ND9100® INTELLIGENT VALVE CONTROLLER

Neles ND9100 is a top class intelligent valve controller designed to operate on every control valve actuator and in all industry areas. It guarantees the end product quality in all operating conditions with unique diagnostics and incomparable performance features. ND9100 is a reliable and future-proof investment with Neles FieldCare™ life-time support.

KEY FEATURES

- Benchmark control performance on rotary and linear valves
- Reliable and robust design
- Easy commissioning and operation
- Language selection: English, German and French
- Local / remote operation
- Expandable architecture
- Advanced device diagnostics including
  - Self-diagnostics
  - Online diagnostics
  - Performance diagnostics
  - Communication diagnostics
  - Extended off-line tests
  - Intelligent Valve Diamond

Options

- Interchangeable communication options:
  - HART
  - FOUNDATION fieldbus
  - Profibus PA
- Limit switches
- Position transmitter (in HART only)
- Full stainless steel enclosure
- Exhaust adapter

Total cost of ownership

- Low energy and air consumption
- Future proof design allows further options at a reduced cost
- Optimized spares program minimizes spare part inventory
- Retro-fit to existing installations (Neles or 3rd party valves)

Minimised 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

- Same device can be used for linear and rotary valves, double and single-acting actuators
- Simple calibration and configuration
  - using Local User Interface (LUI)
  - using FieldCare software in a remote location
  - using Distributed Control System (DCS) asset management tools

Open solution

- Metso is committed to delivering products that freely interface with software and hardware from a variety of manufacturers; ND9100 is no exception. This open architecture allows the ND9100 to be integrated with other field devices to give an unprecedented level of controllability.
- FDT and EDD based multi-vendor support configuration
- Support files for ND9100 are available from our internet page, at www.metso.com/automation
Neles ND9100 in fieldbus networks

- Approved interoperability
- Host interoperability ensured
- FOUNDATION fieldbus ITK version 5.01 certified
- Profibus PA profile version 3.0 PNO certified
- Easy to upgrade; can be done by replacing the HART communication board to 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 ND9100 intelligent valve controller either in 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

ND9100 mounting on actuators and valves

- Mounted on single and double acting actuators
- Both rotary and linear valves
- Flush mounting capability
- 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 as an option
- Protected against humidity
- Maintenance free operation
- Resistant to dirty air
- Wear resistant and sealed components
- Contactless position measurement

Predictive maintenance

- Easy access to collected data with Neles FieldCare software
- Intelligent Valve Diamond to visualise control valve performance & diagnostics
- 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

TECHNICAL DESCRIPTION

The ND9100 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 FieldCare software can be connected to the ND9100 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

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 (α), pressure sensors (Ps, P1, P2) and spool position sensor (SPS). A difference between input signal and position sensor (α) 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. 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. 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 (α) measures the rotation for the μC. The μC using control algorithm modulates the PR-current from the steady state value until a new position of the actuator according to the input signal is reached.
# TECHNICAL SPECIFICATIONS

## ND9100 INTELLIGENT VALVE CONTROLLER

### 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; 10–120 mm / 0.4-4.7 in rotary; 45–95 degrees. Measurement range 110° with freely rotating feedback shaft.

### Environmental influence
- Standard temperature range: -40° – +85 °C / -40° – +185 °F
- Influence of temperature on valve position: 0.5 % /10 °K
- Influence of vibration on valve position: < 1 % under 2g 5–150 Hz, 1g 150–300 Hz, 0.5g 300–2000 Hz

### Enclosure ND9100
- Material: Anodised aluminium alloy and polymer composite
- Protection class: IP66, Nema 4x
- Pneumatic ports: G 1/4
- Cable gland thread: M20x1.5
- Weight: 1.8 kg / 4.0 lbs
- Mechanical and digital position indicator visible through main cover.
- Special corrosion resistance design available as an option for demanging environment.

### Pneumatics
- Supply pressure: 1.4–8 bar / 20–115 psi
- Effect of supply pressure on valve position: < 0.1 % at 10 % difference in inlet pressure
- Air quality:
  - Acc. to ISO 8573-1
  - Solid particles: Class 5 (3 – 5 μm filtration is recommended)
  - Humidity: Class 1 (dew point 10 °C/50 °F below minimum temperature is recommended)
  - Oil class: 3 (or < 1 ppm)
- Capacity with 4 bar / 60 psi supply:
  - 5.5 Nm^3/h / 3.3 scfm (spool valve 2)
  - 12 Nm^3/h / 7.1 scfm (spool valve 3)
  - 38 Nm^3/h /22,4 scfm (spool valve 6)
- Consumption with 4 bar / 60 psi supply in steady state position:
  - < 0.6 Nm^3/h / 0.35 scfm (spool valve 2 & 3)
  - < 1.0 Nm^3/h / 0.6 scfm (spool valve 6)

