Honeywell

SLG700
SmartLine Level Transmitter
Guided Wave Radar
HART® Option
User's Manual

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Honeywell Process Solutions

1250 W Sam Houston Pkwy S

Houston, TX 77042

About This Manual

This manual provides the details of programming and operating Honeywell SLG700 SmartLine Level Transmitters for applications involving HART® versions 5, 6, and 7 communication protocols. For installation, wiring, and maintenance information refer to the SLG700 SmartLine Level Transmitter User Manual, Document # 34-SL-25-11.

The configuration of your Transmitter depends on the mode of operation and the options selected for it with respect to operating controls, displays and mechanical installation. Details for operations involving the Honeywell Multi-Communication (MC) Toolkit (MCT404) are provided only to the extent necessary to accomplish the tasks-at-hand. Refer to the associated MCT404 User Manual for complete details. The "Reference" section in the front matter of this manual lists document titles and numbers.

The SLG700 SmartLine Level transmitter can be digitally integrated with one of two systems:

- Experion PKS: you will need to supplement the information in this document with the data and procedures in the *Experion Knowledge Builder.*
- Honeywell's Total Plant Solutions (TPS): you will need to supplement the information in this document with the data in the *PM/APM SmartLine Transmitter Integration Manual*, which is supplied with the TDC 3000 book set. (TPS is the evolution of the TDC 3000).

Release Information

Rev. 1.0,	April 2015 – First release
Rev. 2.0,	July 2015 – Security Vulnerability section added
Rev. 3.0,	June 2016 – Updates for R101 release. Including SLG726.
Rev. 4.0,	December 2016 – Basic Transmitter added (R102)
Rev. 5.0	February 2017 - Full tank detection information updated (R102_FF)
Rev. 6.0	December 2017 – R200 release which implemented the Saturated Steam and Low DC Applications and FEP-coated probes.

References

The following list identifies publications that may contain information relevant to the information in this document.

- SLG700 SmartLine Level Transmitter Guided Wave Radar User's Manual, #34-SL-25-11
- SLG700 SmartLine Level Transmitter Guided Wave Radar HART Option Safety Manual, #34-SL-25-05
- SLG700 SmartLine Level Transmitter Guided Wave Radar Pocket Configuration Guide, #34-SL-00-01
- HART® 7.x Field Device Specification for Honeywell SLG700 SmartLine Level Transmitter, 34-SL-00-03.
- SLG700 SmartLine Level Transmitter Guided Wave Radar Quick Start Guide, #34-SL-25-04
- SLG700 SmartLine Level Transmitter Guided Wave Radar Specification, #34-SL-03-03
- MC Toolkit (MCT 404) User Manual, #34-ST-25-50
- Smart Field Communicator Model STS 103 Operating Guide, # 34-ST-11-14

Patent Notice

The Honeywell SLG700 SmartLine Guided Wave Radar Level Transmitter family is covered by U. S. Patents 9329072, 9329073, 9476753 and 9518856 and 9329074, 9574929, 9618612, 9711838 and their foreign equivalents and other patents pending.

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

Honeywell Process Solutions	www.honeywellprocess.com
SmartLine Level Transmitters	https://www.honeywellprocess.com/en-US/explore/products/instrumentation/process-level-sensors/Pages/smartline-level-transmitter.aspx
Training Classes	http://www.honeywellprocess.com/en-US/training

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	hfs-tac-support@honeywell.com

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1 Introduction

1.1 Overview

The SLG700 SmartLine Level Transmitter is available for operation with HART® version 7 communication. This manual addresses the processes to configure a Transmitter for HART® communication.

1.1.1 HART® Mode Communication

As indicated in Figure 1, the output of a transmitter configured for HART® protocol includes two primary modes:

- Point-to-Point Mode: where one Transmitter is connected via a two-conductor, 4-20 mA current loop to one receiver.
- Multi-Drop Mode: where multiple Transmitters are connected through a two-conductor network to a multiplexed receiver device.

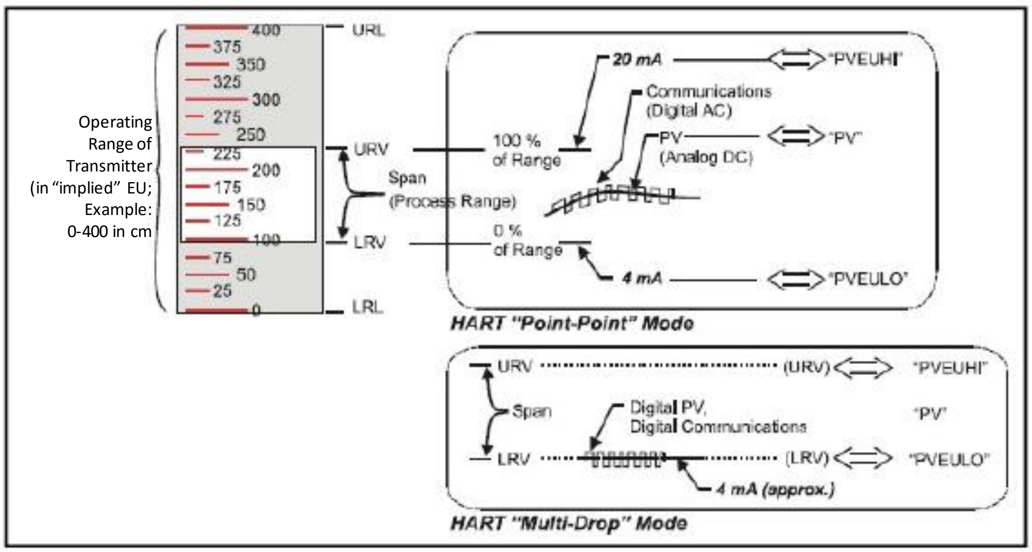


Figure 1: HART Point-to-Point and Multi-drop Value Scaling

In point-to-point mode, the value of the Primary Variable (PV) is represented by a 4-20 mA current loop, almost identical to that of a Transmitter operating in analog mode. In this case, however, the analog signal is modulated by Frequency Shift Keying (FSK), using frequencies and current amplitude that do not affect analog sensing at the receiver. FSK modulation is for sending digital messages in addition to the analog value. The accuracy of the analog level must be precisely controlled for accurate sensing. HART communication will not bump process variables.

In multi-drop mode, theoretically up to 16 devices in HART 5 (addresses 0-15) or up to 64 devices in HART6/7 (addresses 0-63) can exist on the two-conductor network. Practically, the number of devices in a multi-drop installation is limited due to design constraints. When installing into a multi-drop network, consider that the SLG700 requires a minimum startup current of 17 mA and a minimum terminal voltage of 11 V during startup. After this initial startup period (approximately 0.5 seconds), the loop current will be fixed at 4 mA, and the minimum terminal voltage is 14 V. The power source, wiring, intrinsic safety barriers, and other devices in the network must also be considered.

Transmitters with HART capability have features that vary among manufacturers and with the characteristics of specific devices. The FDC software application executing on the MCT404 supports the HART Universal, Common Practice and Device Specific Commands which are implemented in the Honeywell Transmitters.

1.2 Making Transmitter Adjustments

Zero and Span adjustments are possible in new generation SLG700 SmartLine Level Transmitters by using the optional three-button assembly located at the top of the Electronic Housing. However, certain capabilities are limited in the following configurations:

- Without a display – Zero and Span setting only for HART devices.
- With a display – Display supports configuration of basic parameters. Complete transmitter configuration is possible only with DD and DTM.

You can also use the Honeywell MCT404 Configuration Tool to make any adjustments to an SLG700 Transmitter. The MCT404 tool has two applications; MC Toolkit (MCT) and Field Device Configurator (FDC).

Using the FDC application, you can adjust the SLG700 HART model configuration.

Certain adjustments can also be made through the Experion Station if the Transmitter is digitally integrated with a Honeywell Experion System.

SLG700 HART models can be configured using Honeywell tools such as Experion in conjunction with FDM, using DTMs running in FDM or PACTware, or Emerson 375 or 475.

1.2.1 Local Display Options

The SLG700 Level Transmitter offers the Advanced Display; see Table 1 for a list of features.

Table 1 - Available Display Characteristics

Advanced Display	• 360º rotation in 90º increments
	• Three (3) configurable screen formats:
	  – Large process variable (PV)
	  – PV with bar graph
	  – PV with trend (1-999 hours, configurable)
	• Eight (8) screens 3-30 seconds configurable rotation timing
	• Standard and custom engineering units
	• Diagnostic alerts and diagnostic messaging
	• Multiple language support:
	  – Western pack contains: English, French, German, Spanish, Turkish, Italian and Russian
	  – Eastern pack contains: English, Chinese and Japanese
	• Supports optional 3-Button configuration and HART calibration
	• Supports transmitter messaging and maintenance mode indication

2 Configuration Tools and Interfaces

2.1 Overview

This section describes the tools and interfaces involved in configuring a new SLG700 SmartLine Level Transmitter for HART® communication operation. The information in this section also applies to adjusting the configuration of a Transmitter that has been in operation and updating one that is currently in operation.

2.1.1 Prerequisites

The information and procedures in this manual are based on the assumption that personnel performing configuration and calibration tasks are fully qualified and knowledgeable in the use of the Honeywell MC Toolkit or MCT404. The name MC Toolkit or Toolkit and MCT404 are used interchangeably as MCT404 is the model name for the Honeywell MC Toolkit product.

When using MCT404,before connecting to a HART transmitter, verify that the Field Device Configurator (FDC) application is used and not the MC Toolkit application. When you use the MC Toolkit application, the MCT404 is set for DE communications, where the current amplitude can *bump* process variables in either point-to-point or in the multi-drop mode in HART.

Furthermore, we assume that the reader is intimately familiar with the SLG700 family of SmartLine Level Transmitters and thoroughly experienced in the type of process application targeted for Transmitter deployment. Therefore, detailed procedures are supplied only in so far as necessary to ensure satisfactory completion of configuration tasks.

2.1.2 MC Toolkit

Before using the MC Toolkit, be sure that you are aware of the potential consequences of each procedure, and that you use appropriate safeguards to avoid possible problems. For example, if the Transmitter is an element in a control loop, the loop needs to be put in manual mode, and alarms and interlocks (i.e., trips) need to be disabled, as appropriate, before starting a procedure.

2.1.3 MC Toolkit (MCT404) Software Applications

The MC Toolkit (handheld) has two software applications to work with SLG700 SmartLine Level Transmitters:

- **Field Device Configurator (FDC)**. This application is used for configuring, calibrating, monitoring, and diagnosing HART devices. FDC conforms to the IEC 61804-3 EDDL (Electronic Data Description Language) standard specification. The FDC application is an open solution that supports devices with a registered device description (DD) file compatible with HART Communication Foundation (HCF) requirements.
- **MC Toolkit (application)**. This application is used for configuring, calibrating, monitoring, and diagnosing Honeywell Digitally Enhanced (DE) devices. Honeywell SmartLine Level transmitters do not support the DE protocol at present.

Details for working with the MC Toolkit are provided in the *MC Toolkit User Manual,* Document # 34-ST-25-50. In subsequent sections of this manual, explicit operating instructions are provided only in so far as necessary to complete required tasks and procedures.

2.1.4 Configuration Databases

The MC Toolkit is used to establish and/or change selected operating parameters in a Transmitter database.

2.1.5 Configuration

Configuration can be accomplished both online and offline with the Transmitter powered up and connected to the MC Toolkit. Online configuration immediately changes the Transmitter operating parameters. For Offline configuration, Offline files created using Honeywell FDM Tool can be imported into FDC application and then can be downloaded to the Transmitter.

When you set up or configure a Transmitter, it can take up to 30 seconds for the value to be stored in it. If you change a value and Transmitter power is interrupted before the change is copied to nonvolatile memory, the changed value will not be moved to nonvolatile memory.

2.1.6 MC Toolkit–Transmitter Electrical/Signal Connections

Resistor values apply to SLG700 Level transmitters only. Refer to *SLG700 Transmitter User's manual, #34-SL-25-11*, for acceptable power supply and RL ranges.

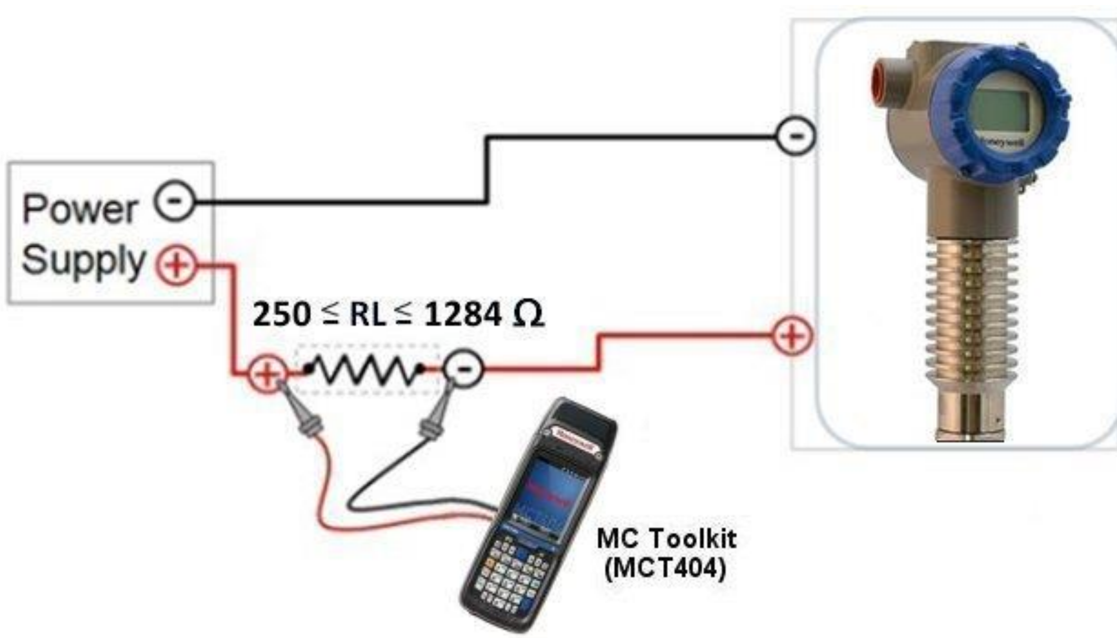


Figure 2: MC Toolkit-Transmitter Electrical/Signal Connections

2.1.7 DTM

The DTM is a Device Type Manager following the FDT specification and can be installed for use by any application that acts as an FDT compliant host container. Of which PACTware is just one. See section 7.

3 Transmitter Configuration

3.1 Using the Field Device Communicator (FDC)

Each new SLG700 Level Transmitter configured for HART protocol is shipped from the factory configured as ordered to meet customer requirements. No reconfiguring should be necessary, however if changes are desired then this section assumes that the user will use the **Field Device Communicator (FDC)** application for HART configuration tasks. The **FDC** application provides the facilities for the online and offline configuration of Transmitters operating with HART protocol.

Online configuration requires that the Transmitter and MC Toolkit are connected and communication between the two has been established. Online configuration provides a set of functions with which to perform various operations on a HART communication network through an active communication link. These operations primarily include configuration, calibration, monitoring, and diagnostics. Typically, these operations could be realized through various constructs exposed by the Device Description (DD) file. In addition, the FDC application provides some functions for convenient execution of these functions.

Offline Configuration refers to configuring a device when the device is not physically present or communicating with the application. This process enables the user to create and save a configuration for a device, even when the device is not there physically. Later when the device becomes available with live communication, the same configuration can be downloaded to the device. This feature enables the user to save on device commissioning time and even helps the user to replicate the configuration in multiplicity of devices with lesser efforts. Currently, FDC does not support creating offline configuration. However, it supports importing of offline configuration from FDM R310 or later versions. The configurations thus imported can be downloaded to the device from FDC.

The following are the tasks that the user needs to perform for importing offline configuration in FDC application software and then downloading it to the device.

- Create offline configuration template in FDM
- Save the configuration in FDM in FDM format.
- Import the offline configuration in FDC
- Download the offline configuration to the device

Note: For details on creating and using offline configuration, refer to section Offline configuration in FDM User's Guide.

3.1.1 Personnel Requirements

The information and procedures in this section are based on the assumption that the person accomplishing configuration tasks is fully qualified and knowledgeable on the use of the MC Toolkit and is intimately familiar with the SLG700 family of SmartLine Level Transmitters. Therefore, detailed procedures are supplied only in so far as necessary to ensure satisfactory configuration.

3.2 Overview of FDC Homepage

The FDC homepage consists of links for Online Configuration, Offline Configuration, Manage DDs, and Settings. See below.

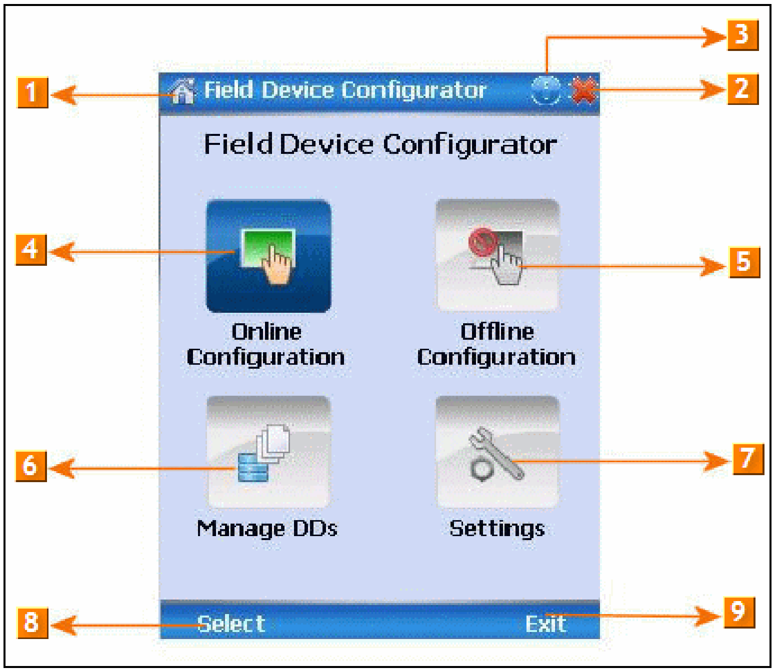


Figure 3: FDC Homepage

Table 2 lists the items that appear on the FDC homepage and its descriptions.

Table 2 - FDC homepage elements

Items	Description
1	Screen title.
2	Tap to quit FDC.
3	Tap to view the application information.
4	Tap to navigate to Online Configuration screen.
5	Tap to navigate to Offline configuration screen.
6	Tap to navigate to Manage DDs screen.
7	Tap to navigate to Settings screen.
8	Tap to select the highlighted menu option.
9	Tap to quit FDC.

Note: To select an option in FDC the user can either select the option then tap **Select** or double-tap the option.

3.2.1 Settings

Use this feature to customize FDC. The user can customize FDC for device detection, DD selection, and other application settings.

Device Identification

Use the following options to configure FDC to identify a device.

- Using Poll Address
  - **Use poll address 0 only:** Use this to detect a device with the poll address as zero.
  - **Find first poll address and use:** Use this to detect a device with the first available poll address in the range of poll addresses that are available.
  - **Use selected poll address:** Use this to detect a device with a specific poll address in the range of zero to 63.
  - **Use From**: Use this to detect a device based on a range of poll addresses.
- **Using Device TAG**: Use this to detect a device with a known HART tag.
- **Using Device LONG TAG**: Use this to detect a device with a known HART long tag (applicable for devices with HART 6 or later Universal revisions).

Note:	If the user chooses the **Using Device TAG** or **Using Device LONG TAG**, the FDC prompts the user to enter a device tag/long tag name during device detection.

DD selection

- Use the following options to configure FDC to select DD files when a DD with matching device revision is not available.
  - **Use DD file of previous device revision**: Use this option to automatically communicate using a DD file having device revision lower than that of the device.
  - **Use generic DD file**: Use this option to automatically communicate to the device using an appropriate generic DD file.
  - **Always ask user**: Use this option to always prompt the user with a choice for communicating to the device either using the previous device revision or using a generic DD file.
  - **Always Use Generic**: Use this option to always communicate to the device using generic DD files even if a DD file with matching device revision as the device is present.

Note:	A generic DD file is a DD file that provides access and interface to the universal data and features of a HART device.

Other settings

Low storage notification: Use this option to set a percentage value and to notify the user with a warning message when the available storage card space is less than the percentage set.

Application diagnostics: Use this option to enable or disable the logging infrastructure for application diagnostics. With this option enabled, FDC creates necessary log files for troubleshooting and diagnostics. These files are stored in SD Card\FDC folder.

Note:	The user must not enable this option unless suggested by Honeywell TAC because this may impact the application performance.

3.2.2 Manage DDs

Using this feature, the user can manage the DD files installed with FDC. A DD file contains descriptive information about the functionality of a device. By default, a set of DD files are installed with FDC. However, if you do not have a DD for a given device, the user can install it using the "Add DD" feature. Similarly, the user can uninstall a DD file or a set of DD files using "Delete DD" feature. The user can also directly copy the DD files in appropriate hierarchy using a card reader or "Active Sync/Mobile Device Center" mechanisms. In such a case, the user should validate the library view using the "Refresh" feature.

Overview

Using **Manage DDs**, the user can view, add, or delete DD files for devices. A list of already available DD files is maintained in the DD Library. FDC lists the installed DD files in a hierarchy as below:

- Manufacturer
- Device Type
- DevRev xx, DDRev yy
- DevRev pp, DDRev qq

Add a DD file

To add a DD file for a device, perform the following steps.

1. From the FDC homepage, tap Manage DDs > Select.

   The **Manage DDs** dialog box appears.

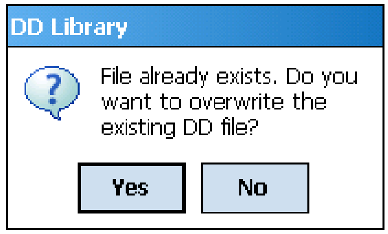
2. Tap Options > Add DD.

   Or

   Tap .

   The **ADD DD files** dialog box appears.

3. Browse to the location in which the DD file (**.fm8)** is located and tap **OK**.
4. If the DD file already exists, then the following message appears.



5. Tap **Yes** to overwrite the existing DD files.
6. If the DD file is successfully added, a success message appears.

Delete a DD file

Using this option, the user can delete a particular version of a DD file. To delete a DD file for a device, perform the following steps.

- From the FDC homepage, tap **Manage DDs** > **Select**.

  The **Manage DDs** dialog box appears.

- The user can choose to delete DD(s) in one of the following ways:
  a) By device manufacturer – Select a device manufacturer to delete all device types and DDs associated with the manufacturer's devices.
  b) By device type – Select a device type to delete all DDs associated with the device.
  c) By device revision and DD revision – Select the specific entry of device revision, DD revision to delete the specific DD
- Tap Options > Delete DD.

Or

Tap .

A confirmation message appears.

- Tap **Yes**.

  If the DD file is deleted successfully, a success message appears.

- Tap **OK** to return to **DD Library** page.

Validating a manually edited library

Besides using the Add/Delete DD features, advanced users may also manipulate a DD library by directly editing the contents of the FDC\Library folder. DD files can also be transferred directly to this location by connecting the MCT to a PC. In such cases, the user must perform the following steps to validate a DD Library, thus edited manually:

1. From the FDC homepage, tap Manage DDs > Select

   The **Manage DDs** dialog box appears

2. Tap Options.
3. Tap Refresh Library.

Or

1. Tap .
2. A confirmation message appears.
4. Tap **Yes**. The DD library is now validated and refreshed.

3.2.3 Online configuration

Using online configuration, you can configure, calibrate, monitor and diagnose a HART device which is connected to MC Toolkit. FDC provides the features to perform these functions through the various constructs offered through the DD file of the device. Besides there are certain other features available under this link for you to conveniently work with a HART device with live communication. After making changes to the device the user can also save a snapshot of the device data as history to later transfer it to FDM for record and audit purposes.

3.2.4 Offline configuration

Offline configuration refers to configuring a device offline (without physically connecting to the device) using a template and then downloading the configuration to the device. Presently, FDC application software does not support creating offline configuration. However, it supports importing of offline configuration from FDM (R310 and above).

3.2.5 Online Configuration Overview

Online Configuration option provides the user a set of functions with which they can perform various operations on a device with an active communication link. These operations primarily include configuration, calibration, monitoring, and diagnostics of a HART device. Typically, these operations could be realized through various constructs exposed by the DD file of the device. In addition, FDC also provides some additional application functions for the user to perform these functions more conveniently.

Online configuration includes a set of functions to perform various operations on a Transmitter with active communication link. These operations primarily include:

- Identifying a Transmitter
- Reading and reviewing Transmitter variable values
- Editing Transmitter variable values
- Downloading the selected/edited variable set to the Transmitter

Detecting and loading a device

Tap the Online Configuration button on the Application Home page.

The device detection and loading process automatically gets started. Depending upon the Device Detection and DD Selection settings the user may have chosen, the user may be prompted for certain inputs as described in the **Settings** section.

3.2.6 Overview of Device Homepage

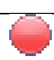
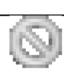
Once the device is detected and loaded successfully, the user can view the device homepage for the identified device.

The workspace area on the device homepage consists of 4 tabs on the left hand side. Selecting a tab displays functions/information associated with that tab on the right hand side.

Figure 4: Device Homepage

Table 3 lists the device health status and their indications.

Table 3 - Device health status

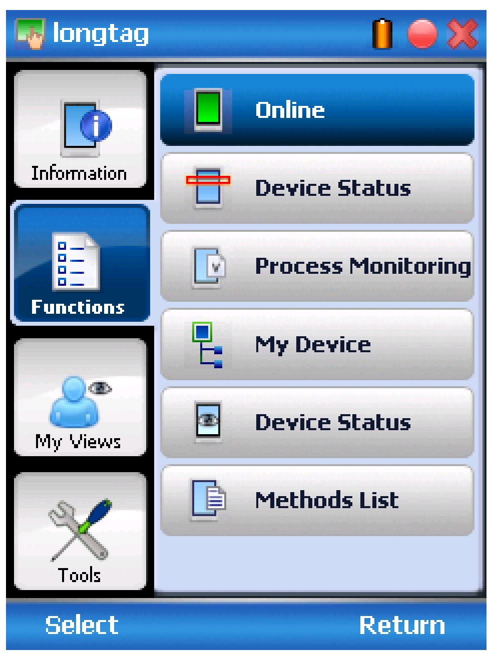
Device health icons	Indications
	Indicates there's no health or status indicators reported by the device
	Indicates that the device is potentially reporting a status which needs attention and further investigation. It is advised that the user use Device Status under Functions tab to further investigate the details.
	Indicates that the device has lost communication with MC Toolkit

3.2.7 Tabs on the Device Home page

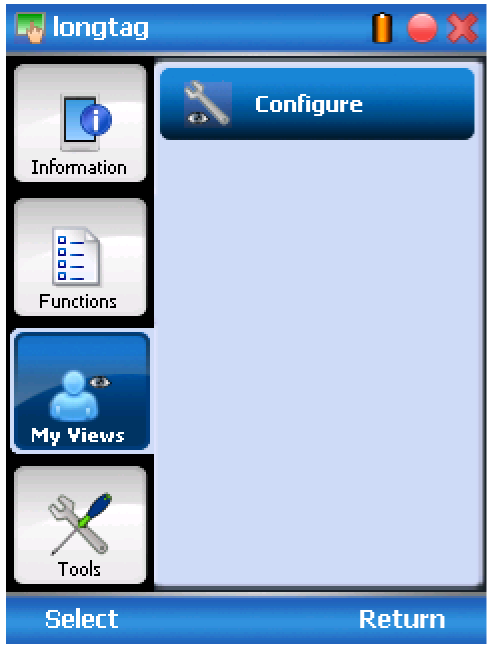
The following are the options that are available on the device homepage.

Information tab: Use this option to view the device identity related information. The user can view the manufacturer name, device type, device revision, DD revision, and universal revision of the HART device.

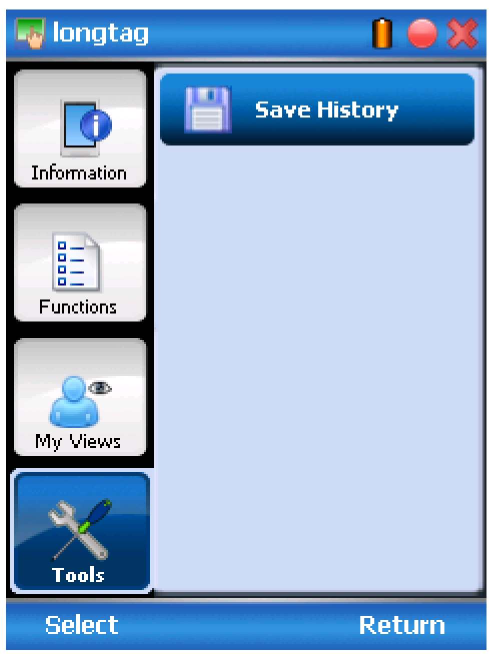
Functions tab: This tab provides various options which the user may use for navigating through the device specific user interface and some standard features offered by FDC across all devices. For the sake of explanations, the right side options under this tab shall be referred as “Entry points” throughout the rest of the document.



My Views tab: Quite often, the user may be interested only in a set of variables of a device. But navigating through the menu tree of a device may not be helpful because of time and further all variables that the user want may not be in the same location. Using this unique feature of FDC, the user can now choose what they want to view in a device in your own views. FDC allows the user to create two such views per device revision of a specific device type. The user can always modify them as per your needs.



Tools tab: This tab is a placeholder for FDC specific tools for providing certain functionality. Currently the only option it provides is called as Save History. Using this option you can save the snapshot of the device variables. This snapshot is saved in a format which can be later imported as a history record in FDM.



3.2.8 Using FDC for various device operations

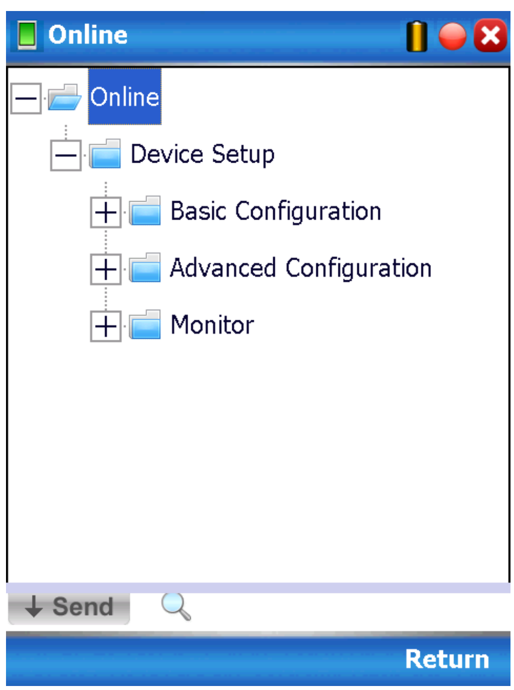
Typical operations with a smart field device involve configuration, monitoring, and diagnostics. FDC enables the user to achieve these operations with a HART device via the various interfaces/constructs exposed through the DD file of the device.

The "Functions" tab under the device home page provides the entry points for navigating through the device specific user interface to perform the above mentioned operations. A device may define up to four entry points in the DD file. All devices shall have at least one entry point, generally referred to as "Online". Besides the device specific entry points, FDC provides custom entry points for navigational aids to specific types of information/features. One such entry point is called Device Status, which is used for reviewing device health. Another is called Methods List, which is used to navigate to all the methods available in a device.

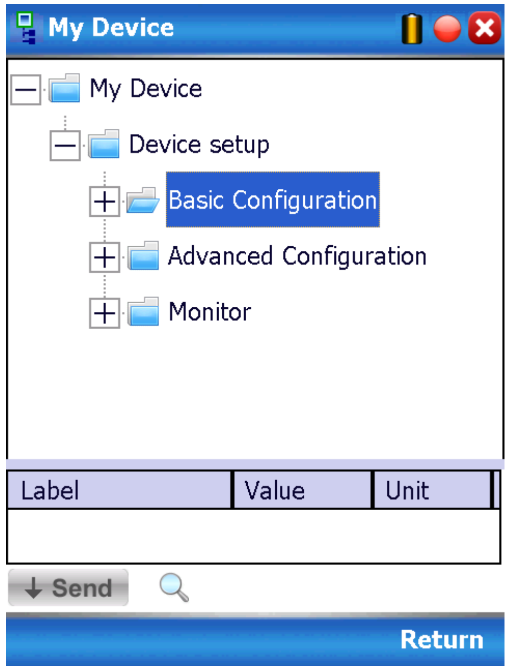
All of the device specific entry points represent the device interface, as explained using the Online entry point as an example. All the other device specific entry points have a similar interface except for the fact that the variables and other DD constructs provided under each may vary as indicated by the title of each entry point.

For the sake of explanation, the pages that appear on navigating through the device specific entry points are referred to as "Device Configuration" pages in this document. However it must be noted that this does not prohibit the user from performing other device operations as explained above.

Online Device Entry Point: When the user tap on to open the Online tab, the device configuration screen appears as shown below.



Alternately the user can access the full EDDL features by selecting the **My Device** Tab



Navigate through the menus to access various functions. See section 3.2.9 page 16 for a complete listing of all the parameters and details.

3.2.9 Device Configuration and Parameter Descriptions

Below are descriptions of all parameters for a HART Transmitter with the Online tab menu path. The same parameters may be accessed via the Shortcuts menu under the My Device tab.

Parameters are grouped under the following headings.

Basic configuration (see Table 4)

- General
- Process
- Measurement
- Dynamic Variables
- 4-20 mA Outputs
- Summary

Advanced Configuration (see Table 5)

- Mounting
- Probe
- Linearization*
- Volume*
- Correlation Algorithm
- Services
- Local Display
- Summary

Monitor (see Table 6)

- Dashboard
- Device Status
- Device Information
- Echo Curve
- Adv Diagnostics

*** The Linearization and Strapping tables may not work with AMS system**

Table 4 - Basic Configuration parameters

Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
General		
Tag		Enter Tag ID name up to 8 characters long.
Long Tag		Enter Tag ID name up to 32 characters long.
Length Unit	m cm mm in ft	Select the unit for all length related parameters.
Temperature Unit	°C °F	Select the unit for all Temperature related parameters.
Volume Unit	liter ft3 in3 US gal imp gal bbl(liq) yd3 m3 bbl	Select the unit for all volume related parameters.
Velocity Unit	ft/s m/s in/min m/h ft/min in/s	Select the unit for all Velocity (rate) related parameters.
Date		Gregorian calendar date that is stored in the Field Device. This date can be used by the user in any way.
Descriptor		Enter any desired or useful descriptor of the transmitter.
Message		Enter a message up to 32 alphanumeric characters) that will be sent to the Display. The message will be shown on the Display interspersed with the configured screens.
<u>Clear message</u>		Select to clear message from transmitter's local display.
Final assembly num		Used for identify electronic components.

