NELES® ND9000 INTELLIGENT VALVE CONTROLLER

Metso’s Neles ND9000 is a top class intelligent valve controller designed to operate on all control valve actuators and in all industry areas. It guarantees end product quality in all operating conditions with unique diagnostics and incomparable performance features. ND9000 is a reliable and future-proof investment with Metso FieldCare™ life-time support.

KEY FEATURES
- Benchmark control performance on rotary and linear valves
- Reliable and robust design
- Easy commissioning and operation
- Safety; IEC 61508 compliant up to and including SIL 2 by TUV
- 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
  - Performance view
  - Online Valve Signature

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 version (up to -53 °C / -64 °F)

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)

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
- Same device can be used for linear and rotary valves, double and single-acting actuators
- Simple fast calibration and configuration
  - using Local User Interface (LUI)
  - using FieldCare software in a remote location
  - using Distributed Control System (DCS) asset management tools
- Extensive selection of mounting kits for 3rd party actuators
- Low power consumption enables installation to all common control systems

Open solution
- Metso is committed to delivering products that freely interface with software and hardware from a variety of manufacturers; ND9000 is no exception. This open architecture allows the ND9000 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 ND9000 are available from our internet pages, at www.metso.com/valves - choose the link: download center
Neles ND9000 in fieldbus networks
- Approved interoperability
- Host interoperability ensured
- FOUNDATION fieldbus ITK version 6.1.2 certified
- Profibus PA profile version 3.0 PNO certified
- 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

ND9000 mounting on actuators and valves
- 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
- Maintenance free operation
- Resistant to dirty air
- Wear resistant and sealed components
- Contactless position measurement

Predictive maintenance
- Easy access to collected data with Metso FieldCare 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 FieldCare 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

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. 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. 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 the new position of the actuator, according to the input signal, is reached.
**TECHNICAL SPECIFICATIONS**

**ND9000 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
Arctic temperature range: -53° – +85 °C / -64° – +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**
Material: ND9100: Anodized aluminum alloy and polymer composite
ND9200: Anodised aluminum alloy and tempered glass
ND9400: Stainless steel and polymer composite
ND9300: Stainless steel
Protection class: IP66, Nema 4x
Pneumatic ports: G 1/4 (ND9100)
1/4 NPT (ND9200, ND9300 & ND9400)

**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 / 18 °F below minimum temperature is recommended)
Oil class: 3 (or < 1 ppm)

**Electronics**
HART
Supply power: Loop powered, 4–20 mA
Minimum signal: 3.6 mA
Current max: 120 mA
Load voltage: up to 9.7 VDC/20 mA
Voltage: max. 30 VDC
Polarity protection: active over 35 mA

**Foundation fieldbus**
Supply power: voltage 9–32 VDC, reverse polarity protection
Max basic current: 17.2 mA
Quiescent Current Draw: 16 mA
Fault current (FDE): 3.9 mA

