Intelligent Valve Controller

- 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°C
- Communication: FOUNDATION fieldbus, Profibus PA
- Limit switch
- Position transmitter (in HART only)
- Remote type
- Stainless steel body

**Standard: IP66/NEMA 4X enclosure**

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

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°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
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
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.

### Technical Description

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 micro controller (µC) reads the input signal, position sensor ($\alpha$), pressure sensors ($P_s, P_1, P_2$) and spool position sensor (SPS).

1. A difference between input signal and position sensor ($\alpha$) measurement is detected by control algorithm inside the µC.

The µC calculates a new value for 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 actuator pressures change accordingly.

1. 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 actuator and feedback shaft rotate. The position sensor ($\alpha$) measures the rotation for the µC. The µC using control algorithm modulates the PR-current from the steady state value until the new position of the actuator, according to the input signal, is reached.
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 feedback 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
<table>
<thead>
<tr>
<th>ND9100</th>
<th>ND9200</th>
<th>ND9300</th>
<th>ND9400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Anodised aluminum alloy and polymer composite</td>
<td>Anodised aluminum alloy and tempered glass</td>
<td>Stainless steel and polymer composite</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP66, NEMA 4X</td>
<td>NPT1/4</td>
<td></td>
</tr>
<tr>
<td>Air connection port</td>
<td>G1/4</td>
<td>NPT1/4</td>
<td></td>
</tr>
<tr>
<td>Electrical connection port</td>
<td>M20 x 1.5</td>
<td>(ND91/9300_U, ND92/9300_E2)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>1.8 kg</td>
<td>3.4 kg</td>
<td>8.6 kg</td>
</tr>
</tbody>
</table>

* 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 485Ω)
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

<table>
<thead>
<tr>
<th>AO</th>
<th>20 ms</th>
<th>DI</th>
<th>15 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>20 ms</td>
<td>IS</td>
<td>15 ms</td>
</tr>
<tr>
<td>PID</td>
<td>20 ms</td>
<td>OS</td>
<td>15 ms</td>
</tr>
<tr>
<td>DO</td>
<td>20 ms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 db IIC T4/T5/T6 Ui ≤ 30 V
### Specifications

#### Approvals and Electrical Values, HART

<table>
<thead>
<tr>
<th>Certificate</th>
<th>Approval</th>
<th>Electrical values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ATEX</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_X</td>
<td>II 1G Ex ia IIC T6...T4 Ga</td>
<td>Input: $U_i \leq 28,V$, $I_i \leq 120,mA$, $P_i \leq 1,W$, $C_i \leq 22,nF$, $L_i \leq 53,\mu H$</td>
</tr>
<tr>
<td></td>
<td>II 1D Ex ia IIC T90°C Da</td>
<td>Output: $U_i \leq 28,V$, $I_i \leq 120,mA$, $P_i \leq 1,W$, $C_i \leq 22,nF$, $L_i \leq 53,\mu H$</td>
</tr>
<tr>
<td></td>
<td>II 2 G Ex ib IIC T6...T4 Gb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II 2 D Ex tb IIC T90°C Db</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II 3 G Ex na IIC T6...T4 Gc</td>
<td>Input: $U_i \leq 30,V$, $I_i \leq 152,mA$</td>
</tr>
<tr>
<td></td>
<td>II 3 D Ex tc IIC T90°C Dc</td>
<td>Output: $U_i \leq 30,V$, $I_i \leq 152,mA$</td>
</tr>
<tr>
<td>ND_E1</td>
<td>II 2 G Ex d IIC T6...T4 Gb</td>
<td>Input: $U_i \leq 30,V$</td>
</tr>
<tr>
<td></td>
<td>II 2 D Ex tb IIC T80°C...T105°C Db</td>
<td>Output: $U_i \leq 30,V$, $P_{max} = \text{device limits itself}$</td>
</tr>
<tr>
<td><strong>IECEx</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_X</td>
<td>Ex ia IIC T6...T4 Ga</td>
<td>Input: $U_i \leq 28,V$, $I_i \leq 120,mA$, $P_i \leq 1,W$, $C_i \leq 22,nF$, $L_i \leq 53,\mu H$</td>
</tr>
<tr>
<td></td>
<td>Ex tb IIC T90°C Db</td>
<td>Output: $U_i \leq 28,V$, $I_i \leq 120,mA$, $P_i \leq 1,W$, $C_i \leq 22,nF$, $L_i \leq 53,\mu H$</td>
</tr>
<tr>
<td></td>
<td>Ex nA IIC T6...T4 Gc</td>
<td>Input: $U_i \leq 30,V$, $I_i \leq 152,mA$</td>
</tr>
<tr>
<td></td>
<td>Ex tc IIC T90°C Dc</td>
<td>Output: $U_i \leq 30,V$, $I_i \leq 152,mA$</td>
</tr>
<tr>
<td>ND_E1</td>
<td>Ex d IIC T6...T4 Gb</td>
<td>Input: $U_i \leq 30,V$</td>
</tr>
<tr>
<td></td>
<td>Ex tb IIC T80°C...T105°C Db</td>
<td>Output: $U_i \leq 30,V$, $P_{max} = \text{device limits itself}$</td>
</tr>
<tr>
<td><strong>INMETRO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_Z</td>
<td>Ex ia IIC T4/T5/T6 Ga</td>
<td>Input: $U_i \leq 28,V$, $I_i \leq 120,mA$, $P_i \leq 1,W$, $C_i \leq 22,nF$, $L_i \leq 53,\mu H$</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC T4/T5/T6 Gb</td>
<td>Output: $U_i \leq 28,V$, $I_i \leq 120,mA$, $P_i \leq 1,W$, $C_i \leq 22,nF$, $L_i \leq 53,\mu H$</td>
</tr>
<tr>
<td></td>
<td>Ex nA IIC T4/T5/T6 Gc</td>
<td>Input: $U_i \leq 30,V$, $I_i \leq 152,mA$</td>
</tr>
<tr>
<td></td>
<td>Ex tc IIC T4/T5/T6 Gc</td>
<td>Output: $U_i \leq 30,V$, $I_i \leq 152,mA$</td>
</tr>
<tr>
<td>ND_E5</td>
<td>Ex d IIC T4/T5/T6 Gb</td>
<td>Input: $U_i \leq 30,V$</td>
</tr>
<tr>
<td></td>
<td>Ex tb IIC T100°C Db</td>
<td>Output: $U_i \leq 30,V$, $P_{max} = \text{device limits itself}$</td>
</tr>
</tbody>
</table>

