must multiply the provided data with an appropriate factor reflecting the difference of the operating conditions from the reference conditions.

- a) For the purpose of these assumptions Device will be taken to mean the equipment which is the subject of this FMEDA.
- b) Only a single component failure will fail the entire device.
- c) Failure rates are constant; wear-out mechanisms are not included.
- d) Propagation of failures external to the device is not considered.
- e) All reasonably expected component failure modes are considered.
- f) The FMEDA results in this document are valid for the temperature range of -25°C to $+40^{\circ}\text{C}$.
- g) The input loop is a 4-20mA current loop.
- h) The input loop is monitored for excessively high and low loop current. In other words any out of range current will be detected as a fault.

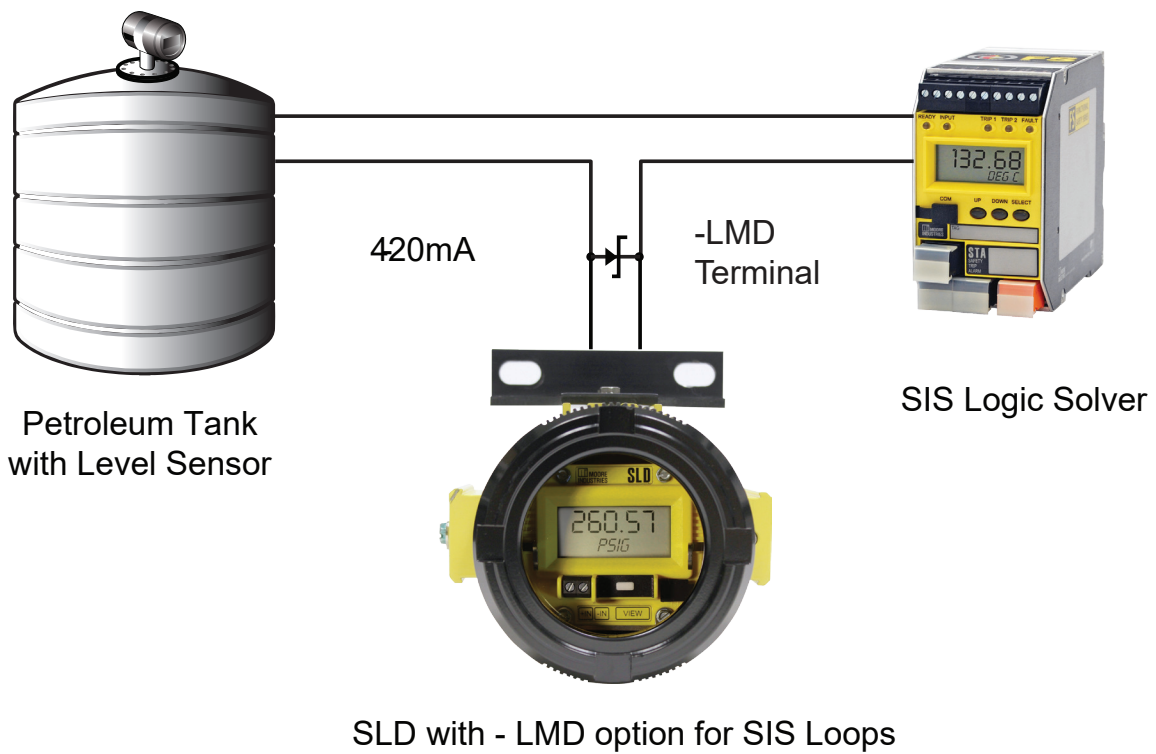
Section 7 - Application

The SLD, a member of the FS Series product line, is designed and built in compliance with IEC 61508, the leading worldwide functional Safety standard.

In this example shown in Figure 7.1, the SLD is installed in a Safety Instrumented Function to display critical tank level at eye level for plant personnel. The display provides additional information but is NOT considered as part of the safety function.

The SLD is a non-interference device, it can be taken out of the loop with the -LMD option (Loop Maintenance Diode) without affecting the integrity of the SIF loop.

Figure 7.1. Application Example of the SLD in a SIS Safety Loop.



Section 8 - Specifications

Performance

Accuracy: $\pm 0.012\%$ of input scale. This includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution. It does not include ambient temperature effect.

