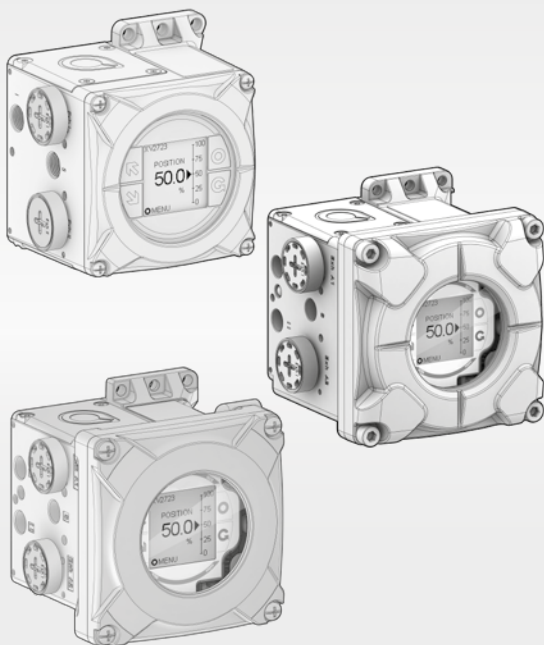


Neles™ NDX™ Intelligent valve controller

Pocket reference guide



Find detailed information and warnings from these links:

IMOs 7NDX70, 7NDX71, and 7NDX72



Software download



Training videos



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1. Sign Product Group

NDX Intelligent valve controller

2. Sign Pneumatic Action

- 1 Single acting
- 2 Double acting

3. Sign Pneumatic Capacity

- 5 Normal (80 Nm³/h)

4. Sign Fail Action

- 1 Fail safe

5. Sign Enclosure

- 0 Compact
- 1 Standard
- 2 Flameproof/Explosion Proof

6. Sign Communication/Input signal range

- H 4-20mA with HART communication
- T 4-20mA with HART+PT
- F Foundation Fieldbus

7. Sign Temperature Range

- G General (-40°C...+85°C/-40°F...+185°F)

(Signs 9, 10, 11, & 13 are options; see Bulletin or IMO for details)

- Be sure air supply is connected and a minimum of 3.8 mA power is supplied
- Set Filter Regulator (40 micron recommended):
For D/A actuators, set approx. 0.7 bar/10 psi below minimum expected air supply pressure.
- For S/A actuators, set at no more than 1 bar/14.5 psi higher than spring rating.
- (For spring ratings below 3.1 bar/45 psi, set at 4.1 bar/60 psi)



Do not exceed the actuator's pressure rating and do not exceed 8 bar/116 psi.

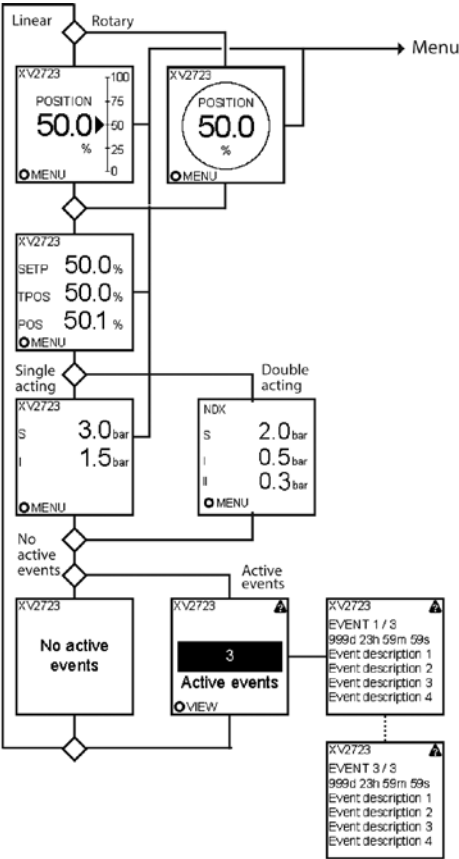
- For rotary applications the rotary magnet will thread directly into the actuator's driver arm (M6 thread). Use spacers or take spacers out to allow for a maximum distance of 5mm/0.2" between the NDX and the magnet. Ensure the NDX and magnet are not contacting.
- For linear applications, the bar magnet will connect to the stem of the linear actuator and the NDX must be mounted to align the channel on the back of the device with the magnet.
- Once the mounting has been completed, per the IMO, the air supply and power can be connected to begin the commissioning.

