WESTLOCK CONTROLS

DIGITAL EPIC-2® TROUBLESHOOTING GUIDE

Use the instructions in this document to troubleshoot any issue with Digital EPIC-2.

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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 Test (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.
The DEPIC-2 comes pre-tested for its proper operation when it is shipped from the factory. However it is possible that user might experience some error or warning messages during the operation of the device due to improper installation, damaged components during shipment or any other reason. Westlock Controls technical support team will always be there to help and resolve any issue you experience with DEPIC-2.This document will serve as a troubleshooting guide for the user to diagnose the warnings and error messages coming up while operating the device.

NOTES

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.

2 CALIBRATION ERRORS

After proper installation of the DEPIC-2 on an actuator and making all necessary electrical and pneumatic connections, the user must calibrate it for its proper operation. It is possible that the calibration might fail due to incorrect configuration, installation or missing electrical or pneumatic connection. This section provides the details of the errors that can come up during the calibration and a guide to troubleshoot and resolve these errors for successful calibration.

Following table shows the calibration errors that can come up on the LCD, DD or DTM, its meaning and a step to resolve the error.

2.1 Valve close error

Error on LCD	Valve close Err / valve not closed.
Error on DD/DTM	Auto/manual calibration couldn't close the valve.
What does it mean?	The DEPIC-2 tried to move the valve to the closed position during the calibration but due to some error the valve couldn't be moved to the closed position.
How to resolve?	Follow the steps in order: 1. Perform the calibration again. 2. Reboot the DEPIC-2 and perform the calibration again. 3. Perform the factory defaults. This can be done from config->factory defaults. Reconfigure all settings and perform the calibration again. 4. Remove the solenoid voltage and then reapply and make sure the valve moves to the de-energized position and then to the fully energized position. If not, troubleshoot the electrical connections. 5. If the valve moves in the step 3, the relay on the DEPIC-2 electronics might be faulty. Contact factory.

2.2 Valve open error

Error on LCD	Valve open Err Valve not opened
Error on DD/DTM	Auto/manual calibration couldn't open the valve.
What does it mean?	The DEPIC-2 tried to move the valve to the open position during the calibration but due to some error the valve couldn't be moved to open position
How to resolve?	Follow the steps in order: 1. Perform the calibration again. 2. Reboot the DEPIC-2 and perform the calibration again. 3. Perform the factory defaults. This can be done from config->factory defaults. Reconfigure all settings and perform the calibration again. 4. Remove the solenoid voltage and then reapply and make sure the valve moves to the de-energized position and then to the fully energized position. If not, troubleshoot the electrical connections. 5. If the valve moves in the step 3, the relay on the DEPIC-2 electronics might be faulty. Contact factory.

2.3 Sensor gain error - span too small

Error on LCD	Sensor gain Err Span too small
Error on DD/DTM	Calibrated position span is too small for both gain settings.
What does it mean?	The DEPIC-2 requires a minimum rotation of 45 degrees for the rotary actuators and 1" stroke for the linear actuators. This gives it enough span for its proper operation. The error indicates that the hall sensor reading for the fully energized and fully de-energized position wasn't enough to meet the minimum span requirement.
How to resolve?	Follow the steps in order: 1. The DEPIC-2 uses two different settings for the hall sensor gain. Try another gain setting. This can be done from config->basic config->sensor gain. Select an alternate gain setting and then perform the calibration again. 2. Perform the factory defaults. This can be done from config->factory defaults. Reconfigure all settings and perform the calibration again. 3. If the DEPIC-2 is mounted on a linear actuator, make sure the actuator type is set to linear. This can be done in the config->basic config menu. 4. Perform the calibration again and observe the rotation/stroke of the actuator. It should be minimum of 45 degrees for the rotary actuator and 1" for the linear actuator. 5. Make sure the beacon is mounted properly as indicated in the installation and operation manual. Correct the beacon if mounted 90 degrees off. 6. Remove the solenoid voltage. Make sure the valve moves to de-energized position. If not, correct the electrical connections. If the valve moves to the de-energized position, note down the position reading in % showed on the LCD main screen. Re-apply solenoid voltage and make sure the valve moves to the fully energized position. Note down the position reading in % shown on the LCD. There should be minimum 50% span between two readings. If not, check the hall sensor cable and the beacon. 7. On large actuators with pressure sensors disabled, the DEPIC-2 might take the reading of one end and then take reading of the same end due to small calibration timeout, which can come up as this error. Try to increase the calibration timeout and recalibrate it. The calibration timeout can be changed in config->basic config ->Disp/Tout on LCD and config->basic config->UI settings on the HART DD/DTM.

2.4 Sensor gain error - position not linear

Error on LCD	Sensor gain Err Pstn not linear
Error on DD/DTM	Position not within linear range for both sensor gain settings.
What does it mean?	The DEPIC-2 uses the hall sensor to measure the position of the valve. The sensor might not be linear to the end points. To improve the accuracy of the hall sensor reading, the DEPIC-2 tries to avoid the valve position falling into certain range at the end points. It uses its internal gain setting to adjust the hall sensor reading such that it will be within the linear range. The error indicates that for the current gain setting it couldn't achieve both end readings into the pre-defined linear range.
How to resolve?	Follow the steps in order: 1. The DEPIC-2 uses two different settings for the hall sensor gain. Try another gain setting. This can be done from config->basic config->sensor gain. Select an alternate gain setting and then perform the calibration again. 2. If the DEPIC-2 is mounted on a linear actuator, make sure the actuator type is set to linear. This can be done in the config->basic config menu. 3. Perform the calibration again and observe the rotation/stroke of the actuator. It should be minimum of 45 degrees for the rotary actuator and 1" for the linear actuator. 4. Make sure the beacon is mounted properly as indicated in the installation and operation manual. Correct the beacon if mounted 90 degrees off.

2.5 Hall sensor reverse

Error on LCD	Hall sen reverse Run calib again
Error on DD/DTM	Beacon detected to be 180 degrees off (open pstn < close pstn). You may correct beacon orientation if desired or just re-calibrate.
What does it mean?	The DEPIC-2 uses the hall sensor to measure the position. The beacon or the magnets have pre-defined orientation that must be followed for installation on the fail open or fail close valves. Some rotary actuators move in clock-wise and others move in counter-clockwise direction when de-energized. Some linear actuators move down and others move up when de-energized. Follow the orientation of the beacon/magnet as mentioned in the installation manual.
How to resolve?	Follow the steps in order: 1. The DEPIC-2 automatically detects that the beacon /magnets are installed 180 degrees from its normal position. It can compensate this incorrect orientation when the user performs the calibration again without performing factory defaults or changing the beacon/magnets. So perform the calibration one more time and this error should go away. 2. Alternatively, the DEPIC-2 can be unmounted from the actuator and the beacon can be rotated 180 degrees from its current position or in the case of linear actuator, the magnets can be rotated 180 degrees. After doing this, perform the factory defaults and reconfigure the basic settings and perform the calibration again.

2.6 Calibration aborted

Error on LCD	Calib aborted
Error on DD/DTM	Calibration aborted
What does it mean?	After the DEPIC-2 starts its calibration process, it can be aborted by the user by pressing the UP+DOWN keys at the same time from keypad if the calibration was started from keypad. In some cases, the DEPIC-2 aborts the calibration due to some internal error or external error like an ESD event occurred during calibration. This error is an indication that the calibrated was aborted either by the user or due to any internal/external event.
How to resolve?	Follow the steps in order: 1. If the user aborted the calibration, just initiate the calibration again. If the calibration was aborted due to an external event like an ESD, make sure the event has been disappeared before performing the calibration again. 2. If the step 1 doesn't solve the issue, perform the factory defaults, reconfigure and perform the calibration again. 3. If the step 2 doesn't solve the issue, reboot DEPIC-2, perform factory defaults, reconfigure and recalibrate

2.7 Calibration start error - device busy

Error on LCD	Calib start Err Device busy!
Error on DD/DTM	Calibration couldn't be started because of semaphore or other process.
What does it mean?	The DEPIC-2 has an internal mechanism to make sure there is only one function running at a time either from Keypad/LCD or HART DD/DTM to avoid conflict. This error indicates that the DEPIC-2 has detected there is some other function running like ESD, PST, FST, SOVT either from keypad or HART and it can't perform the requested calibration at this time.
How to resolve?	Follow the steps in order: 1. Check all user interfaces like local keypad/LCD, 475 handheld, DTM to make sure there is no other function running. If it is running, let it finish properly from the other user interface and then perform the calibration when there is nothing else running from the other user interfaces. 2. If the step 1 doesn't solve the issue, perform the factory defaults, reconfigure and perform the calibration again. 3. If the step 2 doesn't solve the issue, reboot DEPIC-2, perform factory defaults, reconfigure and recalibrate.

