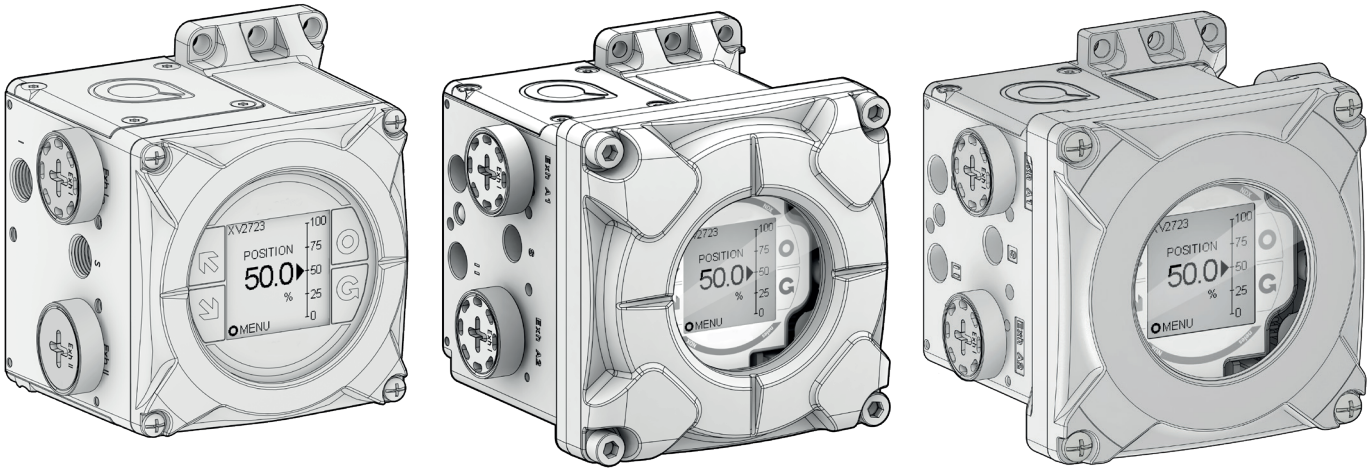
Neles™ NDX™
Intelligent valve controller

Installation, Maintenance and Operating Instructions



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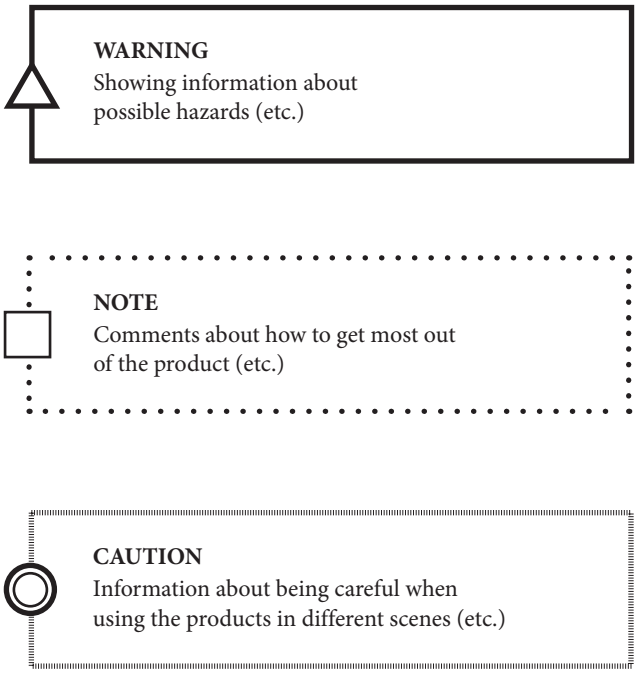

READ THESE INSTRUCTIONS FIRST!
These instructions provide information about the safe handling and operation of the intelligent valve controller.
If you require additional assistance, please contact the manufacturer or manufacturer's representative.
Addresses and phone numbers are printed on the back cover.
See also www.valmet.com/flowcontrol for the latest documentation.
SAVE THESE INSTRUCTIONS!

FOR YOUR SAFETY

NOTE

The valve controller shall be installed and operated only by qualified personnel familiar with process equipment.

READ THESE INSTRUCTIONS FIRST!

These instructions provide information about the safe handling, installation, commissioning, operation, troubleshooting, maintenance and replacement of the intelligent valve controller. These instructions do not contain all detailed information on every possible aspect of installation, operation or maintenance. If you are uncertain about the use of the controller or its suitability for your intended use or if you require additional assistance, please contact the manufacturer or manufacturer's representative.
Addresses and phone numbers are printed on the back cover.

See also www.valmet.com/ndx for the latest documentation.

SAVE THESE INSTRUCTIONS FOR LATER USE!

BEFORE YOU BEGIN

Do not install, operate or maintain intelligent valve controller without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all contents of this user guide, including all safety cautions and warning. It is also important to be authorized by the plant operator before operating the intelligent valve controller.

Note, that there are additional safety regulations which are plant and/or hazardous area related. Those are not covered in this manual.

SAFETY PRECAUTIONS

NOTE
Avoid grounding a welding machine in close proximity to a valve controller. Damage to the equipment may result.

CAUTION
Do not exceed the permitted values!
Exceeding the permitted values marked on the valve controller maycause damage to the controller and to equipment attached to the controller and could lead to uncontrolled pressure release in the worst case. Damage to the equipment and personal injury may result.

CAUTION
Do not remove or dismantle a pressurized controller!
Always shut off the supply air and release the pressure from the pipelines and equipment before removing or dismantling the controller. Otherwise personal injury and damage to equipment may result.
Do not rely on the pressure gauge readings alone to verify that the controller is not pressurized! Compare to local user interface reading or additional gauge.
The check valve installed with double acting actuators (see Fig. 36) will keep the NDX and actuator pressurized even after the air supply is disconnected.

WARNING
During automatic or manual calibration the valve operates between open and closed positions. Make sure that the operation does not endanger people or processes!

WARNING
Do not operate the device with cover removed!
- Environmental influence (water, dust etc.)

WARNING
Do not operate under load.

CAUTION
The pneumatic exhaust may cause high noise levels exceeding 85 dB. Use hearing protection when in proximity.

Intrinsic Safety (Ex i) WARNING
Do not use oxygen as a driving medium!

CAUTION
Rebooting and offline tests can be initiated remotely through the DTM, causing unexpected valve movement.

Ex NOTE
Follow the standards EN/IEC 60079-14 when installing the equipment and EN/IEC 60079-25 when connecting Ex i interfaces.

Ex Note
For ordinary locations and Class I Div 2 installations of NDX_ _ _2 have to be supplied by a Class 2 or Limited Energy Source in accordance with CSA 61010-1-12/UL 61010-1.

Ex NOTE (cCSAus)
When the temperature under rated conditions is higher than 60C at the entry point or 60C at the branching point of the conductors, information shall be marked on the equipment exterior to provide guidance to the user on the proper selection of cable and cable gland or conductors in conduit.

Ex WARNING
Electrostatic charge hazard!
The cover is non-conductive. Clean with a damp cloth only! Spark hazard!
Protect the aluminum housing from impacts and friction!

Ex WARNING
The exposed metal parts are not earthed and have a capacitance of up to 56pF with respect to an earthed conductor. If a charge-generating mechanism is present, an incendive level of charge could migrate to these metal parts and subsequently discharge to earthed metal. Precautions are required to ensure that a charge-generating mechanism is unlikely to be present and/or discharge to earthed metal is improbable.

Ex WARNING
For use in the presence of combustible dust.
- Ignition protection relies on the enclosure. Protect the cover of the valve controller from impacts.
- When temperature is higher than 70 °C / 158 °F the temperature rating of the cable shall be higher than the ambient temperature.
- Device shall not be subjected to a prolific charge generating mechanism.
- Accumulation of dust shall be avoided!

Intrinsic Safety (Ex i) WARNING
- Ensure that the complete installation and wiring is intrinsically safe before operating the device!
- The equipment must be connected via a certified isolator or barrier placed outside the hazardous area.
- Temperature rating of selected connection cable shall be greater than 83 °C.

WARNING
Electrostatic hazard: clean only with damp cloth.

Intrinsic Safety (Ex i) WARNING
A device previously installed in any other protection mode than intrinsically safe (Ex i) shall never be re-installed as Ex i.

Ex n WARNING
At an ambient temperature ≥ +70 °C / 158 °F, the temperature rating of selected connection cable shall be in accordance with the maximum ambient temperature range. Selected cable gland shall not invalidate the type of protection.

Ex d WARNING
At an ambient temperature ≥ +60°C, the temperature rating of the connection cable shall be in accordance with maximum ambient temperature range.

SAFETY PRECAUTIONS

WARNING
Do not open when an explosive atmosphere is present.

Ex d WARNING (NDX Ex d version)
Do not open the device when energized!
Explosion protection is lost.

Ex d WARNING (NDX Ex d version)
After de-energizing, delay one minute before opening!

WARNING
To reduce the risk of ignition of hazardous atmospheres, do not remove cover while circuits are live.

Ex d WARNING (NDX Ex d version)
Tightening torque for the housing cover screws is 15Nm.

Ex d WARNING (NDX Ex d version)
Use a cable gland and blind plug with suitable Ex d certification.
For ambient temperature over 70 °C / 158 °F use a heat resistant cable and cable gland suitable for at least 92 °C / 196 °F.

Ex d WARNING (NDX Ex d version)
Ex d certified cable glands needs to be used.
Maximum of two cable glands installed into NDX 1/2"NPT ports are allowed.

Ex d WARNINGÜ
onduit seal must be installed within 50 mm of the enclosure.

WARNING
Do not separate when energized.

WARNING
Separate only in a NON-HAZARDOUS AREA.

WARNING
Use only thread adapters with suitable certification.

NOTE
Minimum requirements in IEC 60079-1 for flameproof entry devices assume a maximum reference pressure of 2 000 kPa for Group II and 1 333 kPa for Group I. Other devices are available with ratings greater than these minimum requirements.

WARNING
Potential electrostatic charging hazard - see instructions.

WARNING
Live parts behind cover - do not contact.

Ex d WARNING (cCSAus)
Use conductors rated at least 12°C above the maximum ambient temperature.

Ex d WARNING (NDX Ex d version)
Cover and housing and their flange surfaces are Ex d critical parts. Extra caution needs to be taken when handling them. Always keep the flange surfaces clean on both cover and housing. If there are scratches in flange surfaces or if the cover is dropped, the cover and/or device needs to be changed.

Ex d WARNING
Do not use a combustible gas (such as natural gas) as a driving medium.

Conditions of Acceptability (applies to cCSAus approvals):

Hazloc

The maximum allowed ambient temperature ranges for level of protection "ia" and "ib" according to different T Classes are:
-40°C ≤ Ta ≤ +50°C for temperature class T6(IIC) or T_{200}85°C for dust (IIIC)
-40°C ≤ Ta ≤ +65°C for temperature class T5(IIC) or T_{200}100°C for dust (IIIC)
-40°C ≤ Ta ≤ +80°C for temperature class T4(IIC) or T_{200}115°C for dust (IIIC)

2. The maximum allowed ambient temperature ranges for level of protection "ic" according to different T Classes are:
-40°C ≤ Ta ≤ +50°C for temperature class T6(IIC) or T_{200}85°C for dust (IIIC)
-40°C ≤ Ta ≤ +65°C for temperature class T5(IIC) or T_{200}100°C for dust (IIIC)
-40°C ≤ Ta ≤ +85°C for temperature class T4(IIC) or T_{200}115°C for dust (IIIC)

The maximum allowed ambient temperature ranges for level of protection "ec" according to different T Classes are:
-40°C ≤ Ta ≤ +50°C for temperature class T6(IIC) or T_{200}85°C for dust (IIIC)
-40°C ≤ Ta ≤ +65°C for temperature class T5(IIC) or T_{200}100°C for dust (IIIC)
-40°C ≤ Ta ≤ +85°C for temperature class T4(IIC) or T_{200}115°C for dust (IIIC)

1. For level of protection "ec" provision shall be made to provide the transient protection at a level not exceeding 40% of the rated supply voltage.
2. The permissible ambient temperature range depends on the used configuration. The ambient temperature range is marked on the identification plate.
3. At an ambient temperature ≥ +60°C, the temperature rating of the connection cable shall be in accordance with maximum ambient temperature range.
4. Temperature Classes for dust are based on measurement w.r.t. total immersion to dust required for Da equipment.
5. The valve controller shall be connected according to the manufacturer's instructions.
6. The impact test of NDX___0 enclosure was made according to low risk of mechanical danger. The device shall be protected from high level impacts.
7. The plastic covers in the NDX _ _ _ 0/1 enclosures shall be wiped with damp cloth only due to risk of electrostatic charging.
8. Selected cable glands shall conform to the requirements of CAN/CA C22.2 No. 60079-0 and UL 60079-0.

Ordloc

1. The equipment shall be supplied by a Limited Power Source or Class 2 output in accordance with CEC Part 1, Rule 16-200 and NFPA 70, Article 725.121.
2. The equipment has only been tested for safety. No evaluation of functional safety and performance characteristics has been conducted.
3. Equipment is only to be installed by trained and qualified personnel.
4. If at any time there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.
5. Equipment is not to be used with flammable liquids.
6. The equipment is provided with cable gland entries with or without an adapter. Blanking plugs, cable glands, conduit hubs or fittings, shall be appropriately approved under Type 4X and IP66, when used with the equipment.

PRODUCT SUMMARY

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INTRODUCTION TO NELES™ NDX™ INTELLIGENT VALVE CONTROLLER

Neles NDX is the next generation intelligent valve controller working on all type of control valves and in all industry areas. It guarantees end product quality in all operating conditions with incomparable performance, unique diagnostics, and years of reliable service. The NDX is a future-proof investment with life-time support for asset management.

KEY FEATURES

- Reliable and robust design
- Industry leading pneumatic capacity
- Benchmark control performance
- Simple and fast installation and commissioning
- Valve stroke length up to 220 mm
- Local / remote operation
- Wide language support
- Expandable architecture
- HART 7 or HART 6 communication as standard
- FOUNDATION Fieldbus as an option
- Premium device diagnostics including
  - Self-diagnostics
  - Online diagnostics
  - Performance diagnostics
  - Communication diagnostics
  - Extended off-line tests
  - Performance view
  - Online Valve Signature
- Extended off-line test capabilities
- Worldwide support for hazardous area approvals

Total cost of ownership

- Fast and reliable installation process
- Low energy and air consumption
- Easy to use diagnostics simplify determining when valve maintenance is required
- Inherent high air capacity eliminates additional instrumentation
- One positioner that fits to all control valves; small and big, rotary and linear, single and double acting
- Available for intrinsically safe and flameproof applications

Minimized process variability

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

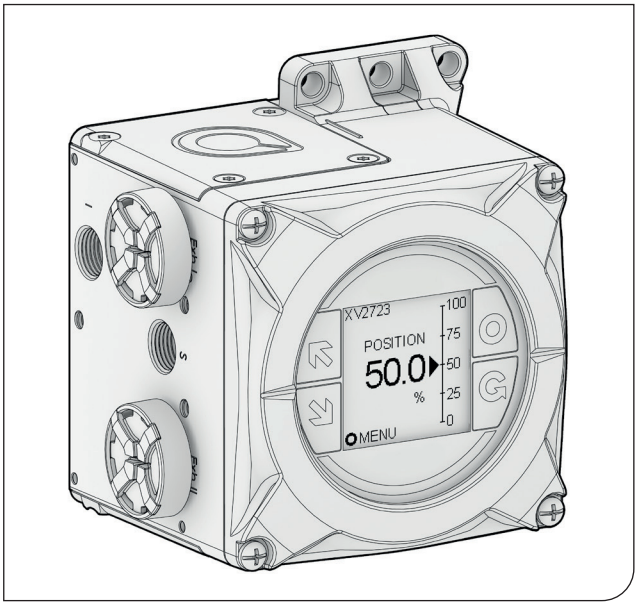

Fig. 1.

Easy installation and configuration

- Simple / fast configuration and calibration using one of the following:
  - Standard Local User Interface (LUI) accessible without opening the device cover
    - LUI can be rotated according to mounting position
  - Distributed Control System (DCS) asset management program
- Backwards compatible with retrofit kits for easy replacement of Neles NE700 and ND9000 positioners.
- Easy retro-fit to an extensive list of 3rd party valves
- Installation to all common control systems

Open solution

- Valmet is committed to delivering products that freely interface with software and hardware from a variety of manufacturers; NDX is no exception. This open architecture allows the NDX 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 NDX are available for free download from www.valmet.com/ndx

NDX mounting on actuators and valves

- Supports all single and double acting pneumatic actuators
- Both rotary and linear valves
- Guided startup and automatic/manual/1-point calibration

NDX in fieldbus networks

- Approved interoperability
- Host interoperability ensured
- FOUNDATION fieldbus ITK version 6.5.0 certified
- Excellent maintainability with firmware download feature
- 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.

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- Back up LAS functionality available in Foundation Fieldbus enviroment
- Input selector and output splitter blocks available in Foundation Fieldbus devices allowing advanced distributed control
- Standard function blocks enables the freedom to use NDX intelligent valve controller either in continuous or on-off control applications
- Open and close information directly available via the fieldbus
- Open and close detection is based on position measurement information

Product reliability

- Designed to operate in harsh environmental conditions
- Rugged modular design
- Excellent temperature characteristics
- Vibration and impact tolerant
- IP66/NEMA4X enclosure
- Protected against humidity
- Resistant to dirty air
- Wear resistant and sealed components
- Fully contactless position measurement
- Fully encapsulated electronics

Predictive maintenance

- Easy access to collected data with any FDT/DTM software and drivers
- Intelligent diagnostics analysis to visualize control valve health and performance
- Patented on-line valve signature
- Historical trend and histogram collection
- Diagnostics collected continuously while the process is running
- Extensive set of off-line tests with accurate key figure calculations
- Clear notifications with on-line alarms
- Condition monitoring tools available

OPERATION PRINCIPLE

NDX_H_ is a 4–20 mA powered with HART communication and NDX_F_ is a fieldbus powered with FOUNDATION Fieldbus communication microcontroller based intelligent valve controller. The device contains a local userr interface enabling configuration and operation without opening the device cover. Configuration and operation can also be made remotely by PC with asset management software connected to the control loop.

After connections of electric signal and pneumatic supply, the micro controller (µC) continuously reads measurements:

- Input signal
- Valve position with contactless sensor (α),
- Actuator pressure (I, II)
- Supply pressure (S)
- Device temperature

Advanced self-diagnostics guarantee that all measurements operate correctly.

Powerful microcontroller calculates a control signal for I/P converter (prestage). I/P converter controls the operating pressure to the pneumatic relay (output stage). Pneumatic relay moves and actuator pressure changes accordingly. The changing actuator pressure moves the control valve. The position sensor measures the valve movement. The control algorithm modulates the I/P converter control signal until the control valve position matches the input signal.

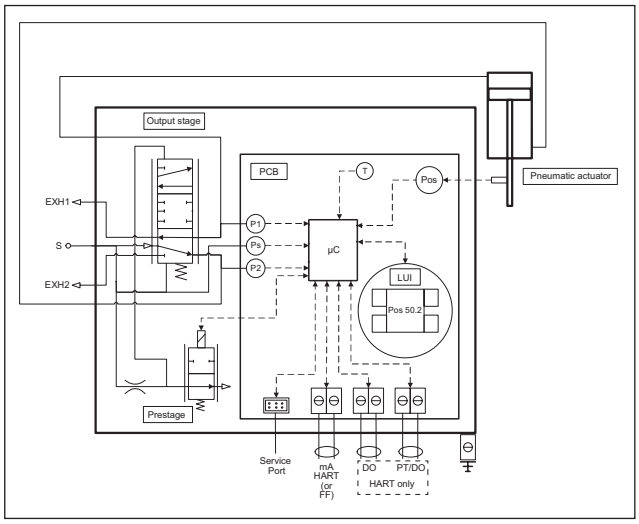


Fig. 2. Operating principle of double acting valve controller (NDX2_).

OPTIONS

Following options are available for NDX valve controller:

- Internal position transmitter (in HART version only)
- Digital output (NAMUR) (in HART version only)
- Gauge block

Internal position transmitter

NOTE
In HART version only.

Optional position transmitter connection is part of the electronics module. Position transmitter is connected to the 2-pole OUT terminal as shown in figure 4. Position transmitter requires an external power supply.

