WESTLOCK CONTROLS

# DIGITAL EPIC-2® DTM®

## USER GUIDE

**TABLE OF CONTENTS**



## 1 INTRODUCTION

Westlock Controls Digital EPIC-2® is a second generation ARM® Cortex-M3 microcontroller based intelligent valve position transmitter with an advanced diagnostics functions designed especially for safety valves. The key application of the DEPIC-2 is on emergency shut-down valves to monitor the valve position in real-time and perform diagnostics functions like Partial-Stroke (PST), Full-Stroke Test (FST) and Solenoid Operated Valve Test (SOVT) to ensure valve will move to its fail-safe position in emergency situation.

The DEPIC-2 is powered through the 9-24 V analog signal from the control system and provides 4-20 mA position feedback and digital HART communication on the same signal to the control system. The safety function is provided from the 0-24 V digital signal from the safety system to DEPIC-2 to de-energize the valve during an emergency shutdown event.

A step by step guided setup wizard on 64x128 graphic LCD and 3 buttons provides an easy way to configure, calibrate and operate the device locally. In addition, the remote HART® DD or FDT® DTM can be used to configure, calibrate and perform advanced diagnostics functions on the device.

Under the hood is a powerful industry leading low power 32 bit ARM® Cortex-M3 microcontroller with one non-contact Hall Effect position sensor, two pressure sensors and one temperature sensor. The low power operation of the microcontroller keeps the device operating even at 3.8 mA with HART® communication during an ESD event.

The DEPIC-2 can be easily mounted using NAMUR compatible mounting kits on linear or rotary actuator. The completely sealed and potted electronics are resistant to dirt and moisture and expanded temperature range of -40°C to +85°C enhances the reliability of the device to work in harsh environments.

The state of the art diagnostic functions like Emergency Shutdown (ESD), Partial Stroke Testing (PST), Solenoid Operated Valve Testing (SOVT) and Full Stroke Testing (FST) lowers the total cost of ownership by suggesting predictive maintenance of the device under operation before it fails and interrupt the process. The artificial intelligence of the underlying alarm system points to the root cause of the problem instead of reporting nuisance alarm.

All packaged and integrated in a single housing, DEPIC-2 offers a unique solution to tackle the problems faced by plant operation team.

The DEPIC-2 offers variety of different user interfaces to operate the device like Keypad/ LCD, HART DD and DTM. FDT is a platform independent technology that standardizes the communication and configuration interface between the devices from different manufactures and communication protocols. FDT provides a common environment for accessing the devices' most sophisticated features. Any device can be configured, operated, and maintained through the standardized user interface – regardless of supplier, type or communication protocol. There are 3 different essential layers of the FDT technology as mentioned below.

- Frame Application like PACTWare
- Communication DTM like HART Communication
- Field Device DTM like DEPIC-2 DTM

The DEPIC-2 DTM provides an interface to access the specific features available on the device like calibration, diagnostics etc. through the FDT frame application. This document is designed as a supplemental guide to help user configure, calibrate and operate DEPIC-2 using the DTM and any DTM based frame application like PACTWare or other host systems.

**NOTE**

The DEPIC-2 is available in variety of different models with different features and functionality. This document is designed to cover all available features and functionality. It is possible that your model MIGHT NOT have some features and functions discussed in this document. In this case, the Westlock Controls sales team should be contacted in order to add/enable certain features/function not available on your model. Furthermore, all menus on the DEPIC-2 DTM are dynamic so depending on a particular setting enabled or disabled it will show or hide other related menus.

## 2 INSTALLATION

This section provides the details of the different software components required to operate DEPIC-2 DTM and its step by step installation procedure.

### 2.1 PACTWare

PACTWare is a free FDT DTM based frame application, which can be used to communicate with the field device using the generic or device specific DTM. There are also other host manufacturers that provide DTM based container or frame application. The DEPIC-2 DTM should work on any FDT 1.2 based frame application like PACTWare. Download the PACTWare from the following website at no cost. http://www.pactware.com/en/downloads/pactware.html
After downloading the PACTWare, run the setup.exe file to start installation. Follow the on screen instructions to complete the installation.

### 2.2 HART Communication

HART communication modem is a required component for DTM to communicate with the DEPIC-2. This is usually provided on the CD that came with the HART Modem or can be downloaded from the website of the HART modem manufacturer. This DTM acts as a driver for the HART modem and makes connection between the PACTWare and the DEPIC-2 DTM. Once downloaded, run the setup.exe file to install the modem driver on a PC.

### 2.3 DEPIC-2 DTM

The DEPIC-2 DTM is a required component to communicate and operate with the DEPIC-2. It might have been supplied with DEPIC-2 or it can be downloaded from the download center below.
http://downloadcenter.
westlockcontrolsmarcom.com/
Once downloaded, run the setup.exe file to start the installation. Follow the on screen instructions to proceed through the installation. A separate DEPIC-2 DTM installation procedure is also available to assist the installation procedure.

## 3 INITIAL SETUP

In order to communicate with the DEPIC-2, a PACTWare project needs to be created with different DTM components. This project will include the generic HART communication DTM as mentioned in the previous section OR a communication DTM specific to the HART modem you are using for the setup. It will also include a DEPIC-2 DTM that was installed in the previous section. Figure 1 shows the basic setup required.

- Connect the HART modem to the HART terminals on the DEPIC-2 and plug modem into PC where PACTWare is installed.
- Power up the DEPIC-2 electronics through the power supply OR 4-20 mA Analog Input block from the DCS. Follow the DEPIC-2 product manual for wiring diagrams and details.

Follow the steps mentioned below to create a PACTWare project.

- Double click on PACTware icon on the desktop to open DTM. You should see a screen as shown in Figure 2.
- Click on Device Catalog which is located on the upper right side. If Device Catalog option is not showing up, click on View on the top of the toolbar and click on Device Catalog. The screen shown in Figure 3 should appear.
- In the Device Catalog windows, Right click on HART communication and then click on Add. The HART communication will be added in the left side project window.

FIGURE 1
Basic setup

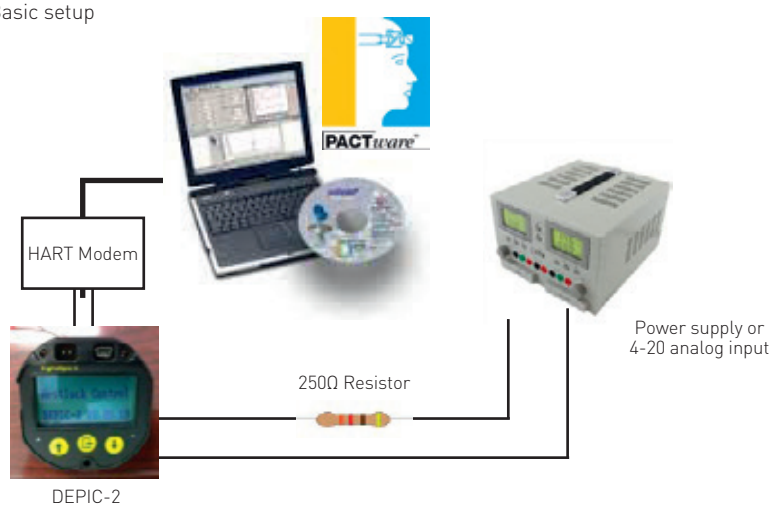



FIGURE 2
PACTWare main screen

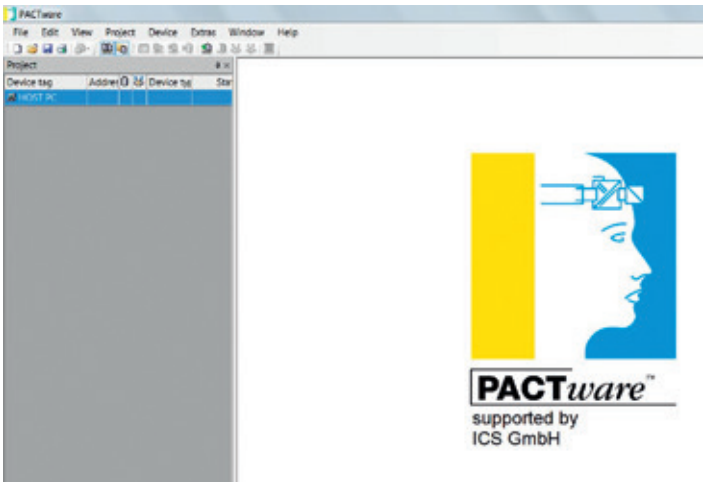



FIGURE 3
Device catalog

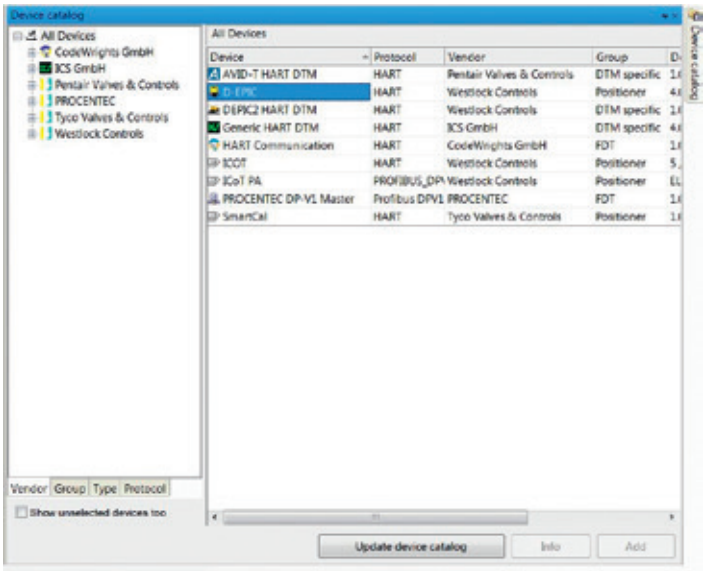


FIGURE 4
Viewing HART communication DTM parameter

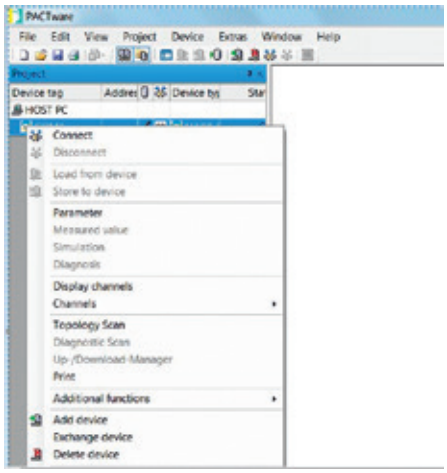
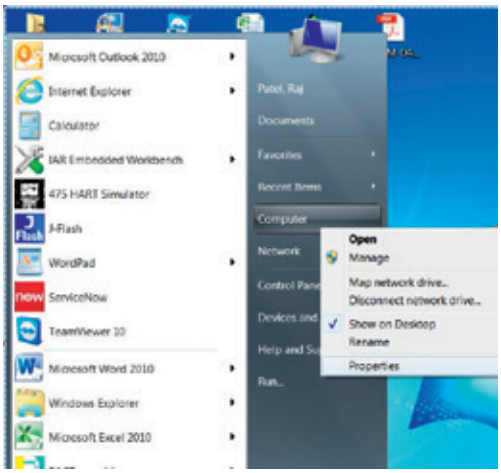



FIGURE 5
Finding COM port for HART modem

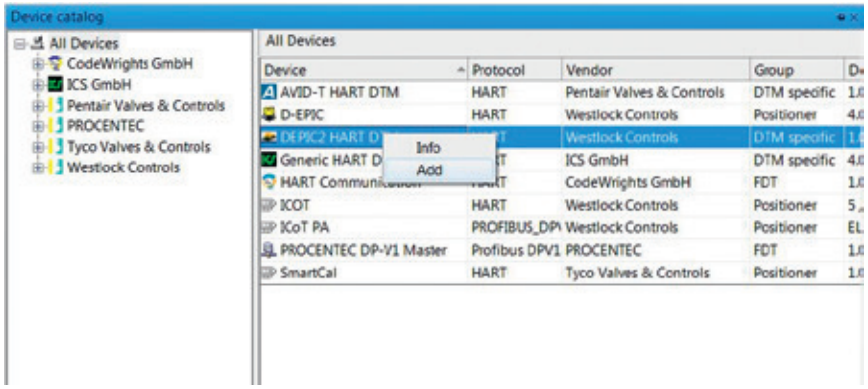



- In the left side Project window, Right click on the communication you just added and select the parameter option as shown in Figure 4.

- Configure the parameters for the HART communication as shown below and then select OK.
  **Communication interface:** HART Modem
  **Preambles:** 5 (Depending on the device, it might need higher value)
  **Communication retries:** 3
  **Serial interface:** This should be the HART modem COM port number. If you are using RS232 HART modem, the default port might be COM1. If you are using the USB HART modem, find out the correct COM port number assigned by the PC to the HART modem and select it in this parameter. Follow the steps below to find out the COM port for your modem.
  - Go to Windows start button and right click on Computer and then properties, as shown in Figure 5.
  - Click on Device Manager and this will open new tab.
  - Click on Ports which will show where the HART modem hardware is connected and the COM Port assigned to the HART modem.