2.8 Stable pressure-1 timeout

Error on LCD	Stable pressure1 timeout
Error on DD/DTM	Calibration timed out waiting for pressure1 to be stable.
What does it mean?	During the calibration, the DEPIC-2 looks for a stable pressure on sensor-1, which should be connected to the actuator port. Before calibrating the pressure, it wants to make sure that the pressure is not fluctuating and stable to take the reading. It takes several sample readings of the pressure and compares them to determine the pressure has stabilized or not. It has a pre-defined hysteresis limit to consider the stable pressure. This error indicates that the DEPIC-2 waited for the time configured by the calibration timeout and couldn't find a stable pressure during this period.
How to resolve?	Follow the steps in order: 1. Make sure the pressure sensor-1 port is pneumatically connected to the actuator port. 2. Perform the calibration again. Observe the supply pressure gauge to look for any fluctuations. If so, apply a stable source of supply pressure and then re-calibrate it. Adding a pressure regulator to the supply pressure can help remove this error or try to remove other devices connected on the same pressure line to isolate an issue. 3. Try to increase the calibration timeout. This might give DEPIC-2 more time to look for stable pressure. The calibration timeout can be changed in config->basic config->Disp/Tout on LCD OR config->basic config->UI Settings on the HART DD or DTM 4. Unscrew the DEPIC-2 electronics from the housing and make sure the pressure sensor cables are connected to the connector W1 and W2 and the pins in the connector are not damaged.

2.9 Stable pressure-2 timeout

Error on LCD	Stable pressure2 timeout
Error on DD/DTM	Calibration timed out waiting for pressure2 to be stable.
What does it mean?	During the calibration, the DEPIC-2 looks for a stable pressure on sensor-2, which should be connected to the supply pressure. Before calibrating the pressure, it wants to make sure that the pressure is not fluctuating and stable to take the reading. It takes several sample readings of the pressure and compares them to determine the pressure has stabilized or not. It has a pre-defined hysteresis limit to consider the stable pressure. This error indicates that the DEPIC-2 waited for the time configured by the calibration timeout and couldn't find a stable pressure during this period.
How to resolve?	Follow the steps in order: 1. Make sure the pressure sensor-2 port is pneumatically connected to the supply pressure. 2. Perform the calibration again. Observe the supply pressure gauge to look for any fluctuations. If so, apply a stable source of supply pressure and then re-calibrate it. Adding a pressure regulator to the supply pressure can help remove this error or try to remove other devices connected on the same pressure line to isolate an issue. 3. Try to increase the calibration timeout. This might give DEPIC-2 more time to look for stable pressure. The calibration timeout can be changed in config->basic config->Disp/Tout on LCD OR config->basic config->UI Settings on the HART DD or DTM. 4. Unscrew the DEPIC-2 electronics from the housing and make sure the pressure sensor cables are connected to the connector W1 and W2 and the pins in the connector are not damaged. 5. If any of the above solutions doesn't work, as a temporary solution, disable the pressure sensor-2, perform the calibration and then enable the pressure sensor-2.

2.10 Stable close position timeout

Error on LCD	Stable Close Pos Timeout
Error on DD/DTM	Calibration timed out waiting for stable close position.
What does it mean?	During the calibration, the DEPIC-2 looks for a stable position. Before calibrating the position, it wants to make sure that the pressure is not fluctuating and it is stable to take the reading. It takes several sample readings of the position and compares them to determine the position has stabilized or not. It has a pre-defined hysteresis limit to consider the stable position. This error indicates that the DEPIC-2 waited for the time configured by the calibration timeout and couldn't find a stable position during this period.
How to resolve?	Follow the steps in order: 1. Make sure the beacon/magnet is mounted as per the installation manual and tightly secured to the actuator shaft. A high vibration with a loose screw can cause the beacon/magnet assembly to wobble creating an unstable position. 2. If the position sensor is remotely mounted, make sure the cable is as per the specifications and doesn't exceed the length limit. The cable should be properly connected to the hall sensor connector in the junction box. 3. Try to increase the calibration timeout. This might give DEPIC-2 more time to look for stable position. The calibration timeout can be changed in config->basic config->Disp/Tout on LCD OR config->basic config->UI Settings on the HART DD or DTM. 4. Unscrew the DEPIC-2 electronics from the housing and make sure the hall sensor cable is connected to the bottom connector and the pins in the connector are not damaged.

2.11 Stable open position timeout

Error on LCD	Stable open pos timeout
Error on DD/DTM	Calibration timed out waiting for stable open position.
What does it mean?	During the calibration, the DEPIC-2 looks for a stable position. Before calibrating the position, it wants to make sure that the pressure is not fluctuating and it is stable to take the reading. It takes several sample readings of the position and compares them to determine the position has stabilized or not. It has a pre-defined hysteresis limit to consider the stable position. This error indicates that the DEPIC-2 waited for the time configured by the calibration timeout and couldn't find a stable position during this period.
How to resolve?	Follow the steps in order: 1. Make sure the beacon/magnet is mounted as per the installation manual and tightly secured to the actuator shaft. A high vibration with a loose screw can cause the beacon/magnet assembly to wobble creating an unstable position. 2. If the position sensor is remotely mounted, make sure the cable is as per the specifications and doesn't exceed the length limit. The cable should be properly connected to the hall sensor connector in the junction box. 3. Try to increase the calibration timeout. This might give DEPIC-2 more time to look for stable position. The calibration timeout can be changed in config->basic config->Disp/Tout on LCD OR config->basic config->UI Settings on the HART DD or DTM. 4. Unscrew the DEPIC-2 electronics from the housing and make sure the hall sensor cable is connected to the bottom connector and the pins in the connector are not damaged.

2.12 Calibration timeout

Error on LCD	Calib timeout
Error on DD/DTM	Cal time out waiting for user action.
What does it mean?	The DEPIC-2 has a configurable calibration timeout to prevent the device getting stuck into the calibration mode indefinitely. In some calibrations like mA and user controlled calibration, it waits for a user action to confirm the value on the LCD or HART DD accepted by the user. This error indicates that the calibration timed out waiting for a user action.
How to resolve?	Follow the steps in order: 1. Perform the calibration again. 2. Try to increase the calibration timeout. This might give DEPIC-2 more time to look for stable position. The calibration timeout can be changed in config->basic config->Disp/Tout on LCD OR config->basic config->UI Settings on the HART DD or DTM.

2.13 Pressure-1 span error

Error on LCD	Press-1 span Err
Error on DD/DTM	Calibration of Pressure sensor 1 has span error. May be either no pressure or not enough pressure.
What does it mean?	During the calibration, the DEPIC-2 calibrates the pressure low and high side of the pressure sensor-1. It requires a minimum span of at least 10 PSI for proper operation of the device. This error indicates that it didn't meet this minimum pressure span requirement.
How to resolve?	Follow the steps in order: 1. Check the pneumatic connections for air. The port P1 of the pressure sensor manifold should be connected to the actuator port and solenoid outlet port with a T connector. Refer to the installation manual for further details. 2. If the pressure sensor is enabled by mistake, disable the pressure sensor. This can be done by disable the setting in config->signature config. 3. Increase the pressure and perform the calibration again. If it doesn't solve the issue, reboot the electronics and the perform the calibration again. 4. If the above steps don't fix the issue, carefully remove the electronics from housing and check the pressure sensor cables from manifold to the connectors on the bottom board of the electronics. They should be connected to the W1 and W2 connectors. 5. Remove the solenoid voltage, wait for 20 seconds and then check the pressure-1 on the keypad/LCD by going into the menu "device status->misc status->pressure" OR on the main screen of the HART DD/DTM. The pressure should be close to zero. Apply the solenoid voltage and take the reading of the pressure. The pressure should be close to the full range of the supply. If not then replace the pressure sensor manifold.