Press the up/down arrow buttons to scroll through the main measurement displays and to view any active events. User can select one of these main displays which will stay on the LUI.

- 1.** Valve position shown in percentage in numerical and graphical format.
- 2.** Setpoint, target position and actual valve position in percentage, setpoint is configurable also for mA.
- 3.** Supply pressure and actuator pressure(s) in bar (default) or psi.
- 4.** Number of active events (if any) and their descriptions listed.

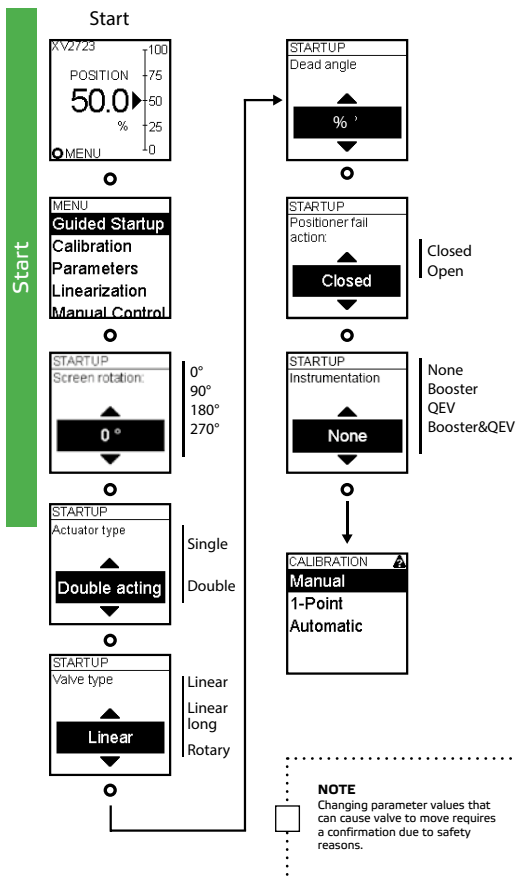
Tag name is shown in all views in the upper left corner.

Measurement monitoring



Guided start-up menu

8



Parameters

To open the main menu, press menu button. Select **Parameters** and press enter to open Parameters menu. In this menu the most important assembly related parameters can be configured and also there are some user interface modification parameters available.

MENU
Guided Startup
Calibration
Parameters
Linearization
Manual Control

Language

- Display language can be changed, available **languages** are English, Chinese, Spanish, Italian, French, Korean, German, Turkish, Dutch, Portuguese.
- Once Language is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.

PARAMETERS
Language
English
Valve type
Linear
Positioner fail action
Closed

Actuator type

- This parameter defines if actuator is **Single Acting** (spring return) or **Double Acting**.
- Once Actuator type is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.
- If single acting actuator is selected, Pneumatics Connection-parameter is always I.
- Once Pneumatics Connection is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.

PARAMETERS	
Language	English
Actuator type	Single acting
Valve type	

Valve Type

- This parameter defines if device is mounted on a **Linear** valve or **Rotary** valve. In the main menu there is different position indicator depending on which valve type is selected.
- If device has an option for **linear long** (stroke length 120-220 mm), it will show in the menu.
- Once Valve type is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.

PARAMETERS	
Language	English
Valve type	Linear
Positioner fail action	Closed

Dead angle

- This setting compensates for the inherent **"Dead angle"** (a0) which is the amount of rotation without flow within rotary valves. The entire signal range is then used to control the effective valve opening, (90 - a0).
- Once Dead angle is selected, press enter to edit the value. Change value with arrow keys and confirm that with enter (see IMO for Dead angle parameters).