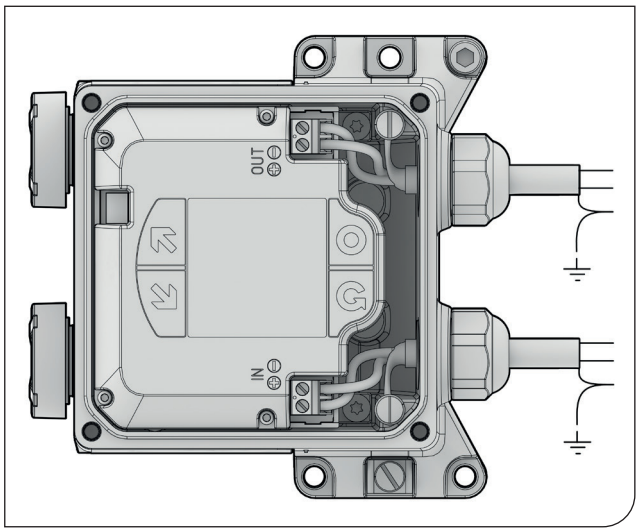


Fig. 3.

PRODUCT SUMMARY

Digital output (NAMUR)

NOTE
In HART version only.

There are up to two configurable NAMUR type digital outputs (DO). They can be configured to activate based on valve position measurement (as a limit switch) or any device status.
Configuration can be done via HART by using Valve Manager (DTM) or EDD.
Output options can be following:

- One PT and one DO
- Two DOs

Gauge block

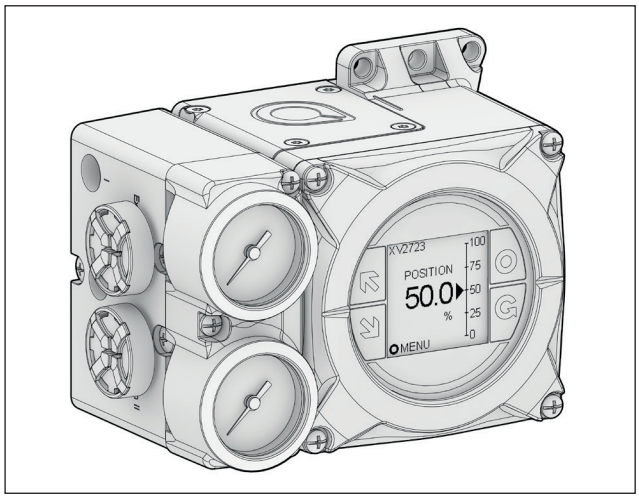


Fig. 4.

Optional gauge block is available in the following three options:
1/4 NPT with gauges (block with 1/4NPT threads + gauges)
G1/4 without gauges (block with G1/4 threads)
G1/4 with gauges (block with G1/4 threads + gauges)

MARKINGS

The valve controller is equipped with three identification plates.

Identification plate

Identification plate includes following markings

- Contact details of the manufacturer
- Input signal (voltage range)
- Transmitter input signal (voltage range)
- Supply pressure range
- Output
- Enclosure type
- Manufacturing serial number*
- Build number
- H/C-code
- Type code (7 signs)
- Gauge block options

*) Manufacturing serial number explained:
TT= device and factory sign
YY= year of manufacturing
WW = week of manufacturing
NNNN = consecutive number
Example: PH17380001 = controller, year 2017, week 38, consecutive number 1

Approval and type code plate

Approval and type code plate includes following markings

- Type code (15 signs)
- C-code
- CE mark
- Approvals (max. two)
- Operational temperature
- Input resistance

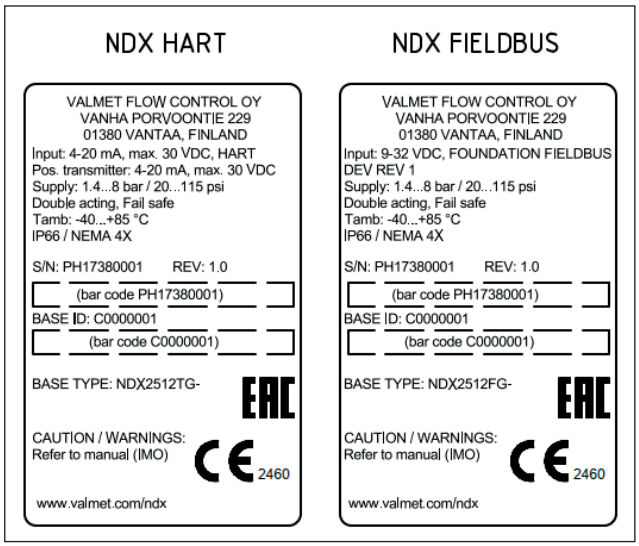


Fig. 5. Example of identification plates

PRODUCT SUMMARY

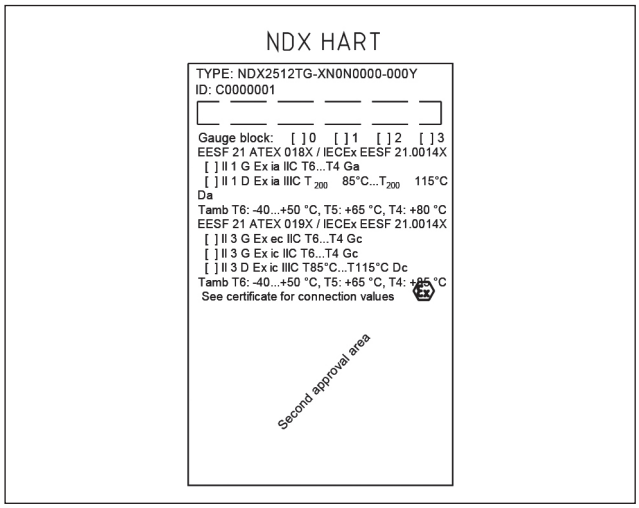


Fig. 6. Example of approval and type code plate of ATEX / IECEx certified NDX

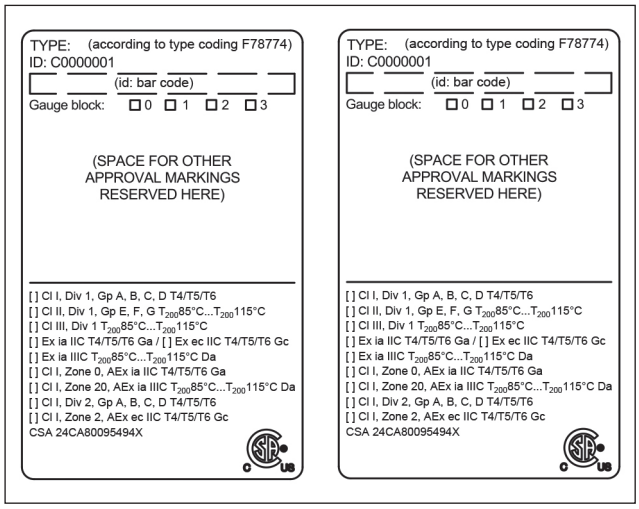


Fig. 7. Approval and type code plates for NDX_0_U and NDX_1_U or NDX_2_U respectively

NOTE

When installing the device, mark the applied hazardous area installation method by ticking the applicable box in the product identification plate when applicable.

Additional plates

Additional plates include explosion hazard warnings.

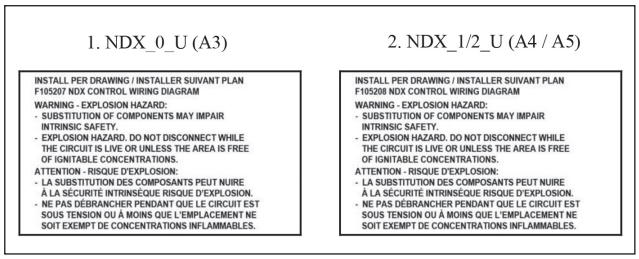


Fig. 8. Additional plate for NDX_0_U and NDX_1_U or NDX_2_U respectively

PRODUCT SUMMARY

EXPLODED VIEW

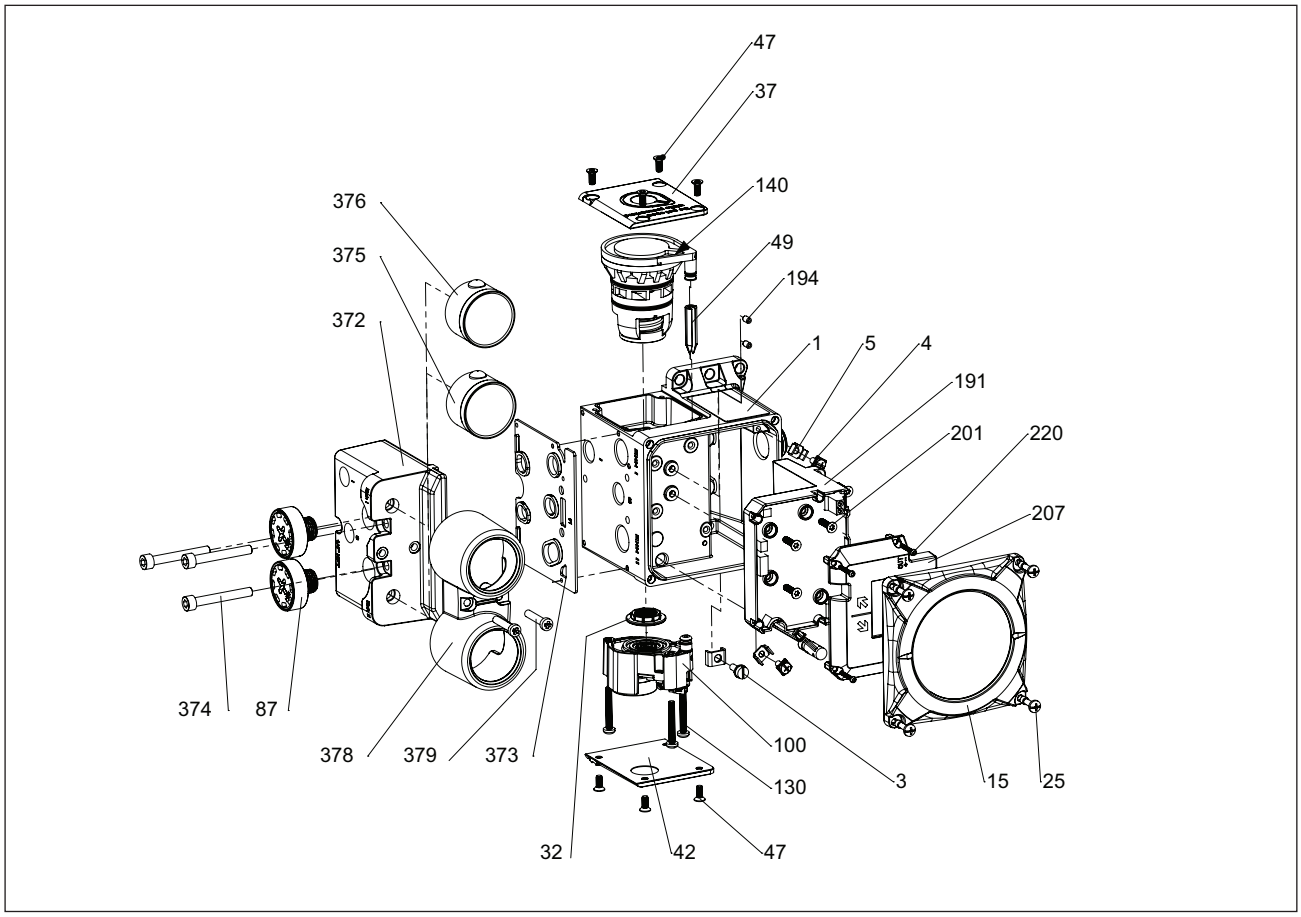


Fig. 9. NDX1510_ exploded view

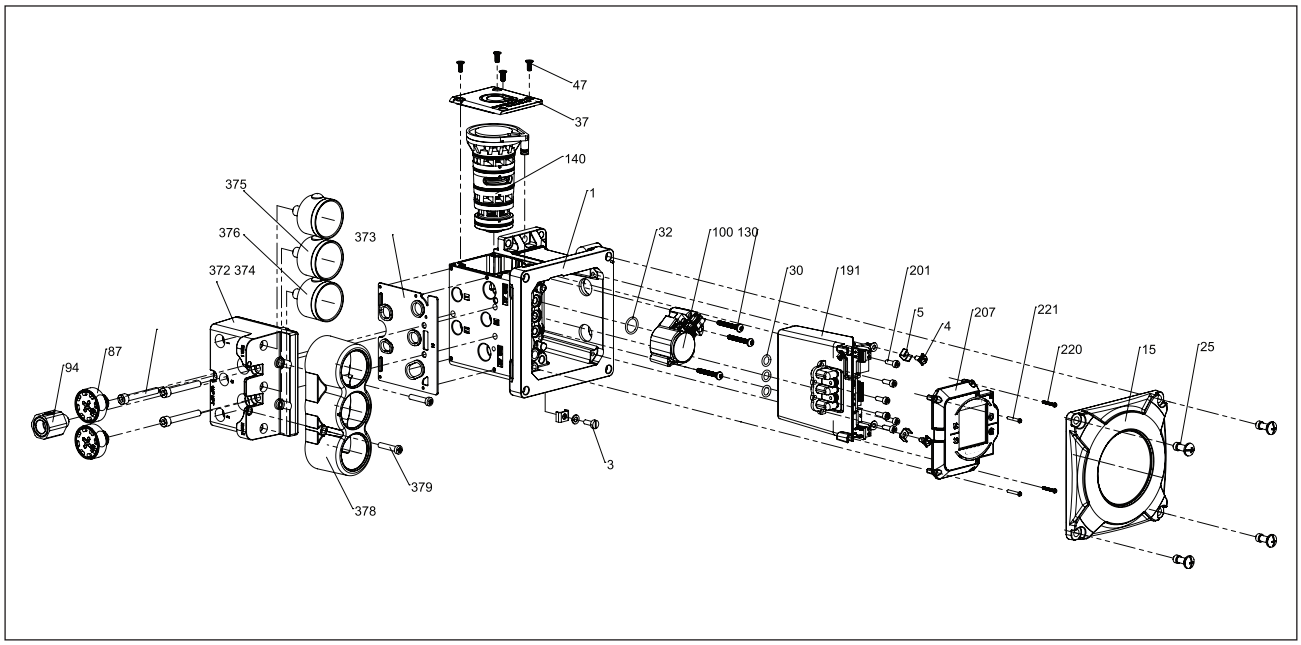


Fig. 10. _NDX_511_exploded_view

PRODUCT SUMMARY

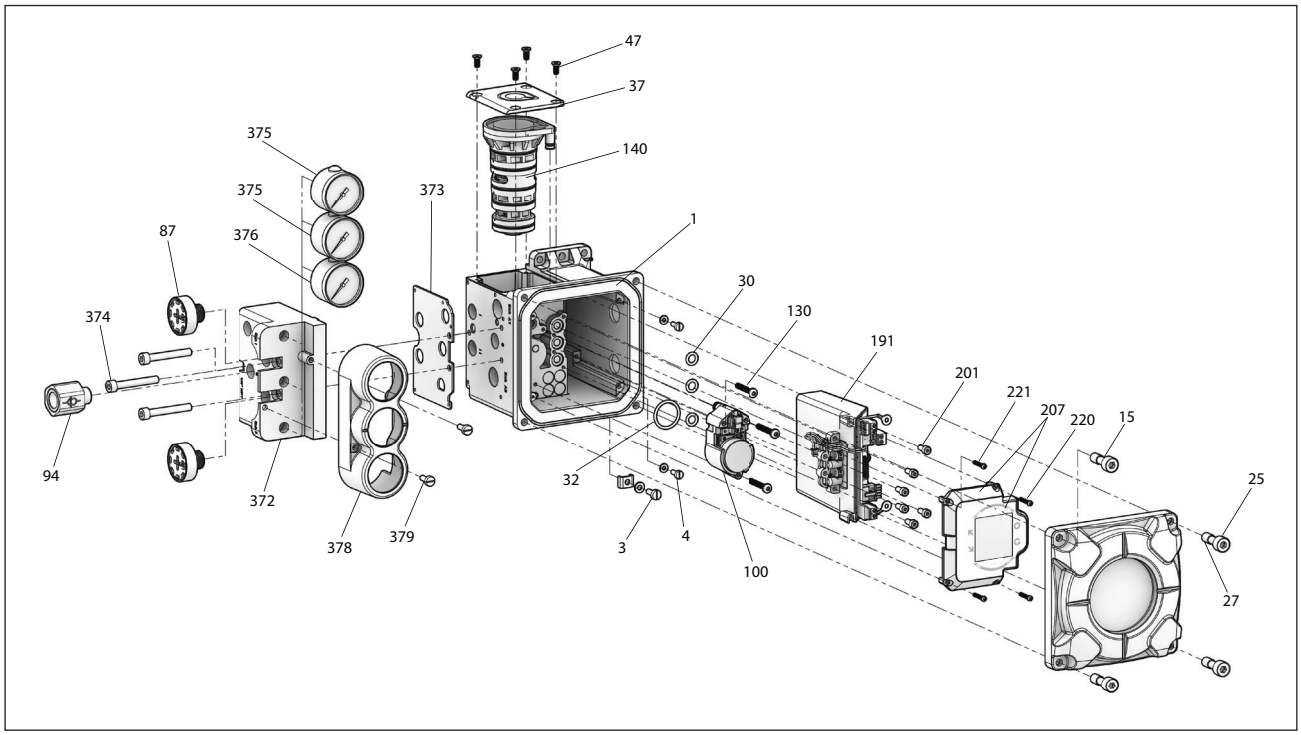


Fig. 11. NDX_512_ exploded view

Linear Magnet Holder Assembly[1] (VD48-55)

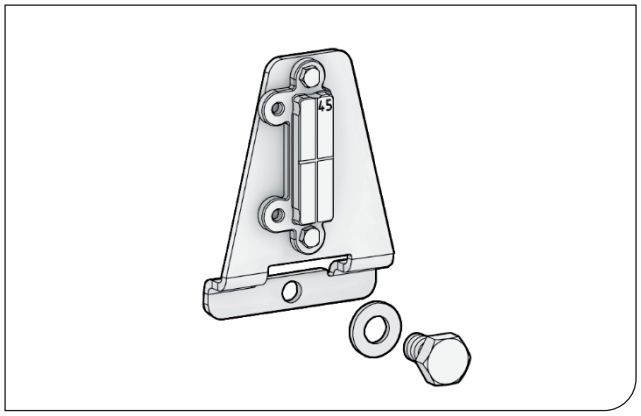


Fig. 12.

[1]The magnet holder assembly model depends on the actuator type. It will be included in the bracket setup.
It will not be included in bareshaft NDX.

Table 1. NDX part list

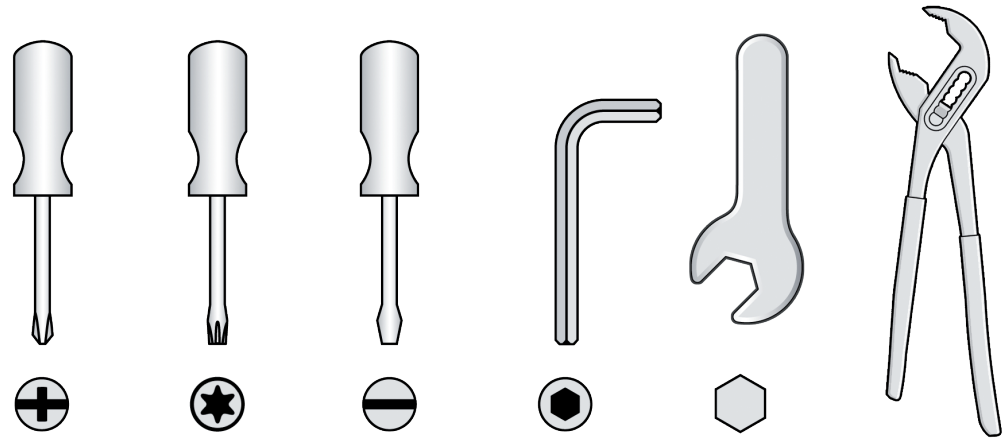
Pos	Description	1510	_511	_512	Tools
1	Housing assem.	x	x	x	
3	Grounding screw, ext.	x	x	x	SLOT8
4	Grounding screw, int.	x	x	x	PH2
15	Cover assem. main *	x	x	x	
25	Cover screw	x	x	-	PH2
25	Cover screw	-	-	x	HEX6
27	Lock washer	-	-	x	
30	O-ring	x	x	x	
32	Prestage bottom filter assem. *	x	-	-	
32	O-ring	-	x	x	
37	Cover assem. relay *	x	x	x	
42	Cover assem. prestage *	x	-	-	
47	Countersunk screw	x	x	x	TX20
49	Prestage channel filling piece	x	-	-	
87	Exhaust cover	x	x	x	
94	Check valve, double act only *	-	x	x	
100	Prestage unit assem. *	x	x	x	
130	Pan head screw	x	x	x	TX20
140	Relay valve assem. *	x	x	x	
191	Electronics module *	x	x	x	
201	Countersunk screw	x	-	-	TX20**
201	Socket head screw	-	x	x	HEX3***
207	Local user interface *	x	x	x	
220	Round head screw	x			TX7
221	Pan head screw	-	x	x	TX8
372	Gauge block	(x)	(x)	(x)	
373	Gasket	(x)	(x)	(x)	
374	Socket head screw	(x)	(x)	(x)	HEX5
375	Pressure gauge, supply	(x)	(x)	(x)	
376	Pressure gauge, actuator	(x)	(x)	(x)	
378	Gauge block frame	(x)	(x)	(x)	
379	Cross rec head screw	(x)	(x)	(x)	PH2

* Sparepart, see details in Maintenance chapter.
** 60 mm / 2,5 inch reach required.
*** 75 mm / 3 inch reach required.
*Sparepart. See detailed instructions in Maintenance chapter.

