

# Intelligent Valve Controller

New



- Can be used for rotary and linear actuators
- SIL 2 certified by TÜV (Acc. to IEC 61508)
- Equipped with a variety of self-diagnostics
- Equipped with fail safe function (fully closed/fully open)
- Compatible with HART communication
- Optional specifications

Arctic temperature specifications:  $-53$  to  $85^{\circ}\text{C}$

Communication · FOUNDATION fieldbus  
· Profibus PA

Limit switch

Position transmitter (in HART only)

Remote type

Stainless steel body



Standard: IP66/NEMA 4X  
enclosure



ND9100 Series

Flameproof (Ex d): IP66/NEMA 4X  
enclosure



ND9200 Series

## ND9000 Series

## ▶ Key Features

- Benchmark control performance on rotary and linear valves
- Reliable and robust design
- Easy commissioning and operation
- Safety; SIL 2 certified by TÜV (Acc. to IEC 61508)
- Language selection: English, German and French
- Local/remote operation
- Expandable architecture
- Equipped with a variety of self-diagnostics  
Self-diagnostics/Online diagnostics/  
Performance diagnostics/Communication diagnostics/  
Extended off-line tests/Performance view/Online Valve Signature



## ▶ Minimized process variability

- Linearisation of the valve flow characteristics
- Excellent dynamic and static control performance
- Fast response to control signal change
- Accurate internal measurements

## ▶ Easy installation and configuration

- Can be used for linear and rotary valves, double and single acting actuators
- Simple fast calibration and configuration using Local User Interface (LUI) using DTM / EDD in a remote location using DCS asset management tools
- Low power consumption enables installation to all common control systems

## ▶ Options

- Interchangeable communication options:  
HART 6 or 7 (H)  
FOUNDATION fieldbus  
Profibus PA
- Limit switches
- Position transmitter (in HART only)
- Full stainless steel enclosure
- Exhaust adapter
- Remote mounting
- Arctic temperature specifications: (Up to  $-53^{\circ}\text{C}$ )



## ▶ Open solution

- The ND9000 can be freely interfaced with software and hardware from a variety of manufacturers. Using this open architecture allows the ND9000 to be integrated with other field devices to give higher controllability.
- FDT and EDD based multi-vendor support configuration
- Support files for ND9000 are available at the following website: [www.metso.com/valves](http://www.metso.com/valves)

## ► Fieldbus networks

- Interoperability
  - Host interoperability
  - FOUNDATION fieldbus ITK version 6.1.2
  - Profibus PA profile version 3.0 PNO
- Easy to upgrade; by replacing the HART communication board with a fieldbus communication board
- Excellent maintainability with firmware download feature
- Advanced communication diagnostics
- Digital communication via the fieldbus includes not only the set point, but also the position feedback signal from the position sensor. No special supplementary modules for analog or digital position feedback are needed when using the fieldbus valve controller.
- Back up LAS functionality available in FOUNDATION fieldbus environment
- Input selector and output splitter blocks available in FOUNDATION fieldbus devices allowing advanced distributed control
- Standard function blocks enables the freedom to use the ND9000 intelligent valve controller in either continuous or on-off control applications
- Open and close information is directly available via the fieldbus
- Open and close detection is based on either position measurement (soft limit switch) or mechanical limit switch information

## ► Mounting on actuators and valves

- Can be mounted on single and double-acting actuators
- Both rotary and linear valves
- Ability to attach options to electronics and mechanics later
- 1-point calibration feature enables mounting without disturbing the process

## ► Product reliability

- Designed to operate in harsh environmental conditions
- Rugged modular design
- Excellent temperature characteristics
- Vibration and impact tolerant
- IP66 enclosure
- Stainless steel enclosure (ND9300 and ND9400)
- Protected against humidity
- Wear resistant and sealed components
- Contactless position measurement

## ► Preventive maintenance

- Easy access to collected data with Metso Device Care software
- Unique Online Valve Signature to detect valve friction even more accurately.
- Performance view with report, which gives guidelines for recommended actions.
- Logical trend and histogram collection
- Information collected during process uptime
- Extensive set of off-line tests with accurate key figure calculations
- Fast notifications with on-line alarms
- Condition monitoring tool available
- Real time monitoring of valve control parameters

## ► Technical Description

The ND9000 is a 4–20 mA or fieldbus powered microcontroller-based intelligent valve controller.

The device contains a Local User Interface (LUI) enabling local configuration.

A PC with Device Care software can be connected to the ND9000 itself or to the control loop.

The powerful 32-bit microcontroller controls the valve position.

The measurements include:

- Input signal
- Valve position with contactless sensor
- Actuator pressures, 2 independent measurements
- Supply pressure
- Spool valve position
- Device temperature

### Self-diagnostics

Advanced self-diagnostics guarantees that all measurements operate correctly.

After connections of electric signal and pneumatic supply the ① micro controller ( $\mu\text{C}$ ) reads the input signal, ② position sensor ( $\alpha$ ), ③ pressure sensors ( $P_s$ ,  $P_1$ ,  $P_2$ ) and ④ spool position sensor (SPS).

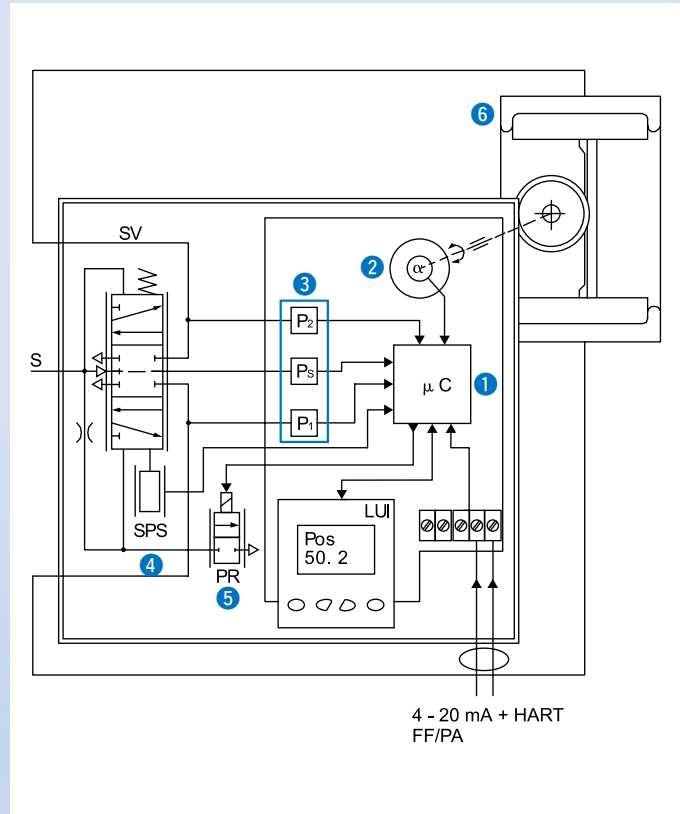
ⓘ A difference between input signal and ② position sensor ( $\alpha$ ) measurement is detected by control algorithm inside the ①  $\mu\text{C}$ .

The ①  $\mu\text{C}$  calculates a new value for ⑤ prestage (PR) coil current based on the information from the input signal and from the sensors. The changed current to the PR changes the pilot pressure to the spool valve. Reduced pilot pressure moves the spool and the ⑥ actuator pressures change accordingly.

ⓘ The spool opens the flow to the driving side of the double diaphragm actuator and opens the flow out from the other side of the actuator.

The increasing pressure will move the diaphragm piston. The ⑥ actuator and feedback shaft rotate.

The ② position sensor ( $\alpha$ ) measures the rotation for the ①  $\mu\text{C}$ . The  $\mu\text{C}$  using control algorithm modulates the ⑤ PR-current from the steady state value until the new position of the ⑥ actuator, according to the input signal, is reached.





# ND9000 Series

## Specifications

### General

Loop powered, no external power supply required.  
Suitable for rotary and linear valves.  
Actuator connections in accordance with VDI/VDE 3845 and IEC 60534-6 standards.

#### [Flush mounting on selected actuators]

Action: Double or single acting  
Travel range: Linear; 10 to 120 mm  
Rotary; 45 to 95°  
Measurement range; 110° with freely rotating feed-back shaft

### Environmental influence

Standard temperature range: -40 to 85°C  
Arctic temperature range: -53 to 85°C  
Influence of temperature on valve position: 0.5%/10°C  
Influence of vibration on valve position:  
Less than 1% under 2G 5 to 150 Hz  
1G 150 to 300 Hz  
0.5G 300 to 2000 Hz

### Enclosure

	ND9100	ND9200	ND9300	ND9400
Material	Anodised aluminum alloy and polymer composite	Anodised aluminum alloy and tempered glass	Stainless steel	Stainless steel and polymer composite
Protection class	IP66, NEMA 4X			
Air connection port	G1/4	NPT1/4		
Electrical connection port	M20 x 1.5 NPT1/2 (ND91/9300_U, ND92/9300_E2)			
Weight	1.8 kg	3.4 kg	8.6 kg	5.6 kg

\* Mechanical and digital position indicator visible through main cover, not applicable to ND9200E2 and ND9300.

### Supply air

Supply pressure: 0.14 to 0.8 MPa  
Effect of supply pressure on valve position:  
Less than 0.1% at 10% difference in inlet pressure  
Air quality : Acc. to ISO 8573-1  
Solid particles : Class 5 (3 to 5 µm filtration is recommended)  
Humidity : Class 1 (dew point 10°C below minimum temperature is recommended)  
Oil class : 3 (or less than 1 ppm)  
Supply pressure: 0.14 to 0.8 MPa  
93 L/min(ANR) (spool valve 2)  
201 L/min(ANR) (spool valve 3)  
634 L/min(ANR) (spool valve 6)  
Consumption with 0.14 to 0.8 MPa supply in steady state position:  
< 9.9 L/min(ANR) (spool valve 2 and 3)  
< 17 L/min(ANR) (spool valve 6)

### Electronics

HART  
Supply power : Loop powered, 4 to 20 mA  
Minimum signal : 3.6 mA  
Current max : 120 mA  
Load voltage : Up to 9.7 VDC/20 mA (corresponding 485 Ω)  
Voltage : Max. 30 VDC  
Polarity protection : -30 VDC  
Over current protection: Active over 35 mA

### Profibus PA and FOUNDATION fieldbus

Supply power : Voltage 9 to 32 VDC, reverse polarity protection  
Max basic current : 17.2 mA  
Stationary current : 16 mA  
Fault current (FDE): 3.9 mA

### FOUNDATION fieldbus function block execution times

AO	20 ms	DI	15 ms
AI	20 ms	IS	15 ms
PID	20 ms	OS	15 ms
DO	20 ms		

### Performance with moderate constant-load actuators

Dead band: ≤ 0.1% F.S.  
Hysteresis: < 0.5% F.S.