#### Japanese Ex-d Certification

| ND_E4       | II 2 G Ex d IIC T6 Gb | Input: $U_i \leq 30\,V$ |
|             | II 2 D Ex tb IIC T80°C Db | Output: $U_i \leq 30\,V$, $P_{max} = \text{device limits itself}$ |
## Specifications

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

<table>
<thead>
<tr>
<th>Certificate</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>ATEX</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_X</td>
<td>II 1G Ex iA IIC T6...T4 Ga</td>
<td>Ui ≤ 24 V, ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 µH</td>
</tr>
<tr>
<td>VTT 09 ATEX 033X</td>
<td>II 1D Ex ta IIC T90°C Da</td>
<td>Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>VTT 09 ATEX 034X</td>
<td>II 2 G Ex ib IIC T6...T4 Gb</td>
<td></td>
</tr>
<tr>
<td>EN 60079-0: 2009/2012</td>
<td>II 2 D Ex tb IIC T90°C Db</td>
<td></td>
</tr>
<tr>
<td>EN 60079-11: 2012</td>
<td>II 3 G Ex na IIC T6...T4 Gc</td>
<td>Ui ≤ 24 V</td>
</tr>
<tr>
<td>EN 60079-26: 2007</td>
<td>II 3 D Ex tc IIC T90°C Dc</td>
<td></td>
</tr>
<tr>
<td>EN 60079-31: 2008</td>
<td>II 3 G Ex ic IIC T6...T4 Gc</td>
<td>Ui ≤ 32 V, ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 µH</td>
</tr>
<tr>
<td>EN 60079-11: 2012</td>
<td>II 3 D Ex tc IIC T90°C Dc</td>
<td>Comply with the requirements for FISCO Ex ic field device</td>
</tr>
<tr>
<td>EN 60079-15: 2010</td>
<td>II 2 G Ex d IIC T6...T4 Gb</td>
<td>Ui ≤ 32 V</td>
</tr>
<tr>
<td>EN 60079-31: 2008</td>
<td>II 2 D Ex tb IIC T80°C...T105°C Db</td>
<td></td>
</tr>
</tbody>
</table>