  **Start address:** 0
  **End address:** 15 (this can be lowered if you know the polling address of the DEPIC-2, which factory default is 0.)
- With the communication port selected on the left Project window, Open the device catalog window again and then Right click on DEPIC-2 HART DTM and then click Add, as shown in Figure 6. The DEPIC-2 HART DTM will be added under the HART communication DTM in the left project window.
- In the left side Project window, Right click on the HART communication DTM (COM#) and click connect. Once the connection is made, COM# will become highlighted.
- In the left side Project window, Right click on Digital DEPIC-2 DTM and click connect. Once the connection is made, it will become highlighted.
- In the left side Project window, Right click on Digital DEPIC-2 DTM and click on Load from device. This will load all parameters from the DEPIC-2 device.

FIGURE 6
Adding DEPIC-2 DTM in the PACTWare project



## 4 PARAMETERIZATION (CONFIGURATION)

This section describes different parameters of the DEPIC-2 that can be configured through the DTM. In the left side Project window, Right click on the DEPIC-2 DTM (It will show up as HART long 'TAG' or other unique string name) and click on the 'Parameter', as shown in Figure 7. It will launch the configuration window of the DEPIC-2 as shown in Figure 8.

### 4.1 Login/logout

This menu has following different kinds of login functions.

- **Factory login-logout:** this can only be used by the Westlock/Crane CPE service engineers to enable/disable certain functions on the device and for troubleshooting.
- **User login-logout:** this can be used by the end user to protect the device from any unauthorized access. The user can enabled the user password setting as explained in the basic configuration section. When the user password is enabled, the DTM will not show any configuration parameters or calibration and diagnostics menu until the user logs in using the password. Once logged in, it is user's responsibility to log-out to prevent unauthorized access using the DTM.

### 4.2 Device info

This menu provides the device related information as shown below.

- **Manufacturer:** displays the name of the manufacturer of this device, which is Westlock Controls or Crane CPE.
- **Device type:** displays the model of this device, which is Digital Epic2 or AVID
- **Device ID:** displays the factory pre-set Device ID of the device required for the HART communication.
- **Show revisions:** displays different hardware and software revision the device is currently using.

### 4.3 Configuration

This menu provides the different settings that can be configured for the proper operation of the device. The settings are categorized and grouped based on the functions as explained below.

*4.3.1 HART identification*

This section under the configuration menu has all settings required and related by the HART specifications as shown in Figure 9. The device will have factory defaults values that can be changed as needed for asset management and tracking.

FIGURE 7
Opening parameter screen

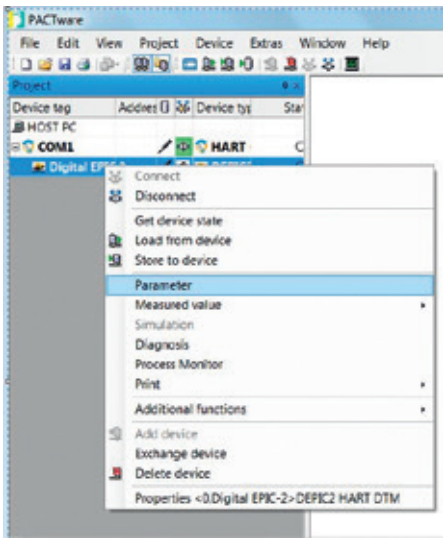
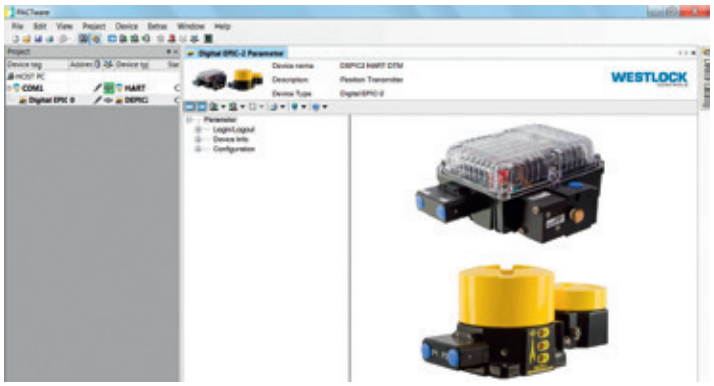
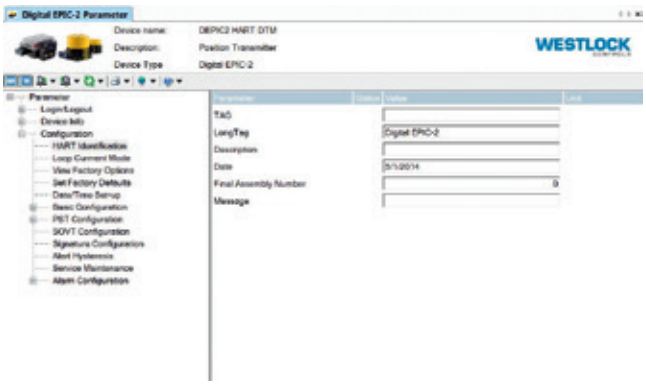



FIGURE 8
DEPIC-2 Parameter screen




If the user login is enabled on the DEPIC-2, the configuration menu will not appear until the user logs-in using the user password.

FIGURE 9
Viewing HART configuration parameters




If any of this setting is changed, the new value MUST be sent to the device by right clicking on the menu and then selecting the option 'Write directories and subdirectories only' or 'Write parameters to device' or 'Store to device'.

*4.3.2 Loop current*

This section under the configuration menu has all settings required and related for the HART communication as shown in Figure 10.

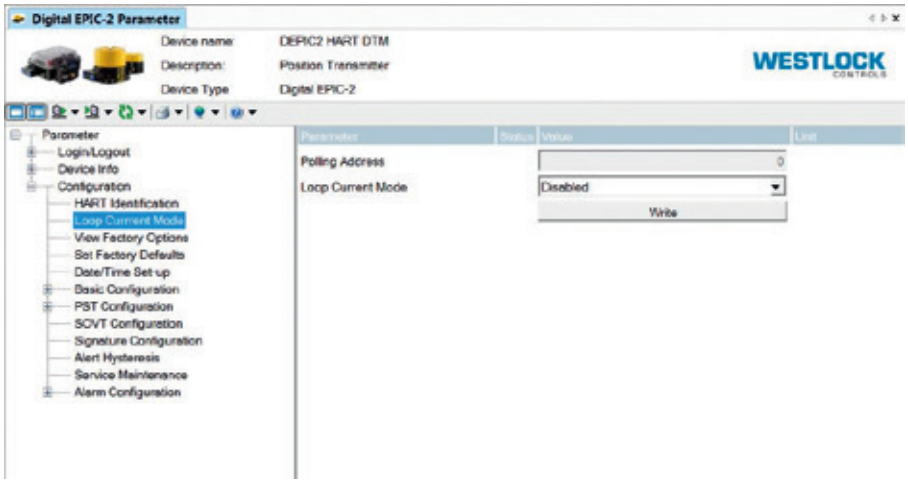
- **Polling address:** The polling address is used by the DTM to initially communicate with the device and determine the full address. The polling address can be changed from its factory default value of 0 if the device is configured for the HART multi-drop mode. In this mode, the loop current mode should be disabled.

**NOTE**

The polling address CANNOT be changed from the DEPIC-2 DTM. To change the polling address, go to the additional functions of the HART communication DTM.

- **Loop current:** the loop current mode can be enabled or disabled and will function as below.
  - **Enabled:** the loop current WILL reflect the current position of the valve
  - **Disabled:** the loop current will be fixed at 4 mA and WILL NOT reflect the current position of the valve.

FIGURE 10
HART communication parameters



*4.3.3 View factory options*
This menu shows the device options that are currently enabled or disabled on the device. These are read only options and cannot be modified by the user. However the user can contact Westlock Controls to enable additional options on the device. For example, if the user purchased the DEPIC-2 without the partial-stroke function and later on decided to add the partial-stroke option, it can be added by contacting the factory.

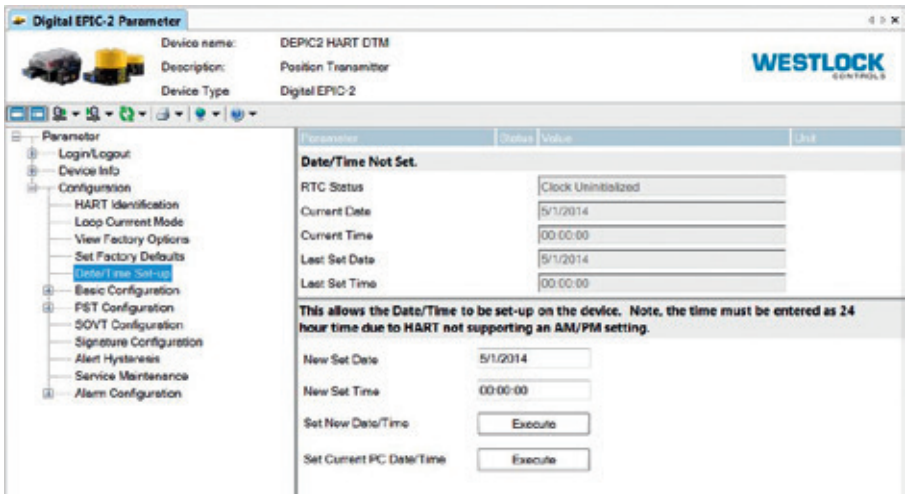
*4.3.4 Factory defaults*
This menu allows the user to perform the factory defaults on the device, which will restore all parameters to the factory default values. The user MUST re-configure and re-calibrate after performing the factory defaults. Certain parameters like Date/Time, LCD rotation, user password will not be restored to factory defaults.

*4.3.5 Date/time setup*
This menu allows the user to configure the clock on the device. The user can view the current status of the clock and also configure the new date and time through the screen shown in Figure 11.

- **RTC status:** shows the current status of the real-time clock.
- **Current date:** shows the current date on the device.
- **Current time:** shows the current time on the device.
- **Last set date:** shows the last date when the clock was setup on the device.
- **Last set time:** shows the last time when the clock was setup on the device.

To setup the new date and time on the clock, follow the steps below.
- In the New Set Date section, enter the new date to be setup.
- In the New Set Time section, enter the new time to be setup. The time should be entered in the 24 hours in HH:MM:SS format. For example 1:30PM should be entered as 13:30:00 and 5:07AM should be entered as 05:07:00.
- Press the Execute button. The DTM will send the new date and time to the device.
- Alternatively to set the exact date and time of the PC that is running the PACTWare, just press the 'Execute' button next to the 'Set Current PC Date/Time'.

FIGURE 11
Date/Time setup



*4.3.6 Basic configuration*

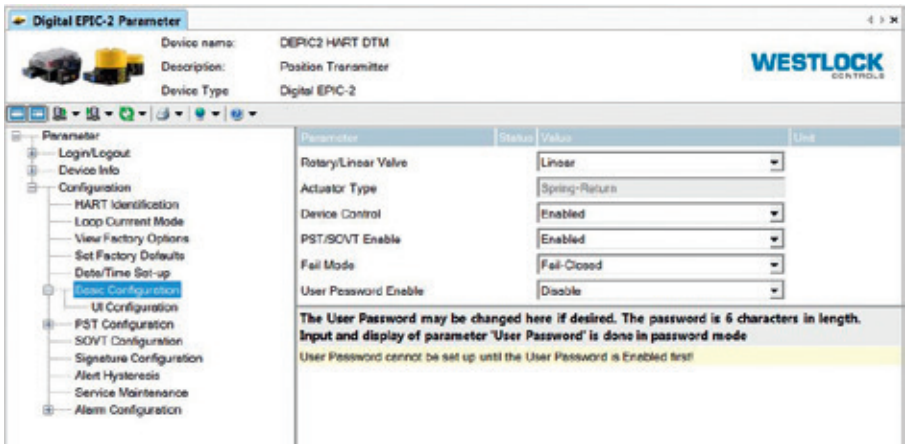
This section has all parameters that need to be configured for the basic operation of the device and to calibrate the device as explained below.

- **Rotary/linear valve:** this setting defines the actuator movement on which the device is mounted as below.
  - **Rotary:** the DEPIC-2 assumes it is mounted on the rotary actuator and so it converts the angular rotary position to the linear position.
  - **Linear:** the DEPIC-2 assumes it is mounted on the linear actuator and so it allows user an optional linear calibration to compensate the non-linearity of the magnets.
- **Actuator type**: this setting defines the actuator action on which the device is mounted. Currently this setting cannot be changed by the user as it only supports the spring-return/single-acting actuator. However a future release of the firmware will have support for the double acting actuator.
- **Device control:** this setting defines whether the DEPIC-2 can control the actuator on which it is mounted in order to perform the calibration and other diagnostics functions.
  - **Enabled:** the DEPIC-2 controls the actuator through the on-board relay so that it can move the valve to close and open position in order to perform the auto calibration and other diagnostics functions like full-stroke signatures.
  - **Disabled:** the DEPIC-2 doesn't control the actuator through the on-board relay except for PST. The auto-calibration is not available in this case so the user has to perform the manual calibration where the user has to move the valve to close and open position when asked during the calibration.