### Local User Interface (LUI) functions

- Local control of the valve
- Monitoring of valve position, target position, input signal, temperature, supply and actuator pressure difference
- Guided-startup function
- LUI may be locked remotely to prevent unauthorized access
- Calibration: Automatic/manual linearization
- One-point calibration
- Control configuration: Aggressive, fast, optimum, stable, maximum stability
- HART version configuration: HART 6 or HART 7
- Configuration of the control valve
- Rotation: Valve rotation clockwise or counter-clockwise to close
- Dead Angle
- Low cut-off, cut-off safety range (default 2%)
- Positioner fail action, open/close
- Signal direction: Direct/reverse acting
- Actuator type, double/single acting
- Valve type, rotary/linear
- Language selection: English, German and French

### Position transmitter (optional)

Output signal : 4 to 20 mA (galvanic isolation; 600 VDC)  
Supply voltage : 12 to 30 VDC  
Resolution : 16 bit/0.244 µA  
Linearity : < 0.05% F.S.  
Temperature effect: < 0.35% F.S.  
External load : Max. 0 to 780 Ω  
Max. 0 to 690 Ω for intrinsically safe  
Ex ia IIC T6 Ui ≤ 28 V  
Ex d IIC T4/T5/T6 Ui ≤ 30 V

## Specifications

### Approvals and Electrical Values, HART

Certificate	Approval	Electrical values
<b>ATEX</b>		
ND_X VTT 09 ATEX 033X VTT 09 ATEX 034X EN 60079-0: 2009/2012 EN 60079-11: 2012 EN 60079-26: 2007 EN 60079-31: 2008	II 1G Ex ia IIC T6...T4 Ga II 1D Ex ta IIIC T90°C Da II 2G Ex ib IIC T6...T4 Gb II 2D Ex tb IIIC T90°C Db	Input: $U_i \leq 28\text{ V}$ , $I_i \leq 120\text{ mA}$ , $P_i \leq 1\text{ W}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 28\text{ V}$ , $I_o \leq 120\text{ mA}$ , $P_o \leq 1\text{ W}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
EN 60079-0: 2009/2012 EN 60079-11: 2012 EN 60079-26: 2007 EN 60079-31: 2008	II 3G Ex nA IIC T6...T4 Gc II 3D Ex tc IIIC T90°C Dc	Input: $U_i \leq 30\text{ V}$ , $I_i \leq 152\text{ mA}$ Output: $U_o \leq 30\text{ V}$ , $I_o \leq 152\text{ mA}$
EN 60079-0: 2009/2012 EN 60079-11: 2012 EN 60079-15: 2010 EN 60079-31: 2008	II 3G Ex ic IIC T6...T4 Gc II 3D Ex tc IIIC T90°C Dc	Input: $U_i \leq 30\text{ V}$ , $I_i \leq 152\text{ mA}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 30\text{ V}$ , $I_o \leq 152\text{ mA}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
ND_E1 SIRA 11 ATEX 1006X EN 60079-0: 2009 EN 60079-1: 2007 EN 60079-31: 2009	II 2G Ex d IIC T6...T4 Gb II 2D Ex tb IIIC T80°C...T105°C Db	Input: $U_i \leq 30\text{ V}$ Output: $U_o \leq 30\text{ V}$ , $P_{\text{max}} = \text{device limits itself}$
<b>IECEX</b>		
ND_X IECEX VTT 10.0004X IECEX VTT 10.0005X IEC 60079-0: 2007/2011 IEC 60079-11: 2011 IEC 60079-26: 2006 IEC 60079-31: 2008	Ex ia IIC T6...T4 Ga Ex ta IIIC T90°C Da Ex ib IIC T6...T4 Gb Ex tb IIIC T90°C Db	Input: $U_i \leq 28\text{ V}$ , $I_i \leq 120\text{ mA}$ , $P_i \leq 1\text{ W}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 28\text{ V}$ , $I_o \leq 120\text{ mA}$ , $P_o \leq 1\text{ W}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
IEC 60079-0: 2007/2011 IEC 60079-11: 2011 IEC 60079-15: 2010 IEC 60079-31: 2008	Ex nA IIC T6...T4 Gc Ex tc IIIC T90°C Dc	Input: $U_i \leq 30\text{ V}$ , $I_i \leq 152\text{ mA}$ Output: $U_o \leq 30\text{ V}$ , $I_o \leq 152\text{ mA}$
IEC 60079-0: 2007/2011 IEC 60079-11: 2011 IEC 60079-15: 2010 IEC 60079-31: 2008	Ex ic IIC T6...T4 Gc Ex tc IIIC T90°C Dc	Input: $U_i \leq 30\text{ V}$ , $I_i \leq 152\text{ mA}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 30\text{ V}$ , $I_o \leq 152\text{ mA}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
ND_E1 IECEX SIR 11.0001X IEC 60079-0: 2011 IEC 60079-1: 2007 IEC 60079-31: 2008	Ex d IIC T6...T4 Gb Ex tb IIIC T80°C...T105°C Db	Input: $U_i \leq 30\text{ V}$ Output: $U_o \leq 30\text{ V}$ , $P_{\text{max}} = \text{device limits itself}$
<b>INMETRO</b>		
ND_Z NCC 12.0793 X NCC 12.0794 X ABNT NBR IEC 60079-0: 2013 ABNT NBR IEC 60079-11: 2009 ABNT NBR IEC 60079-26: 2008 (2009) ABNT NBR IEC 60079-27: 2010	Ex ia IIC T4/T5/T6 Ga Ex ia IIC T4/T5/T6 Gb	Input: $U_i \leq 28\text{ V}$ , $I_i \leq 120\text{ mA}$ , $P_i \leq 1\text{ W}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 28\text{ V}$ , $I_o \leq 120\text{ mA}$ , $P_o \leq 1\text{ W}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
ABNT NBR IEC 60079-0: 2013 ABNT NBR IEC 60079-11: 2009 ABNT NBR IEC 60079-15: 2012 ABNT NBR IEC 60079-27: 2010	Ex nA IIC T4/T5/T6 Gc	Input: $U_i \leq 30\text{ V}$ , $I_i \leq 152\text{ mA}$ Output: $U_o \leq 30\text{ V}$ , $I_o \leq 152\text{ mA}$
ABNT NBR IEC 60079-0: 2013 ABNT NBR IEC 60079-11: 2009 IEC 60079-15: 2012 ABNT NBR IEC 60079-27: 2010 ABNT NBR IEC 60529: 2005	Ex ic IIC T4/T5/T6 Gc	Input: $U_i \leq 30\text{ V}$ , $I_i \leq 152\text{ mA}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 30\text{ V}$ , $I_o \leq 152\text{ mA}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
ND_E5 NCC 12.0795 X ABNT NBR IEC 60079-0: 2013 ABNT NBR IEC 60079-1: 2009 (2011) ABNT NBR IEC 60079-31: 2011 ABNT NBR IEC 60529: 2005	Ex d IIC T4/T5/T6 Gb Ex tb IIIC T100°C Db IP66	Input: $U_i \leq 30\text{ V}$ Output: $U_o \leq 30\text{ V}$ , $P_{\text{max}} = \text{device limits itself}$
<b>cCSAus</b>		
ND_U CSA C22.2 No. 0-M91, CSA C22.2 No. 94-M91, CSA C22.2 No. 142-M1987, CSA C22.2 No. 157-92, CSA C22.2 No. 213-M1987, CSA C22.2 No. 60079-0: 11, CSA C22.2 No. 60079-11: 11, CSA C22.2 No. 60079-15: 12, CSA C22.2 No. 60529: 05, ANSI/ISA 60079-0: 2009, ANSI/ISA 60079-11: 2012, ANSI/ISA 60079-15: 2012, FM 3600 November 1998, FM 3610 October 1999, FM 3611 October 1999, FM 3810-2005, ANSI/NEMA 250: 1991, ANSI/IEC 60529: 2004	IS Class I, Division 1, Groups A, B, C, and D; T4/T5/T6 Ex ia IIC T4/T5/T6 Ga IS Class I, Zone 0 AEx ia IIC T4/T5/T6 Ga	Input: $U_i \leq 28\text{ V}$ , $I_i \leq 120\text{ mA}$ , $P_i \leq 1\text{ W}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 28\text{ V}$ , $I_o \leq 120\text{ mA}$ , $P_o \leq 1\text{ W}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
CSA C22.2 No. 60079-11: 11, CSA C22.2 No. 60079-15: 12, CSA C22.2 No. 60529: 05, ANSI/ISA 60079-0: 2009, ANSI/ISA 60079-11: 2012, ANSI/ISA 60079-15: 2012, FM 3600 November 1998, FM 3610 October 1999, FM 3611 October 1999, FM 3810-2005, ANSI/NEMA 250: 1991, ANSI/IEC 60529: 2004	Class I, Division 2, Groups A, B, C, and D; T4/T5/T6 Ex nA IIC T4/T5/T6 Gc or Ex nA ia IIC T4/T5/T6 Gc Ga Class I, Zone 2 AEx nA IIC T4/T5/T6 Gc or Ex nA ia IIC T4/T5/T6 Gc Ga	Input: $U_i \leq 30\text{ V}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_i \leq 22\text{ nF}$ , $L_i \leq 53\text{ }\mu\text{H}$ Output: $U_o \leq 30\text{ V}$ , $I_o \leq 152\text{ mA}$ , $P_{\text{max}} = \text{device limits itself}$ , $C_o \leq 22\text{ nF}$ , $L_o \leq 53\text{ }\mu\text{H}$
ND_E5 CSA Std C22.2 No.25-1966, CSA Std C22.2 No. 30-M1986, CAN/CSA-C22.2 No.94-M91, C22.2 No.142-M1987, CAN/CSA C22.2 61010-1-04, CAN/CSAC22.2 No 60079-0-07, CAN/CSA-C22.2 No 60079-1-07, CAN/CSA C22.2 No 60079-31-12, CAN/CSA-C22.2 No. 60529-05, FM 3600 (1998), FM 3615 (2006), FM 3810 (2005), ANSI/NEMA 250-1991, ISA 60079-0-07, ISA 60079-1-07, ISA 60079-31-2009, ANSI/IEC 60529: 2004	Class I, Div 1, Groups B, C, D; Class II, Div 1, Groups E,F,G; Class III; T4...T6, Enclosure type 4X Ex d IIC T4...T6 AEx d IIC T4...T6 Ex tb IIIC T100°C IP66 AEx tb IIIC T100°C IP66	Input: $U_i \leq 30\text{ V}$ Output: $U_o \leq 30\text{ V}$ , $P_{\text{max}} = \text{device limits itself}$
<b>Japanese Ex-d Certification</b>		
ND_E4	II 2G Ex d IIC T6 Gb II 2D Ex tb IIIC T80°C Db	Input: $U_i \leq 30\text{ V}$ Output: $U_o \leq 30\text{ V}$ , $P_{\text{max}} = \text{device limits itself}$