2.14 Pressure-2 span error

Error on LCD	Press-2 span Err
Error on DD/DTM	Calibration of Pressure sensor 2 has span error. May be either no pressure or not enough pressure.
What does it mean?	During the calibration, the DEPIC-2 calibrates the pressure low and high side of the pressure sensor-2. It requires a minimum span of at least 10 PSI for proper operation of the device. This error indicates that it didn't meet this minimum pressure span requirement.
How to resolve?	Follow the steps in order: 1. Check the pneumatic connections for air. The port P2 of the pressure sensor manifold should be connected to the supply pressure and solenoid inlet port with a T connector. Refer to the installation manual for further details. 2. If the pressure sensor-2 is enabled by mistake, disable the pressure sensor. This can be done by disable the setting in config->signature config->pressure sensor-2. 3. Increase the pressure and perform the calibration again. If it doesn't solve the issue, reboot the electronics and then perform the calibration again. 4. If the above steps don't fix the issue, carefully remove the electronics from housing and check the pressure sensor cables from manifold to the connectors on the bottom board of the electronics. They should be connected to the W1 and W2 connectors. 5. Reduce the supply pressure to 0 psi, wait for 20 seconds and then check the pressure-2 on the keypad/LCD by going into the menu "device status->misc status->pressure" OR on the main screen of the HART DD/DTM. The pressure-2 reading should be close to 0 psi. Increase the supply pressure to desired value and take the reading of the pressure-2. The pressure-2 reading should be close to the full range of the supply. If not then replace the pressure sensor manifold.

2.15 mA span error

Error on LCD	mA span error
Error on DD/DTM	Calibration of mA output encountered a span error, for example, the energized and de-energized current levels may have been selected to be the same.
What does it mean?	During the mA (transmitter output current) calibration, the DEPIC-2 requires a minimum span of 4 mA, which means the value selected for the energized position output current and the de-energized position output current should have a minimum span of 4 mA. This error indicates that it didn't meet the minimum span requirement during the mA calibration.
How to resolve?	Follow the steps in order: 1. Perform the mA calibration again. Connect the meter in the loop to accurately measure the current. Make sure the value selected for de-energized position and the energized position has a minimum span of 4 mA. For example, the de-energized and energized position mA can be 4 mA and 8 mA respectively but cannot be 4 mA and 6 mA. Any values can be selected between 4 mA and 20 mA but the span should be at least 4 mA 2. Perform the factory defaults mA calibration. This can be done on the keypad/LCD only by going into the menu calibration->ma calib->Fact Def mA. At this point you should have 4 mA for the close position and 20 mA for the open position. If you want to reverse those values, simply go to the calibration->mA calib->Reverse mA calibration on the keypad/LCD. If you want different mA for your open and close position, start the custom mA calibration from the keypad/LCD or HART DD/DTM. Make sure to satisfy the minimum span of 4 mA.

3 PST/SOVT ERRORS AND ALARMS

PST (Partial Stroke Test) is one of the most important diagnostics function offered by the DEPIC-2. This test increases the overall safety rating of the system and avoids any potential failures that can happen in the future. The DEPIC-2 has an intelligent PST algorithm in place to diagnose the issues related with the failure of the actuator or valve. However the device must be configured and operated properly to avoid any nuisance PST failure alarms. This section will explain the PST fail error messages that can come up on the LCD or HART DD/DTM when the PST is performed. A fail PST doesn't always mean a failure in the actuator or valve package. A care must be taken and a step by step procedure is still required before making a final decision of the PST failure. Please follow the steps mentioned for each PST fail error, before a PST can be considered a true failure.

3.1 PST/SOVT aborted

Error on LCD	PST/SOVT aborted
Error on DD/DTM	The baseline/maintenance PST was aborted by the user.
What does it mean?	After the DEPIC-2 starts its PST process, it can be aborted by the user by pressing the UP+DOWN keys at the same time from keypad if the PST was started from keypad. In some cases, the DEPIC-2 aborts the PST due to some internal error or external event like an ESD event occurred during PST. This error is an indication that the PST was aborted either by the user or due to any internal/external event. This error doesn't indicate any failure on the actuator/valve as the DEPIC-2 hasn't finished the PST completely.
How to resolve?	Follow the steps in order: 1. If the user aborted the PST, just initiate the test again. If the PST was aborted due to an external event like an ESD, make sure the event has been disappeared before performing the test again. 2. If the step 1 doesn't solve the issue, reboot the DEPIC-2 and then perform the PST again. 3. If the step 2 doesn't solve the issue, perform factory defaults, reconfigure, recalibrate and then perform the PST again.

3.2 Solenoid failed

Error on LCD	Solenoid failed
Error on DD/DTM	Failure - The solenoid has failed during this baseline/maintenance PST or Duplex PST. No pressure change detected after solenoid de-energized.
What does it mean?	This error can only come up during PST/SOVT. After starting the SOVT, the DEPIC-2 monitors the drop in the pressure of the actuator chamber. If the pressure doesn't drop by a pre-defined rate, it is an indication that the solenoid might have failed.
How to resolve?	Follow the steps in order: 1. Check the solenoid voltage and the supply pressure. 2. Check the exhaust port of the solenoid to see if it is partially or completely clogged. Clean it if necessary and run the test again. 3. If the device is configured in the duplex mode (redundant solenoid), make sure the duplex board is electrically connected properly and the redundant solenoid has enough voltage and the exhaust on the redundant solenoid is not clogged. Clean it if necessary and run the test again. 4. Carefully unscrew the DEPIC-2 electronics from the housing and make sure the pressure sensor cable is connected to the connectors W1 and W2 on the bottom board of the electronics. 5. If all of the above steps don't solve the issue, this could be a true failure detected by the DEPIC-2. Try to replace the solenoid and run the test without changing anything else. The test should pass with the new replaced solenoid.

3.3 Invalid position

Error on LCD	Invalid position
Error on DD/DTM	Failure - PST aborted due to invalid valve start position.
What does it mean?	Before starting a PST/SOVT, the DEPIC-2 wants to make sure that the valve is in fully energized position and within the open/close hysteresis value configured by the user. If the valve is not in fully energized position, it could cause the test to overshoot or move the valve during an SOVT. This error indicates that the DEPIC-2 can't perform PST/SOVT due to invalid start position of the valve. This error doesn't indicate any failure on the actuator/valve as the DEPIC-2 hasn't performed the PST yet.
How to resolve?	Follow the steps in order: 1. Check the solenoid voltage and the supply pressure. The supply pressure must be enough to move the valve in fully energized position. 2. Check the valve coupler and actuator shaft. A loose connection can cause the valve not to fully open/close. 3. Check the current position on the LCD or HART DD/DTM. If the current position is not 100%, the valve is outside the hysteresis configured by the open/close position hysteresis. If the hysteresis value is too low, increase it. This can be done in the config->alert config->open position hysteresis (for fail close valve) or close position hysteresis (for fail open valve). Perform the PST again. 4. If this is the maintenance PST, compare the current temperature of the device to the temperature when the baseline PST was performed. This can be done by looking at the current temperature on the LCD and viewing the baseline PST data. If the difference in the temperature is more than 50°F, a change in temperature might have caused a drift in the hall sensor reading. Perform the low/high calibration at the current temperature to offset the drift and then perform the maintenance PST again.

3.4 PST not reached travel limit

Error on LCD	Not reach trvlmt
Error on DD/DTM	Failure - baseline PST failed to reach travel-limit (set-point).
What does it mean?	This error can only come up during the baseline PST. During the baseline PST, the DEPIC-2 monitors the valve movement to make sure the valve reaches to the travel limit set by the user. If for some reason, after the valve started moving but got stuck and never reaches to the travel limit, this error can come up.
How to resolve?	Follow the steps in order: 1. Check the exhaust port of the solenoid to make sure it is not clogged. 2. Check the valve coupler and actuator shaft. A loose/broken connection can cause the valve not to move. 3. As a test, remove the solenoid voltage and make sure the valve moves to the de-energized position. If it doesn't, identify the issue and then perform the baseline PST again.