**NOTE**

The Partial-Stroke (PST) function will still be available even if the device control setting is disabled.

FIGURE 12
Basic configuration parameters



- **ESD:** this setting is ONLY available if your DEPIC-2 model has the ESD feature enabled from factory options. It defines whether the DEPIC-2 should monitor the voltage signal on the solenoid and generate an alarm when the solenoid is de-energized.
  - **Enabled:** the DEPIC-2 monitors the voltage signal of the solenoid and considers it as normal operation when the solenoid is energized and emergency shut-down when the solenoid is de-energized. When this setting is enabled, it shows other menus related to the ESD to generate an alarm when the ESD occurs. Please see section alarm configuration for ESD related alarms.
  - **Disabled:** the DEPIC-2 does not monitor the voltage signal of the solenoid and doesn't provide indication on the LCD and generate an alarm when the solenoid is de-energized. When this setting is disabled, it also hides certain menus that are related to the ESD like ESD alarm.
- **PST/SOVT:** this setting is ONLY available if your DEPIC-2 model has the PST/SOVT feature enabled from factory options. It defines whether the DEPIC-2 should make the PST and SOVT functionality available to the user under the diagnostics menu.
  - **Enabled:** the DEPIC-2 shows the menus to configure the PST/SOVT related parameters and allows a way to perform these tests under the diagnostics menu.
  - **Disabled:** the DEPIC-2 hides the menus to configure the PST/SOVT related parameters and hides the menu item to perform these tests under the diagnostics menu.
- **Fail mode:** this is an important setting to configure for a successful calibration. It tells DEPIC-2 how the magnet assembly is oriented and how it rotates or moves when the solenoid is de-energized. Please read the DEPIC-2 product manual for installation of the magnet assembly or beacon on a rotary/ linear fail-open/fail-close actuator
  - **Fail close:** the DEPIC-2 assumes when the solenoid is de-energized the valve moves in usually clockwise direction and the closed symbol (T) is visible on the beacon.
  - **Fail open:** the DEPIC-2 assumes when the solenoid is de-energized the valve moves in usually counter clockwise direction and the open symbol (|||) is visible on the beacon.
- **User password:** this setting can be used to block access to certain menus like configuration, calibration and diagnostics.
  - **Enabled:** the DEPIC-2 shows only read-only menus like device status, device unless the user is logged-in with the user password. The user has to enter the password to gain access to other menus like configuration, calibration and diagnostics. The factory default user password is '123456' and the user may need to change and select their own secure password as mentioned in the next parameter 'Change Password'.
  - **Disabled:** the DEPIC-2 doesn't require the user to enter the password to gain access to configuration, calibration and diagnostics menu. All menus are available to all users all the time without password.

There are certain settings available under a separate menu 'User Interface (UI) Configuration' under basic configuration as shown in Figure 13.

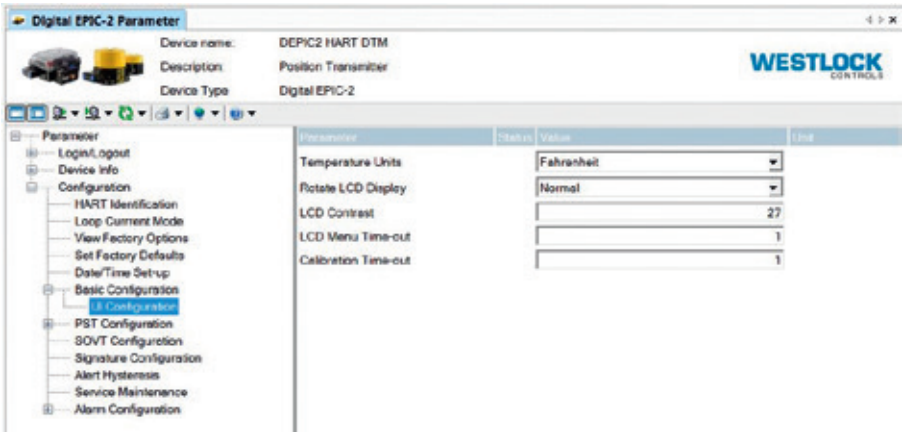
- **Temperature units:** this setting defines how the temperature is displayed on all diagnostics data.
  - **Fahrenheit:** the temperature is displayed in Fahrenheit everywhere including LCD and DTM.
  - **Celsius:** the temperature is displayed in Celsius everywhere including LCD and DTM.
- **Rotate LCD display:** this setting defines how the text appears on the LCD
  - **Normal:** the text appears in normal fashion on the LCD
  - **Rotated:** the text appears 180° rotated on the LCD. This is useful when the DEPIC-2 unit is mounted in such a way where it is difficult to read the text on the LCD
- **LCD Contrast:** this setting defines the contrast of the LCD. The contrast can be set between the value 27(min) to 63(max). The higher contrast helps better visibility of the text on LCD but consumes more current.
- **LCD Menu time-out:** this setting defines the timer for the DEPIC-2 so that when it is in the menu screen on the LCD and there is no keypad activity for a defined timeout period, the DEPIC-2 will exit the menu screen on the LCD and display main screen. It can be set in 1 minute interval from 1 to 60 minutes.

**NOTE**

If the calibration is initiated from the keypad/LCD, this setting is ignored and the DEPIC-2 will stay in the calibration until the calibration finishes.

- **Calibration time-out:** this setting defines the timer for the DEPIC-2 during calibration so that if the calibration doesn't finish within the specified time, it will abort the calibration. It can be set in 1 minute interval from 1 to 60 minutes. It is recommended to set higher value for large actuators where the valve open and close time is too long.

FIGURE 13
UI configuration parameters

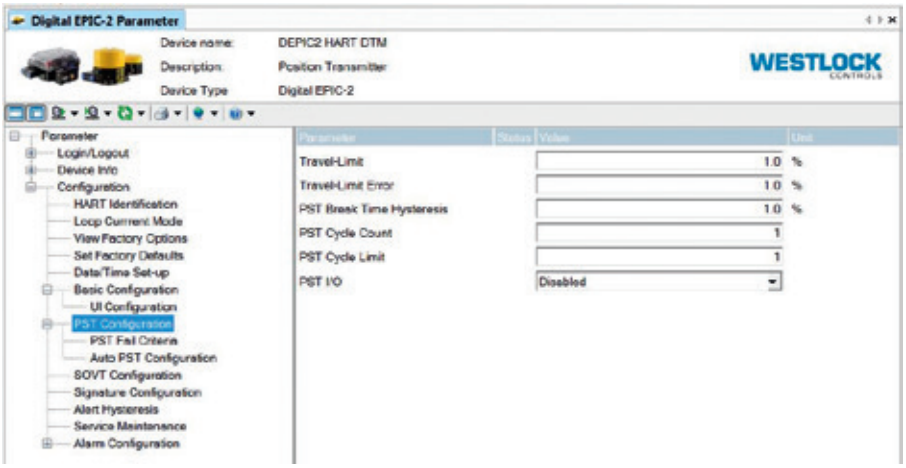


*4.3.7 PST Configuration*

This menu might be available depending on if the DEPIC-2 model has the PST option enabled or disabled and the user has logged in using the user password. Also the user PST setting in the basic configuration MUST be enabled to gain access to this menu. Furthermore, certain parameters might be hidden or not available depending on other setting like Signature. This section shows all configurable parameters for Partial-Stroke Testing. These parameters can be accessed under the PST configuration menu as shown in Figure 14.

- **PST Travel-limit:** this parameter (previously known as PST Set-Point) defines the limit DEPIC-2 cannot cross during the PST from its fully energized position. For example, for 25% travel limit on a fail closed valve, the PST will fail if the valve travels more than 25% from its energized position OR 75% actual position.
- **PST Travel-limit error:** this parameter defines the safe area during the valve movement. For example, for 25% travel limit and 10% travel-limit error setting, the DEPIC-2 will make the valve move 15% and then energize the solenoid to move the valve back to its fully energized position to avoid surpassing the 25% hard travel limit.
- **PST Break-time hysteresis:** this parameter defines the hysteresis limit for the PST break time parameter. During the maintenance PST, the DEPIC-2 compares the break time to the baseline PST's break time and if it is outside the hysteresis limit set in this parameter, it generates an alert to warn the user that the dynamics of the valve/actuator package has changed.
- **PST Cycle limit:** each time the DEPIC-2 perform a PST it keeps track of the number of PST it has performed so far. The user can set this parameter so that DEPIC-2 will generate an alert to warn the user that the DEPIC-2 has performed certain number of PSTs on the attached valve.
- **PST Cycle count:** each time the DEPIC-2 perform a PST it keeps track of the number of PST it has performed so far. This is a parameter that provides this information to the user. In addition, the user can reset this parameter when the attached valve is serviced or replaced with a new valve.
- **PST I/O:** the DEPIC-2 offers digital input to activate the PST through an external dry contact signal and provides the PST status output on another digital output signal. This setting can be enabled or disabled for this functionality. Please read the DEPIC-2 IOM for wiring and signal description.
- **Auto PST:** the DEPIC-2 offers a feature to automatically perform a maintenance PST on a regular time interval. The parameters in this section allow the user to configure this functionality in number of days.

FIGURE 14
PST configuration parameters



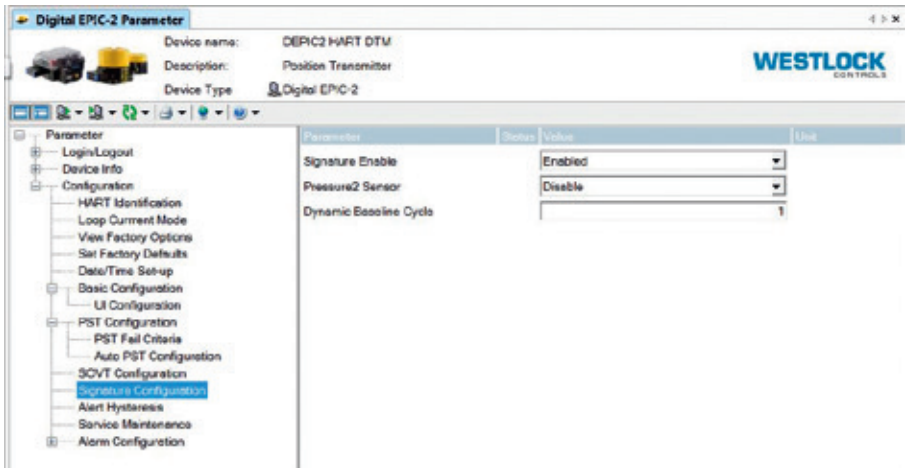
- **PST Fail limits:** this section has the parameters that decides the pass/fail status of the PST as explained below.
  - **Break pressure hysteresis:** this parameter is used to compare the maintenance PST break pressure to the baseline PST break pressure and if it is outside this hysteresis limit, the DEPIC-2 considers the PST as a failure. PST break pressure is the pressure recorded when the DEPIC-2 observes the initial valve movement from its fully energized position during the PST.
  - **Travel-time hysteresis:** this parameter is used to compare the maintenance PST travel-time to the baseline PST travel-time and if it is outside this hysteresis limit, the DEPIC-2 considers the PST as a failure. The PST travel-time is the time recorded by the DEPIC-2 when the valve start movement from its fully energized position to the time it reaches the travel-limit
  - **Total-time limit:** this parameter is ONLY used in the case where the DEPIC-2 model has the pressure sensors (Signature) option disabled. In this case, this parameter is used as a time limit for the PST. If the PST doesn't finish within this time, the DEPIC-2 considers the PST as a failure.

*4.3.8 Signature configuration*

This menu might be available depending on if the DEPIC-2 model has the Signature option enabled or disabled and user has logged in using the user password. Furthermore, certain parameters might be hidden or not available depending on other settings. This section shows all configurable parameters for Full-Stroke Testing. These parameters can be accessed using the 'Signature' menu as shown in Figure 15.

- **Signature:** this parameter can be used to let DEPIC-2 know if it should capture the signatures (pressure and position) samples during the PST and FST. It indirectly indicates if the DEPIC-2 has the pressure sensor-1 connected/used or not.
  - **Enabled:** the DEPIC-2 assumes it has pressure sensor-1 connected electronically and pneumatically so it checks the pressure during calibration and other diagnostics like PST, SOVT and FST. When this parameter is enabled, it is up to the user to select the proper setting for the pressure sensor-2 depending on how it is connected or used.
  - **Disabled:** the DEPIC-2 assumes it doesn't have pressure sensor-1 connected electronically and pneumatically so it doesn't check the pressure during calibration and other diagnostics like PST, SOVT and FST. It also doesn't generate any pressure related alerts or alarms. When this parameter is disabled, the pressure sensor-2 is disabled also.
- **Pressure sensor-2:** this parameter can be used to let DEPIC-2 know if it should monitor the pressure on the pressure sensor-2 during the PST, FST and generate an alert or alarm. The user can connect the pressure sensor-2 port pneumatically to monitor the supply pressure or actuator secondary chamber pressure. In order to monitor the pressure sensor-2, this setting must be enabled.
  - **Enabled:** the DEPIC-2 assumes pressure sensor-2 is electrically connected and it should monitor the pressure on this sensor.
  - **Disabled:** the DEPIC-2 doesn't monitor the pressure on this sensor.

