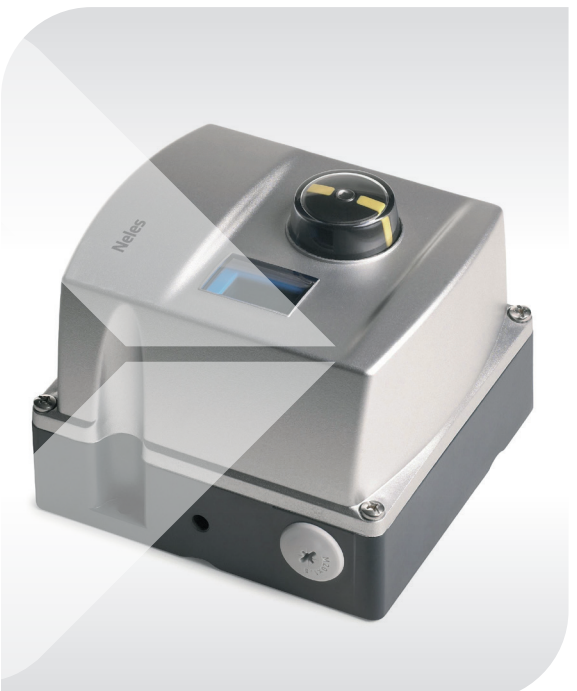
ND9000™ valve controller

Pocket reference guide for revision 4.0



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ND9000 type coding

1. Sign **Product group**

ND Intelligent valve controller

2. Sign **Series code**

9

3. Sign **Enclosure**

10 Standard IP66 / NEMA 4X
20 Flameproof (Ex d) IP66 / NEMA 4X
30 Stainless Steel Flameproof (Ex d) IP66 / NEMA 4X

4. Sign **Spool valve**

2 Low Capacity. Actuator < 1 dm^3
3 Medium Capacity. Actuator 1…3 dm^3
6 High Capacity. Actuator > 3 dm^3

5. Sign **Communication/Input signal range**

H 4-20 mA, HART communication
F Foundation fieldbus
P Profibus PA

(Signs 6, 7, 8, & 9 are options; see IMO for details)

Neles actuator to ND9000 combinations

Neles actuator to ND9000 combinations				
Spool	**QP**	**B1J(A)**	**B1C**	**Stroke volume**
2	1	6	6	<1 dm^3
3	1*, 2, 3	8, 10	6*, 9, 11, 13	1-3 dm^3
6	4, 5, 6	12-322	17-502	>3 dm^3

* Spool size 2 is preferred for accurate control and standard for Neles Control Valves.
Spool size 3 can be used if fast stroke times are required.

Mounting Tips

The ND9000 will only function in the pre-set 90º quadrant, see photo on page 4.

If this is done incorrectly, error "Calibration Failed Due to Valve Position Out of Range" can occur during calibration.

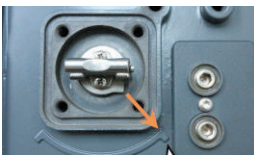
- Be sure air supply is connected and a minimum of 3.6 mA power is supplied.
- Set Filter Regulator:
  For D/A actuators, set approx. 10 PSI below minimum expected air supply pressure.
  For S/A actuators, set at no more than 14.5 psi higher than spring rating.
  (For spring ratings below 45 psi, set at 60 psi.)

Do not exceed the actuator's pressure rating and do not exceed 115 psi.

- When inserting the H-Clip into the bracket, ensure that the H-Clip is straight.
- Once the mounting has been completed, per the IMO, the air supply and power can be connected to begin the commissioning.

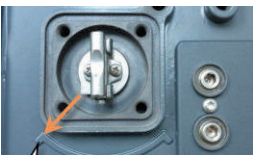
Shaft pointer position prior to mounting on actuator

Note: pointer must rotate within the arc



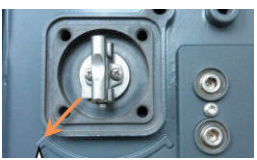
Fail Position:
Close

Rotation:
Clockwise to Close



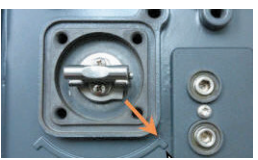
Fail Position:
Open

Rotation:
Clockwise to Close



Fail Position:
Close

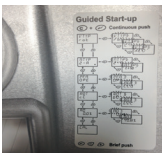
Rotation:
Counterclockwise to Close



Fail Position:
Open

Rotation:
Counterclockwise to Close

Measurement monitoring



Remove cover.
Notice the function menu on the inside of the exterior cover.