Stability: Error is in % of maximum span:

Stability Year(s)	Input to Output		
	1yr	3yrs	5yrs
mA	0.08	0.14	0.18

Resolution:

0.0028% of input scale

Over-Current Protection: 100mA maximum

Display Input Overrange: 24mA

Digital Input Filter: User-programmable; 50 or 60 Hz

Minimum Operating Current: ≥ 3.8 mA

Input Loop Burden:

Volt Drop: 2.3V; 5.1V with -LMD added & SLD removed. Equivalent Resistance: 115 ohms @ 20mA; 255 ohms @ 20mA with -LMD added and SLD removed.

Display

Type: LCD; Top Row, 10mm (0.4 inch) high black digits on a reflective background; Bottom Row, 6mm (0.23 inch) high black digits on a reflective background.

Format: Top row is five alphanumeric characters plus sign and decimal point; Bottom row is five alphanumeric characters.

Range: -99999 to 99999

Display Update Rate: 100msec

Minimum Display Span: 1.00

Ambient Conditions

Operating Range:

-25°C to 85°C

(-13°F to 185°F)

Storage Range:

-45°C to 85°C

(-49°F to 185°F)

Relative Humidity:

0-95%, non-condensing

Ambient Temperature Effect: $\pm 0.015\%$ of span per °C change, maximum

RFI/EMI Immunity:

20V/m @ 80-1000MHz, 1KHz AM, when tested according to IEC 61000-4-3

Common Mode Rejection:

100dB @ 60Hz

Normal Mode Rejection:

30dB @ 60Hz

Weight

HP-Style Housing:

150g (5.3 oz)

BH Housing:

1.37kg (3 lbs, 1.1 oz)

SB Housing:

2.6kg (7 lbs)

Specifications and Information subject to change without notice.

FMEDA (Failure Modes, Effects and Diagnostics Analysis) Report for the SLD Safety Programmable Loop Display can be found in Section 6 of the SLD Installation Manual

Section 9 - Ordering Information

Unit	Input	Output	Power	Options	Housing
SLD Func- tional Safety Loop Display	4-20MA Loop Input	PRG Programmable via FDT host with supplied DTM to display loop current in milliamps (MA), a percent (PCT) or any other Engineering Unit up to 5 characters in length.	2.3VLP Loop Powered	-LMD Loop Maintenance Zener Diode provided at input terminals allowing the SLD to be removed from the loop without interrupting loop continuity -ISE: ATEX Approved Intrinsically-Safe	BH2NG* (*) or (‡) Aluminum 2-Hub, Explosion-Proof enclosure with two, ½-inch NPT entry ports and a glass cover BH2TG* (*) or (‡) Aluminum 2-Hub, Explosion-Proof enclosure with two, ¾-inch NPT entry ports and a glass cover BH2MG* (*) or (‡) Aluminum 2-Hub, Explosion-Proof enclosure with two, M20 x 1.5 entry ports and a glass cover BH3NG* (*) or (‡) Aluminum 3-Hub, Explosion-Proof enclosure with three, ½-inch NPT entry ports and a glass cover BH3TG* (*) or (‡) Aluminum 3-Hub, Explosion-Proof enclosure with two, ¾-inch NPT side-entry ports, one ½-inch NPT bottom-entry port, and a glass cover BH3MG* (*) or (‡) Aluminum 3-Hub, Explosion-Proof enclosure with two, M20 x 1.5 side-entry ports, one ½-inch bottom-entry port, and a glass cover HP Hockey-puck housing and spring clips DN Snap-in mounting for HP case on 32mm G or 35mm Top-Hat DIN-rail FL Mounting flanges on HP suitable for relay track or screw mounting FLD Mounting flanges on HP suitable for 3½" relay track or screw mounting SB2NG* (*) or (‡) 316 Stainless Steel 2-Hub, Explosion-Proof enclosure with two, ½-inch NPT entry ports and a glass cover SB2MG* (*) or (‡) 316 Stainless Steel 2-Hub, Explosion-Proof enclosure with two, M20 x 1.5 entry ports and a glass cover * A suffix (comes supplied with 2" pipe mount hardware) A suffix indicates ANZEx/TestSafe (Ex d) Flameproof approvals (i.e. BH2MGA) ‡ P suffix indicates enclosure comes equipped with base plate and U-bolts for mounting on a 2-inch pipe (i.e. BH2NGP)See BH and SB Datasheets for additional information.