PRODUCT SUMMARY

TOOLS

Following tools are needed for the product installation and maintenance:



PH2

TX 7
TX 8
TX 10
TX 20

3 mm
8 mm

3 mm
5 mm
6 mm
10 mm

13 mm and 21/22 mm with linear actuators.
8 mm and 24 mm with rotary actuators.

Fig. 13.

NOTE
Other tools are dependent on the actuator which the NDX is installed upon.

TECHNICAL DESCRIPTION

General

Either loop powered 4-20 mA or FOUNDATION Fieldbus powered, no external power supply required.
Suitable for linear and rotary valves.
Actuator connections in accordance with VDI/VDE 3845 and IEC 60534-6 standards.

Action:	Single acting or double acting, direct or reverse
Travel range:	Linear (standard): 5-120 mm / 0.2-4.7 in Linear (long range): 120-220 mm / 4.7-8.6 in Rotary: 30-160 degrees

Environmental Influence

Standard temperature range:	-40° – +85 °C / -40° – +185 °F
Influence of temperature on valve position:	Rotary: 0.5 % / 10 °C Linear: 0.1 mm / 10 °C
LUI usable range:	-25° - +65 °C
Temperature cycling/ Dry heat:	Acc. to IEC 60068-2-2
Humidity Limits:	Acc. to IEC 61514-2
Magnetic Fields:	Negligible at 30 A/m Acc. to IEC 61000-4-8
Vibration:	Tested acc. to ANSI/ISA-75.13.01-2013
Environment as required by IEC 61010-1:	Outdoor / wet location
Operating environment with cover closed:	Pollution degree 4
Installation or maintenance with controlled environment	
Relative humidity:	Operating humidity 0 … 100 %RH

Electromagnetic Protection

Emission acc. to IEC 61000-6-4
Immunity acc. to EN 61000-6-2

Enclosure

Housing Material:	Epoxy coated anodized aluminum alloy, EN1706 AC - AlSi12 (b)
Cover Material:	Compact: Polycarbonate Standard: Polycarbonate Explosion Proof: same as housing and glass window
Magnet holder:	Linear, standard: Glass fiber reinforced polyamide, PA66GF20 Linear, long range: Anodized aluminum alloy Rotary: Anodized aluminum alloy
Protection class:	IP66, NEMA 4X IP67 optional for storage and transport
Pneumatic ports:	
Supply air:	1/4 NPT, G1/4 with additional block
Actuator:	1/4 NPT, G1/4 with additional block
Exhausts:	2 or 3 pcs. 3/8 NPT, G3/8 with additional block
Cable entry:	2 pcs. 1/2 NPT (M20 with adapter)
Weight:	2.0 kg / 4.4 lbs (Compact) 2.8 kg / 6.2 lbs (Standard) 3.8 kg / 8.4 lbs (Explosion proof) Gauge block 0.9 kg / 2.0 lbs

Pneumatics

Supply Pressure:	1.4–8 bar / 20–116 psi (single acting) 2.0–8 bar / 29–116 psi (double acting) Pressure range up to 10 bar with limited life time
Supply Media:	Air, nitrogen, sweet natural gas[2, 3]
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 7 (40 µm filtration)
Humidity:	Class 1 (at minimum dew point 10 °C/ 18 °F below minimum temperature is required)
Oil class:	3 (or < 1 ppm)
Air Capacity[1]:	80 Nm³/h / 47.1 scfm
Air Consumption in steady state position[1]:	0.1 Nm³/h / 0.06 scfm

[1] rated at 4 bar / 60 PSI supply pressure
[2] If natural gas is collected from the exhaust, make sure there are no back-pressure in the exhaust side. This applies also to so called re-breather application where the exhaust is piped to the actuator spring side.
[3] Natural gas is not allowed with cCSAus certified devices

Electronics (HART)

HART	Protocol rev. 7 or rev. 6
Supply power:	Loop powered, 4–20 mA
Min. signal:	3.8 mA
Min. control signal:	3.95 mA
Current max:	120 mA
Load voltage:	9.7 VDC at 20 mA 9.0 VDC at 4 mA
Impedance at 20mA:	485 Ω
Maximum Voltage:	30 VDC
Rev. Polarity protection:	-30 VDC
Over current protection:	active over 35 mA
Wire size:	0.5-2.5 mm² (14-20 AWG)
Position transmitter (optional)	
Output signal:	4–20 mA (galvanic isolation; 600 VDC)
Supply Voltage:	12–30 VDC
Linearity:	< 0.05 % FS
Temperature effect:	< 0.35 % FS
Failsafe output:	3.5 mA or 22.5 mA (acc. to NAMUR NE 43)
Maximum External load:	690 Ω for I.S.
Digital output (optional)	
Output signal:	NAMUR <1.0mA = state '0', >2.2mA = state '1' These can be inverted by configuration parameter
Supply voltage:	5…16VDC

Electronics (Foundation fieldbus)

Power supply:	Taken from bus
Bus voltage:	9-32 VDC, reverse polarity
Current consumption:	17mA
Max. fault state current consumption:	19mA
FOUNDATION Fieldbus function block execution times:	
AO	10 ms
AI	10 ms
PID	15 ms
DO	10 ms
DI	10 ms
IS	10 ms
OS	10 ms
MAI	10 ms
MDI	10 ms

Performance

Performance with moderate constant-load actuators

Dead band:	≤ 0.2 %
Hysteresis:	< 0.5 %
Linearity error:	< 0.5 % Long range: < 1.5 %
Repeatability:	< 0.2 %

TECHNICAL DESCRIPTION

Approvals

Table 2.

Approval	EC Type examination	Electrical values	Temperature ranges
NDX HART: II 1 G Ex ia IIC T6 ... T4 Ga II 1 D Ex ia IIIC T_{200}85 °C ... T_{200}115 °C Da II 2 G Ex ib IIC T6...T4 Gb II 2 D Ex ib IIIC T_{200}85 °C ... T_{200}115 °C Db IP66	EESF 21 ATEX 018X EN IEC 60079-0:2018/ A11:2024 EN 60079-11:2012 IEC 60079-11:2023 Edition 7.0	Input: Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 3.7 nF, Li ≤ 10.9 µH. Output: Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 3.7 nF, Li ≤ 10.9 µH. external load resistance 0–690 Ω NAMUR-DO1, NAMUR-DO2 Ui≤ 16 V, Ii = 25 mA, Pi = 100 mW, Ci = 23.4 nF, Li= 27.8 µH	T4: -40 °C ... +80 °C; T5: -40 °C ... +65 °C; T6: -40 °C ... +50 °C
NDX HART: II 3 G Ex ic IIC T6…T4 Gc II 3 G Ex ec IIC T6…T4 Gc II 3 D Ex ic IIIC T85 °C…T115 °C Dc IP66	EESF 21 ATEX 019X EN IEC 60079-0:2018/ A11:2024 EN 60079-11:2012 IEC 60079-11:2023 EN 60079-7:2015/ A11:2024	Input: Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 3.7 nF, Li ≤ 10.9 µH. Output: Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 3.7 nF, Li ≤ 10.9 µH. external load resistance 0–690 Ω NAMUR-DO1, NAMUR-DO2 Ui≤ 16 V, Ii = 25 mA, Pi = 100 mW, Ci = 23.4 nF, Li= 27.8 µH Input values for type of protection “ec”: Ui ≤ 28 V (mA and PT loop) Ui ≤ 16 V (NAMUR-DO1, NAMUR-DO2)	T4: -40 °C ... +85 °C; T5: -40 °C ... +65 °C; T6: -40 °C ... +50 °C
NDX HART: Ex ia IIC T6…T4 Ga Ex ia IIIC T_{200}85 °C…T_{200}115 °C Da Ex ib IIC T6…T4 Gb Ex ib IIIC T_{200}85 °C…T_{200}115 °C Db Ex ic IIC T6…T4 Gc Ex ic IIIC T85 °C…T115 °C Dc Ex ec IIC T6…T4 Gc IP66	IECEx EESF 21.0014X IEC 60079-0:2017 IEC 60079-11:2023 IEC 60079-11:2011 IEC 60079-7:2017	Input: Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 3.7 nF, Li ≤ 10.9 µH. Output: Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Ci ≤ 3.7 nF, Li ≤ 10.9 µH. external load resistance 0–690 Ω NAMUR-DO1, NAMUR-DO2 Ui≤ 16 V, Ii = 25 mA, Pi = 100 mW, Ci = 23.4 nF, Li= 27.8 µH	T4: -40 °C ... +80 °C; T5: -40 °C ... +65 °C; T6: -40 °C ... +50 °C
NDX FF: II 1G Ex ia IIC T6…T4 Ga II 1D Ex ia IIIC T_{200} 85 °C…T_{200} 115 °C Da II 2G Ex ib IIC T6…T4 Gb II 2D Ex ib IIIC T_{200} 85 °C…T_{200} 115 °C Db FISCO field device IP66	EESF 24 ATEX 031X EN IEC 60079-0:2018 EN 60079-11:2012 / IEC 60079-11:2023	FISCO ia/ ib: Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci < 5 nF, Li < 10 µH	T4: -40°C ... +80 °C; T5: -40°C ... +65 °C; T6: -40°C ... +50 °C
NDX FF: II 3G Ex ic IIC T6…T4 Gc II 3D Ex ic IIIC T85 °C…T115 °C Dc FISCO field device II 3G Ex ec IIC T6…T4 Gc IP66	EESF 24 ATEX 034X EN IEC 60079-0:2018 EN 60079-11:2012 / IEC 60079-11:2023 IEC 60079-7:2015/ A1:2018	FISCO “ic”: Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci < 5 nF, Li < 10 µH Increased safety “ec”: UN ≤ 24 V, IN ≤ 23 mA	T4: -40 °C ... +85 °C; T5: -40°C ... +65 °C; T6: -40°C ... +50 °C
NDX FF: Ex ia IIC T6…T4 Ga Ex ia IIIC T_{200} 85 °C…T_{200} 115 °C Da Ex ib IIC T6…T4 Gb Ex ib IIIC T_{200} 85 °C…T_{200} 115 °C Db Ex ic IIC T6…T4 Gc Ex ic IIIC T85 °C…T115 °C Dc FISCO field device or Ex ec IIC T6…T4 Gc IP66	IECEx EESF 24.0040X IEC 60079-0:2017 IEC 60079-11:2023 IEC 60079-7:2017	FISCO ia, ib and ic: Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci < 5 nF, Li < 10 µH Increased safety “ec”: UN ≤ 24 V IN ≤ 23 mA	T4: -40 °C ... +85 °C; T5: -40°C ... +65 °C; T6: -40°C ... +50 °C
HDX HART: II 2GD Ex db IIC T6 ... T4 Gb Ex tb IIIC T85 °C...T113 °C Db IP66	Sira 17ATEX1283X EN 60079-0: 2012 (+A11:2013) EN 60079-1: 2014 EN 60079-31:2014	Input: 4-20 mA, Ui ≤ 30 V Output: 4-20 mA, Ui ≤ 30 V	T4: -40 °C ...+85 °C; T5: ≤+72 °C; T6: ≤+57 °C
NDX HART: Ex db IIC T6 ... T4 Gb Ex tb IIIC T85 °C...T113 °C Db IP66	IECEx SIR 17.0069X IEC 60079-0 : 2011 IEC 60079-1 : 2014-06 IEC 60079-31 : 2013	Input: 4-20 mA, Ui ≤ 30 V Output: 4-20 mA, Ui ≤ 30 V	T4: -40 °C ...+85 °C; T5: ≤+72 °C; T6: ≤+57 °C

Table 3. (Not applicable to NDX FOUNDATION fieldbus version)

Approval	CSA certificate number	Electrical values	Temperature ranges
Class I, Division 1, Groups A, B,C,D T4/T5/T6 Class II, Division 1, Groups E, F, G T_{200}85°C to T_{200}115°C Class III Division 1 T_{200}85°C to T_{200}115°C Ex ia IIC T4/T5/T6 Ga Ex ia IIIC T_{200}85°C to T_{200}115°C Da Class I, Zone 0, AEx ia IIC T4/T5/T6 Ga Class I, Zone 20, AEx ia IIIC T_{200}85°C to T_{200}115°C Da type 4X IP66	**80095494** CAN/CSA C22.2 No. 60079-0:2019 CAN/CSA C22.2 No. 60079-11:2014 CAN/CSA C22.2 No. 60079-7:2016 +AMD1 :2018 UL 60079-0:2019 Ed 7.0 UL 60079-11:2013 Ed 6.0 UL 60079-7:2017 Ed 5.0 CSA C22.2 No. 61010-1-12, UPD1: 2015, UPD2: 2016, AMD1: 2018 UL 61010-1, 3rd Edition (2012) Amd1: 2018 CSA C22.2 No.94.2:20, 3rd Ed UL50E, 3rd Ed (2020)	Input and PT loop: Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1.0 W, Ci ≤ 3.7 nF, Li ≤ 10.9 µH DO loop: Ui ≤ 16 V, Ii ≤ 25 mA, Pi ≤ 100 mW, Ci ≤ 23.4 nF, Li ≤ 27.8 µH NDX---0 intrinsically safe when installed as per F105207 NDX---1 and NDX---2 intrinsically safe when installed as per F105208	For “ia” or “ib”: T6: -40°C … +50°C or T_{200}85°C T5: -40°C … +65°C or T_{200}100°C T4: -40°C … +80°C or T_{200}115°C For “ic” or “ec”: T6: -40°C … +50°C or T_{200}85°C T5: -40°C … +65°C or T_{200}100°C T4: -40°C … +85°C or T_{200}115°C
Class I, Division 2, Groups A, B, C, and D; T4/T5/T6 Ex ec IIC T4/T5/T6 Gc Class I, Zone 2 AEx ec IIC T4/T5/T6 Gc type 4X IP66		Input and PT loop: Umax ≤ 28V DO loop: Umax ≤ 16 V	
Class I, Division 1, Groups B, C, and D; T6…T4 Class II, Division 1, Groups E, F and G; T6 … T4 Enclosure Type 4X Ex db IIB+H2 T6 … T4 Gb (Canada) Class I, Zone 1 AEx db IIB+H2 T6 … T4 Gb (US) Ex tb IIIC T85°C …. T113°C Db (Canada) Zone 21 AEx tb IIIC T85°C …. T113°C Db (US)	**70157477** CSA C22.2 No. 30:20; CSA C22.2 No. 25-17 (R2022); CSA C22.2 No. 60079-0:19; CSA C22.2 No. 60079-1:16 (R2021); CSA C22.2 No. 60079-31:15 (R2020); FM 3600:2022; FM 3615:2022; FM 3616:2022; UL 60079-0:2020 (7th Edition); UL 60079-1:2020 (7th Edition); UL 60079-31:2015 (2nd Edition) CSA C22.2 No. 61010-1-12, UPD1: 015, UPD2: 2016, AMD1: 2018 UL 61010-1, 3rd edition (2012), AMD1: 2018 CSA C22.2 NO. 94.2:20, 3rd Ed UL 50E, 3rd Ed	Input and PT loop: U ≤ 28 VDC, I = 4 - 20 mA DO loop: U ≤ 16 VDC	-40°C ≤ Ta ≤ +75°C for temperature code T6 (Gas) -40°C ≤ Ta ≤ +74°C for temperature code T85°C (Dust) -40°C ≤ Ta ≤ +85°C for temperature code T5 (Gas) -40°C ≤ Ta ≤ +75°C for temperature code T95°C (Dust) -40°C ≤ Ta ≤ +85°C for temperature code T4 (Gas) -40°C ≤ Ta ≤ +75°C for temperature code T113°C (Dust)

NOTE
See latest up-to-date information of approvals on www.valmet.com/ndx

TRANSPORTATION AND STORAGE

The valve controller is a sophisticated instrument and it shall be handled with care. Products must be stored in a clean, dry environment. Device is delivered in IP67 packaging for storage and transportation.

- Check the controller for any damage that may have occurred during transportation.
- Store the uninstalled controller preferably indoors, keep it away from rain and dust.
- Do not unpack the device until installing it.
- Do not drop or knock the controller.
- Keep the flow ports and cable glands plugged until installing.
- Follow instructions elsewhere in this manual.

WARNING

Do not use the positioner as a lifting point!

Do not lift a valve assembly or positioner-actuator assembly from the positioner or from the positioner mounting bracket. The bracket attachment may fail leading to serious injury and damage.

RECYCLING AND DISPOSAL

RECYCLING AND DISPOSAL

Most valve controller parts can be recycled if sorted according to material. A valve controller may also be returned to manufacturer for recycling and disposal.

MOUNTING

WARNING
Some positioner - actuator linkages may cause severe injury to fingers or hands when the actuator operates. Prevent access of unqualified personnel to the installation. Take precautions when working on the unit.

NOTE
Especially in corrosive environment like at or near sea it is recommended to use grease in aluminum housing female threads on the exterior of the device: main cover / pneumatics cover fixing screws and bracket bolts at the bottom side.
Grease with good corrosion preventive properties and washout resistance is recommended, for example Molykote BR 2 Plus has been successful in tests.

NOTE
Recommended mounting fastener torques:
M8: 20 Nm
M6: 8.0 Nm
M5: 6.0 Nm (iron actuator threads)
M5 4.8 Nm (aluminium actuator threads)

NOTE
Minimum requirements in IEC 60079-1 for flameproof entry devices assume a maximum reference pressure of 2 000 kPa for Group II and 1 333 kPa for Group I. Other devices are available with ratings greater than these minimum requirements.

LINEAR MOUNTING

Installation to Neles Globe

NOTE
The enclosure of NDX meets the IP66 protection class according to EN 60529. Cable entry needs to be plugged according to IP66 and it is not allowed to mount NDX in a position where the cable entry is pointing upwards. Based on good mounting practice, the recommended mounting position is electrical connections placed downwards. This recommendation is shown in our mounting position coding for control valves.
If these requirements are not fulfilled, and the cable gland is leaking and the leakage is damaging NDX, our warranty is not valid.

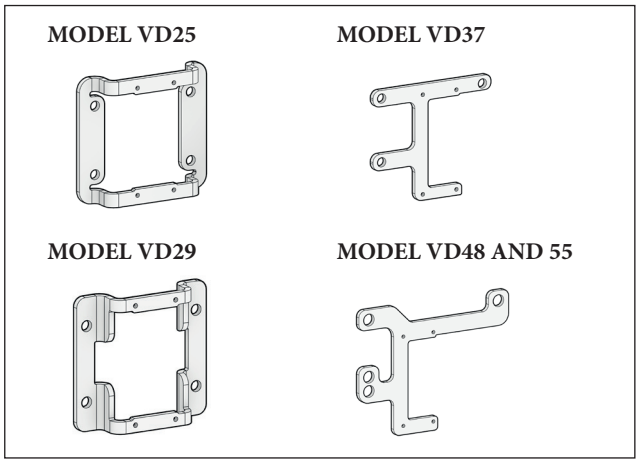


Fig. 14.