# ND9000 Series

## Specifications

### Approvals and Electrical Values, FOUNDATION fieldbus and Profibus PA

Certificate	Approval	Electrical values
<b>ATEX</b>		
ND_X VTT 09 ATEX 033X VTT 09 ATEX 034X EN 60079-0: 2009/2012 EN 60079-11: 2012 EN 60079-26: 2007 EN 60079-31: 2008	II 1G Ex ia IIC T6...T4 Ga II 1D Ex ta IIIC T90°C Da II 2 G Ex ib IIC T6...T4 Gb II 2 D Ex tb IIIC T90°C Db	Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Comply with the requirements for FISCO field device
EN 60079-0: 2009/2012 EN 60079-11: 2012 EN 60079-15: 2010 EN 60079-31: 2008	II 3 G Ex nA IIC T6...T4 Gc II 3 D Ex tc IIIC T90°C Dc	Ui ≤ 24 V
EN 60079-0: 2009/2012 EN 60079-11: 2012 EN 60079-15: 2010 EN 60079-31: 2008	II 3 G Ex ic IIC T6...T4 Gc II 3 D Ex tc IIIC T90°C Dc	Ui ≤ 32 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Compatible with the requirements for FISCO Ex ic field device
ND_E1 SIRA 11 ATEX 1006X EN 60079-0: 2009 EN 60079-1: 2007 EN 60079-31: 2009	II 2 G Ex d IIC T6...T4 Gb II 2 D Ex tb IIIC T80°C...T105°C Db	Ui ≤ 32 V
<b>IECEX</b>		
ND_X IECEX VTT 10.0004X IECEX VTT 10.0005X IEC 60079-0: 2007/2011 IEC 60079-11: 2011 IEC 60079-26: 2006 IEC 60079-31: 2008	Ex ia IIC T6...T4 Ga Ex ta IIIC T90°C Da Ex ib IIC T6...T4 Gb Ex tb IIIC T90°C Db	Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Comply with the requirements for FISCO field device
IEC 60079-0: 2007/2011 IEC 60079-11: 2011 IEC 60079-15: 2010 IEC 60079-31: 2008	Ex nA IIC T6...T4 Gc Ex tc IIIC T90°C Dc	
IEC 60079-0: 2007/2011 IEC 60079-11: 2011 IEC 60079-15: 2010 IEC 60079-31: 2008	Ex ic IIC T6...T4 Gc Ex tc IIIC T90°C Dc	Ui ≤ 32 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Comply with the requirements for FISCO field device
ND_E1 IECEX SIR 11.0001X IEC 60079-0: 2011 IEC 60079-1: 2007 IEC 60079-31: 2008	Ex d IIC T6...T4 Gb Ex tb IIIC T80°C...T105°C Db	Ui ≤ 32 V
<b>INMETRO</b>		
ND_Z NCC 12.0793 X NCC 12.0794 X ABNT NBR IEC 60079-0: 2008 (2011) ABNT NBR IEC 60079-11: 2009 ABNT NBR IEC 60079-26: 2008 (2009) ABNT NBR IEC 60079-27: 2010 ABNT NBR IEC 60079-0: 2008 (2011) ABNT NBR IEC 60079-11: 2009 IEC 60079-15: 2010 ABNT NBR IEC 60079-27: 2010 ABNT NBR IEC 60529: 2009	Ex ia IIC T4/T5/T6 Ga Ex ia IIC T4/T5/T6 Gb	Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Comply with the requirements for FISCO field device
	Ex nA IIC T4/T5/T6 Gc Ui ≤ 24 V	Ui ≤ 24 V
	Ex ic IIC T4/T5/T6 Gc	Ui ≤ 32 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Compatible with the requirements for FISCO Ex ic field device
ND_E5 NCC 12.0795 X ABNT NBR IEC 60079-0: 2008 (2011) ABNT NBR IEC 60079-1: 2009 (2011) ABNT NBR IEC 60079-31: 2011 ABNT NBR IEC 60529: 2009	Ex d IIC T4/T5/T6 Gb Ex tb IIIC T100°C Db IP66	Ui ≤ 32 V
<b>cCSAus</b>		
ND_U CSA C22.2 No. 0-M91, CSA C22.2 No. 94-M91, CSA C22.2 No. 142-M1987, CSA C22.2 No. 157-92, CSA C22.2 No. 213-M1987, CSA C22.2 No. 60079-0: 11, CSA C22.2 No. 60079-11: 11, CSA C22.2 No. 60079-15: 12, CSA C22.2 No. 60529: 05, ANSI/ISA 60079-0: 2009, ANSI/ISA 60079-11: 2012, ANSI/ISA 60079-15: 2012, FM 3600 November 1998, FM 3610 October 1999, FM 3611 October 1999, FM 3810-2005, ANSI/NEMA 250: 1991, ANSI/IEC 60529: 2004	Class I, Division 1, Groups A, B, C, and D; T4/T5/T6 Ex ia IIC T4/T5/T6 Ga Class I, Zone 0 AEx ia IIC T4/T5/T6 Ga	Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Comply with the requirements for FISCO field device
	Class I, Division 2, Groups A, B, C, and D; T4/T5/T6 Ex ic IIC T4/T5/T6 Gc Class I, Zone 2 AEx ic IIC T4/T5/T6 Gc	Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 μH Compatible with the requirements for FISCO Ex ic field device
ND_E5 CSA Std C22.2 No.25-1966, CSA Std C22.2 No.30-M1986, CAN/CSA-C22.2 No.94-M91, C22.2 No.142-M1987, CAN/CSA C22.2 61010-1-04, CAN/CSA C22.2 No 60079-0-07, CAN/CSA-C22.2 No 60079-1-07, CAN/CSA C22.2 No 60079-31-12, CAN/CSA-C22.2 No. 60529-05, FM 3600 (1998), FM 3615 (2006), FM 3810 (2005), ANSI/NEMA 250-1991, ISA 60079-0-07, ISA 60079-1-07, ISA 60079-31-2009, ANSI/IEC 60529: 2004	Class I, Div 1, Groups B, C, D; Class II, Div 1, Groups E, F, G; Class III; T4...T6, Enclosure type 4X Ex d IIC T4...T6 AEx d IIC T4...T6 Ex tb IIIC T100°C IP66 AEx tb IIIC T100°C IP66	Ui ≤ 32 V
<b>Japanese Ex-d Certification</b>		
ND_E4	II 2 G Ex d IIC T6 Gb II 2 D Ex tb IIIC T80°C Db	Input: Ui ≤ 30 V Output: Ui ≤ 30 V, Pmax = device limits itself



## Specifications

### Electromagnetic Protection

Electromagnetic compatibility acc. to  
Emission: EN 61000-6-4 (2007) + A1 (2011)  
Immunity: EN 61000-6-2 (2005)

### Safety

IEC 61508 compliant up to and including SIL 2 by TÜV

### CE marking

EMC 2014/30/EU

ATEX 2014/34/EU (from 20 April 2016)

### Proximity Sensors and Limit Switches

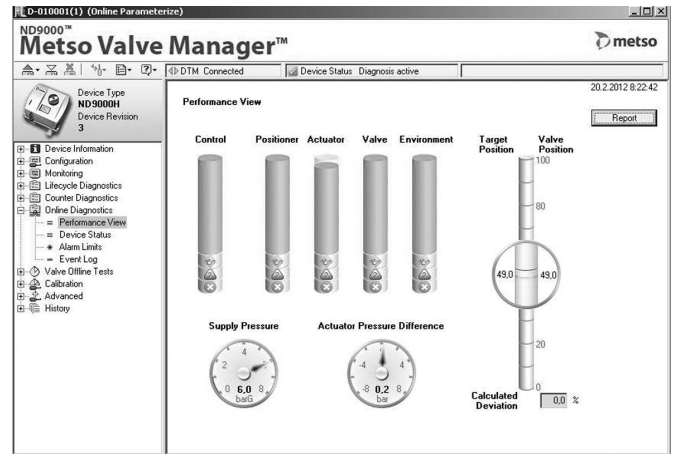
(Optional with Extension Module for ND9100, ND9200 and ND9300)

Code	Description
D33	SST Sensor Dual Module
D44	NAMUR Sensor Dual Module
I02	P+F NJ2-12GK-SN, 2 sensors
I09	P+F; NCB2-12GM35-N0
I32	Omron E2E-X2Y1, micro switch, 2 sensors
I41	P+F, NJ4-12GK-SN, 2 sensors
I45	P+F NJ3-13GK-S1N, 2 sensors
I56	IFC 2002-ARKG/UP, 2 sensors
K05	Omron D2VW-5, micro switch, 2 sensors
K06	Omron D2VW-01 gold plated, micro switch
B06	Omron D2VW-01 gold plated, micro switch, 2 sensors

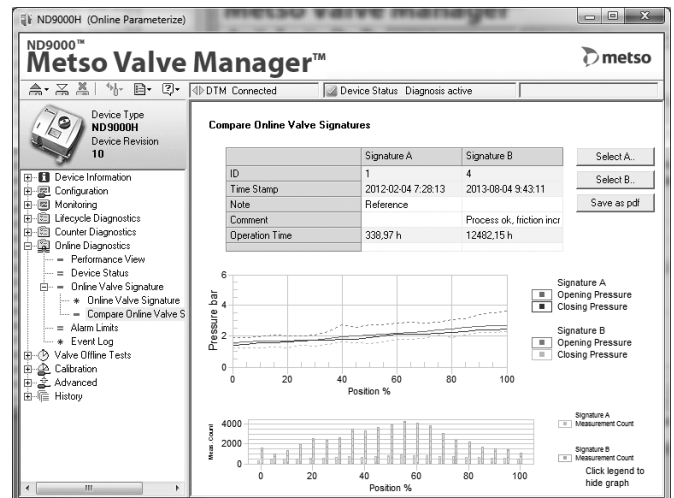
\* Bus powered, no external power and cabling needed.