**Performance with moderate constant-load actuators**
Dead band: ≤ 0.1 %
Hysteresis: < 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 linearization
- 1-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: 4–20 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
Ex ia IIC T6 Ui ≤ 28 V
Ex d IIC T4/T5/T6 Ui ≤ 30 V
## 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>
</tbody>
</table>
| ND X        | VTT 09 ATEX 033X | II 1G Ex ia IIC T6,T4 Ga  
II 1D Ex za IIC T90 °C Da  
II 2 G Ex lb IIC T8,T4...T4 Gb  
II 2 D Ex lb IIC T90 °C Db  |
|             | EN 60079-0: 2009/2012  
EN 60079-11: 2012  
EN 60079-26: 2007  
EN 60079-31: 2008  |
|             | EN 60079-0: 2009/2012  
EN 60079-11: 2012  
EN 60079-15: 2010  
EN 60079-31: 2008  |
|             | Input: $U_i \leq 28 \, V$, $I_i \leq 120 \, mA$, $P_i \leq 1 \, W$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$.  
Output: $U_i \leq 28 \, V$, $I_i \leq 120 \, mA$, $P_i \leq 1 \, W$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$, external load resistance $0–690 \, \Omega$.  |
|             | 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 lb IIC T80 °C...T105 °C Db  |
|             | Input: $U_i \leq 30 \, V$, $I_i \leq 152 \, mA$, $P_{\text{max}} = \text{device limits itself}$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$.  
Output: $U_i \leq 30 \, V$, $I_i \leq 152 \, mA$, $P_{\text{max}} = \text{device limits itself}$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$, external load resistance $0–780 \, \Omega$.  |
| **IECEx**   |          |                   |
| ND X        | IECEx VTT 10.0004X | Ex ia IIC T6,T4 Ga  
Ex ta IIC T90 °C Da  
Ex lb IIC T6,...T4 Gb  
Ex lb IIC T90 °C Db  |
|             | IEC 60079-0: 2007/2011  
IEC 60079-11: 2011  
IEC 60079-26: 2006  
IEC 60079-31: 2008  |
|             | Ex nA IIC T6,T4 Gc  
Ex tc IIC 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 IIC T90 °C Dc  |
|             | Input: $U_i \leq 28 \, V$, $I_i \leq 120 \, mA$, $P_i \leq 1 \, W$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$.  
Output: $U_i \leq 28 \, V$, $I_i \leq 120 \, mA$, $P_i \leq 1 \, W$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$, external load resistance $0–690 \, \Omega$.  |
|             | Ex nA IIC T4/T5/T6 Ga  
Ex ia IIC T4/T5/T6 Gb  |
|             | IEC 60079-0:2011  
IEC 60079-1-2007  
IEC 60079-31-2008  |
|             | Ex nA IIC T4/T5/T6 Gc  
Ex ic IIC T4/T5/T6 Gc  |
|             | Input: $U_i \leq 30 \, V$, $P_{\text{max}} = \text{device limits itself}$, external load resistance $0–780 \, \Omega$.  |
| **INMETRO** |          |                   |
| ND E1       | SIRA 11 ATEX 1006X | II G Ex ia IIC T6,...T4 Ga  
II 3 G Ex ia IIC T6,...T4 Gc  
II 3 G Ex ia IIC T6,...T4 Gc  
II 3 D Ex ia IIC T90 °C Dc  |
|             | EN 60079-0:2009  
EN 60079-1-2007  
EN 60079-31-2009  |
|             | Ex d IIC T6,...T4 Gb  
Ex tb IIC T80 °C...1105 °C Db  |
|             | Input: $U_i \leq 30 \, V$, $P_{\text{max}} = \text{device limits itself}$, external load resistance $0–780 \, \Omega$.  |
| **CSAus**   |          |                   |
| ND U        | NCC 12.0793 X | IS Class I, Division 1, Groups A, B, C, D, T4,...T6  
IS Class I, Zone 0, AEx ia, IIC T4...T6  |
|             | NCC 12.0794 X | Ni Class I, Division 2, Groups A, B, C, D, T4,...T6  
Ni Class I, Zone 2, Ex nA IIC T4...T6.  |
|             | ABNT NBR IEC 60079-0:2013  
ABNT NBR IEC 60079-11:2009  
ABNT NBR IEC 60079-27:2010  |
|             | ABNT NBR IEC 60079-0:2013  
ABNT NBR IEC 60079-11:2009  
ABNT NBR IEC 60079-27:2010  |
|             | Ex d IIC T4/T5/T6 Gb  
Ex tb IIC T100 °C Db IP66  |
|             | Input: $U_i \leq 28 \, V$, $I_i \leq 120 \, mA$, $P_i \leq 1 \, W$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$.  
Output: $U_i \leq 28 \, V$, $I_i \leq 120 \, mA$, $P_i \leq 1 \, W$, $C_i \leq 22 \, nF$, $L_i \leq 53 \, \mu H$, external load resistance $0–690 \, \Omega$.  |
| **TIIS (JIS)** |          |                   |
| ND E4       | Ex d II C T6 | Input: $U_i \leq 30 \, V$, $P_{\text{max}} = \text{device limits itself}$, external load resistance $0–780 \, \Omega$.  |
## Approvals and Electrical Values, Foundation fieldbus and Profibus PA