FIGURE 15
Signature configuration



- **Pressure sensor-2 usage:** this setting is ONLY available if the pressure sensor-2 is enabled. It basically tells DEPIC-2 how the pressure sensor-2 is connected pneumatically.
  - **Supply pressure:** the DEPIC-2 assumes pressure sensor-2 is pneumatically connected to monitor the supply pressure.
  - **Actuator chamber:** the DEPIC-2 assumes pressure sensor-2 is pneumatically connected to monitor the pressure within the second chamber of the actuator.
- **Dynamic baseline:** the DEPIC-2 offers a way to capture the FST signature automatically without direct user intervention. This setting can be used to configure automatic capture of the baseline full-stroke signature on a particular valve cycle. For example, if the setting is configured at 5, the DEPIC-2 will capture the full stroke signature when the valve cycles full-stroke 5th time. The minimum required value for this setting is 2. This can be used by a user who wants to capture a baseline signature after a break-in period on a new valve.

*4.3.9 SOVT Configuration*

This menu will ONLY be available if the DEPIC-2 model has the Signature option enabled; the user has enabled the signature parameter as mentioned in the above section and the user has logged in using the user password.

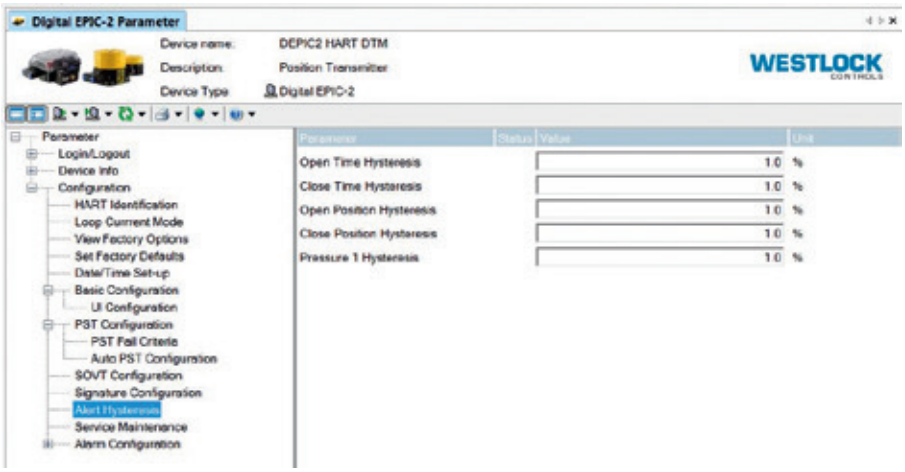
- **Auto SOVT:** the DEPIC-2 offers a feature to automatically perform maintenance SOVT on a regular time interval. The parameters in this section allow the user to configure this functionality in number of days.

*4.3.10 Alert hysteresis configuration*

This menu provides different hysteresis parameters that can be configured by user to control the generation of Alerts. DEPIC-2 considers alerts as a warning signal and not a critical failure. Thus the values in these parameters should be different than the Alarm hysteresis since an alert indicates a trend building towards a potential failure but not a failure yet. These parameters can be accessed and configured as shown in Figure 16.

- **Open time:** this value represents the allowable deviation value (±%) from its baseline open break and travel time before generating an alert. It is used for the FST and PST travel-time.
- **Close time:** this value represents the allowable deviation value (±%) from its baseline close break and travel time before generating an alert. It is used for FST and PST travel-time.
- **Open position:** this value represents the allowable deviation value (±%) from its baseline open position before generating an alarm. It is used to determine the valve movement during PST and FST.
- **Close position:** this value represents the allowable deviation value (±%) from its baseline close position before generating an alarm. It is used to determine the valve movement during PST and FST.
- **Pressure-1:** this value represents the allowable deviation value (±%) from its baseline break or supply pressure-1 reading before generating an alarm. It is only available for the devices with signature option.
- **Pressure-2:** this value represents the allowable deviation value (±%) from its baseline break or supply pressure-2 reading before generating an alarm. This parameter is only available if the user enabled the pressure sensor-2 and signature.

FIGURE 16
Alert hysteresis parameters



*4.3.11 Service/maintenance configuration*

This menu provides the parameters to set a reminder to service the valve or actuator by specified date. It also shows the information about the last service performed as shown in Figure 17.

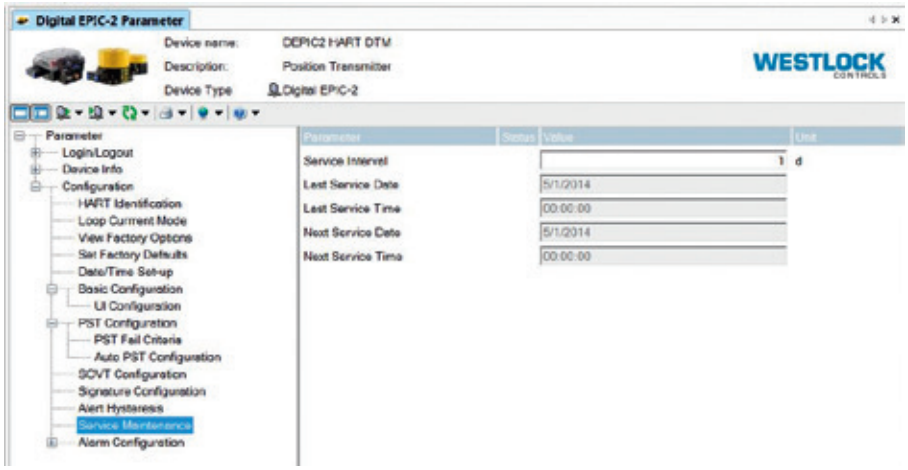
- **Service interval:** this parameter can be used to set a reminder so that DEPIC-2 will generate an alarm to warn the user to perform the service on valve or actuator. The service alarm should be enabled to get an alarm generation as discussed in the alarm configuration section.
  - **0 (Disabled):** when this parameter has value 0, it is disabled.
  - **1-365:** the interval in number of days to generate a service alarm.
  - **Last service date:** the date when the last service was performed. This is basically a date when the service interval was re-configured.
  - **Last service time:** the time when the last service was performed. This is basically a time when the service interval was re-configured.
  - **Next service date:** the date when the next service should be performed or an alarm will be generated
  - **Next service time:** the time when the next service should be performed or an alarm will be generated. The time is based on the last time the service interval was re-configured.

*4.3.12 Alarm configuration*

This section contains the parameters to configure different critical alarms on the DEPIC-2 to let user know about a specific failure that occurred on the device. The parameters are explained below.

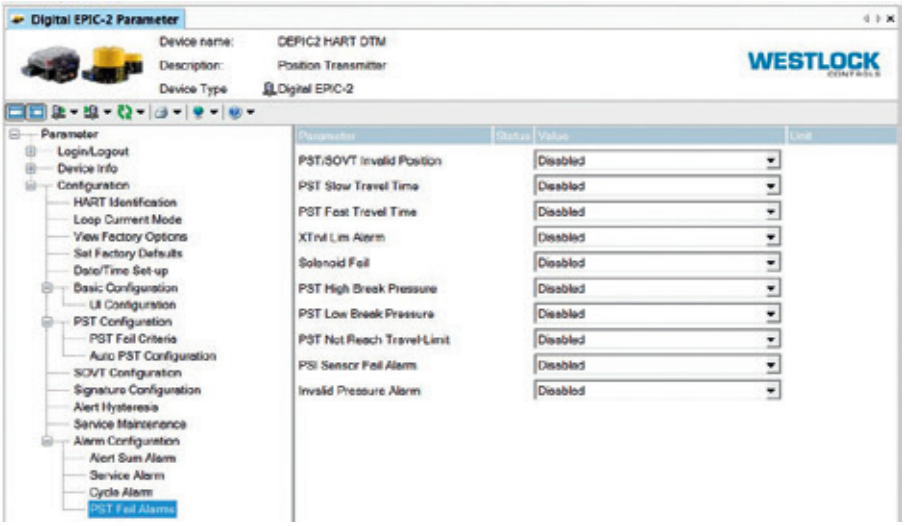
- **Alert alarm:** the DEPIC-2 has two types mechanism to let user know about fault conditions on the device. One is the Alert, which is not critical but still informational and another is Alarm, which is a critical failure and requires an immediate attention. This alarm when enabled, warns user if there is any active alert on the device. It is up to the user to browse through the alert file and find out the specific alert that triggered this alarm. When disabled, the device will not report any active alert generation through this alarm.
- **Service alarm:** this alarm is tied to the service/maintenance configuration mentioned in the previous section. When the service interval is configured and this alarm is enabled, the device will generate an alarm when the service period expires to let user know. When the alarm is disabled, the user has to manually look at the service parameter and find out when the next service is due on the device. This alarm is for information only and doesn't indicate any critical failure.

FIGURE 17
Service configuration parameters



- **Cycle alarm:** the DEPIC-2 keeps count of the number of cycle valve has performed. This count can be useful in determining when the valve or actuator is coming to an end of life or requires maintenance. The user can configure this alarm to get that information. Cycle alarm has three different parameters as shown below.
  - **Cycle count:** provides the current count of the valve cycles.
  - **Cycle limit:** indicates the limit to generate a cycle alarm (if enabled) when the Cycle Count reaches this value.
  - **Cycle alarm:** if enabled, generates an alarm when the Cycle Count reaches to the Cycle Limit. If disabled, this check is ignored. This alarm is for information only and doesn't indicate any critical failure.
- **ESD Alarm:** this alarm is tied to the ESD monitor setting in the basic configuration. If the ESD monitoring is disabled, this alarm is not accessible. If the ESD monitoring is enabled, this alarm can be enabled to generate an alarm and let user know when the ESD condition occurred. If disable, the ESD condition will be displayed on the LCD but will not be reported as an alarm for immediate attention.
- **PST Fail alarms:** this section provides a way to configure all PST fail alarms, which are all enabled as a factory default option but can be disabled by the user. When disabled, the device will not generate an alarm when the PST failed due to that specific failure as explained below. The PST alarms can be accessed and configured using the screen shown in Figure 18.
  - **Invalid position:** PST/SOVT Valve was in an Invalid Postion from which to perform the requested operation. This can be caused due to not enough supply pressure or solenoid voltage to keep the valve to its fully energized position.
  - **PST Fast travel time:** the maintenance PST travel time was more than the baseline PST travel time by the PST travel time hysteresis value configured by the user.
  - **PST Slow travel time:** the maintenance PST travel time was less than the baseline PST travel time by the PST travel time hysteresis value configured by the user.
  - **PST High break pressure:** the maintenance PST break pressure was higher than the baselin PST break pressure by the PST break pressure hysteresis set by user.
  - **PST Low break pressure:** the maintenance PST break pressure was lower than the baselin PST break pressure by the PST break pressure hysteresis set by user.
  - **PST Not reached travel limit:** the baseline PST didn't reach to the travel limit set by the user. It indicates the valve started moving but then got stuck before it reaches to the travel limit
  - **Solenoid fail:** this is an indication of a solenoid failure during PST or SOVT as it didn't detect the expected change in the pressure at various stages of PST/SOVT.
  - **Solenoid2 fail:** this is an indication of a solenoid2 failure during PST for duplex board or SOVT on solenoid 2 as it didn't detect the expected change in the pressure at various stages of PST/SOVT.
  - **Pressure sensor fail:** this is an indication that the pressure sensor is not working as expected and might be damaged or unplugged.
  - **Invalid pressure:** this indicates that the pressure measured before starting the PST is outside the hysteresis limit set so the PST can't be started. This is helpful in the situation where the low supply pressure can cause too much overshoot or affect the ability of the valve to come back to fully energized position after performing PST.

FIGURE 18
PST fail alarms configuration



## 5 CALIBRATION

This section provides methods to perform different types of calibration as discussed below. Follow the steps below to access the calibration menu, as shown in Figure 19.

- In the left side project windows, Right click on the DEPIC-2 long tag.
- Browse to 'Additional Functions'.
- Select 'Calibrate Device'.
- The calibration menu screen will pop up as shown in Figure 20.

**NOTE**

If the user password setting under the basic configuration menu is enabled, the calibration menu WILL ONLY be available after the user logs in using the password.

Each item available under this menu is explained in details as below.

### 5.1 Last full calibration

This is a read only parameter and provides the information about the last successful full auto or manual calibration. This parameter is not updated if the user perform other types of calibration like low, high, mA etc.