| **IECEx**   |          |                   |
| ND_X        | Ex ia IIC T6...T4 Ga | Ui ≤ 24 V, ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 µH |
| IECEx VTT 10.0004X | Ex ta IIC T90°C Da | Comply with the requirements for FISCO field device |
| IECEx VTT 10.0005X | Ex ib IIC T6...T4 Gb |                   |
| IEC 60079-0: 2007/2011 | Ex tb IIC T90°C Db |                   |
| IEC 60079-11: 2011 | Ex na IIC T6...T4 Gc |                   |
| IEC 60079-26: 2006 | Ex tb IIC T90°C Dc |                   |
| IEC 60079-31: 2008 | Ex iC IIC T6...T4 Gc | Ui ≤ 32 V, ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 µH |
| IEC 60079-11: 2011 | Ex tc IIC T90°C Dc | Comply with the requirements for FISCO field device |

| **INMETRO** |          |                   |
| ND_E1       | Ex d IIC T6...T4 Gb | Ui ≤ 32 V |
| IECEx SIR 11.0001X | Ex tb IIC T80°C...T105°C Db |                   |
| IEC 60079-0: 2011 | Ex ia IIC T4/T5/T6 Ga | Ui ≤ 24 V, ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 µH |
| IEC 60079-1: 2007 | Ex ia IIC T4/T5/T6 Gb | Comply with the requirements for FISCO field device |

| **cCSAus**  |          |                   |
| ND_U        | Class I, Division 1, Groups A, B, C, and D, T4/T5/T6 | Ui ≤ 24 V, ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 µH |
| ND_E5       | Class I, Division 2, Groups A, B, C, and D, T4/T5/T6 | Ui ≤ 24 V, ii ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 nF, Li ≤ 10 µH |

| **Japanese Ex-d Certification** |          |                   |
| ND_E4       | II 2 G Ex d IIC T6 Gb | Input: Ui ≤ 30 V |
|            | II 2 D Ex tb IIC T80°C Db | Output: Ui ≤ 30 V, Pmax = device limits itself |
Specifications

Electromagnetic Protection
Electromagnetic compatibility acc. to
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)

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

∗ 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.
ND9300/I, ND9300/K, ND9300/B

ND9300

ND9300

Linear actuator

The feedback lever according to actuator

VDI/VDE 3845

Option J
How to Order

**ND 9203HE1TV02/K05-KS-CE09**

1. **Intelligent Valve Controller**
2. **Series Code**
   - Series 9000 valve controller with universal shaft and attachment face according to standard VDI/VDE 3845.
3. **Spool Valve**
   - **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).
4. **Pneumatic Connections (S, C1, C2)**
5. **Approval**
   - (For details, refer to page 12.)
6. **Options of Valve Controller**
   - (For details, refer to page 13.)
7. **Limit Switch Type**
   - (For details, refer to page 14.)
8. **Branded Model for SMC**
9. **Additional Accessories**
   - (Refer to page 15 for details.)
   - The part numbers of additional accessories are not included on the product name plate.

**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.

**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.
**Approval for Hazardous Areas**

| N  | No approvals for hazardous areas. M20 x 1.5 conduit entry. 
|    | Temperature range: –40 to 85°C.
|    | Not applicable to sign "2". |
| N7 | No approvals for hazardous areas. 
|    | Like N, but this is with Russian language machine plate. |

**ATEX and IECEx certifications:**

- **E1**: II 2 G Ex d IIC T6...T4 Gb
- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 65°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**Japanese Ex-d certification:**

- **E4**: II 2 G Ex d IIC T6 Gb
- **E5**: II 2 D Ex db IIC T60°C Db

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to 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

**INMETRO certification:**

- **E6**: Ex d IIC T4…T6
- **E7**: Ex db IIC T6...T4

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**ATEX and IECEx certifications:**

- **E1**: II 2 G Ex d IIC T6...T4 Gb
- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 65°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**cCSAus certifications:**

- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to 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

**INMETRO certification:**

- **E6**: Ex d IIC T4…T6
- **E7**: Ex db IIC T6...T4

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**ATEX and IECEx certifications:**

- **E1**: II 2 G Ex d IIC T6...T4 Gb
- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 65°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**Japanese Ex-d certification:**

- **E4**: II 2 G Ex d IIC T6 Gb
- **E5**: II 2 D Ex db IIC T60°C Db

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to 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

**INMETRO certification:**

- **E6**: Ex d IIC T4…T6
- **E7**: Ex db IIC T6...T4

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**ATEX and IECEx certifications:**