Installation to Neles Globe (VD29)

1. Mount the magnet holder with magnet to the actuator coupler, tighten the fixing screw.

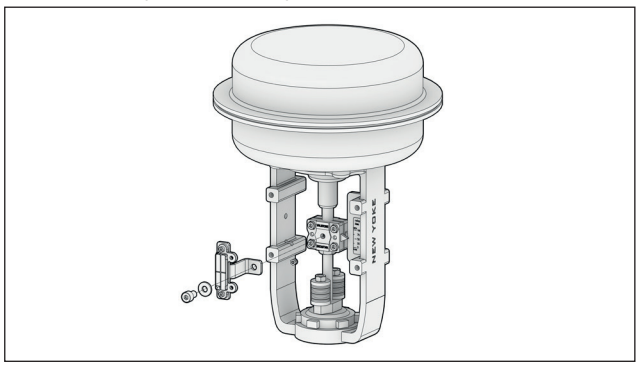


Fig. 15.

2. Mount the bracket to the actuator, leaving the screws loose.

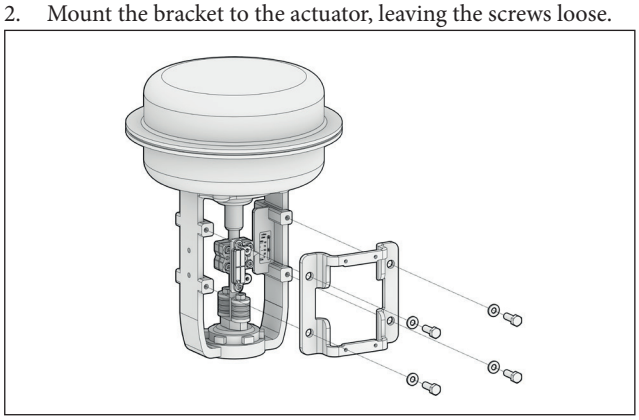
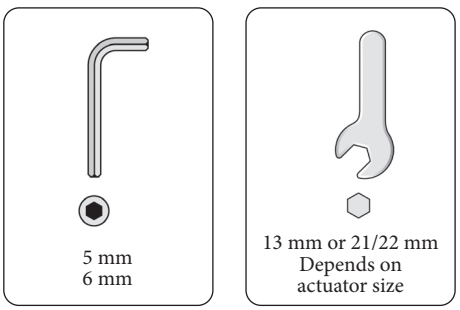


Fig. 16.



MOUNTING

NOTE
Similar mounting steps apply also with other Neles Globe actuator sizes.

NOTE
The bracket can be rotated 180° or flipped front/backside. If the bracket is flipped, the magnet needs to be flipped correspondingly.
If needed, check the magnet installation tolerances from the picture in section 7.3 “Installation to any linear actuator”

3. Attach the magnet alignment tool to the magnet. Adjust the position of the bracket so that the magnet slides smoothly in the magnet alignment tool groove and tighten the magnet alignment tool fixing bolts.

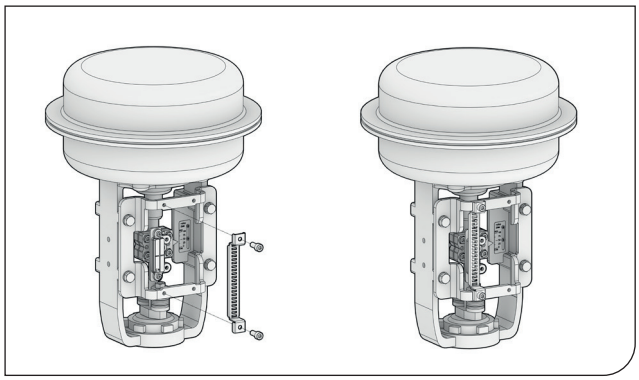


Fig. 17.

4. Tighten the bracket screws from step 2. Remove the magnet alignment tool.

5. Mount the NDX to the bracket.

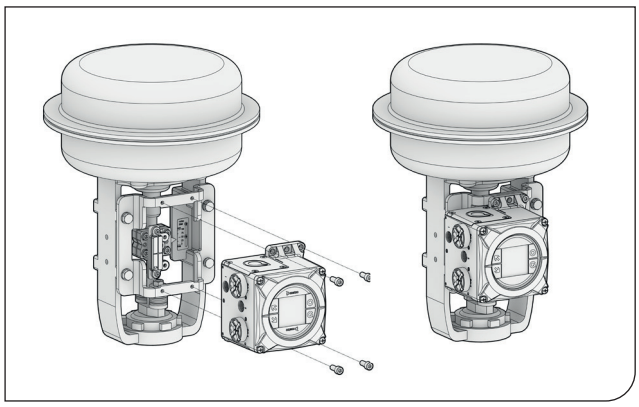
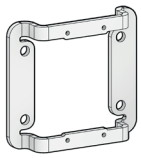
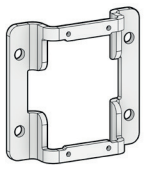


Fig. 18.

Table 4. Bracket Orientation Table – Neles Globe

Neles Actuator	Size	Stroke (mm)	Bracket Model / Orientation
VD	#25	20	
	#29	40	
	#37	20, 40	
	#48	40, 50, 60	
	#55	80, 90	

MOUNTING

Installation to IEC mounting face

The following mounting brackets are designed for linear actuators using the IEC 60534-6 interface. These kits include an alignment tool which makes device installation very easy.

1. Mount the IEC bracket to the actuator, leaving the screws loose.
2. Mount the magnet alignment tool (magnetically) to the magnet bracket.
3. Mount the magnet bracket to the actuator coupler, leaving the screws loose.

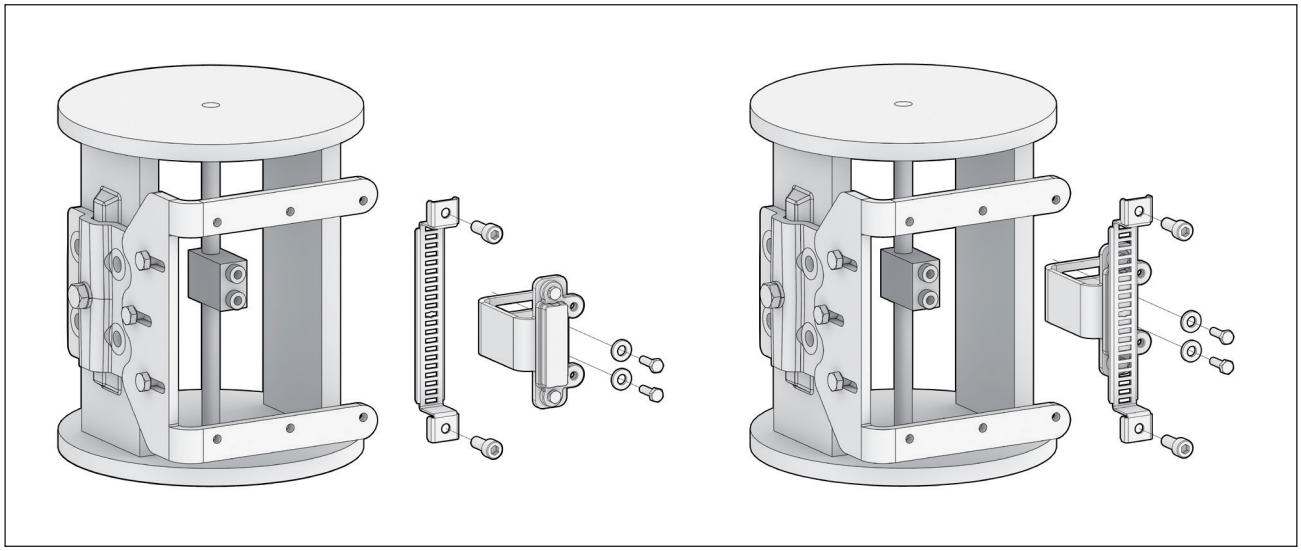


Fig. 19.

4. Attach the magnet alignment tool to the center holes on the IEC bracket.

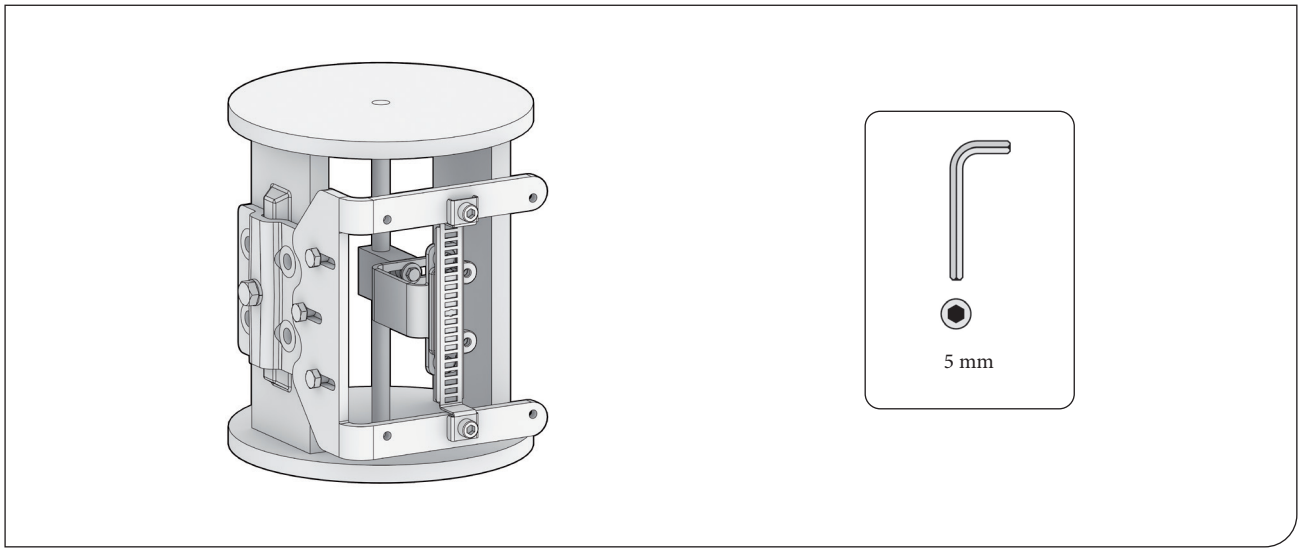


Fig. 20.

NOTE
Other tools are dependent on the actuator which the NDX is installed upon.

MOUNTING

5. Adjust the position of the magnet bracket (and the IEC bracket) so that the magnet slides smoothly in the magnet alignment tool groove.
6. Tighten the magnet bracket screws.
7. When the magnet moves smoothly in the magnet alignment tool, that automatically defines the correct alignment and distance from the device position sensor. Tighten the IEC bracket to the actuator and remove the magnet alignment tool.

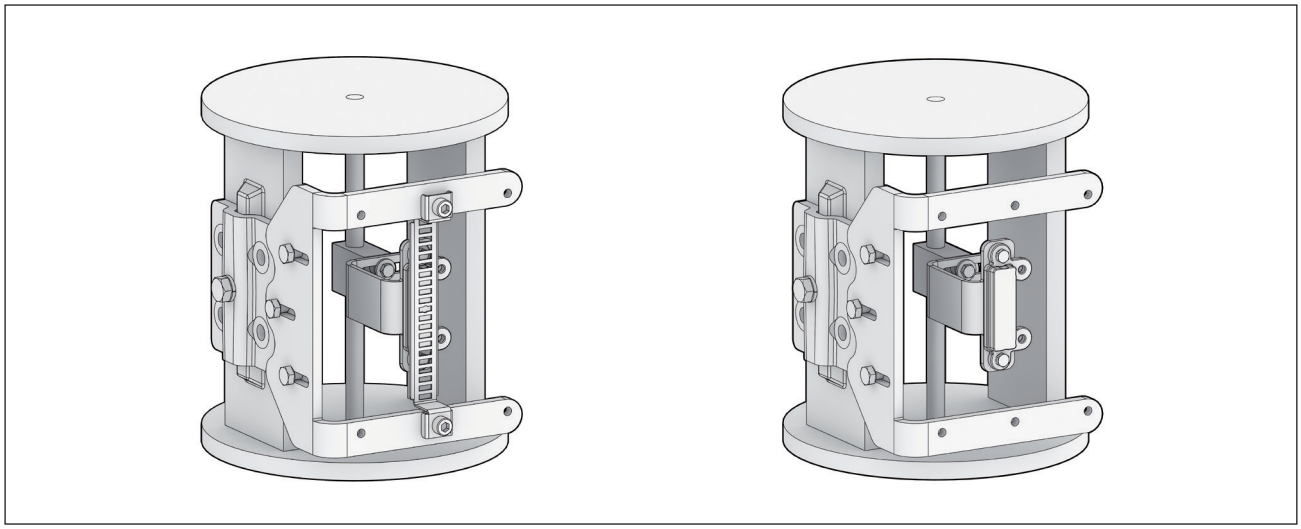


Fig. 21.

8. Mount the device to the IEC bracket by four screws.

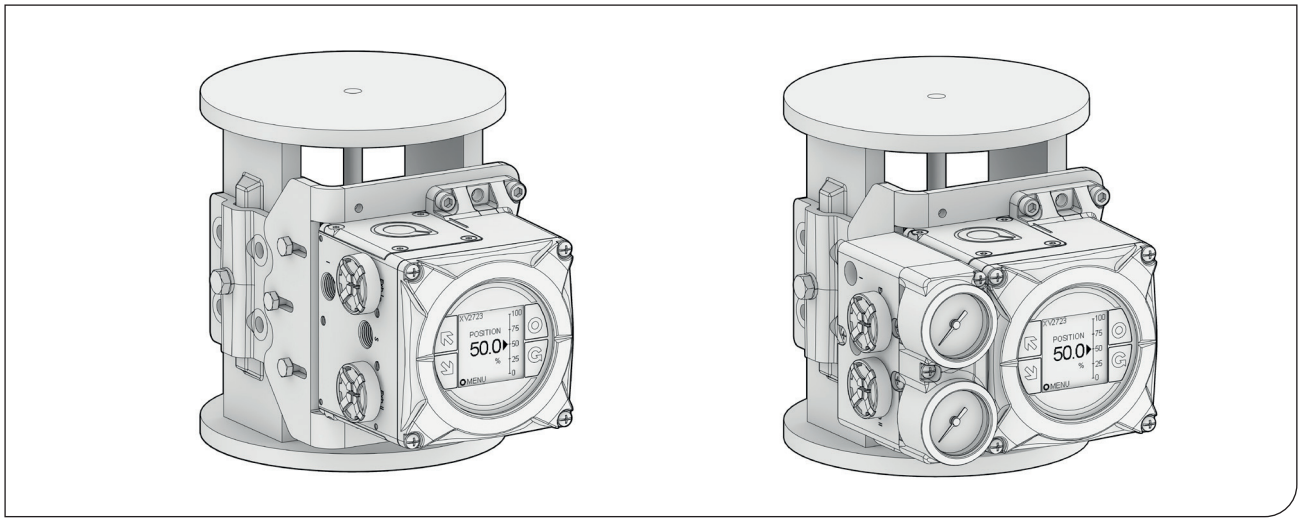


Fig. 22.

MOUNTING

Installation to any linear actuator

NDX can be easily installed to any linear actuator when the following installation rules are followed. In order to guarantee the best possible position measurement accuracy, NDX and position feedback magnet must be positioned according to the following guidelines.

NOTE
Use only Neles original magnets.
Bracket and fixing bolt material should have low magnetic permeability (e.g. AISI316 or aluminium).

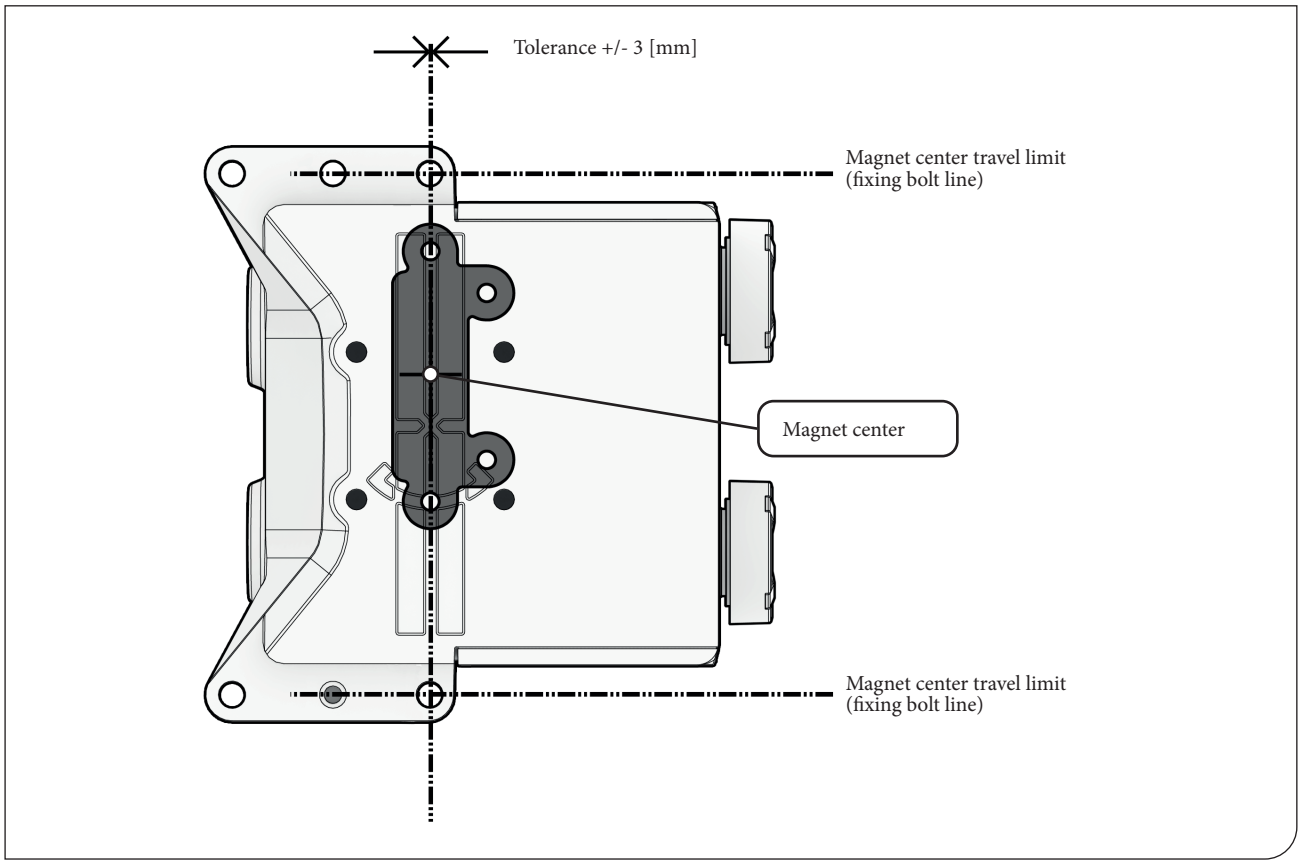


Fig. 23.

When installing the device to any other actuator model make sure that the following tolerances are followed with magnet mounting.

1. Magnet shall be centered within +/- 3 mm tolerance as shown in the picture.
2. Magnet center shall never exceed the magnet center travel limits shown in the picture.

NOTE
Always ensure that the magnet center stays within magnet center travel limits on the complete operation range of the valve.

NOTE
Shorter actuator stroke allows more freedom for alignment of the magnet and NDX in actuator stroke direction. Magnet position does not affect the measurement accuracy as long as the magnet center stays within the magnet center travel limits for whole travel range.

MOUNTING

3. The distance between the magnet and the device bottom shall be 4.5 mm with +/- 3 mm tolerance (1.5 - 7.5 mm). See fig 24.
4. Check that following magnet alignment requirements are not exceeded. See fig 26.

Figure 25 shows the exclusion zone. There is no material limitation outside the exclusion zone, but to guarantee the optimal performance do not use any magnetic material inside the zone. Inside the exclusion zone but close to the ”walls” AISI 304 and any austenitic steel can be used.