### Electronics
- HART
  - Supply power: Loop powered, 4–20 mA
  - Minimum signal: 3.6 mA
  - Current max: 120 mA
  - Load voltage: up to 9.5 VDC/20 mA (corresponding 475 Ω)
  - Voltage: max. 30 VDC
  - Polarity protection: -30 VDC
  - Over current protection: active over 35 mA
- EEx ia IIC T6:
  - Ui ≤ 28 V
  - Ii ≤ 120 mA
  - Pi ≤ 1 W
  - Ci = 22 nF
  - Li = 53 μH

### Profibus PA and FOUNDATION fieldbus
- Supply power: voltage 9–32 VDC, reverse polarity protection
- Max basic current 17.2 mA
- Fault current (FDE) 3.9 mA

### FOUNDATION fieldbus function block execution times
- AO 20 ms
- PID 25 ms
- DO 15 ms
- DI 15 ms
- IS 15 ms
- OS 20 ms

### Performance with moderate constant-load actuators EC05-EC10 in ambient temperature
- Dead band acc. to IEC 61514: ≤0.1 %
- Hysteresis acc. to IEC 61514: <0.5 %

### 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 unauthorised access
- Calibration: Automatic / Manual with or without tuning
- 1-point calibration
- Control configuration: aggressive, fast, optimum, stable, maximum stability
- 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: 4–20 mA (galvanic isolation; 600 VDC)
Supply voltage: 12–30 VDC
Resolution: 16 bit / 0.244 μA
Linearity: <0.05 % FS
Temperature effect: <0.35 % FS
External load: max 0–780 Ω
max 0–690 Ω for intrinsically safe
EEEx ia IIC T6
Ui ≤28 V
li ≤120 mA
Rx = 0–690 Ω
Pi ≤1 W
Ci = 22 nF
Li = 53 μH

APPROVALS

Intrinsically safe and non incendive
ATEX
EC-Directive 94/9/EC;
II 1 GD, EEEx ia IIC T4...T6 T90 °C (EN 50014, EN 50020,
EN 50284, EN50281-1-1)
II 2 GD, EEEx ia IIC T4...T6 T90 °C (EN 50014, EN 50020,
EN50281-1-1)
II 3 GD, EEEx nA IIC T4...T6 T90 °C (EN 50014, EN 50021,
EN50281-1-1)
II 3 GD, EEEx nL IIC T4...T6 T90 °C (EN 50014, EN 50021,
EN50281-1-1)

CSA
CAN/CSA-C22.2-0,-142, -157;
CAN/CSA-E60079-0,-11, -15
IS Class I, Div. 1, Groups A, B, C, D T4...T6
IS Class I, Zone 0, Ex ia IIC T4...T6
NI Class I, Div. 2, Groups A, B, C, D T4...T6
NI Class I, Zone 2, Ex nA IIC T4...T6.

FM
FM Class 3600, 3610, 3611, 3810:
IS Class I, Div. 1, Groups A, B, C, D T4...T6
IS Class I, Zone 0, AEx ia IIC T4...T6
NI Class I, Div. 2, Groups A, B, C, D T4...T6
NI Class I, Zone 2, Ex nA IIC T4...T6.

Electromagnetic Protection

Electromagnetic compatibility
Emission acc. to EN 61000-6-4 (2001) and FCC 47 CFR PART 15,
SUBPART B, CLASS B (1994)
Immunity acc. to EN 61000-6-2 (2001)

CE Marking
89/336/EEC
Electromagnetic compatibility 94/9/EC
ATEX (when applicable)

PROXIMITY SENSORS AND LIMIT SWITCHES
(OPTIONAL WITH EXTENSION MODULE)

Code I02 P+F NJJ2-12GK-SN, 2 sensors
Code I09 P+F; NCX2-12GM35-N0
Code I56 IFC 2002-ARKG/UP, 2 sensors
Code K05 Omron D2VW-5, micro switch, 2 sensors
Code K06 Omron D2VW-01 gold plated, micro switch
Code B06 Omron D2VW-01 gold plated, micro switch, 2 sen-
sors. (Bus powered, no external power and cabling needed).

Fig. 1. Local User Interface (LUI) enables real time awareness of control parameters in the device at a glance.

Fig. 2. Trend collection enables fast and easy predictive maintenance. The need for maintenance is reduced and increased plant and process availability are realised.
HOW TO ORDER
INTELLIGENT VALVE CONTROLLER ND9100

1. PRODUCT GROUP
ND Intelligent valve controller

2. SERIES CODE
9 Series 9000 valve controller with universal shaft and attachment face according to standard VDI/VDE 3845, EC/ECJ actuators and Metso standard. Relevant shaft adapter included in mounting kits. When valve positioners are separate deliveries, shaft adapter kit is supplied.