LCD indicates POS, valve position (% [DEFAULT], ANG).

Press the [+] key once.
The LCD displays TPOS, target position (%).

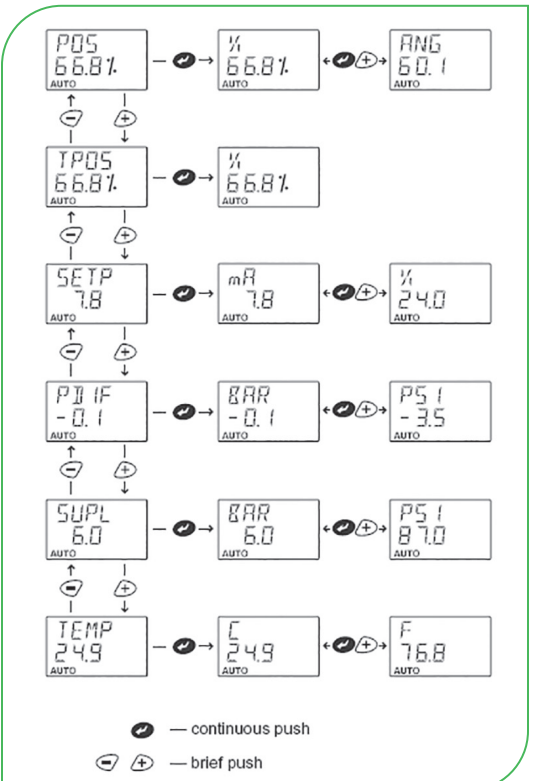
Press the [+] key once.
The LCD displays SETP, setpoint (mA [DEFAULT], %)

Press the [+] key once.
The LCD displays PDIF, actuator pressure differential (BAR [DEFAULT], PSI)

Press the [+] key once.
The LCD displays SUPL,
supply pressure
(BAR [DEFAULT], PSI)

Press the [+] once.
The LCD display TEMP,
temperature (C [DEFAULT], F)

Changing the units in measurement monitoring



Guided start-up menu

Press [C] and [↲] keys simultaneously.

Guided start-up menu		
VTYPE (Valve type)*	Rot Lin nCG FLI	Rotary valve Linear valve (corrected for nonlinearity) NelesCV globe valve Linear valve (not corrected)
ATYPE (Actuator type)*	2-A 1-A	Double-acting Single-acting
PFA (Positioner fail action)*	CLO OPE	Fail closed Fail open
ROT (Valve rotation direction)*	cC ccC	Clockwise to close Counterclockwise to close
A0 (Valve dead angle)	A0 – 0%	(Default), set as required by valve type
CAL (Calibration)	AUTO CAL MAN CAL 1-PT CAL ANG LCAL 3P LCAL 9P	Automatic calibration Manual calibration 1 Point calibration Maximum tuning angle 3-point linearization 9-point linearization

* Modifying this parameter requires calibrating and tuning of the device.

Configuration menu

Press [+] and [-] keys simultaneously.

Configuration menu		
MODE (Mode menu)	AUTO	Controlled by 4-20mA input signal
	MAN	Manually controlled by keypad
PAR (Configuration parameters)	**PERF (Performance Level)**	
	A(1)	Agressive
	B(1)	Fast
	C(1)	Optimum
	D(1)	Stable
	E	Maximum stability(1) is for volume boosted and/ or very fast actuators
	CUTL (Low cut-off)	
	2.0%	(Default), adjust as necessary
	DIR (Signal Direction)	
	OPE	Rising signal to open
	CLO	Rising signal to close
	VTYP (Valve Type)*	
	Rot	Rotary valve
	Lin	Linear valve (corrected for nonlinearity)
	nCG	NelesCV globe valve
	FLI	Linear valve (not corrected)
	ATYP (Actuator Type)*	
	1-A	Single acting actuator
	2-A	Double acting actuator

* Modifying this parameter requires calibrating and tuning of the device.

Configuration menu	
PAR (Configuration parameters)	**PFA (Positioner fail action)*** CLO Closed OPE Open
	ROT (Valve rotation direction)* cC Clockwise to close ccC Counterclockwise to close
	A0 (Valve dead angle) 0% (Default), set as required by valve type
	HRTI (Hart version) 6 HART 6 (Default) 7 HART 7
	LANG EnG English GEr German FrE French
CAL (Valve travel calibration)	AUTO CAL Automatic calibration MAN CAL Manual calibration 1-PT CAL 1 Point calibration ANG Maximum tuning angle LCAL 3P 3-point linearization LCAL 9P 9-point linearization

* Modifying this parameter requires calibrating and tuning of the device.