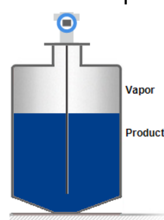
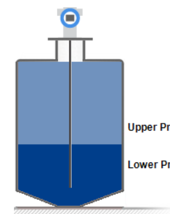
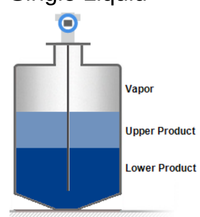
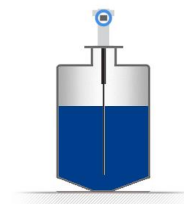
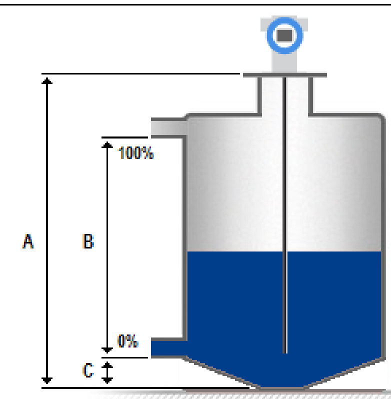
Table 4 - Basic Configuration parameters, cont’d		
Key: Plain = Read only	**Bold** = Configurable	**<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph
Process		
Measured Products	Single Liquid Two Liquids, Flooded Two Liquids, Non- Flooded Saturated Steam Single Liquid, Low DC	Select measured product.
Meas. Prod. Ref. Image.		Provides the image based on configured measured product.  Single Liquid  Two Liquids Flooded  Two Liquids Non-Flooded  Saturated Steam
<u>Config. DC Param.</u>	Vapor DC Product DC Upper Prod DC Lower Prod DC	Select dielectric constant (DC) values for measured product. A drop-down list of typical products and their DCs is provided.
Lower Prod DC		.
Upper Prod DC		For single liquid, this is Product DC.
Vapor DC		
Max. Filling Rate	#	Enter Maximum filling/emptying speed.
Measurement		
Sensor Height	See A in image	
Max. Product Level	See B in image	
Level Offset	See C in image	
Measurement Range Details Image		
Probe Length		Enter probe length.

Table 4 - Basic Configuration parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Dynamic Variables		
Measured Products (Read only)	Single Liquid, Two Liquids Flooded Two Liquids Non-Flooded Saturated Steam Single Liquid, Low DC	Selected product being measured. **IMPORTANT:** If the user changes the Measured Product after configuring Dynamic Variables, always check that dynamic variables configuration corresponds to the new Measured Product. (For example, an error will be generated if PV is Intf Level while Measured Product is Single Liquid.)
<u>Config. Dynamic Var.</u>		
PV (Primary Variable and loop current) SV (Secondary Variable) TV (Tertiary variable) QV (Quaternary variable)	Product Level Product Level % Distance To Product Product Level Rate Vapor Thickness Vapor Thickness % Interface Level Interface Level % Distance To Interface Interface Level Rate Upper Product Thickness Product Volume Vapor Volume Lower Product Volume Upper Product Volume	Four dynamic variables PV, SV, TV, and QV can each be configured to monitor a different device variable. These 4 dynamic variables and their live measured values will be displayed under the Monitor tab. **Note:** The device variables available to PV, SV, TV and QV will vary according to the measured products. For example, Dist to Intf will not be available for a single liquid. Also, the volume-related device variables are available only if the volume calculation method has been configured (page **Error! Bookmark not defined.**). Always check configuration after changing Measured Product configuration. **IMPORTANT:** The PV primary variable is the process variable that controls the loop output, whereas the SV, TV and QV are monitored only. For more details on abbreviations used please refer to DD help files.
PV is	PV's assigned variable.	
SV is	SV's assigned variable.	
TV is	TV's assigned variable.	
QV is	QV's assigned variable.	

Table 4 - Basic Configuration parameters, cont'd

Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph

4-20 mA Outputs

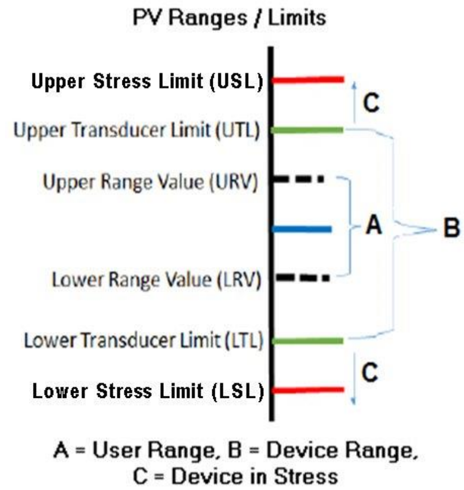
PV Levels Image		. 
PV URV	#	Enter the measured PV upper range value for which the analog output will be scaled to 20 mA.
PV LRV	#	Enter the measured PV lower range value for which the analog output will be scaled to 4 mA.
PV Damp	#	Enter number of seconds damping time applied to the analog output.
PV % rnge	#	PV's value expressed as % of range.
PV Loop current		PV's loop current (4-20 mA).
PV Alrm typ		Defines the loop current value when device detects critical fault. **Hi:** Loop current is set to more than 21 mA **Low:** Loop current is set to less than 3.6 mA.
Loop current mode		Enable: Enables loop current mode (analog output will operate as a 4 to 20 mA signal consistent with the transmitter output). Disable: Disables loop current mode (analog output will be fixed to value set by user).
Poll addr	#	Address used by the Host to identify a Field Device, and changeable by the User to control: the Multidrop Mode for Analog Output 1), and the Analog Output Fixed Mode of Analog Output 1).
Num req preams	#	Number of request preambles required from the Host request by the Field Device for Synchronization.
Echo Lost Timeout	#	Enter number of seconds. In case of Echo is lost (peaks are not detected), device waits for configured timeout to report fault.

Table 4 - Basic Configuration parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Latching mode		Determines behavior in the event of a critical error. **Latching:** The transmitter will stay in the critical error state until the user performs a hardware or software reset. **Non-Latching:** The transmitter will leave the critical error state automatically, after the circumstances leading to the critical state cease to exist.
NAMUR output		Enabled: High saturation current value set to 20.5. Disabled: High saturation current value set to 20.8.
Summary		
Summary		Shows important basic configuration parameters.

Table 5 - Advanced Configuration parameters

Table 5 - Advanced Configuration parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
<u>Mounting</u>		
Transmitter Model (Read only)	SLG720: Standard SLG726: High Temperature & High Pressure	
Process Connection Type (Read only)	Threaded Flanged	
Sensor Connection (Read only)	Direct Remote	
Mounting Location	Tank Bracket	
Nozzle	Nozzle Height Nozzle Diameter	
Bypass/standpipe	Bypass/Standpipe Height Bypass/Standpipe Diameter	
Stillwell	Stillwell Height Stillwell Diameter	
Mounting Angle	In Degrees	
Full Tank Detection	Disabled Enabled	Enabled: Detection of product at top of flange.
Background Type	Built-in Field Obstacle	Built-in: Use default factory loaded background for noise cancellation Field: Use captured field background for noise cancellation in the process connection area. Obstacle: Use captured obstacle background potentially up to probe end for noise cancellation.
Dynamic background	OFF ON	This feature provides enhanced immunity against changes in measurement conditions by dynamically adjusting the active Field or Obstacle background profile. This feature is not applicable for the Factory background. When enabled, the sensor periodically schedules automatic updates to the background echo profile."
<u>Start Capture</u>	This will initiate capture of a new background echo	

Table 5 - Advanced Configuration parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Probe		
<u>Config. Probe</u>		
Probe Type	Custom Rod Wire Coax Multi Twist Wire PTFE Rod PTFE Wire	
Probe Diameter	Custom 4mm 6mm 7mm 8mm 12mm 16mm 22mm 42mm	
Probe End Type	None Clamp Weight Loop	
Centering Disk Type	Custom 316/316L Stainless Steel PTFE C-276 Nickel Alloy	
Probe material	Custom 316/316L Stainless Steel PFA coated stainless steel C-276 Nickel Alloy	
Centering Disk Diameter	2 inches 3 inches 4 inches 6 inches 8 inches	
Probe Propagation Factor	0.9 to 1.1	
Probe Length	Refer to *SLG700 Transmitter User's manual #34-SL-25-11*	

Table 5 - Advanced Configuration parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Probe Details Image		
Steam Reference Probe Type	None 30cm 50cm	
Probe Length Calibration	Calibrates the precise length of the probe which is required for single liquid low DC application.	
Steam Reference Calibration	Calculates the actual length of the saturated steam reference probe.	
<u>Config. Blocking Dist</u>		
Block. Dist. High (Read only)	See B in image	A region near the flange where measurements are not possible or are inaccurate.
Block. Dist. Low (Read only)	See C in image	A region near the probe end where measurements are not possible or are inaccurate. This is somewhat dependent on the DC of the material being measured.
Loop Current in BD	High Saturation, Low Saturation, Last Known Good value, Default	Select behavior of the analog output when the PV measurement is in the blocking distance. **High Saturation:** Sets loop current to either 20.5 or 20.8 based on Namur Selection. **Low Saturation:** Sets loop current to 3.8 mA. **Last Known Good Value:** Loop current follows the last known PV value. **Default:** If distance is in High zone, loop current is set to high saturation current. If distance is in Low zone set loop current to 3.8 mA.

Table 5 - Advanced Configuration parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Linearization		
Linearization	Disabled Enabled	The linearization table in the transmitter is either Enabled or Disabled. When enabled the transmitter's, measured values are replaced by corresponding user-specified corrected values from the linearization table. Before enabling the user must first configure linearization table, then Send it to the transmitter. The table can be updated either as complete block (dry calibration) or single entry (wet calibration) measurements are active. **Note:** The Level Linearization feature does not affect the values reported for the Distance to Product and Distance to Interface device variables. If Level Linearization is enabled, measured level is no longer described solely by the basic geometry and it is possible that the Product Level will not be equal to (Sensor Height – Level Offset – Distance to Product). Likewise, for the measured interface if is applicable based on measured product type.
<u>Config. Linearization Points In Use</u>	2-32	Enter number of index points to be used in the dry and wet linearization tables. The user can enter up to a maximum of 32 points to construct the tables.
Level Points In Use	2-32	
Linearization Table		In this table for dry linearization, the user can enter pairs of Measured Level and a corresponding Corrected Level. Press Send to download the table to the transmitter's memory. Table will be used after Linearization is enabled.
Refresh Linearization Table		Updates the table with recent changes made.
Length Unit (Read only)	m cm mm in ft	Length unit used in the linearization tables.
<u>Wet Linearization</u>		In this wet Linearization method, enter a linearized level for the corresponding level. Press Send to download the table to the transmitter's memory.
<u>Save Linear. Date</u>		Enter the date of creation for the linearization table.
<u>Linearization Records</u>		Date of saved linearization table.

Table 5 - Advanced Configuration parameters, cont'd

Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph

Volume		
Vol Calc. Type	• None • Ideal Tank Shape • Strapping Table Calculation	Choose volume calculation method as Ideal tank shape if tank has ideal shape such as Sphere or Cylinder. If tank has irregular shape, then user can select volume calculation type as Strapping Table Calculation and define Level to Volume relationship in the table. **Note:** Select **Volume Calculation Type** as **None** if Volume related device variables (eg. Product Volume) are not required to be measured and monitored by device.
Volume Offset		Enter volume correction value, if desired.
<u>Config. Strapping Points In Use</u>		2-50
Volume Points in Use		2-50
Strapping Table		In this dry volume strapping table, for each point enter a Level and a corresponding Volume. Press Send to download the table to the transmitter's memory.
<u>Refresh Strapping Table</u>		Updates table with any changes made.
Length Unit (Read only)		m cm mm in ft
Volume Unit (Read only)		L ft3 in3 gallon ImpGal bbl liquid yd3 m3
<u>Wet Volume Calibration</u>		In this wet volume strapping table, enter a volume for the corresponding level for each point. Press Send to download the table to the transmitter's memory.
<u>Save Strap. Date</u>		Enter the date of creation/modification of the strapping table.
<u>Strapping Records</u>		Read Only, Date as configured using "Save Strap Date".

Table 5 - Advanced Configuration parameters, cont'd	
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph	
Correlation Algorithm	
Config. Corr. Algorithm	The correlation algorithm searches the full echo curve looking for reflection shapes that match (that is, correlate highly with) models for reference, surface, and interface. Each reflection model is a waveform whose shape is defined by parameters such as gain, width, and amplitude. Under normal circumstances, the transmitter will automatically find the level of the surface and interface (if applicable) using the configuration that was shipped from the factory. If the observed echo curve not correctly indicating reference, surface or interface then try the following. 1. Step through the basic configuration and make sure that all entries are correct. 2. Review the Probe Parameters under Advanced Configuration and make sure that all entries are correct. (Accurate basic and advanced configuration settings help ensure accurately defined reflection models.) 3. Capture an echo curve. 4. If needed, adjust the radar pulse reflection model parameters for the Reference, Surface, and Interface (if applicable) to match the radar pulse reflections in the echo curve.
Reference Reflection	If the transmitter is not finding the Reference point, then adjust the Reference parameters to match what is seen on the observed echo at the Reference point location. For example, suppose by zooming in on the observed echo curve at the Reference point position user can see the *observed* Reference Pulse greatest amplitude is -13000 and its width is 180 mm at the x axis; whereas the *configured* Reference Gain is -15000 and *configured* Reference Width is 200 mm. This means user needs to change the *configured* Gain to -13000 and *configured* Width to 180 mm to match the *observed* curve.
Refer. Refle. Width	Determines the width of the Reference Pulse where it crosses the x axis (one half wavelength).
Refer. Refle. Gain	Amplitude (height) of the Reference Pulse wave shape.
Refer. Refle. Attenuation	The attenuation parameter governs how fast the sine wave dies off. Increased attenuation results in smaller side lobes.
Refer. Refle. Threshold	If changing the gain does not help, try increasing threshold. This value is related to whether the model pulse match is accepted. Typically, values are 0.5 to 0.6. Increasing it allows poorer matches of the model to the echo.
Prod/Surface Reflection	If the transmitter is not detecting the Product/Surface level, then adjust the Product/Surface reflection model parameters to match what is seen on the observed echo at the Surface point location. For example, suppose by zooming in on the observed echo curve at the Surface point position the *observed* Surface wave's greatest amplitude is 9000 and its *observed* greatest width is 150 mm at the x axis; whereas the *configured* Surface Gain is 7500 and *configured* Surface Width is 140mm. This means user needs to change the *configured* Gain to 9000 and *configured* Width to 150 mm to match the *observed* curve.
Prod. Refle. Width	Determines the width of the Surface wave where it crosses the x axis (one half wavelength).
Prod. Refle. Gain	Amplitude of the Product/Surface Peak wave shape.
Prod. Refle. Attenuation	Increased attenuation results in smaller side lobes of the wave's shape. Increased attenuation results in smaller side lobes of the wave's shape.
Prod. Refle. Threshold	If changing the gain does not help, try increasing threshold. This value is related to whether the model pulse match is accepted. Typically, values are 0.5 to 0.6. Increasing it allows poorer matches of the model to the echo.

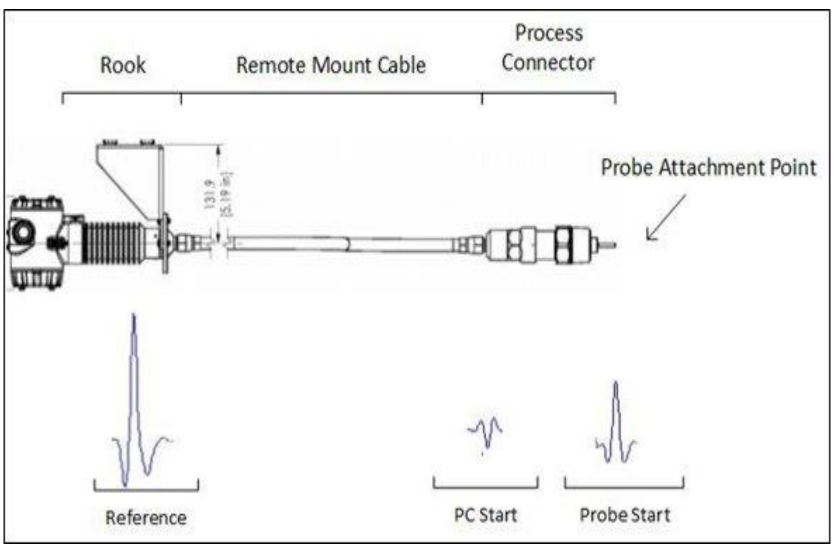
Table 5 - Advanced Configuration parameters, cont'd	
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph	
Correlation Algorithm, cont'd	
Interface Reflection	If the transmitter is not detecting the Interface Level then adjust the Interface Reflection parameters to match what is seen on the observed echo curve at the Interface peak reflection. For example, suppose by zooming in on the observed echo curve at the Interface peak reflection position, user sees the *observed* Interface wave's greatest amplitude is 1200 and its *observed* greatest width is 150 mm at the x axis; whereas the *configured* Interface Gain is 1000 and *configured* Interface Width is 140 mm. Then user needs to change the *configured* Gain to 1000 and *configured* Width to 140 mm to match the *observed* curve.
Intef Refle. Width	Determines the width of the Interface wave where it crosses the x axis (one half wavelength).
Intef. Refle. Gain	Amplitude of the peak corresponding to Interface wave shape.
Intef Refle. Attenuation	Increased attenuation results in smaller side lobes of the wave's shape.
Intef. Refle. Threshold	If changing the gain does not help, try increasing threshold. This value is related to whether the model pulse match is accepted. Typically, values are 0.5 to 0.6. Increasing it allows poorer matches of the model to the echo.
Probe End Reflection	If the Probe End point is not being found, then adjust the Probe End Reflection parameters to match the observed echo at the Probe End point location. For example, suppose by zooming in on the observed echo curve at the Probe End point position the user can see the *observed* Probe End wave's greatest amplitude is 2000 and its *observed* greatest width is 90 mm at the x axis; whereas the *configured* Probe End Gain is 1500 and *configured* Probe End Width is 70mm. This means the user needs to change the *configured* Gain to 2000 and *configured* Width to 70 mm to match the *observed* curve. **Note** that the transmitter will only attempt to find the Probe End Reflection if the surface level is close or below the end of probe.
Prb End Refle. Width	Determines the width of the Probe End wave where it crosses the x axis (one half wavelength).
Prb End Refle. Gain	Amplitude of the wave shape.
Prb End Refle. Attenuation	Increased attenuation results in smaller side lobes of the wave's shape.
Prb End Threshold	If changing the gain does not help, try increasing threshold.
Process Connector Reflection	
Prcs Connector Refle. Width	Determines the width of the Process Connector where it crosses the x axis (one half wavelength).

Table 5 - Advanced Configuration parameters, cont'd	
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph	
Prcs Connector Refle. Gain	Amplitude of the wave shape.
Correlation Algorithm, cont'd	
Prcs Connector Refle. Attenuation	Increased attenuation results in smaller side lobes of the wave's shape.
Prcs Connector Threshold	If changing the gain does not help, try increasing threshold.
Steam Refrerence Reflection	If the transmitter is not detecting the steam reference Level, then adjust the steam reference Reflection parameters to match what is seen on the observed echo curve at the steam reference peak reflection. For example, suppose by zooming in on the observed echo curve at the steam reference peak reflection position, user sees the *observed* steam reference wave's greatest amplitude is 1200 and its *observed* greatest width is 150 mm at the x axis; whereas the *configured* Interface Gain is 1000 and *configured* Interface Width is 140mm. Then user needs to change the *configured* Gain to 1000 and *configured* Width to 140 mm to match the *observed* curve.
Steam Ref. Refle. Width	Determines the width of the steam reference wave where it crosses the x axis (one half wavelength).
Steam Ref. Refle. Gain	Amplitude of the peak corresponding to steam refrence wave shape.
Steam Ref. Refle. Attenuation	Increased attenuation results in smaller side lobes of the wave's shape.
Steam Ref. Refle. Threshold	If changing the gain does not help, try increasing threshold.
<u>Amplitude Tracking</u>	This feature enhances the sensor to track levels under dynamic conditions or when the radar pulse attenuations in the media are not well known. Once the sensor has locked onto a correct level, it will track the amplitude of the reflection rather than using the user configured model amplitude
<u>Config. Calib. Offset</u>	
Calibration Offset	Offset to compensate for a change in geometry at the process connector that affects the measurement.
Reference Plane offset	Read only. Distance between the reference radar pulse reflection and the physical reference plane (flange) in the factory.
Proces. Connec. Offset	Read only.
Steam reference offset	Read only. Distance between process connector reflection and steam reference reflection under nominal condition.
<u>Config. Attenuation</u>	
Vapor Attenuation	This sets the linear attenuation coefficient (Radar Pulse energy dissipation) of Vapor.
Upper Prod. Attenuation	This sets the linear attenuation coefficient (Radar Pulse energy dissipation) of Upper Product (For Two Liquids, otherwise this is just Product/Surface attenuation).
Lower Prod. Attenuation	This sets the linear attenuation coefficient (Radar Pulse energy dissipation) of Lower Product. (For Two Liquids, only).

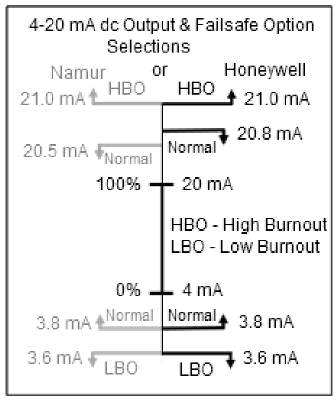
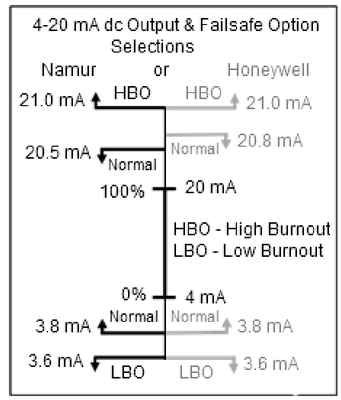
Table 5 - Advanced Configuration parameters, cont'd		
Key: Plain = Read only Bold = Configurable Bold underline = Method Bold italic = Table or graph		
Services		
Install Date		(One time editable) Transmitter installation date in MM/DD/YYYY format. **Note**: If install date is not configured default date is shown as 01/01/1972.
NAMUR Output	Enabled, Disabled	Enable or disable the NAMUR output. **Enable:** High Saturation current is set to 20.5. **Disable:** High Saturation current is set to 20.8.
NAMR Level Image		 NAMUR Disabled  NAMUR Enabled

Table 5 - Advanced Configuration parameters, cont'd	
Key: Plain = Read only Bold = Configurable Bold underline = Method Bold italic = Table or graph	
Services cont.	
Write Protection Image	

Write protect	Displays the current configuration of the write protect function. Write Protect is “Enabled” if either the write protect jumper on the electronics board is in the “ON” position or the firmware write protect has been enabled. The write protect jumper must be set in the Enabled position for SIL safety applications.
Write Protect On/Off	Configure the firmware write protect option. Write Protect selections are: **Enable:** Enables the firmware write protect option (changes in configuration parameters will not be permitted). **Disable:** Disables the firmware write protect option (requires a password). A 4-digit password is required to change the Write Protect option from “Enabled” to “Disabled” to allow configuration changes. The default password is “0000”, and can be re-configured by the user. **Note:** This cannot be changed if transmitter’s Write Protect hardware jumper is disabled. See the *SLG700 Transmitter User’s Manual*, Document #34-SL-25-11 for details.
Change Password	Used to change the write protect password. Disable write protect option before changing the password. Disable: Disables the firmware write protect option (requires a password). A 4-digit password is required to change the Write Protect option from “Enabled” to “Disabled” to allow configuration changes. The default password is “0000”, and can be re-configured by the user. Enter old password and then enter New password.
Apply values	Applied re-range. Set 4 mA and 20 mA by current applied process values
D/A trim	Defined in section 4.3.1
Loop test	Used to perform the loop test. Choose 4 mA and 20 mA analog output levels and fix the field device outputs at 4 mA and 20 mA

Table 5 - Advanced Configuration parameters, cont'd		
Key: Plain = Read only Bold = Configurable Bold underline = Method Bold italic = Table or graph		
Services cont.		
<u>Config. Tamper Alarm</u>		The Tamper Alarm feature provides a warning if more than a specified number of *attempts or actual* configuration changes are made, *whether write protected or not*, when Tamper Alarm is Enabled. The warning stays active until the specified latency period has elapsed after the Primary Master reads the corresponding status byte. Examples of attempted configuration changes: moving the Write-Protect jumper, entering a wrong password. The method allows user to configure the following parameters in the order as specified below: 1. Tamper Mode 2. Tamper Latency 3. Maximum Allowable Attempts
Tamper Mode		When enabled, the "Attempt Counter" will keep track of the number of times an attempt is made. After the configured "Max Attempts", an alarm status (non-critical flag) is generated.
Attempt Counter		Displays the number of device configuration change attempts made when tamper mode is enabled. Changing the tamper mode from enable to disable and vice-versa is also considered as configuration change attempt and "Attempt Counter" is incremented. If user configures "Max Allowable Attempts" to a value less than the current "Attempt Counter " then "Attempt Counter " is clamped to "Max Allowable Attempts.
Tamper Latency		0-60 seconds. Tamper latency is the time period for which the tamper alarm remains set in response of command 48 and reflected as "Tamper Alarm" Device Status condition.
Max Allowable Attempts		Maximum number of tamper attempts to be permitted before the Tamper Alarm is generated.
<u>Reset Tamper Counter</u>		Reset the Attempt Counter to zero.
<u>Master Reset</u>		Selecting this option will cause a Master Reset of the transmitter, which is the equivalent to power cycling the device.
<u>Lock/Unlock Device</u>		Select the Lock state for access by HART configuration tools. If "Yes" is selected to lock the device, also select "Yes" or "No" to choose whether the lock is "permanent." If the lock is not permanent, it will be cleared on power cycle or Master Reset of the device. If "Yes" is selected to unlock the device, the lock state will be cleared.
<u>Factory Reset</u>		Resets all device configuration parameters to their factory defaults and triggers a soft reset. The User will be prompted to confirm they want to take this action.
<u>Reconcile Model Numbers</u>		Read and display both Comm and Sensor Model Numbers. Display Model Number Mismatch non-critical diagnostic. Provide a Match Model Number command with selections to match from Comm or match from Sensor, which is only visible or enabled during a Model Number Mismatch diagnostic.
<u>Reset NVRAM Corruption</u>		Displays the status of NVRAM in Communication module and Sensor Module. In case of NVRAM corruption you can select to reset the individual error, condition and revert to the default parameters. Warning, this can lead to incorrect measurements and should be used with caution
<u>Licensed Option</u>		Displays the currently enable Licensed Options and allows the entry of a license key to enable newly purchased options.

Table 5 - Advanced Configuration parameters, cont'd		
Key: Plain = Read only Bold = Configurable Bold underline = Method Bold italic = Table or graph		
Local Display		
Display Connected		**Yes:** Display is connected **No:** Display is not connected
Type of Display		Type of local display installed on the transmitter.
Common Setup		
<u>Change Password</u>		Select password that will be required for access to the display.
Language		User configurable languages supported by transmitter are English, French, German, Spanish, Russian, Turkish and Italian.
Rotation Time		Length of time each configured screen is visible before rotating to the next available screen, when screen rotation time is selected as "Yes". Available range of screen rotation time is from 3 to 30 seconds.
Screen Rotation		Screen rotation configuration can be either Yes or No. When user selects Screen Rotation as Yes, all the screens configured will rotate with set Rotation Time.
Contrast Level		Display contrast level selection range from 1 (low) to 9 (high).
Screen Info		
<u>Read Display Screen</u>		Method used to read selected screen configuration details.
<u>Configure Display Screen</u>		Method used to configure specific screen.
Screen Number		Provides details of last configured screen using method "Configure Display Screen". Possible Screen numbers are 1-8.
Custom Tag		Custom tag name for the screen title up to 14 alphanumeric characters
Disp High Limit		Upper limit shown on the Bar Graph or Trend screen
Disp Low Limit		Lower limit shown on the Bar Graph or Trend screen.
Screen Format		Provides details of last configured screen using method "Configure Display Screen". Possible Screen formats are: PV only PV & bar graph PV & trend

Local Display, cont'd		
Screen Info		
PV Selection	Product Level Product Level % Distance To Product Product Level Rate Vapor Thickness Vapor Thickness % Interface Level Interface Level % Distance To Interface Interface Level Rate Upper Product Thickness Product Volume Vapor Volume Lower Product Volume Upper Product Volume Loop Output Percent (Output mA)	Select Process Variable (PV) to be displayed. Choices depend on product being measured.
Display Units	Distance: ft, in, m, cm, mm Volume: ft3, in3, US gal, Imp gal, barrels, yd3, m3, liters Level Rate: ft/s, m/s, in/min, m/h Internal temp: F, C	Select display's units.
Decimals		Display's decimal point position.
Trend Duration		For "PV and trend" display option, enter a trend duration time from 1 to 999 hours.
Summary		
Summary		Shows the important advanced configuration parameters.

Table 6 - Monitor parameters

Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Dashboard		
PV Is PV SV Is SV TV Is TV QV Is QV	Product Level Product Level % Distance To Product Product Level Rate Vapor Thickness Vapor Thickness % Interface Level Interface Level % Distance To Interface Interface Level Rate Upper Product Thickness Product Volume Vapor Volume Lower Product Volume Upper Product Volume	Displays measured values for dynamic variables PV, SV, TV and QV, as configured from the choices at left.
PV Loop current		Live value of PV output current.
Internal Elect. Temp.		Live value of sensing module electronics temperature.
Interface Sig. Strength		Lower Product signal strength.
Interface Sig. Quality		Lower Product signal quality.
Surface Sig. Strength		Upper Product signal strength.
Surface Sig. Quality		Upper Product signal quality.
<u>Refresh Signal Info</u>		This will get the live values of signal Strength and Quality.
Meas. Product Level		Non linearized value of product level.
Distance To Product		Live value of distance to product.
Distance To Interface		Live value of distance to interface.
Meas. Interface level		Non linearized value of Interface level.

Table 6 - Monitor parameters**, cont'd**		
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph		
Dashboard, cont'd		
Process monitoring		Live values of dynamic variables in trend or meter form.
PV		
Trend of PV		
PV		
PV Meter		
SV		
Trend of SV		
SV		
SV Meter		
TV		
Trend of TV		
TV		
TV Meter		
QV		
Trend of QV		
QV		
QV Meter		
ET		Live value of sensing module internal electronics temperature.
Trend of ET		
ET		
ET Meter		
PV AO		Live value of PV analog output.
Trend of AO		
PV loop current		Live value of loop current.
AO Meter		Live value of AO
PV AO Percent		Live AO %
PV % rnge		Live PV %
PV % rnge		Live PV %

Table 6 - Monitor parameters**, cont'd**

Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph

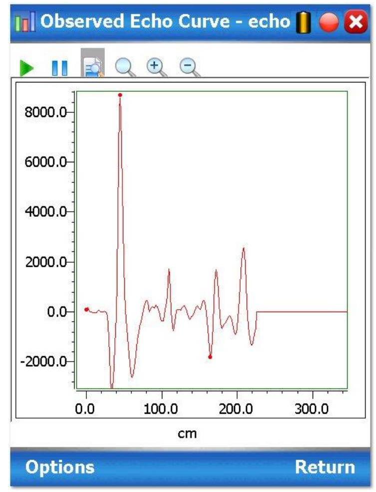
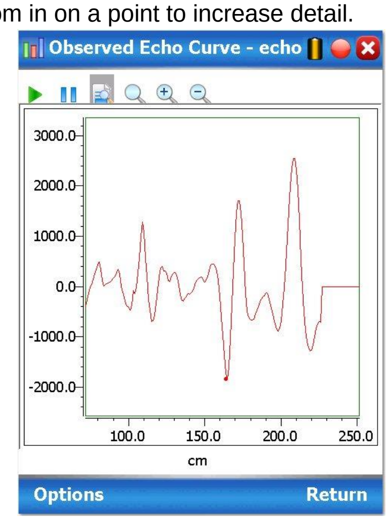
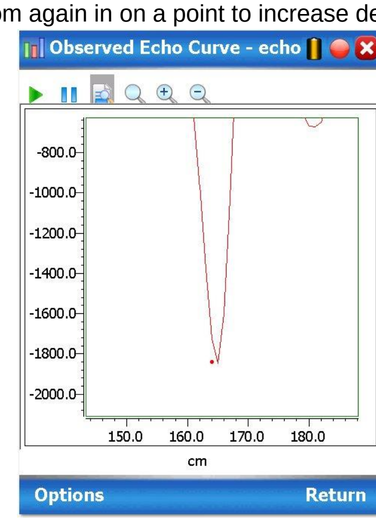
	Device Status	
Critical		Displays all possible Critical Status faults and indicates OFF for inactive faults or ON for active faults.
<u>Help- Critical Diagnostics</u>		Provides a more detailed description of each Critical Status fault.
Non-Critical		Displays the first set of possible Non-Critical Status faults and indicates OFF for inactive faults or ON for active faults.
<u>Help- Non Crit. Diagnostics</u>		Provides a more detailed description of each of the first set of Non-Critical Status faults.
Non-Critical		Displays the second set of possible Non-Critical Status faults and indicates OFF for inactive faults or ON for active faults.
<u>Help- Non Crit. Diagnostics</u>		Provides a more detailed description of each of the second set of Non-Critical Status faults.
Non-Critical		Displays the third set of possible Non-Critical Status faults and indicates OFF for inactive faults or ON for active faults.
<u>Help- Non Crit. Diagnostics</u>		Provides a more detailed description of each of the third set of Non-Critical Status faults.
Non-Critical		Displays the fourth set of possible Non-Critical Status faults and indicates OFF for inactive faults or ON for active faults.
<u>Help- Non Crit. Diagnostics</u>		Provides a more detailed description of each of the fourth set of Non-Critical Status faults.
Extd dev status		Displays all possible Extended Device Status faults and indicates OFF for inactive faults or ON for active faults.
<u>Help- Extended Device Status</u>		Provides a more detailed description of each Extended Device Status fault.
Additional status		Displays additional status of these components.
DAC Failure		
Communication		
Display & Sensor		
Other Info		
Sensor		
Sensor		
Database integrity		
Database integrity		
RAM Integrity		
RAM Integrity		
Display Integrity		
<u>Reset Database</u>		Provides recovering from NVRAM corruption. When this is activated sensor/COMM will reset NVRAM corrupted alarm and default the database. Resetting of COMM/Sensor NVRAM alarms should be done separately - specific user interface and separate bits in HART command that specify which alarm should be reset. When resetting COMM alarm, a warning "transmitter configuration will be defaulted" should be displayed. For sensor alarm reset, warning should be "calibration and characterization data will be defaulted".

Table 6 - Monitor parameters, cont'd

Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph

Device Information		
Manufacturer		Manufacturer ID
Model		Model ID
Dev id		Device ID
Universal rev		HART universal revision
Fld dev rev		Device revision
Software rev		Device software revision
Sensor SW Rev		Sensor module software revision number
Dev SW Rev		
Database SW Rev		
Display SW Rev		Display module software revision number
Install Date		Installation date
Cfg chng count		Number of times any configuration parameter was changed.
Final asmbly num		
Num req preams		Number of request preambles.
Poll addr		Polling address of device
Service Life		Percent of expected Service Life that device has been in service. Value is based on electronics temperature. Service life accumulates faster at higher temperatures with an exponential relationship.
Stress Life		Percent of service life spent in stressful conditions. Indicates the % of service life where electronics temperature is within 10% of respective range limit % of Service life spent either in 10% of lower limit range or 10% of upper limit range. Refer to Table 11.
Power Cycles		Number of power cycles.
System Connections		Typical system connection image
<u>Model Number</u>		Provides details of device Model key and Model Number information.

Table 6 - Monitor parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Echo Curve		
<u>Config. Echo Curve</u>		Configures how to generate echo curve from transmitter.
Echo Curve Type	Windowed Echo Curve Full Echo Curve Processed (Full) Echo Curve Background Subtraction Array	**Windowed Echo Curve:** Used by algorithm to find level measurements. Surface and Interface windows are tracking surface level and interface level respectively. Background subtraction near the reference plane is applied when needed. Useful for troubleshooting correlation algorithm. **Full Echo Curve:** The full "raw" echo curve, i.e. not windowed and no background removal or other processing done to it. Useful for troubleshooting process. **Processed (Full) Echo Curve:** Echo curve with background removal. Useful for troubleshooting process or correlation algorithm. **Background Subtraction Array:** This array contains the echo curve in the reference plane region when the surface level is far away from the reference plane. This array can then be subtracted from the echo curve to improve near zone performance.
Echo Distance Unit	Ft m in cm mm	Units of distance on curve.
Echo Curve Start Distance		Distance from reference to begin the curve.
Echo Curve End Distance		Distance from reference to end the curve.
Echo Curve Resolution		Distance between samples on the curve. Lower number results in more detail but takes longer to process.
Echo Resolution Unit		Units for Echo Curve resolution

Echo Curve, cont'd		
Observed Dist. Echo Curve		Displays the echo curve observed. Key points are marked by dots. Example below.  Zoom in on a point to increase detail.  Zoom again in on a point to increase detail. 