### 5.2 Full device controlled calibration

This calibration method is ONLY available if the device control setting under the basic configuration menu is enabled. This calibration allows the device to perform the full calibration automatically without user intervention to move the valve to de-energized and energized position using the relay on the board. During the calibration, the DEPIC-2 reads the lower and upper end of the position and pressure sensors and also measures the opening and closing speed of the valve. If the transmitter output current is not correct after this calibration, it is recommended to perform the mA calibration. Please follow the instruction messages displayed on the screen during this calibration to finish the calibration.

**NOTE**

The valve MUST be in its fully energized position to start this calibration.

FIGURE 19
Accessing calibration menu

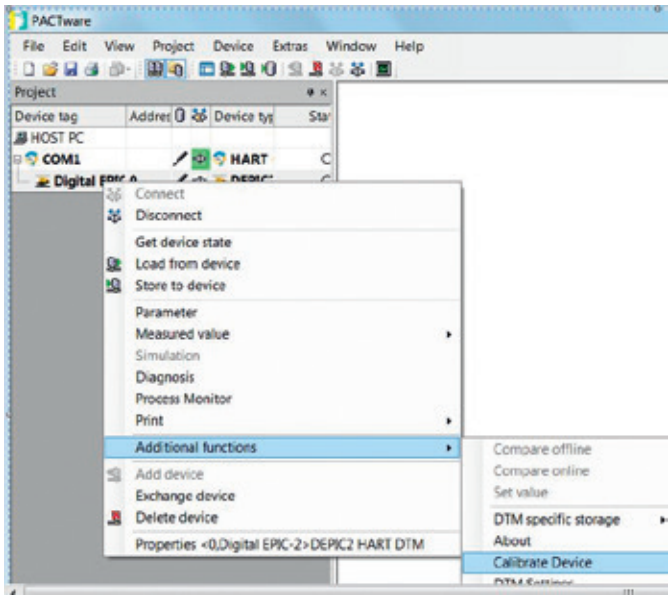
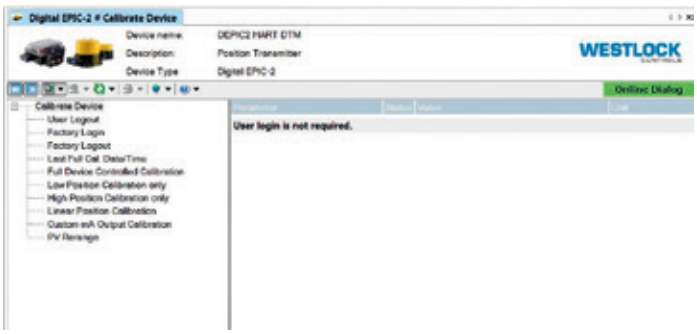



FIGURE 20
Calibration menu



**5.3 Full user controlled calibration**
This calibration method is ONLY available if the device control setting under the basic configuration menu is disabled. This calibration allows user to perform the calibration manually with user moving the valve to de-energized and energized position manually. During this calibration, the DEPIC-2 reads the lower and upper end of the position and pressure and also calibrates the mA transmitter output current. If the transmitter output current is not correct after this calibration, it is recommended to perform the mA calibration. Please follow the instruction messages displayed on the screen during this calibration to finish the calibration.

**5.4 Low position calibration**
This calibration method allows the user to perform only the lower end of the position (0%) without affecting any other parameters within the full calibration like the upper end position, pressure readings, speed etc. The user MUST have completed either the full device controlled or full user controlled calibration before performing this calibration. This calibration is useful in the case where after performing the full device/user controlled calibration, the user observes drift in the position for the lower end over the time due to the change in temperature, pressure, magnets degrading or weakening actuator spring or lose valve shaft coupler. The valve must be in appropriate position before starting this calibration.

**5.5 High position calibration**
This calibration method allows the user to perform only the upper end of the position (100%) without affecting any other parameters within the full calibration like the lower end position, pressure readings, speed etc. The user MUST have completed either the full device controlled or full user controlled calibration before performing this calibration. This calibration is useful in the case where after performing the full device/user controlled calibration, the user observes drift in the position for the upper end over the time due to change in temperature, pressure, magnets degrading or weakening actuator spring or lose valve shaft coupler. The valve must be in appropriate position before starting this calibration.

**5.6 mA Output calibration**
The DEPIC-2 provides the valve position feedback through the 4-20 mA analog output current. This mA output current has factory default value as 4 mA for the valve close (0%) position and 20 mA for the valve open (100%) position. It might be useful to the user to fine tune these values or perform a custom mA calibration where the desired mA output values different than the factory default values. This calibration allows the user to adjust these values. The user is required to connect the accurate mA current meter in the loop during this calibration. Please follow the instructions displayed on the screen to perform this calibration.

**5.7 PV Re-range**
This function allows the user to change the range of the primary variable, which is the valve position so that the DEPIC-2 provides the alerts for appropriate position. The user can change the factory default values to its custom required values so that the DEPIC-2 will generate an alert like PV out of range any time the valve position is outside the values specified in this parameter.

## 6 DIAGNOSIS

This menu provides access to different diagnostics functions available on the DEPIC-2. Follow the steps below to access this menu, as shown in Figure 21. If the user has enabled the password setting in the basic configuration menu, some of the items in the Diagnostics menu might not be available until the user logs in using the password.

- In the left hand side project window, Right click on the DEPIC-2 DTM and select 'Diagnosis'.
- It will open the diagnostics menu in a new window as shown in Figure 22.

### 6.1 Diagnostics

This menu has different diagnostics functions available on the DEPIC-2. Following sections describes the details of each diagnostic function available under this menu.

*6.1.1 Fixed mA loop test*

This method allows user to put the device into fixed current mode instead of representing the actual valve position. This is useful to the user in finding any issues related to the HART communication 4-20 mA loop. The user can select the value for the fixed current mode. The device will stay in fixed current mode until the user ends this test. The user is recommended to connect an accurate mA meter in the loop during this test. Please follow the instructions displayed on the screen to finish the test.

*6.1.2 Squawk*

This function helps user visually locate the DEPIC-2 to make sure the DTM is communicating with the correct device in case of multi-drop mode OR if the device is located at a different location such as overhead with the HART communication access points at other location. When invoked, the DTM will instruct the DEPIC-2 to blink the LED on the board as a visual indication that it is receiving the command sent from DTM. Follow the instructions on the screen. If the number of Squawk is 5, the DEPIC-2 will flash the LED 5 times. This number can be changed by the user.

*6.1.3 Device reboot*

This method allows the user to reboot the DEPIC-2 from the DTM without disconnecting the power physically. This will help user if the device is being stuck in some mode and it is necessary to reboot the device. Please follow the instructions displayed on the screen to perform the reboot on the device.

FIGURE 21
Accessing diagnostics menu

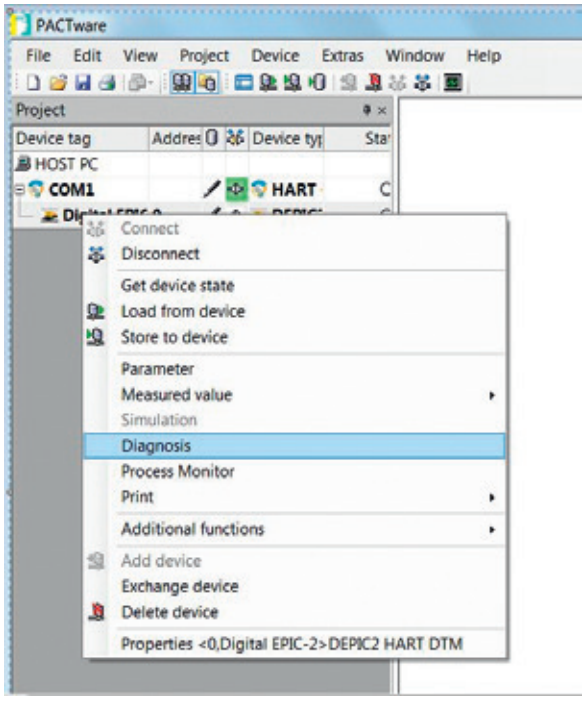
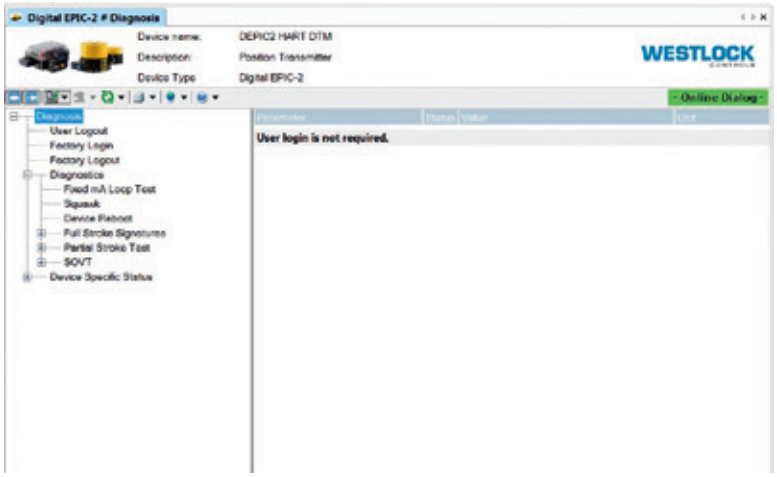



FIGURE 22
Diagnostics menu



*6.1.4 FST*

This menu will only be available if the factory Signature option is enabled and the user has enabled the signature setting under the configuration menu. Signatures is one of the diagnostic features available to the user (if he permits the movement of the valve for full-stroke) by which the user can determine degrading performance of the actuator/valve by comparing the Baseline runtime data to the last captured Maintenance runtime data. The signature data itself is used for plotting in graphical format and includes 255 samples of position and pressure readings during the valve movement from open to close and vice versa. The intelligent alarm system compares the maintenance signature runtime data to the baseline signature runtime data and generates an alarm if there is a deviation that exceeds the specified tolerance limit in the hysteresis settings. The following section describes each function available under this menu in detail.

*6.1.4.1 Generate new signatures*

This menu allows user to capture the Baseline and Maintenance signatures on the device by de-energizing the solenoid to move the valve to its fail-safe position and then re-energizing solenoid to bring the valve back to its original position. The user can generate following two types of signatures using the DTM. Follow the instructions displayed on the screen to capture the signatures.

- **Baseline signatures:** this signature must be captured before capturing the maintenance signature as it serves as a reference to compare the future maintenance signatures against. This signature should be generated when the valve/actuator package is installed and commissioned.
- **Maintenance signatures:** the baseline signature must be captured before capturing this signature. The maintenance signature should be captured by the user periodically to detect the degrading valve/actuator performance. The latest maintenance signature will be compared to the baseline signature data and any deviation in the parameter by the specified hysteresis limits in the configuration menu will generate an alert to warn user about potential issue. The device can store maximum of 4 maintenance signatures at a time. The user has the ability to lock and unlock the specific maintenance signature data. The user can lock maximum of 2 maintenance signatures leaving the other 2 to capture the latest data. If a maintenance signature is out of tolerance with the baseline, the device will automatically lock that maintenance signature for future reference until unlocked by the user.

**NOTE**

The valve MUST be in its fully energized position to capture full stroke signature.

*6.1.4.2 Show all signatures*

This menu allows user to view the signature data and plot for the current signatures captured by the user on the device. This screen will show the number of total signatures and maintenance signatures available on the device as shown in Figure 23.

**NOTE**

As explained below, the DTM allows the user to view/plot following signatures under this menu.

- **Integrator signature**

  This signature will only be available to view only (not for plotting the graph) if the user has captured the integrator signature using the keypad/LCD. The integrator signature is basically generated by the person who is integrating DEPIC-2 with valve and actuator from different manufactures. The purpose of generating this signature is to make sure the whole package was tested when it was integrated at the distributor location. This signature can only be generated using the keypad/LCD and not from the DTM, as shown in Figure 24. However the data can be viewed from the DTM. None of the data from this signature is used to compare against other data to generate any alert or alarm.