3.5 Slow travel time

Error on LCD	Slow travel time
Error on DD/DTM	Failure - exceeded slow travel time limit to reach travel-limit of the baseline PST
What does it mean?	This error can only come up during the maintenance PST (not baseline PST). During the maintenance PST, the DEPIC-2 compares the travel time measured to the travel time captured during the baseline PST. Travel time is the time measured when the valve makes 3% movement until valve reaches the travel limit. This error indicates that the valve has slowed down as compared to the baseline PST.
How to resolve?	Follow the steps in order: 1. Check the travel time hysteresis setting in the config->PST config->PST Fail Limits. If the hysteresis value is too low, there might not be anything wrong with the valve actuator package. The hysteresis should be set very carefully after considering various factors as mentioned below so that it doesn't generate any nuisance alarm and it can detect a potential failure. Consider following factors when setting the travel time hysteresis value. • Actuator spring degradation over time. Determine a value that can truly be a failure of the actuator spring. For example, if the travel time changes by 20%, it could be a weakness in the actuator spring. • Environmental factors like temperature that can affect the characteristics of the actuator spring, lubrication inside the actuator etc. • Plant process temperature and pressure (load) that can affect the actuator/valve movement. 2. Compare the maintenance PST parameters to the baseline PST parameters and identify the issue that might have caused the travel time of the maintenance PST to exceed the hysteresis limit set. Below are few check points: • Compare the supply pressure of the maintenance PST to the baseline PST. If they vary more than 10%, it might have caused the travel time to change. Perform the maintenance PST at the same supply pressure when the baseline PST was captured. • Compare the external temperature of the maintenance PST to the baseline PST. If they vary by more than 40°F, the change in temperature might have changed the characteristics of the actuator spring and solenoid spool valve. • The baseline PST and maintenance PST must be done under identical conditions to detect any issue. If the baseline PST was taken when the process in the plant was not running and the maintenance PST is taken when the process is running, the load on the valve can change, which can make the maintenance PST to fail. If the maintenance PST was performed when the process was running, it might cause high vibration on the device. Make sure both are performed under the same load and conditions. 3. After verifying the step 1 and step2, perform the maintenance PST again. If it still fails with the same error, it could be true failure condition indicating a potential problem. Below are few possible issues. • The actuator spring might have weakened over time causing slower movement of the valve. • The solenoid exhaust port might have started clogging due to dust, which will exhaust the air very slowly causing the slower movement in the actuator. Clean the solenoid exhaust port. • The load on the valve might have changed causing the actuator to work hard, which will slow down the actuator movement. • Check the valve movement and make sure the valve is not sticking during the movement.

3.6 Fast travel time

Error on LCD	Fast travel time
Error on DD/DTM	Failure - exceeded fast travel time limit to reach travel-limit of the baseline PST.
What does it mean?	This error can only come up during the maintenance PST (not baseline PST). During the maintenance PST, the DEPIC-2 compares the travel time measured to the travel time captured during the baseline PST. Travel time is the time measured when the valve makes 3% movement until valve reaches the travel limit. This error indicates that the valve has become faster in movement as compared to the baseline PST.
How to resolve?	Follow the steps in order: 1. Check the travel time hysteresis setting in the config->PST config->PST Fail Limits. If the hysteresis value is too low, there might not be anything wrong with the valve actuator package. The hysteresis should be set very carefully after considering various factors as mentioned below so that it doesn't generate any nuisance alarm and it can detect a potential failure. Consider following factors when setting the travel time hysteresis value. • Actuator spring degradation over time. Determine a value that can truly be a failure of the actuator spring. For example, if the travel time increases by 20%, it could be possible that the coupler between the actuator shaft and the valve could be becoming loose. • Environmental factors like temperature that can affect the characteristics of the actuator spring, lubrication inside the actuator etc. • Plant process temperature and pressure (load) that can affect the actuator/valve movement. 2. Compare the maintenance PST parameters to the baseline PST parameters and identify the issue that might have caused the travel time of the maintenance PST to exceed the hysteresis limit set. Below are few check points: • Compare the supply pressure of the maintenance PST to the baseline PST. If they vary more than 10%, it might have caused the travel time to change. Perform the maintenance PST at the same supply pressure when the baseline PST was captured. • Compare the external temperature of the maintenance PST to the baseline PST. If they vary by more than 40°F, the change in temperature might have changed the characteristics of the actuator spring and solenoid spool valve. • The baseline PST and maintenance PST must be done under identical conditions to detect any issue. If the baseline PST was taken when the process in the plant was not running and the maintenance PST is taken when the process is running, the load on the valve can change, which can make the maintenance PST to fail. If the maintenance PST was performed when the process was running, it might cause high vibration on the device. Make sure both PSTs are performed under the same load and conditions. 3. After verifying the step 1 and step2, perform the maintenance PST again. If it still fails with the same error, it could be true failure condition indicating a potential problem. Below are few possible issues. • The load on the valve might have been reduced, which will make the actuator movement faster. • The coupler between the valve and actuator shaft might have been loose causing valve to slip and making the actuator movement faster.

3.7 High break pressure

Error on LCD	High break PSI
Error on DD/DTM	Failure - maintenance PST Failed because the break pressure was over the high limit of the baseline PST break pressure high limit of the baseline PST break pressure.
What does it mean?	This error can only come up during the maintenance PST (not baseline PST). During the maintenance PST, the DEPIC-2 compares the travel time measured to the travel time captured during the baseline PST. Travel time is the time measured when the valve makes 3% movement until valve reaches the travel limit. This error indicates that the valve has become faster in movement as compared to the baseline PST.
How to resolve?	Follow the steps in order: 1. Check the break pressure hysteresis setting in the config->PST config->PST Fail Limits. If the hysteresis value is too low, there might not be anything wrong with the valve actuator package. The hysteresis should be set very carefully after considering various factors as mentioned below so that it doesn't generate any nuisance alarm and it can detect a potential failure. Consider following factors when setting the break pressure hysteresis value. • Actuator spring degradation over time. Determine a value that can truly be a failure of the actuator spring. For example, if the baseline PST had break pressure of 50 psi and the maintenance PST had 70 psi, it could be possible that the coupler between the actuator shaft and the valve could be becoming loose and the valve can start moving at the higher pressure. • Environmental factors like temperature that can affect the characteristics of the actuator spring, lubrication inside the actuator etc. • Plant process temperature and pressure (load) that can affect the actuator/valve movement. 2. Compare the maintenance PST parameters to the baseline PST parameters and identify the issue that might have caused the break pressure of the maintenance PST to exceed the hysteresis limit set. Below are few check points: • Compare the supply pressure of the maintenance PST to the baseline PST. If they vary more than 10%, it might have caused the travel time to change. Perform the maintenance PST at the same supply pressure when the baseline PST was captured. • Compare the external temperature of the maintenance PST to the baseline PST. If they vary by more than 40°F, the change in temperature might have changed the characteristics of the actuator spring and solenoid spool valve. • The baseline PST and maintenance PST must be done under identical conditions to detect any issue. If the baseline PST was taken when the process in the plant was not running and the maintenance PST is taken when the process is running, the load on the valve can change, which can make the maintenance PST to fail. If the maintenance PST was performed when the process was running, it might cause high vibration on the device. Make sure both PSTs are performed under the same load and conditions. 3. After verifying the step 1 and step2, perform the maintenance PST again. If it still fails with the same error, it could be true failure condition indicating a potential problem. Below are few possible issues. • The load on the valve might have been reduced, which will make the actuator movement faster. • The coupler between the valve and actuator shaft might have been loose causing valve to slip and making the actuator movement faster.

3.8 Low break pressure

Error on LCD	Low break PSI
Error on DD/DTM	Failure - Maintenance PST failed because the break pressure was the low limit of the baseline PST break pressure.
What does it mean?	This error can only come up during the maintenance PST (not baseline PST). During the maintenance PST, the DEPIC-2 compares the break pressure measured to the break pressure captured during the baseline PST. Break pressure is the pressure recorded in the actuator chamber (sensor-1) when the valve makes 3% movement. This error indicates that the valve is experiencing more load as compared to the baseline PST.
How to resolve?	Follow the steps in order: 1. Check the break pressure hysteresis setting in the config->PST config->PST Fail Limits. If the hysteresis value is too low, there might not be anything wrong with the valve actuator package. The hysteresis should be set very carefully after considering various factors as mentioned below so that it doesn't generate any nuisance alarm and it can detect a potential failure. Consider following factors when setting the break pressure hysteresis value. • Actuator spring degradation over time. Determine a value that can truly be a failure of the actuator spring. For example, if the baseline PST had break pressure of 50 psi and the maintenance PST had 30 psi, it could be possible that the actuator spring might have weakened or the valve has more load. • Environmental factors like temperature that can affect the characteristics of the actuator spring, lubrication inside the actuator etc. • Plant process temperature and pressure (load) that can affect the actuator/valve movement. More load on the valve will cause the break pressure to go low as the spring has to work harder to move the air out of the actuator chamber 2. Compare the maintenance PST parameters to the baseline PST parameters and identify the issue that might have caused the break pressure of the maintenance PST to exceed the hysteresis limit set. Below are few check points: • Compare the supply pressure of the maintenance PST to the baseline PST. If they vary more than 10%, it might have caused the travel time to change. Perform the maintenance PST at the same supply pressure when the baseline PST was captured. • Compare the external temperature of the maintenance PST to the baseline PST. If they vary by more than 40°F, the change in temperature might have changed the characteristics of the actuator spring and solenoid spool valve. • The baseline PST and maintenance PST must be done under identical conditions to detect any issue. If the baseline PST was taken when the process in the plant was not running and the maintenance PST is taken when the process is running, the load on the valve can change, which can make the maintenance PST to fail. If the maintenance PST was performed when the process was running, it might cause high vibration on the device. Make sure both PSTs are performed under the same load and conditions. 3. After verifying the step 1 and step2, perform the maintenance PST again. If it still fails with the same error, it could be a true failure condition indicating a potential problem. Below are few possible issues. • The load on the valve might have been increased due to increased process pressure or temperature, which will make the actuator work harder • Check the valve movement and make sure the valve is not sticking during the movement • The exhaust port on the actuator might be clogged, which will make the actuator exhaust the air slower than normal.