Echo Curve, cont'd		
Echo Curve Type		Windowed Echo Curve Full Echo Curve Processed (Full)Echo Curve Background Subtraction Array
Start Distance		Distance from reference to begin the curve.
End Distance		Distance from reference to end the curve.
Echo Distance Unit	Ft m in cm mm	Distance units used on curve.
Echo Resolution Units		
Echo Resolution		Distance between samples on the curve. Lower number results in more detail but takes longer to process.
Echo Curve Stem Plot Data		
Reference Amplitude		Observed reference amplitude
Process Conn. Refl. Amplitude		Observed reference amplitude
Prod/Surface Amplitude		Observed Surface amplitude
Product/Surface At		True Surface distance
Interface Amplitude		Observed Interface amplitude
Interface Refl. At		True Interface distance
Probe End Amplitude		Observed Probe End amplitude
Probe End Refl. At (True)		True Probe End distance

Table 6 - Monitor parameters, cont'd		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Adv Diagnostics		
PV Tracking		See Table 9 - PV Tracking Diagnostics page 54.
<u>PV Low Value</u>		
<u>PV High Value</u>		
Low Alarm Limit		
Low Alarm Counter		
High Alarm Limit		
High Alarm Counter		
<u>Change Alarm Limits</u>		
<u>Reset PV Tracking</u>		
SV Tracking		See Table 10 - SV Tracking Diagnostics page 55.
<u>SV High Value</u>		
<u>SV Low Value</u>		
Low Alarm Limit		
High Alarm Limit		
Low Alarm Counter		
High Alarm Counter		
<u>Change Alarm Limits</u>		
<u>Reset SV Tracking</u>		
ET Tracking		See Table 11 - ET Diagnostics page 56.
ET		
Max ET Limit		
Max ET Value		
Last ET Up Details		
<u>ET USL</u>		
Time Above USL		
Min ET Limit		
Min ET Value		
<u>Last ET Down Details</u>		
<u>ET LSL</u>		
Time Below LSL		

Adv Diagnostics, cont'd		
Operating Voltage		See Table 12 - Operating Voltage Diagnostics
Loop Voltage		
Min Loop Voltage		
MSP 430 VCC		
Voltage Tracking		
Reset Volt. Tracking		
MCU Supply Voltage		
Power Cycles		
Last Power Cycle		
Config History		Displays a history of the last five configuration parameters that have been changed. See Table 13 - Configuration Change History Diagnostics
First History Parameter		
Second History Parameter		
Third History Parameter		
Fourth History Parameter		
Fifth History Parameter		
Exit		
Error Log		Enable and disable error logging. If error log is enabled all critical errors triggered will be logged with a time stamp (elapsed time since power up). See Table 14 - Error Log Diagnostics
Error Log Flag		
Show Error Log		
Reset Error Log		

Table 7 - Tamper Reporting Logic Implementation with Write Protect

Write Protect Jumper Status	Write Protect Software Status	Configuration Change Allowed?	Tamper Reporting Status	Tamper Alerted Posted?
ON	ON or OFF	NO		
OFF (or missing)	ON	NO		
OFF (or missing)	OFF	YES		
			ON	YES
			OFF	NO

Note: Tamper Reporting is independent of Write Protect status.

The following sections give some examples as to how to edit the configuration parameters and execute Methods.

3.2.10 Procedure to Enter the Transmitter Tag

1. From the My Device menu, make the following menu selections:
2. Shortcuts > Device Setup > Basic Configuration > General > Tag.
3. Click Edit. The Tag screen will be displayed.
4. Key in the tag name (for example: SLG700) which can be a maximum of eight characters.
5. Click OK. The Send to Device screen will be displayed.
6. Select the Tag check box.
7. Click Send to download the change to the Transmitter, or Click Return to continue making changes.

3.2.11 Saving device history

FDC provides the user with a feature wherein they can save the device configuration snapshot as history. This history record may then be transferred to a central asset management database such as FDM.

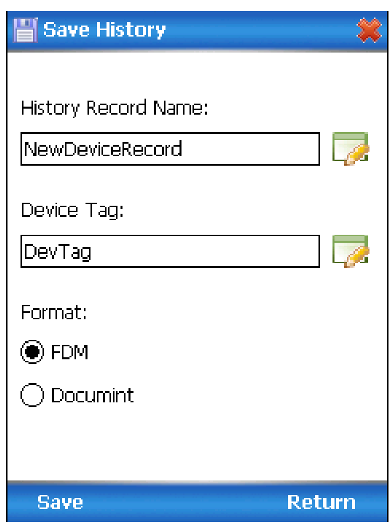
Using this feature the user can save the device configuration snapshot as device history of a connected device at any given time in a predefined location. The following are the features of save device history option.

- Two formats of history are supported: FDM and DocuMint.
- Only one snapshot per device instance is allowed to be saved and can save the snapshot of a device any number of times overwriting the existing one.

To save device history, perform the following steps.

1. On Device Home page, tap Tools.
2. Select Save History and tap Select

The **Save History** page appears.

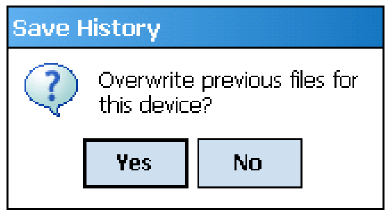


1. Enter the **History Record Name** using the keypad and tap **OK**. History Name field accepts alphanumeric characters, underscore, and no other special characters.

2. Enter the **Device Tag** using the keypad and tap **OK**. Device Tag field accepts alphanumeric characters, underscore, and no other special characters.

Note: The device can be identified with **History Record Name** and **Device Tag** in FDM, once the record is imported in FDM, provided the device is not already present in the FDM network.

3. Select the **Format**. The following are the available formats:
4. FDM
5. DocuMint
6. Tap **Save** to save device history record.
7. If a history record for this device already exists, the following warning message appears.



8. Tap **Yes** to overwrite the existing name. A overwrite success message appears.
9. Tap **OK** to return to **Device Home** page.

3.2.12 Exporting device history records to FDM

The history snapshot saved in FDC can be imported into FDM for record and audit purposes. This is enabled by the standard Import/Export wizard in FDM. This way FDM allows synchronizing the device configuration data through the MC Toolkit handheld.

1. To export device history from FDC and import it in FDM, perform the following steps.
2. Connect the MC Toolkit handheld to the computer as described earlier.
3. Browse to the folder on the computer, SD Card > FDC > Resources > History.
4. The FDC history records are named as per the following convention for the primary name: DeviceTag_ManufacturerIDDeviceTypeDeviceRevisionDDRevision_DeviceID
5. Copy the desired Device History Record files (with .fdm extension) from the above mentioned location to a temporary location on FDM Client computer.
6. Use FDM Import/Export wizard to import the history records into FDM. After imported successfully:
7. The snapshot would get imported into FDM database and appear as a history record for the corresponding device in FDM.
8. The Audit Trail entry for such a record identifies it as being imported through the MC Toolkit handheld.
9. If the device is not part of any of the FDM configured networks, it would appear under ‘Disconnected Devices’ in FDM network view.
10. All operations allowed on Device History Record in FDM will be allowed for the record imported through the MC Toolkit handheld.

Note: For more details on using FDM Import/Export feature, refer to section Importing and Exporting Device History in FDM User’s Guide.

3.2.13 Exporting device history records to Documint

To export device history from FDC and import it in FDM, perform the following steps.

1. Connect the MC Toolkit handheld to the computer as described earlier.
2. Browse to the folder on the computer, SD Card > FDC > Resources > History.
3. The FDC history records are named as per the following convention for the primary name: DeviceTag_ManufacturerIDDeviceTypeDeviceRevisionDDRevision_DeviceID
4. Copy the desired Device History Record files (with .xml extension) from the above mentioned location to a temporary location on the DocuMint system.
5. For Importing in DocuMint: Select Procedures > Import or the Import option in the tool bar.

Note:	For more details on using DocuMint Import feature, refer to section Importing from XML File in Document Help.

3.2.14 Custom Views

FDC provides the user a unique feature wherein the user can choose what they want to view in a device and thus creating your own custom views. This is a very convenient utility when the user is interested in select few variables in a device and saves time for navigating through the menus.

The user can create two views per device type with maximum of 10 variables selected for each custom view.

To create/modify the custom views, perform the following.

1. On Device Home page, tap My Views.
2. Tap Configure and tap Select.

The Configure My Views dialog box appears.

To customize **View1** and **View2**, select the variables by checking the box against desired variables.

3. Tap or to navigate to previous and next set of variables.
4. Once done, tap **Options** to select **Save My Views**.

Two custom views are ready with selected variables.

Note:	Since a custom view can contain only up to 10 variables each, a warning is displayed if more than 10 variables have been selected

To rename the views, perform the following.

5. Tap Options > Rename View1.

A dialog box appears informing the user to enter the name.

6. Tap **Ok**.
7. Tap Option>Save to persist the change
8. Tap **Return** to return to My Views page. There are two options with the names assigned to the newly created views.

Note: To view the custom views, tap **My View 1** > **Select**.

The My View 1 page appears.

Edit the parameters that are Read / Write and select Send.

For more details on any of the FDC features, refer to the *MC Toolkit User Manual,* Document # 34-ST-25-50.

3.2.15 Offline Configuration

Overview

Offline Configuration refers to configuring a device when the device is not physically present or communicating with the application. This process enables the user to create and save a configuration for a device, even when the device is not there physically. Later when the device becomes available with live communication, the same configuration can be downloaded to the device. This feature enables the user to save on device commissioning time and even helps the user to replicate the configuration in multiplicity of devices with lesser efforts. Currently, FDC does not support creating offline configuration. However, it supports importing of offline configuration from FDM R310 or later versions. The configurations thus imported can be downloaded to the device from FDC.

The following are the tasks that the user needs to perform for importing offline configuration in FDC application software and then downloading it to the device.

- Create offline configuration template in FDM
- Save the configuration in FDM in FDM format.
- Import the offline configuration in FDC
- Download the offline configuration to the device

Note:	For details on creating and using offline configuration, refer to section Offline configuration in FDM User's Guide.

Importing offline configuration

Using this feature the user can import offline configuration template. The offline configuration template has to be created in FDM and saved in FDM format. Copy the .fdm files into the storage location of the FDC.

To import an offline configuration, perform the following steps.

1. On the FDC homepage, tap Offline Configuration > Select.

The Offline Configurations page appears.

2. Tap Options > Import.

The **Select a File** dialog box appears.

3. Navigate to the location where the offline configuration template is stored.
4. Select the required offline configuration template from the list.
5. Double-tap and the offline configuration template is imported.

A success message appears.

Note:	In case if the offline configuration template is already imported, an overwrite message appears.

6. Tap OK to return to the Offline Configurations page. The device details appear on the bottom of the page.

Deleting offline configuration

Using this feature the user can delete an offline configuration template.

To delete an offline configuration, perform the following steps.

1. On the FDC homepage, tap Offline Configuration > Select.
2. The Offline Configurations page appears.
3. Select the required offline configuration template from the list.
4. Tap **Options** > **Delete**. A warning message appears.
5. Tap **Yes** to delete the offline configuration template.

Downloading an offline configuration

Using this feature, the user can download the offline configuration when the device is online.

To download an offline configuration, perform the following steps.

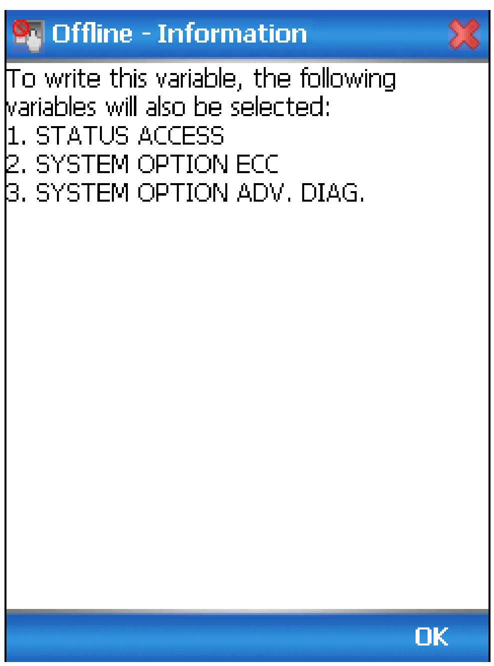
1. On the FDC homepage, tap Offline Configuration > Select.

   The Offline Configurations page appears.
2. Select the required offline configuration template from the list.
3. Tap Options > Download.

The **Offline – Select Variables** page appears with the all the variables.

Note:	By default, all the variables selected in FDM will appear as selected and non-editable variables appear in grey color.

1. Select the required variable. In case the user selects a dependent variable, then variables on which it is dependent on will also be selected and the following warning appears.

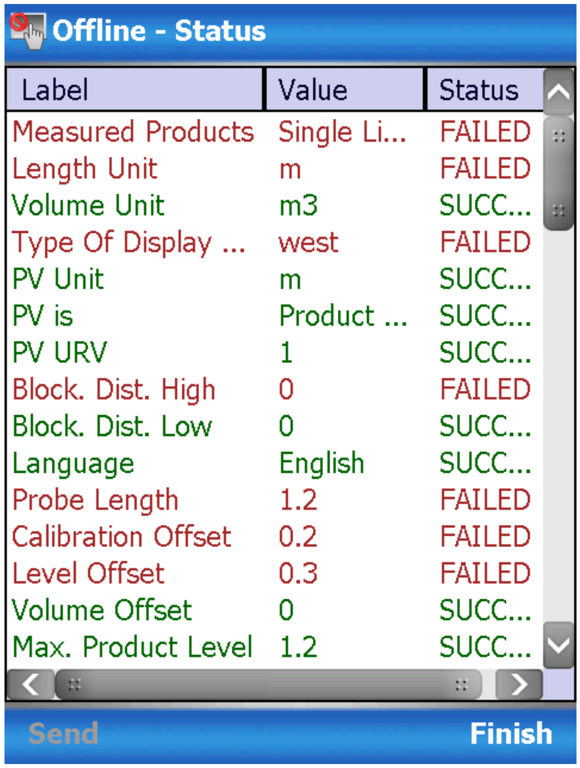


2. Tap **OK** to return to the offline wizard.

3. Tap **Next**.

The **Offline – Review and Send** page appears with the list of selected variables.

1. Tap **Send** and the process to send the variables to the device starts. Once the downloading is complete, the following page appears.



Note:	If the variables are downloaded successfully, status appears as **SUCCESS** in green color; and if failed, status appears as **FAILED** in red color.

2. Tap **Finish** to return to **FDC Homepage**.

4 Analog Output Calibration

4.1 About This Section

This section provides information about how to calibrate a transmitter's analog output circuit.

All procedures in this manual assume the Transmitter is configured for Loop Current Mode enabled, see section 4.3.2.

4.2 Equipment Required

- Digital Voltmeter or milli-meter with 0.02 % accuracy or better
- 250 ohm resistor with 0.01 % tolerance or better

4.3 Analog Output Signal Calibration Trim

With a Transmitter in its constant current source mode, its analog output circuit can be trimmed at its 0 (zero) % and 100 % levels. It is not necessary to remove the Transmitter from service.

The user can calculate milliamperes of current from a voltage measurement as follows:

Dc milliamps = 1000 X voltage/resistance

IMPORTANT: Be sure that the accuracy of the resistor is 0.01% or better for current measurements made by voltage drop.

4.3.1 Procedure with handheld communicator

1. Connect the MC Toolkit across loop wiring, and turn it on. See Figure 2 page 4 for a sample test equipment hookup.
2. Launch the FDC application.
3. On the Home page, select Online and establish a connection with the device as follows;
4. Select the My Device menu, and choose from the following menus:
    a. Online>Device setup>Advanced Configuration>Services>D/A Trim
    b. My Device> Device setup>Advanced Configuration>Services>D/A Trim
5. The user will be prompted to remove the loop from automatic control; after removing the loop from automatic control, press OK.
6. When a prompt appears connect reference meter in the loop to check readings, and press OK. The following prompts will be displayed:

a. Setting fld dev to output to 4mA. Press OK
b. Enter meter value. Key in the meter value, and press ENTER.
c. Fld dev output 4.000 mA equal to reference meter?

1 Yes

2 No

- If the reference meter is not equal to the field device output then select No and press Enter
- Key in the new meter value
- Return back to the "Enter Meter Value" prompt until the field device output equals the reference meter
- Select Yes and press Enter

7. The following display prompts will appear:

- Setting fld device output to 20mA. Press OK
- Enter meter value. Key in the meter value, and press ENTER.
- Field device output 20.000 mA equal to reference meter?

  1 Yes

  2 No

  - If the reference meter is not equal to the field device output then select No and press Enter
  - Key in the new meter value
  - Return back to the "Enter Meter Value" prompt until the field device output equals the reference meter
  - Select Yes and press Enter

8. The prompt notifies the user that the field device will be returned to its original output

4.3.2 Procedure with DTM

1. Go to Advanced Configuration>Services>DAC Calibration
2. Press the Begin button. (This will automatically put transmitter into Fixed Current Mode at 4mA)
3. Enter the value read at multi-meter into field under “Enter Zero Trim Value (4mA) read at multi-meter”
4. Press the Set button under Enter Zero Trim Value (4 mA) read at multi-meter. This will automatically put transmitter into Fixed Current Mode at 20 mA.
5. Enter the value read at multi-meter into field under.
6. Press the Set button under Enter Span Trim Value (20mA) read at multi-meter. This will automatically **put transmitter into Loop Current Mode (where current follows PV value).**

5 Advanced Diagnostics

5.1 About This Section

This section provides information about the Advanced Diagnostic features in the SLG700 SmartLine Level Transmitter.

5.2 Advanced Diagnostics

Table 8 - Viewing Advanced Diagnostics

What you want to view	What to do
PV (Primary Variable) Tracking SV (Secondary Variable)Tracking ET (Electronics Temperature) Tracking Operating Voltage Tracking Configuration History Error Log	Select Start>FDC to Launch the FDC application on the MC Toolkit. On the Home page, select Online and establish connection with the device. Select My Device>Monitor>Adv Diagnostics.

Table 9 - PV Tracking Diagnostics

PV Low Value	Method	Description	Minimum PV that the device has experienced since power-up, in user selected units.
		Set-up	None. Value initialized to Min PV Limit value prior to leaving the factory. Updates to current PV automatically when powered at user site after valid initial measurement.
PV High Value	Method	Description	Maximum PV that the device has experienced since power-up, in user selected units.
		Set-up	None. Value initialized to Min PV Limit value prior to leaving the factory. Updates to current PV automatically when powered at user site after valid initial measurement.
Low Alarm Limit	Parameter	Description	PV specified lower operating limit in user-selected units
		Set-up	None
Low Alarm Counter	Parameter	Description	Number of times PV Low Alarm Limit has occurred.
		Set-up	None
High Alarm Limit	Parameter	Description	PV specified upper operating limit in user selected units.
		Set-up	None
High Alarm Counter	Parameter	Description	Number of times PV High Alarm Limit has occurred.
		Set-up	None
Change Alarm Limits	Method	Description	Changes alarm limits.
		Set-up	None
Reset PV Tracking	Parameter	Description	Resets alarm counters to 0. Sets PV Low and High limit values to current measured PV value.
		Set-up	None

Table 10 - SV Tracking Diagnostics

SV Low Value	Method	Description	Minimum SV that the device has experienced in user selected units.
		Set-up	None. Value initialized to Min SV Limit value prior to leaving the factory. Updates to current SV automatically when powered at user site after valid initial measurement.
SV High Value	Method	Description	Maximum SV that the device has experienced in user selected units.
		Set-up	None. Value initialized to Min SV Limit value prior to leaving the factory. Updates to current SV automatically when powered at user site after valid initial measurement.
Low Alarm Limit	Parameter	Description	SV specified lower operating limit in user-selected units
		Set-up	None
Low Alarm Counter	Parameter	Description	Number of times SV Low Alarm Limit has occurred.
		Set-up	None
High Alarm Limit	Method	Description	SV specified upper operating limit in user selected units.
		Set-up	None.
High Alarm Counter	Parameter	Description	Number of times SV High Alarm Limit has occurred.
		Set-up	None
Change Alarm Limits	Method	Description	Changes alarm limits.
		Set-up	None.
Reset SV Tracking	Parameter	Description	Resets alarm counters to 0. Sets SV Low and High limit values to current measured SV value...
		Set-up	None.

Table 11 - ET Diagnostics

Max ET Limit	Parameter	Description	Electronics Temperature (ET) upper operating limit from specification. Value is in user specified temperature units.
		Set-up	None.
ET USL(upper stress limit)	Method	Description	Actual limit used in “Time Above Limit” and “Time Since Last Event”. Value is equal to “Max ET Limit” less 10% of limits range.
		Example	Electronics Temperature range is -40°F to 185°F for a total of 225°F. “ET Upper Stress Limit”= 185°F - 10% of 225°F = 162.5°F.
		Set-up	None – calculation is automatic.
Max ET Value	Parameter	Description	Highest Electronics Temperature ever experienced by the device. Value is in user specified temperature units,
		Set-up	None.
		NVM	Update every 8 hour.
Time Above USL (Upper Stress Limit)	Parameter	Description	Accumulation of minutes that device’s Electronics Temperature has been above the value of “ET Upper Stress Limit”.
		Set-up	None.
		NVM	Backup once each 8 hour period
Last ET up details (Time Since Last ET Up)	Method	Description	Time that has passed since the last time device’s Electronics Temperature has passed above the value of “ET Upper Stress Limit” (in days, hours and minutes).
		Set-up	None.
		NVM	Backup once each 8 hour period
Min ET Limit	Parameter	Description	Electronics Temperature (ET) lower operating limit from specification. Value is in user specified temperature units.
		Set-up	None.
ET LSL (Lower Limit for Stress Condition)	Method	Description	Actual limit used in “Time Below Limit” and “Time Since Last Event”. Value is equal to “Min ET Limit” plus 10% of limits range.
		Example	Electronics Temperature range is -40°C to 85°C for a total of 125°C. “ET Lower Stress Limit” -40°C + 10% of 125°C = -27.5°C.
		Set-up	None – calculation is automatic.
Min ET Value	Parameter	Description	Lowest Electronics Temperature ever experienced by the device. Value is in user specified temperature units.
		Set-up	None.
		NVM	Update every 8 hour.
Time Below LSL (Lower Stress Limit)	Parameter	Description	Accumulation of minutes that device’s Electronics Temperature has been below the value of “ET Lower Stress Limit”.
		Set-up	None.
		NVM	Backup once each 8 hour period
Last ET Down Details (Time Since Last ET Down)	Method	Description	Time that has passed since the last time device’s Electronics Temperature has passed below the value of “ET Lower Stress Limit” (in days, hours, and minutes).
		Set-up	None.
		NVM	Backup once each 8 hour period

Table 12 - Operating Voltage Diagnostics

MSP 430 VCC	Parameter	Description	MSP430 VCC in volts
Loop Voltage (Current Op Voltage)	Parameter	Description	Operating voltage available at device terminals.
		Set-up	None – units always in volts.
		NVM	none
		Note	**No accuracy is specified for this measurement! This value is intended to be used for informational purposes only and should not be used for control.**
Min. Loop Voltage (Minimum Operating Voltage)	Parameter	Description	Minimum operating voltage experienced by device at terminals since last reset of operating voltage parameters.
		Set-up	User can reset as desired using method described in item below.
		NVM	Backup once each 8 hour period
Voltage Tracking (Time Since Last Voltage Low)	Method	Description	Displays time since last minimum operating voltage event in minutes.
		Set-up	User can reset as desired using method described in item below.
		NVM	Update every 8 hour.
Reset Vol. Tracking(Operating Voltage Parameters)	Method	Description	Causes "Min Op Voltage" to be set to 32 volts and "Time Since Last Event" to be reset to zero. Within a short period of time "Min Op Voltage" will assume operating voltage value.
		Set-up	User actuates as desired.
MCU Supply Voltage	Parameter	Description	Sensor MCU Supply voltage in volts
Power Cycles	Parameter	Description	Total number of power-ups experienced by the device.
		Set-up	None – initialized to zero prior to leaving factory.
		NVM	The count is stored in NVM.
Time Since Last Power Cycle	Method	Description	Displays time since last power cycle event happened in minutes.
		Set-up	None.
		NVM	The information is stored in NVM at every 8 hours of continuous device operation.

Table 13 - Configuration Change History Diagnostics

Config History	Method	Description	Provides configuration change history of device parameters. Out of the last five configuration change instances, user can select the specific instance to view the associated parameter changed.
		Set-up	None
		NVM	Information is stored in NVM whenever configuration change is successful, Configuration change details of Linearization and Strapping details are not tracked and cannot be retrieved using configuration change history

Table 14 - Error Log Diagnostics

Error Log	Method	Description	Error log time stamp is provided based on sequence number of error event
		Set-up	Error log has to be enabled to log details.
		NVM	The information is stored in NVM at every 8 hours of continuous device operation.

6 Troubleshooting and Maintenance

6.1 Power-Up Behavior

On power-up the loop current is set to 21.5 mA and HART digital communication by default. Start up time is 45 seconds from when the device is powered up.

Distance to Product and Distance to Interface (if applicable) are set to zero and the loop current to 21.5 mA until a valid level is detected by the transmitter. In case of critical faults the device sets the loop current to burnout level as programmed (Low scale <3.6 mA or High scale 21.5 mA).

6.2 HART Diagnostic Messages

6.2.1 Critical diagnostics

Table 15 details critical HART diagnostic messages, also called alarms.

Table 15 - HART Critical Diagnostic Messages

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Reset required	This flag is set when sensor parameters configuration is changed that requires a device reset.	Power cycle the device to perform a hard reset of all transmitter electronics. New reflection models and minimum blocking distance limits will be calculated while the transmitter is starting up.
Measurement Failure	This is a roll-up status bit that is set when any of the following critical status conditions are present. If Device variable selected as Primary Variable (PV) is not applicable for configured measured product.	If the non-critical Device Variable Not Supported status is set, check if the device variable selected as Primary Variable is applicable for the configured measured product type. See page 19.
	• PV selected is any of Volume device variables and the value is either infinite or not a valid number.	If the non-critical Volume Calculation Failure status is set, check if Volume Calculation Type is configured as "Strapping table", check the Strapping table entries for valid data. If Volume calculation type is selected as "Ideal Tank Shape" check the tank dimensions configured are valid and correct.
	• PV Selected is derived from measured level which is either infinite or not a valid number.	If the non-critical Linearization Table Error Status is set, check the Linearization table for valid entries corresponding to Measured and Adjusted level values.
	• Primary Variable bad	If the non-critical PV bad is set, check the distance to interface or distance to product used to derive the Primary variable is valid or not. The reason may be due to loss of surface or Interface peak.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Sensor Critical Failure	This is a roll-up status bit that is set when any of the following critical status conditions are present: • Power Accumulator Fault • Sensor Board Oscillator Failure • Sensor Code Flow Fault • Sensor External RAM Failure • Sensor Internal RAM Failure • Sensor Flash CRC Failure • Sensor in Test Mode • Sensor in Factory Mode • Sensor in Low Power Mode • Reference reflection not found • Sensor Power Supply 2.5V Fault • Sensor Power Supply 2.5V OSC Fault • Sensor Power Supply 3.3V status Fault • Sensor NVRAM corrupt	Refer to each condition later in this table
Power Accumulator Fault	Power Accumulator board is damaged or malfunctions.	Power-cycle the device and if problem persists replace sensing housing... If problem still persists replace the terminal block assembly.
Primary Variable Bad	The distance to interface or distance to product used to derive the Primary variable is in critical status, the reason may be loss of echo peak.	Read the Echo curve and check if valid peaks are detected by device and stem markers show valid peak positions. If not configure the correlation algorithm parameters for each peak reflections. Ensure the Dielectric constants configured are valid for the vapor and products in the tank.
Sensor Board Oscillator Failure	If no power accumulator faults are detected then most likely the sensor board is damaged/defective.	Power cycle the device if problem persists replace the Sensor housing.
Sensor Code Flow Fault	The sensor is detecting that the time between measurements has exceeded the allowed limit.	Ensure configuration is correct and restart the sensor. If problem persists, replacement of the Sensor housing may be necessary.
Sensor External Ram Failure	Sensor board external RAM corruption detected.	Power-cycle the device and see if the condition re-occurs. If so, replacement of the Sensor housing is required.
Sensor Internal Ram Failure	Sensor board internal RAM corruption detected.	Power-cycle the device and see if the condition re-occurs. If so, replacement of the Sensor housing is required.
Sensor Flash CRC Failure	Sensor board firmware has been corrupted.	Attempt to reload the sensor firmware. If problem persists after flashing sensor firmware, replacement of the Sensor housing is required.
Sensor in Factory Mode	Unit is in factory/test mode.	Power-cycle the device and check if problem re-occurs.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Sensor in Low Power Mode	The sensor is in Low Power Mode designed to handle low range burnout.	The fault is set if any critical faults are set and device burnout direction (Fail safe) is low scale (3.5 mA). Please perform a hard or soft reset.
Reference reflection not found	Sensor is not able to detect the reference refection for level measurement in direct or remote mount transmitters or process connector reflection in remote mount transmitters.	Upload an echo curve and confirm that the reference and process connector (only for remote mount) model parameters are set for a good match with actual reflections. Perform a soft or hard reset.
Sensor Power Supply 2.5V OSC Fault	Power Accumulator board is damaged or malfunctions.	Power-cycle the device and if problem persists replace Sensor housing If problem still persists replace the terminal block assembly.
Sensor Power Supply 2.5V Fault	Power Accumulator board is damaged or malfunctions.	Power-cycle the device and if problem persists replace Sensor housing. If problem still persists replace the terminal block assembly.
Sensor Power Supply 3.3V OSC Fault	Power Accumulator board is damaged or malfunctions.	Power-cycle the device and if problem persists replace Sensor housing. If problem still persists replace the terminal block assembly.
Sensor NVRAM corrupt	Sensor board NVRAM data has been corrupted.	Use sensor NVRAM corrupt reset method from host to clear the sensor NVRAM error. This method will default the sensor NVRAM data. This will reset the critical NVRAM corruption alarm but the non-critical not characterized/calibrated alarms will stay. If the problem persist then change the sensor module.
Comm Module Critical Failure 2	This is a roll-up status bit that is set when any of the following critical status conditions are present. • Program Flow Failure • Communication Board Vcc (3.3V) Failure • RAM CRC Failure • RAM Walk Test Failure • ROM Failure	Refer to each condition later in this table.
Program Flow Failure	Communication firmware Program Flow Failure. This fault will get set if any of the critical part of the code is not executed after expected duration.	Check if any other faults are reported like DAC faults, if DAC faults are reported replace the communication board. If there are no DAC faults, check the connection between communication and Sensor housing. Power cycle the device and if problem persists replace the Communication module.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Communication Board Vcc (3.3) Failure	Communication board power supply is bad.	Power cycle the device. If problem persist, Check if there are critical faults related to Power Accumulator module. If power Accumulator faults are noticed replace the Sensor housing and if still problem persists replace the Terminal block assembly. If problem continue replace the Communication module.
RAM CRC Failure	SIL diagnostic failure. Checksum of critical parameters stored in RAM has failed.	Power cycle the device. If the problem persists after power cycle then RAM might be damaged so need to replace Communication module.
RAM Walk Test Failure	Communication board RAM Failure.	Power cycle the device. If the problem persists after power cycle then RAM might be damaged so need to replace Communication module. Before replacing the Communication module ensure that the device is operating in environment which falls under the specifications as mentioned in *SLG700 Transmitter User's Manual*, #34-SL-25-11.
ROM Failure	Communication board ROM Failure.	Power cycle the device. If the problem persists after power cycle then RAM might be damaged so need to replace Communication module. Before replacing the Communication module ensure that the device is operating in environment which falls under the specifications as mentioned in the *SLG700 Transmitter User's Manual*, Document #34-SL-25-11.
Invalid Reference Plane Offset	Sensor module factory configuration does not match the application. For example, sensor module configured in factory for direct mount used in remote mount or STSP sensor module used with HTHP setup.	Replace with sensor module with matching factory configuration.
Low DC application is not licensed. Saturated steam application is not licensed. Interface measurement is not licensed.	Installed license key does not allow configured application type.	Update the license key.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Device Configuration Failure	This is a roll-up status bit that is set when any of the following critical status conditions are present. • Algorithm Configuration DB Corrupt • Common DB Corrupt • Sensor and Comm. Board DB Data Mismatch • Sensor and Comm. Board DB Version Mismatch • Sensor Characterization Data Failure • Sensor Configuration DB Corrupt • Sensor Characterization Data Failure • Sensor Parameter Write Failure • Vital Configuration DB Corrupt • Miscellaneous DB Corrupt • General Configuration DB Corrupt • Model Number Mismatch • License key Errors: include interface measurement not licensed, saturated steam not licensed, single liquid low DC not licensed and incorrect reference plane offset. The following non-critical conditions can also cause this to be set. Level linearization table 1 or table 2 corrupted in Communication Board when linearization is Enabled Volume Strapping table 1 or table 2 corrupted in Communication Board when volume calculation type is Strapping Table	Refer to each condition later in this table. Refer to Table 16 - HART Non-Critical Diagnostic Messages page 67.
Algorithm Configuration DB Corrupt	NVM copy of Sensor algorithm database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the algorithm block NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication board. User may require to configure the correlation algorithm parameters if device does not make valid level measurements.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Common DB Corrupt	NVM copy of Common database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the common database block NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module.
Sensor and Comm. Board DB Data Mismatch	Comm sensor database Parameter Inconsistent	Check the cable between Communication module and Sensor housing is correct. Power cycle the device if problem still persists load the correct communication and sensor firmware versions.
Sensor and Comm. Board DB Version Mismatch	Communication firmware is not compatible with sensor firmware.	Update communication and sensor boards with compatible version of firmware. Check with Service person/support team for version details.
Sensor Characterization Data Failure	Sensor Characterization Data CRC corruption	Re-load the sensor firmware and if problem still persists replace the Sensor housing.
Sensor Configuration DB Corrupt	NVM copy of Sensor configuration database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the sensor configuration block NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module.
Sensor Parameter Write Failure	Sensor housing does not have the latest parameter configuration	Power cycle the device and perform device configuration again. If problem still persists load the correct communication and sensor firmware versions.
Vital Configuration DB Corrupt	NVM copy of Vital configuration database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the communication module vital block NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module
Miscellaneous DB Corrupt	NVM copy of miscellaneous database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the communication module miscellaneous NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
General Configuration DB Corrupt	NVM copy of general configuration database found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the communication module general config block NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module.
Model Number Mismatch	The model number present in sensor module is different than communication module	Used Reconcile model number method from HART host (DTM/DD) to recover from this fault. Need to select correct model number either from sensor module or communication board module to reconcile. If the both module model number are not correct then change the sensor board.
Sensor Comm. Timeout	If there is no communication between Communication Board and Sensor Board or invalid data on communication line due to noise	User can verify the cable/connector between communication and sensor board to ensure that it is not damaged. Verify by replacing Communication module If it does not fix the problem, replace the Sensor Housing.