<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></td>
<td></td>
</tr>
<tr>
<td>VTT 09 ATEX 033X</td>
<td>II 1G Ex e IIC T6...T4 Ga</td>
<td>Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH. Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>VTT 09 ATEX 034X</td>
<td>II 1D Ex ta IIC T90 °C Da</td>
<td></td>
</tr>
<tr>
<td>EN 60079-0: 2009/2012</td>
<td>II 2 G Ex db IIC T6...T4 Gb</td>
<td></td>
</tr>
<tr>
<td>EN 60079-11: 2012</td>
<td>II 2 D Ex tb IIC T90 °C Db</td>
<td></td>
</tr>
<tr>
<td>EN 60079-26: 2007</td>
<td>II 3 G Ex nA IIC T6...T4 Gc</td>
<td>Ui ≤ 32 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH. Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>EN 60079-31: 2008</td>
<td>II 3 D Ex tc IIC T90 °C Dc</td>
<td></td>
</tr>
<tr>
<td>EN 60079-0: 2009/2012</td>
<td>II 3 G Ex ic IIC T6...T4 Gc</td>
<td></td>
</tr>
<tr>
<td>EN 60079-11: 2012</td>
<td>II 3 D Ex tc IIC T90 °C Dc</td>
<td></td>
</tr>
<tr>
<td>EN 60079-15: 2010</td>
<td>Ex ia IIC T6...T4 Ga</td>
<td>Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH. Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>EN 60079-31: 2008</td>
<td>Ex ta IIC T90 °C Da</td>
<td></td>
</tr>
<tr>
<td>EN 60079-0: 2009/2012</td>
<td>Ex ib IIC T6...T4 Gb</td>
<td></td>
</tr>
<tr>
<td>EN 60079-11: 2012</td>
<td>Ex tb IIC T90 °C Db</td>
<td></td>
</tr>
<tr>
<td>EN 60079-26: 2007</td>
<td>Ex na IIC T6...T4 Gc</td>
<td>Ui ≤ 32 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH. Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>EN 60079-31: 2008</td>
<td>Ex tc IIC T90 °C Dc</td>
<td></td>
</tr>
<tr>
<td>EN 60079-0: 2009/2012</td>
<td>Ex ic IIC T6...T4 Gc</td>
<td></td>
</tr>
<tr>
<td>EN 60079-11: 2012</td>
<td>Ex tc IIC T90 °C Dc</td>
<td></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>
<tr>
<td><strong>IECEx</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IECEx VTT 10.0004X</td>
<td>Ex ia IIC T6...T4 Ga</td>
<td>Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH. Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>IECEx VTT 10.0005X</td>
<td>Ex ta IIC T90 °C Da</td>
<td></td>
</tr>
<tr>
<td>IEC 60079-0: 2007/2011</td>
<td>Ex ib IIC T6...T4 Gb</td>
<td></td>
</tr>
<tr>
<td>IEC 60079-1: 2007</td>
<td>Ex tb IIC T90 °C Db</td>
<td></td>
</tr>
<tr>
<td>IEC 60079-26: 2006</td>
<td>Ex na IIC T6...T4 Gc</td>
<td>Ui ≤ 24 V</td>
</tr>
<tr>
<td>IEC 60079-31: 2008</td>
<td>Ex tc IIC T90 °C Dc</td>
<td></td>
</tr>
<tr>
<td>IEC 60079-0: 2007/2011</td>
<td>Ex ic IIC T6...T4 Gc</td>
<td>Ui ≤ 32 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH. Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>IEC 60079-11: 2011</td>
<td>Ex tc IIC T90 °C Dc</td>
<td></td>
</tr>
<tr>
<td>IEC 60079-26: 2006</td>
<td>Ex d IIC T6...T4 Gb</td>
<td>Ui ≤ 32 V</td>
</tr>
<tr>
<td>IEC 60079-31: 2008</td>
<td>Ex tb IIC T80 °C...T105 °C Db</td>
<td></td>
</tr>
<tr>
<td><strong>INMETRO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_Z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCC 12.0793 X</td>
<td>Ex ia IIC T4/T5/T6 Ga</td>
<td>Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH. Comply with the requirements for FISCO field device</td>
</tr>
<tr>
<td>NCC 12.0794 X</td>
<td>Ex ia IIC T4/T5/T6 Gb</td>
<td></td>
</tr>
<tr>
<td>ABNT NBR IEC 60079-11: 2009</td>
<td>Ex ic IIC T4/T5/T6 Gc</td>
<td></td>
</tr>
<tr>
<td>ABNT NBR IEC 60079-27: 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABNT NBR IEC 60079-0: 2008 (2011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABNT NBR IEC 60079-11: 2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IEC 60079-15: 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABNT NBR IEC 60079-27: 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABNT NBR IEC 60529:2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>cCSAus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_U</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Class I, Division 1, Groups A, B, C, D, T4...T6</td>
<td>Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH</td>
<td></td>
</tr>
<tr>
<td>IS Class I, Zone 0, AEx ia, IIC T4...T6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NL Class I, Division 2, Groups A, B, C, D, T4...T6</td>
<td>Ui ≤ 24 V, li ≤ 380 mA, Pi ≤ 5.32 W, Ci ≤ 5 mF, Li ≤ 10 μH</td>
<td></td>
</tr>
<tr>
<td>NL Class I, Zone 2, Ex na IIC T4...T6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND_E5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980091</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I, Div 1, Groups B, C, D; Class II, Div 1, Groups E, F, G; Class III; T4...T6, Enclosure type 4X</td>
<td>Ui ≤ 32 V</td>
<td></td>
</tr>
<tr>
<td>Ex d IIC T4...T6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex d IIC T4...T6 AEx d IIC T4...T6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex tb IIC T100 °C IP66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex tb IIC T100 °C IP66</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes
- **ATEX** certificates indicate compliance with ATEX Directive 94/9/EC, which covers equipment intended for use in potentially explosive atmospheres.
- **IECEx** certificates indicate compliance with the IECEx Certification Scheme, covering equipment for use in explosive atmospheres.
- **INMETRO** certificates indicate compliance with Brazilian standards and regulations.
- **cCSAus** certificates indicate compliance with Australian standards and regulations.