PARAMETERS
Valve type
Rotary
Dead angle
0.0%
Positioner fail action

Positioner fail action

- Positioner fail action will take place in case of signal or supply pressure failure or when the controller software discovers a fatal device failure. For single acting actuators set value in the spring direction (Open or Close). This means that changing this parameter will not change actual fail action, this parameter tells the device which is the actual fail action direction defined by the actuator.
- Once positioner fail action is selected, press enter to edit the parameter. Select or change value with arrow keys and confirm that with enter.

PARAMETERS
Tag
XV1234
Valve type
Linear
Positioner fail action
Closed

Performance level

- This parameter defines the **performance level** for the valve control.
- Following performance level options can be selected: Max Stability, Stable, Optimum (factory default), Fast, Aggressive, Max Stability FO, Stable FO, Optimum FO, Fast FO, Aggressive FO. PSA1 (Opt), PSA2 (Fast) and PSA3 (Aggr).
- **Max Stability:** Slowest response to signal changes and no overshoot. Trying to keep the valve position as stable as possible.
Stable: Fairly slow response to signal changes and no overshoot.
Optimum (factory default): Optimum performance controlling the valve regarding response time and valve speed when signal changes. There is typically no overshoot.
Fast: Fast response to signal changes but may also have small overshoot.
Aggressive: Fastest possible response to signal changes and typically some overshoot.
- FO = **Fast Open**; The reaction time to setpoint change will be faster when recovering from the cut-off position.
- Max Stability FO, Stable FO, Optimum FO, Fast FO, Aggressive FO: Similar behavior than in above mentioned performance levels respectively, but always faster recovering from cut-off than above

PARAMETERS	
valve type	Linear
Positioner fail action	Close
Performance level	Optimum

because of fast open (FO) function.

- Once Performance level is selected, press enter to edit the parameter. Change value with arrow keys and confirm that with enter.
 - PSA modes where fastest possible setpoint tracking is optimized. Small pressure will remain in the actuator when valve is closed to reduce the delay on opening and have minimum possible opening time. Optimum, Fast and Aggressive options in PSA modes are similar to explained above.
-

Dead zone target

- The dead zone target defines a small range around the desired setpoint where the controller allows minor deviation without constantly trying to correct them. This helps avoid unnecessary adjustments and keeps the control stable.
- **Default setting:** 0.3% - Works well in most situations.
- **Minimum setting:** 0.01% - Use this if you need very precise control and your valve setup allows it.
- **Maximum setting:** 0.5% - Recommended if the system shows repetitive movement due to friction.

PARAMETERS
None
Symmetry
1.00
Dead zone target
0.30%

Cut-off closed

- **Cut-off closed** is used with valves that require great torque to be closed. It is used to ensure that the valve is fully closed at a 4-mA input signal.
- When this value is exceeded, the valve is forced to a 0 % position. This is called the tight cut-off feature. If, for example, the value is 2 %, tight shut-off starts when the input signal goes below 2 %, then valve is closed with full actuator force.
- Once Cut-off closed is selected, press enter to edit the parameter. Change value with arrow keys and confirm that with enter.

PARAMETERS
valve type
Linear
Positioner fail action
Closed
Cut-off closed
0.0 %

Signal direction (HART only)

- This parameter defines opening and closing direction of the valve with rising current loop signal. The value **Rising** signifies the increasing mA signal to open the valve and **Falling** means the decreasing mA signal to open the valve.
- Once signal direction is selected, press enter to edit the parameter. Select or change value with arrow keys and confirm that with enter.