### Screen display

The Performance View of the Metso Valve Manager graphically displays indexes of the valve, actuator and positioner, as well as indexes of control performance and the application environment. Report will show explanations of the status of each component and guidelines for recommended actions.



Valve Online Signature feature shows friction of the control valve online, under normal process conditions when ever the valve is changing position.



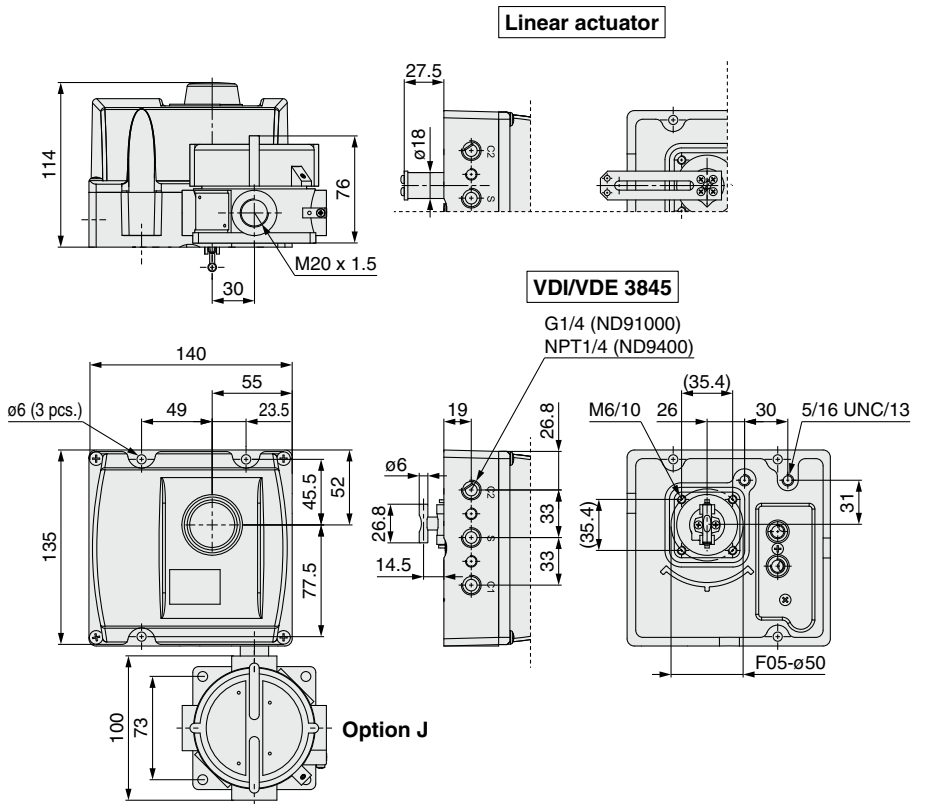
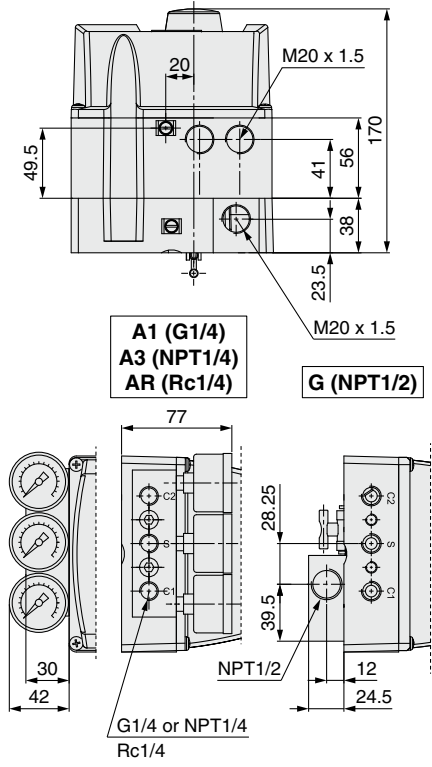
# ND9000 Series

## Dimensions

### ND9100 and ND9400

ND9100/I, ND9100/K, ND9100/B

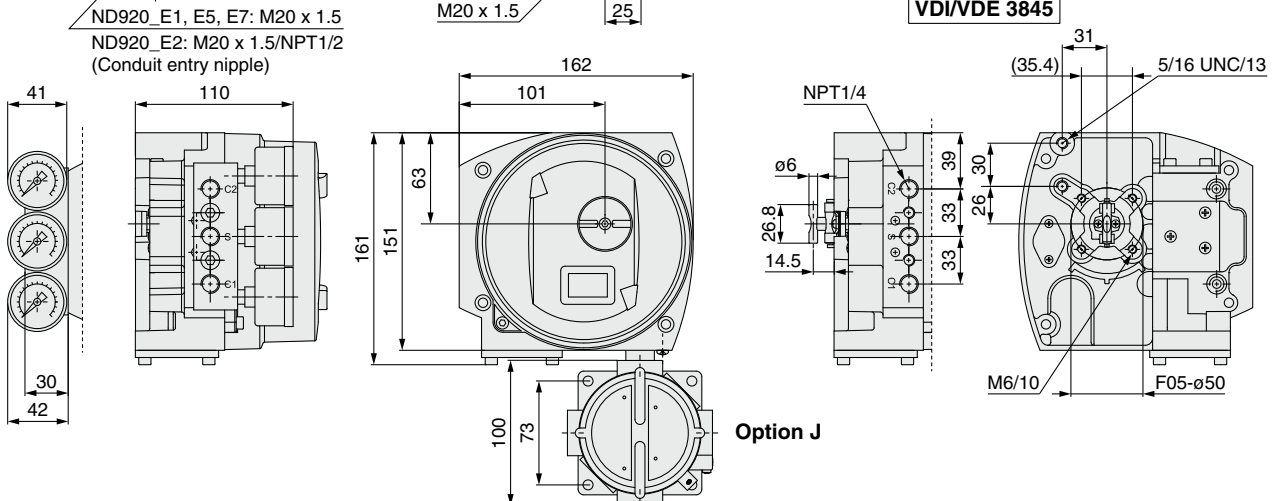
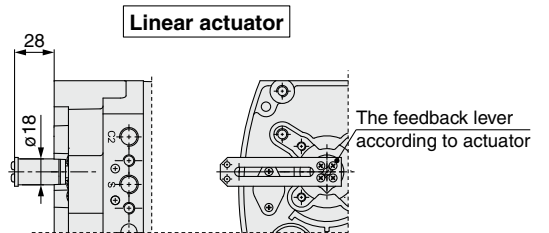
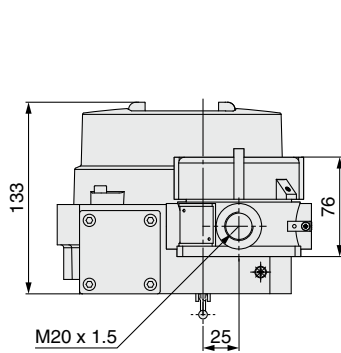
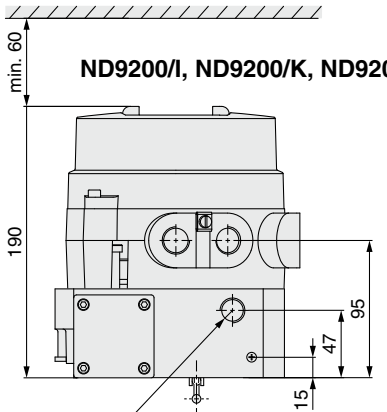
ND9100, ND9400