Electronic Module Critical Failure 2	This is a roll-up status bit that is set when any of the following critical status conditions are present: • DAC SPI Interface Failure • DAC Packet Error • DAC Over Current • DAC Under Current • DAC Temperature Above 140 °C • DAC Control Word Write Fault	Refer to each condition later in this table.
DAC SPI Interface Failure	DAC SPI Interface Failure.	Power cycle the device. Check the power supply and loop resistance are within specifications. If they are, then replace the Communication module.
DAC Packet Error	Packet Error. DAC or microcontroller chip may be damaged	Check the power supply and loop resistance are within spec. If they are, then replace the Communication module.
DAC Over Current	DAC Over Current. The loop current value is greater than actual required value. This might be due to some component is damaged and taking more current than expected.	Power cycle the device. If problem persist, replace the Communication module or sensing assembly or terminal block assembly.
DAC Under Current	DAC Under Current. The loop current value is below the actual required value.	Power cycle the device. If problem persist, replace the Communication module.
DAC Temperature Above 140 °C	The board temperature is high	Verify the environment is within the operating specification of GWR transmitter. If it is, then replace the Communication module.
DAC Control Word Write Fault	Control Word Write Fault. DAC or microcontroller chip may be damaged.	Power cycle the device. If problem persist, replace the Communication module.

6.2.2 Non-Critical Diagnostics

Table 16 lists and describes the HART non-critical diagnostics.

Table 16 - HART Non-Critical Diagnostic Messages

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Field Background Not set	Field background is enabled before capture.	Capture a new field background and perform a soft or hard reset.
Field Background Not compatible	Field background was taken with a different set of mounting configuration than the current configuration.	Capture a new field background and perform a soft or hard reset.
Field background Load error	Field background could not be loaded from non-volatile memory.	Capture a new field background and perform a soft or hard reset.
Device in Power up mode	This status bit will set at power mode & it will reset once device found valid surface/Interface Level.	If the bit is not reset then the check the echo curve for valid surface or Interface peaks.
Sensor Failure	This is a roll-up status bit that is set when any of the following non critical status conditions are present: • Sensor Electronic Over Temperature • Distance in blocking higher zone • Distance in blocking lower zone • Sensor Characterization Status • Sensor Calibration Status	Refer to each condition later in this table.
Sensor ET Over Temperature	Sensor module temperature exceeded the operating temperature range specification which is -40 to +85 Degrees Celsius.	Ensure that the process temperature is within the operating temperature range of the transmitter (-40 to +85 Degrees Celsius). If it is certain that the reading is in error, the Sensor housing may need to be replaced.
Interface Distance is in Higher Blocking Zone	This indicates that interface reflection has been tracked into the upper zone near the Reference Plane where measurements are not accurate.	This is a condition that can occur during normal operation and does not generally require corrective action. If this condition is triggered when it is not expected, verify that the Blocking Distance High parameter is set correctly for the current conditions. If distance to interface is in Higher zone then status associated with device variables derived from distance to interface will be shown as uncertain in local display and on HART host the status would be poor accuracy.
Interface Distance is in Lower Blocking Zone	This indicates that interface reflection has been tracked into the lower zone near the End of Probe where measurements are not accurate.	This is a condition that can occur during normal operation and does not generally require corrective action. If this condition is triggered when it is not expected, verify that the Blocking Distance Low parameter is set correctly for the current conditions. If distance to interface is in Lower zone then status associated with device variables derived from distance to interface will be shown as uncertain in local display and on HART host the status would be poor accuracy.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Surface Distance in Blocking Higher Zone	This indicates that either the surface or interface reflection has been tracked into the upper zone near the Reference Plane where measurements are not accurate.	This is a condition that can occur during normal operation and does not generally require corrective action. If this condition is triggered when it is not expected, verify that the Blocking Distance High parameter is set correctly for the current conditions. If distance to product is in Higher zone then status associated with device variables derived from distance to product will be shown as uncertain in local display and on HART host the status would be poor accuracy.
Surface Distance in Blocking Lower Zone	This indicates that either the surface or interface reflection has been tracked into the lower zone near the End of Probe where measurements are not accurate.	This is a condition that can occur during normal operation and does not generally require corrective action. If this condition is triggered when it is not expected, verify that the Blocking Distance Low parameter is set correctly for the current conditions. If distance to product is in Lower zone then status associated with device variables derived from distance to product will be shown as uncertain in local display and on HART host the status would be poor accuracy.
Sensor Characterization Status	This indicates that device is not characterized, this has an impact on accuracy of device measurements at different temperatures.	Replace the Sensor housing with characterized Sensor housing and send the un characterized device to factory.
Sensor Calibration Status	This indicates device is not calibrated and impacts the accuracy of measurements at different positions of level	Replace the Sensor housing with calibrated Sensor housing and send the non-calibrated device to factory.
Electronic Module Comm Failure	This is a roll-up status bit that is set when any of the following non critical status conditions are present: • DAC Temperature above 100 °C • Config change database block is corrupted in Communication board. • Advance diagnostics database block is corrupted in Communication board • Brownout Status.	Refer to each condition later in this table.
DAC Temperature Above 100 °C	The communication board temperature is high above 100 °C.	Check the ambient temperature and if ambient temperature is well below 100 deg C, check if there are other DAC faults reported by device. Power cycle the device and if error still persists replace the Communication module.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Config Change DB corrupt	NVM copy of Configuration history database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the communication module config change NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module.
Adv Diag DB RAM corrupt	Communication board RAM copy of Advanced diagnostics database block found corrupt.	Power cycle the device. If the problem still persists then RAM might be damaged so need to replace Communication module
Brownout Status	This indicates that device is reset due to fluctuations in supply voltage of communication board.	Verify the supply voltage to transmitter and loop resistance and any noise source near transmitter. Power cycle the device and if problem still persists then replace Communication module.
Local Display Failure	This is a roll-up status bit that is set when any of the following critical status conditions are present. • Meter (Display) Timeout • Display NVM Corrupt • Display View1 corrupt • Display View2 corrupt • Display View3 corrupt • Display View4 corrupt • Display View5 corrupt • Display View6 corrupt • Display View7 corrupt • Display View8 corrupt	Refer the resolution column corresponding to respective non critical status conditions.
Meter (Display) Timeout	Display module not connected properly to Comm module or the interface connector or hardware of either Comm module or display module is damaged.	Power cycle the device and check the local display connectivity. Secure Display connections and recheck Refer to Maintenance in User manual 34-SL-25-11 for more details about how to connect the display module with Communication module. If problem still persists, replace the display module
Display NVM Corrupt	Display configuration data has been corrupted.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display general configurtaion NVM data. Power cycle the device. Reconfigure Display general configuration like screen rotation, language and password. If individual views are corrupted then reconfigure the corresponding view that is defaulted.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Display View1 corrupt	Display View1 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view1 NVM data. Power cycle the device. User will need to reconfigure Display view1.
Display View2 corrupt	Display View2 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view2 NVM data. Power cycle the device. User will need to reconfigure Display view2.
Display View3 corrupt	Display View3 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view3 NVM data. Power cycle the device. User will need to reconfigure Display view3.
Display View4 corrupt	Display View4 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view4 NVM data. Power cycle the device. User will need to reconfigure Display view4.
Display View5 corrupt	Display View5 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view5 NVM data. Power cycle the device. User will need to reconfigure Display view5.
Display View6 corrupt	Display View6 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view6 NVM data. Power cycle the device. User will need to reconfigure Display view6.
Display View7 corrupt	Display View7 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view7 NVM data. Power cycle the device. User will need to reconfigure Display view7.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Display View8 corrupt	Display View8 database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view8 NVM data. Power cycle the device. User will need to reconfigure Display view8.
Device Variable Not Supported	This condition indicates that one of the Dynamic Variables is mapped to a Device Variable that is not supported by the current Measured Product. This condition is considered non-critical for the SV, TV and QV Dynamic Variables. However, if this condition is true for the PV Dynamic Variable, then the critical Measurement Failure condition will also be set.	Reconfigure the dynamic variables PV, SV, TV and QV correctly for the configured measured product type. See page 19.
Volume Calculation Failure	This condition indicates that one of the Dynamic Variables is mapped to a Device Variable that calculates a volume and the volume calculation failed. This condition is considered non-critical for the SV, TV and QV Dynamic Variables. However, if this condition is true for the PV Dynamic Variable, then the critical Measurement Failure condition will also be set.	Verify the strapping table data or the dimensions of ideal tank shape.
Linearization Table Error	This condition indicates that one of the Dynamic Variables is mapped to a Device Variable that is derived from a linearized level measurement and the corrected level calculation failed. This condition is considered non-critical for the SV, TV and QV Dynamic Variables. However, if this condition is true for the PV Dynamic Variable, then the critical Measurement Failure condition will also be set.	Ensure that the Level linearization table has at least two entries, that the entries in both measured and corrected level columns are in Ascending or descending order and also all of the entries are within the range specified by the measurement configuration parameters.
Linearization Table 1 Config DB corrupt	NVM copy Level linearization table-1 database block found corrupt. This non critical alarm can occur even linearization is disabled	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Linearization table NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module. User may require to configure Linearization table again for his application.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Linearization Table 2 Config DB corrupt	NVM copy of Level linearization table-2 database block found corrupt. This non critical alarm can occur even linearization is disabled	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Linearization table NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module. If problem does not re-occur, device parameters part of this block are re-stored to default values. User may require to configure Linearization table again for his application.
Volume Strapping Table 1 Config DB corrupt	NVM copy of Volume strapping table-1 database block found corrupt. This non critical alarm can occur irrespective of Volume calculation type	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Volume strapping table NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module. If problem does not re-occur, device parameters part of this block are re-stored to default values. User may require to configure Strapping table again for his application.
Volume Strapping Table 2 Config DB corrupt	NVM copy of Volume strapping table-2 database found corrupt. This non critical alarm can occur irrespective of Volume calculation type	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Volume strapping table NVM data. Power cycle the device. If the problem still persists then NVM might be damaged so need to replace Communication module. If problem does not re-occur, device parameters part of this block are re-stored to default values. User may require to configure Strapping table again for his application.
No DAC Compensation	Communication board DAC compensation is not performed... Loop accuracy may be slightly compromised. Effect will be minor degradation of ambient temperature influence specifications.	Replace Communication module to achieve the maximum current loop accuracy and return the device to factory for DAC compensation.
Unreliable Sensor Communication	Communication between sensor and communication modules is not proper due to damaged connector or hardware issue with Comm module or sensor module	Verify the cable/connector between communication and Sensor housing to ensure that it is not damaged. Either the transmitter is installed in a noisy environment or internal communication quality between the Electronics Module and Sensor is degrading. Try replacing either Communication module or Sensor housing.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
PV Out of Range	PV value is not within LRV and URV	Check if digital value of PV is out of configured LRV and URV. Read the echo curve to see if stem markers are valid for distance to product and distance to interface (if applicable based on measured product type). If PV selected is derived from either strapping table or Linearization table, check the tables for valid entries.
Fixed Current Mode	Output current is fixed and not varying as per input. Loop current mode is disabled or Loop Test is active. This is information to user.	Enable loop current mode if it is disabled or exit the Loop Test mode if active
Low Supply Voltage (DAC)	Incorrect supply voltage at the transmitter terminals.	Check the power supply and loop resistance are within specification or not. If they are correct, then replace the terminal block assembly.
Device Variable Out Of Range	User can notice this alarm if the distance to the interface is bad but device variable selected as PV is derived from distance to product which is valid.	Read the Echo curve and verify valid stem markers for distance to interface, and configure the correlation algorithm parameters for interface peak reflections.
Tamper Alarm	The Tamper Alarm is set if more than a specified number of attempted or actual configuration changes are made, when Tamper Alarm is Enabled (Device can be either Write Protected or not). The warning stays active until the specified latency period has elapsed.	See page 32 for Tamper Alarm configuration.
Sensor in Sleep Mode	Sensor in Sleep Mode due to Configuration Change. Sensor module adjusting model parameters and waiting for sufficient power to measure level.	Power cycle the device and if problem persist for more than 4 minutes replace the Sensor housing
Loop Current Noise	DAC Not able to regulate loop current. If this condition is observed frequently, it could be an early indication of critical under or over-current failure.	Try to find the source of the noise. It could be bad loop wires, a hardware problem inside the transmitter, loop wires running close to a noise source etc. If the environment is ok, replace the Electronics Module.
AO Saturated	Calculated analog output is either above or below the specified loop current limits (LRV and URV).	Verify that the LRV and URV values are in specified range or not. Check if distance to product or distance to interface is in blocking zones.
URV Set Error - Span Config Button	Set operation using external Span button was rejected.	Please check whether the inputs are valid for the intended operation.
LRV Set Error - Zero Config Button	Set operation using external Zero button was rejected.	Please check whether the inputs are valid for the intended operation.
Surface signal quality bad	Surface signal quality is bad.	Read the Echo curve and configure algorithm and DC parameters accordingly using the DTM.
Surface signal strength bad	Surface signal strength is weak	Read the Echo curve and configure algorithm and DC parameters accordingly.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Interface signal quality bad	Interface signal quality is bad.	Read the Echo curve and configure algorithm and DC parameters accordingly.
Interface signal strength bad	Lower product signal strength is weak.	Read the Echo curve and configure algorithm and DC parameters accordingly.
Sensor Configuration DB RAM Corrupt	RAM copy of Sensor configuration database block found corrupt.	Power cycle the device
Strapping/Linearization Table Absent	1. If linearization table is not available in communication board NVM when level linearization is enabled 2. If strapping table is not available when volume calculation type is Strapping table.	Configure the Linearization table before level linearization is enabled. Configure the Strapping table to select Volume calculation type "Strapping table".
Display Common Config DB corrupt	NVM copy of Display general parameters database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display common NVM data. Power cycle the device and re-configure display configuration if required.
Display View Config DB corrupt	NVM copy of Display view/screen configuration database block found corrupt.	Use clear NVM corrupt method from host to clear the NVM error. This method will default the Display view data. Power cycle the device and re-configure display configuration if required.
Display Common DB RAM Corrupt	RAM copy of display general parameters database block found corrupt.	Power cycle the device and re-configure display configuration if required.
Display View DB RAM Corrupt	RAM copy of display view/screen configuration database block found corrupt.	Power cycle the device and if problem still persists replace the Communication module.
Adv Diag DB RAM corrupt	RAM copy of advanced diagnostics database block found corrupt	Power cycle the device and if problem still persists replace the Communication module.
Config Change DB RAM corrupt	RAM copy of configuration history database block found corrupt.	Power cycle the device and if problem still persists replace the Communication module.
General Config DB RAM corrupt	RAM copy of general configuration database block found corrupt.	Power cycle the device and if problem still persists replace the Communication module.
Vital Configuration DB RAM Corrupt	RAM copy of Vital configuration database block found corrupt	Power cycle the device and if problem still persists replace the Communication module.
Common DB RAM Corrupt	RAM copy of Common database block found corrupt.	Power cycle the device and if problem still persists replace the Communication module.
Miscellaneous DB RAM Corrupt	RAM copy of Miscellaneous database block found corrupt.	Power cycle the device If the problem persists even after power cycle then Communication module needs to be changed.

Name (DTM/DD)	Description (Cause)	Resolution (Steps to take)
Linearization Table 1 Config DB RAM corrupt	Level linearization table 1 RAM copy of database block found corrupt. This non critical alarm can occur even linearization is disabled	Power cycle the device and if problem still persists replace the Communication module.
Linearization Table 2 Config DB RAM corrupt	Level linearization table 2 RAM copy of database block found corrupt. This non critical alarm can occur even linearization is disabled	Power cycle the device and if problem still persists replace the Communication module.
Volume Strapping Table 1 Config DB RAM corrupt	RAM copy of Volume strapping table 1 database block found corrupt. This non critical alarm can occur even volume calculation type is none	Power cycle the device and if problem still persists replace the Communication module.
Volume Strapping Table 2 Config DB RAM corrupt	RAM copy of Volume strapping table 2 database block found corrupt. This non critical alarm can occur even volume calculation type is none	Power cycle the device and if problem still persists replace the Communication module.
Sensor Algorithm Config DB RAM Corrupt	Sensor algorithm RAM copy of database block found corrupt.	Power cycle the device and if problem still persists replace the Communication module.

7 HART DD binary file format compatibility matrix

Table 17: HART DD Compatibility Matrix

"Host - SLG700 - HART DD binary file format" compatibility matrix	
Host	DD file format to be used
Experion R410 and above versions	Fm8
Experion R400 to R300	Fm6
Experion below R300	Fms
FDM R430 and above versions	Fm8
FDM R410 – R302	Fm6
FDM Below R302	Fms

Refer the respective Tools' User Manual for details on loading the DD file on these Tools.

7.1 HART DD files – Download

Go to:

https://www.honeywellprocess.com/en-US/support/Pages/all-downloads.aspx

Type in SLG700 in the Search field.

The results will show an entry similar to the one below:

HART Device Description (DD) files for Honeywell HART Devices

This .zip file contains the latest version of the DD files for all of Honeywell's HART field devices. Unzip the file to locate the DD files applicable to the SLG700 series.

8 Using DTMs

8.1 Introduction

A DTM is an application that that can detect and utilize the services provide by vendor supplied device and communication DTMs to facilitate configuration and monitoring of devices such as HART commands that the SLG Level transmitter supports. To set up the DTM network on the FDM/Experion, refer to the *FDM/Experion User Guide*. In this manual, the procedure is given to run the SLG700 HART DTM on PACTware (Version 4.1 or above).

8.2 Components

To be able to use the HART DTM the user needs the following:

1. PACTware or some other FDT Container application.
2. Microsoft .NET Framework 2.0
3. The latest HART Communication DTM.
4. The "Honeywell SLG700 HART DTM" which is separate from the library of DTMs supplied by CodeWrights which contains the DTMs for all of the other SmartLine transmitters.
5. A HART modem, which is available with RS-232 or USB serial interfaces for connection to a PC.

8.3 Downloads

- **Download 1**: PACTware 4.x and .NET 2.0
  Download from http://pactware.software.informer.com/download/
- **Download 2**: HART Communication DTM
  Download from http://www.codewrights.biz/
- **Download 3**: Honeywell SLG700 HART DTM (see item 4 above)
  Download from HPS web site: https://www.honeywellprocess.com/smartline-level-transmitter.aspx

8.4 Procedure to Install and Run the DTM

1. Install the Downloads 1, 2, and 3 above.
2. Connect the Transmitter to the DC power supply with at least 250 ohm loop resistance. The voltage at the Transmitter terminals must be at least 14 V.
3. Connect the HART modem terminals to the Transmitter LOOP +/- terminals, or across the HART load resistor.
4. Connect the HART modem serial or USB connector to a PC COM port.
5. Run PACTware and select the Device Catalog option on the Window menu. The Device Catalog window should open to the right-hand side of the display.
6. Click on the Update Device Catalog button at the bottom of the Device Catalog window and click on Yes in the confirmation pop-up window. Make sure that the SLG700 HART

Rev 4 Device DTM shows up in the catalog. **Note:** With PACTware, this update procedure may need to be repeated a couple of times.

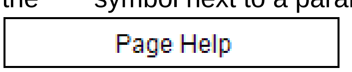
7. Select the Project option on the Window menu to close the Device Catalog window and select the top level of the project view, which may be labeled HOST PC.
8. Right click on the top level item in the project tree and select Add Device from the context menu. In the device pop-up window select the HART Communication device and click on the OK button at the bottom of the window.
9. Right click on the added HART communication DTM in the project menu and select Parameter from the context menu.
10. In the HART Communication DTM's Parameter window, click on the Serial Interface pull-down menu and select the correct port that the HART modem has been connected to, then click on the OK button in the lower right-hand corner.
11. Right click on the HART Communication DTM in the project view and select Add Device from the context menu. In the device pop-up window select the SLG700 HART device that matches the transmitter model, SLG700 HART Rev 1, SLG700 HART Rev 2, SLG700 HART Rev 3 or SLG700 HART Rev 4. Click on the OK button at the bottom of the window.
12. Right click on the SLG700 HART device in the project menu and select Connect from the context menu. After a few seconds the device label should turn to bold.
13. Right click on the SLG700 HART device in the project window and select Parameter→Online Parameterization from the context menu. The SLG700 Welcome screen will be displayed while the DTM is reading some basic configuration parameters from the transmitter.
14. When the initial reading of data is completed the Welcome display will provide 3 options to advance to the main menu items. If familiar with the device, select proceed to Advanced Setup. Browse through the menus to access various parameters/functions.

8.5 SLG700 Online Parameterization

The following sections provide a high-level overview of SLG700 DTM screens.

- Guided setup takes the user step by step through the Basic Configuration, page 79.
- Advanced Setup goes to Advanced Configuration tab, page 95.
- Dashboard goes to the Monitor tab, page 129

8.6 DTM Help

Mouse over the  symbol next to a parameter to read its description. On some pages the user can click on 

if available.

8.7 Configuring the Transmitter

8.7.1 Basic Configuration

Note:	The DTM version offers two setup options: Guided and Unguided. The local display and DD version do not offer a guided setup option.

Completion of the Basic Configuration is a quick way to start operating the SLG700 transmitter in most applications. This configuration consists of only few steps and the Guided Setup option, available from the Welcome page, is provided to step the user through the various menu items in this configuration category. After completing the Guided Setup process the Basic Configuration menu can be revisited at any time by selecting Basic Configuration from the top three menu buttons, as shown below in Figure 5.

The Basic Configuration menu groups the most commonly modified parameters into five categories; General, Process, Measurement, Dynamic Variables, and 4-20mA Outputs. The parameters in these groups address the major site-specific configuration that might be needed during the commissioning of a transmitter. When accessing the display for each of these groups through the Basic Configuration menu there are a few additional parameters available that are not present when accessing these displays through the Guided Setup mode.

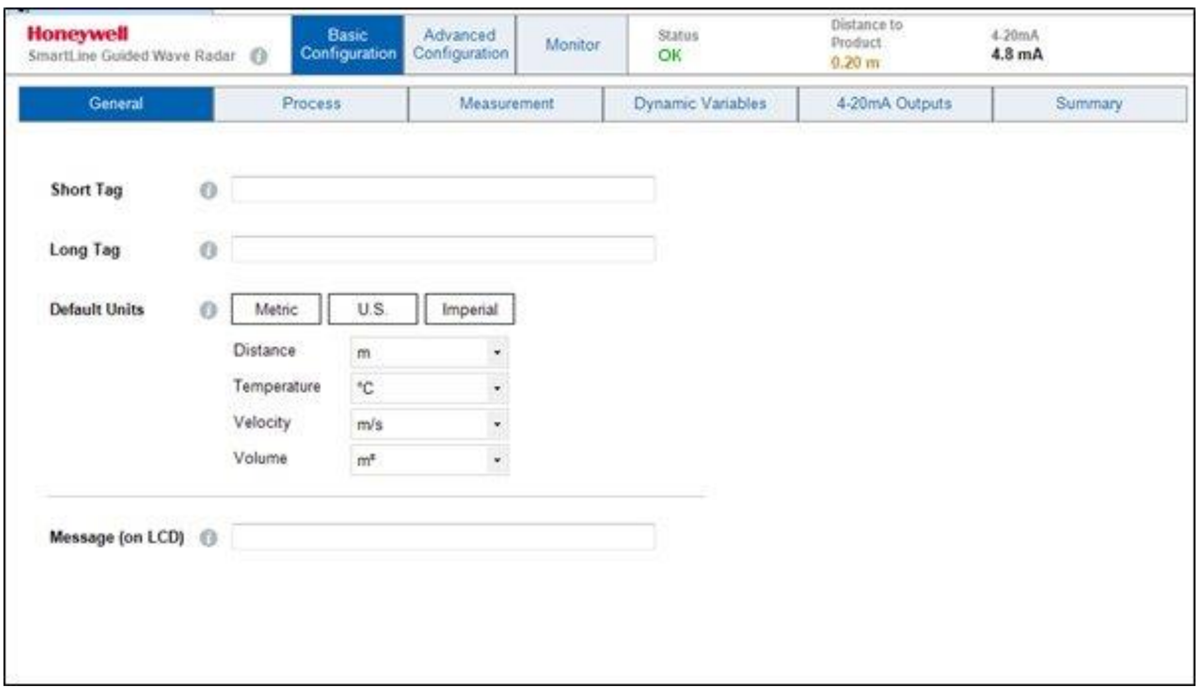


Figure 5: Basic Configuration - General

8.7.2 General

This group contains some parameters to allow the device to be identified.

There is an additional parameter that allows the user to enter a message that will be displayed on the local display. This parameter is not available when the General parameters are being entered in the Guided Setup mode but it is available if the page is visited in the unguided mode, as shown in Figure 5.

Short Tag: A tag used to identify or characterize the transmitter with a maximum of 8 characters from the HART Packed ASCII character set.