PARAMETERS
Positioner fail action
Closed
Cut-off closed
0.0 %
Signal direction
Rising

Instrumentation

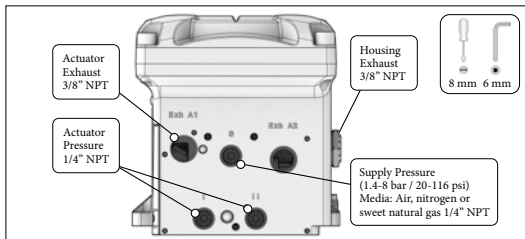
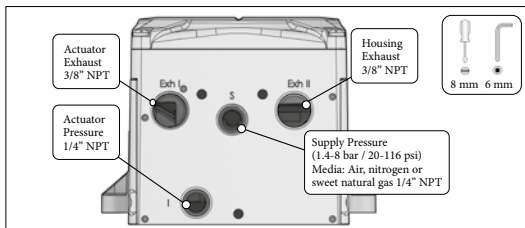
- This parameter defines additional instrumentation for the fast valve opening and/ or closing.
- Following **Instrumentation** options can be selected: None, Booster, QEV, Booster&QEV and Restrictor. The default value is None meaning that there are no additional instrumentation in the valve assembly. If there is a volume booster in the assembly, select Booster. If there is a quick exhaust valve in the assembly, select QEV. If there is a combination of volume boosters and quick exhaust valves in the assembly, select Booster&QEV. If there is restrictor in pneumatic pipe between NDX and actuator to limit operation speed, select restrictor.
- Once instrumentation option is selected, press enter to edit the parameter. Change value with arrow keys and confirm that with enter.

INSTRUMENTATION
None
Booster
QEV
Booster&QEV
Restrictor

Pneumatic connections

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Pneumatics piping



NOTE

NDX251_ is equipped with double acting pneumatics relay, but it can also be used with single acting spring return actuator when port II is plugged.

NOTE

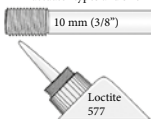
When NDX251_ is used with single acting actuator, port II needs to be plugged. Install steel plug with 6 mm hexagon wrench.

WARNING

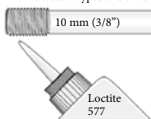
Do not exceed the maximum supply pressure of the actuator!

A filter regulator is not a safety device! Adjust the network pressure below the maximum pressure of all actuators or use pressure relief valves. Do not exceed the permitted supply pressure (8 bar / 115 psi) of the NDX.

Supply Pressure (S)
All actuator types and size



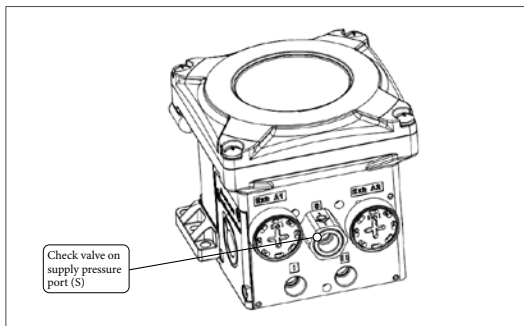
Actuator Pressure (I and II)
All actuator types and sizes



Pneumatic connections

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Check Valve information



CAUTION

If double acting version of NDX (NDX251_) is installed on single acting actuator, the check valve must be removed.

CAUTION

Do not remove or dismantle a pressurized controller!

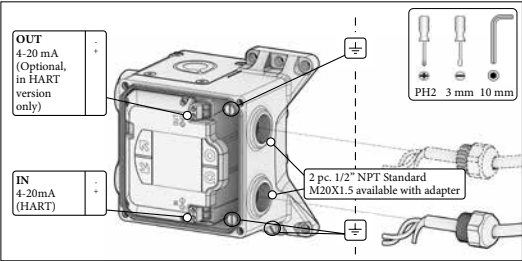
Always shut off the supply air and release the pressure from the pipelines and equipment before removing or dismantling the controller. Otherwise personal injury and damage to equipment may result.

Do not rely on the pressure gauge readings alone to verify that the controller is not pressurized! Compare to local user interface reading or additional gauge.

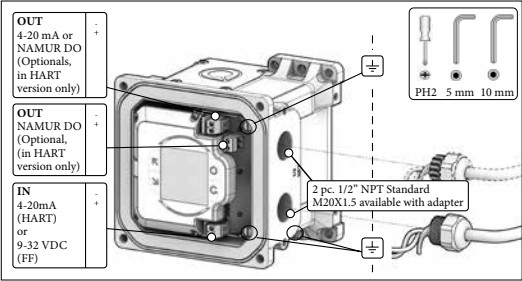
The check valve installed with double acting actuators (see picture above) will keep the NDX and actuator pressurized even after the air supply is disconnected.