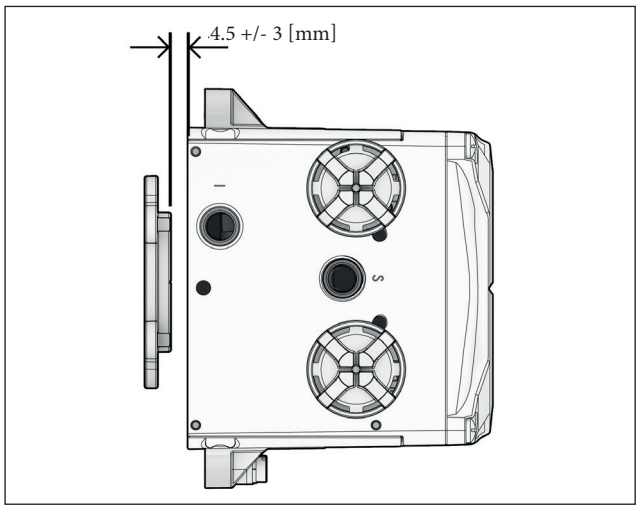


Fig. 24.

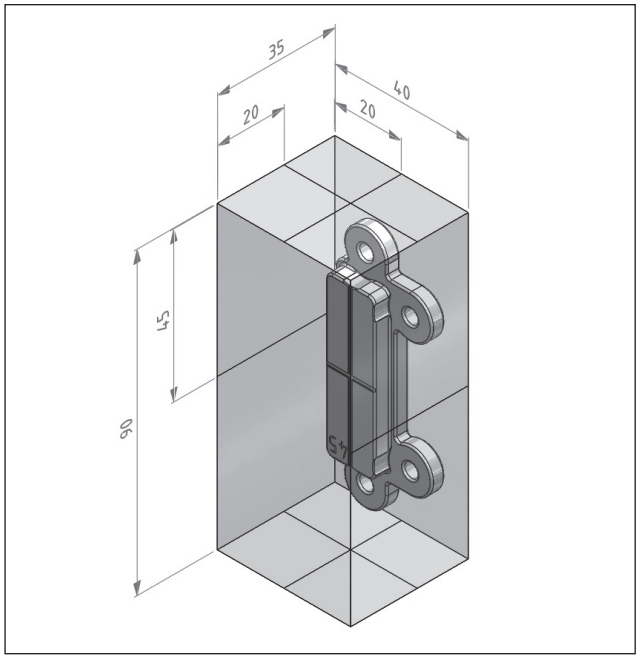


Fig. 25.

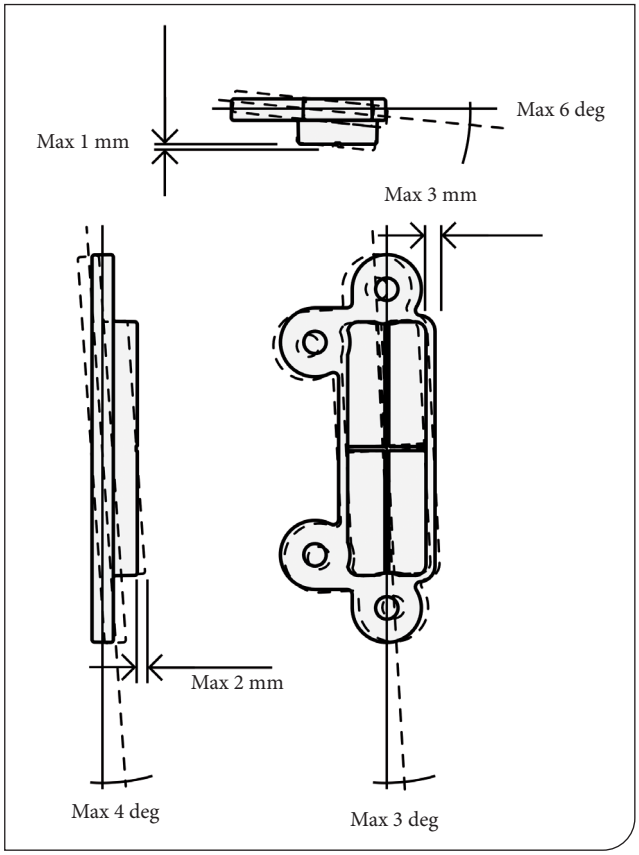


Fig. 26.

INSTALLATION OF LONGSTROKE MAGNET

NDX with long stroke magnet can be installed to a linear actuator with a stroke distance between 120-220mm. Long stroke adaptation has a different position feedback magnet than standard stroke (5-120mm). NDX and the long stoke position feedback magnet must be positioned according to the following guidelines.

When installing the device to any other actuator model make sure that the following tolerances are followed with magnet mounting.

1. Magnet shall be centered within +/- 3mm tolerance as shown in the picture.
2. Magnet travel limit marks on magnet body shall never exceed the

NOTE

Use only Neles original magnets. Bracket and fixing bolt material should have low magnetic permeability (e.g. AISI316 or aluminium).

MOUNTING

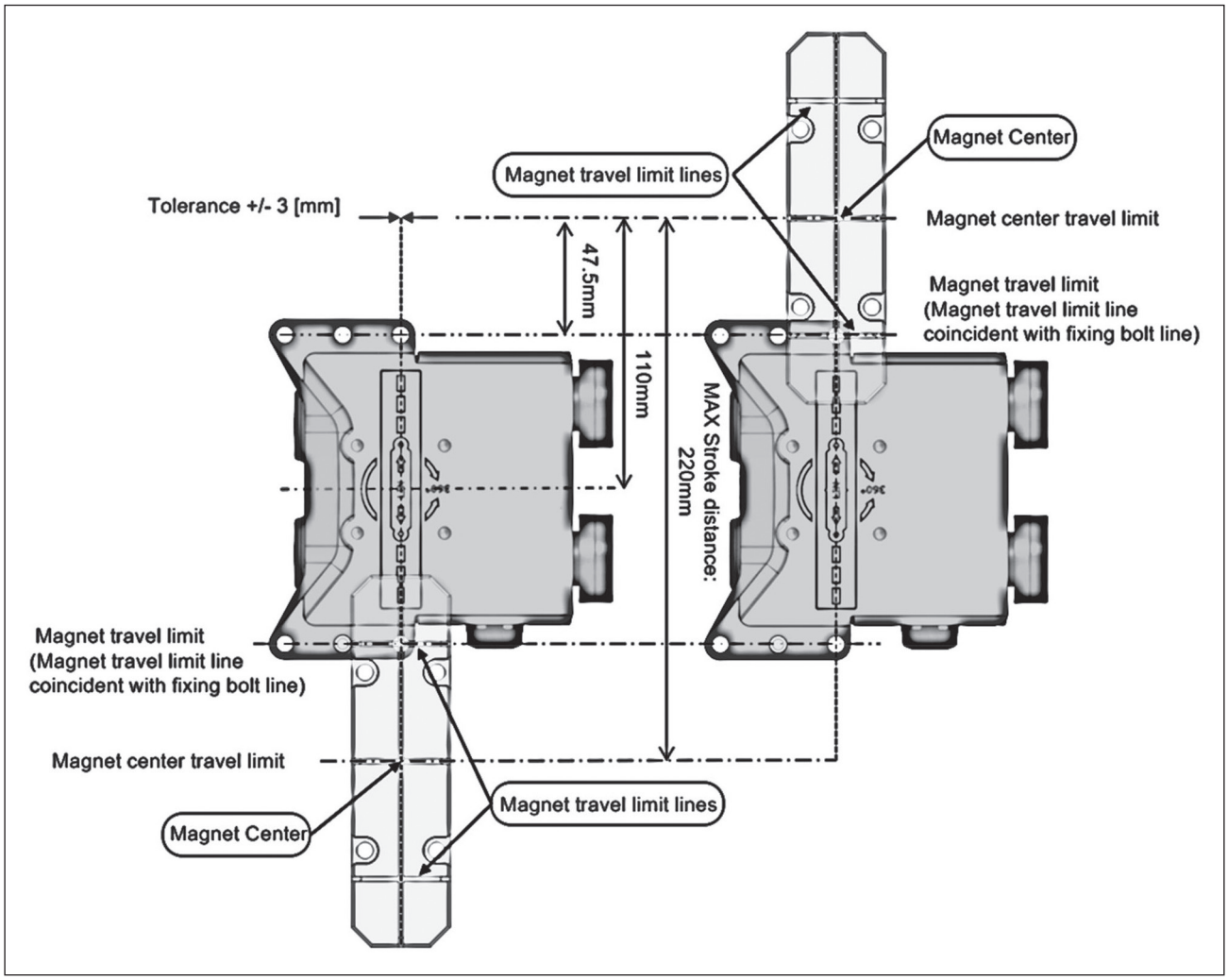


Fig. 27.

NOTE
The magnet must be aligned with the actuator shaft.

NOTE
Magnet body in the picture is faced upside down to give a better picture.

3. The distance between the magnet and the device bottom shall be 15 +/- 5 mm tolerance (10…20 mm). See fig 28.

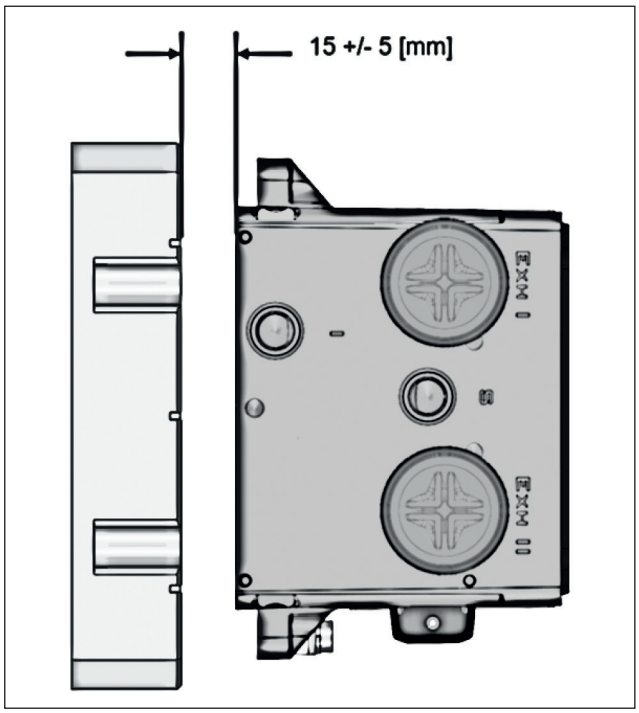


Fig. 28.

MOUNTING

4. Check that following magnet alignment requirements are not exceeded. See fig 29.

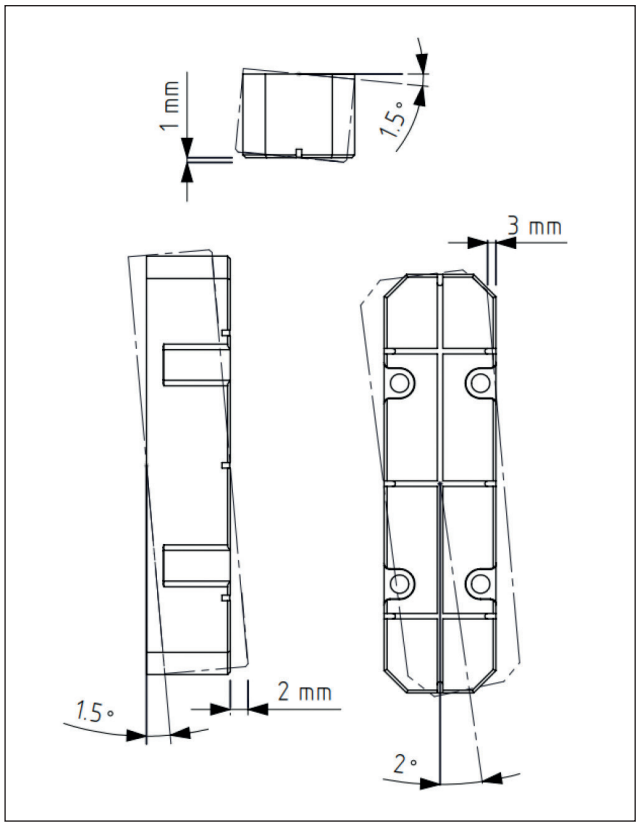


Fig. 29.

Figure 30 shows the exclusion zone. There is no material limitation outside the exclusion zone, but to guarantee the optimal performance do not use any magnetic material inside the zone. Inside the exclusion zone but close to the" walls" AISI 304 and any austenitic steel can be used.

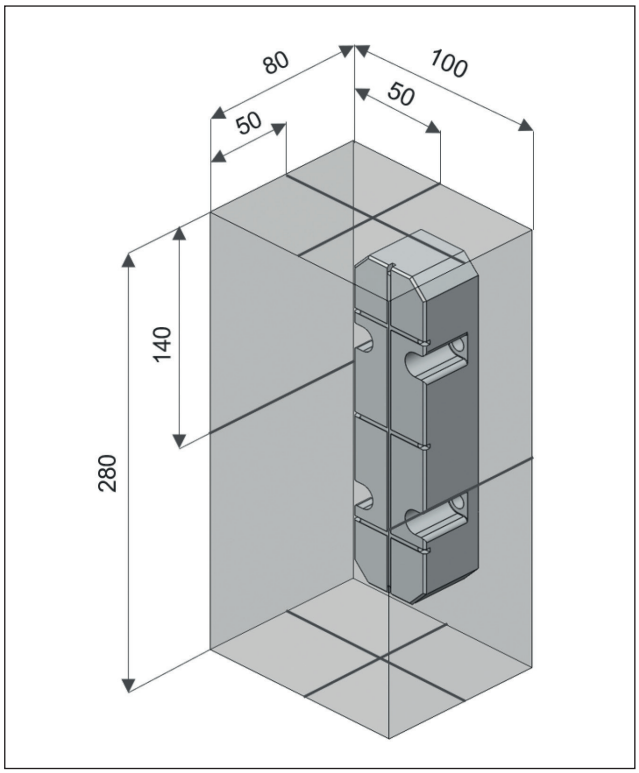


Fig. 30.

MOUNTING

ROTARY MOUNTING

Rotary mounting is designed according to VDI/VDE 3845 interface.

NOTE

The enclosure of NDX meets the IP66 protection class according to EN 60529. Cable entry needs to be plugged according to IP66 and it is not allowed to mount NDX in a position where the cable entry is pointing upwards. Based on good mounting practice, the recommended mounting position is electrical connections placed downwards. This recommendation is shown in our mounting position coding for control valves.

If these requirements are not fulfilled, and the cable gland is leaking and the leakage is damaging NDX, our warranty is not valid.

Installation to Neles B-series actuators - MAGNET MOUNTING

- Mounting set includes mechanical position indicator. It can be used if there is no position indicator in the actuator.
- Place position indicator plate to the correct position so that it correspond to the valve position.
- Lock position indicator plate with screw driver so that it can't turn by bending locking tabs.
- Mount magnet to the actuator

There shall be use thread locking in magnet assembly to prevent magnet loosening under heavy vibration. Thread locking should be low or medium strength, e.g. Loctite 243.

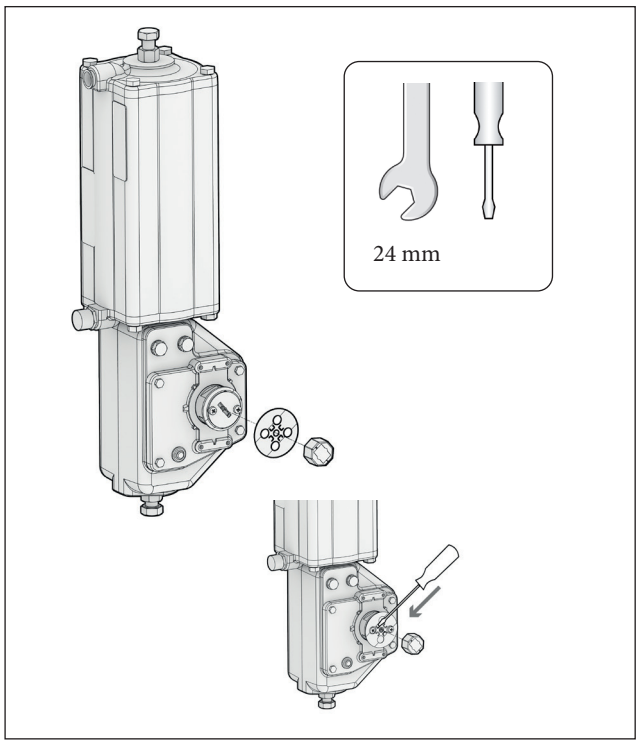


Fig. 31.

Magnet will be tightened as tight as 4 Nm. From the operation point of view magnet can be in any position so there is no adjustment needed.

Installation to Neles B-series actuators - BRACKET MOUNTING

For Neles BJ actuators there are few different mounting brackets, depending on actuator size. This example shows NDX mounting to Neles BJ6 actuator. For other sizes bracket types vary a little, but main steps are the same. When mounting NDX to the Neles actuators, there is no mechanical adjustment needed.

- Mount bracket to the NDX
- Mount bracket to the actuator

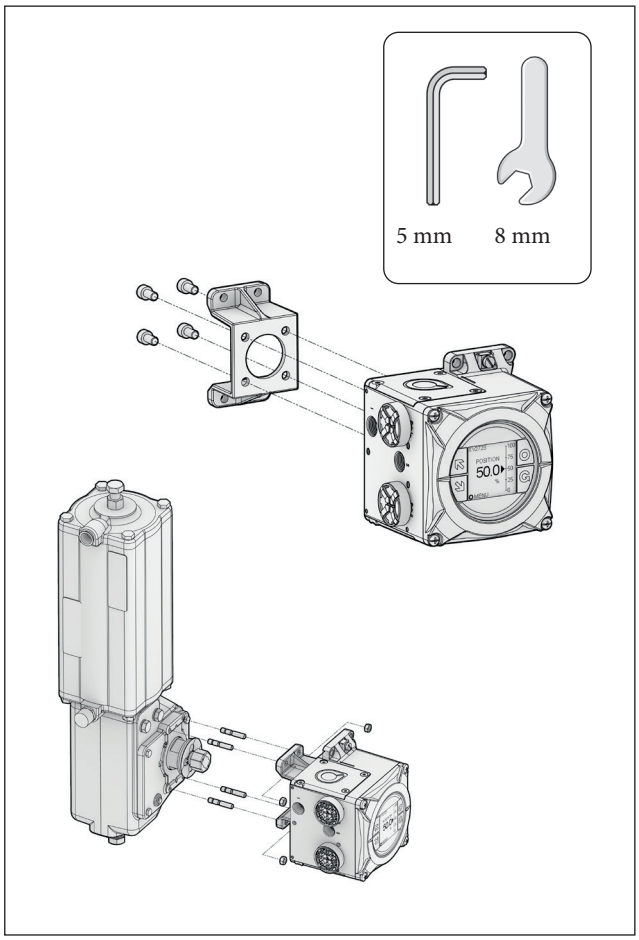


Fig. 32.

MOUNTING

Installation to any rotary actuator

NDX can be easily installed to any rotary actuator when the following installation rules are followed. In order to guarantee the best possible position measurement accuracy, NDX and position feedback magnet must be positioned according to the following guidelines.

NOTE

Use only Neles original magnets. Bracket and fixing bolt material should have low magnetic permeability (e.g. AISI316 or aluminium).

Aim for small mechanical clearance, but avoid contact. there shall be max 5 mm gap between the magnet and NDX. Tilt is not critical. Aim for zero eccentricity. Polarity of the magnet is irrelevant.

Figure 33 shows the exclusion zone. There is no material limitation outside the exclusion zone, but to guarantee the optimal performance do not use any magnetic material inside the zone. Inside the exclusion zone but close to the ”walls” AISI 304 and any austenitic steel can be used.

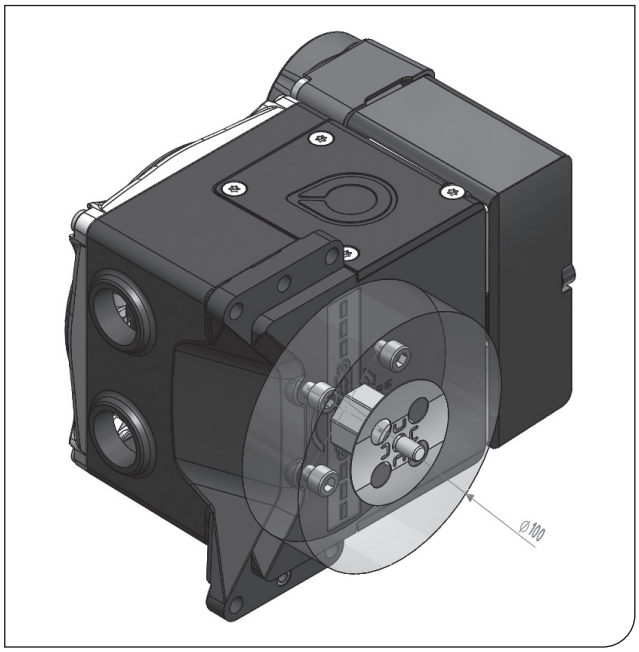


Fig. 33. Exclusion zone for magnetic material.