### Electrical Values
- **Ui** is the maximum permitted voltage.
- **li** is the maximum permitted current.
- **Pi** is the maximum permitted power.
- **Ci** is the maximum capacitance.
- **Li** is the maximum inductance.
Electromagnetic Protection

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 94/9/EC (until 19 April 2016)
ATEX 2014/34/EU (from 20 April 2016)

PROXIMITY SENSORS AND LIMIT SWITCHES
(Optional with extension module for ND9100, ND9200 & ND9300)

- Code D33 SST Sensor Dual Module
- Code D44 Namur Sensor Dual Module
- Code I02 P+F NJ2-12GK-5N, 2 sensors
- Code I09 P+F, NCB2-12GM35-N0
- Code I32 OMRON E2E-X2Y1, micro switch, 2 sensors
- Code I41 P+F, NJ4-12GK-5N, 2 sensors
- Code I45 P+F NJ3-13GK-5N, 2 sensors
- 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 sensors.
  (Bus powered, no external power and cabling needed).

Figure 1. 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.

Figure 2. Valve Online Signature feature shows friction of the control valve online, under normal process conditions when ever the valve is changing position.
DIMENSIONS

ND9100 and ND9400
ND9100/I, ND9100/K and ND9100/B

ND9200
ND9200/I, ND9200/K and ND9200/B
### HOW TO ORDER

**INTELLIGENT VALVE CONTROLLER ND9000**

LIMIT SWITCH (ND9000/D__, ND9000/I__, ND9000/K0_ or ND9000/B06)

<table>
<thead>
<tr>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND</td>
<td>9</td>
<td>2</td>
<td>03</td>
<td>H</td>
<td>E1</td>
<td>T</td>
<td>/</td>
<td>K05</td>
</tr>
</tbody>
</table>

#### 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. Relevant shaft adapter included in mounting kits. When valve controllers are separate deliveries, shaft adapter kit is supplied.