FIGURE 23
Viewing all maintenance FST signatures

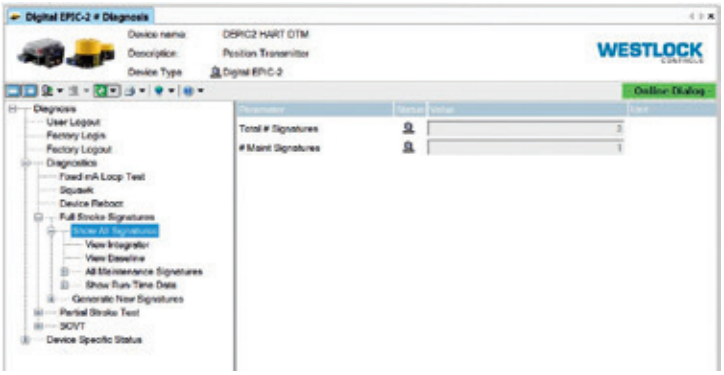
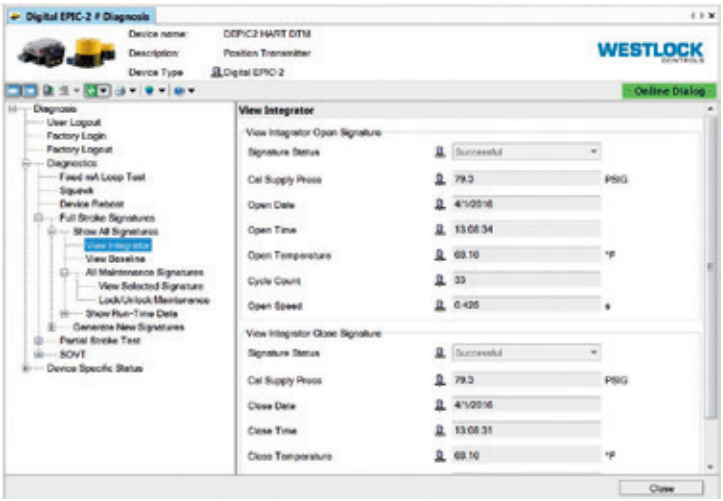


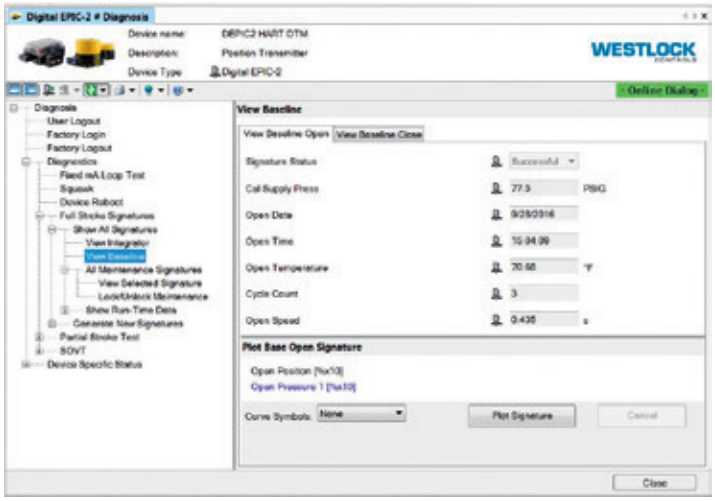

FIGURE 24
Viewing integrator FST signature



- **Installation signature**
  This signature will only be available to view only (not for plotting the graph) if the user has captured the installation signature using the keypad/LCD. The installation signature is basically generated by the person who is installing the whole integrated valve package to the process plant. The purpose of generating this signature is to make sure the whole package was tested when it was installed at the plant but before the plant starts running the process. This signature can only be generated using the keypad/LCD and not from the DTM. However the data can be viewed from the DTM. None of the data from this signature is used to compare against other data to generate any alert or alarm.

- **View baseline signature**
  This menu will only be available if the user has captured the baseline signature on the device. As explained before, this signature acts as a baseline reference to compare all future maintenance signature data against and generate degradation alerts. This signature is usually captured during commissioning of the plant. Once captured, the signature data can be viewed under this menu. The user can also view the signature plot by clicking the 'Read Values' button on the bottom right corner of the screen. Once clicked, the DTM will download all signature data and plot it as a graph of position/ pressure vs. time, as shown in Figure 25.

FIGURE 25
Viewing baseline FST signature



• **All maintenance signatures**
This menu allows the user to view the number of maintenance signatures available on the device and plot the signature graph and also lock/unlock a specific maintenance signature. As explained before, the DEPIC-2 allows the user to store up to four maintenance signatures. The main screen on this menu shows the currently selected maintenance signature by the user. The user can select a different maintenance signature to view by selecting it from the selection box shown on this screen, shown in Figure 26.

- **List available signatures**
The user can view the available maintenance signatures on the device by selecting this option on the menu. The DTM will display all available maintenance signatures and the latest and oldest maintenance signature as shown below.

- **View selected signature**
This menu allows the user to view the selected maintenance signature data and plot the graph. The signature MUST be selected under the 'All Maintenance Signatures' screen discussed before. The user first should browse to the menu 'List Available Signatures' to determine which signature are available on the device and then go to 'All Maintenance Signatures' menu to select a particular maintenance signature he want to view and then come to this menu to view or plot the data as shown on the screen below. Click on the button 'Read Values' on the bottom right corner of the screen to download the signature data and plot it as a graph, as shown in Figure 27.

FIGURE 26
Maintenance FST signature summary

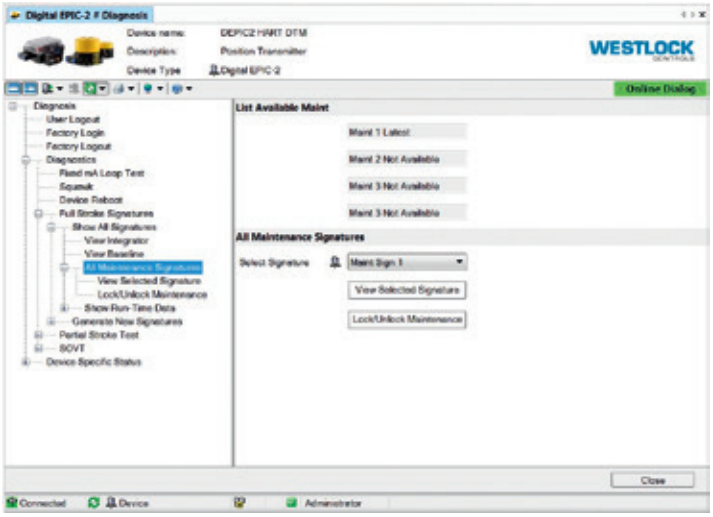
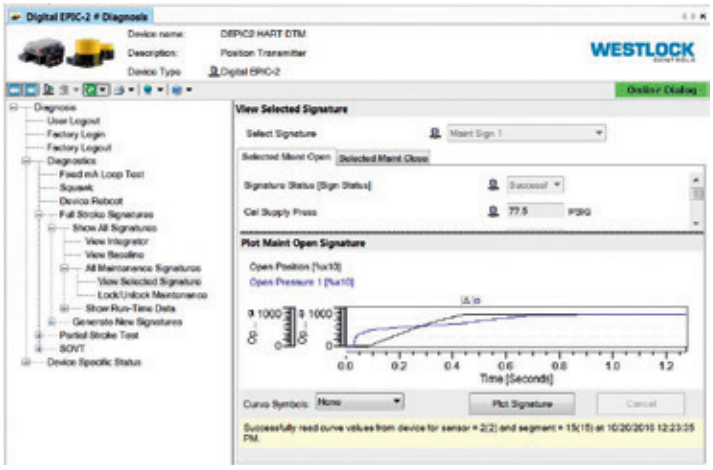
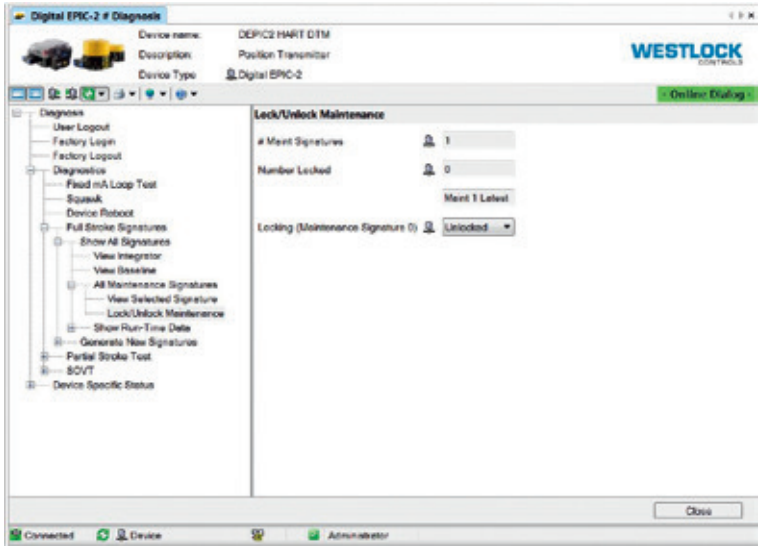



FIGURE 27
Viewing maintenance FST signature



- **Lock/unlock signature**
  This screen allows the user to view the current lock status of each maintenance signature available on the device and change the status to locked/unlocked. As explained before, the DEPIC-2 allows the user to store up to four maintenance signatures and lock up to two maintenance signatures to preserve it for future reference. This feature allows user to lock a particular signature if he find anything suspicious in the valve/actuator characteristics and wants to look at later time to compare with another maintenance signature. Once locked, the DEPIC-2 will not overwrite that signature data with any new signature it captures. Once the user is satisfied with the analysis, he can unlock the particular maintenance signature he locked previously or the device locked automatically. This functionality can be accessed from the menu shown in Figure 28.

FIGURE 28
Locking/unlocking maintenance FST signature



- **Show run-time data**
  This menu will only be available if the user has captured the baseline signature and at least one maintenance signature. This menu allows the user to view the run-time data captured by the DEPIC-2 during the signature. Since there is a lot of data, the run-time data are separated into groups of signature data that are critical for the valve/actuator operation and to make comparison between the last maintenance signature run-time data and baseline signature run-time data.
- **View run-time summary**
  This menu allows user to view the summary of run-time data failure alerts. Once the user captures the baseline signature and at least one maintenance signature, the DEPIC-2 compares the maintenance signature run-time data to the baseline signature run-time data as per the hysteresis limits set by the user under the configuration menu. If any parameter goes out of the hysteresis limits, the DEPIC-2 will flag it as a failure and a checkbox will be displayed for that parameter under this screen as shown in Figure 29.
- **Opening run-time data**
  This menu, as shown in Figure 30, allows user to look at the baseline and latest maintenance signature run-time data when the valve opened. It also allow user to look at the comparison between the baseline and latest maintenance open signature run-time data grouped by time and pressure related parameters.

FIGURE 29
Run-time data summary

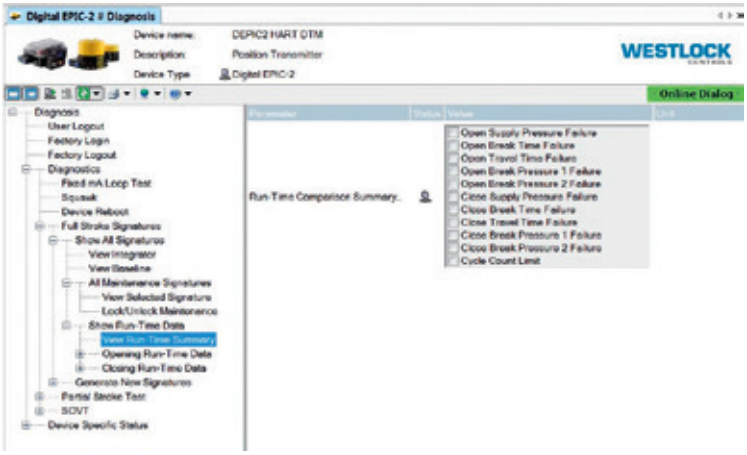
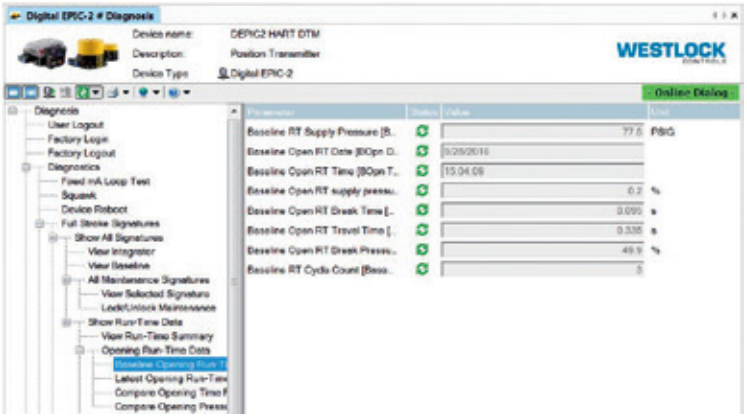



FIGURE 30
Opening Run-time data



- **Closing run-time data**
  This menu, as shown in Figure 31, allows user to look at the baseline and latest maintenance signature run-time data when the valve closed. It also allow user to look at the comparison between the baseline and latest maintenance closed signature run-time data grouped by time and pressure related parameters.

*6.1.5 PST*

This menu will only be available if the factory PST/SOVT option is enabled; the user has PST/SOVT setting enabled under the Basic Configuration menu and the user has logged in using the user password. If the device also has the singnature option enabled, it will capture the pressure readings during PST and use it to plot along with position vs. time. If the signature option is enabled, the device needs to have the pressure sensors and the PST algorithm will use the pressure limits at different decision points to abort the PST if out of tolerance. If the device doesn't have the signature option, the PST will use the total time limit to abort the PST if it takes too long. Using this test, the user can diagnose any issue involving valve/actuator performance degradation over time without the possible disruption of the process by using partial-stroke signatures. A successful test ensures that the valve will move to its fail safe position during an emergency situation.