As a general rule: [↲] selects anything so it is blinking and enters menus. [+] and [-] change anything that is blinking and move between menus/settings. [C] cancels any action and returns the user interface view up one level.

Configuring the positioner

Press the [+] and [-] simultaneously to access the Configuration Menu (refer to chart on pg. 16/17). This menu will allow access to all configuration settings available from the Local User Interface (LUI).

Setting the mode

The mode menu (MODE) screen will be displayed. Pressing [↲] will cause MODE to start blinking. Use the [+] and [-] keys to move between AUTO (automatic operation) and MAN (adjust TPOS using the [+] and [-] keys). Press [↲] to select the desired mode.

Configuration parameters

Press [+] to display the configuration parameters (PAR) screen. Pressing [↲] will enter the parameters menu.

The first parameter in the menu is performance level (PERF) setting. Pressing [↲] will cause PERF to start blinking. Use the [+] and [-] keys to move between performance levels (A…E, A1…D1). Press [↲] to select the desired performance level.

Selection	Meaning	Description
A	Aggressive	Immediate response to signal changes, overshoots
b	Fast	Fast response to signal changes, small overshooting
C	Optimum	Very small overshoot with minimum step response time
d	Stable	No overshooting, slow response to input signal changes
E	Maximum stability	No overshooting, deadband may increase, slow but stable behaviour

For use with volume boosters and/or very fast actuators, additional performance levels A1 to D1 can be used. Characteristics of these extended levels are the same as those in the table above. However, with performance level settings A1 to D1, adaptive properties of the ND9000 control algorithm are disabled.

Press [+] to display the Low cut-off (CUTL) setting. Pressing [↲] will cause CUTL to start blinking. Use the [+] and [-] keys to change the signal percentage that forces the valve closed (Default = 2%). Press [↲] to select the desired value.

Press [+] to display the Signal Direction (DIR) setting. Pressing [↲] will cause DIR to start blinking. Use the [+] and [-] keys to move between rising signal to open (OPE), and rising signal to close (CLO). Press [↲] to select the desired value.

Press [+] to display the Valve Type (VTYP) setting. Pressing [↲] will cause VTYP to start blinking. Use the [+] and [-] keys to move between Rotary valve (Rot), Linear valve (Lin), NelesCV Globe Valve (nCG), and Linear valve, not corrected, (FLI). Press [↲] to select the desired setting.

Press [+] to display the Actuator Type (ATYP) setting. Pressing [↲] will cause ATYP to start blinking. Use the [+] and [-] keys to move between single-acting (1-A) and double-acting (2-A). Press [↲] to select the desired setting.

Press [+] to display the Positioner Fail Action (PFA) setting. Pressing [↲] will cause PFA to start blinking. Use the [+] and [-] keys to move between fail open (OPE) and fail close (CLO). Set in spring direction for single-acting actuators. For double-acting actuators, set CLO for direct piping and OPE for reversed piping. Press [↲] to select the desired setting.

Press [+] to display the Valve Rotation Direction (ROT) setting. Pressing [↲] will cause ROT to start blinking. Use the [+] and [-] keys to move between clockwise to close (cC) and counterclockwise to close (ccC). Press [↲] to select the desired setting.

Press [+] to display the Dead Angle (A0) setting. Pressing [↲] will cause A0 to start blinking. Use the [+] and [-] keys to enter the correct value from the below table. This value will compensate for the inherent "dead angle" of segmented and ball valves, allowing the entire signal range to be used for control.

Note: Valve position will offset from the input signal. (see IMO for details.) Press [↲] to select the desired setting.

Table 5 Dead angle in percentage

Valve size		Valve series											
		MBV QMBV 1)	MBV QMBV 2)	D, P, C	T5, QT5	QX-T5	T25, QT25	QX-T25	R, QR	E	R-SOFT 3)	FL 4)	ZX
mm	in	Dead angle, %											
15	1/2												15
20	3/4												15
25	1	14	-	-	25.5	19.5	-	-	15	25.5	27		12.5
25/1	1/1											11	
25/2	1/2											11	
25/3	1/3											10	
40	1 1/2	12	-	-	24.5	12.5	-	-	12	16	21		12.5
50	2	10	9	13.5	24.5	12.5	18	8	17	20.5	23		12.5
65	2 1/2	9	-	-	-	-	-	-	13	-	18		
80	3	10	8	12	18	8	16.5	8.5	9	8.5	15.5		
100	4	10	8	12	16.5	8.5	16	9	8	7	14.5		
125	5	12	-	-	-	-	12	6.5	8	-			
150	6	10	8	11.5	16	9	13.5		8	13.5	13		
200	8	9	7	8.5	12	6.5	9.5		7		11.5		
250	10	9	7	7.5	13.5		9.5		7		10.5		
300	12	8	6	6.5	9.5		7.5		6		9.5		
350	14		6	6	-				5		9.5		
400	16		5	5.5	9.5 (14")				5		9.5		
450	18			6	7.5 (16")								
500	20			6					4.5				
600	24			5.5									
650	26			7									
700	28			7									
750	30			6									
800	32			-									
900	36			5.5									