#### 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
- PNEUMATIC CONNECTIONS
  - 02: Low capacity. Stroke volume of actuator < 1 dm³.
  - 03: Medium capacity. Stroke volume of actuator 1–3 dm³.
  - 06: High capacity. Stroke volume of actuator > 3 dm³.

#### 5. COMMUNICATION / INPUT SIGNAL RANGE
- 4–20 mA, HART (6 and 7) communication.
- 1/4 NPT conduit entry.
- G 1/4 (ND9100), 1/4 NPT (ND9200/ND9300/ND9400).
- G 1/2 (ND9200/ND9300/ND9400).

#### 6. APPROVALS FOR HAZARDOUS AREAS
- ATEX and IECEx certifications:
  - G 1/2 Conduit entry and Cable entry adapter.
  - G 1/2 or 1/2 NPT conduit entry.
  - Ex ia IIC T6.
  - Ex ia IIC T6.
  - Ex ic IIC T4/TS/76.
  - Not applicable to 3. sign "1" or "4".

- TIS (US) certifications:
  - Ex d IIC T6.
  - Not applicable to 3. sign "1" or "4".

- METRO certification:
  - CG41:
  - CG42:

- TECHNICAL BULLETIN

- NOTE:
- Deliveries always with TIS (US) approved cable gland and conduit entry nipple (accessory CG42 or CG41), see type code from Accessories for Positioners item 10.
- G 1/2 or 1/2 NPT conduit entry.

- ATEX and IECEx certifications:
  - Ex ia IIC T4/TS/76 Ga
  - Ex ia IIC T4/TS/76 GB
  - Temperature range: T4: -40° to +80 °C; T5: < +65 °C; T6: < +50 °C.
  - Ex na IIC T4/TS/76 Gc
  - Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C.
  - Ex ic IIC T4/TS/76
  - Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C.

- N I Class I, Div 1, Groups A, B, C, D; Class II, Div 1, Groups E, F, G; Class III; T4...T6, Enclosure type 4X
  - Class I, Div 1, Groups A, B, C, D; Class II, Div 1, Groups E, F, G; Class III; T4...T6, Enclosure type 4X
  - II 3 G Ex nA IIC T6...T4 Ga
  - II 2 G Ex d IIC T6...T4 Gb
  - Temperature range: T4: -40° to +80 °C; T5: < +65 °C; T6: < +50 °C.
  - II 3 G Ex ic IIC T6...T4 Gc
  - Ex ic IIC T4/TS/76
  - Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C.

- N I Class I, Zone 2, Ex na IIC T4...T6.
  - Temperature range: T4: -40° to +85 °C; T5: < +70 °C; T6: < +55 °C.
  - No Zener Barrier needed.
  - Not applicable to 3. sign "2" or "4".

- cCSAus certifications:
  - Class I, Division 1, Groups A, B, C, D, T4...T6
  - Class I, Division 2, Groups A, B, C, D, T4...T6.
  - Not applicable to 3. sign "1" or "4".

- INMETRO certifications:
  - Ex ia IIC T4/TS/76 Ga
  - Ex ia IIC T4/TS/76 GB
  - Temperature range: T4: -40° to +80 °C; T5: < +65 °C; T6: < +50 °C.
  - Ex na IIC T4/TS/76 Gc
  - Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C.
  - Ex ic IIC T4/TS/76
  - Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C.

- INMETRO certification:
  - Ex ia IIC T4/TS/76 Ga
  - Ex ia IIC T4/TS/76 GB
  - Temperature range: T4: -40° to +80 °C; T5: < +65 °C; T6: < +50 °C.
  - Ex na IIC T4/TS/76 Gc
  - Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C.
  - Ex ic IIC T4/TS/76
  - Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C.