3. ENCLOSURE
8 Low capacity.

4. SPOOL VALVE
G 1/4

5. COMMUNICATION / INPUT SIGNAL RANGE
H 4-20 mA, HART communication.
F Supply voltage 30 V DC. Load voltage: up to 9.5 V DC at 20 mA corresponding to 475 Ω (maximum voltage drop).
P Profibus PA

6. APPROVALS OF VALVE controller
N No approvals for hazardous areas. M20x1.5 conduit entry. Temperature range -40° – +85 °C / -40° – +185 °F.
X1 ATEX certifications:
- I 1 GD Ex ia IIC T4, T6 T90 °C (EN 50014, EN 50020, EN 50284, EN50281-1-1): M20x1.5 conduit entry. Temperature range: T4; -40° – +80 °C / -40° – +167 °F. T5; < +65 °C / < +149 °F. T6; < +50 °C / < +122 °F. Not available with any limit switches (8. sign I, K or B.
- ND91_HU1: Ui ≤ 28 V, Li ≤ 120 mA, Pi ≤ 1 W. Li = 53 μH, Ci = 22 nF.
X2 ATEX certifications:
- I 1 GD Ex ia IIC T4, T6 T90 °C (EN 50014, EN 50020, EN 50281-1-1): M20x1.5 conduit entry. Temperature range: T4; -40° – +80 °C / -40° – +167 °F. T5; < +65 °C / < +149 °F. T6; < +50 °C / < +122 °F. Not available with any limit switches (8. sign I or K).
X3 ATEX certifications:
- I 1 GD Ex ia IIC T4, T6 T90 °C (EN 50014, EN 50020, EN 50281-1-1). FNICO model
- ND91_H: Not applicable
- ND91_FU: Ui ≤ 32 V, Ci = 5 nF, Li = 10 μH, Pi = 5.32 W. Li = 53 μH, Ci = 22 nF. M20x1.5 conduit entry. Temperature range: T4; -40° – +85 °C / -40° – +185 °F. T5; < +65 °C / < +149 °F. T6; < +50 °C / < +122 °F.
- ND91_FU1 and ND91_PU1: Ui ≤ 24 V, Li ≤ 380 mA, Pi ≤ 5.32 W. Ci = 5 nF Li = 10 μH. M20x1.5 conduit entry. Temperature range: T4; -40° – +80 °C / -40° – +176 °F. T5; < +65 °C / < +149 °F. T6; < +50 °C / < +122 °F. Not available with any limit switches (8. sign I, K or B).

7. OPTIONS OF VALVE CONTROLLER
ND9_H only: Internal 2-wire (passive) position transmitter. Analog output feedback signal. Output signal 4-20 mA, HART communication. Power and cabling needed. Extrinsic safety is assured.

8. LIMIT SWITCH TYPE
Inductive proximity switches, 2 pcs.
- P+F; NJ2-12GK-SN, 2-wire type, DC; > 3 mA; < 1 mA.
- P+F; NCB2-12GM35-N0, 2-wire type, DC; > 3 mA; < 1 mA.
- P+F; NC2-12GM35-N0, 2-wire type, DC; > 3 mA; < 1 mA.
- Ifm IFCD2002-ARKG/UP, 2-wire type, DC; 2.5 A, 10–36 V DC, leakage current < 0.6 mA.
- OMRON D2VW-5; 3 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC.
- OMROND2W-6; 5 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC.
- OMROND2W-7; 5 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC.
- OMROND2W-8; 5 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC.
- OMROND2W-9; 5 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC.
- OMROND2W-10; 5 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC.

9. OPTIONS OF LIMIT SWITCH
Y Special construction, to be specified.

Note! Information regarding flameproof ND9200 design, see bulletin 7 ND92 20.
Note! Information regarding stainless steel flameproof ND9300 design, see bulletin 7 ND93 20.