PNEUMATICS PIPING

PNEUMATICS PIPING

NDX pneumatics piping

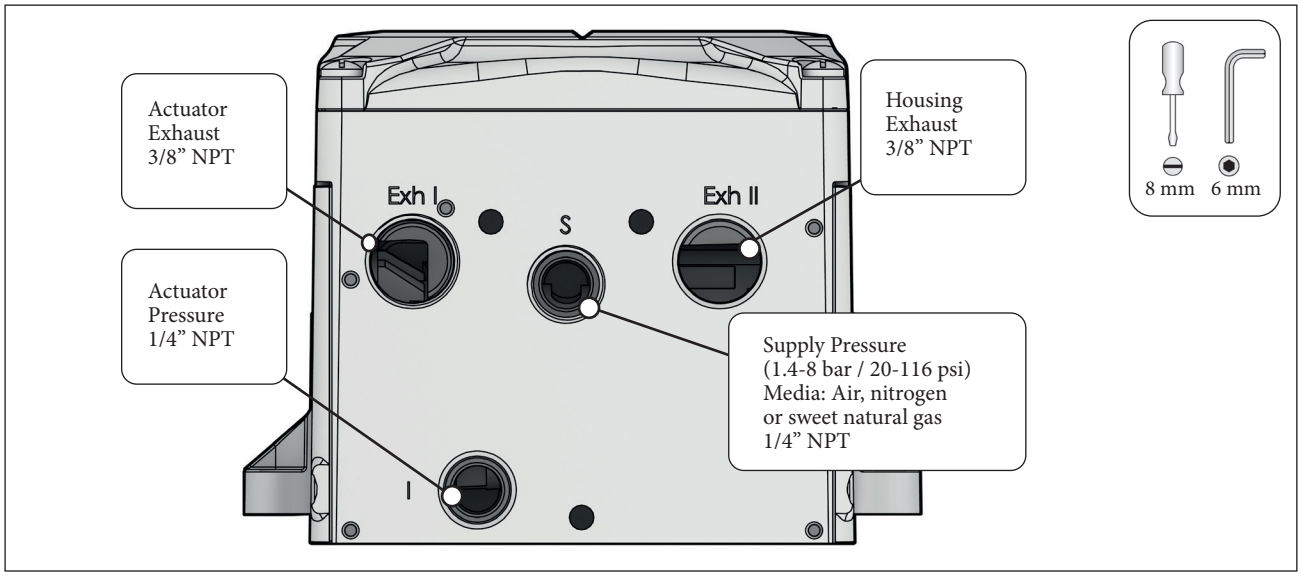


Fig. 34. NDX1510_ piping

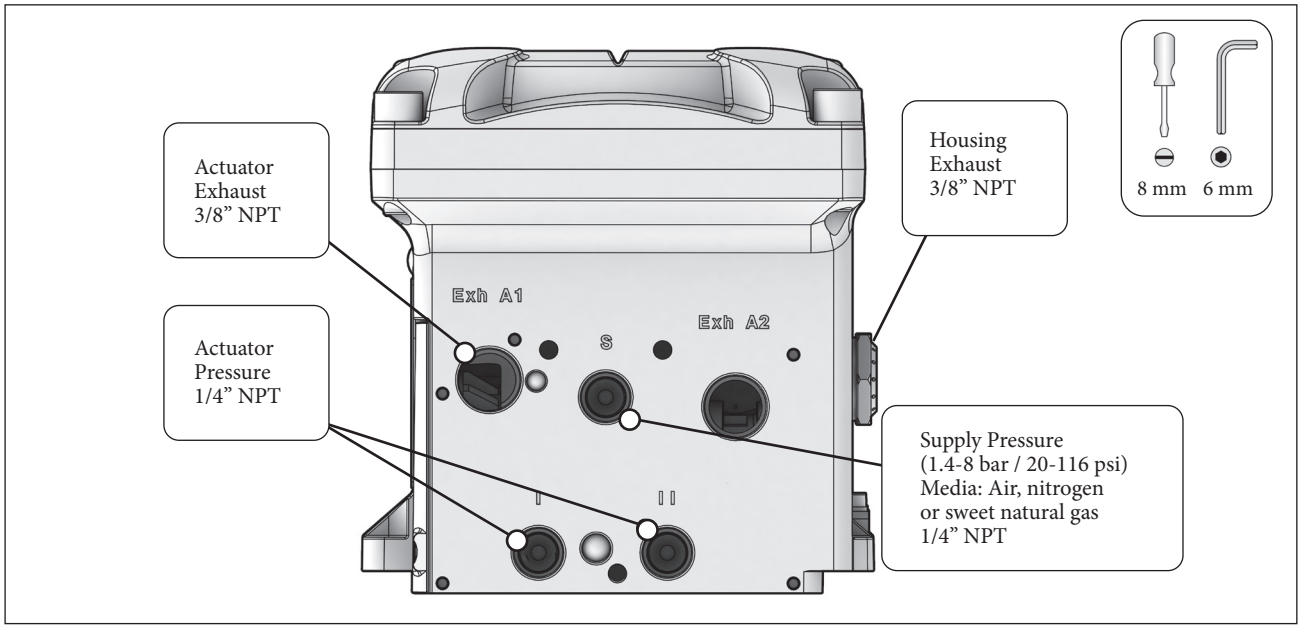


Fig. 35. NDX_511_ and NDX_512_ piping

NOTE

NDX251_ is equipped with double acting pneumatics relay, but it can also be used with single acting spring return actuator when port II is plugged.

WARNING

Do not exceed the maximum supply pressure of the actuator!

A filter regulator is not a safety device! Adjust the network pressure below the maximum pressure of all actuators or use pressure relief valves.

Do not exceed the permitted supply pressure (8 bar / 115 psi) of the NDX

NOTE

Remove all temporary transportation plugs with 8 mm flat-head screwdriver.

NOTE

When NDX251_ is used with single acting actuator, port II needs to be plugged. Install steel plug with 6 mm hexagon wrench.

PNEUMATICS PIPING

Check valve on supply pressure port

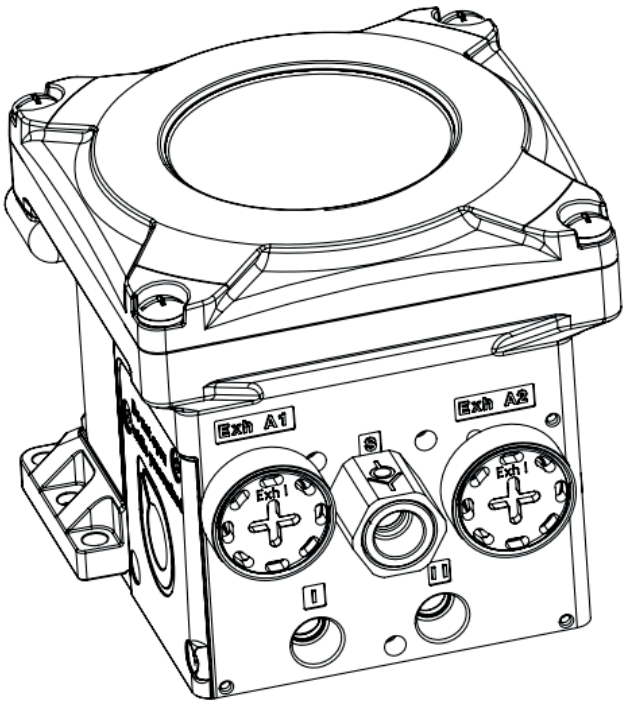


Fig. 36. Check valve on supply pressure port (S)

Check valve on supply pressure port (S) is installed and shall be used on double acting version of NDX (NDX251_) only.

NOTE

Supply pressure to NDX can drop due to varying air consumption of other connected devices in the same supply pressure line. If the supply pressure drops below the actuator pressure (ports I or II), the actuator pressure is dropping to the level of supply pressure. The air is then actually flowing from the cylinder to the supply line and the valve could move. This backflow is prevented by the check valve in NDX.

CAUTION

If double acting version of NDX (NDX251_) is installed on single acting actuator, the check valve must be removed.

PNEUMATICS PIPING

Pneumatics piping when pressure gauge block is installed

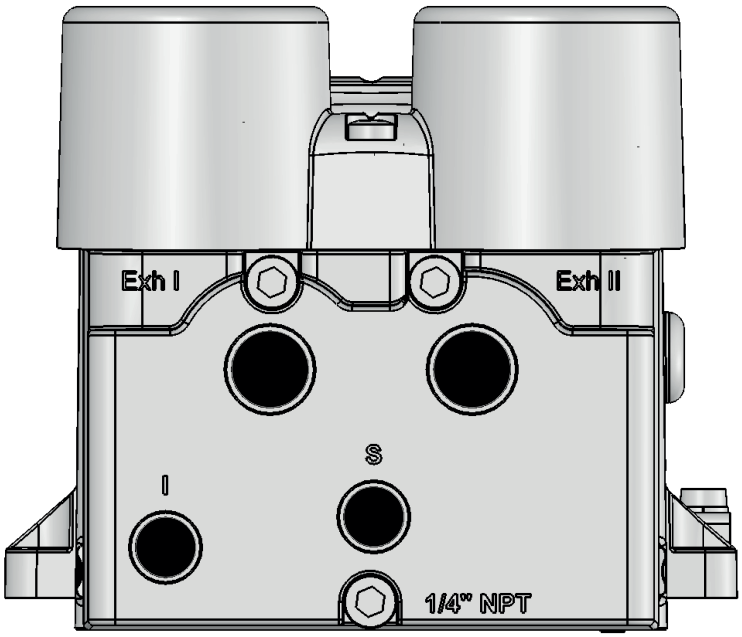


Fig. 37.

NOTE
Placement and distances between exhaust and pressure channels are different than without the pressure gauge block. See Dimension drawings for details.

NOTE
When NDX251_ is used with single acting actuator, port II needs to be plugged. Install steel plug with 6 mm hexagon wrench.

PNEUMATICS PIPING

Exhaust covers installed

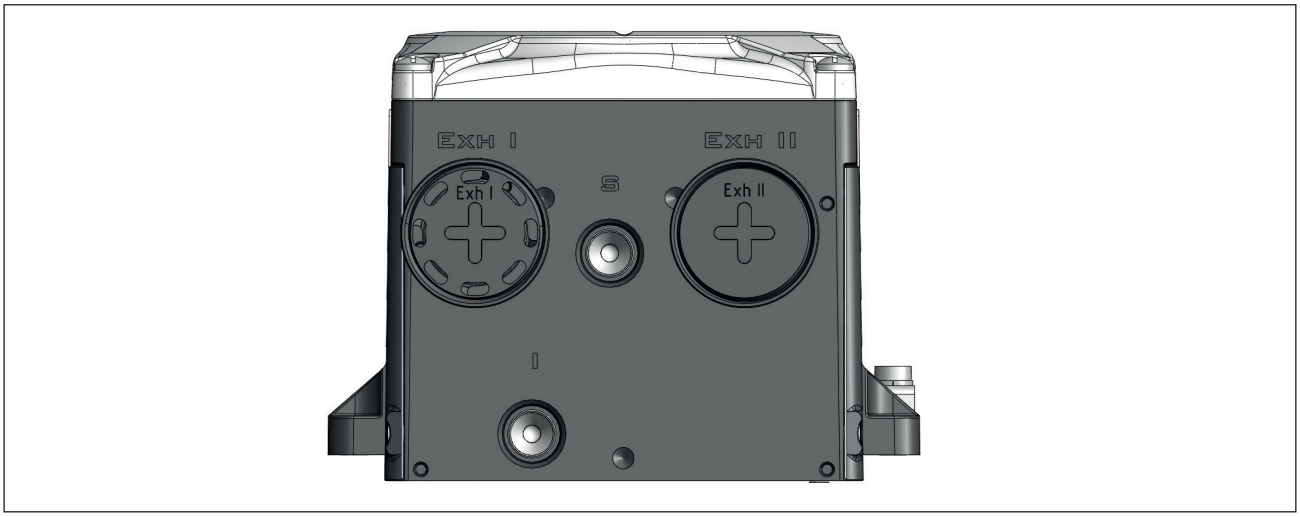


Fig. 38. NDX1510_exhaust covers

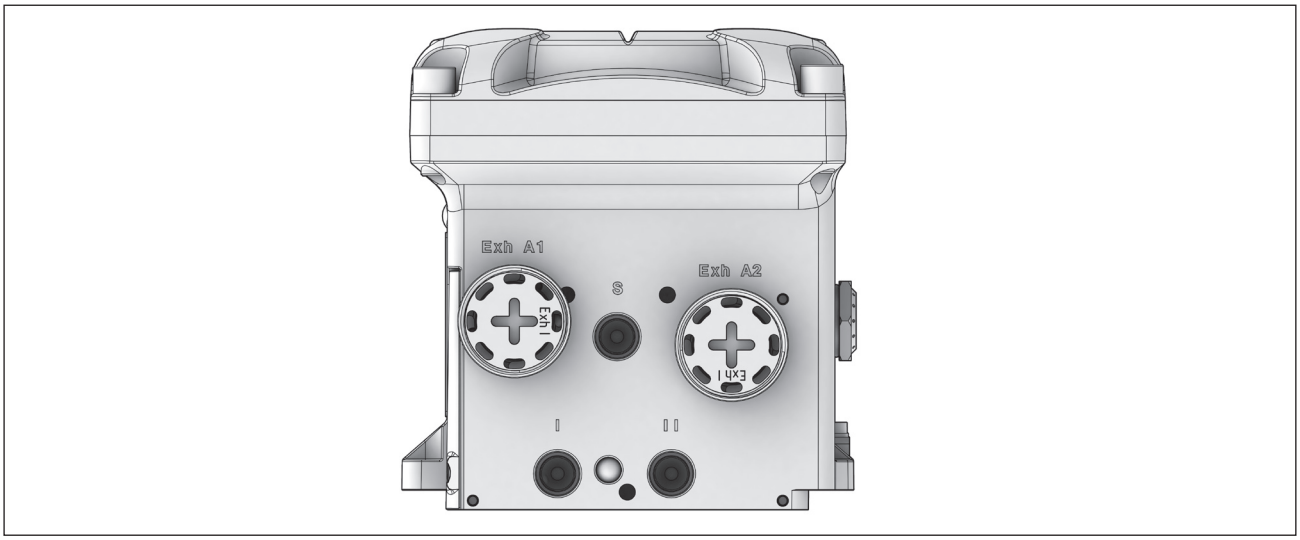


Fig. 39. NDX_511_ and NDX_512_exhaust covers

NOTE (NDX1510_)
Exhaust covers are different for Exh I and Exh II and shall not be mixed. Make sure that they are reinstalled to right exhaust port if removed. See Fig 38.

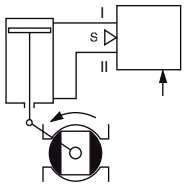
NOTE
In only I pneumatics port can be used with single acting actuator.

CAUTION
Restricting the air exhaust will cause incorrect operation and may prevent valve safety action.
To use exhaust to flush the actuator spring chamber ('rebreathing'): Do not connect directly. Contact Valmet for instructions.

NOTE
When mounting the pneumatic connectors, the exhaust cover may need to be removed temporarily. Mount the exhaust cover back when the pneumatic connectors are mounted.
Do not leave device without exhaust cover. Water and dirt may get into the device.

NOTE
If electrical input signal is lost, the actuator port I is exhausted (0 pressure) and actuator port II goes to supply pressure.

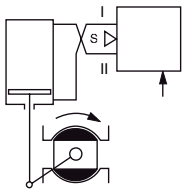
PNEUMATICS PIPING



DOUBLE-ACTING ACUATOR

1. Increasing input singnal to open valve (shown)
   Actuator type: Double acting
   Positioner fail action: Close
   Signal direction: Rising (in HART version only)
   Other parameters according to assembly

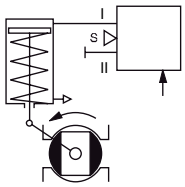
2. Increasing input signal to close valve (not recommended)
   Actuator type: Double acting
   Positioner fail action: Close
   Signal direction: Falling (in HART version only)
   Other parameters according to assembly



DOUBLE-ACTING ACTUATOR, REVERSED PIPING

3. Increasing input signal to open valve (not recommended)
   Actuator type: Double acting
   Positioner fail action: Open
   Signal direction: Rising (in HART version only)
   Other parameters according to assembly

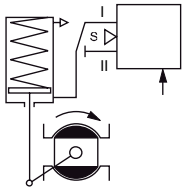
4. Increasing input signal to close valve (shown)
   Actuator type: Double acting
   Positioner fail action: Open
   Signal direction: Falling (in HART version only)
   Other parameters according to assembly



SINGLE-ACTING ACTUATOR, SPRING TO CLOSE

5. Increasing input signal to open valve (shown)
   Actuator type: Single acting
   Positioner fail action: Close (must be in the spring direction)
   Signal direction: Rising (in HART version only)
   Other parameters according to assembly

6. Increasing input signal to close valve (not recommended)
   Actuator type: Single acting
   Positioner fail action: Close (must be in the spring direction)
   Signal direction: Falling (in HART version only)
   Other parameters according to assembly



SINGLE-ACTING ACTUATOR, SPRING TO OPEN

7. Increasing input signal to close valve (shown)
   Actuator type: Single acting
   Positioner fail action: Open (must be in the spring direction)
   Signal direction: Falling (in HART version only)
   Other parameters according to assembly

8. Increasing input signal to open valve (not recommended)
   Actuator type: Single acting
   Positioner fail action: Open (must be in the spring direction)
   Signal direction: Rising (in HART version only)
   Other parameters according to assembly

Fig. 40. Operation directions and air connections

PNEUMATICS PIPING

Suggested Piping Size

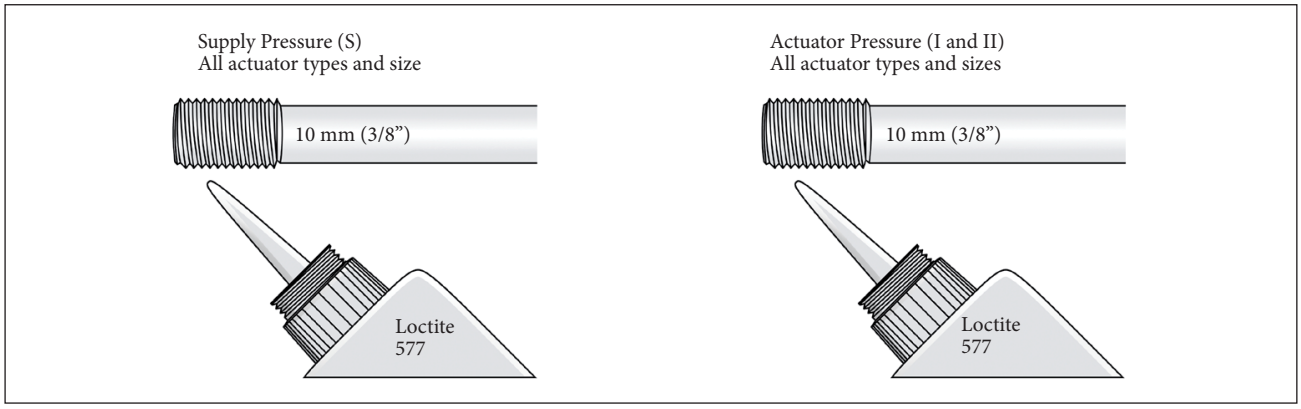


Fig. 41.

NOTE
It is recommended to use 10 mm (3/8") (inside diameter) supply air and actuator pressure piping.

NOTE
Liquid sealant such as Loctite 577 is recommended. Excess sealant may result in faulty operation. Sealing tape is not recommended. Ensure that the air piping is clean. When pneumatic connector is removed from the housing and reinstalled, make sure the old sealant is removed and threads are clean. Otherwise the dry old sealant might go to pneumatic components and affect the controllability or damage the device.

NOTE
Do not exceed torque of 30 Nm/22 lbf ft when fitting 1/4" NPT connectors.

NOTE
The stroking times mentioned in the table below are trendsetting. They are measured with 3 bar supply air pressure without a process pressure. They may vary significantly due to different factors such as, but not limited to, pressure difference of the valve, the stiction of the actuator, supply air pressure, the capacity of the supply air system and the dimensions of the supply air piping.