- Ex na IIC T4/TS/76 Gc
- Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +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.

- Ex na IIC T4/TS/76 Gc
- Temperature range: T4: -40° to +85 °C; T5: < +75 °C; T6: < +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.
### Options of Limit Switch

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>Options Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND91_HXT, ND91_HZT, ND92_HXT, ND93_HXT, ND93_HZT, ND94_HXT</td>
<td></td>
</tr>
<tr>
<td>II 1</td>
<td>G Ex ia IIC T6...T4 Ga</td>
</tr>
<tr>
<td>II 2</td>
<td>G Ex ia IIC T6...T4 Gb</td>
</tr>
<tr>
<td>II 3</td>
<td>G Ex ia IIC T6...T4 Gc</td>
</tr>
<tr>
<td>ND91_HXT, ND91_HZT, ND92_HXT, ND93_HXT, ND94_HXT</td>
<td></td>
</tr>
<tr>
<td>Ii 1</td>
<td>G Ex na IIC T6...T4 Gc</td>
</tr>
<tr>
<td>II 3</td>
<td>G Ex ia IIC T6...T4 Gc</td>
</tr>
<tr>
<td>III 3</td>
<td>Ex tc IIC T90°C Dc</td>
</tr>
</tbody>
</table>

### Technical Bulletin

7. **OPTIONS OF VALVE CONTROLLER**

- **Internal 2-way (passive) position transmitter. Analog position feedback signal, output 4–20 mA, supply voltage 12–30 V DC, external load resistance 0–780 Ω.**
- **ND91_HXT, ND91_HZT, ND92_HXT, ND93_HXT, ND94_HXT:**
  - II 1: G Ex ia IIC T6...T4 Ga
  - II 2: G Ex ia IIC T6...T4 Gb
  - II 3: G Ex ia IIC T6...T4 Gc
- **ND91_HUX, ND91_HUX1, ND92_HUX, ND93_HUX, ND94_HUX:**
  - II 1: G Ex na IIC T6...T4 Gc
  - II 2: G Ex ia IIC T6...T4 Gc
  - II 3: G Ex ia IIC T6...T4 Gc
- **ND91_HUX1T and ND93_HUX1T:**
  - Ul ≤ 30 V, Ii ≤ 152 mA, Pi ≤ 1 W, Ci ≤ 22 nF, Li ≤ 53 μH,
  - External load resistance 0–780 Ω.
- **Remote mounting**
  - Applicable only to 3. Sign "N", "X" and "E1".
  - Requires always external position measurement. For rotary actuator see accessory code.

**R**

### Options of Limit Switch Type

<table>
<thead>
<tr>
<th>Limit Switch Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductive proximity switches, 2 pcs.</td>
<td>IP66 / NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.). Option E2: 1/2 NPT conduit entry (2 pcs.). Limit switches applicable only with ND9100, ND9200 and ND9300.</td>
</tr>
<tr>
<td>ND91_HUX, ND91_HUX1, ND92_HUX, ND93_HUX, ND94_HUX</td>
<td></td>
</tr>
</tbody>
</table>
| II 1 | G Ex ia IIC T6...T4 Ga
| II 2 | G Ex ia IIC T6...T4 Gb
| II 3 | G Ex ia IIC T6...T4 Gc

### Mechanical micro switches, 2 pcs.

- **IP66 / NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.). Option E2: 1/2 NPT conduit entry (2 pcs.). Limit switches applicable only with ND9100, ND9200 and ND9300.**
- **Opto switch, 2-wire type, DC, 10–36 V DC, leakage current < 0.6 mA.**
  - Temperature range: -20° to +85°C / -4° to +185°F.