- **E1**: II 2 G Ex d IIC T6...T4 Gb
- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 65°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**cCSAus certifications:**

- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to 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

**INMETRO certification:**

- **E6**: Ex d IIC T4…T6
- **E7**: Ex db IIC T6...T4

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**ATEX and IECEx certifications:**

- **E1**: II 2 G Ex d IIC T6...T4 Gb
- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 65°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**Japanese Ex-d certification:**

- **E4**: II 2 G Ex d IIC T6 Gb
- **E5**: II 2 D Ex db IIC T60°C Db

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to 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

**INMETRO certification:**

- **E6**: Ex d IIC T4…T6
- **E7**: Ex db IIC T6...T4

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**ATEX and IECEx certifications:**

- **E1**: II 2 G Ex d IIC T6...T4 Gb
- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 65°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.

**cCSAus certifications:**

- **E2**: I 2 G Ex ib IIC T6...T4 Gb
- **E3**: II 2 G Ex db IIC T6...T4 Gb

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to 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

**INMETRO certification:**

- **E6**: Ex d IIC T4…T6
- **E7**: Ex db IIC T6...T4

Temperature range: T4: –40 to 85°C; T5: < 75°C; T6: < 60°C

Not applicable to sign "1" or "4".

M20 x 1.5 conduit entry.
Options of Valve Controller

| Nil | None |

- 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.
- ND91_HXT, ND91_HZT, ND92_HXT, ND93_HXT, ND93_HZT, ND94_HXT:
  - I 1 G Ex ia IIC T6...T4 Ga
  - I 1 D Ex tb IIC T90°C Da
  - I 2 G Ex ib IIC T6...T4 Gb
  - I 2 D Ex tb IIC T90°C Db
  - Uᵢ ≤ 28 V, Iᵢ ≤ 120 mA, Pᵢ ≤ 1 W, Cᵢ ≤ 22 nF, Lᵢ ≤ 53 µH, external load resistance 0 to 690 Ω.
- ND91_HX, ND91_HZT, ND92_HXT, ND93_HXT, ND93_HZT, ND94_HXT:
  - I 3 G Ex na IIC T6...T4 Gc
  - I 3 D Ex tc IIC T90°C Dc
  - Uᵢ ≤ 30 V, Iᵢ ≤ 152 mA, Cᵢ ≤ 22 nF, Lᵢ ≤ 53 µH, external load resistance 0 to 780 Ω.
- 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.
  - Exhaust adapter. ND9100: 1 x NPT1/2 thread, ND9200 and ND9300: 2 x NPT1/2 thread.

### Arctic temperature option.

- Temperature range: –53 to 85°C
- Applicable to sign “2” and “3”.
- Applicable to sign “X”, “X7”, “E1”, “E2”, “E7” and “U”.
- Not applicable to sign J (External junction box).
- * Limit switch may limit the temperature range.

### Remote mounting

- Applicable to sign “1” only.
- Applicable to sign “N”, “N7”, “X”, “X7”, “Z”, “E1”, “E2” or “E7”.
- * Not applicable to limit switch.
- Always requires external position measurement. For rotary actuators, see Remote Mounting Accessories on page 16.

### Output values for:

- **HART**
  - Uₒ(Voc) = 3.53 V, Iₒ(Isc) = 12.6 mA, Pₒ = 11.1 mW,
  - Co(Ca) = 10 nF, Lo(La) = 10 µH
- **FOUNDATION fieldbus and Profinet**
  - Uₒ(Voc) = 5.0 V, Iₒ(Isc) = 17.8 mA, Pₒ = 22.2 mW,
  - Co(Ca) = 10 nF, Lo(La) = 10 µH
## 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.