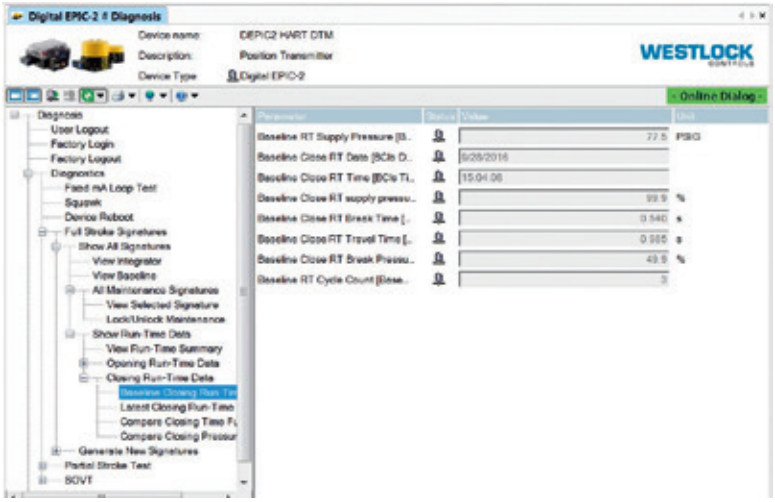
During the PST, the device will de-energize the solenoid to move the valve towards the fail safe position. When the valve reaches or exceeds the specified travel limit, it will re-apply the solenoid voltage to bring the valve back to its original position. The valve must be in its energized position to perform the test. The test has a number of configurable parameters like break pressure hysteresis, travel time to the travel limit (setpoint), travel time hysteresis etc. If the test exceeds any of these specified limits, it will fail and generate an alarm. During the test, the device will also capture 255 samples of position and pressure readings, which can be used to plot a graph.

The following section will describe each function available under this menu.

*6.1.5.1 Start new baseline PST*

This menu allows the user to perform the Baseline PST test. Upon a successful test, the device will store this data as baseline PST data. A Baseline PST should generally be performed once the valve/actuator is first installed in-process. Any maintenance PST data will be compared to the baseline PST data and an alarm will be generated if any parameter exceeds the specified hysteresis limit. Follow the instructions on the screen to perform this test.

FIGURE 31
Closing Run-time data



*6.1.5.2 View/plot baseline PST*
This menu selection will only be available if the user has performed the baseline PST on the device. Once selected, it will show the Baseline PST data captured by the device as shown in Figure 32.

If the device has the signature option enabled, the device will capture the signature data during the PST. To download the signature data from the device, press the "Read Values" button on the bottom right corner of the screen. Once all signature data is downloaded, the DTM will plot a graph of signature data while downloading, which will be displayed as a pressure and position vs. time as shown on the screen below.
In the plot, all parameters are displayed in % times 10. For example, 13.5% position will be displayed as 135. The position will be displayed in the black, pressure sensor-1 in blue and pressure sensor-2 in green color. Furthermore, if the pressure sensor-2 is disabled, the graph will not show the data for the pressure sensor-2.

*6.1.5.3 Start new maintenance PST*
This menu entry allows the user to perform the maintenance PST test. Upon a successful test, the device will store this data as a Maintenance PST data. The user can only perform the maintenance PST after successful completion of a baseline PST. Upon successful completion of the test, the device will compare the data to the baseline PST data. Any deviation from the specified hysteresis limits will generate an alarm. Follow the instructions on the screen to perform this test from DTM.

*6.1.5.4 View/plot maintenance PST*
This menu selection will only be available if the user has performed the maintenance PST on the device. Once selected, it will show the maintenance PST data captured by the device as shown in Figure 33.
If the device has the signature option enabled, it will also be possible to download the signature data from the device and plot it as a graph. Press the "Read Values" button on the lower right corner of the screen to download the signature data. Once all signature data is downloaded, the DTM will plot a graph of signature data while downloading, which will be displayed as a pressure and position vs. time as shown in the screen below.
In the plot, all parameters are displayed in % times 10. For example, 13.5% position will be displayed as 135. The position will be displayed in the black, pressure sensor-1 in blue and pressure sensor-2 in green color. Furthermore, if the pressure sensor-2 is disabled, the graph will not show the data for the pressure sensor-2.

FIGURE 32
Viewing baseline PST

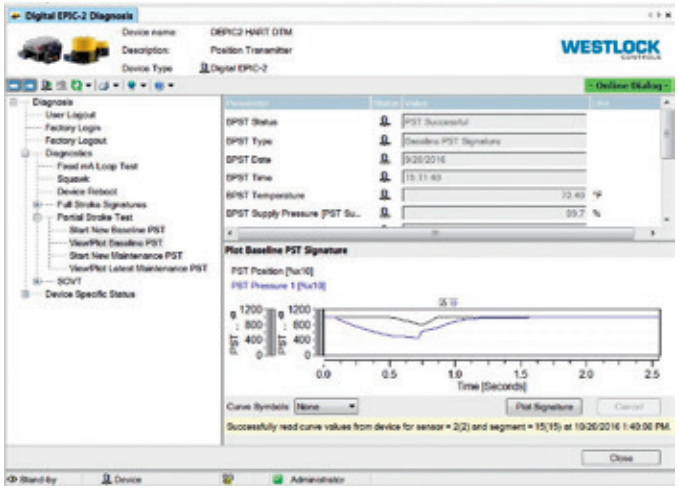
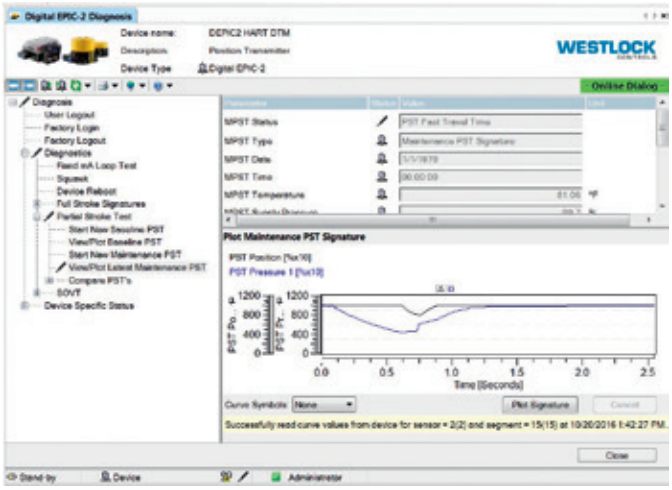



FIGURE 33
Viewing maintenance PST



*6.1.5.5 Compare PSTs*

This menu, as shown in Figure 34, will only be available if the device has the Baseline PST and Maintenance PST performed. It will allow user to compare the Maintenance PST data to the Baseline PST data side by side to find any deviation in the critical parameters. This menu will be divided into two sections as shown below.

- **Compare PST non-timing:** this will allow the user to compare the PST parameters that are not based on time such as pressure, temperature etc.
- **Compare PST timing:** this menu, as shown in Figure 35, will allow the user to compare the PST parameters that are based on time such as travel time, date/time stamp etc.

FIGURE 34
Comparing PST non-timing data

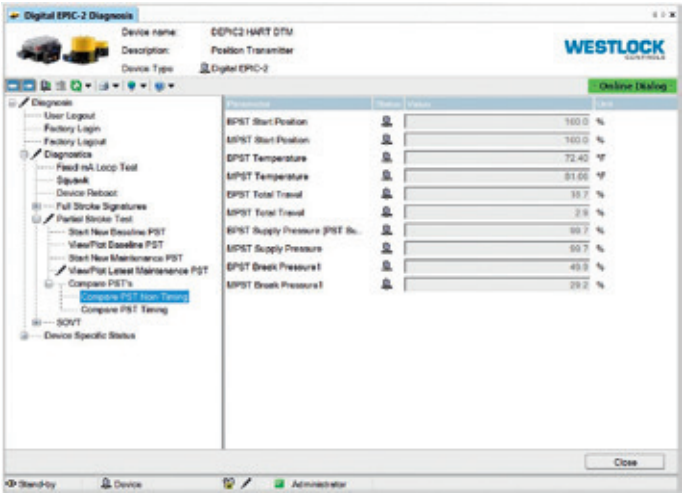
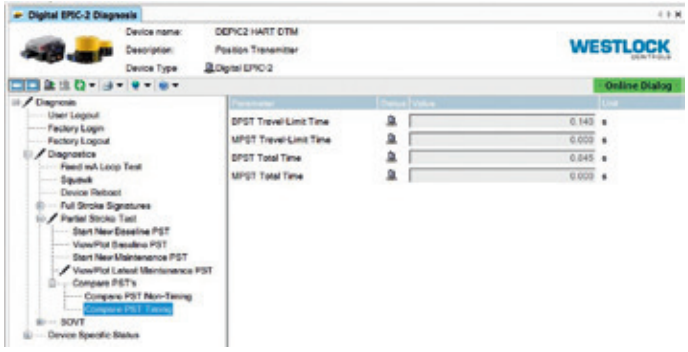



FIGURE 35
Comparing PST timing data



*6.1.6 SOVT*

This menu entry will only be available if the device has the Factory PST/SOVT and signature option enabled and the user has enabled the PST/SOVT and signature setting under the Configuration menu. The user can only perform the SOVT after the baseline PST is successfully finished, mainly due to parameters established during a baseline PST are used to help determine if an SOVT is successful. By performing this test, the user can diagnose any issue with the solenoid, which can prevent the valve moving to the fail safe position during an emergency shut down situation. During the test, the device cuts the solenoid voltage through a relay on the board, which in turn starts dropping the air pressure inside the actuator chamber which would move the valve towards the fail safe position. However unlike PST test, this test re-applies the solenoid voltage back when the air pressure inside the actuator chamber drops to about 50% of the difference between the Nominal Supply Pressure and the Baseline PST break pressure and thereby stopping before any valve movement occurs during this test. This verifies that the solenoid is operating correctly by checking the drop in the air pressure but not making any actual valve movement. The following section describes the functions available under this menu.

*6.1.6.1 Start new SOVT*

This menu entry will allow the user to perform the SOVT, as shown in Figure 36. Follow the instruction displayed on the screen to perform this test from the DTM.

*6.1.6.2 View last SOVT*

This menu will allow the user to view the status and parameters captured for the last SOVT performed on the device. When selected, it will download all data from the device and the DTM will display the data on screen as shown in Figure 37.

FIGURE 36
Starting new SOVT

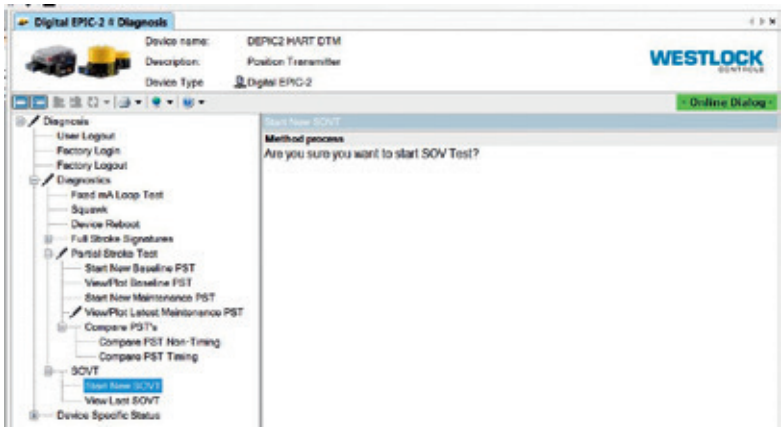
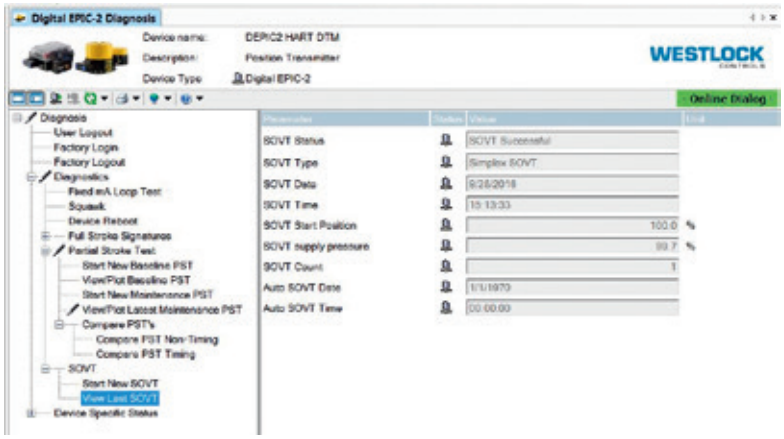



FIGURE 37
Viewing SOVT data



**6.2 Device specific status**

This menu has different device status available on the DEPIC-2. The following sections describe the details of each device status parameter available under this menu as shown in Figure 38.

*6.2.1 Field device status*

This menu shows the field device status as specified by the HART specifications. Please refer to the HART specifications for the details of each status bit available under this menu.

**NOTE**

Due to the limitation of the DTM technology, the cold start bit of the device will not work as specified in the HART specifications. If the device is reset manually or due to power failure, the cold start bit will remain cleared on the DTM.