### Bus powered mechanical micro switches, 2 pcs.

- **IP66 / NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.). Option E2: 1/2 NPT conduit entry (2 pcs.). Limit switches applicable only with ND9000F and ND9000P.**

### Exhaust adapter

- **ND91100 and ND9400: 1x 1/2 NPT thread, ND9200 and ND9300: 2 x 1/2 NPT thread.**

### Special construction

- **ND91100**
- **ND9400**
- **ND9200**
- **ND9300**

---

9. **OPTIONS OF LIMIT SWITCH**

- **Special construction.**
## ADDITIONAL ACCESSORIES

### CONDUIT ENTRY NIPPLES

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE07</td>
<td>1/2 NPT conduit entry nipples M20x1.5 / 1/2 NPT (ND9100 and ND9400)</td>
</tr>
<tr>
<td>CE08</td>
<td>R1/2 (PF1/2) conduit entry nipples M20x1.5 / R1/2 (ND9100 and ND9400)</td>
</tr>
<tr>
<td>CE09</td>
<td>1/2 NPT conduit entry nipples Brass M20x1.5 / 1/2 NPT, Exd approved (ND9200)</td>
</tr>
<tr>
<td>CE19</td>
<td>1/2 NPT conduit entry nipples Stainless Steel M20x1.5 / 1/2 NPT, Exd approved (ND9300)</td>
</tr>
</tbody>
</table>

### FILTER REGULATORS

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Filter regulator for supply air. Filter size 5 μm. Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40 °C...+82 °C / -40 °F...+180 °F. K option includes a thread nipple 1/4&quot;NPT to 1/4&quot;NPT which is suitable with ND9200 &amp; ND9300 positioner options A3 and A5 (1/4&quot;NPT AIR CONNECTION).</td>
</tr>
<tr>
<td>K1</td>
<td>Filter regulator for supply air. Filter size 5 μm. Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40 °C...+82 °C / -40 °F...+180 °F. K1 option includes a thread nipple 1/4&quot;NPT to G1/4&quot; which is suitable with ND9100 and ND9400 positioner and with option A1 (G1/4 AIR CONNECTION).</td>
</tr>
<tr>
<td>K2</td>
<td>Stainless steel (AISI 316) filter regulator for supply air. Filter size 5 μm. Pressure gauge, scale bar/psi/kPa/kg/cm2, silicone oil, AISI 316, Temperature range -40 °C...+80 °C...-40 °F...+176 °F.</td>
</tr>
</tbody>
</table>

### CABLE GLANDS

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG5</td>
<td>M20x1.5 grey/plastic, IP66</td>
</tr>
<tr>
<td>CG6</td>
<td>M20x1.5 blue/plastic, IP66, Ex e</td>
</tr>
<tr>
<td>CG42</td>
<td>G 1/2 Conduit entry and Cable entry adapter, JIS approved (ND9200H)</td>
</tr>
<tr>
<td>CG41</td>
<td>1/2 NPT Conduit entry and Cable entry adapter, JIS approved (ND9200H)</td>
</tr>
</tbody>
</table>

### PRESSURE GAUGES AND CONNECTION BLOCKS

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Pressure gauges, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40...+185 °C / -40...+365 °F. Pneumatic connection block, material AISI/Mg-anodized grey. Connections G1/4 (S, C1, C2).</td>
</tr>
<tr>
<td>A3</td>
<td>Pressure gauges, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40...+185 °C / -40...+365 °F. Pneumatic connection block, material AISI/Mg-anodized grey. Connections 1/4&quot;NPT (S, C1, C2), converses also NS91, connections to 1/4&quot;NPT.</td>
</tr>
<tr>
<td>A5</td>
<td>Pneumatic connection block, converts ND91, connections to 1/4&quot;NPT. Material AISI 316. Only for ND9100.</td>
</tr>
<tr>
<td>A6</td>
<td>Pressure gauges with connections G1/4. Material AISI 316. Only for ND9100 and ND9400</td>
</tr>
<tr>
<td>A7</td>
<td>Pressure gauges with connections 1/4&quot;NPT. Material AISI 316. Only for ND9100 and ND9400</td>
</tr>
<tr>
<td>A10</td>
<td>Pressure gauges with connections 1/4&quot;NPT for ND9300 or ND9400 AISI 316, pressure gauges for severe off-shore use, safety glass window.</td>
</tr>
</tbody>
</table>