### ND9200

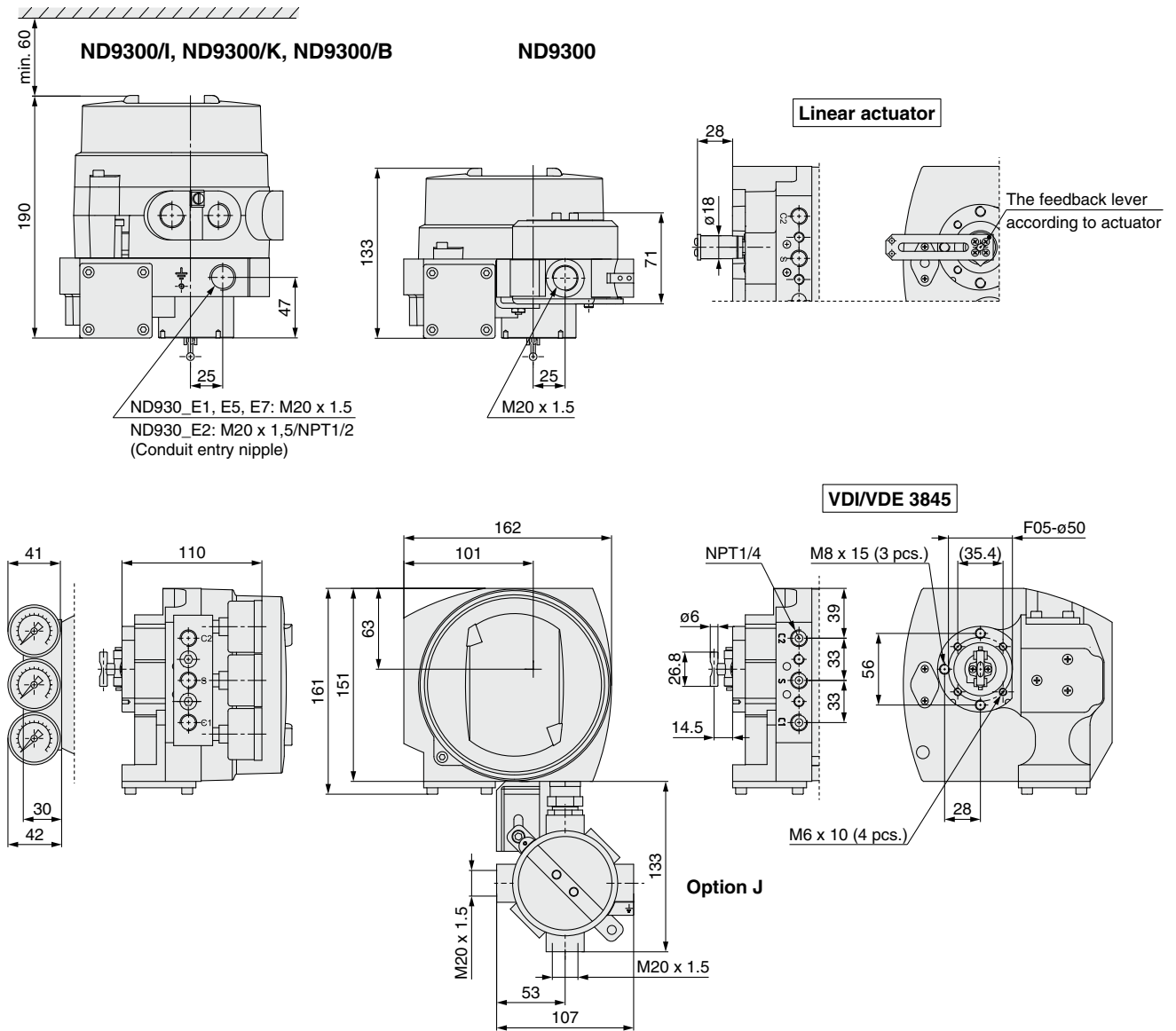
ND9200/I, ND9200/K, ND9200/B

ND9200

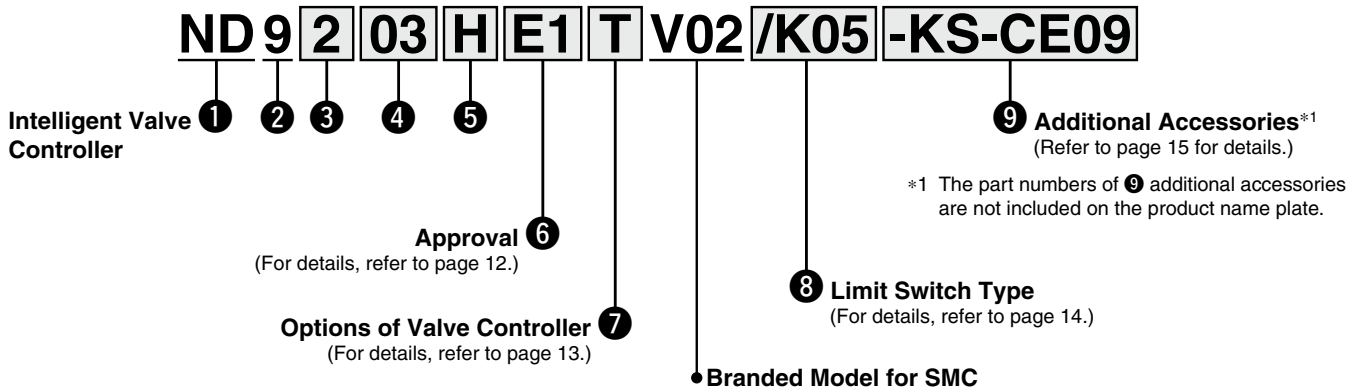


## Dimensions

### ND9300



## How to Order



### ② Series Code

Series 9000 valve controller with universal shaft and attachment face according to standard VDI/VDE 3845.

### ③ Enclosure

1	Standard IP66/NEMA 4X enclosure.
2	Flameproof (Ex d) IP66/NEMA 4X enclosure.
3	Stainless steel flameproof (Ex d) IP66/NEMA 4X enclosure
4	Stainless steel IP66/NEMA 4X enclosure, polymer composite cover

### ④ Spool Valve

	Spool Valve	Pneumatic Connections (S, C1, C2)
02	Low capacity. Stroke volume of actuator < 1 L.	G1/4 (ND9100), NPT1/4 (ND9200/ND9300/ND9400).
03	Medium capacity. Stroke volume of actuator 1 to 3 L.	G1/4 (ND9100), NPT1/4 (ND9200/ND9300/ND9400).
06	High capacity. Stroke volume of actuator > 3 L.	G1/4 (ND9100), NPT1/4 (ND9200/ND9300/ND9400).

### ⑤ Communication/Input Signal Range

H	4 to 20 mA, HART (6 and 7) communication. Supply voltage 30 VDC. Load voltage: up to 9.7 VDC at 20 mA corresponding to 485 Ω (maximum voltage drop).
F	FOUNDATION fieldbus, physical layer according to IEC 61158-2.
P	Profibus PA, physical layer according to IEC 61158-2.

**6 Approval**

**Approvals for Hazardous Areas**

<b>N</b>	No approvals for hazardous areas. M20 x 1.5 conduit entry. Temperature range: -40 to 85°C. Not applicable to ③ sign "2".
<b>N7</b>	No approvals for hazardous areas. Like N, but this is with Russian language machine plate.
<b>X</b>	<p><b>ATEX and IECEx certifications:</b>                      II 1 G Ex ia IIC T6...T4 Ga      II 2 G Ex ib IIC T6...T4 Gb                      II 1 D Ex ta IIIC T90°C Da      I 2 D Ex tb IIIC T90°C Db                      Temperature range: T4: -40 to 80°C; T5: &lt; 65°C; T6: &lt; 50°C</p> <p>II 3 G Ex nA IIC T6...T4      Gc II 3 D Ex tc IIIC T90°C Dc                      Temperature range: T4: -40 to 85°C; T5: &lt; 75°C; T6: &lt; 60°C</p> <p>II 3 G Ex ic IIC T6...T4 Gc      II 3 D Ex tc IIIC T90°C Dc                      Ex ic IIC T6...T4                      Temperature range: T4: -40 to 85°C; T5: &lt; 75°C; T6: &lt; 60°C</p> <p>Available without limit switches or with ATEX or IECEx certified inductive limit switches.                      M20 x 1.5 conduit entry.                      With limit switch temperature range is updated according to switch type.                      * Dust approval:                      II 1 D Ex ta IIIC T90°C Da      II 2 D Ex tb IIIC T90°C Db                      II 3 D Ex tc IIIC T90°C Dc                      Not applicable to ③ sign "4".</p>
<b>X7</b>	<b>ATEX and IECEx certifications:</b> Like X, but this is with Russian language machine plate. Check details of marking from X
<b>U</b>	<p><b>cCSAus certifications:</b>                      IS Class I, Division 1, Group A, B, C, D; T4/T5/T6                      Ex ia IIC T4/T5/T6 Ga                      IS Class I, Zone 0 AEx ia IIC T4/T5/T6 Ga                      Temperature range: T4: -40 to 80°C; T5: &lt; 65°C; T6: &lt; 50°C                      Not applicable to ③ sign "2" or "4".</p> <p>Applicable for ⑤ sign "H".                      Class I, Division 2, Group A, B, C, D; T4/T5/T6                      Ex nA IIC T4/T5/T6 Gc or Ex nA ia IIC T4/T5/T6 Gc Ga                      Class I, Zone 2 AEx nA IIC T4/T5/T6 Gc or Ex nA ia IIC T4/T5/T6 Gc Ga                      Temperature range: T4: -40 to 80°C; T5: &lt; 65°C; T6: &lt; 50°C</p> <p>Applicable for ⑤ sign "F" or "P".                      Class I, Division 2, Group A, B, C, D; T4/T5/T6                      Ex ic IIC T4/T5/T6 Gc                      Class I, Zone 2 AEx ic IIC T4/T5/T6 Gc                      Temperature range: T4: -40 to 80°C; T5: &lt; 65°C; T6: &lt; 50°C                      No Zener Barrier needed.                      NPT1/2 conduit entry.                      With limit switch temperature range is updated according to switch type.</p>
<b>Z</b>	<p><b>INMETRO certifications:</b>                      Ex ia IIC T4/T5/T6 Ga      Ex ia IIC T4/T5/T6                      Ex ia IIC T4/T5/T6 Gb                      Temperature range: T4: -40 to 80°C; T5: &lt; 65°C; T6: &lt; 50°C</p> <p>Ex nA IIC T4/T5/T6 Gc                      Temperature range: T4: -40 to 85°C; T5: &lt; 75°C; T6: &lt; 60°C</p> <p>Ex ic IIC T4/T5/T6 Gc      Ex ic IIC T4/T5/T6                      Temperature range: T4: -40 to 85°C; T5: &lt; 75°C; T6: &lt; 60°C                      Not applicable to ③ sign "2" or "4".                      Available without limit switches or with IECEx certified inductive limit switches.                      M20 x 1.5 conduit entry.                      With limit switch temperature range is updated according to switch type.</p>

<b>E1</b>	<p><b>ATEX and IECEx certifications:</b>                      II 2 G Ex d IIC T6...T4 Gb                      II 2 D Ex tb IIIC T80°C..T105°C Db                      Temperature range: T4: -40 to 85°C; T5: &lt; 75°C; T6: &lt; 60°C                      Not applicable to ③ sign "1" or "4".                      M20 x 1.5 conduit entry.</p>
<b>E2</b>	<p><b>cCSAus certification:</b>                      Class I, Div 1, Groups B, C, D; Class II, Div 1, Groups E, F, G;                      Class III; T4...T6, Enclosure type 4X                      Ex d IIC T4...T6                      AEx d IIC T4...T6                      Ex tb IIIC T100°C IP66                      AEx tb IIIC T100°C IP66                      Temperature range: T4: -40 to 85°C; T5: &lt; 75°C; T6: &lt; 60°C                      Not applicable to ③ sign "1" or "4".                      NPT1/2 conduit entry.</p>
<b>E4</b>	<p><b>Japanese Ex-d certification:</b>                      II 2 G Ex d IIC T6 Gb                      II 2 D Ex tb IIIC T80°C Db                      Temperature range:                      T6: &lt; 60°C</p> <p>Not applicable to ③ sign "1" or "4".                      A cable gland approved by IECEx is required.                      Select an appropriate cable gland from additional accessories for positioners (accessory CG43 or CG44).                      CG43: NPT1/2 conduit entry and cable entry adapter                      CG44: G1/2 conduit entry and cable entry adapter</p>
<b>E5</b>	<p><b>INMETRO certification:</b>                      Ex d IIC T4/T5/T6 Gb                      Ex tb IIIC T100°C Db IP66                      Temperature range: T4: -40 to 85°C; T5: &lt; 75°C; T6: &lt; 60°C                      Not applicable to ③ sign "1" or "4".                      M20 x 1.5 conduit entry.</p>
<b>E7</b>	<b>ATEX and IECEx certifications:</b> Like "E1", but this is with Russian language machine plate. Check details of marking from "E1"