TECHNICAL BULLETIN 12/08
## ADDITIONAL ACCESSORIES

<table>
<thead>
<tr>
<th>FILTER REGULATOR</th>
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<tbody>
<tr>
<td><strong>K</strong> Filter regulator for supply air.</td>
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<tr>
<td>Filter size 5 μm.</td>
</tr>
<tr>
<td>Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled.</td>
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<tr>
<td>Temperature range: -40 °C...+85 °C / -40 °F...+185 °F.</td>
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<tr>
<td>K option includes a thread nipple 1/4&quot;NPT to 1/4&quot;NPT which is suitable with ND9000 positioner options A3 and A5 (1/4&quot;NPT AIR CONNECTION)</td>
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<tr>
<th>CONNECTION PLUGS</th>
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<tbody>
<tr>
<td><strong>P1H</strong> ND9100H (HART): Connection plug according to M20x1.5 / DIN 43650A (ISO 4400). Not applicable with 5. sign &quot;F&quot; and &quot;P&quot;.</td>
</tr>
<tr>
<td>6. sign &quot;X1&quot;, &quot;X2&quot;, &quot;X3&quot;, &quot;U1&quot; and &quot;U2&quot;.</td>
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<tr>
<td><strong>P4H</strong> Valve controller and limit switch with connection plugs (1 + 1 pc) ND9100H (HART), M20x1.5 / DIN 43650A (ISO 4400), ND9100/000 or 2 wire ND9100/100 limit switches only: Male M20x1.5 / M12.</td>
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<tr>
<td>Not applicable with 5.sign &quot;F&quot; and &quot;P&quot;.</td>
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<tr>
<td><strong>P2F</strong> ND9100F (FOUNDATION fieldbus): Connection plug male eurofast, Turck FSV49, M20x1.5 / M12.</td>
</tr>
<tr>
<td>P2 is not applicable with 5. sign &quot;H&quot;, 6. sign &quot;X1&quot;, &quot;X2&quot;, &quot;X3&quot;, &quot;U1&quot; and &quot;U2&quot;.</td>
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<tr>
<td><strong>P2P</strong> ND9100P (Profibus PA): Connection plug male, Weidmuller 842593, M20x1.5 / M12.</td>
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<tr>
<td>P2 is not applicable with 5. sign &quot;H&quot;, 6. sign &quot;X1&quot;, &quot;X2&quot;, &quot;X3&quot;, &quot;U1&quot; and &quot;U2&quot;.</td>
</tr>
<tr>
<td><strong>P3F</strong> ND9100F (FOUNDATION fieldbus): Connection plug male minifast, Turck RSFV49, M20x1.5 / 7/8&quot;.</td>
</tr>
<tr>
<td>P3 is not applicable with 5. sign &quot;H&quot;, 6. sign &quot;X1&quot;, &quot;X2&quot;, &quot;X3&quot;, &quot;U1&quot; and &quot;U2&quot;.</td>
</tr>
<tr>
<td><strong>P3P</strong> ND9100P (Profibus PA): Connection plug male minifast, Turck RSFV49, M20x1.5 / 7/8&quot;.</td>
</tr>
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<td>P3 is not applicable with 5. sign &quot;H&quot;, 6. sign &quot;X1&quot;, &quot;X2&quot;, &quot;X3&quot;, &quot;U1&quot; and &quot;U2&quot;.</td>
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<tr>
<th>CONDUIT ENTRY NIPPLES</th>
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<tbody>
<tr>
<td><strong>CE07</strong> 1/2 NPT conduit entry nipples M20x1.5 / 1/2 NPT</td>
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<tr>
<td><strong>CE08</strong> R1/2 (PF1/2) conduit entry nipples M20x1.5 / R1/2</td>
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<tr>
<td><strong>CE09</strong> 1/2 NPT conduit entry nipples M20x1.5 / 1/2 NPT Exd approved</td>
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<tr>
<th>CABLE GLANDS</th>
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<tbody>
<tr>
<td><strong>CG5</strong> M20x1.5 grey/plastic, IP66</td>
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<tr>
<td><strong>CG6</strong> M20x1.5 blue/plastic, IP66, EEExe</td>
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<tr>
<th>PNEUMATIC CONNECTION BLOCKS</th>
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<tbody>
<tr>
<td><strong>A1</strong> Pressure gauges, scale bar/psi/kPa, basic material brass, housing nickel plated stainless steel, glycerine filled.</td>
</tr>
<tr>
<td>Connections G1/4 (S, C1, C2). Temperature range: -40 °C...+85 °C / -40 °F...+185 °F.</td>
</tr>
<tr>
<td><strong>A3</strong> Pressure gauges, scale bar/psi/kPa, basic material brass, housing nickel plated stainless steel, glycerine filled.</td>
</tr>
<tr>
<td>Connections 1/4 NPT (S, C1, C2). Temperature range: -40 °C...+85 °C / -40 °F...+185 °F.</td>
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<tr>
<td><strong>A5</strong> Pneumatic connection block. Material AlSiMg, anodised grey.</td>
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<tr>
<td>Connections 1/4 NPT (S, C1, C2). Temperature range: -40 °C...+85 °C / -40 °F...+185 °F.</td>
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</table>

Subject to change without prior notice.