Note: The HART Packed ASCII character set is a subset of the ASCII character set that is limited to the following characters:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ@[\]^_
0123456789:;<=>? !"#$%&'()*+,-./
```

Characters not included in this character set will not display.

Long Tag: Allows the entry of a longer tag with a maximum of 32 characters from the (ISO Latin 1 character set).

Default Units: This sub-menu item allows selection of the units to be used for the four physical properties applicable to the transmitter. All configuration parameters or process output variables for a given property will be displayed in the selected units. The available options are:

Distance: mm, cm, m, in, ft

Temperature: °C, °F

Velocity: m/s, m/h, in/s, in/min, ft/s, ft/min

Volume: l, m^3, in^3, ft^3, yd^3, US gal, US bbl (liq), US bbl (oil), imp gal

Note: For the HART DTM interface, clicking on the Metric, U.S. or Imperial buttons is only used to pre-select a set of values. Individual units can be selected from different measurement systems if this is desirable.

8.7.3 Process

The five parameters in this group allow the products involved in the process of operating the tank to be identified, as shown below in Figure 6. The first consideration to be made is the number of products involved, and secondly the dielectric constant of each product. The dielectric constant of a medium affects radar measurements in two ways:

1. Pulses travelling through a medium are slowed by an amount related to the dielectric constant.
2. The relative amount of the original pulse that is reflected from the boundary between two mediums is related to the dielectric constants of the media on each side of the interface. For the reflected pulse, the reduction in the amplitude with respect to the original pulse amplitude can be calculated from the dielectric constants of the media on each side of the interface.

Common dielectric constants can be found from the pull-down lists. If a material is not present on the list or if the dielectric constant is not correct, the correct value can be entered in the corresponding textbox.

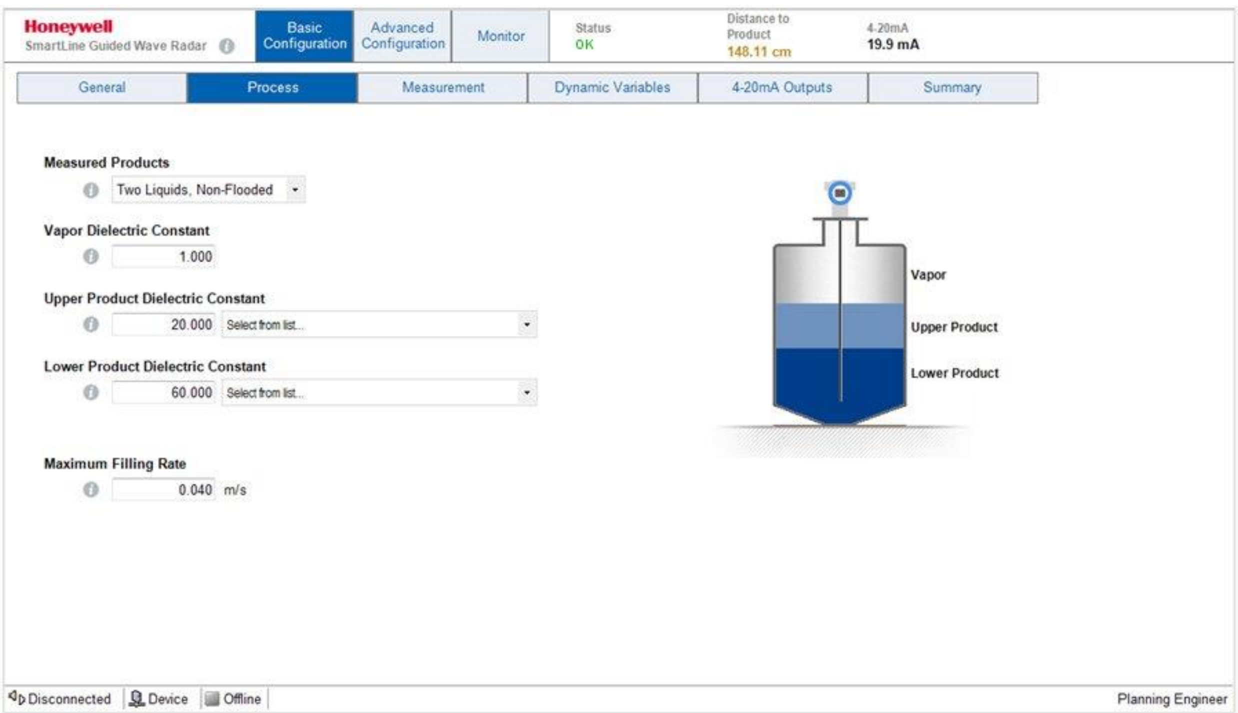


Figure 6: Basic Configuration – Process

Measured Products

This configuration parameter allows the number and type of products in the tank to be identified. This determines the various reflections that the transmitter will search for, how they will be used and the number of output variables calculated.

Note:	Starting with the R200 release (HART Device Revision 4), advanced applications of the transmitter require the purchase of the corresponding software license, so not all the selections listed below will be available in all cases. Refer to SLG Transmitter User's Manual #34-SL-25-11 for more information on purchasing additional software licenses.

Single Liquid: In this application, the SLG700 measures the level of one liquid product in the tank with a vapor, which is usually air, above the product. This application is always available and is shown in Figure 7.

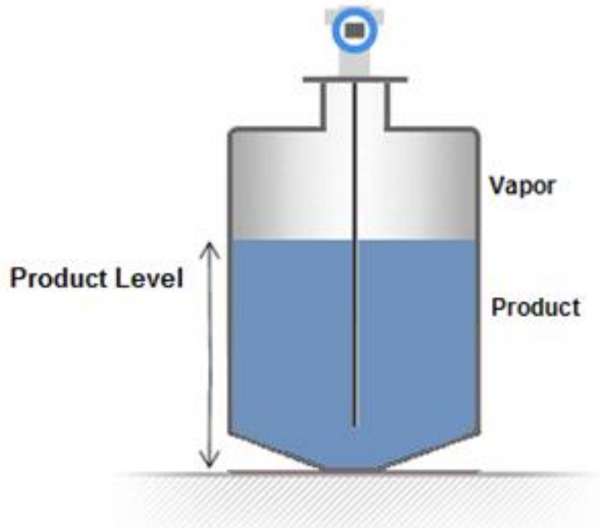


Figure 7: Single Liquid Application

Two Liquids Flooded: In this application, there are two liquid products in the tank; one supported on top of the other, as shown below in Figure 8. As the name indicates, the tank is always full with the Upper Product occupying the entire upper portion of the tank so that there is no vapor above the Upper Product. The SLG700 measures the level of the interface (boundary) between the two liquid products in the tank.

Note:	This application requires the Interface Measurement software license.

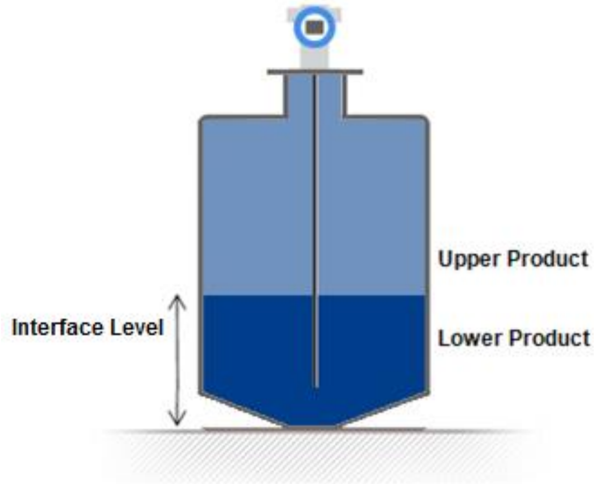


Figure 8: Two Liquids Flooded Application

Two Liquids Non-Flooded:In this application there are also two liquid products in the tank, however, the tank is not normally full so that there is a vapor above the Upper Product, as shown below in Figure 9. The SLG700 measures the total level of the products in the tank as well as the level of the interface (boundary) between the two liquid products in the tank. While both level measurements (or derived measurements such as upper and lower product volumes) are available for monitoring through the HART digital interface, only one measurement can be assigned to provide the analog loop current signal to a control system.

Note:	This application requires the Interface Measurement software license.

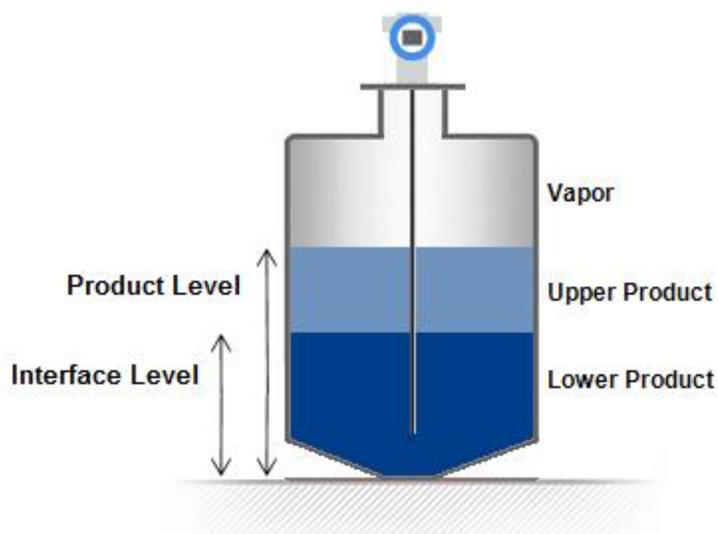


Figure 9: Two-liquid Non-flooded Application

Saturated Steam: Sensor revision R200 introduced a new application type, the level of water level in steam boilers. This application is similar to the Single Liquid application shown in Figure 7, however, unlike regular single liquid measurement applications where the medium above the liquid has a constant dielectric constant, the steam inside a boiler has a dynamic dielectric constant which varies with the steam pressure and temperature. To measure the resulting varying speed of the radar pulse, the measurement rod is extended to include a reference reflector that sits above the measurement area.

Note: This application requires the Saturated Steam Application software license and is only available for the SLG726 high temperature and pressure transmitter model.

Single Liquid, Low DC: R200 introduced a new measurement technique that can be helpful when the surface reflection is either very small or otherwise unstable. This application is similar to the Single Liquid application shown in Figure 7, however, the low dielectric constant of the medium makes it transparent enough that the sensor can always detect the pulse reflected at the end of the probe. The apparent shift of the end of probe signal when the product level rises is used to calculate the level of the surface. This technique requires precise knowledge of both the probe length and the dielectric constant of the medium.

Note: This application requires the Low DC Application software license.

Vapor Dielectric Constant

Depending on the selection above, the user interface allows users to enter values for the dielectric constant (DC) for each of the products present, as shown in Table 18.

Table 18 - Dielectric Constants Required by Application

Single Liquid and Single Liquid, Low DC	Two Liquid Non-Flooded	Two Liquid Flooded
Vapor DC	Vapor DC	
Product DC	Upper Product DC	Upper Product DC
	Lower Product DC	Lower Product DC

Note: For the Saturated Steam application, none of the dielectric constants can be entered by the user as they are dynamically calculated.

The dielectric constant of most gasses is very close to 1.0 and the Vapor Dielectric Constant parameter will most often not need to be edited. Enter the correct value if it is significantly different than 1.0.

Upper/Lower Product Dielectric Constants

For liquid products the dielectric constants vary much more. For the two liquid applications, Two Liquids Flooded and Two Liquids Non-Flooded, the value entered for the Upper Product Dielectric Constant will have a significant impact on the accuracy of the reported Interface Level. Entering of the correct value for the DC of the Upper Products ensures accurate measurement of the Interface, because the speed of the measuring signal varies with the DC of the Upper Product.

To aid in the selection of the correct DC value for the liquid products, the DTM offers the ability to select the product type from a list that will automatically populate the DC entry field. Click on the **Select from list…** option, as shown in Figure 6. After selecting a product from the list the DC value can still be edited manually if needed.

Maximum Filling Rate

This parameter indicates the maximum rate at which the tank is expected to be filled or emptied. This allows the transmitter to collect data over the correct area of the probe so that the surface and/or interface positions can be tracked effectively and aids in the rejection of false reflections that might look similar to the correct reflections. The valid range is between 0.04-0.9 m/s (0.1312-0.656 ft/s). The sensor uses this value to discard erroneous echoes. It is recommended that a value somewhat larger than that expected from typical fill and draining operations is entered, typically at least 0.1 m/s.

If the maximum filling rate is exceeded, the transmitter will continue to search for it in a narrow region until the echo-lost timeout is expired. The transmitter will then enter a measurement fault condition and search for the level over the entire probe length.

Note that if the rate of change is greater than 0.9 m/s, the transmitter will likely not track the level and only a level lost fault condition is set, without the ROC alarm. If the measurement is outside the blocking zones the transmitter will display a measurement fault until the echo lost timeout period has been exceeded, and then it will search for the level again. If it starts in a blocking distance position, it will stay in the blocking distance until the level reappears within the distance allowed by the ROC limit. However, as of R200, if the level appears suddenly outside of blocking distance, failing ROC a level lost fault condition is set and output is maintained at the value of the blocking zone. This change has important consequences if latching mode is not set.

8.7.4 Measurement

The GWR transmitter inherently measures the time of flight of radar pulses that reflect off the boundary between two different mediums. This time is first transformed into a measure of the distance between a fixed point on the transmitter body, referred to as the **Reference Plane**, and the boundary between the two mediums. The Reference Plane has been chosen to be a flat machined surface near the probe connection point.

Figure 10 shows the location of the Reference Plane, denoted as R, for the two basic methods of connecting the transmitter to the tank, either threaded or flanged. Refer to the Radar Level Measurement section in the *SLG700 Transmitter User's manual #34-SL-25-11.*

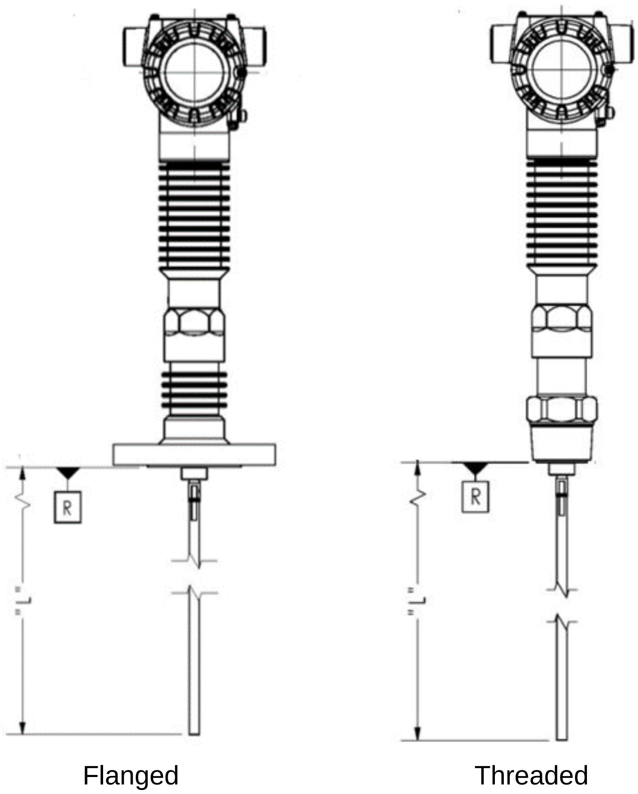


Figure 10: Reference plane R for flanged and threaded connections

Most users are more interested in the height of the liquid surface or interface relative to some lower datum point, such as the bottom of the tank, rather than the transmitter's reference plane. Measurements made relative to this lower, user-defined datum point are referred to as *levels* to distinguish them from the *distances* measured from the transmitter's datum point. In order to convert *distance* measurements to *level* measurements, the following parameters are used to describe the geometry of the installation:

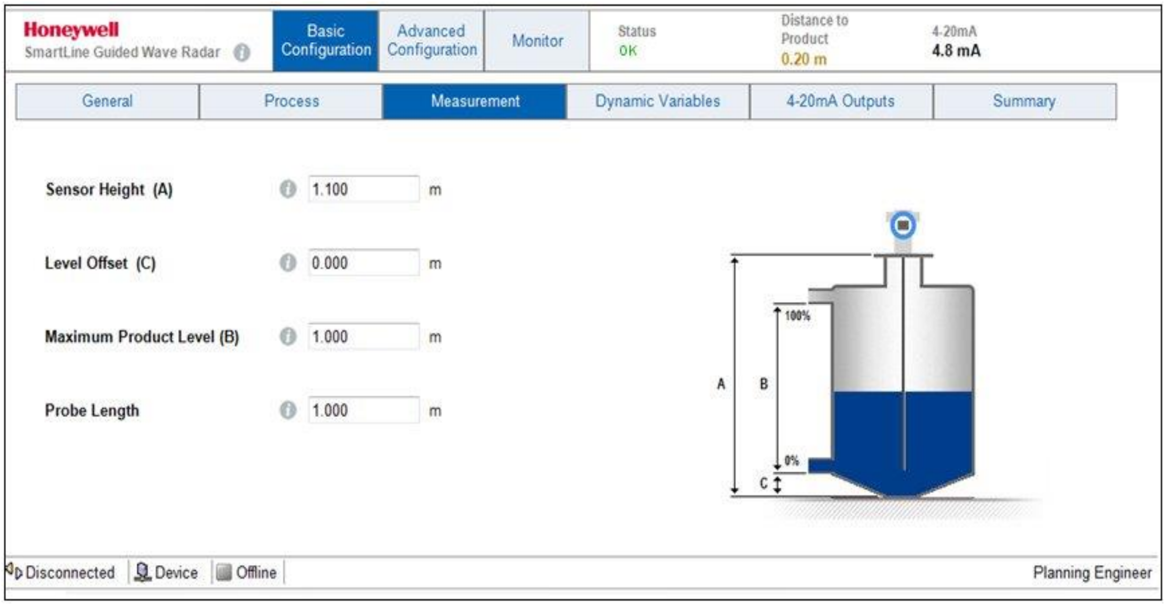


Figure 11: Basic Configuration – Measurement

Sensor Height (A)

Height of the transmitter's Reference Plane above some user-defined fixed bottom reference plane. This fixed bottom reference plane should be a location from which accurate measurements to the transmitter's Reference Plane can be obtained. It may be the bottom of the vessel but it may also be the ground or other convenient location and does not necessarily have to be the plane that represents a level of 0.0.

Level Offset (C)

The distance between the user-defined reference plane and the plane that represents a level of 0.0. This offset may be positive (upward), negative (downward) or zero if it coincides with the user-defined reference plane. This offset defines the zero point for the transmitter's level measurements.

Maximum Product Level (B)

The maximum level reading, in length units, above the Level Offset point that is expected when the tank is considered full. This parameter is used primarily to allow the level to be reported in units of % as well as in the specified length units.

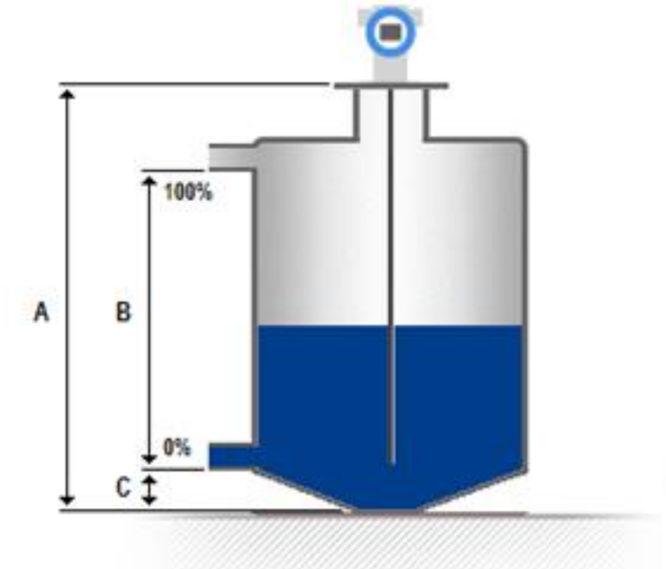


Figure 12- Distance to level conversion dimensions

Probe Length

The distance from the transmitter's Reference Plane to the end of the probe. This parameter is normally entered by the factory based on the model number ordered and does not need to be changed. See *SLG700 Transmitter User's manual #34-SL-25-11* for trimming probes.

- For coax probes and rod probes without a centering disk the distance to enter is the distance to the physical end of the probe.
- For rod probes with a centering disk attached the distance to the top surface of the disk should be entered.
- For wire probes with an end-weight attached it should be the distance to the top of the end weight.

8.7.5 Dynamic Variables

In addition to converting the time of flight of reflected radar pulses into a measure of distance, the SLG700 transmitter can calculate a number of related process measurements, such as volume. In many control systems, these measurements are referred to simply as process variables, however, in the terminology of the HART protocol they are referred to as Device Variables. In total 15 different process calculations are supported as outlined in Table 19.

Table 19 - Device variables

Device Variables	Device Variable code	Supported Units
Product Level	0	ft, in, m, cm, mm
Product Level %	1	%
Distance to Product	2	ft, in, m, cm, mm
Product Level rate	3	ft/s, m/s, in/min, m/h, ft/min, in/sec
Product Volume	4	ft^3, in^3, US gal, Imp gal, barrels, yd^3, m^3, liters, bbl liq
Vapor Thickness	5	ft, in, m, cm, mm
Vapor Thickness %	6	%
Vapor Volume	7	ft^3, in^3, US gal, Imp gal, barrels, yd^3, m^3, liters, bbl liq
Interface Level	8	ft, in, m, cm, mm
Interface Level %	9	%
Distance To Interface	10	ft, in, m, cm, mm
Interface Level Rate	11	ft/s, m/s, in/min, m/h, ft/min, in/sec
Upper Product Thickness	12	ft, in, m, cm, mm
Lower Product Volume	13	ft^3, in^3, US gal, Imp gal, barrels, yd^3, m^3, liters, bbl liq
Upper Product Volume	14	ft^3, in^3, US gal, Imp gal, barrels, yd^3, m^3, liters, bbl liq

In each installation, however, the actual number of measurements available is dependent on the application and optional settings such as the additional configuration required for volume measurements, as shown in Table 20.

Table 20 - Device variables according to measured product type

Single Liquid Single Liquid, Low DC Saturated Steam	Two Liquid Flooded	Two Liquid Non -Flooded
Product Level	Intf Level	Product Level
Prod Level %	Intf Level %	Prod Level %
Dist To Prod	Dist To Intf	Dist To Prod
Prod Lvl Rate	Intf Lvl Rate	Prod Lvl Rate
Product Volume[1]	Upr Prod Thick	Product Volume[1]
Vapor Thick	Lower Prod Vol[1]	Vapor Thick

Vapor Thick %	Upper Prod Vol[1]	Vapor Thick %
Vapor Volume[1]		Vapor Volume[1]
		Intf Level
		Intf Level %
		Dist To Intf
		Intf Lvl Rate
		Upr Prod Thick
		Lower Prod Vol[1]
		Upper Prod Vol[1]

[1]The highlighted Volume measuring values are available only after activating the Volume calculation, the method for Volume calculation has been selected and relevant tank data entered by the user. This can be done through the Advanced Configuration menu, section 8.8.

In addition to the Device Variables, the HART protocol has a concept of Dynamic Variables which allows up to four Device Variables to be configured for possible connection to an analog output channel and for access by a smaller more widely implemented command set.

These Dynamic Variables are referred to as:

- Process Variable (PV)
- Secondary Variable (SV)
- Tertiary Variable (TV)
- Quaternary Variable (QV)

Of the variables, the PV is unique as it is always assigned to the analog output channel that drives the loop current which may be monitored by the control system.

The DTM allows device variables to be assigned to the 4 Dynamic Variables, as shown below in Figure 13.

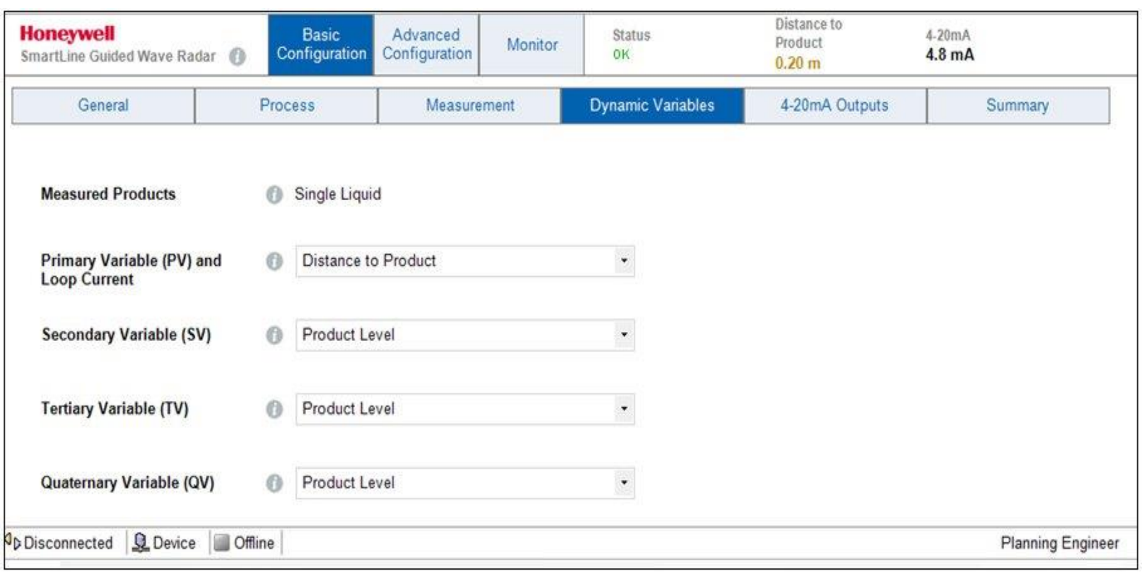


Figure 13: Basic Configuration - Dynamic Variables

8.7.6 4-20 mA Outputs Configurations

The digital value calculated by the transmitter for the Primary Variable, be it a distance, volume or percent, must be conveyed to the control system as an analog signal by adjusting the amount of current flowing in the loop connecting the two components. This is done by a linear mapping of a range of the Primary Variable scale to the 4-20 mA scale of the loop current. This mapping can be adjusted via the controls shown in Figure 14 below.

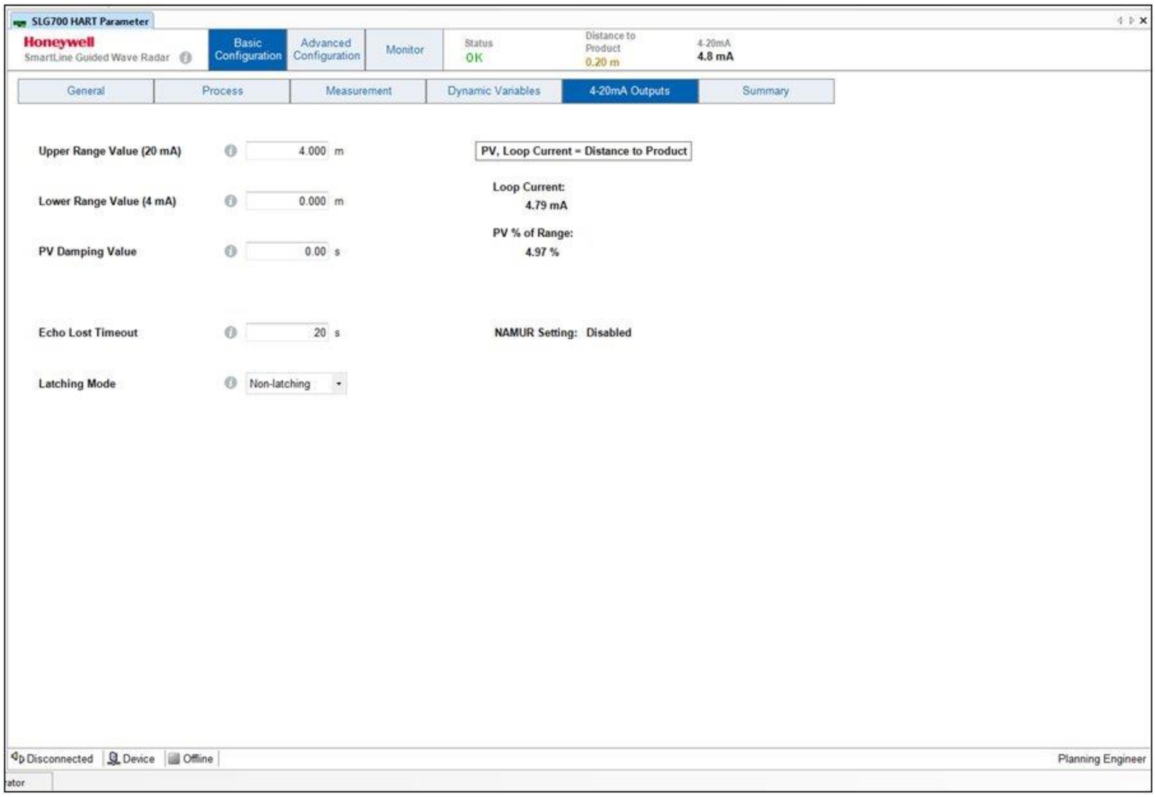


Figure 14: Basic Configuration - 4-20 mA Outputs

Lower Range Value (LRV):

The measured value of the Primary Variable for which the 4-20 mA loop current output will be scaled to 4 mA. This value must be within the upper and lower limits for the current Primary Variable, which will vary depending on the type of the variable (Level, Volume, etc.).

Note:	It is possible to have a high Primary Variable value mapped to 4 mA if a reverse relationship is required.

Upper Range Value (URV):

The measured value of the Primary Variable for which the 4-20 mA loop current output will be scaled to 20 mA. This value must be within the upper and lower limits for the current Primary Variable, which will vary depending on the type of the variable (Level, Volume, etc.).

Note:	It is possible to have a low Primary Variable value mapped to 20 mA if a reverse relationship is required.

Damping (PV Damping Value):

Allows damping of the analog current output to filter out rapid fluctuations. The range of the damping value is from 0 to 60 seconds, which represents one time constant (i.e. response to step input reaches 63% of final steady-state value after the specified time has elapsed), as per the HART specification. This damping is applied to both the digital Primary Variable as well as the analog Loop Current.

When accessing the 4-20 mA Outputs page outside of the Guided Setup mode, the page offers the additional options to adjust the following parameters:

Echo Lost Timeout:

The number of seconds that the transmitter will wait after the reflection from the product has been lost before setting a critical alarm and entering failsafe (burnout) mode. The same behaviour will result if instead of the measurement being completely lost, the rate of change has been exceeded.

Latching Mode:

This parameter allows selecting the behavior of the GWR transmitter in case of a critical error. If the Latching option is selected, the GWR transmitter will stay in the critical error state until a user performs a hardware or software reset. If the Non-latching option is selected, the GWR transmitter will leave the critical error state automatically, after the circumstances leading to the critical state cease to exist and attempts to re-measure level over the entire probe length.

8.7.7 Summary

The Summary display is the last step of the Guided Setup mode and the last menu option on the Basic Configuration menu. This display provides a tabularized list of the current value of all of the parameters available on the Basic Configuration menu, as shown below in Figure 15. The DTM ensures that each of these parameters have been read from the transmitter whenever this page is opened, regardless if they were entered through the Guided Setup mode or not.

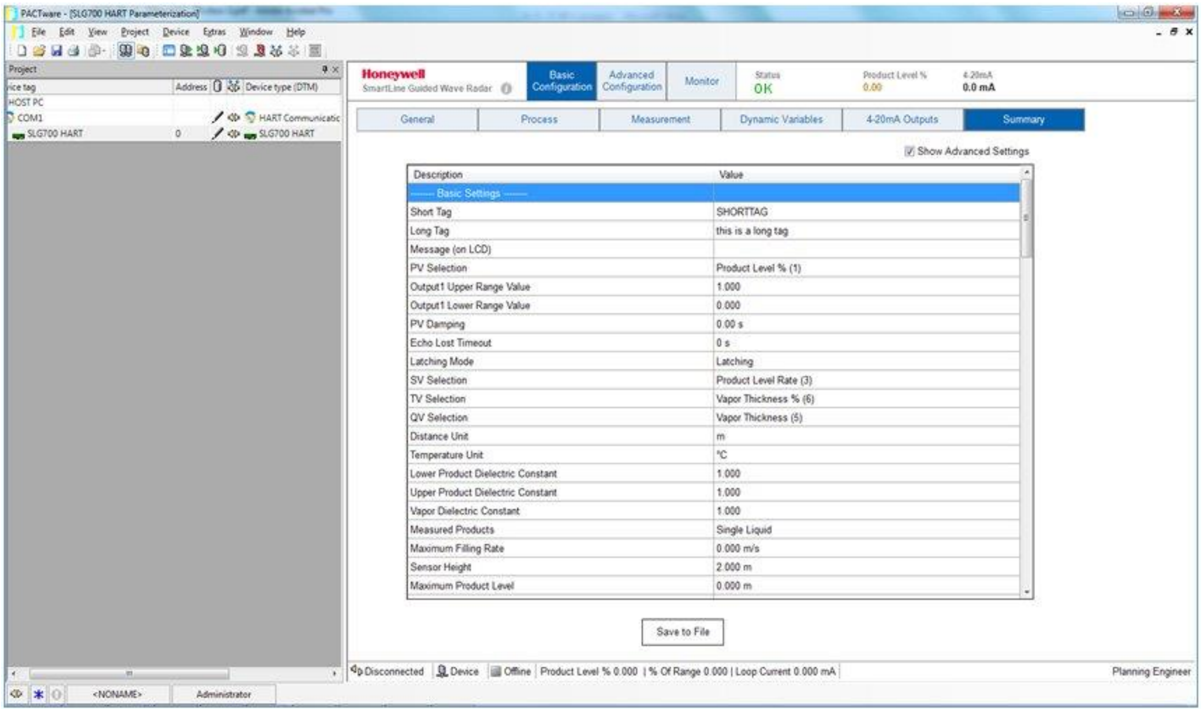
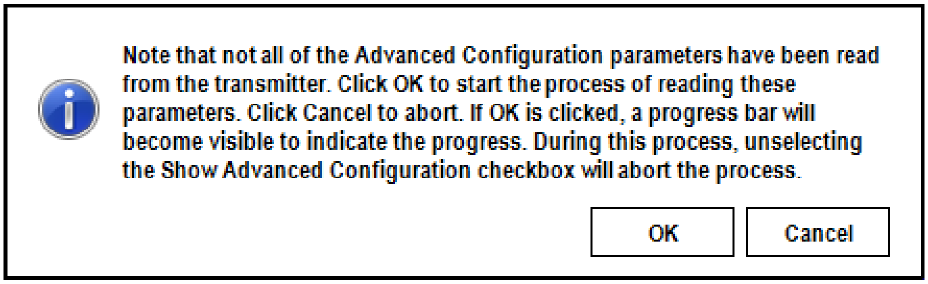


Figure 15: Basic Configuration - Summary

In addition to the parameters from the Basic Configuration menu, the Summary display also allows the parameters available from the

Advanced Configuration menu (see section 8.8) to be included in the summary table. This can be done by clicking the Show Advanced Settings checkbox in the top right-hand corner of the display. When this option is selected, the DTM first checks to see if all of the Advanced Configuration parameters have been read from the transmitter yet. If all of the Advanced Configuration displays have not been visited, it is likely that the DTM has not read all of the parameters yet. In this case the DTM will display the following message box indicating that it will take some time to read the advanced parameters and provide the user with the option to cancel this operation.



The **Save to File** button located at the bottom of the Summary display allows the contents of the Summary table to be written to a text file. Before performing this operation it is advisable to turn on the **Show Advanced Settings** option.

In the Offline Parameterization mode, the Summary display provides the added ability to read a previously saved configuration file. Clicking on the **Load from File** button will allow the user to browse for the desired configuration file. All the configurations stored in the file will be loaded into the corresponding menu pages where they can be edited further and resaved to a file if necessary. Once loaded into memory, the previously saved configuration can also be used to restore a replacement transmitter. To do this, first close down the user interface, then use the FDT host container's **Connect** and **Load to Device** options to download the configuration.

8.8 Advanced Configuration

The Advanced Configuration menu items deal with fine tuning of the algorithms used inside the transmitter and generally do not need to be adjusted. However, in demanding applications or if the process or mounting configuration changed from what was ordered, some of the default options may need to be adjusted.

8.8.1 Mounting