# ND9000 Series

## 7 Options of Valve Controller

<b>Nil</b>	None
<b>T</b>	<p>Internal 2-wire (passive) position transmitter. Analog position feedback signal, output 4 to 20 mA, supply voltage 12 to 30 VDC, external load resistance 0 to 780 Ω.</p> <p>ND91_HXT, ND91_HZT, ND92_HXT, ND93_HXT, ND93_HZT, ND94_HXT:            II 1 G Ex ia IIC T6...T4 Ga            II 1 D Ex ta IIIC T90°C Da            II 2 G Ex ib IIC T6...T4 Gb            II 2 D Ex tb IIIC T90°C Db  <math>U_i \leq 28 \text{ V}</math>, <math>I_i \leq 120 \text{ mA}</math>, <math>P_i \leq 1 \text{ W}</math>, <math>C_i \leq 22 \text{ nF}</math>, <math>L_i \leq 53 \text{ } \mu\text{H}</math>, external load resistance 0 to 690 Ω.</p> <p>ND91_HXT, ND91_HZT, ND92_HXT, ND93_HXT, ND93_HZT, ND94_HXT:            II 3 G Ex nA IIC T6...T4 Gc            II 3 D Ex tc IIIC T90°C Dc  <math>U_i \leq 30 \text{ V}</math>, <math>I_i \leq 152 \text{ mA}</math>            II 3 G Ex ic IIC T6...T4 Gc            II 3 D Ex tc IIIC T90°C Dc  <math>U_i \leq 30 \text{ V}</math>, <math>I_i \leq 152 \text{ mA}</math>, <math>P_{\text{max}} = \text{device limits itself}</math>, <math>C_i \leq 22 \text{ nF}</math>, <math>L_i \leq 53 \text{ } \mu\text{H}</math>, external load resistance 0 to 780 Ω.</p> <p>ND91_HUT and ND93_HU1T:            Class I, Division 1, Group A, B, C, D; T4/T5/T6            Ex ia IIC T4/T5/T6 Ga            Class I, Zone 0 AEx ia IIC T4/T5/T6 Ga  <math>U_i \leq 28 \text{ V}</math>, <math>I_i \leq 120 \text{ mA}</math>, <math>P_i \leq 1 \text{ W}</math>, <math>C_i \leq 22 \text{ nF}</math>, <math>L_i \leq 53 \text{ } \mu\text{H}</math>, external load resistance 0 to 690 Ω.</p> <p>Class I, Division 2, Group A, B, C, D; T4/T5/T6            Ex nA IIC T4/T5/T6 Gc or Ex nA ia IIC T4/T5/T6 Gc Ga            Class I, Zone 2 AEx nA IIC T4/T5/T6 Gc or Ex nA ia IIC T4/T5/T6 Gc Ga  <math>U_i \leq 30 \text{ V}</math>, <math>P_{\text{max}} = \text{device limits itself}</math>, <math>C_i \leq 22 \text{ nF}</math>, <math>L_i \leq 53 \text{ } \mu\text{H}</math>, external load resistance 0 to 780 Ω.</p> <p>ND92_HE1T, ND92_HE2T, ND92_HE4T, ND92_HE5T, ND93_HE1T, ND93_HE5T:  <math>U_i \leq 30 \text{ V}</math>, <math>P_{\text{max}} = \text{device limits itself}</math>, external load resistance 0 to 780 Ω.            Applicable to 5 sign "H".</p>
<b>R</b>	<p>Remote mounting            Applicable to 3 sign "1" only.            Applicable to 6 sign "N", "N7", "X" and "X7".            * Not applicable to limit switch.            Always requires external position measurement. For rotary actuators, see Remote Mounting Accessories on page 16.            Output values for:            HART  <math>U_o (\text{Voc}) = 3.53 \text{ V}</math>, <math>I_o (\text{Isc}) = 12.6 \text{ mA}</math>, <math>P_o = 11.1 \text{ mW}</math>,  <math>C_o (\text{Ca}) = 10 \text{ nF}</math>, <math>L_o (\text{La}) = 10 \text{ } \mu\text{H}</math>            FOUNDATION fieldbus and Profibus  <math>U_o (\text{Voc}) = 5.0 \text{ V}</math>, <math>I_o (\text{Isc}) = 17.8 \text{ mA}</math>, <math>P_o = 22.2 \text{ mW}</math>,  <math>C_o (\text{Ca}) = 10 \text{ nF}</math>, <math>L_o (\text{La}) = 10 \text{ } \mu\text{H}</math></p>

<b>C</b>	<p>Arctic temperature option.            Temperature range: -53 to 85°C            Applicable to 3 sign "2" and "3".            Applicable to 6 sign "X", "X7", "E1", "E2", "E7" and "U".            Not applicable to 7 sign J (External junction box).            * Limit switch may limit the temperature range</p>
<b>J</b>	<p>ND91_H, ND94_H, ND92_H and ND93_H:            External junction box for all 4 to 20 mA wirings, including position transmitter, if applicable.            Junction box is connected to the enclosure, 2 pcs. M20 x 1.5 conduit entry.            ND91_F, ND92_F, ND94_F, ND93_F, ND91_P, ND92_P, ND94_P and ND93_P:            External junction box for wirings, including option for parallel connection of external surge protector.            Junction box is connected to the enclosure, 2 pcs. M20 x 1.5 conduit entry.            Applicable to 6 sign "N", "N7", "X", "X7", "Z", "E1", "E2" or "E7".</p>
<b>G</b>	<p>Exhaust adapter. ND9100: 1 x NPT1/2 thread, ND9200 and ND9300: 2 x NPT1/2 thread.</p>

## 8 Limit Switch Type

Inductive proximity switches, 2 pcs.  
 IP66/NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.).  
 Option E2: NPT1/2 conduit entry (2 pcs.).  
 Limit switches applicable only with ND9100, ND9200 and ND9300.

Nil	None
/D33	Metso; SST Sensor Dual Module, NO, 8 to 125 VDC/24 to 125 VAC Temperature range: -40 to 82°C Usable up to SIL3 acc. to IEC61508 Applicable to ⑥ sign "N", "N7", "E1", "E2", "E5" and "E7".
/D44	Metso; NAMUR Sensor Dual Module, 6-29 VDC, > 3 mA; < 1 mA. Temperature range: -40 to 82°C Usable up to SIL3 acc. to IEC61508 Applicable to ⑥ sign "N", "N7", "U", "E1", "E2", "E5" and "E7".
/I02	P+F; NJ2-12GK-SN, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC Temperature range: -40 to 85°C Not applicable to ⑥ sign "E4". Usable up to SIL3 acc. to IEC61508 * In safety-related applications the sensor must be operated with a qualified fail safe interface, such as P+F KFD2-SH-EX1.
/I09	P+F; NCB2-12GM35-N0, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC Temperature range: -25 to 85°C Not applicable to ⑥ sign "E4". Usable up to SIL2 acc. to IEC61508
/I32	Omron E2E-X2Y1, 2-wire type; AC; < 100 mA; 24 to 240 VAC Temperature range: -40 to 85°C Applicable to ⑥ sign "N" and "N7". Temperature range: -25 to 75°C Applicable to ⑥ sign "E1", "E2", "E5" and "E7".
/I41	P+F; NJ4-12GK-SN, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC Temperature range: -50 to 85°C Not applicable to ③ sign "1". Not applicable to ⑥ sign "E4". * That device may limit temperature range.
/I45	P+F; NJ3-18GK-S1N, 3-wire type, DC; > 3 mA; < 1 mA, NAMUR NO Temperature range: -25 to 85°C Not applicable to ⑥ sign "E4". Usable up to SIL3 acc. to IEC61508 * In safety-related applications the sensor must be operated with a qualified fail safe interface, such as P+F KFD2-SH-EX1.
/I56	ifm; IFC 2002-ARKG/UP, 2-wire type, DC; 150 mA, 10 to 36 VDC, leakage current < 0.6 mA. Temperature range: -20 to 85°C Not applicable to ⑥ sign "X", "X7", "Z", "U", "E2" and "E4".

Mechanical micro switches, 2 pcs.  
 IP66/NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.).  
 Option E2: NPT1/2 conduit entry (2 pcs.).  
 Limit switches applicable only with ND9100, ND9200 and ND9300

Nil	None
/K05	Omron D2VW-5; 3 A-250 VAC, 0.4 A-125 VDC, 5 A-30 VDC Temperature range: -40 to 85°C Not applicable to ⑥ sign "X", "X7", "Z", "U" and "E4".
/K06	Omron D2VW-01; gold plated contacts, 100 mA-30 VDC/125 VAC Temperature range: -40 to 85°C Not applicable to ⑥ sign "X", "X7", "Z", "U" and "E4".

Bus powered mechanical micro switches, 2 pcs.  
 Applicable to ND9000F and ND9000P only.  
 Limit switches applicable only with ND9100, ND9200 and ND9300  
 IP66/NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.).  
 Option E2: NPT1/2 conduit entry (2 pcs.).

Nil	None
/B06	Omron D2VW-01, gold plated contacts; Bus Powered, no external power needed. Temperature range: -40 to 85°C Not applicable to ⑤ sign "H". Not applicable to ⑥ sign "U" and "E4".

# ND9000 Series

Additional accessory symbol: When more than one accessory is required, indicate in ascending numerical order from 1) to 8).



\*1 The part numbers of ⑨ additional accessories are not included on the product name plate.