3.9 PST Exceeded total time limit (TTL)

Error on LCD	PST Exceed TTL (PST Exceeded total time limit)
Error on DD/DTM	Failure - The last PST exceeded total time limit. This is only used for devices with the signature option disabled.
What does it mean?	This error can only come up if the DEPIC-2 has the signature disabled and the pressure sensors are not used. In this case, the DEPIC-2 performs the PST using the time algorithm where the total time limit can be configured in the config->PST config->PST Fail Limits. During the PST, the DEPIC-2 monitors the total time it takes to perform the PST and if it exceeds the total time limit configured, it considers it a fail PST.
How to resolve?	Follow the steps in order: 1. Check the total time limit setting configured in the config->PST Config->PST Fail Limits menu. The total time limit should be configured after considering various factors as mentioned below. • Actuator spring degradation over time. Determine a value that can truly be a failure of the actuator spring. For example, if the baseline PST took 5 seconds and the maintenance PST took 8 seconds, it could be possible that the actuator spring might have weakened or the valve has more load. • Environmental factors like temperature that can affect the characteristics of the actuator spring, lubrication inside the actuator etc. • Plant process temperature and pressure (load) that can affect the actuator/valve movement. More load on the valve will cause the valve to move slowly as the spring has to work harder to move the air out of the actuator chamber. 2. Compare the maintenance PST parameters to the baseline PST parameters and identify the issue that might have caused it to take more time to finish the PST and exceed the PST total time limit. Below are few check points: • Compare the supply pressure of the maintenance PST to the baseline PST. If they vary more than 10%, it might have caused the PST to take longer time as the increased supply pressure has to be exhausted before the valve can start movement. Perform the maintenance PST at the same supply pressure when the baseline PST was captured. • Compare the external temperature of the maintenance PST to the baseline PST. If they vary by more than 40°F, the change in temperature might have changed the characteristics of the actuator spring and solenoid spool valve. 3. The baseline PST and maintenance PST must be done under identical conditions to detect any issue. If the baseline PST was taken when the process in the plant was not running and the maintenance PST is taken when the process is running, the load on the valve can change, which can make the maintenance PST to fail as it will take longer time to finish. If the maintenance PST was performed when the process was running, it might cause high vibration on the device. Make sure both PSTs are performed under the same load and conditions.

3.10 Pressure sensor failed

Error on LCD	PSI Sensor fail
Error on DD/DTM	Failure - The device has detected a failure of the Pressure Sensor 1 during the Maintenance PST.
What does it mean?	This error indicates that the DEPIC-2 observed something abnormal on the PSI sensor. It could be intermittent that might go away by itself but it couldn't continue the PST as it can't rely the reading from the pressure sensors. This error doesn't indicate any failure on the actuator/valve as the DEPIC-2 hasn't performed the PST yet.
How to resolve?	Follow the steps in order: 1. Run the PST again. It could be possible that the electrical signal might be disturbed due to external noise. If you are using a radio very close to the DEPIC-2, move it away and rerun the PST. 2. Check the supply pressure. A fluctuating pressure can cause the pressure sensor reading unstable, which can cause this error. 3. Carefully remove the DEPIC-2 electronics from housing and check the pressure sensor cables. There are two cables that go from manifold to the connectors W1 and W2 on the bottom electronic board. Make sure they are properly connected and the pins on the connector are not damaged. 4. Reboot the DEPIC-2 and try to run the PST again. 5. Check the pressure that DEPIC-2 is reading through the pressure sensor. This can be done from the menu "device status->miscellaneous device status->pressure" menu or on the main screen of the HART DD or on the measured value screen on the DTM. If the pressure reading is not matching to the supply pressure, the pressure sensors might be damaged.

3.11 Invalid pressure

Error on LCD	Invalid pressure
Error on DD/DTM	Failure - PST aborted (not initiated) due to supply pressure outside the hysteresis.
What does it mean?	This error can only come up during the maintenance PST or SOVT. During these tests, the DEPIC-2 compare the supply pressure to the baseline PST supply pressure and if it is outside the hysteresis limit configured, it aborts the PST as there is a chance that the valve might exceed the travel limit and cannot come back to its fully energized position due to low pressure. It also aborts SOVT as there is a chance that the valve might start movement during SOVT due to low pressure. This error doesn't indicate the failure on the valve/actuator as the DEPIC-2 hasn't performed the PST completely yet.
How to resolve?	Follow the steps in order: 1. Check the following hysteresis settings. If those settings are too low, increase them to work on the air system on your plant as they are dependent on the overall pneumatic system of the plant like how many devices connected, how many devices running at the same time that can cause the drop in the supply pressure, how much the supply pressure can vary etc. • If the pressure sensor-2 is enabled and tied to supply pressure, check the pressure-2 hysteresis in the "config->alert hyst" menu. • If the pressure sensor-2 is disabled, check the pressure sensor-1 hysteresis in the "config->alert hysteresis" menu. 2. Check the supply pressure. A fluctuating pressure can cause the pressure go out of the hysteresis limits set in the step 1. Add a pressure regulator to stabilize the pressure if necessary. The supply pressure must be equal or above the supply pressure when the baseline PST was performed. Increase the supply pressure, wait for 15 seconds and then run the PST again. 3. If above steps don't solve the issue, Reboot the DEPIC-2 and try to run the PST again. 4. Check the pressure that DEPIC-2 is reading through the pressure sensor. This can be done from the menu "device status->miscellaneous device status->pressure" menu or on the main screen of the HART DD or on the measured value screen on the DTM. If the pressure reading is not matching to the supply pressure, the pressure sensors might be damaged. 5. Carefully remove the DEPIC-2 electronics from housing and check the pressure sensor cables. There are two cables that go from manifold to the connectors W1 and W2 on the bottom electronic board. Make sure they are properly connected and the pins on the connector are not damaged.

3.12 PST Exceeded travel limit

Error on LCD	Exceed Trvl Lmt (Exceeded Travel Limit)
Error on DD/DTM	The maintenance PST exceeded Travel-Limit.
What does it mean?	During the PST, the DEPIC-2 monitors the movement of the valve. Once the valve reaches within the hysteresis of the configured travel limit, it re-energizes the solenoid to move the valve back to its fully energized position. Before the valve changes its movement to the opposite direction, if it exceeds the travel limit, the PST can fail.
How to resolve?	Follow the steps in order based on if the error comes during the baseline PST or maintenance PST: *Baseline PST:* 1. The DEPIC-2 automatically reconfigures the travel-limit hysteresis after it detects this error. Just re-run the baseline PST again without changing anything. If it fails 3 times with the same error, follow the step 2. 2. Check the supply pressure and make sure it is high enough and stable enough to run the PST. If the pressure is not enough, the valve move not fast enough when the DEPIC-2 reenergizes the solenoid to move the valve to fully energized position. 3. If the step 2 doesn't solve the issue, check the travel limit and travel limit hysteresis in the "config->PST config" menu. The travel limit tells the DEPIC-2 the valve should not exceeds this limit while the travel limit hysteresis tell DEPIC-2 to consider a valid PST as soon as it reaches within this % of the travel limit. For example, for travel limit of 25% and travel limit hysteresis of 10%, the DEPIC-2 moves the valve and as soon as it makes 15% movement (25 % minus 10%), it re-energizes the solenoid. If these values are too close to each other, it could cause the valve to exceed the travel limit. Increase the travel limit to 40% and travel limit hysteresis to 25% and then run the baseline PST again. 4. If the step 3 doesn't solve the issue, check the solenoid lag time and the size of the actuator. If the actuator has a stroke time less than one second and the solenoid has a lag time (time it takes to reverse direction) more than 500ms, it is not possible to successfully run the PST as the solenoid is not quick enough to respond during PST. Try to slow down the actuator using the needle valve or some other mechanism or replace the solenoid with faster response time and then rerun the baseline PST. *Maintenance PST:* 1. Check the supply pressure to make sure it is the same when the baseline PST was run. Low supply pressure can cause the valve not to reverse direction fast enough during the maintenance PST. 2. Environmental factors like temperature that can affect the characteristics of the actuator spring, lubrication inside the actuator, solenoid spool to react faster etc. 3. Plant process temperature and pressure (load) that can affect the actuator/valve movement. More load on the valve will cause the valve to move slowly as the spring has to work harder to move the air out of the actuator chamber. 4. Check the coupler for the valve shaft. A loose coupler will make the valve slip and exceed the travel limit. 5. Check the solenoid and its spool valve. The solenoid might have degraded over time to react faster.