The main configuration parameters in this group deal with describing how the transmitter is physically mounted to the tank, as shown below in Figure 16. The lower portion of the display provides access to a number of advanced options and actions that may be necessary to fine tune the transmitter performance in cases where the characteristics of the mounting cause disturbances that cannot be modeled in the factory.

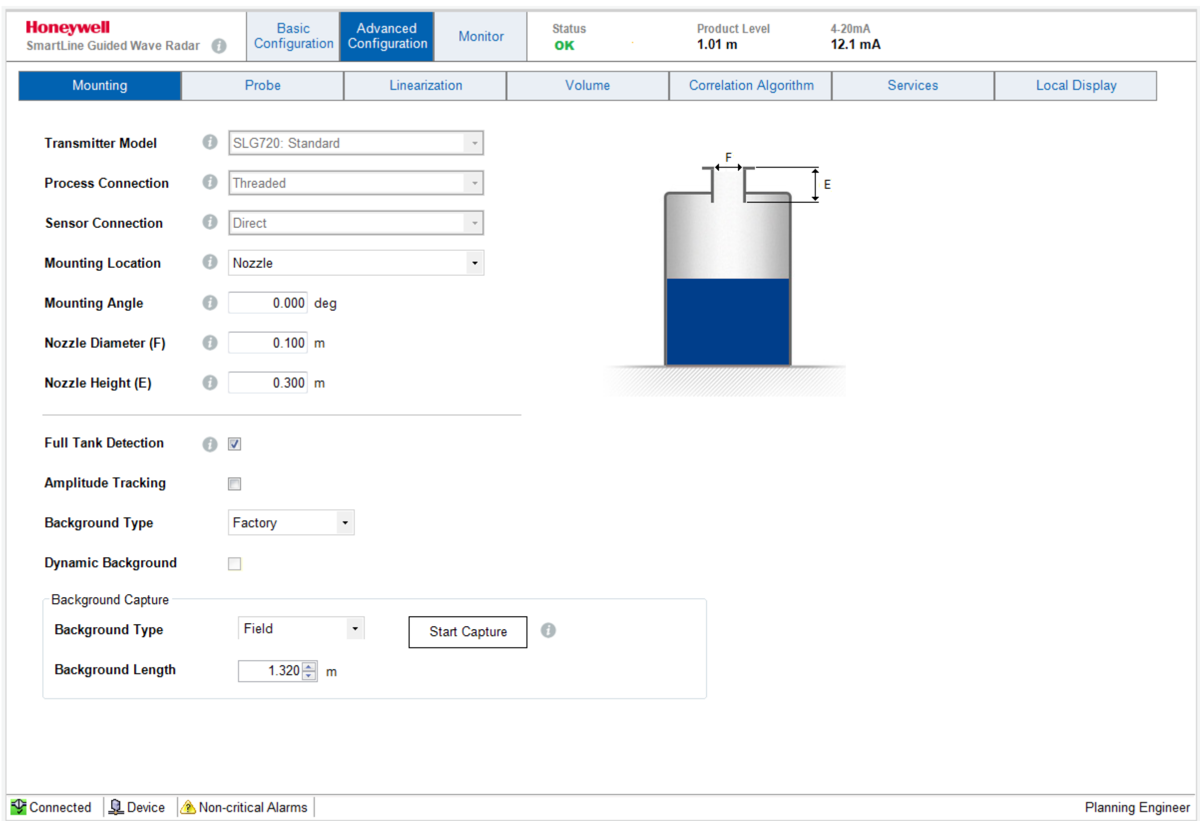


Figure 16: Advanced Configuration – Mounting

Transmitter Model:

Read-only parameter reflecting the model of transmitter ordered, either SLG720 or SLG726.

Process Connection:

Read-only parameter indicating whether the transmitter was ordered with a flange for mounting to the tank or with a simple threaded connection.

Sensor Connection:

Read-only parameter indicating how the Sensor Housing and Process Connector are connected. In most cases these two components are connected end-to-end in the **Direct** mount mode. For harsh environments where the temperature at the Process Connector is too high for the electronics inside the Sensor Housing, a 3 m Remote Mount cable is available to physically separate the electronics from the process connector. When the **Remote** mount mode is used, the transmitter will acquire a longer echo curve to cover the additional length of the Remote Mount cable, and will use the process connector reflection as the datum point to find the transmitter's Reference Plane location.

Mounting Location:

This parameter allows users to select the option that best describes how the GWR transmitter is located on the tank. The available selections are:

- Tank: (Mounted to a flat surface in the tank ceiling or wall)
- Bracket: (Mounted to a bracket over an open roof tank)
- Nozzle: (See transmitter specifications for limits on nozzle dimensions)
- Bypass: (See transmitter specifications for limits on bypass dimensions)
- Stillwell: (Stillwell must extend beyond the length of the probe)
- Unknown: (To be used only if none of the above are applicable)

Selecting the **Bypass** or **Stillwell** options require an additional parameter entry to specify the inside diameter of the bypass or stillwell. Selecting the **Nozzle** option requires two additional parameter entries to specify both the inside diameter and length of the nozzle, as shown in Figure 16.

Mounting Angle:

The physical angle at which the probe is mounted relative to vertical (0 degrees means the probe is perfectly vertical).

Full Tank Detection:

Full tank detection enables the detection of a level within the upper blocking distance at startup and it ensures reliable measurement when the block distance high (BDH) is reduced below the transition upper distance.

This feature enables the transmitter to perform additional analysis on the data in the region near the reference plane where the product reflections become mixed with reflections from the physical mounting components such as a flange or nozzle. This additional analysis allows the transmitter to detect the presence of product in this region even if the shape of the product reflections deviate significantly from the expected shape. This option should only be enabled if a recently captured Field or Obstacle background is in use (see below) and the Dielectric Constant of the Upper Product is above 12. It should not be enabled for products with low Dielectric Constants or when the Factory background type is being used.

In a demanding application where measurements close to the process connector are required but large temperature fluctuations are expected it is also recommended to enable Dynamic Background updates as discussed below.

Amplitude Tracking:

This feature enhances the sensor to track levels under dynamic conditions or when the radar pulse attenuations in the media are not well known. Once the sensor has locked onto a correct level, it will track the amplitude rather than use the initial (user specified) model amplitude. These values are periodically permanently stored and are hence recovered after a power down. Stored values are cleared and re-initialized to the user provided amplitudes by turning off Amplitude Tracking (and applying this change) and then turning it back on it. Amplitude tracking is not a replacement for setting correct correlation models and will not track pulses whose amplitudes differ more than about 40% from the user specified pulse model amplitudes. It is recommended that amplitude tracking is turned on when the attenuations are not well known or vary over time, such as in the Saturated Steam application.

Background Type:

The physical components used to mount the transmitter to the tank will always cause some reflection of the radar pulse as the pulse leaves the confines of the process connector and starts to travel through the medium in the region near the reference plane. Depending on the configuration, these reflections may appear very similar to the reflections from the products in the tank and therefore should be ignored. In addition obstacles present close to the wave guide can cause reflections that mimic levels. The SLG700 transmitter utilizes a means of subtracting out these static background reflections before processing the data for reflections from the product(s).

All transmitters have pre-configured backgrounds for standard probe configurations which can be selected with the **Factory** option. In all but the simplest applications, these should be replaced if possible in-situ with one of the other two options using the capture mechanism described below.

- The **Field** option is meant to reduce the effect of the process connector reflection created when the radar pulse traverses between two regions of different impedances. The preset length varies from 1.32 m (standard temperature and pressure gauge) to 2.38 m (high pressure high temperature model) from the measurement Reference Plane. The user needs to ensure that the level in the tank is below these values when acquiring the background. The field background is stored in permanent memory.

- The **Obstacle** option is similar to the field background but is intended to both suppress process connector reflections as well as any false echoes generated by obstacles in the tank (ladders, pipes, valves) in the vicinity of the probe. There is no limit on the length that can be specified by the user. As with the field background, the level in the tank needs to be about
30 cm below the end of the requested echo. One difference between the obstacle suppression echo and the field background echo is that the sensor algorithms analyze this echo and store only those sections of the profile that are found to contain false echoes. For example, if a ladder exists 2m down a tank and a pipe inlet 19 m down the tank, the user should obtain an obstacle echo up to approximately 20 m. The sensor will automatically detect the two objects and permanently store the relevant data, omitting quiet regions in between.

The active Background Type selection is independent of the capture Background Type described below. New backgrounds are applied immediately once captured. However, it is not possible to stay in **obstacle** mode after collecting a **field** type background because it is likely that the obstacle background is significantly longer than the field background just collected. Normal operation is to choose a background mode, apply, then collect a background in that mode. Backgrounds can be verified on the Echo Curve display on the Monitor menu.

Note:	Background subtraction is not available in the Saturated Steam application.

Dynamic Background:

The feature provides enhanced immunity against measurement conditions by dynamically adjusting the active **Field** or **Obstacle** background profile. (This feature is not available for the Factory Background Type.) With Dynamic Background enabled, the sensor periodically schedules automatic updates to the background echo profile. Echoes are only updated if the level is outside of the transition zones (see section 8.8.3) and the signal is of good quality. Data is collected up to approximately 30 cm from the level at the time, if this distance is within the requested background echo length.

The most recently updated background is also stored in permanent memory and is applied after a sensor reset if dynamic background is enabled. At all times the sensor maintains a copy of the original user acquired (static) background echo and will revert to this if the dynamic background feature is once again disabled. Re-enabling dynamic background at that point starts the process anew. It is recommended that this feature is turned on in all installations where probe build-up or large ambient temperature swings over 30° C are expected.

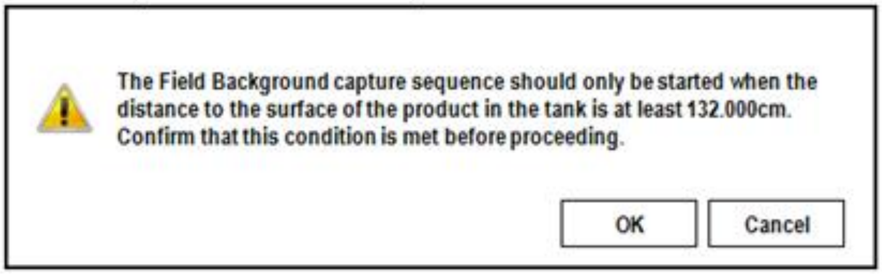
Background Capture: This group of controls provide the mechanism for obtaining new background echoes for the Field and Obstacle background types described above. These controls are only visible when no other parameters are being edited as the background echoes are inherently dependent on the current mounting configuration. All edits must be applied or discarded before a background capture may be started.

- **Background Type:** This control allows the user to select the type of background profile that should be collected as either **Field** or **Obstacle**. (The **Factory** background profile is completely static and cannot be captured or dynamically updated.) This type parameter does not have to be the same as the active Background Type parameter described above which is located outside this group of controls. In fact, a Field or Obstacle background profile must be collected first before it can be activated.

- **Background Length:** This control allows the user to enter the desired length of background profile to collect as measured from the Reference Plane. For the Field background type the control will be automatically populated with a preset length based on the current mounting configuration. The length cannot be increased beyond this preset value and should only be lowered in extreme cases when it is not possible to bring the surface of the product below this length. For the Obstacle background type the control will also be automatically populated with this preset length but the value may be increased as required to cover all obstacles, up to the measureable length of the probe.

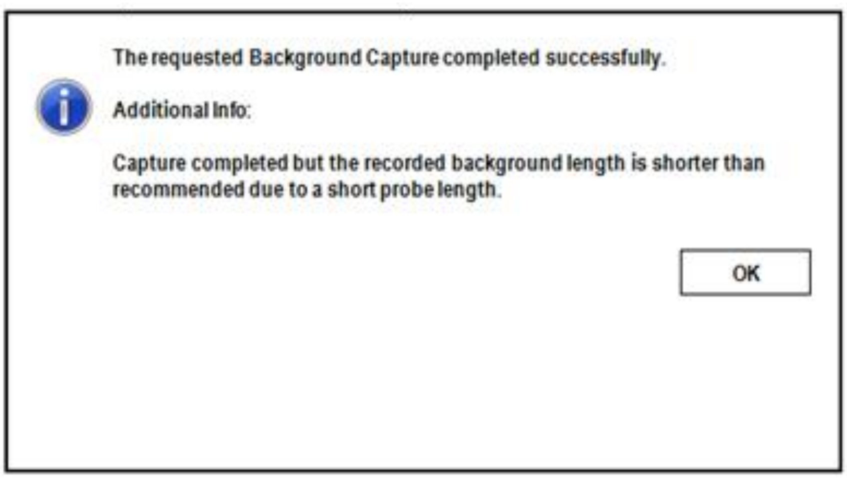
Start Capture:

This button activates the process of collecting a new background echo for the selected type and length. This process should only be performed when there is no product in the region over which the background will be captured. The length of this region varies with the transmitter model, mounting location and probe type. A pop-up message similar to the one shown below will be displayed indicating the required length.



If the OK option is selected, the transmitter will start the capture sequence and a progress bar will be displayed to show the progress. The function of the button will also change, as shown below, allowing the user to cancel the currently active sequence if required.

Upon completion of the process, a pop-up message such as the one shown below will be displayed indicating whether the capture was successful or not. In the case of a successful capture there may also be some additional information or warnings provided. The new background is immediately applied by the transmitter, but see the comments above for the active Background Type parameter.



8.8.2 Probe

The main configuration parameters in this group deal with describing how the probe, or waveguide, that guides the radar pulse towards the bottom of the vessel is constructed, as shown below in Figure 16. The lower portion of the display provides access to a number of advanced options and actions that may be necessary to fine tune the transmitter performance in cases where the characteristics of the probe are particularly important and cannot be modeled accurately in the factory.

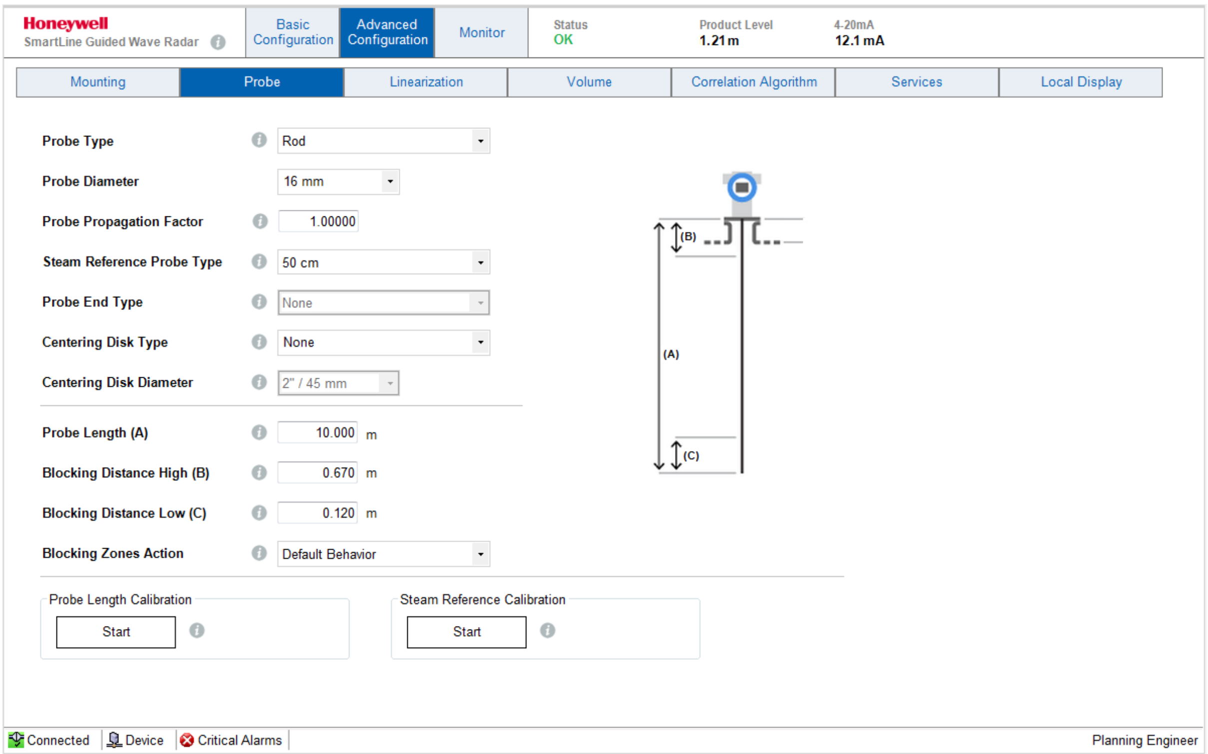


Figure 17: Advanced Configuration – Probe

Probe Type:

Only adjust this if you are changing the type of probe. Adjustments to the calibration offsets and many other tuning parameters may be necessary if the probe is changed. The available options are: Custom, Rod, Wire, Multi-Twist Wire, Coax and, with R200, FEP-coated wires and rod. Not all probe types are compatible with both transmitter models (SLG700 and SLG726) and all applications so some options may not be available.

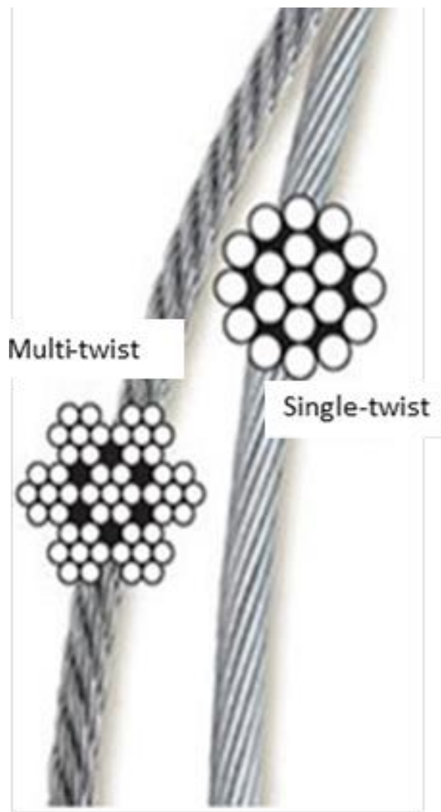


Figure 18 – Wire Probe Types

Note:

> The wire probe type comes in two different constructions, as shown in Figure 18 above and it is important to select the correct one.
>
> The **Wire** selection refers to the single-twist 1x19 construction which consists of 19 individual strands twisted together in a single bundle with a cable-like appearance.
>
> The **Multi-Twist Wire** selection refers to the 7x7 construction which is made up of 7 bundles, each consisting of 7 individual strands, which gives it a more rope-like appearance.

If FEP-coated probes are used, it is important that the user makes the correct selection here – for these types of probes, the RADAR pulse changes shape as it travels down the probe and this requires activation of special algorithms in the sensor.

Probe Diameter:

This parameter specifies the nominal diameter of the probe. In most cases, there is only one valid diameter for a given transmitter model and probe type combination, so this parameter cannot be changed from the default value. Currently the only exception is for a rod type probe attached to an SLG720 transmitter, which can be ordered with either an 8 or 12 mm diameter.

Propagation Factor:

Propagation factor will be factory set for the probe type ordered. If the probe is changed or a customer supplied probe is used, this value may need to be adjusted to scale the apparent distance to product appropriately. Consult Honeywell for details.

Steam Reference Probe Type:

This parameter is only applicable for the Saturated Steam application and identifies the length of the larger diameter rod installed at the top of the probe that provides the additional Steam Reference reflection. The available options are None, 30 cm and 50 cm.

Probe End Type:

This parameter specifies how the probe is terminated. For Rod and Coaxial probes the only available option is None. For Wire probes the available options are Clamp, Weight and Loop.

Centering Disk Type:

This parameter identifies if a centering disk is present and if so the material that it is made off. If the centering disk was ordered with the transmitter this will be correctly set when the transmitter leaves the factory.

Centering Disk Diameter:

If the Centering Disk Type is not set to None, an additional parameter is required to specify the diameter of the disk. If the centering disk was ordered with the transmitter this will be correctly set when the transmitter leaves the factory.

Probe Length:

This is a factory setting based on the purchase order. Adjustments to this parameter is only required if the probe has been replaced or cut shorter. This parameter should always be measured from the reference plane to the effective end of the probe. For a Coaxial probe and a Rod probe without a centering disk, the effective end of the probe is the physical end of the probe. For a Rod probe with a centering disk attached, the effective end of the probe is the top surface of the centering disk. For a Wire probe with an end weight, the effective end of the probe is the top of the end weight.

Blocking Distance High:

Blocking distances are areas of the sensor reading range where it is not desirable to search for reflections, possibly due to poor signal to noise ratios. The Blocking Distance High is the distance value measured starting from the Sensor Reference Plane. The transmitter will not attempt to make a reading in this area. The factory-set blocking distance is set to the transition distance high. It is recommended that the blocking distance is set to the largest value the measurement can tolerate and that the loop current is adjusted to reach maximum before level reaches the blocking distance. The minimum value for Blocking Distance High, as well as the transition distances is shown in the table below.

Blocking Distance Low:

Blocking distances are areas of the sensor reading range where it is not desirable to search for reflections, possibly due to poor signal to noise ratios. The Blocking Distance Low is the distance value measured starting from the Probe End. For a wire probe with an end weight, the end of the probe is the top of the end weight. The transmitter will not attempt to make a reading in this area. A minimum value is predefined by the factory to be the same as the Low Transition Distance. The minimum value for Blocking Distance Low, as well as transition distances, is shown in the table below

Blocking Zones Action:

This is the action to take regards to loop current when the surface or interface enters one of the two low accuracy zones defined by the Blocking Distance Low and Blocking Distance High parameters, as indicated in Figure 17. The Default Behavior option means that when in Blocking Distance Low, set to Low Saturation, and when in Blocking Distance High, set to High Saturation.

Steam Reference Calibration

In Saturated Steam applications, this procedure calibrates the length of the Steam Reference rod. This operation is critical for good level measurement since the apparent length of the rod at high temperature and pressure is used to calculate the propagation speed of the radar pulses. Since there is some tolerance in the mechanical mounting of the rod with respect to the process connector, this operation is required after installation and before steam is applied to the bypass (or coaxial tank) installation. The operation can fail if the correct rod length is not selected during set up, if the reference and steam reference models are not correct or if the measured lengths are significantly different from the default. Multiple measurements are made, averaged and stored to the sensors permanent memory.

Probe Length Calibration

The probe length value is significant to the algorithm in two cases: when the level drops near the bottom of the probe, the sensor must distinguish between the surface (or the interface reflection) and that of the end of probe. The second case is when choosing Low DC measurement – in that case the value of the probe length is part of the distance to the surface calculation and must be known precisely. This procedure, which can only be carried out if the tank is empty, determines the observed probe length by measuring the position of the end of probe reflection multiple times and storing the result in permanent sensor memory.

8.8.3 Transition zones

Transition zones are areas close to the process connector and close to the end of probe where measurements have reduced accuracy, see table below.

For more information on transitions zones for the various sensor configurations (i.e. coax, rope, rod, HTHP, Saturated Steam application, etc.), refer to *SLG700 SmartLine Level Transmitter User's manual, #34-SL-25-11*.

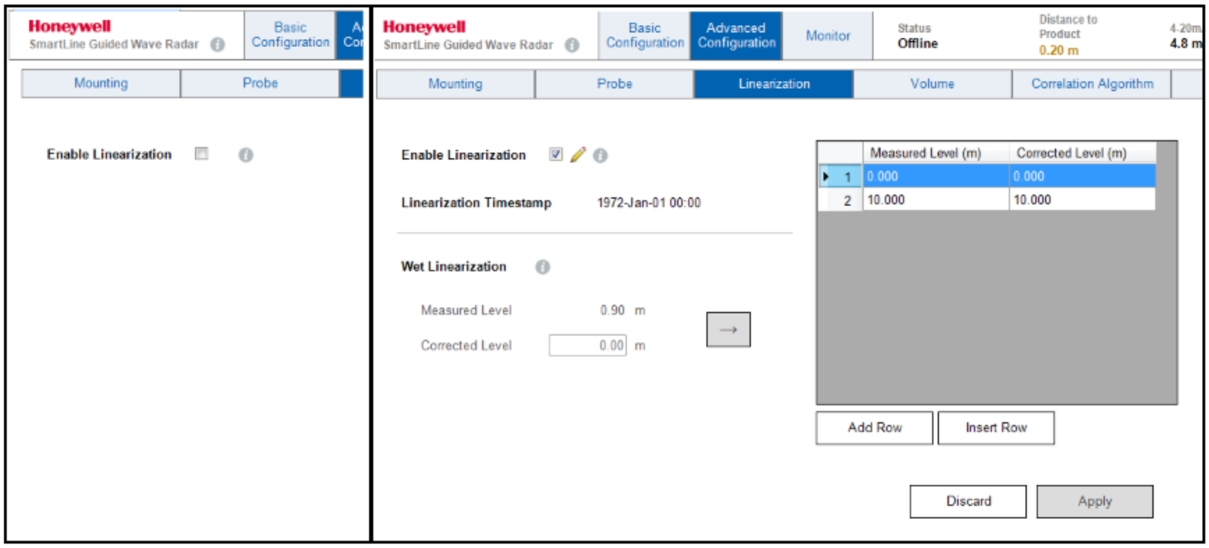
Table 21 - Minimum blocking distances and transition zones for the various probe types

Probe Type	Media in Tank	Minimum Blocking Distance High [cm]	Upper Transition Zone, T_{up} [cm]	Minimum Blocking Distance Low [cm]	Lower Transition Zone, T_{low} [cm]
Rod/Wire	Water (DC=80)	9	13	0	1
Rod/Wire	Oil (DC=2)	7	14	0	12
Coax	Water (DC=80)	5	14	2	0
Coax	Oil (DC=2)	5	8	6	7

8.8.4 Linearization

This option allows users to adjust the level measurement to agree with a customer measurement. It is available only through the use of a PC-based DTM / DD.

Configure the linearization table to make the transmitter output agree with an independent level measurement.



Linearization Disabled **Linearization Enabled**

Figure 19: Advanced Configuration – Linearization

Note: The Level Linearization feature does not affect the values reported for the Distance to Product and Distance to Interface device variables. If Level Linearization checkbox is enabled, associated level are no longer described solely by the basic geometry and it is possible that the Product Level will not be equal to (Sensor Height – Level Offset – Distance to Product). Likewise for the Interface if is being calculated.

Enable Linearization:

If enabled, linearization will convert the level as measured by the sensor to a corrected level value as defined by the user in the linearization table on this page (max 32 points). This may be used to correct for any non-linearity's that may occur. For example, a tank for which the roof height changes during filling.

Wet Linearization:

When the measured level for the tank reaches a level where the corresponding corrected level is known, select a row in the linearization table, enter the corrected level in the textbox below, and press the arrow button. This will immediately set the current measured level and the corrected level into the selected row in the table (i.e. immediately set in the transmitter).