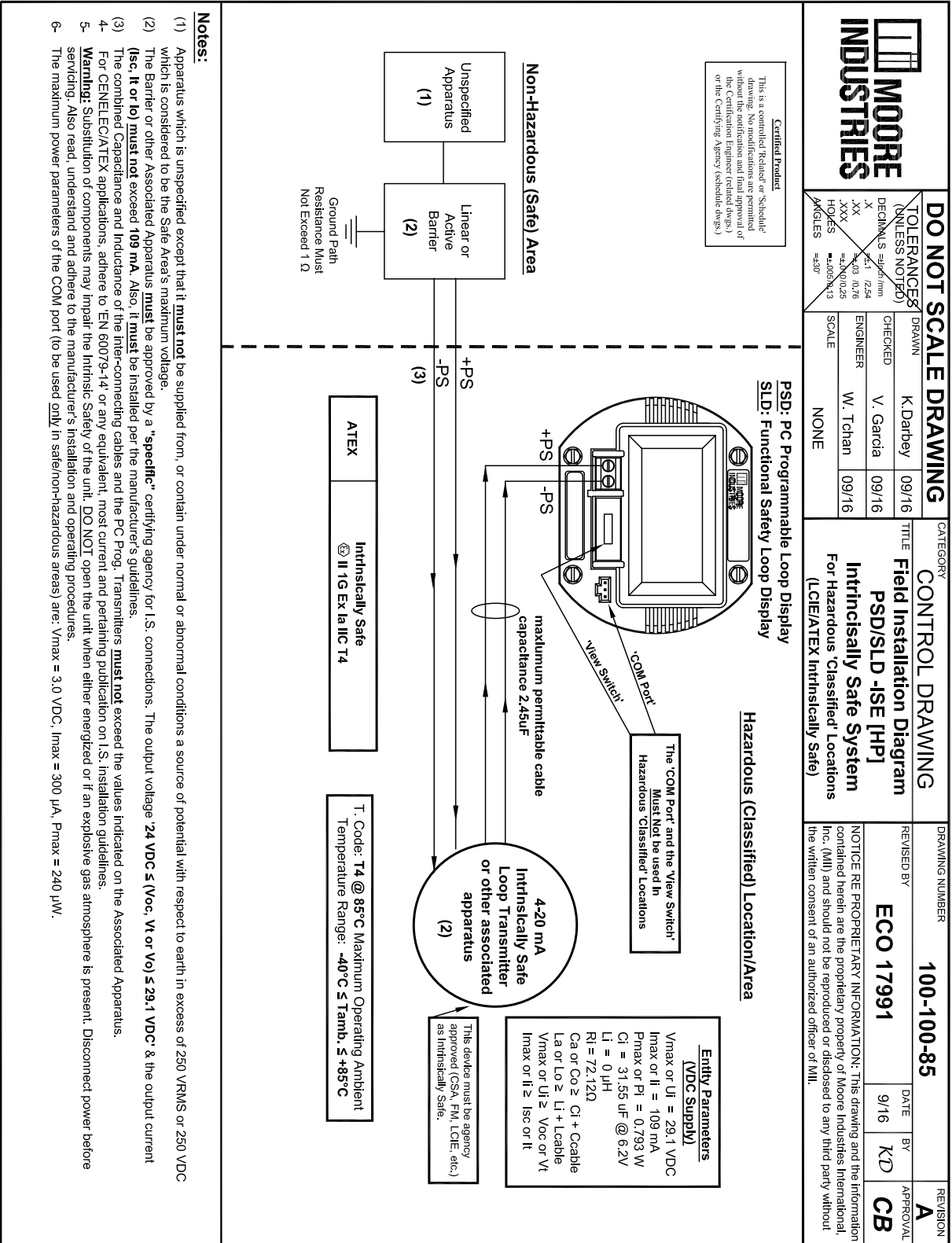
When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: SLD / 4-20MA / PRG / 2.3VLP / -LMD [BH2NG]

► Accessories

PACTware software is available for free on the Moore Industries web site. Visit www.miinet.com/pactware. Cables must be purchased separately.

Part Number	Part
804-030-26	Non-Isolated Fuse Protected USB Communication Cable (required by ATEX for products installed in Intrinsically-Safe areas)
803-040-26	Non-Isolated Serial Configuration Cable for 2-Wire Instruments
See section 6 in manual	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)

Section 10 - Certification Information



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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