## ⑨ Additional Accessories

### 1) Filter Regulator

Nil	None
-KS*1	Filter regulator for supply air, Nominal filtration rating 5 μm Pressure gauge, scale bar, psi, kPa, kg/cm <sup>2</sup> , basic material: brass, nickel plated, housing stainless steel, glycerine filled Temperature range: -40 to 82°C KS option includes a thread nipple NPT1/4" to NPT1/4" between filter regulator and positioner which is suitable with ND9100 and ND9200 positioner options A3 and A5 (NPT1/4 air connection). Supply air connector in the filter regulator is female 1/4".
-K1S*1	Filter regulator for supply air, Nominal filtration rating 5 μm Pressure gauge, scale bar, psi, kPa, kg/cm <sup>2</sup> , basic material: brass, nickel plated, housing stainless steel, glycerine filled Temperature range: -40 to 82°C K1S option includes a thread nipple NPT1/4" to G1/4" between filter regulator and positioner which is suitable with ND9100 positioner and with option A1 (G1/4 air connection). Supply air connector in the filter regulator is female 1/4".
-K2*1	Stainless steel (AISI 316) filter regulator for supply air Filter size 5 μm Pressure gauge, scale bar, psi, kPa, kg/cm <sup>2</sup> , silicone oil, AISi 316, temperature range: -40 to 80°C Applicable to ③ sign "3" and "4".

### 2) Conduit Entry Nipples

Nil	None
-CE07	NPT1/2 conduit entry nipples M20 x 1.5/NPT1/2 (ND9100 and ND9400)
-CE08	R1/2 (PF1/2) conduit entry nipples M20 x 1.5/R1/2 (ND9100 and ND9400)
-CE09	NPT1/2 conduit entry nipples Brass M20 x 1.5/NPT1/2, Exd approved (ND9200) Not applicable to ⑥ sign "E4".
-CE19	NPT1/2 conduit entry nipples Stainless Steel M20 x 1.5/NPT1/2, Exd approved (ND9300) Not applicable to ⑥ sign "E4".

### 3) Cable Glands

Not to be used together with conduit entry nipples (CE\_) or connection plugs (P\_).

Nil	None
-CG5	M20 x 1.5 grey/plastic, IP66 Applicable to ③ sign "1" and "4".
-CG6	M20 x 1.5 blue/plastic, IP66, Ex e Applicable to ③ sign "1" and "4".
-CG43	Conduit entry and cable entry adapter for ND9200 and ND9300 M20 (male thread)/NPT1/2 (female thread) SS Ex d II C Ex db II C Gb, IP66
-CG44	Conduit entry and cable entry adapter for ND9200 and ND9300 M20 (male thread)/G1/2 (female thread) SS Ex d II C Ex db II C Gb, IP66

### 4) Pressure Gauges and Connection Blocks

Nil	None
-A1*1	Pressure gauges, scale 0-12 bar, psi, kPa, kg/cm <sup>2</sup> , basic material: brass, nickel plated, housing stainless steel, oil filled Temperature range: -40 to 85°C/-40 to 185°F, pneumatic connection block, material: AISiMg, anodized grey, connections G1/4 (S, C1, C2) Only for ND9100
-A1B*1	Same as A1 but includes two pressure gauges with G1/4 (S, C2) connections, only for use with the single-acting type, only for ND9100
-A3*1	Pressure gauges, scale 0-12 bar, psi, kPa, kg/cm <sup>2</sup> , basic material: brass, nickel plated, housing stainless steel, oil filled Temperature range: -40 to 85°C/-40 to 185°F, pneumatic connection block, material: AISiMg, anodized grey Connections NPT1/4 (S, C1, C2), also converts ND91_ connections to NPT1/4, only for ND9100 and ND9200
-A3B*1	Same as A3 but includes two pressure gauges with NPT1/4 (S, C2) connections Also converts ND91_ connections to NPT1/4, only for use with the single-acting type, only for ND9100 and ND9200
-A5	Pneumatic connection block, converts ND91_ connections to NPT1/4 Material: AISiMg, anodized grey, connections NPT1/4 (S, C1, C2), only for ND9100.
-A6*1	Pressure gauges with G1/4 connections, material: AISI 316, scale 0-12 bar, psi, kPa, kg/cm <sup>2</sup> , only for ND9300 and ND9400
-A7*1	Pressure gauges with NPT1/4 connections, material: AISI 316, scale 0-12 bar, psi, kPa, kg/cm <sup>2</sup> , only for ND9300 and ND9400
-A10*1	Pressure gauges with NPT1/4 connections for ND9300 or ND9400, scale 0-12 bar, psi, kPa, kg/cm <sup>2</sup> AISI 316, pressure gauges for severe off-shore use, safety glass window, only for ND9300 and ND9400
-D3*1	Non oil filled, dry pressure gauges, scale 0-12 bar, psi, kPa, kg/cm <sup>2</sup> , basic material: brass, nickel plated, housing stainless steel Temperature range: -40 to 85°C/-40 to 185°F, pneumatic connection block, material: AISiMg, anodized grey Connections NPT1/4 (S, C1, C2), also converts ND91_ connections to NPT1/4, only for ND9100
-D3B*1	Same as D3 but includes two pressure gauges with NPT1/4 (S, C2) connections Also converts ND91_ connections to NPT1/4. Only for use with the single-acting type, only for ND9100
-AR	Pressure gauges, scale 0.1-1.2 MPa, basic material: brass, nickel plated, housing stainless, glycerin filled Temperature range: -50 to 85°C/-67 to 185°F Pneumatic connection block, material: AISiMg, connections Rc1/4 (S, C1, C2), only for ND9100
-ARB	Same as AR but includes two pressure gauges with Rc1/4 (S, C2) connections, only for use with the single-acting type, only for ND9100

\*1 Under the New Measurement Law, products for overseas use only (SI unit type for use in Japan)



## 5) Connection Plugs

Not to be used together with conduit entry nipples (CE\_) or cable glands (CG\_).  
Not applicable to ⑥ sign "X", "X7" and "U".

<b>Nil</b>	None
<b>-P1H</b>	ND9100H (HART): Connection plug according to M20 x 1.5/DIN 43650A (ISO 4400) Not applicable to ⑤ sign "F" and "P".
<b>-P4H</b>	Valve controller and limit switch with connection plugs (1 + 1 pc.) ND9100H (HART): M20 x 1.5/DIN 43650A (ISO 4400) ND9100/K00 or 2-wire ND9100/100 Not applicable to ⑤ sign "F" and "P".
<b>-P2F</b>	ND9100F and ND9100F/B06 (FOUNDATION fieldbus): Connection plug male eurofast, Turck FSV49, M20 x 1.5/M12 Not applicable to ⑤ sign "H" and "P".
<b>-P3F</b>	ND9100F and ND9100F/B06 (FOUNDATION fieldbus): Connection plug male minifast, Turck RSFV49, M20 x 1.5/7/8" Not applicable to ⑤ sign "H" and "P".
<b>-P2P</b>	ND9100P and ND9100P/B06 (Profibus PA): Connection plug male, Weidmuller 842593, M20 x 1.5/M12 Not applicable to ⑤ sign "H" and "F".
<b>-P3P</b>	ND9100P and ND9100P/B06 (Profibus PA): Connection plug male minifast, Turck RSFV48, M20 x 1.5/7/8" Not applicable to ⑤ sign "H" and "F".

## 6) Driver Sets (Connection Fitting)

Driver sets including the needed parts when assembling ND9000 on rotary actuators with VDI/VDE 3845 attachment face or Neles standard mounting faces.

Select the correct driver set according to the actuator and the pneumatic connections of valve controller or gauge block when applicable.

\* Earlier the DS04 was delivered with bareshaft positioners as default. This practice is no longer valid, the needed driver set must be ordered as an accessory.

<b>Nil</b>	None
<b>-DS01</b>	Driver set for ND9100 on actuators with VDI/VDE3845 attachment face. Set includes the G1/4 plug for single acting actuators. The driver set should also be applied with all ND7/9 with gauge blocks A1, A2 or A6.
<b>-DS02</b>	Driver set for ND92/93/94 on actuators with VDI/VDE 3845 attachment face. Set includes the NPT1/4 plug for single acting actuators. The driver set should also be applied with all ND with gauge blocks A3, A5, A7 or A10.
<b>-DS04</b>	General driver set for ND91/92/94/93 on actuators with VDI/VDE 3845, actuators of Neles E Series, or actuators with Neles standard attachment face (e.g. when replacing NE7/NP7 or ND800 with S2 shaft). Earlier default driver set. The set includes the NPT1/8, NPT1/4, and G1/4 plugs needed when used with a single acting actuator or flush mounted on an E Series actuator.

## 7) 3rd Party Mounting Sets

Mounting sets between the ND9000 generation valve controllers and linear actuators, including bracket and ball joint based feedback system.

\* Sets are including the pneumatic plugs needed when used with single acting actuators.

\* All available mounting sets listed in [http://www2.stonel.com/utilities/metso/mkdbase\\_open.htm](http://www2.stonel.com/utilities/metso/mkdbase_open.htm)

<b>Nil</b>	None
<b>-MS01</b>	Mounting set (MS01) for linear actuators, attachment face according to IEC 60534-6 Stroke length 10 to 55 mm
<b>-MS02</b>	Mounting set (MS02) for linear actuators, attachment face according to IEC 60534-6, stroke length 55 to 120 mm
<b>-MS03</b>	Mounting set for Masoneilan 87/88 actuators, sizes 6 to 23 Stroke length 12 to 64 mm

## 8) Remote Mounting Accessories

<b>Nil</b>	
<b>-RR01</b>	ND remote mount rotary sensor QNCOK05HDM
<b>-RR02</b>	Remote mount rotary sensor QNCAK05HDM
<b>-RC01</b>	Cable assembly remote mount sensor cable 1.2 m, straight connector
<b>-RC02</b>	Cable assembly remote mount sensor cable 3.0 m, angle connector
<b>-RC03</b>	Cable assembly remote mount sensor cable 30 m, angle connector

# ND9000 Series

## Countries and Regions Where ND9000 Series Products are Available

### Countries Where Products are Available

ND9000 series products are only available in the countries and regions listed below. For details, contact your nearest sales branch.