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
</table>
| **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** sign “N”, “N7”, “E1”, “E2”, “E5” and “E7”. |
| **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** sign “N”, “N7”, “U”, “E1”, “E2”, “E5” and “E7”. |
| **P+F; NJ2-12GK-SN, 2-wire type, DC; >3 mA; <1 mA, NAMUR NC** | **Temperature range:** –25 to 85°C  
**Not applicable to** sign “E4”.  
**Usable up to SIL2 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.”** |
| **P+F; NCB2-12GM35-N0, 2-wire type, DC; >3 mA; <1 mA, NAMUR NC** | **Temperature range:** –25 to 85°C  
**Not applicable to** sign “E4”.  
**Usable up to SIL2 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.”** |
| **Omron E2E-X2Y1, 2-wire type, AC; <100 mA; 24 to 240 VAC** | **Temperature range:** –40 to 85°C  
**Applicable to** sign “N” and “N7”.  
**Temperature range:** –25 to 75°C  
**Applicable to** sign “E1”, “E2”, “E5” and “E7”. |
| **P+F; NJ4-12GK-SN, 2-wire type, DC; >3 mA; <1 mA, NAMUR NC** | **Temperature range:** –50 to 85°C  
**Not applicable to** sign “1”.  
**Not applicable to** sign “E4”.  
**That device may limit temperature range.”** |
| **P+F; NJ3-18GK-S1N, 3-wire type, DC; >3 mA; <1 mA, NAMUR NO** | **Temperature range:** –25 to 85°C  
**Not applicable to** 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.”** |
| **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** sign “E4”.  
**That device may limit temperature range.”** |

## 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

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
</table>
| **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** sign “X”, “X7”, “Z”, “U” and “E4”. |
| **Omron D2VW-01; gold plated contacts, 100 mA-30 VDC/125 VAC** | **Temperature range:** –40 to 85°C  
**Not applicable to** 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.).

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
</table>
| **Omron D2VV-01, gold plated contacts; Bus Powered, no external power needed.** | **Temperature range:** –40 to 85°C  
**Not applicable to** sign “H”.  
**Not applicable to** sign “U” and “E4”. |
ND9000 Series

Additional Accessories

1) Filter Regulator

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
</table>
| -KS | Filter regulator for supply air. Nominal filtration rating 5 μm. Pressure gauge, scale bar, psi, kPa, kg/cm², basic material: brass, nickel plated, housing stainless steel, glycerine filled. Temperature range: -40 to 62°C. Ks option includes a thread nipple NPT1/4" to G1/4" 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".

2) Conduit Entry Nipples

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>-CE07</td>
<td>NPT1/2 conduit entry nipples. M20 x 1.5/NPT1/2 (ND9100 and ND9400)</td>
</tr>
<tr>
<td>-CE08</td>
<td>R1/2 (PF1/2) conduit entry nipples. M20 x 1.5/R1/2 (ND9100 and ND9400)</td>
</tr>
<tr>
<td>-CE09</td>
<td>NPT1/2 conduit entry nipples. Brass M20 x 1.5/NPT1/2, Exd approved (ND9200). Not applicable to θ sign &quot;E4&quot;.</td>
</tr>
<tr>
<td>-CE19</td>
<td>NPT1/2 conduit entry nipples. Stainless Steel M20 x 1.5/NPT1/2, Exd approved (ND9300). Not applicable to θ sign &quot;E4&quot;.</td>
</tr>
</tbody>
</table>

3) Cable Glands

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>-CG6</td>
<td>M20 x 1.5 blue/plastic, IP66. Only for ND9100.</td>
</tr>
<tr>
<td>-CG4</td>
<td>M20 (male thread)/NPT1/2 (female thread) SS Ex d II C Ex db II C Gb, IP66.</td>
</tr>
<tr>
<td>-CG44</td>
<td>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.</td>
</tr>
</tbody>
</table>

4) Pressure Gauges and Connection Blocks

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
</table>
| -A1 | Pressure gauges, scale 0-12 bar, psi, kPa, kg/cm², basic material: brass, nickel plated, housing stainless steel, oil filled. Temperature range: -40 to 65°C. |-40 to 185°F. Pneumatic connection block, connects ND91_ connections to NPT1/4. Material: AISI316, anodized grey, connections G1/4 (S, C1, C2) only for ND9100.
| -A1B | 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 | Pressure gauges, scale 0-12 bar, psi, kPa, kg/cm², basic material: brass, nickel plated, housing stainless steel, oil filled. Temperature range: -40 to 65°C. |-40 to 185°F. Pneumatic connection block, connects ND91_ connections to NPT1/4. Material: AISI316, anodized grey, connections G1/4 (S, C1, C2) only for ND9100. |
| -A3B | 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 | Pressure gauges with G1/4 connections, material: AISI316, scale 0-12 bar, psi, kPa, kg/cm², only for ND9300 and ND9400. |
| -A6 | Pressure gauges with NPT1/4 connections, material: AISI316, scale 0-12 bar, psi, kPa, kg/cm², only for ND9300 and ND9400. |
| -A7 | Pressure gauges with NPT1/4 connections for ND9300 or ND9400, scale 0-12 bar, psi, kPa, kg/cm², only for ND9300 and ND9400. AISI 316, pressure gauges for severe off-shore use, safety glass window, only for ND9300 and ND9400. |
| -A10 | Non oil filled, dry pressure gauges, scale 0-12 bar, psi, kPa, kg/cm², basic material: brass, nickel plated, housing stainless steel. Temperature range: -40 to 65°C. |-40 to 185°F. Pneumatic connection block, connects ND91_ connections to NPT1/4, only for ND9100. |
| -D3 | 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 65°C. |-50 to 185°F. Pneumatic connection block, connects 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. |