1) Seat supported 2) Trunnion 3) Soft seated R-valve 4) Low Cv Finetrol

Press [+] to display the HART version (HRTI) setting. Pressing the [↲] will cause HRTI to start blinking. Use the [+] and [-] keys to change from HART 6 to HART 7. Press [↲] to select the desired setting. Cycle power to the ND9000 for the change to take effect.

Press [+] to display the Language Selection (LANG) setting. Pressing [↲] will cause LANG to start blinking. Use the [+] and [-] keys to move between English (EnG), German (GEr), and French (FrE). Press [↲] to select the desired setting.

Valve travel calibration

Press [C] to exit the parameters menu. Then press [+] to view the valve travel calibration (CAL) screen. Press [↲] to enter the calibration menu.

The Automatic calibration (AUTO CAL) will be flashing. Use AUTO Calibration for actuators that have both Open & Close mechanical stops. Press [↲] to start the calibration with the tuning function.

Press [+] to display manual calibration (MAN CAL) flashing. Select MANUAL Calibration if you cannot drive the valve into a fully open position or of there is no mechanical limit stop. Press [↲] to start the calibration with the tuning function.

First use the [+] and [-] keys to drive the valve to the closed position, then press [↲]

Next use the [+] and [-] keys to drive the valve to the open position, then press [↲]. The rest of the calibration will run automatically.

Press [+] to display 1-point calibration (1PT CAL) flashing.Select 1-Point Calibration if the valve controller needs to be changed but the valve is not allowed to change position (i.e. the valve is active). This procedure does not ensure the best possible control performance, and it is always recommended to run either AUTO or MAN calibration with tuning as soon as possible.

Before starting 1-point calibration ensure that the valve is mechanically locked. Change the MODE to manual (MAN) and adjust target position (TPOS) so that it matches the physical position of the valve.

Do not connect supply pressure until 1-point calibration is successfully complete.

Press [↲] to display ANG which will be flashing. Use the [+] and [-] keys to enter the maximum tuning angle that the valve can perform, then press [↲].

After a successful calibration the LCD will display CALIBRATION SUCCESSFUL. Press [C] twice to get back to measurement view.

Linearization

Linearization can be used to correct for linear valve linkage geometry, when external position measurement is available to compare actual position to given position. This can be done with 3 points (25%, 50%, 75%) or 9 points (10%, 20% … 90%) plus the end points.

Note: Prior to linearization, the VTYP must be set to FLI and a Auto or Manual calibration should be performed.

While in the Calibration menu, press [+] to display LCAL 3P for 3 point linearization or LCAL 9P for 9 point linearization. Press [enter] to start the linearization. Press the [+] or [–] buttons to drive the valve to the displayed position then press [enter]. Continue setting the displayed valve positions until the last point is confirmed. Calibration is successful will be displayed.

Error messages on LCD

Error messages on LCD

If an online alarm has been detected the “X” symbol is activated. You can view the reason for the alarm by pressing the ”C” and ”-” keys simultaneously.

Failsafe Errors

Failsafe Errors	
Display message	**Action**
Position sensor failure	Change the ND9000 device to a new one.
Setpoint sensor failure	Change the ND9000 device to a new one.
Prestage shortcut error	Shortcut in prestage unit. Replace prestage unit.
FAE nnn	Fatal malfunction in the device, nnn is a number between 001 - 004. Change the ND9000 device to a new one.

Alarms

Alarms	
Display message	**Action**
Deviation alarm	Valve deviation out of limits.
Stiction low alarm	Stiction has exceeded the low limit.
Stiction high alarm	Stiction has exceeded the high limit.
Load for opening low	Load for opening has exceeded the low limit.
Load for opening high	Load for opening has exceeded the high limit.
Spool valve problem	Check the spool valve unit and replace if necessary.
Pneumatics problem	Check pneumatic connections and actuator leakage.
Friction problem	Valve is not moving correctly. Check load factor.