NOTE

Supply pressure to NDX can drop due to varying air consumption of other connected devices in the same supply pressure line. If the supply pressure drops below the actuator pressure (ports I or II), the actuator pressure is dropping to the level of supply pressure. The air is then actually flowing from the cylinder to the supply line and the valve could move. This backflow is prevented by the check valve in NDX.



Connector	Function	Power Source	Min. Power	Impedance	Other
IN	Setpoint / HART	4-20 mA Loop Power	3.8 mA, 9.7 VDC	485 Ω at 20 mA	
OUT	Position Transmitter	External 12 ... 30 VDC		780 Ω max, 690 Ω for I.S.	Fail safe output is 3.5 mA or 22.5 mA



NOTE

HART modem can be connected to "IN 4-20mA" connection loop or metal clips found next to the "IN" +/- terminals.

Alarm/Warning Descriptions

Control performance

Status	Status description
Open Position Drifting Alarm Limit Exceeded	Valve fully open position measurement is not within expected limits.
PROPOSED ACTIONS	
Check drift direction from Open Position Drifting trend.	
In case of negative average value, perform the following checks.	
• Check NDX magnet installation and installation bracket between NDX and actuator. • Check for residue or mechanical damage in the trim or valve. • Spring to close actuator, supply pressure could be not high enough to compress the spring fully. • Spring to open actuator, spring could be damaged. • In case of globe valve, check valve trim and shaft clamp connection. Autocalibration of globe valve without mechanical limit stopper could cause this alarm. • In case of eccentric disc valve, check valve trim and valve shaft connection. Disc valve shaft could be permanently twisted. • In case of ball valve, check actuator travel limit stopper and valve shaft connection. Ball valve shaft could be permanently twisted.	
In case of positive average value, perform the following checks.	
• Check NDX magnet installation and installation bracket between NDX and actuator. • Check installation bracket between valve and actuator. • In case of globe valve, check valve trim and shaft clamp connection. • In case of eccentric disc valve, check valve trim and valve shaft connection. Disc valve shaft could be permanently twisted. • In case of ball valve, check actuator travel limit stopper and valve shaft connection. Ball valve shaft could be permanently twisted.	
Closed Position Drifting Alarm Limit Exceeded	Valve fully closed position measurement is not within expected limits.
PROPOSED ACTIONS	
Check drift direction from Closed Position Drifting trend.	
In case of negative average value, perform the following checks.	
• Check NDX magnet installation and installation bracket between NDX and actuator. • Check installation bracket between valve and actuator. • In case of globe valve, check valve trim and shaft clamp connection. • In case of eccentric disc valve, check valve trim and valve shaft connection. Disc valve shaft could be permanently twisted. • In case of ball valve, check actuator travel limit stopper and valve shaft connection. Ball valve shaft could be permanently twisted.	
In case of positive average value, perform the following checks.	
• Check NDX magnet installation and installation bracket between NDX and actuator. • Check for residue or mechanical damage in the trim or valve. • Spring to open actuator, supply pressure could be not high enough to compress the spring fully. • Spring to close actuator, spring could be damaged. • In case of globe valve, check valve trim and shaft clamp connection. • In case of eccentric disc valve, check valve trim and valve shaft connection. Disc valve shaft could be permanently twisted. • In case of ball valve, check actuator travel limit stopper and valve shaft connection. Ball valve shaft could be permanently twisted.	