### CONNECTION PLUGS

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1H</td>
<td>ND9000H (HART): Connection plug according to M20x1.5 / DIN 43650A (ISO 4400). Not applicable with S.sign &quot;F&quot; and &quot;P&quot;.</td>
</tr>
<tr>
<td>P4H</td>
<td>Valve controller and limit switch with connection plugs (1 + 1 pc). ND9000 (HART): M20x1.5 / DIN 43650A (ISO 4400). ND9000/200 or 2 wire ND9100/100. Not applicable with S.sign &quot;F&quot; and &quot;P&quot;.</td>
</tr>
<tr>
<td>P2F</td>
<td>ND9000F and ND9000F/B06 (FOUNDATION fieldbus): Connection plug male eurofaz, Turck FSV49, M20x1.5 / M12. Not applicable with S.sign &quot;F&quot; and &quot;P&quot;.</td>
</tr>
<tr>
<td>P3F</td>
<td>ND9000F and ND9000F/B06 (FOUNDATION fieldbus): Connection plug male manifold, Turck FSV49, M20x1.5 / 7/8&quot;. Not applicable with S.sign &quot;F&quot; and &quot;P&quot;.</td>
</tr>
<tr>
<td>P2P</td>
<td>ND9000P and ND9000P/B06 (Profibus PA): Connection plug male, Weidmuller 842593, M20x1.5 / M12. Not applicable with S.sign &quot;F&quot; and &quot;F&quot;.</td>
</tr>
<tr>
<td>P3P</td>
<td>ND9000P and ND9000P/B06 (Profibus PA): Connection plug male manifold, Turck FSV49, M20x1.5 / 7/8&quot;. Not applicable with S.sign &quot;F&quot; and &quot;F&quot;.</td>
</tr>
</tbody>
</table>

### DRIVER SETS

- **DS01** Driver set for ND7100 / ND7100 / ND9400 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 ND79/79 with gauge blocks A1, A2 or A6. Earlier the DS04 was delivered with baseburnt positions as default. This practice is no longer valid, the needed driver set must be ordered as an accessory.

- **DS02** Driver set for ND72/92/93 on actuators with VDI/ D3845 attachment face. Set includes the 1/4"NPT plug for single acting actuators. The driver set should also be applied with all ND90/79 with gauge blocks A3, A5, A7 or A10.

- **DS04** General driver set for ND71/72/91/92/94/93 on actuors with VDI/ VDE 3845, Neles E-series actuators and 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 positions as default. This practice is no longer valid, the needed driver set must be ordered as an accessory.

### 3RD PARTY MOUNTING SETS

Mounting sets between the ND9000 generation valve controllers and linear actuators, including bracket and ball joint based feedback system. Note! Sets are including the 1/4" pneumatic plugs needed when used with single acting actuators.

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M501</td>
<td>Mounting set for linear actuators, attachment face according to IEC 60534-6, stroke length 10-55 mm. (H116240)</td>
</tr>
<tr>
<td>M502</td>
<td>Mounting set for linear actuators, attachment face according to IEC 60534-6, stroke length 55-120 mm. (H120404)</td>
</tr>
<tr>
<td>M503</td>
<td>Mounting set for Maseonell 87/88 actuators, sizes 6...23. Stroke length 12-64 mm. (H112089)</td>
</tr>
</tbody>
</table>

### REMOTE MOUNTING ACCESSORIES

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR01</td>
<td>MA0054129 ND remote mount rotary sensor QNSOK05HD-MET77</td>
</tr>
<tr>
<td>RC01</td>
<td>H126144 Cable assembly remote mount sensor cable 1.2 m, straight connector</td>
</tr>
<tr>
<td>RC02</td>
<td>H126145 Cable assembly remote mount sensor cable 3.0 m, angle connector</td>
</tr>
<tr>
<td>RC03</td>
<td>H127093 Cable assembly remote mount sensor cable 30 m, angle connector</td>
</tr>
</tbody>
</table>