PNEUMATICS PIPING

Table 5.

Actuator						NDX	
Model	Size	Stroke length	Stroke Volume		NPT	Stroking times	
		mm	dm^3	in^3			
Single acting						Spring	Air
VD	25	20	0.9	54.9	1/4"	0.9	0.7
	29	20	1.8	109.8		1.1	0.8
		40				TBD	TBD
	37	20	3.5	213.5		TBD	TBD
		40				2.4	1.8
		50				TBD	TBD
	48	20	10.2	622.4		TBD	TBD
		40				4.5	3.0
		50				TBD	TBD
		60				TBD	TBD
		70				TBD	TBD
	55	20	15.0	915.4		TBD	TBD
		40				TBD	TBD
		50				TBD	TBD
		60				TBD	TBD
		70				TBD	TBD
		80				TBD	TBD
B1JU	6		0.47	28.7	3/8"	0.5	0.9
	8		0.9	55		0.6	1.0
	10		1.8	111		0.9	1.2
	12		3.6	225	1/2"	1.7	1.7
	16		6.7	415		3.0	2.6
	20		13	793	3/4"	5.4	5.1
	25		27	2048		9.9	6.5
	32		53	3234	1"	TBD	TBD
	322		106	6468		TBD	TBD
QP	1		0.62	37	3/8"	0.5	1.4
	2		1.08	66		0.7	1.2
	3		2.18	133		1.1	2.3
	4		4.34	265		2.0	3.1
	5		8.7	531		4.2	4.6
	6		17.5	1068	3/4"	TBD	TBD
Double acting						Close	Open
B1CU	6		0.33	20	1/4"	0.5	0.9
	9		0.6	37		0.7	1.2
	11		1.1	67	3/8"	0.6	1.2
	13		2.3	140		1.0	1.6
	17		4.3	262	1/2"	1.7	2.5
	20		5.4	330		2.0	2.7
	25		10.5	610		3.4	4.2
	32		21	1280	3/4"	6.4	7.2
	40		43	2624		TBD	TBD
	50		84	5126	1"	TBD	TBD
	60		121	7380		TBD	TBD
	75		189	11500		TBD	TBD
	502		195	11900		TBD	TBD
	602		282	17200		TBD	TBD
	752		441	26900		TBD	TBD
VC	30	60	8.2	500	3/8"	TBD	TBD
		80				TBD	TBD
		100				TBD	TBD
	40	80	20.7	1262	1/2"	TBD	TBD
		100				TBD	TBD
		120				TBD	TBD
	50	100	32.6	1999	1/2"	TBD	TBD
		120				TBD	TBD
		140				TBD	TBD
	60	120	63.6	3884	1/2"	TBD	TBD
		140				TBD	TBD
		180				TBD	TBD
	70	140	74.8	4564	1/2"	TBD	TBD
		180				TBD	TBD
		240				TBD	TBD
	80	180	118	7229	1/2"	TBD	TBD
		240				TBD	TBD
		280				TBD	TBD
VB	32	50	9.2	561.5	3/4"	TBD	TBD
		60				TBD	TBD
		70				TBD	TBD
		80				TBD	TBD
		120				TBD	TBD
	40	60	22.4	1358.8		TBD	TBD
		70				TBD	TBD
		80				TBD	TBD
		120				TBD	TBD
	50	60	35	2135.2	1"	TBD	TBD
		70				TBD	TBD
		80				TBD	TBD
		120				TBD	TBD
VBD/R	60	60	79	4830.4	1"	TBD	TBD
		70				TBD	TBD
		80				TBD	TBD
		120				TBD	TBD
		140				TBD	TBD
		160				TBD	TBD
		180				TBD	TBD
		200				TBD	TBD
		280				TBD	TBD
VBC	60	140				TBD	TBD
		160				TBD	TBD
		180				TBD	TBD
		200				TBD	TBD
		280				TBD	TBD

Example stroking times with supply pressure 5 bar.

PNEUMATICS PIPING

Table 6. Spring Range and Supply Pressure Table

Actuator Type	Spring Range	Supply Pressure		
		MIN	Suggested	MAX
Neles VD***C	0.8 .. 2.6 bar / 11 .. 37 psi	2.6 bar / 38 psi	3.6 bar / 52 psi	4.0 bar / 58 psi
Neles VD***A	0.2 .. 1.0 bar / 3 .. 15 psi	1.4 bar / 20 psi	2.1 bar / 30 psi	
Neles VD***B	0.4 .. 2.1 bar / 6..30 psi	2.1 bar / 30 psi	3.1 bar / 45 psi	
Other	-	1.4 bar / 20 psi	-	8 bar / 116 psi

Table 7. Spring rates

Actuator type	Spring rate (bar/psi)
B1JK	3 / 43
B1J	4.2 / 61
B1JV	5.5 / 80
QPB	3 / 43
QPC	4.3 / 62
QPD	5.6 / 81
Adjust regulator pressure to a level that is max 1 bar (14.5 psi) + spring rate.	

NOTE
Always use a filter regulator for single acting actuators.
It is recommended to use a filter regulator for all actuators for additional protection from debris in the air.

ELECTRICAL INSTALLATION

ELECTRICAL INSTALLATION

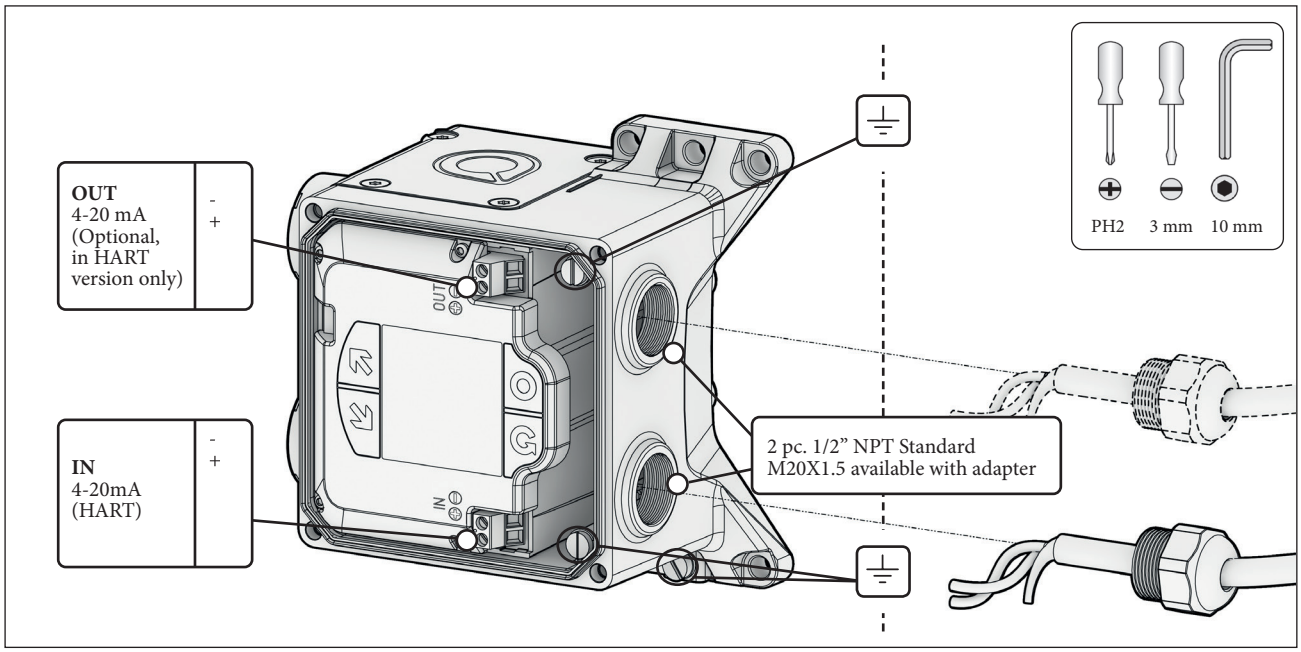


Fig. 42. Wiring of NDX1510_

Connector	Function	Power Source	Min. Power	Impedance	Other
IN	Setpoint / HART	4-20 mA Loop Power	3.8 mA, 9.7 VDC	485 Ω at 20 mA	
OUT	Position Transmitter	External 12 ... 30 VDC		780 Ω max, 690 Ω for I.S.	Fail safe output is 3.5 mA or 22,5 mA

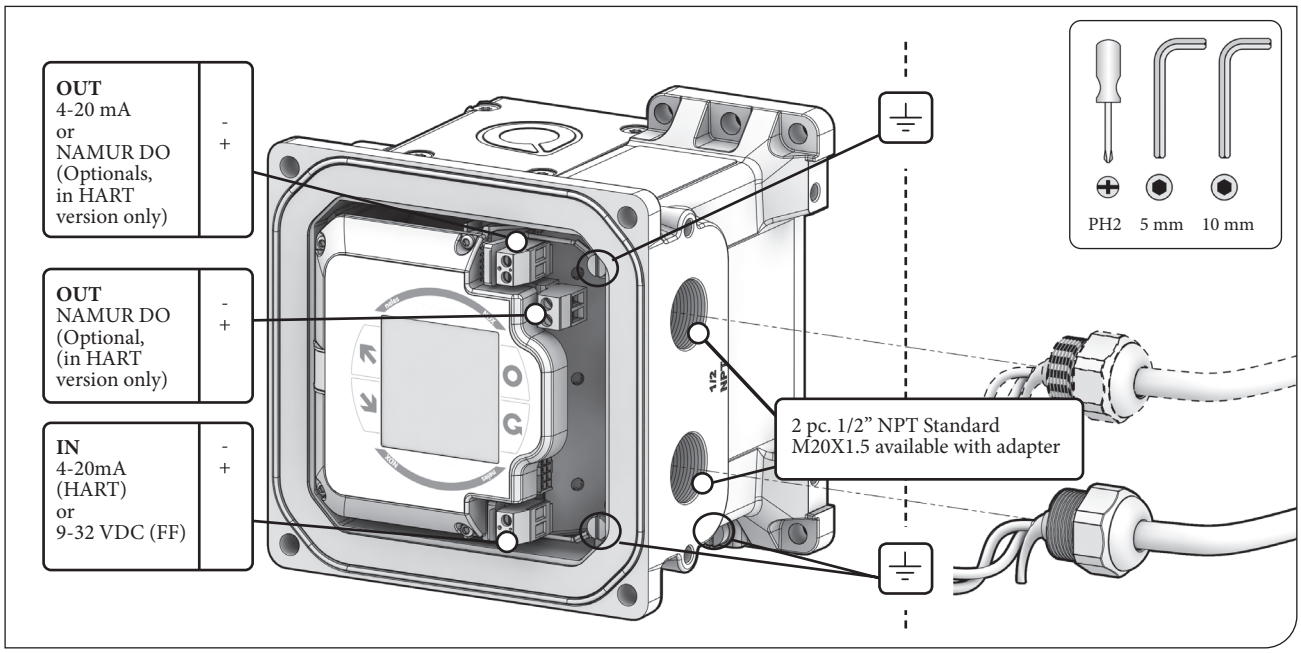


Fig. 43. Wiring of NDX_511_ and NDX_512_

CAUTION

Free wires or strands may cause a short circuit and valve movement.

Use ferrules to terminate the wires. Leave no free wires or a free cable shield. It is recommended to cut the cable shield to where the insulation ends.

NOTE

Remove temporary cable gland plugs with 10 mm hexagon wrench.

ELECTRICAL INSTALLATION

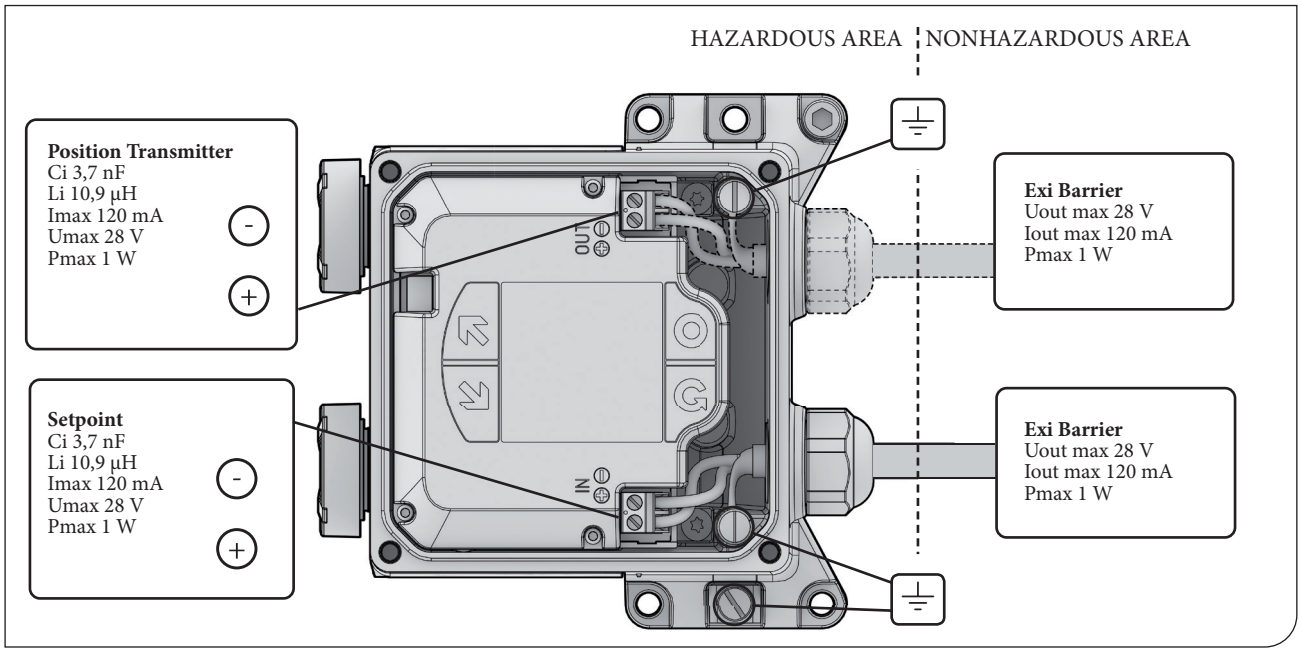


Fig. 44. Input values for NDX1510_H_

NOTE
It is recommended that grounding of the input cable be carried out from one end only.

NOTE
Tightening torque for the wiring terminal screws shall be 0.4-0.6 Nm.

Intrinsic Safety (Ex i) WARNING
A device previously installed in any other protection mode than intrinsically safe (Ex i) shall never be re-installed as Ex i.

Ex NOTE:
When installing mark the applied protection mode permanently in the identification plate.
Punch a mark inside the '[ ]' brackets on the left of the applicable Ex marking.

Recommended Wire Type: Shielded twisted pair with a max conductor size of 2.5 mm^2 / 14 AWG.

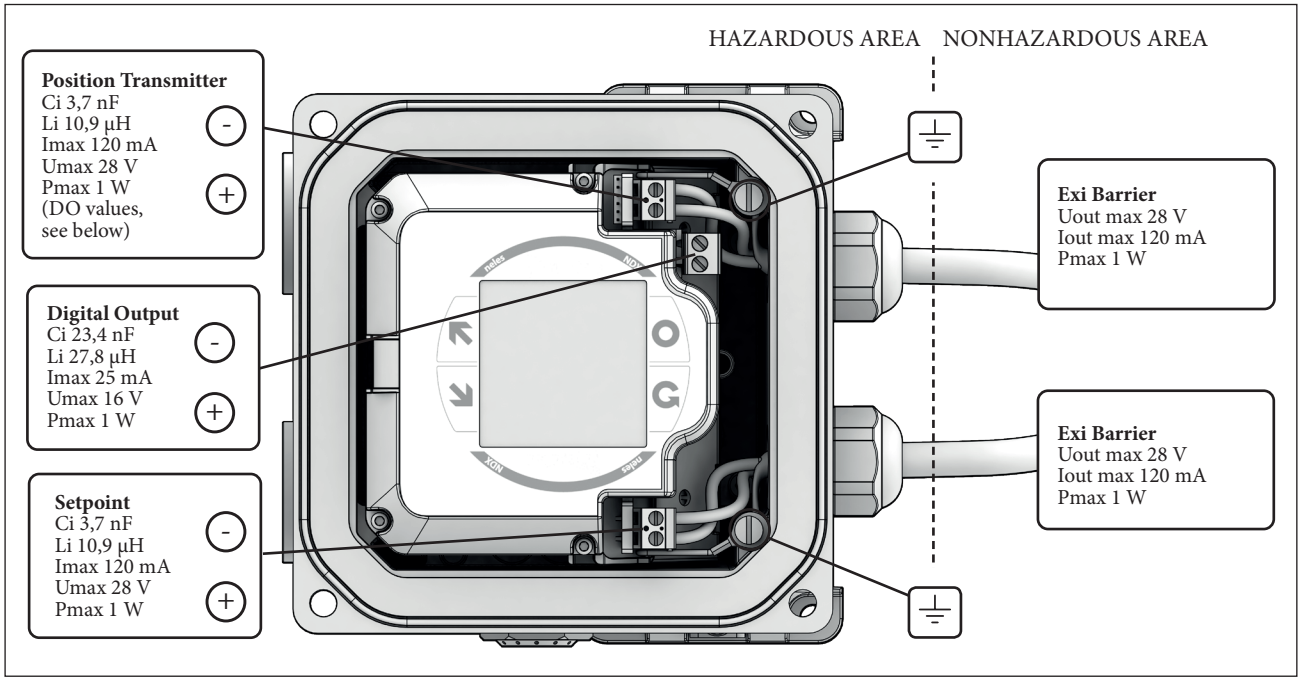


Fig. 45. Input values for NDX_511_H_ and NDX_512_H_

ELECTRICAL INSTALLATION

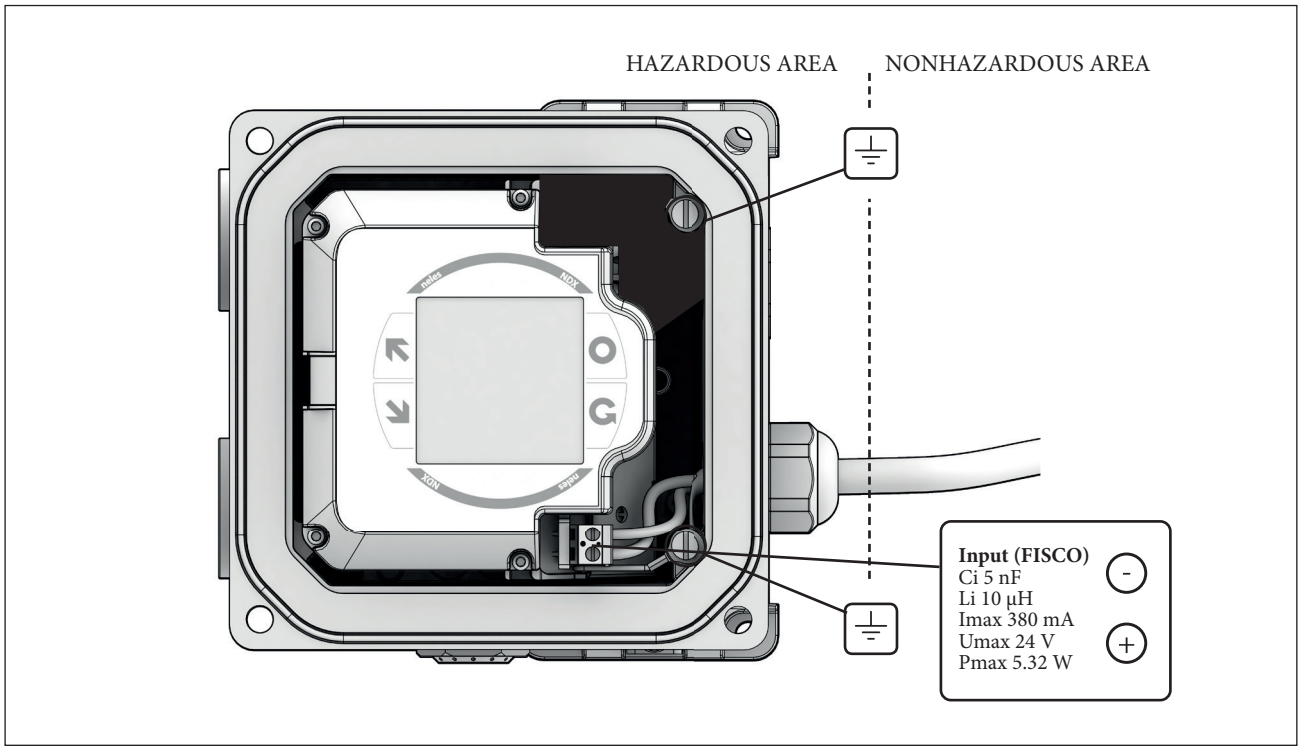


Fig. 46. Input values for NDX_511_F_-_

NOTE

The Valve Controller can be earthed using the external earthing terminal. Earthing can be done with 1 or 2 stranded wires with cross sections of 4 mm^2 with ferrule, 6 mm^2 without ferrule or with one 10 mm^2 stranded wire if the strands are divided on both sides of the screw.