Errors

Errors	
Display message	**Action**
Prestage cut error	Prestage wire is cut or connector is loose.
Pressure sensor 1 failure	The device performance is reduced (D/A only). Change the ND9000 device to a new one during next maintenance activity.
Pressure sensor 2 failure	The device performance is reduced. Change the ND9000 device to a new one during next maintenance activity.
Pressure sensor 3 failure	Supply pressure sensor failed. No affect on performance.
Spool valve sensor failure	Check the sensor connections. Device performance level is reduced. For ND9100 replace spool valve assembly. For ND9200/ 9300 replace device.
Temp. sensor failure	Check the spool valve unit and replace if necessary.
Statistics database error	Failed to store statistics. New measurements will be lost.
Event database error	Failed to store events. New events will be lost.

Errors	
Display message	**Action**
Pos. calibration failed	Given samples in Linearization are too small, closer than 5% to each other.
Position change too small	Given samples in Linearization are too small, closer than 5% to each other.
Linearization failed	3 Pt./9 Pt linearization failed.
Factory setting restore failed	Factory setting restore failed.
Too small valve movement	Position sensor range failed during calibration. Valve controller shaft failed to rotate minimum 45º. Check the configuration parameters and controller mounting. Check that the controller shaft is correctly aligned.
Positioner shaft movement out of range	Pointer out of mark on housing. See page 4
Calibration timeout	Check configuration and installation.
Calibration start failed	Check the supply pressure.

Errors	
Display message	**Action**
Too small spool valve movement	Spool sensor rang failed during position calibration. Check the configuration parameters. Check the prestage and spool valve unit.
Poor valve package controlability	Position calibration takes controlability too long due to poor controlability.
Check assembly related parameters	Verify that the valve related parameters assembly matches the assembly related parameters and start calibration again.
Calibration fail: Supply pressure out of range	Supply pressure out of range during calibration.
Calibration fail: Sensor failure	Failed valve/spool position sensor detected during calibration.
Calibration fail: Position out of range	Valve position out of range detected during calibration.

Warnings

Warnings	
Display message	**Action**
Total operation time	Operating Time Exceeded Limit.
Valve full strokes warn.	Valve Stroke Counter Limit Reached.
Valve reversals warn.	Valve Reversals counter limit reached.
Act. Full strokes warn.	Actuator Stroke counter limit reached.
Actuator reversals warn.	Actuator Reversals counter limit reached.
Spool full strokes warn.	Spool reversals counter limit reached.
Spool reversal warn.	Check pneumatic connections and actuator leakage.
Steady state dev. warn.	Steady State deviation has increased.
Dyn. state dev. warn.	Dynamic State deviation has increased.
Stiction low warn.	Stiction has exceeded the low limit.
Stiction high warn.	Stiction has exceeded the high limit.
Ld. for opening too low	Load for opening has exceeded the low limit.

Warnings	
Display message	**Action**
Ld. for opening too high	Load for opening has exceeded the high limit.
Supp. press. out of limit	Supply pressure has exceeded the specified operating conditions.
Temperature out of limit	Temperature has exceeded the specified operating conditions.
Hunting detection warn.	Change performance level to less aggressive to stabilize valve. Check that the spool valve capacity is suitable for the actuator.
Reduced perform activ.	Performance is reduced due to defective spool valve sensor. Change the spool valve assembly.
Too low supply pressure for 1-ACT actuator	Increase supply pressure.
Valve rev. trend warn.	Valve reversals per day has exceeded the limit.
Valve rev. while stable SP	Valve reversals while setpoint is stable, per day, has exceeded the limit.
Setpoint rev. trend warn.	Setpoint reversals per day has exceeded the limit.
Valve travel trend warn.	Valve travel per day has exceeded the limit.

Notifications

Notifications	
Display message	**Action**
Successful	Position Calibration successfully performed.
Linearization successful	3 Pt./ 9 Pt. linearization successfully performed.
Test cancelled	Off-line test cancelled.
Test done	Off-line test successfully performed.
Test failed	Off-line test failed. Repeat the test sequence.
Calibration cancelled	Calibration cancelled.
Factory defaults activated	Factory settings activated. Reconfigure and calibrate device.
PT not activated	(Only with position transmitter option). The position transmitter is not energized.
1PT cal failed	1-point calibration failed. Check the mounting of the valve controller. Verify input parameter (range value. Check rotation parameter (ROT).
Reduced perf deactivated	Spool valve measurement and normal valve control is recovered.

Valmet's professionals around the world work close to our customers and are committed to moving our customers' performance forward – every day.

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