Note: This feature is disabled when a user makes other changes on this screen. Apply or discard any other changes before configuring Wet Linearization.

8.8.5 Volume

While the SLG700 transmitter is generally used to measure the level of a product within a vessel, it can also be used to estimate the volume of product that corresponds to that level. This feature is turned off by default, but as shown below in Figure 20 through Figure 22, the calculation of volume can be based on the geometry of the vessel or through a piece-wise linear mapping, often referred to as a Strapping Table.

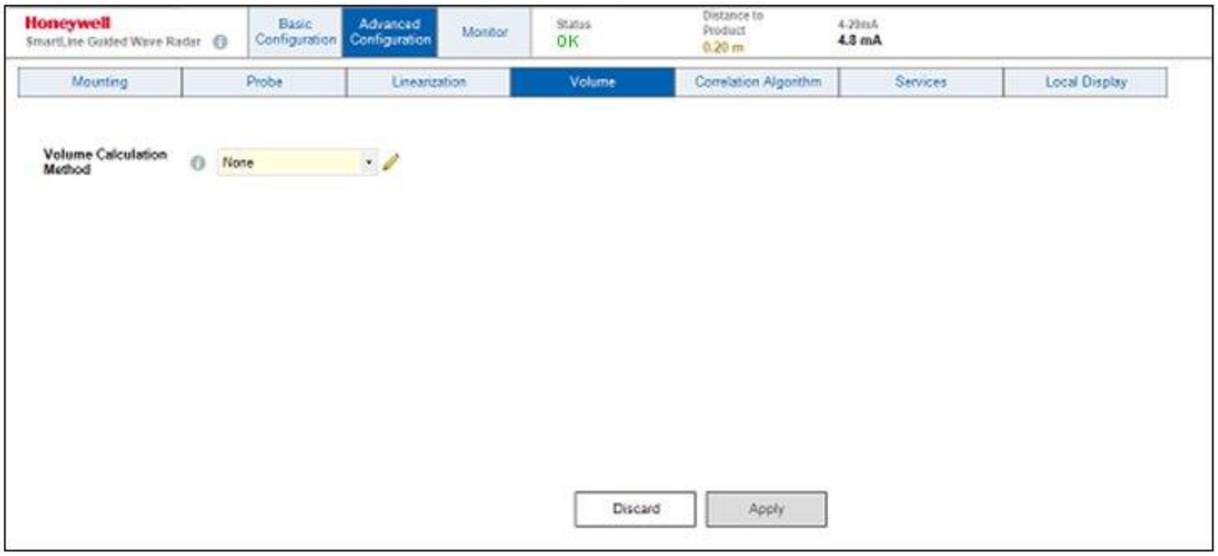


Figure 20: Advanced Configuration: Volume Calculation – None

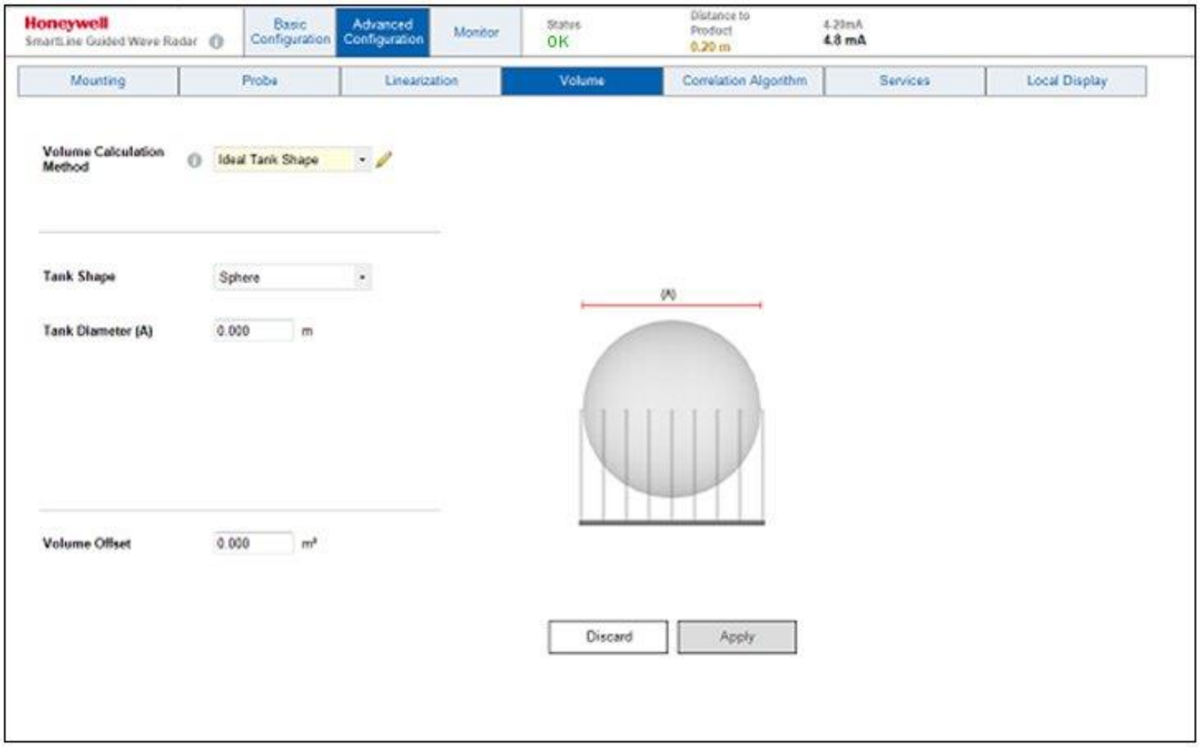


Figure 21: Advanced Configuration: Volume Calculation - Ideal Tank Shape

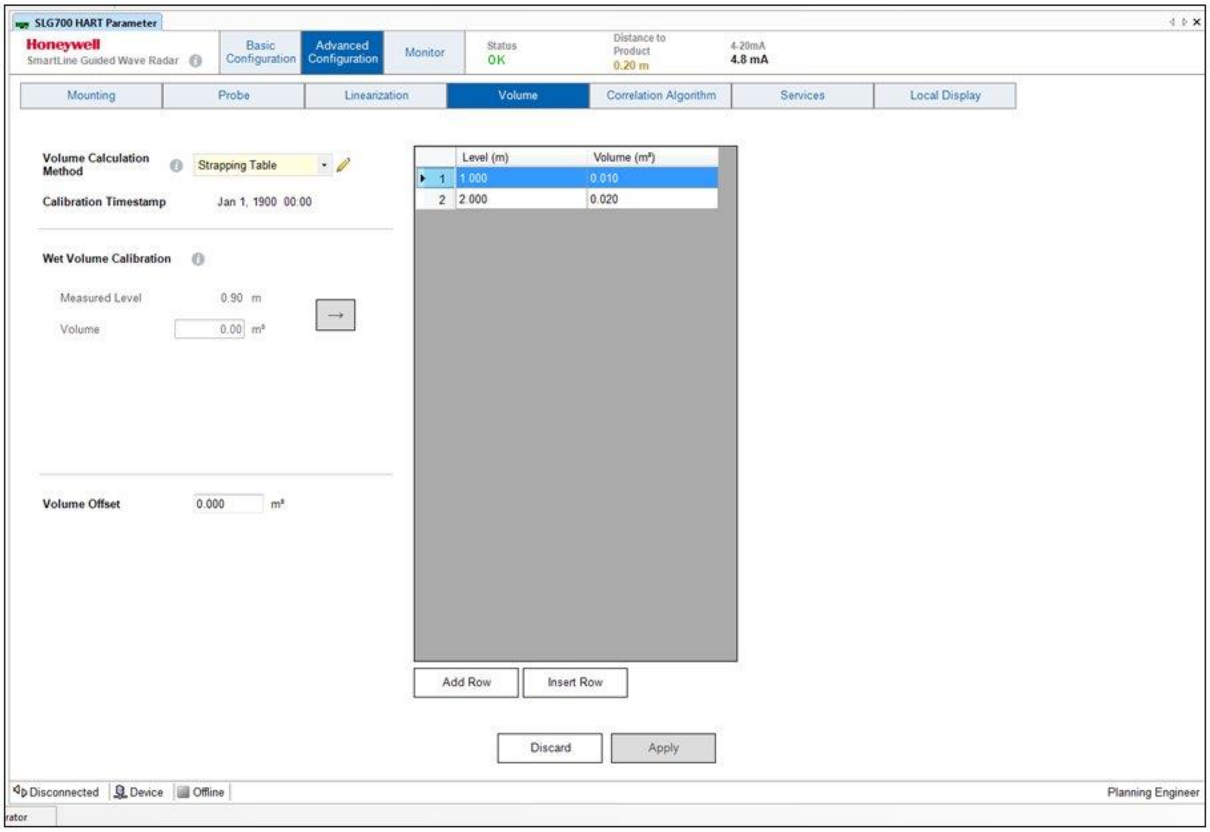


Figure 22: Advanced Configuration: Volume Calculation – Strapping Table

Wet Volume Calibration

When the measured level for the tank reaches a level where the corresponding volume is known, select a row in the strapping table, enter the corresponding volume in the textbox below, and press the arrow button. This will immediately set the values into the selected row in the strapping table (i.e. immediately set in the transmitter).

Note:	This feature is disabled when a user makes other changes on this screen. Apply or discard any other changes before configuring **Wet Volume calculation**

8.8.6 Correlation Algorithm

The method by which the distance to product surface and distance to interface is found is based on correlation between the measured echo curve and reflection models. The algorithm slides the models across the echo curve, and at each step calculates the difference between the model and the echo curve, referred to as the Objective Function. Typically the smallest value of the Objective Function corresponds to the level selected by the sensor algorithms but the values must be below a user defined threshold. In case of multiple local minima, there is additional logic to select the best candidate. The final best candidate is used to calculate the distance to the product surface and/or the distance to interface. Default threshold values are typically 0.5 to 0.6.

Figure 23 shows the DTM display used for configuration and troubleshooting of the algorithm.

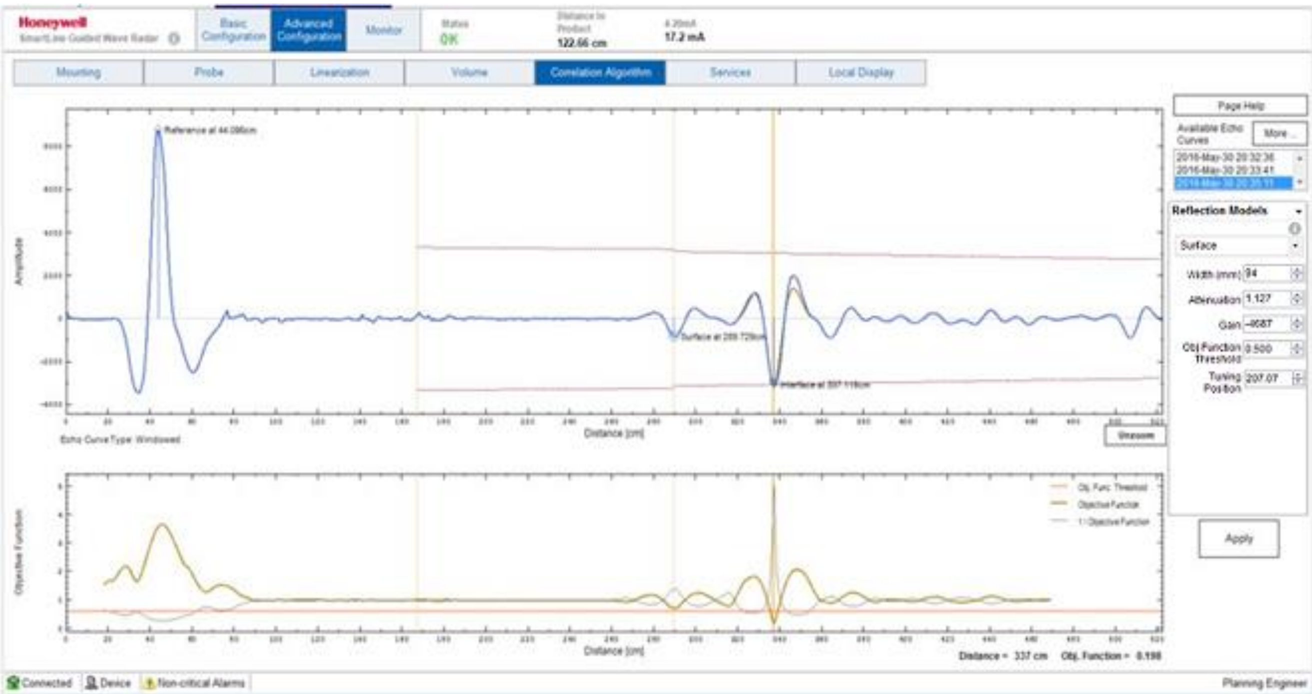


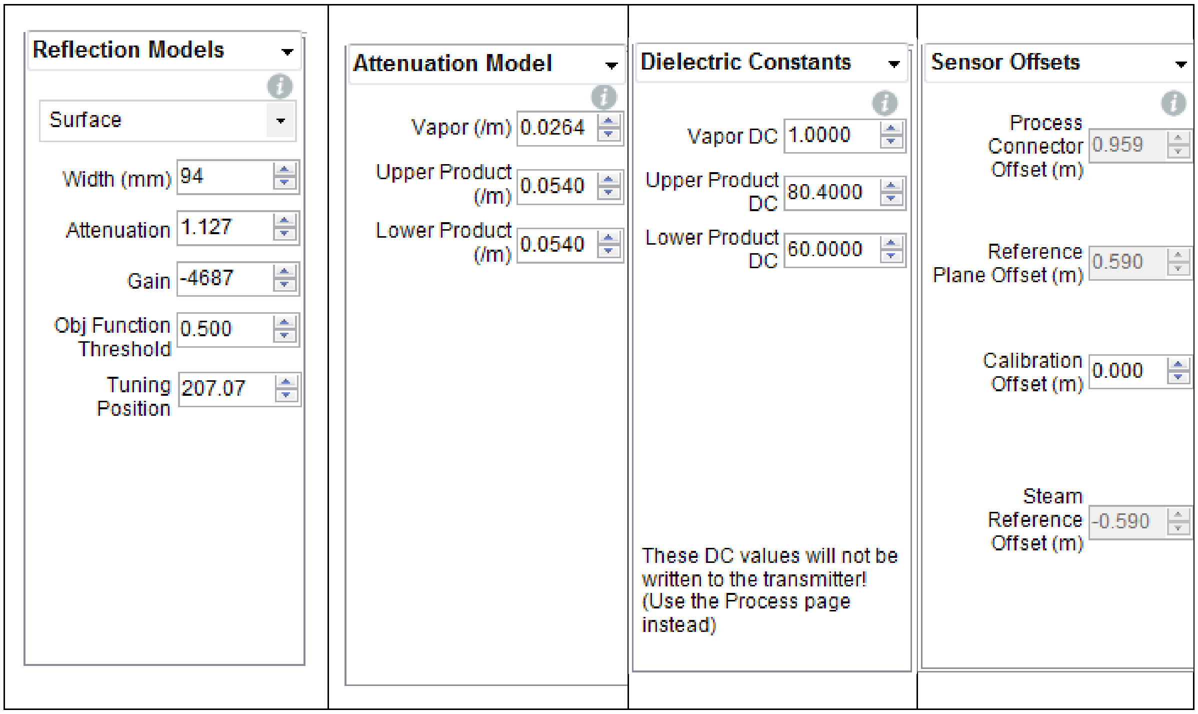
Figure 23: Advanced configuration: Correlation algorithm screen

Different captured echo curves can be selected for analysis from the list in the upper right corner.

The upper graph displays the echo curve with the found reflections as well as the reflection models of interest, i.e. surface reflection model. The bottom graph shows the objective function and its threshold. Algorithm parameters are entered in the configuration section to the right of the graphs just below the list of available echo curves.

This section consists of 4 panels accessed through the combo-box pull-down control located at the top of this section, as shown below in Table 22.

Table 22 - Algorithm parameters



The four Algorithm parameter panel details follow:

1. Reflection Models
2. Attenuation Model
3. Dielectric Constraints
4. Sensor Offsets

Reflection Models

The radar impulse reflection model is an asymmetric damped cosine function that takes 3 configurable parameters as listed in the leftmost **Reflection Models** panel in Table 22.

The model and its gain, width and attenuation parameters are illustrated in Figure 24.

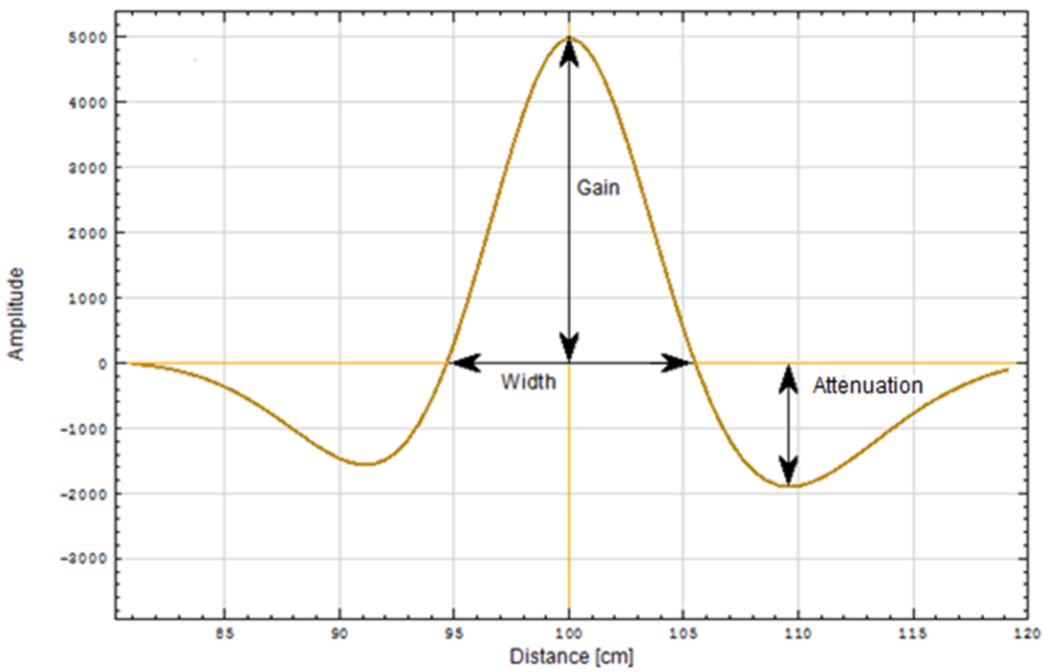


Figure 24: Radar Impulse Reflection Model

- **Gain:** This parameter determines the magnitude of the central peak of the damped cosine function.
- **Width**: This parameter determines the width of the central lobe of the damped cosine function. It approximately equals the width between the zero crossings of the function.
- **Attenuation**: This parameter determines how fast the cosine wave is reduced to zero magnitude, and therefore determines the height and width of the side lobes to either side of the central lobe. Increased attenuation results in smaller side lobes. Note that the asymmetric property means that the side lobes will each have a slightly different shape. This attenuation parameter should not be confused with the medium attenuation that determines how the RADAR amplitude diminishes as it propagates down the probe.

There is a total of 6 reflection models maintained by the transmitter to represent the types of reflections that might be visible in an echo curve. These can be selected through the Reflection Model pull-down selector under the Model tab shown in Table 22, and include:

- Reference
- Process Connector
- Steam Reference
- Surface
- Interface
- End of Probe

Note: Some of the selections may be disabled in the pull-down depending on the application and mounting configuration.

The **Reference** reflection is a reflection caused by an impedance change where the transmission line connects to the sensor board that generates the radar pulses. This reflection is always present and its characteristic shape is not altered by any environmental or process conditions. In cases where the sensor housing is directly connected to the process connector, the Reference reflection serves as an internal datum point for locating the position of the transmitter's Reference Plane in the echo curve.

The **Process Connector** reflection is a reflection caused by an impedance change within the body of the process connection that provides the physical connection to the process. There are actually a number of impedance changes in this section depending on the transmitter model and type of connection, and therefore a number of reflections. The specific reflection of interest, if any, depends on the application and hardware configuration.

One case where the Process Connector reflection is utilized is when the sensor housing is separated from the process connector by the optional 3m Remote Mount Cable. Since the remote cable may be subject to a high temperature gradient, its apparent length to the sensor may change. In this case a reflection near the start of the process connector is used as the new datum point for locating the transmitter's Reference Plane, eliminating temperature dependences of the level measurement. The observed distance between this reflection and the standard Reference reflection is dynamically updated as the Process Connection Offset.

Another case where the Process Connector reflection is always utilized is the Saturated Steam Application. In this case, it is possible for high temperature steam to be present behind the Reference Plane, which also impacts the apparent distance to the Reference Plane. In this case a reflection near the end of the process connector is used as the datum point for locating the transmitter's Reference Plane. For this application, the far reflection is used as the Process Connector reflection, even if a Remote Mount Cable is in use.

The **Steam Reference** reflection model is used to describe the characteristic of the reflection from the additional Steam Reference Probe which is only used in the Saturated Steam application. This reflection is dynamically monitored to determine the change in the dielectric constant of the steam as the pressure and temperature inside the boiler increases or decreases.

The **Surface** model is used to describe the characteristics of the reflection caused as the radar pulse encounters the boundary between a vapor and a liquid product. The **Interface** model is used to describe the reflection caused as the radar pulse encounters the boundary between two liquid products. Refer to section 8.7.3 for a description of when each of these types of reflections may be present.

The **End of Probe** model is used to describe the characteristics of the reflection caused as the radar pulse encounters the physical end of the probe or a centering disk attached to the probe. The shape of these reflections vary depending on the probe type and end treatment as well as the transmitter model and other mounting considerations. While the physical end of the probe is always present, depending on the transmission characteristics and amount of product(s) above the end of the probe, this reflection may not be noticeable in an echo curve.

Linear Attenuation Model

The gain (amplitude) of the radar reflection is exponentially decayed based on the linear attenuation coefficient. This accounts for radar pulse energy dissipation to the vapor and media surrounding the probe and is a function of the distance travelled. This is modeled as:

$$g_{\text{surface}}(x) = g_{\text{surface}}(0)e^{-\alpha x}$$

Where:

x = the distance from the reference plane

α = the linear attenuation coefficient

The linear attenuation of the gain is plotted in red in the upper graph in Figure 24. There is one linear attenuation coefficient for each possible medium in the tank:

- Vapor
- Upper product
- Lower product

These are available on the **Attenuation Model** panel shown in Table 22.

For each possible medium in the tank there is also a reference point from which the linear attenuation should be applied. For the Steam Reference, Surface and End of Probe reflections this reference point is the transmitter's Reference Plane. For the Interface reflection, this reference point is the location of the Surface reflection in non-flooded applications and the location of the transmitter's Reference Plane for flooded applications. The **Reflection Model** panel has entry fields where the locations of these reference points can be entered. In many cases, these locations will have been determined by the transmitter and these entry fields will be pre-populated with the correct values from the echo curve data.

Dielectric Constants

Under the **Dielectric Constants** tab, the user may enter the dielectric constants for the Vapor, Upper Product, and Lower Product (not applicable for the Saturated Steam application). The user can experiment with changing the DCs to see the effect on the derived gains that are automatically re-calculated. Note that changing the DC values on this display does not actually send the new values to the transmitter. Once the desired values are determined, the DC values must be changed on the Process display and written to the transmitter.

Sensor Offsets

There are three offsets used by the algorithm in calculating the distance to surface measurement. The **Process Connector Offset** (m) is only used for cases where the Process Connector reflection is utilized (see the section on Reflection Models above), as it indicates the observed distance between the Reference and Process Connector reflections. It is a calculated offset and is therefore a read-only parameter. If the Process Connector reflection is not required for the current application, this offset will default to zero.

The **Reference Plane Offset** (m) is a read-only parameter that is determined in the factory for each transmitter. It corresponds to the distance between the physical reference plane and the internal datum point, which is the location of either the Reference reflection or the Process Connector reflection, depending on whether or not the optional remote mount cable has been ordered.

The **Calibration Offset** (m) is a user-entered offset that may be used to adjust for minor inaccuracies in the distance measurements caused by differences between the factory and field conditions. It has a range of ±1.0m and is always treated as a vertical measurement, even if the probe is mounted on an angle.

The **Steam Reference Offset** (m) is a read-only parameter that is only available for the Saturated Steam application. It is the distance between the Reference Plane and the Steam Reference reflection as observed at normal atmospheric conditions, without steam.

Under normal circumstances, the only parameter that may require adjustment in the field is the **Gain** parameter under the **Model** tab. The models which should be inspected for each application type are listed in Table 23.

Table 23 - Models used for each application type

Application	Reference	Surface	Interface	End of Probe	Process Connector	Steam Reference
Single Liquid	Yes	Yes		Yes	Remote mount only	
Two Liquids Flooded	Yes		Yes	Yes	Remote mount only	
Two Liquids non-Flooded	Yes	Yes	Yes	Yes	Remote mount only	
Saturated Steam	Yes	Yes		Yes	Yes	Yes
Single Liquid, Low DC	Yes			Yes	Remote mount only	

8.8.1 Correlation Model Recalculation

Information on what triggers a Correlation Model Recalculation is summarized in Table 24 below.

Table 24 - Correlation Model Recalculation

Parameter recalculated	Parameters that will trigger recalculation / reset required
Surface Model Gain	Vapor DC, Upper Product DC, Lower Product DC, Measured Products, Probe Type, Transmitter Model, Mounting Location, Sensor Connection Type, Mounting Diameter
Interface Model Gain	Upper Product DC, Lower Product DC, Application Type, Probe Type, Transmitter Model, Mounting Location, Sensor Connection Type, Mounting Diameter
End Of Probe Model Gain, Width, Attenuation	Probe Type, Probe End Type, Centering Disc Diameter, Transmitter Model, Mounting Location, Sensor Connection Type, Mounting Diameter, Measured Products
Process Connector Model Gain, Width, Attenuation	Transmitter Model, Sensor Connection Type, Probe Type, Measured Products
Steam Reference Model Gain	Steam Reference Probe Type, Measured Products
Propagation Factor	Transmitter Model, Probe Type
Vapor Attenuation	Transmitter Model, Probe Type
Minimum BDH/BDL	Vapor DC, Upper DC, Lower DC, Probe Type, Measured Products
BDH/BDL	Vapor DC, Upper DC, Lower DC, Probe Type, Measured Products
Steam Reference Model Width, Attenuation and Threshold	Measured Products (Saturated Steam)
Vapor DC, Upper Product DC, Lower Product DC	Measured Products (Saturated Steam)
Amplitude Tracking	Measured Products (Saturated Steam)
Field Background Type	Measured Products (Saturated Steam)
Mounting Location	Measured Products (Saturated Steam)
Mounting Diameter	Measured Products (Saturated Steam)
Probe Type	Measured Products (Saturated Steam)
Steam Reference Probe Type	Measured Products (Saturated Steam)

8.8.2 How to configure the algorithm

Under normal circumstances, the transmitter will automatically find the level of the surface and interface (if applicable) using the configuration that was shipped from the factory:

1. Step through the basic configuration and make sure that all entries are correct.
2. Review the Probe and monitoring parameters under Advanced Configuration and ensure that all entries are correct.
3. Capture an echo curve as described in section 8.9.4.
4. Navigate to the **Correlation Algorithm** page and load the captured echo curve. Any reflections that were located by the sensor in the echo curve will be identified in the blue echo curve plot and the corresponding model will be placed at that location.
5. Select the reflection model that is to be tuned, either by clicking on the vertical positioning line if the model is currently displayed in the graph, or by selecting it from the pull-down to the right.
6. The selected model appears highlighted on the upper graph as a bold orange line to distinguish it from the blue echo curve and the other unselected models.
7. Click on the vertical positioning line of the selected model and drag the model over the relevant part of the curve. The example curve shown in Figure 25 below represents a scenario of a two liquid non-flooded application with oil on top of water. In the example the transmitter has correctly located the surface of the upper oil layer, but has failed to find the interface boundary between the oil and water due to a model mismatch. In this case the Interface model should be selected and dragged to a location to the right of the Surface reflection where the interface is known to be.
8. The closer the model shape matches the curve shape, the lower the Objective Function value, as shown in the lower right-hand corner below the bottom graph. In the example, the brown Interface model does not match the blue curve at the selected position (240 cm) so the Objective Function value is high (greater than 1).

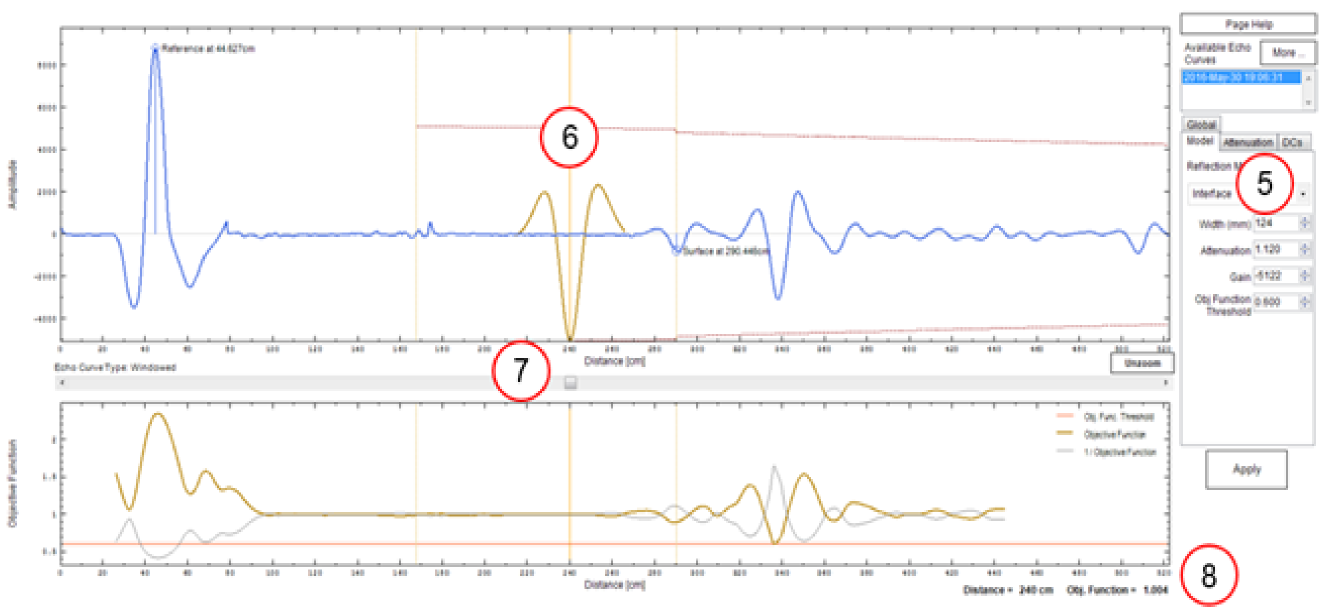


Figure 25: Adjusting the Correlation Algorithm

9. **Zoom view:** Use the mouse to draw a zoom box around the model, then click and drag the model position for best match to the curve. Notice that by dragging the model over the similarly shaped blue curve at 338cm, the Objective Function value has decreased from 1.004 to 0.658, indicating a higher correlation between the shapes.

	TIP: By slowly dragging the model back and forth over the curve you can home in on the position with the lowest Objective Function value.

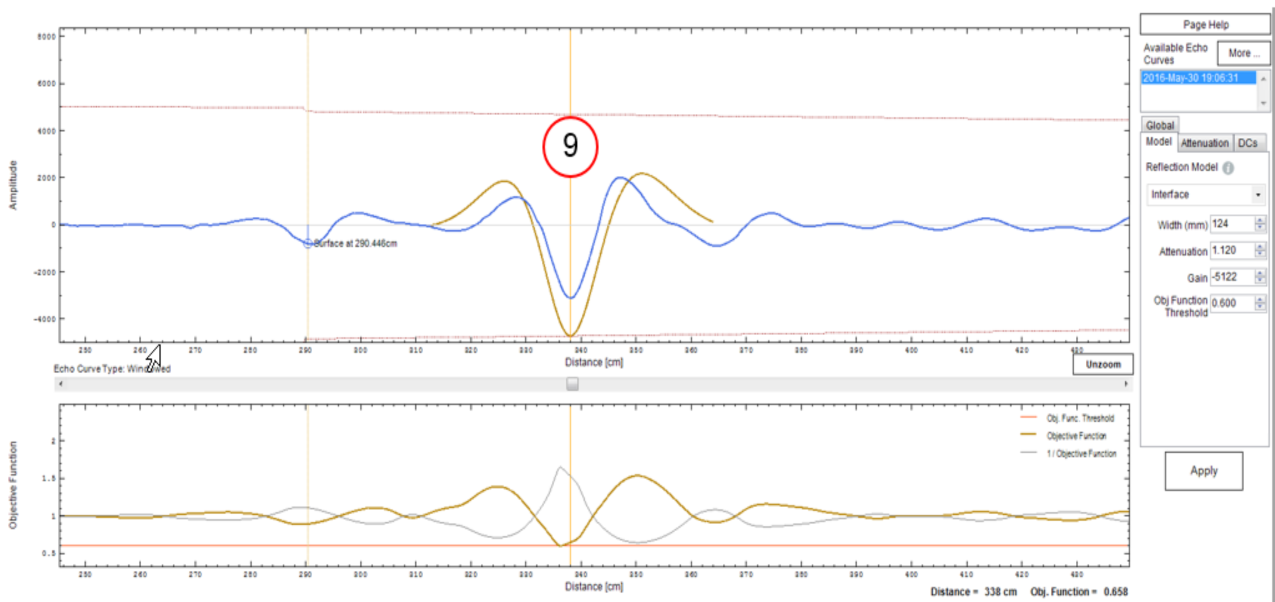


Figure 26 Zoom View

10. Notice at previous step, the brown model line's amplitude is slightly larger than the blue curve's amplitude. To reduce the model's amplitude to better match the blue curve, decrease the Gain. By gradually decreasing Gain from 5122 to 3322 the model more closely matches the blue curve while the Objective Function value has improved from 0.658 to 0.580.

	TIP: By using the up and down arrows to increase and decrease Gain you can home in on the lowest Objective Function value.

11. In the bottom graph of the Objective Function the red line indicates the Threshold. The brown curve of the Objective Function must dip below this red Threshold line to be recognized. If the Threshold is too low, increase its value to raise the red line slightly above the dip as shown. Note that there should be only one dip that falls below the Threshold line on the graph. If there are more than one, then the transmitter may report incorrect position for the reflection. Recommended values of the object function threshold are between 0.5 and 0.6. Higher values may cause selection of the incorrect levels peaks. Lower values may not accommodate minor pulse radar changes due to changing tank conditions.

12. In most cases changing the position, Gain, and occasionally Threshold should fix any problems with the echo reading. Click **Apply** to save your changes.

Note:	In this example, the model mismatch was exaggerated to better illustrate the process. See step 14 for the final model parameters.

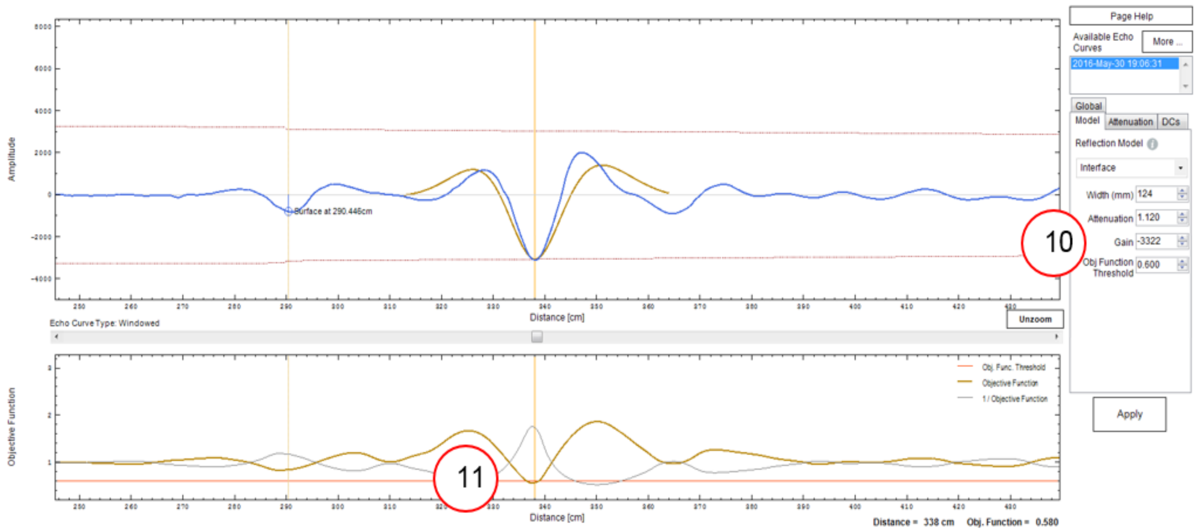


Figure 27: Adjusting the Gain (Amplitude) Parameter

13. Next, go to Monitor and read a full echo curve. Check that the correct Reference, Surface and Interface measurements were found.

14. If the algorithm is still not finding a match then the model's other parameters, Width and Attenuation, can be adjusted to get an even closer match between the model and the curve. Note that it may be necessary to collect echo curves with various levels of product to ensure that the reflection model provides a good match through the full range. Figure 28 shows the example with the Gain, Width and Attenuation parameters optimized to give and Object Function reading of 0.177.

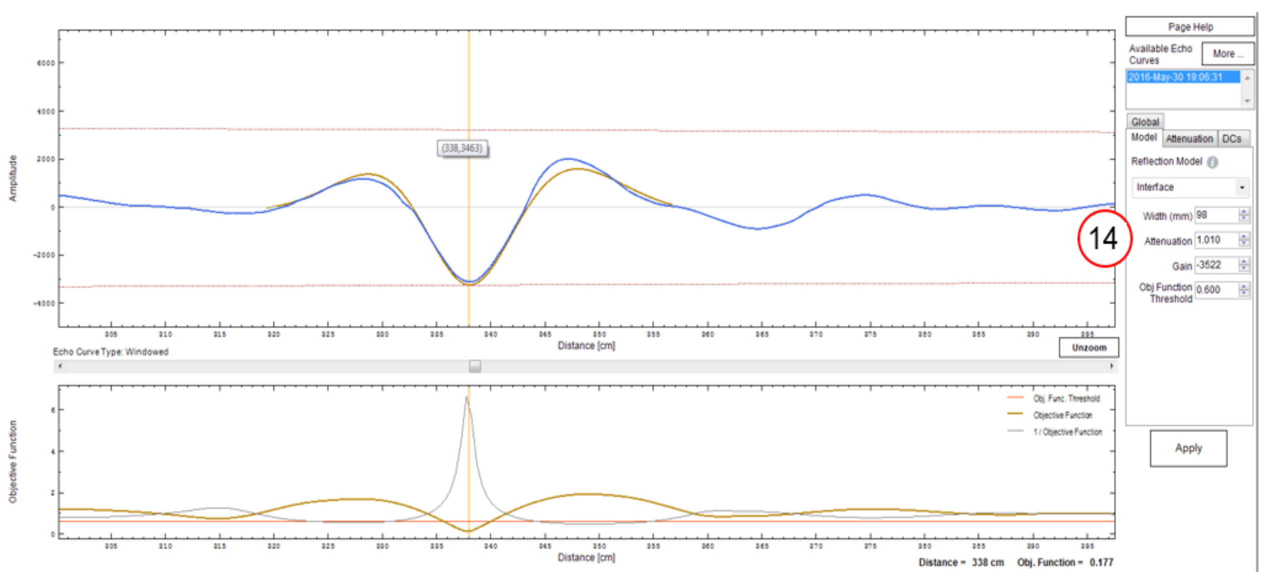


Figure 28: Adjusting the Width and Attenuation Parameters

In two liquid non-flooded applications, when the upper product thickness drops below 15cm approximately, the surface and interface reflections start to overlap. The transmitter will continue to measure the upper product thickness accurately down to 7 cm although the echo curve might only show one reflection for both surface and interface. If the transmitter fails to measure thicknesses below 15 cm or if the measurement of thin interfaces is inaccurate, it might be necessary to adjust the reflection models as described above. However, to tune the surface and interface models properly, a minimum upper product thickness of approximately 20 cm is required.

8.8.3 Tuning of linear attenuation

The linear attenuation for vapor will generally be correct for most applications and may not need any tuning. However, the linear attenuation for the upper product will vary significantly from application to application and the default value might not be appropriate. The upper product linear attenuation describes how fast the radar pulse intensity decays with distance as it travels through the upper medium. A precise upper product linear attenuation is therefore important in 2-liquid flooded and 2-liquid non-flooded applications. A procedure to tune the upper product linear attenuation is as follows:

1. Collect a minimum of two processed full echoes. One for a thin interface (20 cm) and one for a thick interface (the thicker the better). Ensure that the interface level is away from any disturbances that may affect the reflection amplitude.
2. In the Correlation Algorithm page, select the thin interface echo and place the surface and interface models at the surface and interface reflection, respectively (if not already done automatically).
3. Adjust the Interface model gain so the model matches the interface reflection
4. Select the thick interface echo and place the models appropriately