3.13 Solenoid-2 failed

Error on LCD	Solenoid2 failed
Error on DD/DTM	The maintenance PST on second (redundant) solenoid failed (only applies to duplex).
What does it mean?	This error should only come up when the DEPIC-2 is configured for the duplex solenoid (redundant solenoid) option. When the DEPIC-2 is configured for the duplex option, the DEPIC-2 performs the PST on the primary solenoid (1) and SOVT on the redundant solenoid (2). If the SOVT is performed, the DEPIC-2 switches the solenoid during each SOVT performed. This error indicates that the DEPIC-2 has detected a solenoid failure for the second solenoid.
How to resolve?	Follow the steps in order: 1. Check the solenoid voltage of the solenoid-2 and the supply pressure. 2. Check the exhaust port of the solenoid-2 to see if it is partially or completely clogged. Clean it if necessary and run the test again. 3. Carefully unscrew the DEPIC-2 electronics from the housing and make sure the pressure sensor cable is connected to the connectors W1 and W2 on the bottom board of the electronics. 4. If all of the above steps don't solve the issue, this could be a true failure detected by the DEPIC-2. Try to replace the solenoid and run the test without changing anything else. The test should pass with the new replaced solenoid.

3.14 Software failed

Error on LCD	Software failed
Error on DD/DTM	Firmware fail!
What does it mean?	This error indicates that the software running on the DEPIC-2 has experienced some internal error and the results of the performed PST can't be reliable.
How to resolve?	Follow the steps in order: 1. Perform the PST again. 2. If the same error comes up again, reboot the DEPIC-2 and then perform the PST again.

3.15 PST Never done

Error on LCD	PST Never done
Error on DD/DTM	PST Not Done, possibly because no Baseline Signature or Baseline PST.
What does it mean?	This error indicates that the requested PST or SOVT couldn't be done as there is no baseline PST.
How to resolve?	Follow the steps in order: 1. Check to make sure if a successful baseline PST exists. If not, perform the baseline PST first. 2. Check to make sure there is no ESD condition and the valve is in fully energized position then perform the maintenance PST.

4 FST ERRORS

FST (Full Stroke Test) is another very smart diagnostic function offered by the DEPIC-2. This test increases the overall safety rating of the system and avoids any potential failures that can happen in the future. The DEPIC-2 has an intelligent FST algorithm in place to diagnose the issues related with the failure of the actuator or valve. Unlike PST, the DEPIC-2 moves the valve completely to its de-energized position and then back to its fully energized position. The FST will not only ensure the valve will move to its fail safe position but also detect any degradation of the valve/actuator performance. However the device must be configured and operated properly to avoid any nuisance FST failure errors. This section will explain the FST fail error messages that can come up on the LCD or HART DD/DTM when the FST is performed. A fail FST doesn't always mean a failure in the actuator or valve package. A care must be taken and a step by step procedure is still required before making a final decision of the FST failure. Please follow the steps mentioned for each FST fail error, before a FST can be considered a true failure.

4.1 Open/close signature large

Error on LCD	Open/close sign large
Error on DD/DTM	Open/close signature exceeded memory.
What does it mean?	During the calibration, DEPIC-2 measures the valve open/close time and calculates the sampling rate (interval) to capture signature samples. This error indicates that the valve opening/closing time has increased and all signature samples can't be captured with the previously calculated sampling rate.
How to resolve?	Follow the steps in order: *Baseline FST:* 1. Make sure the supply pressure hasn't changed and is the same when the calibration was performed. 2. Make sure the supply pressure was stable and not fluctuating when the calibration was performed. It can cause the device to calculate wrong opening/closing time if the supply pressure is not stable. Add a pressure regulator if needed. 3. Make sure the FST is captured right after the successful calibration and there is no change in the physical or environmental conditions like external temperature, process temperature, process pressure. Perform the calibration again and then capture the baseline FST right after successful calibration. 4. Decrease the open/close speed index value. This can be done only on the keypad/LCD. Go to the config->device status->misc. device status->open/close speed index. Decrease the value by 1 and then try to capture the baseline FST again. Keep reducing the value until the baseline FST succeeds. *Maintenance FST:* 1. Make sure the supply pressure hasn't changed and is the same when the baseline FST was captured. The supply pressure must be stable and not fluctuating during the signature capture. 2. Make sure there is no change in the physical or environmental conditions like external temperature, process temperature, process pressure. If the baseline FST and the maintenance FST are not performed under identical conditions, it can cause the valve to take longer time to open. If any of these conditions has changed, it is recommended to capture new baseline FST and then capture the maintenance FST. 3. Make sure the valve is not sticking, the exhaust port on the solenoid is not clogged, the solenoid has voltage, the solenoid spool valve and actuator spring hasn't slowed down due to stiffness or due to more load on the valve.

4.2 Open/close signature small

Error on LCD	Open/close sign large
Error on DD/DTM	Open/close signature too small.
What does it mean?	During the calibration, DEPIC-2 measures the valve open/close time and calculates the sampling rate (interval) to capture signature samples. This error indicates that the valve opening/closing time has decreased.
How to resolve?	Follow the steps in order: *Baseline FST:* 1. Make sure the supply pressure hasn't changed and is the same when the calibration was performed 2. Make sure the supply pressure was stable and not fluctuating when the calibration was performed. It can cause the device to calculate wrong opening/closing time if the supply pressure is not stable. Add a pressure regulator if needed 3. Make sure the FST is captured right after the successful calibration and there is no change in the physical or environmental conditions like external temperature, process temperature, process pressure. Perform the calibration again and then capture the baseline FST right after successful calibration 4. Increase the open/close speed index value. This can be done only on the keypad/LCD. Go to the config->device status->misc. device status->open/close speed index. Increase the value by 1 and then try to capture the baseline FST again. Keep increasing the value until the baseline FST succeeds. *Maintenance FST:* 1. Make sure the supply pressure hasn't changed and is the same when the baseline FST was captured. The supply pressure must be stable and not fluctuating during the signature capture. 2. Make sure there is no change in the physical or environmental conditions like external temperature, process temperature, process pressure. If the baseline FST and the maintenance FST are not performed under identical conditions, it can cause the valve to take less time to open/close. If any of these conditions has changed, it is recommended to capture new baseline FST and then capture the maintenance FST. 3. Make sure the valve coupler is not broken, the solenoid has voltage and the valve has the same load when the baseline FST was performed. A change in the process pressure or temperature can change the load on the valve, which can change the valve opening/closing time.

4.3 No signature data

Error on LCD	No sign data
Error on DD/DTM	Baseline signature invalid or never done.
What does it mean?	The DEPIC-2 marks the signature invalid and changes its status upon successful capture of the new signature. This error indicates that the currently captures signature is not a valid signature and it should be ignored.
How to resolve?	Capture the signature again.

4.4 Sign locked

Error on LCD	Sign locked
Error on DD/DTM	Baseline signature cannot be performed, temporarily locked-out awaiting dynamic baseline.
What does it mean?	This error can only come up during the baseline FST signature. The DEPIC-2 can capture the baseline signature either manually or automatically using dynamic baseline feature. This error indicates that the user has enabled to capture the baseline FST automatically through the dynamic baseline so user can't capture it manually at the same time.
How to resolve?	Disable the dynamic baseline FST. This can be done in the config->sign config->dynamic baseline. Try to capture the signature manually after disabling the dynamic baseline.