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

1) Filter Regulator
2) Conduit Entry Nipples
8) Additional Accessories

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

*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 sign “X”, “X7” and “U”.

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>-P1H</td>
<td>ND9100H (HART): Connection plug according to M20 x 1.5/DIN 43650A (ISO 4400) Not applicable to sign “F” and “P”.</td>
</tr>
</tbody>
</table>
| -P4H | Valve controller and limit switch with connection plugs (1 + 1 pc.)
ND9100H (HART): M20 x 1.5/DIN 43650A (ISO 4400)
ND9100K00 or 2-wire ND9100/100
Not applicable to sign “F” and “P”. |
| -P2F | ND9100F and ND9100F/B06 (FOUNDATION fieldbus): Connection plug male eurofast, Turck FSV49, M20 x 1.5/M12
Not applicable to sign “H” and “P”. |
| -P3F | ND9100F and ND9100F/B06 (FOUNDATION fieldbus): Connection plug male mini fast, Turck RSFV49, M20 x 1.5/7/8”
Not applicable to sign “H” and “P”. |
| -P2P | ND9100P and ND9100P/B06 (Profibus PA): Connection plug male, Weidmuller 842593, M20 x 1.5/M12
Not applicable to sign “H” and “F”. |
| -P3P | ND9100P and ND9100P/B06 (Profibus PA): Connection plug male mini fast, Turck RSFV48, M20 x 1.5/7/8”
Not applicable to 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.

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.html

8) Remote Mounting Accessories

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>-RR01</td>
<td>ND remote mount rotary sensor QNCOK0SHDM</td>
</tr>
<tr>
<td>-RR02</td>
<td>Remote mount rotary sensor QNCAK0SHDM</td>
</tr>
<tr>
<td>-RC01</td>
<td>Cable assembly remote mount sensor cable 1.2 m, straight connector</td>
</tr>
<tr>
<td>-RC02</td>
<td>Cable assembly remote mount sensor cable 3.0 m, angle connector</td>
</tr>
<tr>
<td>-RC03</td>
<td>Cable assembly remote mount sensor cable 30 m, angle connector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nil</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>-MS01</td>
<td>Mounting set (MS01) for linear actuators, attachment face according to IEC 60534-6 Stroke length 10 to 55 mm</td>
</tr>
<tr>
<td>-MS02</td>
<td>Mounting set (MS02) for linear actuators, attachment face according to IEC 60534-6, stroke length 55 to 120 mm</td>
</tr>
<tr>
<td>-MS03</td>
<td>Mounting set for Masoneilan 87/88 actuators, sizes 6 to 23 Stroke length 12 to 64 mm</td>
</tr>
</tbody>
</table>
ND9000 series products are only available in the countries and regions listed below. For details, contact your nearest sales branch.

### Countries Where Products are Available

**North, Central, and South America**

1. **Mexico**
   - SMC Corporation (Mexico), S.A. de C.V.
   - Camino Sierra de Matamoros 315, Monterrey, N.L., Mexico

2. **Peru**
   - SMC Corporation Peru S.A.C.
   - Avenida Arequipa 302, Lima-Lima-Peru
   - URL: [www.smcperu.com](http://www.smcperu.com)

3. **Brazil**
   - SMC Automação do Brasil Ltda.
   - Av. Pirapora, 777 Barro Planejado, São Bernardo do Campo São Paulo, Brazil
   - URL: [www.smcbr.com.br](http://www.smcbr.com.br)

4. **Chile**
   - SMC Corporation (Chile), S.A.
   - Av. Argentina 1058, Santiago, Chile
   - URL: [www.smcbr.com](http://www.smcbr.com)