Alarm/Warning Descriptions

Control performance

Status	Status description
Steady State Deviation Control Warning Limit Exceeded	Increased friction in valve or actuator, leakage in pneumatics or insufficient supply pressure.
PROPOSED ACTIONS Inspect steady state deviation control trend to determine if there have been any recent significant increases. Evaluate if limits and timeout (premium diag) or latch time (advanced diag) are correctly set. Check previous alarms for prior conditions. Check actuator for pneumatics leakage and that valve is able to move in whole operating range. Run calibration if needed (calibration will help to compensate changed operating conditions) and check performance. Check valve at next maintenance opportunity.	
Steady State Deviation Control Alarm Limit Exceeded	Increased friction in valve or actuator, leakage in pneumatics or insufficient supply pressure.
PROPOSED ACTIONS Inspect steady state deviation control trend to determine if there have been any recent significant increases. Evaluate if limits and timeout (premium diag) or latch time (advanced diag) are correctly set. Check previous alarms for prior conditions. Check actuator for pneumatics leakage and that valve is able to move in whole operating range. Run calibration if needed (calibration will help to compensate changed operating conditions) and check performance. Check valve at next maintenance opportunity.	
Dynamic State Deviation Warning Limit Exceeded	Valve position is not able to follow setpoint as fast as expected.
PROPOSED ACTIONS Large dynamic state deviation can be a result of small air capacity, due to small piping. Also, an increase in dynamic state deviation can be caused by dirty supply air filters, friction or anything that can cause slower movement. The absolute value of the dynamic state deviation is not important, only changes should be monitored. Dynamic state deviation value also depends on the process conditions and the application (control valve or on/off valve like PSA applications). In on-off applications the values are typically high. Changes in the operation of the valve influences the trend. The dynamic state deviation trend is influenced by the supply pressure level, supply pressure capacity, piping, performance level, as well as calibration and tuning of the device. This should be noted when interpreting changes in the trend. If there is a big actuator and setpoint changes are usually quite big, the trend shows that there is dynamic deviation. The reason for this is that a big actuator is slow and takes some time to reach the setpoint. Also check the event log if there are supply pressure problem events. Especially if there are several devices with the same problem, check that supply air filter is not blocked (dirt, frozen,...). If dynamic state deviation has increased and there is volume booster installed, check also condition of booster. There can be also leakage in diaphragms or it can be stuck.	
Hunting Detected	Improper selection of position control performance level. If there are boosters, the hunting may be caused by those.
PROPOSED ACTIONS Check position control performance level, possibly change to less aggressive to stabilize valve. Try to open booster bypass valve. The correct way to tune the boosters is commonly to adjust those so that boosters are not active if you make step change less than 5 percent and if step size is larger than 5 percent boosters will be active. Check valve at next maintenance opportunity.	

Alarm/Warning Descriptions

Positioner

Status	Status description
Total Operation Time Limit Exceeded	User-defined limit exceeded.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Total Operation Time Limit in DTM/EDD Status Configuration view.	
Supply Pressure Sensor Failure	Supply pressure measurement is faulty. Control performance is reduced.
PROPOSED ACTIONS Change the printed circuit board module to a new one during next maintenance activity. Follow instructions in User Guide.	
Setpoint Sensor Failure	mA measurement failed.
PROPOSED ACTIONS Change the printed circuit board module to a new one and calibrate device. Follow instructions in User Guide.	
Prestage Short-Circuit	Short-Circuit in the prestage unit. Device will go to Failsafe position.
PROPOSED ACTIONS Change Prestage unit and calibrate device. Follow instructions in User Guide.	
Position Sensor Failure	Position measurement faulty.
PROPOSED ACTIONS Change the printed circuit board module to a new one and calibrate device. Follow instructions in User Guide.	
Prestage Open Circuit	Prestage wire is cut or connector is loose.
PROPOSED ACTIONS Change Prestage unit and calibrate device. Follow instructions in User Guide.	
Position Transmitter Not Connected	Position transmitter is available. External supply voltage is not connected.
PROPOSED ACTIONS Connect external supply voltage or disable status in DTM/EDD Status Configuration view.	
Missing Position Feedback Magnet	Position feedback magnet is missing.
PROPOSED ACTIONS Check magnet installation. Calibrate the device.	