#### Europe



**1 Austria**  
**SMC Austria GmbH**  
 Girakstrasse 8, AT-2100 Korneuburg, Austria  
 URL <http://www.smc.at>



**2 Belgium**  
**SMC Belgium N.V./S.A**  
 Temesselei 232, 2160 Wommelgem, Belgium  
 URL <http://www.smc-pneumatics.be>



**3 Finland**  
**SMC Automation Oy**  
 PB72, 02231, Espoo, Finland  
 URL <http://www.smc.fi>



**4 Germany**  
**SMC Deutschland GmbH**  
 Boschring 13-15, 63329 Egelsbach, Germany  
 URL <http://www.smc.de>



**5 Italy**  
**SMC Italia S.p.A.**  
 Via delle Donne Lavoratrici, 20861 Brugherio (MB)  
 URL <http://www.smcitalia.it>



**6 Netherlands**  
**SMC Nederland B.V.**  
 De Ruyterkade 120, NL-1011 AB Amsterdam, the Netherlands  
 URL <http://www.smc.nl>



**7 Russia**  
**SMC Pneumatik LLC**  
 Business center, building 3, 15 Kondratjevskij prospect, St.Petersburg, Russia, 195197  
 URL <http://www.smc-pneumatik.ru/>



**8 Spain**  
**SMC España SA**  
 Zuazobidea 14, 01015 Vitoria, Spain  
 URL <http://www.smc.eu>



**9 Sweden**  
**SMC Automation AB**  
 Ekhagsvägen 29-31, SE-141 71 Segeltorp, Sweden  
 URL <http://www.smc.nu>



**10 U.K.**  
**SMC Pneumatics (U.K.) Ltd.**  
 Vincent Avenue, Crownhill, Milton Keynes, Buckinghamshire MK8 0AN, United Kingdom  
 URL <http://www.smc-pneumatics.co.uk/>



**11 Brazil**  
**SMC Automação do Brasil Ltda.**  
 Av. Piraporinha, 777 Barro Planalto, São Bernardo do Campo São Paulo, Brazil  
 URL <http://www.smcbr.com.br>



**12 Chile**  
**SMC Corporation (Chile), S.A.**  
 Av. La Montana, #1115 P. Norte km. 16.5 Parque Industrial Valle Grande, Lampa, Santiago, Chile  
 URL <http://www.smcchile.cl>



**13 Mexico**  
**SMC Corporation (Mexico), S.A. de C.V.**  
 Carr. Silao-Trejo K.M. 2.5 S/N Predio San Jose del Durazno C.P. 36100, Silao, Gto. Mexico  
 URL <http://www.smc.com.mx>



**14 Peru**  
**SMC Corporation Peru S.A.C.**  
 AV.Argentina 2078 -Lima-Lima-Peru.  
 URL <http://www.smcperu.com>



**15 Australia**  
**SMC Corporation (Australia) Pty Ltd**  
 14-18 Hudson Avenue, Castle Hill, Sydney, New South Wales 2154, Australia  
 URL <http://www.smcworld.com/en-jp/>



**16 China <Beijing / Shanghai Area>**  
**SMC (China) Co., Ltd.**  
 A2, XingSheng Street, BDA, Beijing, 100176 P.R. China  
 URL <http://www.smc.com.cn>



**17 China <Guangzhou Area>**  
**SMC Automation (Guangzhou) Ltd.**  
 2, Dongming Road 3, Science Park Guangzhou Hi-Tech Industrial Development Zone, Guangzhou, P.R.China  
 URL <http://www.smcgz.com.cn>



**18 India**  
**SMC Corporation (India) Pvt. Ltd.**  
 A-4, Sector-88, Noida-201 305 India  
 URL <http://www.smc.in>



**19 Japan**  
**SMC Corporation**  
 Akihabara UDX 15F, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo, Japan  
 URL <https://www.smcworld.com>



**20 New Zealand**  
**SMC Corporation (NZ) Limited**  
 5 Pacific Rise Mt Wellington Auckland 1060, New Zealand (P O Box 62-226, Sylvia Park, Auckland, 1644)  
 URL <http://www.smcworld.com/en-jp/>



**21 Taiwan**  
**SMC Automation (Taiwan) Co., Ltd.**  
 No.16, Lane 205, Nansan Rd., Sec.2, Luzhu-Dist. Taoyuan-City, Taiwan  
 URL <http://www.smc.com.tw>




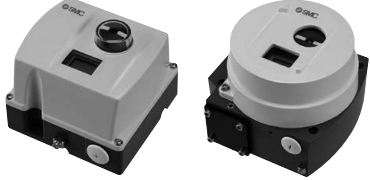
**22 Thailand**  
**SMC Thailand Ltd.**  
 134/6 Moo 5, Tiwanon Road, Bangkadi Amphur, Muang, Patumthani 12000, Thailand  
 URL <http://www.smcthai.co.th>

\* The names of countries listed in each area are alphabetically indexed.

As of September 2019

# ND9000 Series


# Comparison of Specifications


Model		ND9000 Series	ND7000 Series
Product name		Intelligent Valve Controller	Digital Valve Controller
Item			 Refer to the <b>Web Catalog</b> for details.
Input current		4 to 20 mA DC	
Min. operating current		3.6 mA DC	
Supply pressure		0.14 to 0.8 MPa	
Valve type (Standard stroke)	Linear	10 to 120 mm	10 to 120 mm
	Rotary	45 to 95°	45 to 95°
Actuator type	Single acting	Can be used for both types	Can be used for both types
	Double acting	Can be used for both types	Can be used for both types
Stroke/Opening feedback type		Mechanical joint	
Performance	Hysteresis	< 0.5% F.S.	
	Dead band	≤ ± 0.1% F.S.	
	Coefficient of temperature	≤ 0.5% F.S./10°C	
	Output flow (Supply pressure: 0.4 MPa)	93 L/min (ANR) (Spool valve 02)	
		201 L/min (ANR) (Spool valve 03)	
		634 L/min (ANR) (Spool valve 06)	
	Air consumption (Supply pressure: 0.4 MPa)	< 9.9 L/min (ANR) (Spool valves 02 and 03)	
< 17 L/min (ANR) (Spool valve 06)			
Ambient and fluid temperatures		-40 to 85°C	
Exterior covering enclosure		IP66, NEMA 4X	
Low-temperature specification		○ (-53 to 85°C)	○ (-53 to 85°C)
Safety integrity level (IEC 61580)	SIL	SIL 2	SIL 2
Explosion proof construction (Option)	Intrinsically safe explosion-proof	○	○
	Explosion-proof	○	○
Transmission	HART	●	●
	Profibus PA	○	—
	FOUNDATION fieldbus	○	—
Limit switch		○	○
Position transmitter (in HART only)		○	○
Remote type		○	○
Self-diagnostics		● (Advanced)	●
Fail safe (fully closed/fully open)		●	●
Corrosion resistant	Stainless steel enclosure	● (ND93 series)	—
	Stainless steel body/ Polymer composite cover	● (ND94 series)	—
Air connection port	Rc1/4 female thread	○ (Adapter)	○ (Adapter)
	NPT1/4 female thread	● (ND92, ND93, ND94 series)	● (ND72 series)
	G1/4 female thread	● (ND91 series)	● (ND71 series)
Electrical connection port	M20 female thread	●	●
	NPT1/2 female thread	○ (In compliance with explosion-proof specifications)	○ (In compliance with explosion-proof specifications)
	G1/2 female thread	○ (In compliance with explosion-proof specifications)	○ (In compliance with explosion-proof specifications)
Weight	1.8 kg	Standard/Intrinsically safe explosion-proof (ND91 series)	1.8 kg Standard/Intrinsically safe explosion-proof (ND71 series)
	3.4 kg	Flameproof (ND92 series)	3.4 kg Flameproof (ND72 series)
	8.6 kg	Stainless steel enclosure (ND93 series)	
	5.6 kg	Stainless steel body/Polymer composite cover (ND94 series)	


●: Standard ○: Option

## Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “**Caution**,” “**Warning**” or “**Danger**.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)\*1), and other safety regulations.

 **Caution:** **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

 **Warning:** **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

 **Danger :** **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

\*1) ISO 4414: Pneumatic fluid power – General rules relating to systems.  
ISO 4413: Hydraulic fluid power – General rules relating to systems.  
IEC 60204-1: Safety of machinery – Electrical equipment of machines.  
(Part 1: General requirements)  
ISO 10218-1: Manipulating industrial robots – Safety.  
etc.

### Warning

#### 1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

#### 2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

#### 3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

#### 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
2. An application which could have negative effects on people, property, or animals requiring special safety analysis.
3. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

## Limited warranty and Disclaimer/ Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

### Limited warranty and Disclaimer

**Scope of Warranty:** Warranty shall be granted for non-conformity of the Company's product (“Product”) to the relevant specifications. Any such non-conformity resulting from wear of expendable parts resulting from the Customer's normal use thereof, or from the Customer's inappropriate, insufficient or inexperienced maintenance or from the Customer's inappropriate storage, installation, use, operation or the like, or from the Customer's modification or the like are excluded from warranty.

**Period of Warranty:** One (1) year from the commencement of use by the Customer or one year and half (1.5) from the delivery of the Product; whichever expires earlier.

**Claiming Procedures:** If the Customer determines that the Product is non-conforming, the Customer shall immediately notify the Company. If the notice does not arrive at the Company within two (2) weeks from the date of expiration of the relevant warranty period, the Customer's rights to warranty is forfeited. Even in the case where the notice arrives within the period prescribed above, liability for any damage arising from any delay of the notice shall be borne by the Customer.

**Remedies:** If any non-conformity is actually found in the Product as a result of an inspection made by the Company, the Company shall, upon consultation, repair or replace the Product. The Company will not accept any other claims (such as monetary compensation).

**Related Expenses:** Where the Product is eligible for warranty, shipment expenses therefor shall be borne by the Company. Regardless of whether or not the Product is eligible for warranty, expenses for removal and installation incurred in relation to replacement of the Product shall be borne by the Customer.

**Limitation of Liability:** Even if any legal liability in whichever form other than the warranties set forth above arises in respect of the Company, the Company's scope of liability shall be limited as follows:

- The Company shall be held liable only to the extent that the relevant liability is caused by its act or omission due to its negligence.
- The Company's liability shall not exceed the amount of direct damages incurred by the Customer in respect of the Product, and the Company shall not be held liable for any indirect, contingent, consequential or punitive damage.
- The Company's liability shall not exceed the amount of the sales price of the Product.
- The Company shall not be held liable for any damage caused to the nuclear energy, space or aviation business, for any damage due to any force majeure events including war, terrorist activities or natural disasters, or for compliance with safety regulations or environmental regulations that is beyond the scope of business of the Company.

### Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

### Caution

**SMC products are not intended for use as instruments for legal metrology.** Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

## Safety Instructions

Be sure to read the “Handling Precautions for SMC Products” (M-E03-3) and “Operation Manual” before use.