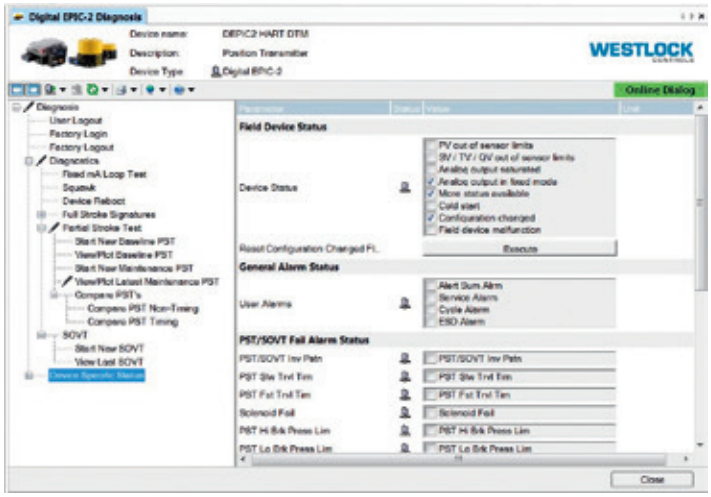
*6.2.2 General alarm status*

This menu shows the status (active or in-active) of general alarms if enabled in the general alarms under the basic configuration menu. If the checkbox displays the √ symbol next to the alarm, it means the alarm is active otherwise it is in-active.

*6.2.3 PST Fail alarm status*

This menu shows the status (active or in-active) of PST/SOVT alarms if enabled in the PST/ SOVT Fail Alarms under the basic configuration menu. If the checkbox displays the √ symbol next to the alarm, it means the alarm is active otherwise it is inactive.

FIGURE 38
Device specific status



*6.2.4 Calibration error alarms*

This menu shows the status of any error that occurred during the last calibration on the device. If the checkbox displays the √ symbol next to the calibration error, it means the calibration error is active otherwise it is in-active. The following table describes the meaning of each calibration error.

| Calibration error alarm | Description |
|---|---|
| Valve close error | This error can come up if the device wasn't able to fully close the valve during the auto calibration. |
| Valve open error | This error can come up if the device wasn't able to fully open the valve during the auto calibration. |
| Sensor gain span error | The device applies two hall sensor gain settings to get the better hall sensor reading for the position, which improves the linearity and provides larger span. The device will generate this error if the hall sensor position reading didn't pass the minimum span requirement even after applying both sensor gain settings. |
| Sensor gain linearity error | The device applies two hall sensor gain settings to get the better hall sensor reading for the position, which improves the linearity and provides larger span. The device will generate this error if the hall sensor position reading in not within the pre-defined linear range even after applying both sensor gains setting. |
| Beacon error | This error can come up during the calibration if the device detects the open position reading smaller than the close position reading, which is most probably caused because of the beacon is mounted 180 degree from its normal position. The device automatically sets the bit to fix this error and the user is asked to recalibrate the device. |
| Calibration aborted | This error message can pop up if the user aborted the calibration without letting it finish either from the keypad or from HART or an ESD prevented completion. |
| Calibration start error | This error message can pop up if the calibration is not started because there is another active process running. For example, if the user initiates calibration but the device is already in the ESD mode. |
| Calibration unstable pressure-1 | During the calibration, the device captures the reading for the pressure sensor-1. It checks if the pressure is not changing and is stable for a certain time depending on the calibration timeout setting. If the pressure-1 reading isn't stable within this specified time limit, it will generate this error message. |
| Calibration unstable pressure-2 | During the calibration, the device captures the reading for the pressure sensor-2. It checks if the pressure is not changing and is stable for a certain time depending on the calibration timeout setting. If the pressure-2 reading isn't stable within this specified time limit, it will generate this error message. |
| Calibration close position error | During the calibration, the device captures the reading for the close position. It checks if the position is not changing and is stable for a certain time depending on the calibration timeout setting. If the close position reading isn't stable within this specified time limit, it will generate this error message. |
| Calibration open position error | During the calibration, the device captures the reading for the open position. It checks if the position is not changing and is stable for a certain time depending on the calibration timeout setting. If the open position reading isn't stable within this specified time limit, it will generate this error message. |
| Calibration timeout | There is a setting to configure the calibration timeout. If the calibration is not finished within this time limit, which also decides the time limit to detect the stable pressure and stable position, the calibration will timeout and it will generate this error message. In this case, the user should increase the calibration timeout and perform the calibration again. |
| Pressure-1 span error | During the calibration, the device captures the reading for the pressure sensor-1. It checks if the pressure sensor-1 is working properly and it has at least the minimum span it needs. If not, the calibration will fail with the pressure-1 span error. The possible cause of this error might be: No air pressure, No pressure sensor, damaged pressure sensor etc. |
| Pressure-2 span error | During the calibration, the device captures the reading for the pressure sensor-2. It checks if the pressure sensor-1 is working properly and it has at least the minimum span it needs. If not, the calibration will fail with the pressure-2 span error. The possible cause of this error might be: No air pressure, No pressure sensor, damaged pressure sensor etc. |
| mA Out span error | During the mA calibration, the device captures the reading for the mA output current. It checks if the mA output configured has enough span. If not, calibration will fail with the mA Out Span Error. In this case, the span should be increased during the mA output calibration and perform the mA calibration again. |

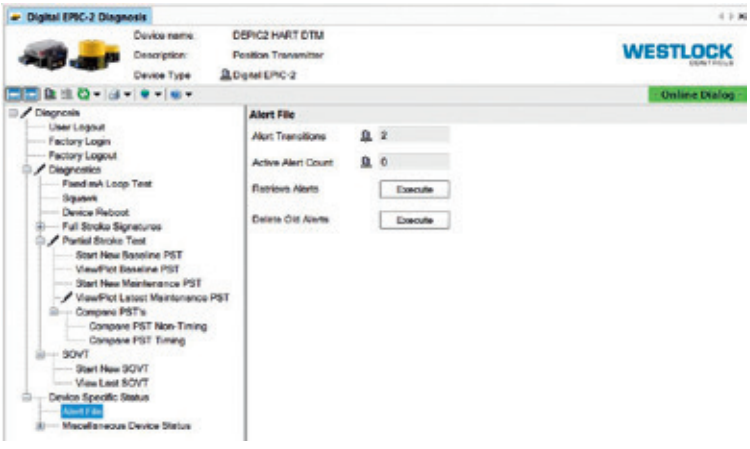
*6.2.5 Alert file*

This menu, as shown in Figure 39, shows the status of each alert (active or in-active) on the device. All alerts are enabled by default and cannot be disabled. However the hysteresis of each alert can be configured as mentioned in the Alert Hysteresis under the Basic Configuration menu.

The Alert File contains time/date stamped alerts detected by the firmware as deviations between Baseline and Maintenance Signatures of Full Stroke or Partial Stroke as well as a number of other dynamic process conditions. The device will store up to the last 16 alerts.

- **Alert transitions:** the number of alerts transitions (active to in-active and vice versa) so far recorded on the device.
- **Active alert count:** the number of active alerts recorded so far on the device.
- **Retrieve alerts:** download all alerts (active or in-active) from the device to DTM for review. After this method execution, the DTM should show the date/time stamped alert tables of all alerts transitions and active alerts.
- **Delete old alerts:** this function will delete the alerts on the device that occurred before the last re-boot of the device. This is useful to track the alerts that occurred since the last re-boot.

FIGURE 39
Viewing alerts



*6.2.6 Miscellaneous device status*

This menu, as shown in Figure 40, shows the read only status information that might be useful to the end user or Westlock Controls factory personnel to troubleshoot any issue with the device.

Following section describes each status parameter available on this screen.

- **Factory cycle count:** the value in this parameter represents the number of full stroke cycles the DEPIC-2 has recorded since it was built by the Westlock Controls.
- **Beacon orientation:** this parameter shows the orientation of the beacon or magnet assembly as detected by the DEPIC-2 during the full auto or manual calibration.
- **Open speed index:** this parameters shows the index calculated by the DEPIC-2 for the valve opening speed during the last full auto calibration. The value represents an index into the look-up tables that has different sample rates required to record the signature samples during PST or FST.
- **Close speed index:** this parameters shows the index calculated by the DEPIC-2 for the valve closing speed during the last full auto calibration. The value represents an index into the look-up tables that has different sample rates required to record the signature samples during PST or FST.
- **mA out reversed:** this parameter shows the mA output calibration as detected by the DEPIC-2 during the mA output calibration. The normal status indicates that the mA output current for the valve close position is less than the mA output current for the valve open position while the reverse status indicates the mA output current for the valve close position is more than the mA output current for the valve open position.
- **Device temperature:** displays the current temperature in configured units as recorded by the internal temperature sensor on the DEPIC-2
- **HART DLL statistics:** as shown in Figure 41, this menu shows the different kind of HART DLL communication errors occurred so far during the HART communication with the host software (DD, DTM etc.). The counter can be reset by the user to count new errors from that point on.
- **Sensor A/D:** this screen, as shown in Figure 42, shows the different analog to digital values recorded by the DEPIC-2 during the calibration and can be useful to the Westlock Controls factory personnel to troubleshoot the issue on the device.

FIGURE 40
Miscellaneous device status

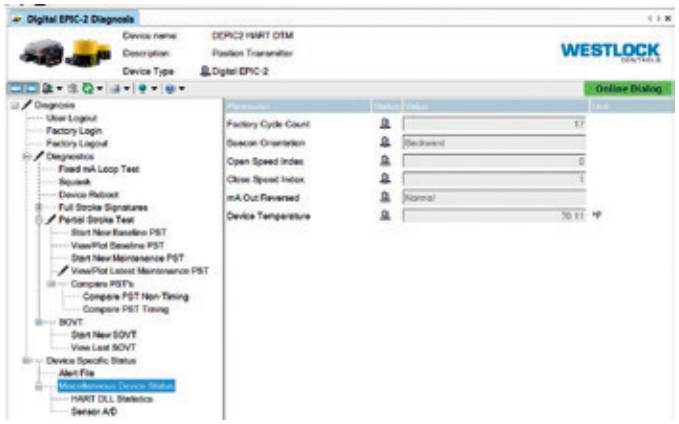



FIGURE 41
HART DLL statistics

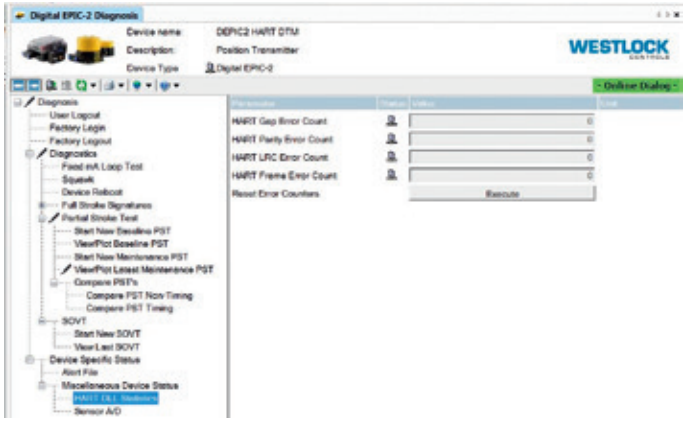
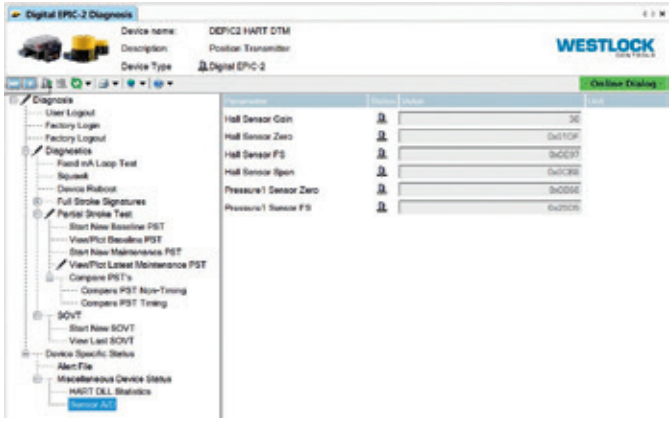



FIGURE 42
Viewing sensor data



## 7 ABBREVIATIONS

| | |
|---|---|
| DEPIC-2 | Digital EPIC-2 |
| ESD | Emergency shut-down |
| PST | Partial stroke test |
| SOVT | Solenoid operated valve test |
| FST | Full stroke test |
| DTM | Device type manager |
| DD | Device description |
| DDL | Data link layer |
| FDT | Field device type |
| I/O | Input/output |
| LED | Light emitting diode |
| LCD | Liquid crystal display |
| UI | User interface |

## 8 REFERENCES

- www.westlockcontrols.com
- www.hartcomm.org
- www.fdtgroup.org

**Engineering document reference**
This DTM user guide is based on the latest engineering update, and forms part of the certification for the DEPIC-2 series. To ensure you have the most recent version of this document, please check the document library on our website (westlockcontrols.com).

**Translations**
Where translated the copy is taken from the original English document VCIOM-04615-EN as checked by the relevant certification body and therefore the original English document will prevail. No rights or liability can be derived from any translation.

**Previous documents**
VCIOM-04615 replaces all previous DTM user guides for the DEPIC-2 series including NPD-2015-021.

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