4.5 Stable pressure timeout

Error on LCD	Stable PSI tout
Error on DD/DTM	Baseline Signature cannot be performed as the pressure is not stable.
What does it mean?	The DEPIC-2 waits for the pressure to stabilize before moving the valve to capture the signature. This error indicates that the pressure wasn't stable and it timed out waiting for the pressure to be stable.
How to resolve?	Follow the steps in order: 1. Make sure the supply pressure is stable before capturing the signature. Add regulator if needed. 2. Increase the calibration timeout period. This can be done in the config->basic config->Disp/Tout. 3. Check the pneumatic connections as per the installation manual.

4.6 Signature aborted

Error on LCD	Sign aborted
Error on DD/DTM	Signature aborted by the user either from HART or keypad.
What does it mean?	The user can abort the signature after starting to capture it. This error indicates that the signature was aborted by the user either from keypad or HART DD/DTM.
How to resolve?	Initiate the signature again to recapture.

4.7 Signature wait timeout

Error on LCD	Sign wait tout
Error on DD/DTM	Baseline Signature time-out waiting for it to be finished.
What does it mean?	This error indicates that the DEPIC-2 started the signature and it is waiting for the valve to open/close but it didn't so it timed out capturing the signature.
How to resolve?	Follow the steps in order: 1. Make sure the solenoid has the voltage. 2. Make sure the valve moves to its complete open/close position during the signature and doesn't get stuck in between. 3. Perform the calibration again and then capture the signature.

5 RUN-TIME DATA COMPARISON AND FAILURES

DEPIC-2 has a sophisticated algorithm to compare the data collected during the baseline FST and the maintenance FST. These data are compared automatically and the run-time data comparison summary is displayed on the DD/DTM. These data can be viewed only after the device has the baseline FST and at least one maintenance FST signature. The failures in the run-time data can be viewed under the "Diagnostics->Full Stroke Signatures->View Full Stroke Signatures->Run-time Data" on the HART DD/DTM. The run-time summary indicates a certain parameter going out of hysteresis value as compared to the baseline FST parameter. However the device must be configured and operated properly to avoid any nuisance run-time signature data failure. This section will explain each parameter in the run-time data comparison report and its related hysteresis value that should be configured to avoid nuisance failure and detect a true failure.

5.1 Open/close supply pressure failure

Error on DD/DTM	Open/close supply pressure failure
What does it mean?	The supply pressure during the valve opening/closing for the maintenance FST was outside the hysteresis as compared to the supply pressure during the baseline FST.
How to resolve?	Follow the steps in order: 1. Check the supply pressure. If it is not stable, add the regulator 2. Check the pressure-1 hysteresis value in "config->alert hysteresis" menu. If the value is too tight, increase it according to the current installation.

5.2 Open/close break time failure

Error on DD/DTM	Open/close break time failure
What does it mean?	The break time recorded for the maintenance FST during valve opening/closing was outside the hysteresis band when compared to the break time recorded for the baseline FST during valve opening/closing.
How to resolve?	Follow the steps in order: 1. Check the supply pressure. Change in supply pressure can change the break time. Make sure to run the maintenance FST at the same supply pressure when the baseline FST was captured. 2. Check the external factors like device temperature, process temperature and pressure. Run the maintenance FST under the same conditions as the baseline FST. The change in process pressure or temperature can change the load on the valve, which can change the break time. 3. Check the exhaust port of the solenoid. If it is clogged, it can increase the break time. 4. Check the coupler that connects the actuator shaft to the valve. A broken or loose coupler can change the break time. 5. Make sure the beacon or magnet assembly is tightly secured and is not shaking due to vibration. 6. Check the open/close time hysteresis value in the "config->alert config" menu. If it is too tight, widen it according to the current application and installation.

5.3 Open/close travel time failure

Error on DD/DTM	Open/close travel time failure
What does it mean?	The travel-time (time after the valve starts movement to the time it travels to the other end) recorded for the maintenance FST during the valve opening/closing was outside the hysteresis band when compared to the travel time recorded for the baseline FST.
How to resolve?	Follow the steps in order: 1. Check the supply pressure. Change in supply pressure can change the travel time. Make sure to run the maintenance FST at the same supply pressure when the baseline FST was captured. 2. Check the external factors like device temperature, process temperature and pressure. Run the maintenance FST under the same conditions as the baseline FST. The change in process pressure or temperature can change the load on the valve, which can change the travel time. 3. Check the exhaust port of the solenoid. If it is clogged, it can increase the travel time. 4. Check the coupler that connects the actuator shaft to the valve. A broken or loose coupler can change the travel time. 5. Make sure the beacon or magnet assembly is tightly secured and is not shaking due to vibration. 6. Check the open/close time hysteresis value in the "config->alert config" menu. If it is too tight, widen it according to the current application and installation.

5.4 Open/close break pressure-1 failure

Error on DD/DTM	Open/close break pressure-1 failure
What does it mean?	The break pressure (pressure measured on sensor-1 when valve starts movement) recorded for the maintenance FST during the valve opening/closing was outside the hysteresis band when compared to the travel time recorded for the baseline FST.
How to resolve?	Follow the steps in order: 1. Check the supply pressure. Change in supply pressure can change the break pressure. Make sure to run the maintenance FST at the same supply pressure when the baseline FST was captured. 2. Check the external factors like device temperature, process temperature and pressure. Run the maintenance FST under the same conditions as the baseline FST. The change in process pressure or temperature can change the load on the valve, which can change the break pressure. 3. Check the exhaust port of the solenoid. If it is clogged, it can change the break pressure. 4. Check the coupler that connects the actuator shaft to the valve. A broken or loose coupler can change the break pressure. 5. Make sure the beacon or magnet assembly is tightly secured and is not shaking due to vibration. 6. Check the open/close position hysteresis value in the "config->alert config" menu. The break pressure is recorded when the valve moves to the position configured in these hysteresis value. The recommended value is 3%. If you change this value, make sure you run the baseline FST first and then run the maintenance FST. 7. Check the pressure-1 hysteresis value in the "config->alert config" menu. If it is too tight, widen it according to the current application and installation.

5.5 Open/close break pressure-2 failure

Error on DD/DTM	Open/close break pressure-2 failure
What does it mean?	The break pressure (pressure measured on sensor-2 when valve starts movement) recorded for the maintenance FST during the valve opening/closing was outside the hysteresis band when compared to the travel time recorded for the baseline FST.
How to resolve?	Follow the steps in order: 1. Check the supply pressure. Change in supply pressure can change the break pressure. Make sure to run the maintenance FST at the same supply pressure when the baseline FST was captured. 2. Check the external factors like device temperature, process temperature and pressure. Run the maintenance FST under the same conditions as the baseline FST. The change in process pressure or temperature can change the load on the valve, which can change the break pressure. 3. Check the exhaust port of the solenoid. If it is clogged, it can change the break pressure. 4. Check the coupler that connects the actuator shaft to the valve. A broken or loose coupler can change the break pressure. 5. Make sure the beacon or magnet assembly is tightly secured and is not shaking due to vibration. 6. Check the open/close position hysteresis value in the "config->alert config" menu. The break pressure is recorded when the valve moves to the position configured in these hysteresis value. The recommended value is 3%. If you change this value, make sure you run the baseline FST first and then run the maintenance FST. 7. Check the pressure-2 hysteresis value in the "config->alert config" menu. If it is too tight, widen it according to the current application and installation.

5.6 Cycle count limit failure

Error on DD/DTM	Cycle count limit failure
What does it mean?	This error indicates that the cycle count on the maintenance FST has exceeded the configured cycle count limit.
How to resolve?	Follow the steps in order: 1. Reconfigure the cycle count limit. This can be done in "config->alarm config->cycle alarm->cycle limit".

6 FAQS

This section is designed to answer many frequently asked questions regarding the operation of the DEPIC-2. It is divided into different sections based on the functionality of the device for easy navigation. For complete details of the device installation and datasheet, it is recommended to read the installation and operation manual.

6.1 Calibration

This section answers the common questions asked by the user regarding calibration of the device. It is assumed the user has installed the device and magnet assembly as per the installation manual and connected the air supply as per the pneumatic connections.