5. Adjust the upper product linear attenuation so that the interface model matches the interface reflection
6. If the tuned interface gain and upper product linear attenuation provide a good model match for interface for both echoes, click apply

8.8.4 Services

The Services page provides access to many configuration settings and procedures related to the maintenance and troubleshooting of the SLG700 transmitter. These features are organized into several panels arranged in an accordion style container, as shown below in Figure 29.

Individual panels may be expanded or collapsed by clicking on either the panel's title or the arrow icon next to the title. A collapsed panel is indicated by a downward facing arrow while an expanded panel is indicated by a right facing. Only one panel may be expanded at a time so expanding a new panel will automatically cause the previously expanded panel to collapse. A collapsed panel does, however, retain any edits made while it was expanded that were not applied to the transmitter.

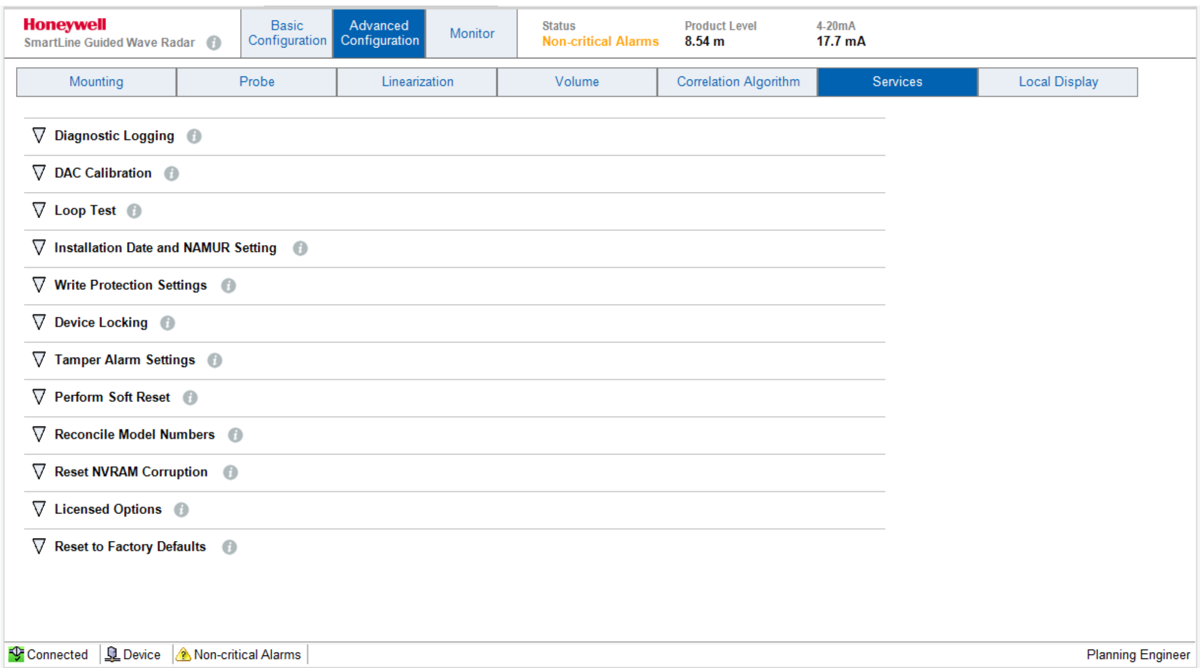


Figure 29: Advanced Configuration – Services Menu

Diagnostic Logging

The Diagnostic Logging panel, shown in Figure 30, allows diagnostic logging information recorded by the transmitter to be uploaded and stored in a file for analysis by a qualified Honeywell expert. The types of log files available are Startup, Live, and Error. Since some of the logs are very long, once the reading of a log has been started, it may be cancelled at any time once the required lines have been obtained.

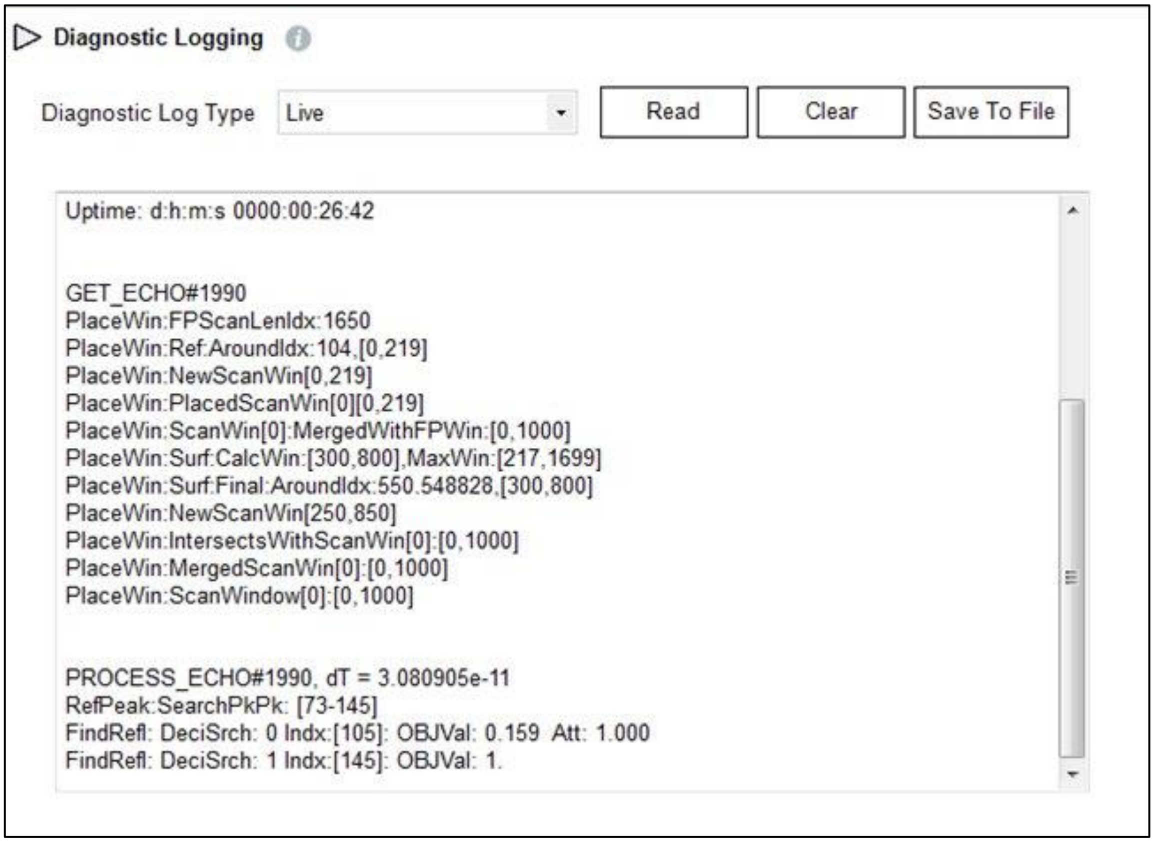


Figure 30 Services – Diagnostic Logging

DAC Calibration

The DAC Calibration panel provides a procedure for adjusting the slope (span) and offset (zero) applied to the output of the Digital to Analog Converter circuitry, which is responsible for controlling the amount of current flowing in the current loop. It is important that this analog current level accurately matches the digital value that the transmitter has calculated to represent the value of the Primary Variable, so that a control system reading the analog value will translate it into the correct response. More detailed information about the overall procedure and the equipment required can be found in Chapter 4. The layout of the DAC Calibration panel is shown below in Figure 31.

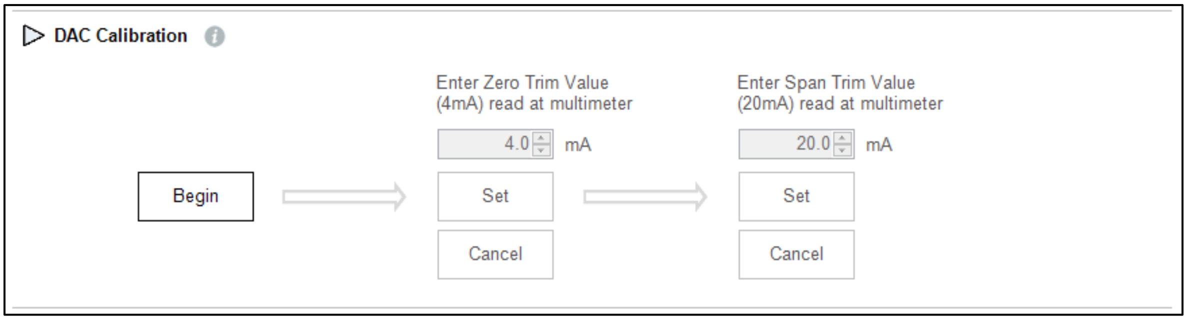


Figure 31 Services – DAC Calibration Panel

1. Clicking on the Begin button will automatically put the transmitter into Fixed Current Mode at 4 mA. Make sure that any control loops monitoring the transmitter output have been put in manual mode before starting this procedure.
2. The buttons and data entry field in the middle column will become enabled. Enter the value read at multi-meter into the numeric data entry field, which should be close to the 4.0 mA requested current. If it is significantly different, press the Cancel button to abort the procedure and investigate the transmitter hardware further.
3. Click on the Set button in the Zero Trim column to allow the transmitter to adjust its zero offset to remove any error in the 4 mA reading. This will automatically start the next step in the sequence and put the transmitter into Fixed Current Mode at 20 mA.
4. The buttons and data entry field in the right-hand column will become enabled. Enter the value read at multi-meter into the numeric data entry field, which should be close to the 20.0 mA requested current. If it is significantly different, press the Cancel button to abort the procedure and investigate the transmitter hardware further.
5. Click on the Set button in the Span Trim column to allow the transmitter to adjust its slope to remove any error in the 20 mA reading. This will automatically put the transmitter into Signaling Mode where loop current follows the calculated PV value.

Loop Test

The Loop Test panel facilitates testing of the current loop wiring and connections right through to the control system by allowing the sensor to be put into Fixed Current mode at any desired loop current value between 3.8 and 20.8 mA (20.5 if NAMUR enabled). This is a step that is often required as part of the Loop Check function during the commissioning phase, but it can also be performed at any time after the transmitter is fully installed. The layout of the Loop Test panel is shown below in Figure 32.

Figure 32 Services – Loop Test Panel

1. Enter the desired loop current value in the numeric entry field.
2. Click on the Set button to put the transmitter into Fixed Current mode.
3. Steps 1 and 2 may be repeated as often as required.
4. Click on the Exit button to exit Fixed Current mode and put the transmitter into Signaling Mode where loop current follows the calculated PV value.

Installation Date and NAMUR Setting

The Installation Date and NAMUR Setting pane allows the setting of two unrelated configuration parameters as shown below in Figure 33.

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Figure 33 Services – Installation Date and NAMUR Setting

1. The Install Date entry field is for recording the installation date of the transmitter. Note that the transmitter firmware only allows this date to be set once as it is the datum point for the Time in Service and Service Life Remaining diagnostic values. If the installation date has not already been set in the transmitter, the data entry field will show the default date of January 1, 1972 and the control will be enabled. Otherwise the configured installation date will be shown and the control will be disabled.
2. The NAMUR Enable entry field enables or disables the NAMUR setting for the transmitter's loop current high saturation level. Enabling this will make the analog output compliant with NAMUR standards, and will change the saturation output to 20.5 mA. Disabling this will change the high saturation output level to Honeywell's standard 20.8 mA.

Write Protection Settings

The Write Protection Settings panel allows the configuration of the transmitter's Software Write Protection feature. This is a write protection scheme that can be enabled and disabled without dismantling the transmitter and is in addition to the physical Hardware Write Protection feature which can only be changed by opening the transmitter and moving a jumper. See the *SLG700 Transmitter User's Manual*, *Document #34-SL-25-11* for details. The Software Write Protection setting is overridden if the Hardware Write Protection is enabled.

Figure 34 and Figure 35 below show two different views of the Write Protection Settings panel. The first shows the panel as it is first opened when it is displaying the current setting of the feature. Figure 35 shows all the data entry fields that are available on the panel for configuring this feature. (The panel is not normally seen in this manner though, as the controls on the right-hand side are only visible after the Change Password button is clicked and that button is not active while the Apply and Discard buttons are visible in the left-hand side.)

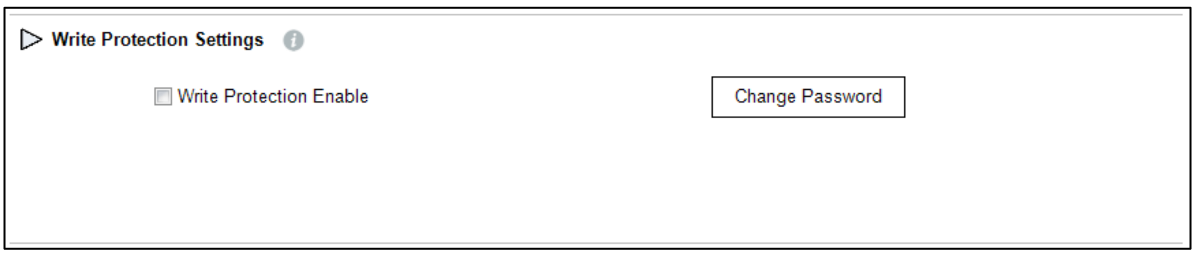

Figure 34 Services – Displaying Write Protection Settings

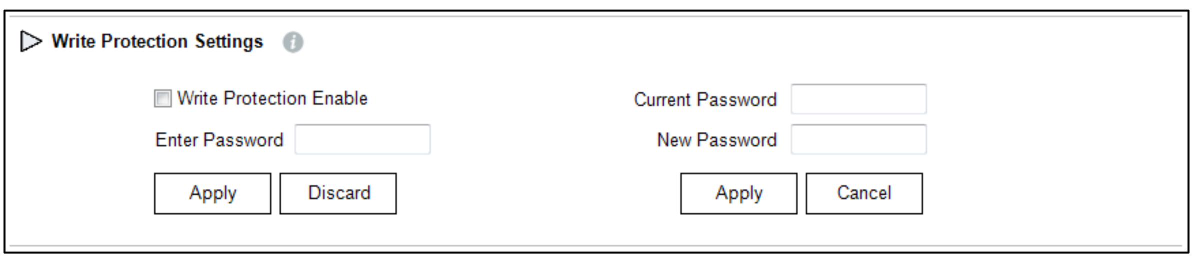

Figure 35 Services – Changing Write Protection Settings

1. Changing the Enabled or Disabled state of the write protection feature is performed by simply changing the current state in the checkbox. The other controls then become available to apply the new state to the transmitter. Note that write protection can be turned from Off to On without providing a password, but the correct 4-digit password must be entered in order to turn it from On to Off.
2. The 4-digit password required to turn the software write protection Off can be changed by clicking on the Change Password button. The additional controls then become available for entering the current and new passwords, which must both be sent to the transmitter to complete the change.

Device Locking

Device Locking is a HART 7 supported Common Practice feature that allows a HART master to temporarily or permanently lock an instrument, preventing another master or the local operator display from changing the transmitter's configuration or calibration. The Device Locking panel, shown in Figure 36 displays the current state of the transmitter and allows the user to apply a new setting. The available options are Unlocked, Locked Temporarily and Locked Permanently. A temporary device lock is automatically cleared whenever the transmitter goes through a power cycle or a soft reset is performed. A permanent device lock is maintained through a power cycle or reset and must be explicitly cleared by the master, either Primary or Secondary, which initiated the lock.

Figure 36 Services – Device Locking

Tamper Alarm Settings

The Tamper Alarm feature allows a warning to be generated if more than a specified number of *attempts or actual* configuration changes are made, *whether write protected or not*. The warning stays active until the specified latency period has elapsed after the Primary Master reads the corresponding status byte. Examples of attempted configuration changes are moving the Write-Protect jumper or entering a wrong password. The panel for configuring this feature is shown below in Figure 37.

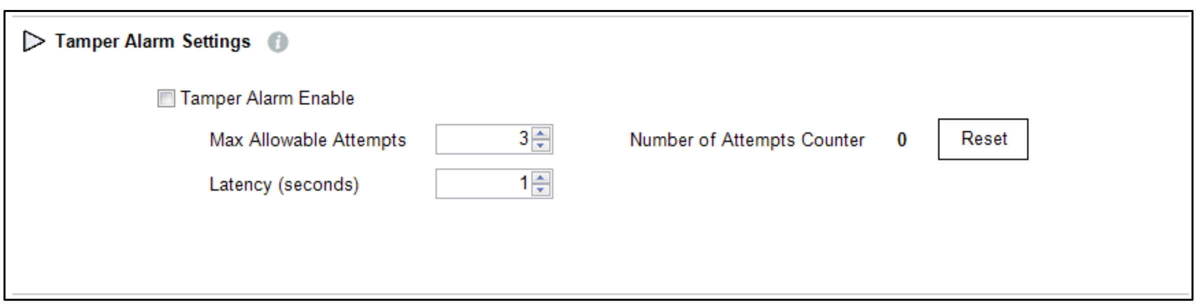

Figure 37 Services – Tamper Alarm Settings

1. The Tamper Alarm Enable checkbox allows the feature to be turned On and Off.
2. The Max. Allowable Attempts entry field specifies the number of change attempts can be tolerated before the non-critical status warning is generated.
3. The Latency entry field specifies the number of seconds, from 0 to 60, for which the tamper alarm warning condition remains set after generated.
4. The Number of Attempts Counter indicator specifies the number of attempts to make changes that have been detected since the warning condition was cleared.
5. Clicking on the Reset button will reset the Number of Attempts counter back to zero.

Perform Soft Reset

The Soft Reset panel, shown in Figure 38, provides the ability to cause the transmitter to reset its microprocessors. The resulting restart is similar to a normal power up sequence. The only difference is if the Primary Variable is valid at the start of the reset sequence. If it is, the value will be maintained until the initialization is performed, after which a new value will be sent out on the analog output channel.

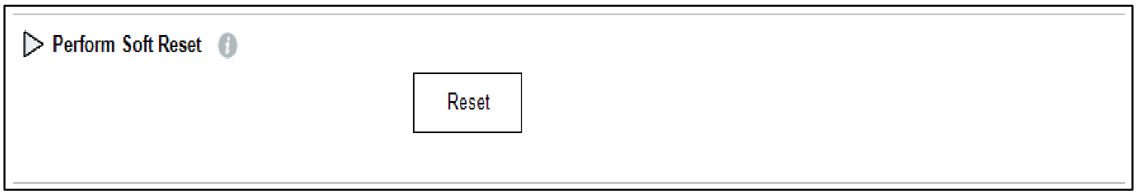

Figure 38 Services – Soft Reset

Reconcile Model Numbers

The SLG700 transmitter maintains a copy of the unit's model number in both the Communication Module and the Sensor Module. Under normal circumstances these are the same value, however, if one of the modules is replaced there can be a mismatch between the model numbers, which identifies the components configured. In this case, an alarm condition will be generated.

The Reconcile Model Numbers panel, shown below in Figure 39, displays the Model Key and Model Number in both the Communication Module and the Sensor Module. In the case of a mismatch, buttons become available next to each model number, allowing the user to select the Model Key/Model Number pair to be used to update the transmitter. The Model Key/Model Number from the selected component will be written to the other component.

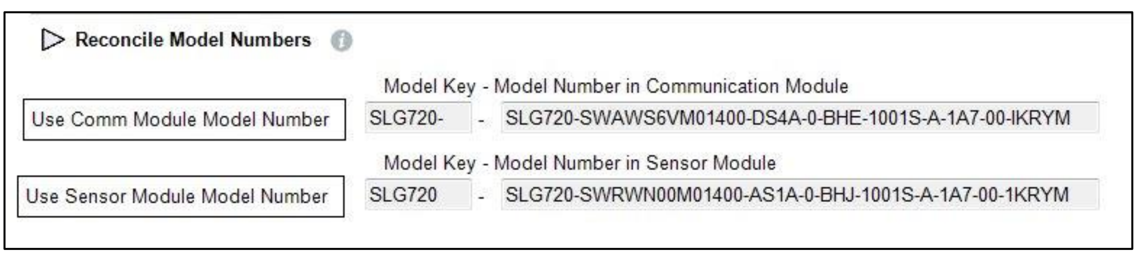

Figure 39 Services – Reconcile Model Numbers

Reset NVRAM Corruption

The Reset NVRAM Corruption panel, shown below in Figure 40, displays the current status of the NVRAM Corrupt flag for both the Communication Module and the Sensor Module. In the case of a corruption the corresponding indicator will be red and a Reset button will be available to allow the user to attempt a reset of the appropriate NVRAM. Note that this will cause default values to be used and should be done only in rare occasions.

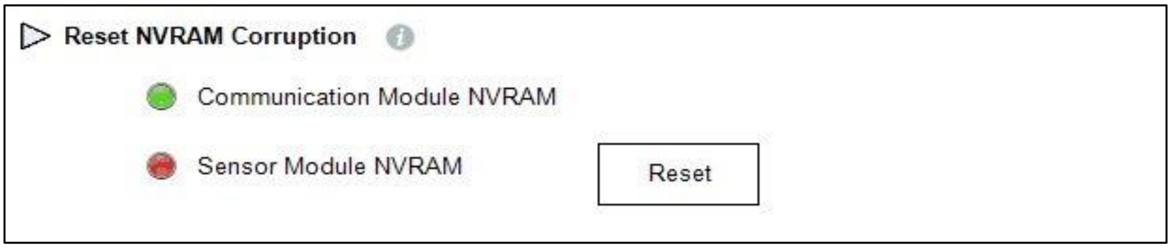

Figure 40 Services – Reset NVRAM Corruption

Licensed Options

Starting with the R200 release of the transmitter, certain firmware features require a license for them to be activated. Normally these features will be purchased and licensed when the transmitter is first purchased, however, there is also the possibility to purchase new features and relicense the transmitter after it is installed. Check with your Honeywell representative for more information on this feature.

The Licensed Options panel, shown in Figure 41, displays the currently enabled Licensed Options and allows the entry of a License Key to enable newly purchased options.

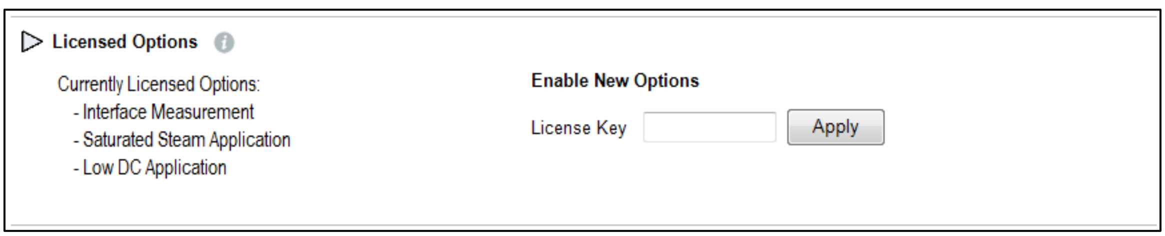

Figure 41 Services – Licensed Options

Reset Factory Defaults

The Reset Factory Defaults panel, shown in Figure 42, provides the ability to reset all device configuration to the factory defaults, and trigger a soft reset. This will overwrite any configuration changes made since the transmitter left the factory and should only be done to recover a corrupted transmitter. The user will be prompted for confirmation before this action is taken.

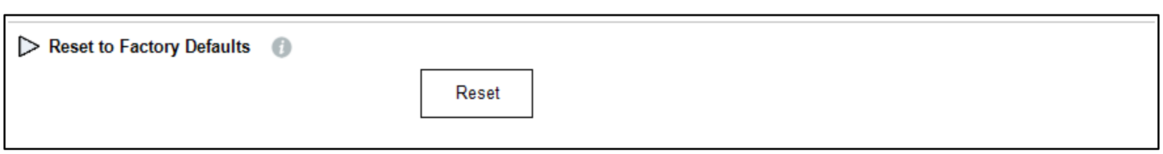

Figure 42 Services – Reset Factory Defaults

8.8.5 Local Display

Configure global settings and up to 8 screen formats of the transmitter's display.

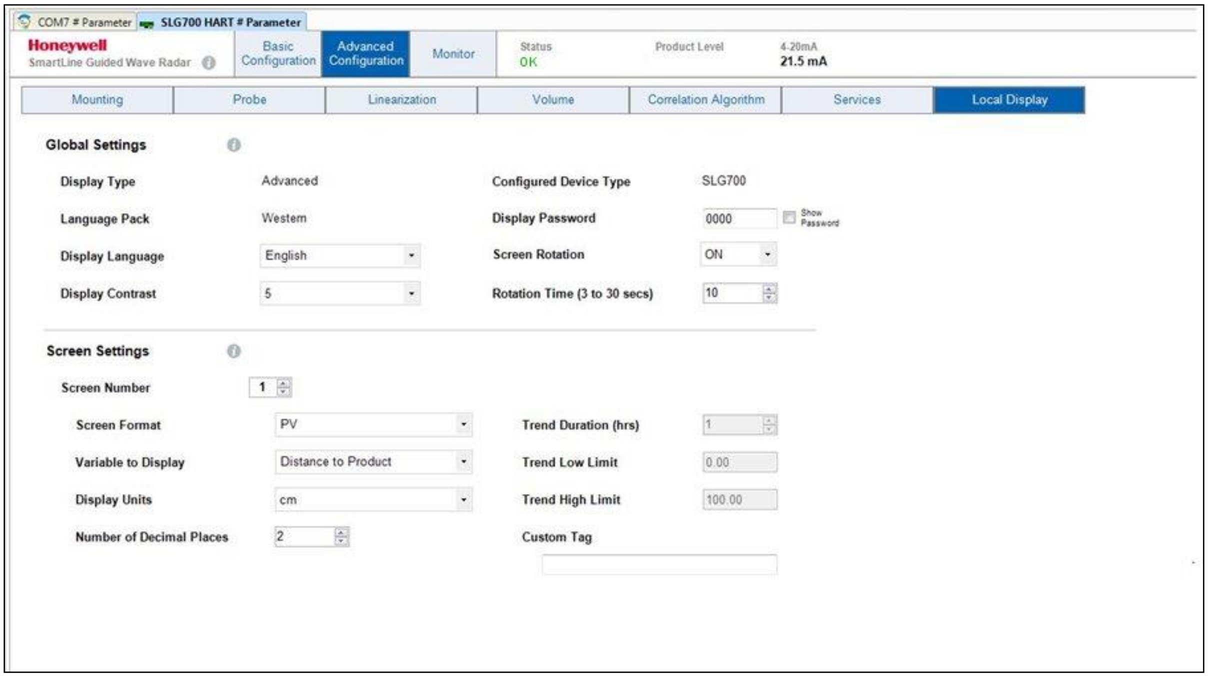

Figure 43 Local Display Configuration

8.9 Monitor

8.9.1 Dashboard

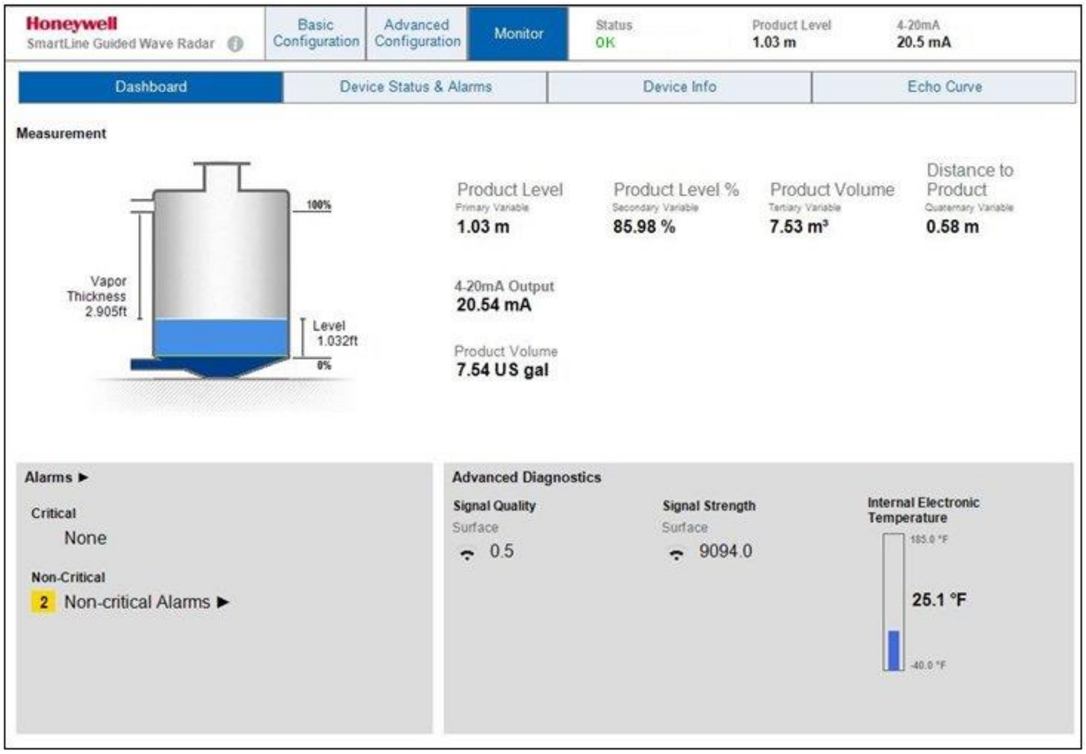

Figure 44: HART DTM Dashboard

The dashboard displays the current state of the system, including the state of the transmitter and the associated readings and number of active alarms. When the saturated steam application is being used, the dielectric constant of the steam will also be presented.

Signal Quality:

This variable indicates the degree of match between the reflection model and the live echo curve data. This value is 1 minus the objective function value (see section 8.8.6) and values close to 1 represent a very good match. If this number drops too low the reflection models should be checked as described in section 0.

Signal Strength:

This variable indicates the amplitude of the indicated reflection. The level and interface reflections are negative; therefore, a lower higher value indicates a larger amount of the radar energy was reflected which should provide a good signal to noise ratio. If this value drops too low the transmitter may not be able to reliably track the associated level. A good reflection should be approximately the same size as the gain for the correlation model peak: the acceptable values are dielectric constant and range dependent. Good values are in the range between -500 and -9000 counts.

When the tank is empty or nearly empty, the reported Signal Strength and Signal Quality for Surface and Interface will instead be the ones for the End of Probe reflection.

8.9.2 Details Status and Alarms.

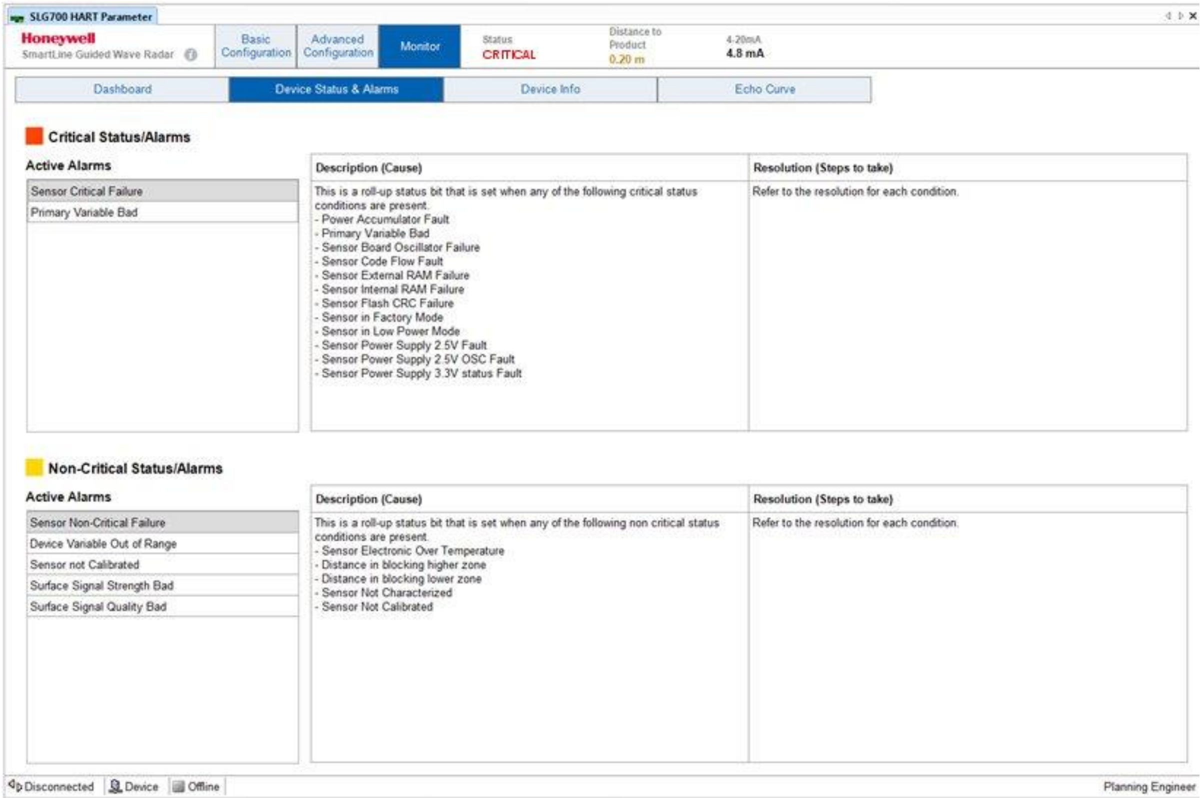

Figure 45: Device Status & Alarms screen

The **Device Status & Alarms** screen displays all active critical and non-critical alarms. The blanker the screen, the better the health of the system. For a description of all of the conditions that may appear on this display, refer to Section 6.2.

For any active alarm, follow the instructions in the Resolution column to clear the alarm.

8.9.3 Device Information

The **Device Info** screen displays the current revision numbers of the software, hardware, install date and so forth.

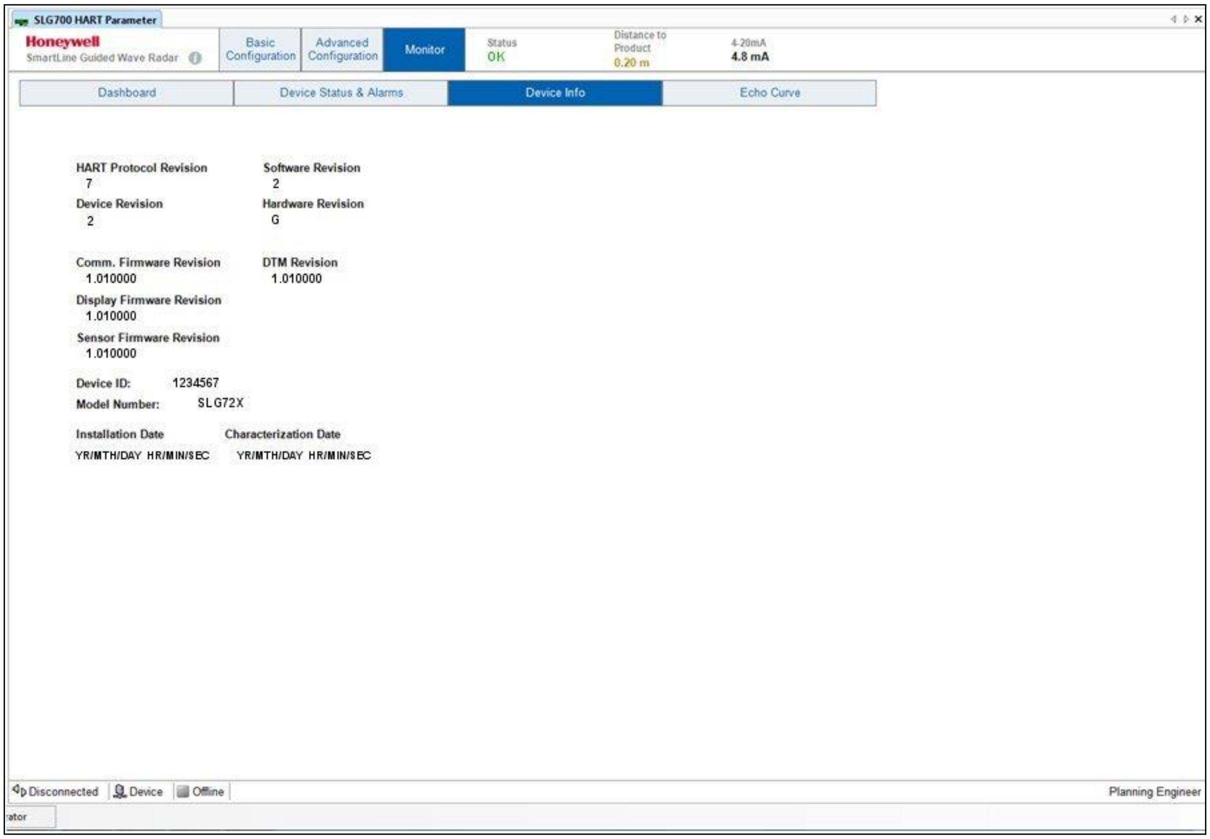

Figure 46: Device Info screen

8.9.4 Echo Curve

The Echo Curve display allows users to capture echo curves for commissioning or troubleshooting purposes.

- Start Distance
- End Distance
- Units
- Show Behind Reference Plane: to select a region.
- Resolution: to select the resolution to select the resolution of the data collected (impacts upload time)
- Read and Clear to plot data.
- Save To File / Open File: Allows users to save to disk and later perform analyses on the data or send for offline analysis by experts.

The Honeywell SLG700 captures four types of echo curves:

1. Windowed
2. Full
3. Processed
4. Background Subtraction Array

Figure 47: Echo Curve screen

Echo Curve Types

Windowed Echo Curve: In this echo curve type, data is shown only in the areas where the transmitter is currently searching for reflections. On short probes (about 5 m depending on present location of the level and process connector type) this will cover the full length of the probe but on longer probes where the transmitter tracks the surface/interface reflections as they move, there will be areas with no data visible. Subtraction of background reflections near the reference plane has been applied to this data array so unwanted reflections, due to a nozzle for instance, will not be visible. This type of echo curve is useful for troubleshooting the Correlation Algorithm settings as it represents the data on which the correlation algorithm works.

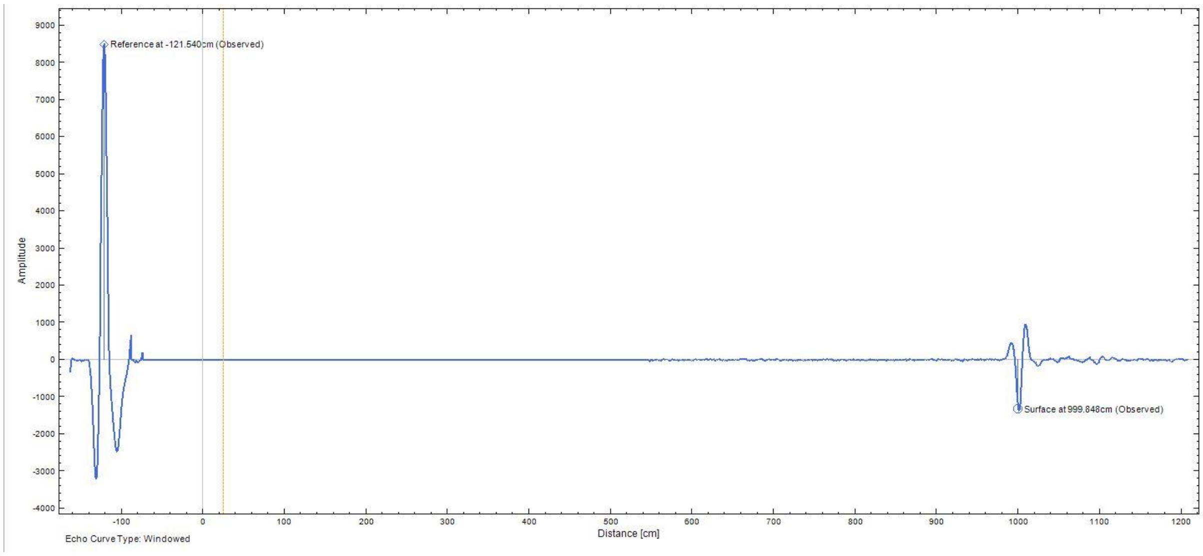

Figure 48: Windowed Echo Curve

Full Echo Curve: This echo curve type includes data collected over the full length of the probe. Subtraction of background reflections near the reference plane is not applied so all physical reflections, due to a nozzle for instance, will be visible. This type of echo curve is useful for troubleshooting problems in the region near the reference plane. Note that for longer probes, the data shown on this echo curve was collected over multiple echo scans.

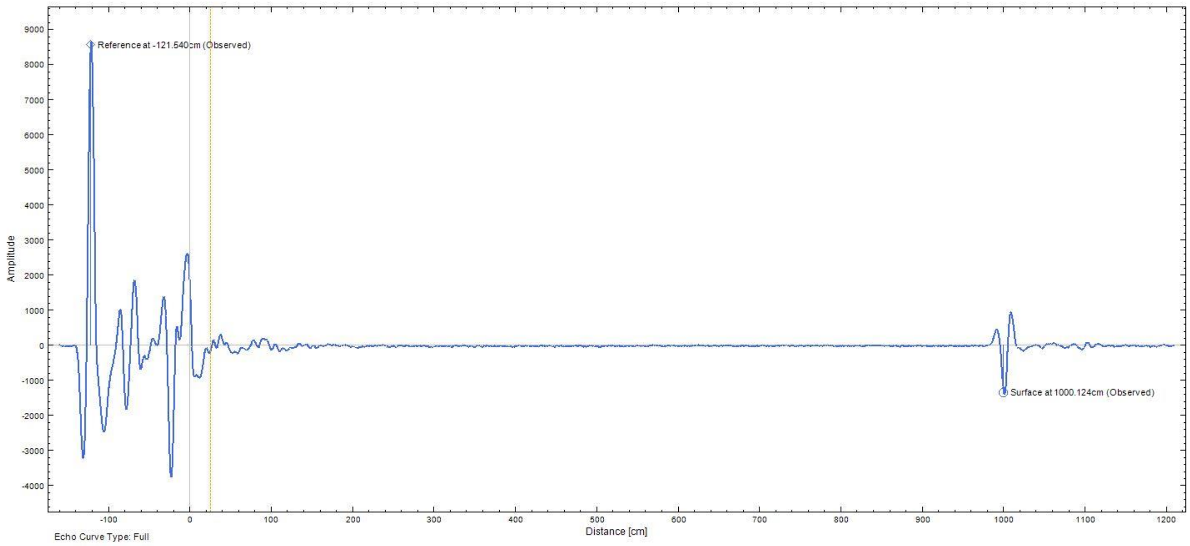

Figure 49: Full Echo Curve

Note:	A Full Echo Curve will likely take much longer to capture than a Windowed Echo Curve.

Processed Full Echo Curve: Similar to the Full Echo Curve type, but with subtraction of background reflections near the reference plane applied. This type of echo curve is useful for process and/or algorithm troubleshooting.

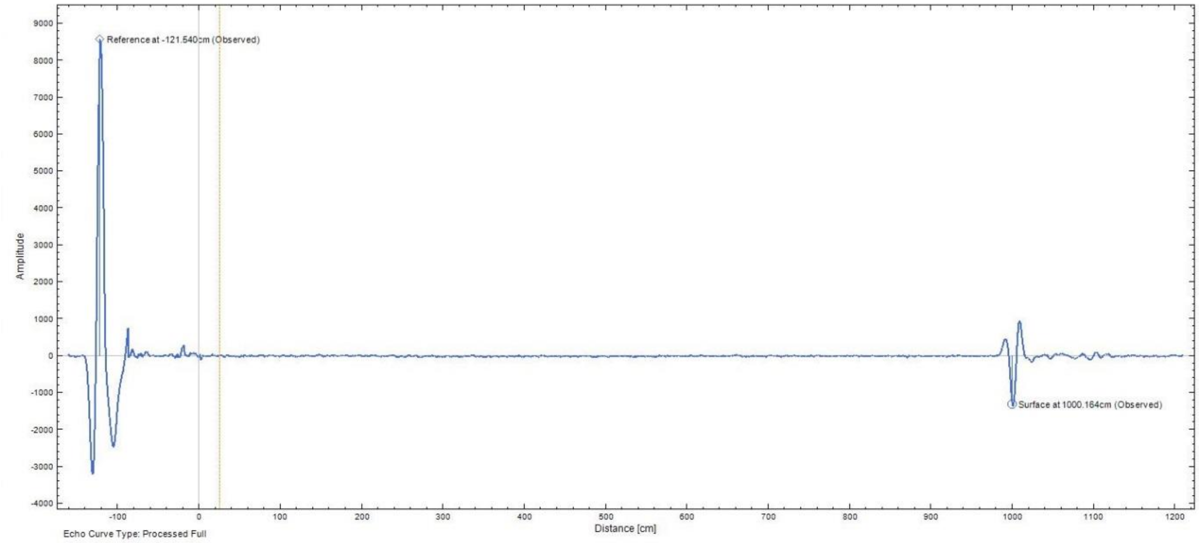

Figure 50: Processed (Full) Echo Curve

Background Subtraction Array: Selecting this echo curve type allows the data array that is used to remove unwanted reflections in the region near the reference plane to be uploaded and viewed. This type of echo curve is useful for troubleshooting problems in the region near the reference plane and checking whether any obstacles (if present) are found at expected locations.

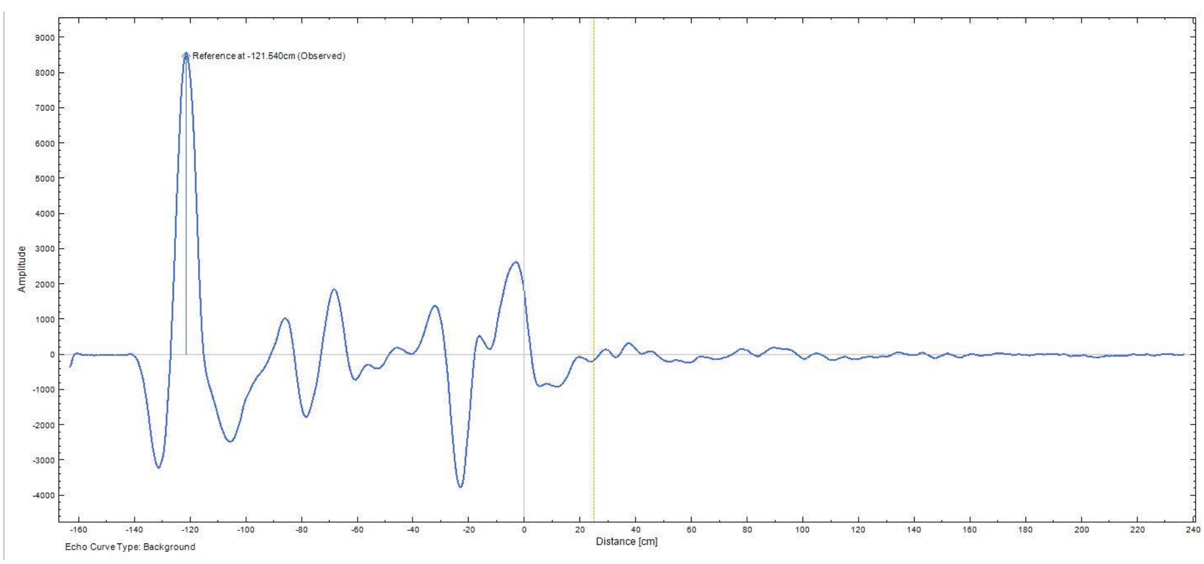

Figure 51: Background Subtraction Array

9 Security

9.1 How to report a security vulnerability

For submission, a security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software or device.

Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services.

To report potential security vulnerability against any Honeywell product, please follow the instructions at:

https://honeywell.com/pages/vulnerabilityreporting.aspx

Submit the requested information to Honeywell using one of the following methods:

• Send an email to security@honeywell.com.

or

• Contact your local Honeywell Process Solutions Customer Contact Centre (CCC) or Honeywell Technical

Assistance Centre (TAC) listed in the "Support and Contact information" section of this document.

Glossary

AWG	American Wire Gauge
d1	Inside diameter of pipe
DD	Device Description
EDDL	Electronic Data Description Language
DTM	Device Type Manager
EMI	Electromagnetic Interference
FTA	Field Termination Assembly
Hz	Hertz
LRL	Lower Range Limit
LRV	Lower Range Value
mA DC	Milliamperes Direct Current
mV	Millivolts
Nm	Newton·meters
NPT	National Pipe Thread
NVM	Non-Volatile Memory
PM	Process Manager
PV	Process Variable
PWA	Printed Wiring Assembly
RFI	Radio Frequency Interference
RTD	Resistance Temperature Detector
SFC	Smart Field Communicator
STIM	Level Transmitter Interface Module
STIMV IOP	Level Transmitter Interface Multivariable Input/Output Processor
URL	Upper Range Limit
URV	Upper Range Value
US	Universal Station
Vac	Volts Alternating Current
Vdc	Volts Direct Current
HART	Highway Addressable Remote Transducer
HCF	HART Communication Foundation
EEPROM	Electrically Erasable Programmable Read Only Memory

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Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

Honeywell Process Solutions,
(TAC) **hfs-tac-support@honeywell.com**

Australia
Honeywell Limited
Phone: +(61) 7-3846 1255
FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Shanghai
Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

Singapore
Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea
Honeywell Korea Co Ltd
Phone: +(822) 799 6114
Fax: +(822) 792 9015

EMEA

Honeywell Process Solutions,
Phone: + 80012026455 or
+44 (0)1344 656000

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

AMERICAS

Honeywell Process Solutions,
Phone: (TAC) 1-800-423-9883 or
215/641-3610
(Sales) 1-800-343-0228

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

Specifications are subject to change without notice.

For more information
To learn more about SmartLine Transmitters,
visit www.honeywellprocess.com
Or contact your Honeywell Account Manager

Process Solutions
Honeywell
1250 W Sam Houston Pkwy S
Houston, TX 77042

Honeywell Control Systems Ltd
Honeywell House, Skimped Hill Lane
Bracknell, England, RG12 1EB

Shanghai City Centre, 100 Jungi Road
Shanghai, China 20061

Honeywell

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