Alarm/Warning Descriptions

Positioner

Status	Status description
Actuator Pressure Sensor Failure	Actuator pressure sensor has failed. Control performance is reduced.
PROPOSED ACTIONS Change the printed circuit board module to a new one during next maintenance activity. Follow instructions in User Guide.	
Electronics Problem	Electronics problem in the device.
PROPOSED ACTIONS Replace printed circuit board module. Follow instructions in User Guide.	
Failsafe Activated	Linear magnet not detected. Setpoint sensor or position sensor has failed.
PROPOSED ACTIONS Check position feedback magnet and recalibrate the device. Replace printed circuit board module. Follow instructions in User Guide.	

Alarm/Warning Descriptions

Actuator

Status	Status description
Total Actuator Travel Limit Exceeded	User-defined limit exceeded.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Total Actuator Travel Limit in DTM/EDD Status Configuration view.	
Total Actuator Reversals Limit Exceeded	User-defined limit exceeded.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Total Actuator Reversals Limit in DTM/EDD Status Configuration view.	

Alarm/Warning Descriptions

Valve

Status	Status description
Total Valve Travel Limit Exceeded	User-defined limit exceeded.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Total Valve Travel Limit in DTM/EDD Status Configuration view.	
Total Valve Reversals Limit Exceeded	User-defined limit exceeded.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Total Valve Reversals Limit in DTM/EDD Status Configuration view.	
Valve Position Above High Limit	Valve position is above high limit.
PROPOSED ACTIONS Check that valve is able to move in whole operating range and reason why range is exceeded. Run calibration if needed (calibration will help to compensate changed operating conditions) and check performance.	
Valve Position Below Low Limit	Valve position is below low limit.
PROPOSED ACTIONS Check that valve is able to move in whole operating range and reason why range is exceeded. Run calibration if needed (calibration will help to compensate changed operating conditions) and check performance.	
Maximum Stiction Too High	Maximum stiction is above high limit. Valve or actuator static friction has increased. This may cause accuracy problems and ultimately prevent valve from moving.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Maximum Stiction High Limit in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	
Minimum Stiction Too Low	Minimum stiction is below low limit. Valve or actuator static friction has decreased. This may indicate problems such as intensive wear or shaft break.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Minimum Stiction Low Limit in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	
Pressure For Opening Too High	Pressure for opening is above high limit.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Load For Opening High Limit in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	
Pressure For Opening Too Low	Pressure for opening is below low limit.
PROPOSED ACTIONS Review device performance. If performance is adequate, increase Load For Opening Low Limit exceeded in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	

Alarm/Warning Descriptions

Operating condition

Status	Status description
Temperature Above High Limit	Positioner has detected that the temperature is above specification limits.
PROPOSED ACTIONS Inspect the positioner and operating conditions.	
Temperature Below Low Limit	Positioner has detected that the temperature is below specification limits.
PROPOSED ACTIONS Inspect the positioner and operating conditions.	
Supply Pressure Above High Limit	Positioner diagnostics have detected that instrument air pressure to positioner is above acceptable limits.
PROPOSED ACTIONS Check supply pressure level.	
Supply Pressure Below Low Limit	Positioner diagnostics have detected that instrument air pressure to positioner is below acceptable limits.
PROPOSED ACTIONS Check supply pressure level and supply pressure capacity.	
Calibration Recommended	Previous calibration was cancelled, single point calibration is used, an assembly-related parameter was changed (actuator type, valve type, positioner fail action or pneumatic connection), the device is unable to detect the magnet in the whole position range, or factory default parameters were taken in use.
PROPOSED ACTIONS Run position calibration. If the device is unable to detect the magnet, first check that the magnet is installed according to the User Guide, then re-calibrate.	
Calibration Required	Calibration required prior to use.
PROPOSED ACTIONS Device needs to be configured and calibrated before it is switched to automatic control mode. Follow the instructions on the LUI first screen and proceed to guided start-up.	
Supply Pressure Too Low for Single-Acting Actuator	Instrument air pressure to positioner is too low to drive valve for whole operation range.
PROPOSED ACTIONS Check supply pressure level and supply pressure capacity.	
Cover Is Open	Cover is opened.
PROPOSED ACTIONS Check that cover is not left open by accident.	



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