1. **When I perform an auto calibration, it fails with an error**
   The auto calibration can fail for various reasons. Please refer to the section 2 "Calibration Errors" of this document to resolve the calibration error
2. **When I try to perform the calibration, it asks to configure the clock**
   The clock must be configured on the device before any other function can be performed. Please configure the clock in the "config->date/time->set new clock"
3. **When I try to perform the calibration, it gives an error "Another process active, try later"**
   The DEPIC-2 allows only one function to be performed at a time. This error indicates that there is another active process running. Check the keypad/LCD or DD/DTM to make sure there is no other process running. Also make sure the solenoid has the voltage and valve is in fully energized positon. If the solenoid voltage is lost, the device might be in the ESD mode where any other function is prohibited. If the device is configured for duplex (redundant solenoid) option, make sure both solenoids have the voltage.

6.2 PST/SOVT

1. **I DO NOT see an option to perform PST in diagnostics menu**
   The FST function is controlled through two settings. Make sure the device control setting is enabled in the "config->basic config" menu and the PST setting is enabled in the "config->PST config" menu
2. **When I try to perform the PST, it gives an error "Another process active, try later"**
   The DEPIC-2 allows only one function to be performed at a time. This error indicates that there is another active process running. Check the keypad/LCD or DD/DTM to make sure there is no other process running. Also make sure the solenoid has the voltage and valve is in fully energized positon. If the solenoid voltage is lost, the device might be in the ESD mode where any other function is prohibited. If the device is configured for duplex (redundant solenoid) option, make sure both solenoids have the voltage.
3. **When I perform the PST, it fails with an error**
   The PST can fail for many reasons. Please refer to the section 3 "PST/SOVT Errors" to resolve the issue.

6.3 FST

1. **I DO NOT see an option to perform FST in diagnostics menu**
   The FST function is controlled through two settings. Make sure the device control setting is enabled in the "config->basic config" menu and the signature setting is enabled in the "config->sign config" menu.
2. **When I try to perform the FST, it gives an error "Another process active, try later"**
   The DEPIC-2 allows only one function to be performed at a time. This error indicates that there is another active process running. Check the keypad/LCD or DD/DTM to make sure there is no other process running. Also make sure the solenoid has the voltage and valve is in fully energized positon. If the solenoid voltage is lost, the device might be in the ESD mode where any other function is prohibited. If the device is configured for duplex (redundant solenoid) option, make sure both solenoids have the voltage.
3. **When I perform the FST, it fails with an error**
   The FST can fail for many reasons. Please refer to the section 4 "FST Errors" to resolve the issue.

6.4 HART Communication

1. **When I try to communicate with the device using HART communicator or other host system, it cannot communicate with the device**
   There could be multiple reasons for device not communication with the HART communicator. Please follow the steps below to diagnose the issue:
   - The device MUST have at least 3.8 mA for HART communication. Connect the current meter and make sure the device has 3.8 mA or above.
   - There should be a 250Ω resistor to match the impedance between the power supply and the device.
   - If using the 475 simulator or other host system, make sure it is configured with the correct I/O and the COM port.
   - Check the polling address of the DEPIC-2 and make sure the 475 or host system is configured to scan that polling address. The polling address of the DEPIC-2 can be found under "config->Loop Current Mode->Polling Address".
   - Make sure the HART communication modem is an approved device from HART and it is connected to DEPIC-2.
   - Make sure you are using the correct DD. The latest DD can be downloaded from www.hartcomm.org website for manufacture "Westlock Controls" and the device type "Digital EPIC-2".
2. **I want to configure DEPIC-2 for multi-drop mode OR I want to disable the loop current**
   Change following two settings to configure DEPIC-2 in multi-drop mode:
   - Disable the loop current mode. This can be done from the "Config->Loop Current Mode->Loop Current Mode" menu.
   - Change the polling address of DEPIC-2. This can be done from "Config->Loop Current Mode->Polling Address".

6.5 Position transmitter and output current

1. **After I finish auto calibration, the LCD shows 19.7 mA for 100% position or 3.9 mA for 0% position**
   The DEPIC-2 is calibrated with the default values of mA at the factory. However these values can deviate for every device and installation due to tolerances of components, impedances of wiring etc. It is recommended to perform mA calibration after auto calibration to get an accurate reading of the transmitter output current. The mA calibration can be done through keypad/LCD or DD/DTM from the calibration menu.
2. **I DO NOT see an option to perform auto calibration in the calibration menu**
   The auto calibration option is controlled through the setting "device control" in the "config->basic config" menu. Enable this setting and the go back to the calibration menu to perform auto calibration.
3. **I performed the calibration and the device was operating correctly and showing correct position and mA current. However after few weeks/months, I see the position drifting from its calibrated values**
   There might be many reasons for the position drift over time. Please check following:
   - Make sure there is enough supply pressure to close/open the valve completely.
   - Make sure the beacon/magnet assembly is tightly secured and hasn't loosened due to vibration over the time.
   - Make sure the coupler that connects the actuator shaft to the valve is tightly secured and is not loose.
   - If there was a huge change in the temperature (> 50F) when the device was calibrated, it is recommended to perform the low/high calibration to read new position values and cancel any drift caused due to temperature shift.
   - If the drift is causing any nuisance alarm, it can be shut off by increasing the open/close position hysteresis in the "config->alert hysteresis" menu.
4. **My device currently shows 20 mA for 100% position and 4 mA for 0% position. However I want it to be reversed so that I can have 4 mA for 100% position and 20 mA for 0% position**
   Perform the reverse mA calibration. This can only be done from Keypad/ LCD. Go to the menu calibration->mA calibration->Reverse mA calibration. Once it is finished the device should show the mA values reversed.

5. **My device currently shows 21 mA on the LCD. It says "Fixed" above the mA**
   The device goes into 21 mA fixed current mode anytime a PST/SOVT is performed and it fails. Perform another PST/SOVT successfully to get the device back into normal mode. If the PST/SOVT cannot be performed successfully at this time, follow the steps below to get out of fixed current mode temporarily.
   - Go to the "Diagnostics->Fixed mA Test->End fixed mA" on the Keypad/LCD menu.
   - After the fixed mA test is ended, the device should show the mA based on the current position of the valve and should get out of the 21 mA fixed current mode.
6. **My device currently shows 4 mA on the LCD. It says "Fixed" above the mA**
   The device goes into 4 mA fixed current mode when the loop current mode is disabled. Enable the loop current to get out of this mode. This can be done from "Config->Loop Current Mode->Loop Current Mode" setting.

6.6 Keypad/LCD

1. **My device currently shows "KPAD-LOCK" on the LCD**
   The device locks up the keypad when the mA calibration is initiated from the HART DD or DTM to prevent access to someone performing same task from keypad at the same time. This message on the LCD should go away when the user finishes mA calibration from HART DD/DTM. In some cases, if the user aborts the mA calibration or doesn't finish it completely from HART DD/DTM, the device might be stuck in this mode waiting for the user to finish his actions. However if the user wants, he can reboot the DEPIC-2 to get out of this mode. The user can reboot the DEPIC-2 by going into the menu "Diagnostics->Reboot DEPIC".
2. **My device currently shows the temperature in Fahrenheit on the LCD. How can I change it display in Celsius?**
   This can be done either from HART DD/DTM or Keypad/LCD by changing the setting "temp display" in "config->basic config->disp/tout (UI config)".
3. **My device currently shows different abbreviated messages on the bottom right corner of the LCD and they change automatically. What should I do?**
   The DEPIC-2 has a smart user interface to guide the user of any missing setup step or any action user should be aware of. The messages on the bottom right corner are guiding the user to perform that action to complete the setup. Once all steps are finished, it should change to "OK" status message in this area. Please refer to the operation manual for details of each message.
4. **My device currently shows "ALT-X" on the bottom left corner of the LCD and the number changes automatically. What should I do?**
   The DEPIC-2 has a smart user interface to guide the user of any potential alert conditions. The message "ALT" is advising the user the total number of active alerts on the device since the device was last powered up. If the number is more than zero, it means the device has an active alert, which the user should take some action to clear it. The details of active alerts can be found using HART DD/DTM or Keypad/LCD from the menu "Device Status->Alert File->View Active Alerts".

Engineering document reference
This trouble shooting guide is based on the latest engineering update, and form part of the document package 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-05045-EN as checked by engineering team and therefore the original English document will prevail. No rights or liability can be derived from any translation.

Previous documents
VCIOM-05045 replaces all previous ' troubleshooting guide' documents for the DEPIC-2 series including NPD-2015-041.

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