**Asia / Oceania**

5. **China <Beijing-Shanghai Area>**
   - SMC Corporation (China) Co., Ltd.
   - 42, Xizheng Street, XID, Beijing, 100017, P.R. China

6. **India**
   - SMC Corporation (India) Pvt. Ltd.
   - A-4, Sector-89, Noida-201 305 India
   - URL: [www.smcindia.com](http://www.smcindia.com)

7. **Japan**
   - SMC Corporation
   - 1-18, Nakahara, Tsurumi-ku, Yokohama, Japan
   - URL: [www.smcworld.com](http://www.smcworld.com)

8. **New Zealand**
   - SMC Corporation (NZ) Limited
   - 5 Pacific Rise Mt Wellington Auckland 1060, New Zealand
   - URL: [www.smcworld.com/en-gb](http://www.smcworld.com/en-gb)

9. **Taiwan**
   - SMC Automation (Taiwan) Co., Ltd.
   - No.16, Lane 205, Nanbin Rd., Sec.2, Luchu-Dist, Taoyuan-City, Taiwan

10. **Thailand**
    - SMC Thailand Ltd.
    - 13/4 Moi S, Thanon Road, Banglad Amphur, Muang, Pathumthani 12000, Thailand
    - URL: [www.smcthai.co.th](http://www.smcthai.co.th)

11. **Australia**
    - SMC Corporation (Australia) Pty Ltd
    - 14-18 Hudson Avenue, Castle Hill, Sydney, New South Wales 2154, Australia

12. **China <Guangzhou Area>**
    - SMC Automation (Guangzhou) Ltd.
    - 2, Guangzhou Science Park Guangzhou Hi-Tech Industrial Development Zone, Guangzhou, P.R. China
    - URL: [www.smcgt.com.cn](http://www.smcgt.com.cn)

13. **Germany**
    - SMC Deutschland GmbH
    - Boschring 13-15, 63329 Egelsbach, Germany
    - URL: [www.smc.de](http://www.smc.de)

14. **Italy**
    - SMC Italia S.p.A.
    - Via delle Donne Lavoratrici, 20861 Brugherio (MB)
    - URL: [www.smcitalia.it](http://www.smcitalia.it)

15. **Japan**
    - SMC Corporation
    - Akihabara UDX 15F, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo, Japan
    - URL: [www.smcworld.com](http://www.smcworld.com)

16. **Netherlands**
    - SMC Nederland B.V.
    - De Ruderlaan 130, NL-1111 AB Amsterdam, the Netherlands
    - URL: [www.smc.nl](http://www.smc.nl)

17. **Sweden**
    - SMC Automation AB
    - Enskogsvägen 29-31, SE-141 71 Segeltorp, Sweden
    - URL: [www.smcru.com](http://www.smcru.com)

18. **U.K.**
    - SMC Pneumatics (U.K.) Ltd.
    - Vincent Avenue, Crowthorne, Berkshire RG10 9AA, United Kingdom
    - URL: [www.smpneumatic.co.uk](http://www.smpneumatic.co.uk)

19. **Thailand**
    - SMC Thailand Ltd.
    - 134/6 Moo 5, Tiwanon Road, Bangkadi Amphur, Muang, Pathumthani 12000, Thailand
    - URL: [www.smcthai.co.th](http://www.smcthai.co.th)

20. **Spain**
    - SMC España SA
    - Zuazobidea 14, 01015 Vitoria, Spain
    - URL: [www.smc.es](http://www.smc.es)

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

As of September 2019
## ND9000 Series Comparison of Specifications

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

Refer to the Web Catalog for details.

<table>
<thead>
<tr>
<th>Specifications</th>
<th>ND9000 Series</th>
<th>ND7000 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>M20 female thread</td>
<td>1.8 kg</td>
<td>1.8 kg</td>
</tr>
<tr>
<td>NPT1/2 female thread</td>
<td>3.4 kg</td>
<td>3.4 kg</td>
</tr>
<tr>
<td>G1/2 female thread</td>
<td>8.6 kg</td>
<td>8.6 kg</td>
</tr>
<tr>
<td>Standard/Intrinsic all safe explosion-proof (ND91 series)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flameproof (ND92 series)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel enclosure (ND93 series)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel body/Polymer composite cover (ND94 series)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

**Safety Instructions**

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

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

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

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

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### Safety Instructions

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.

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### 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.

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### 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.

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**Caution:** Mujermal 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 ordered by the metrology (measurement) laws of each country.