INSTALLATION OF DEVICE OPTIONS

INSTALLATION OF DEVICE OPTIONS

Pressure Gauge Block installation

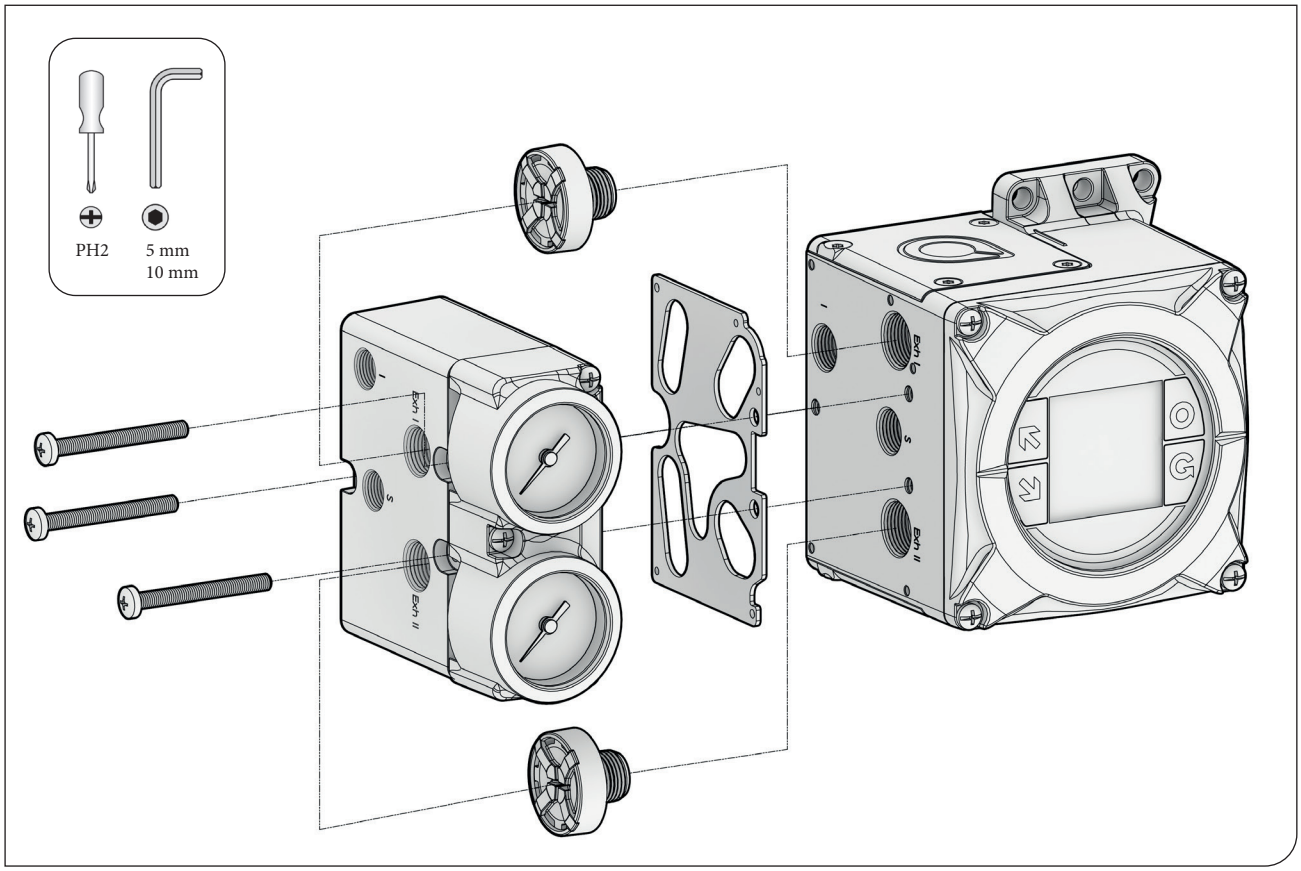


Fig. 47. Pressure gauge installation of NDX1510_

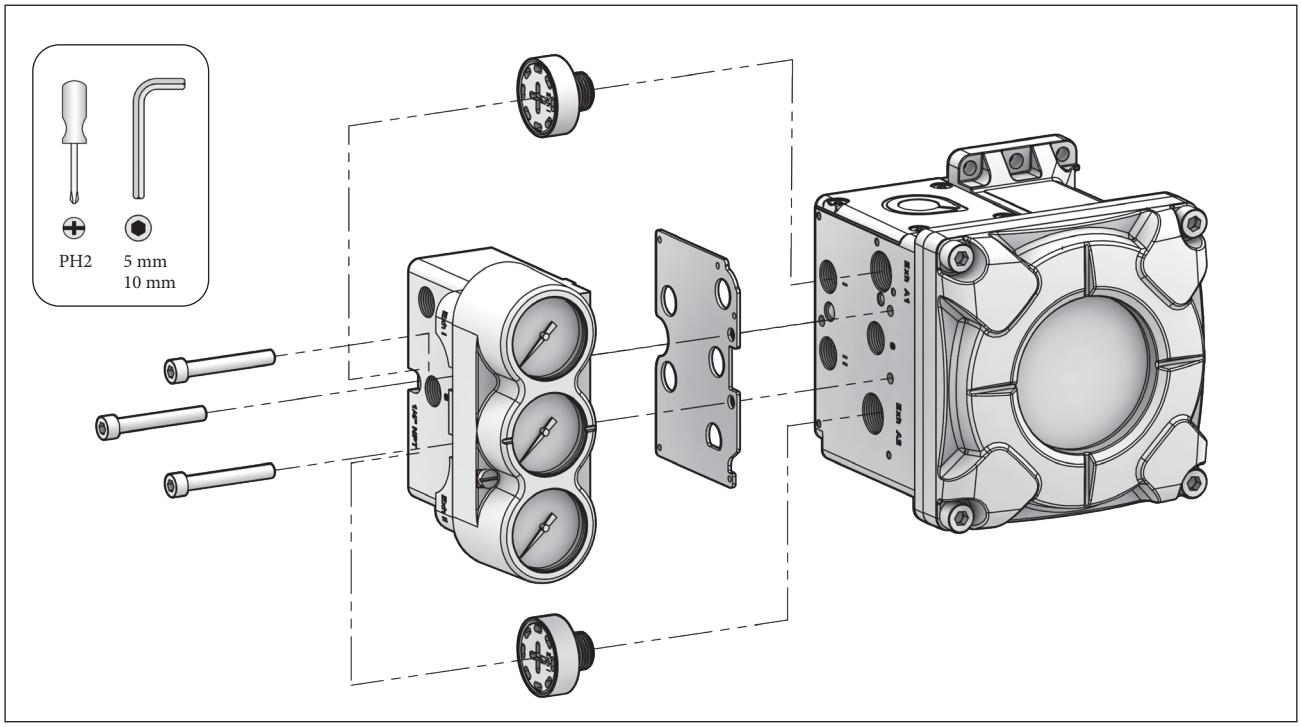


Fig. 48. Pressure gauge installation of NDX_511_ and NDX_512_

INSTALLATION OF DEVICE OPTIONS

1. Remove exhaust covers from the device exhaust ports I and II by hand.
2. Set the gasket onto the pressure gauge block.
3. Set the pressure gauge block against to the device and tighten three screws.
4. Install and tighten the exhaust covers into the exhaust ports I and II by hand.

NOTE

Remove all temporary transportation plugs with 10 mm hexagon wrench just before installing the pressure gauge block.

During transportation and storage the plugs shall be mounted.

NOTE

Exhaust covers are different for Exh I and Exh II and shall not be mixed. Make sure that they are reinstalled to right exhaust port.
See figure 38 in Chapter 9.

LOCAL USER INTERFACE (LUI)

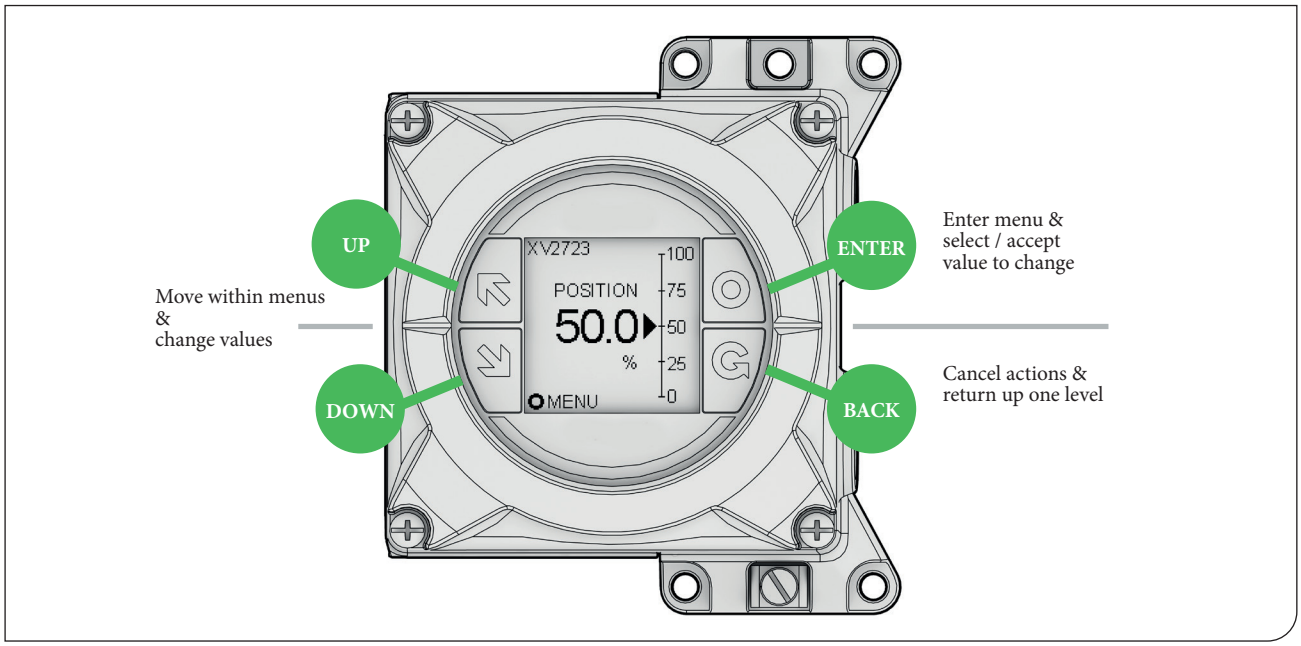


Fig. 49.

NOTE
Buttons can be used with the cover installed or removed.

NOTE
In the both ends of the device temperature range, operation of the LUI might be limited.

Overview

The NDX Local User Interface (LUI) includes 4 capacitive touch buttons which can be used with the cover installed or removed. When power is applied to the NDX, the external buttons can be used to configure, calibrate, test, and monitor the status of the device.
The LUI touch buttons area for sensing the touch of the finger may not be exactly on top of the button symbol but more on the screen area. This applies to the enclosure type NDX2 with thick aluminum cover.

Local User Interface (LUI) functions

- User access control
- Guided-startup wizard
- Calibration: Automatic / Manual / 1-point
- 3 point measurement linearization
- Configuration of the control valve
  - Actuator Type & Valve Type
  - Valve Dead Angle
  - Performance Level
  - Safety Cut-off Range
  - Input Signal Direction (HART only)
  - Positioner Fail Action
  - Language Selection
  - Simulate enable (FF only)
- Monitoring of valve position, target position, input signal, supply and actuator pressure
- Local control of the valve

NOTE (NDX1510_)
When installing the cover make sure that the cover button symbols are at the same position as the symbols on the LUI module inside the device

NOTE (NDX_511_ and NDX_512_)
When installing the cover check inside to define it's correct position. The magnet in the cover shall be on the wiring terminal side.

NOTE
The LUI touch buttons area for sensing the touch of the finger may not be exactly on top of the button symbol but more on the screen area. This applies to the enclosure types NDX_511_ and NDX_512_ with thick aluminum cover.

LUI - User access control

User LUI access can be restricted to guarantee safe and secure process operation. Any user is always able to see all LUI information without restrictions (read only mode), but modification of settings or activating any local command or function can be restricted.
User access can be controlled with following methods:

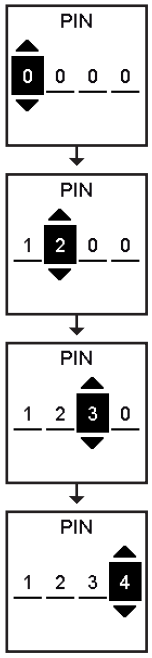
1. Cover lock (factory default)
2. PIN lock
3. Cover & PIN lock

LOCAL USER INTERFACE (LUI)

When Cover lock is enabled, detaching the main cover will unlock the LUI for editing. When the cover is re-attached, LUI is again locked to read only mode.
When PIN lock is enabled, PIN code is required to unlock editing mode. PIN lock automatically re-locks after one minute of inactivity and at the same time LUI returns to monitoring view.
If both Cover and PIN lock are active, user must first detach the cover and after that enter the PIN code to enable the editing mode. One minute of inactivity enables PIN lock and re-attaching the cover locks the Cover lock.

As factory setting default, device has Cover lock active and PIN lock non-active. Default PIN code is 1234.

Enter the PIN using the up/down buttons and then press Enter to select each value.
Entering invalid PIN gives Invalid PIN -notification.



Different lock settings can be configured in DTM. See detailed instructions in Operation chapter 13.5.2.4 All parameters.

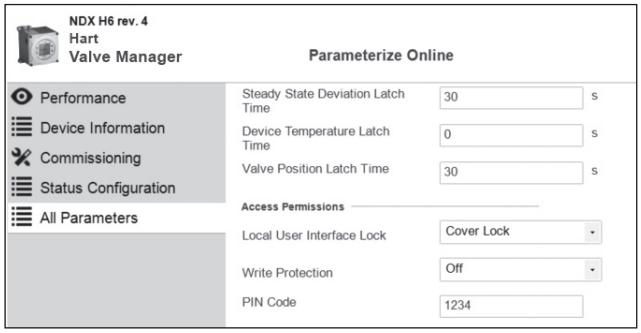


Fig. 50.

Calibration required prior to start

Device needs to be configured and calibrated before it is switched to automatic control mode. Follow the instructions on the LUI first screen and proceed to guided start-up.
Canceling at this points returns user to main monitoring view. User is allowed to view monitoring views and active events and make parameter changes. Calibration required event is shown until one of the calibrations is successfully done.
User needs to select guided start-up or go directly to calibration menu to run the calibration. After successful calibration the calibration required event disappears and device goes to automatic control mode.

NOTE
Remote calibration using the DTM or EDD is possible but for safety not recommended .

CAUTION
Changing the critical parameters (the parameters set in the guided startup) may cause faulty operation and unanticipated stroking of the valve. Damage to the process and injury may result.
Changing the critical parameters remotely through DTM or EDD is not recommended. Note that the download all function in the DTM may change critical parameters!

WARNING
Wrong configuration parameters may cause unexpected stroking of the valve. Do not change configuration parameters with the process running.

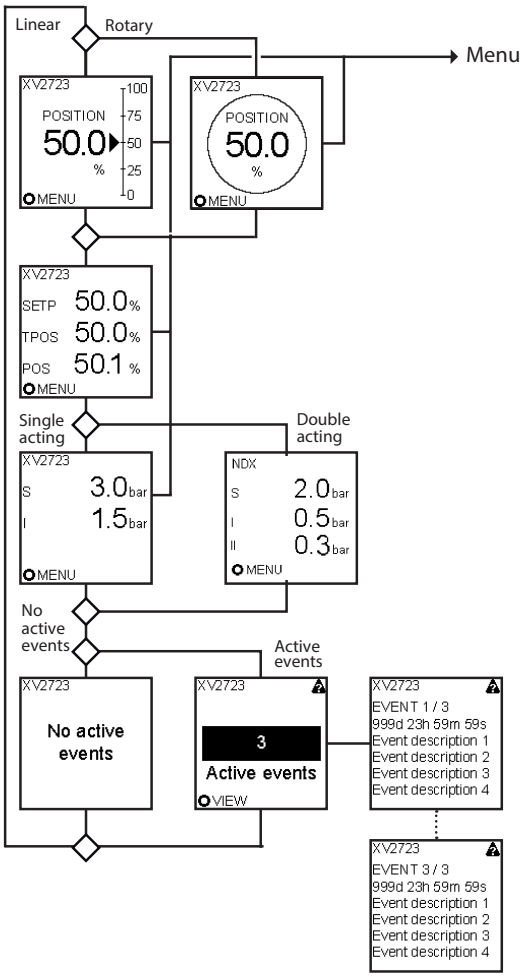
LOCAL USER INTERFACE (LUI)

Monitoring views

Press the up/down arrow buttons to scroll through the main measurement displays and to view any active events. User can select one of these main displays which will stay on the LUI.

1. Valve position shown in percentage in numerical and graphical format.
2. Setpoint, target position and actual valve position in percentage, setpoint is configurable also for mA.
3. Supply pressure and actuator pressure(s) in bar (default) or psi.
4. Number of active events (if any) and their descriptions listed.

Tag name is shown in all views in the upper left corner.

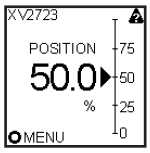


Active alerts

When an active alert appears, it will be shown in the upper right corner of the all LUI views as long as there are active alerts. Then user can check then active event detail from the event list as shown on previous page.

Active status when in main monitoring views

After button, icon



Active status in menus

Icon only

Tag:
Device tag is visible in all views. Tag name can be modified with DTM by using the tag field (HART tag or PD tag).

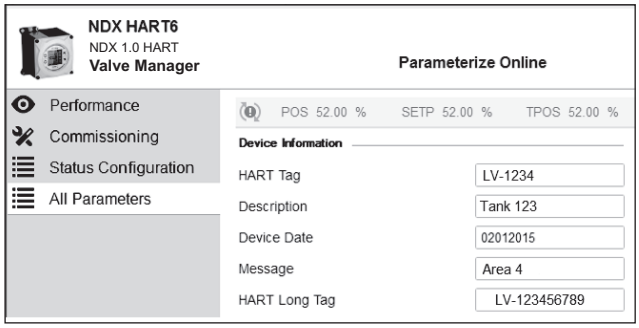


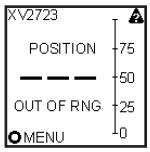
Fig. 51. Example of HART Tag in DTM

LOCAL USER INTERFACE (LUI)

Exceptions

If position measurement goes out of range or fails, position indicator shows - - - on the LUI.

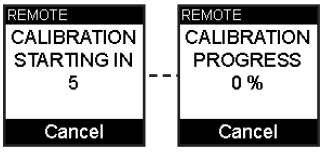
POS > 999 % or sensor broken



Remote actions

When calibration or offline test is started remotely (i.e. from DTM), there is a warning on the LUI before the valve starts to move.

There is a warning if remote device reboot is done after FW download. For safety reasons it can be aborted from LUI.



Menu

Press Enter (o) to open menu.

- Guided start-up
- Calibration
- Parameters
- Linearization
- Manual control
- User Guide
- About

WARNING

A firmware download will cause a reboot and valve movement. Ensure this does not endanger people or processes!

LOCAL USER INTERFACE (LUI)

Guided start-up

Guided startup offers a fast and easy way to go through all necessary steps for start up of the device. When all parameters are set, Guided start up guides you through calibration procedure.

When Guided Startup is highlighted press ⭘ to enter the menu. Press ⭘ to see the parameter options, then use ↖ ↘ to select the correct value and press ⭘ to accept the new value. Once the Calibration screen is displayed, select manual, 1-point or automatic calibration.

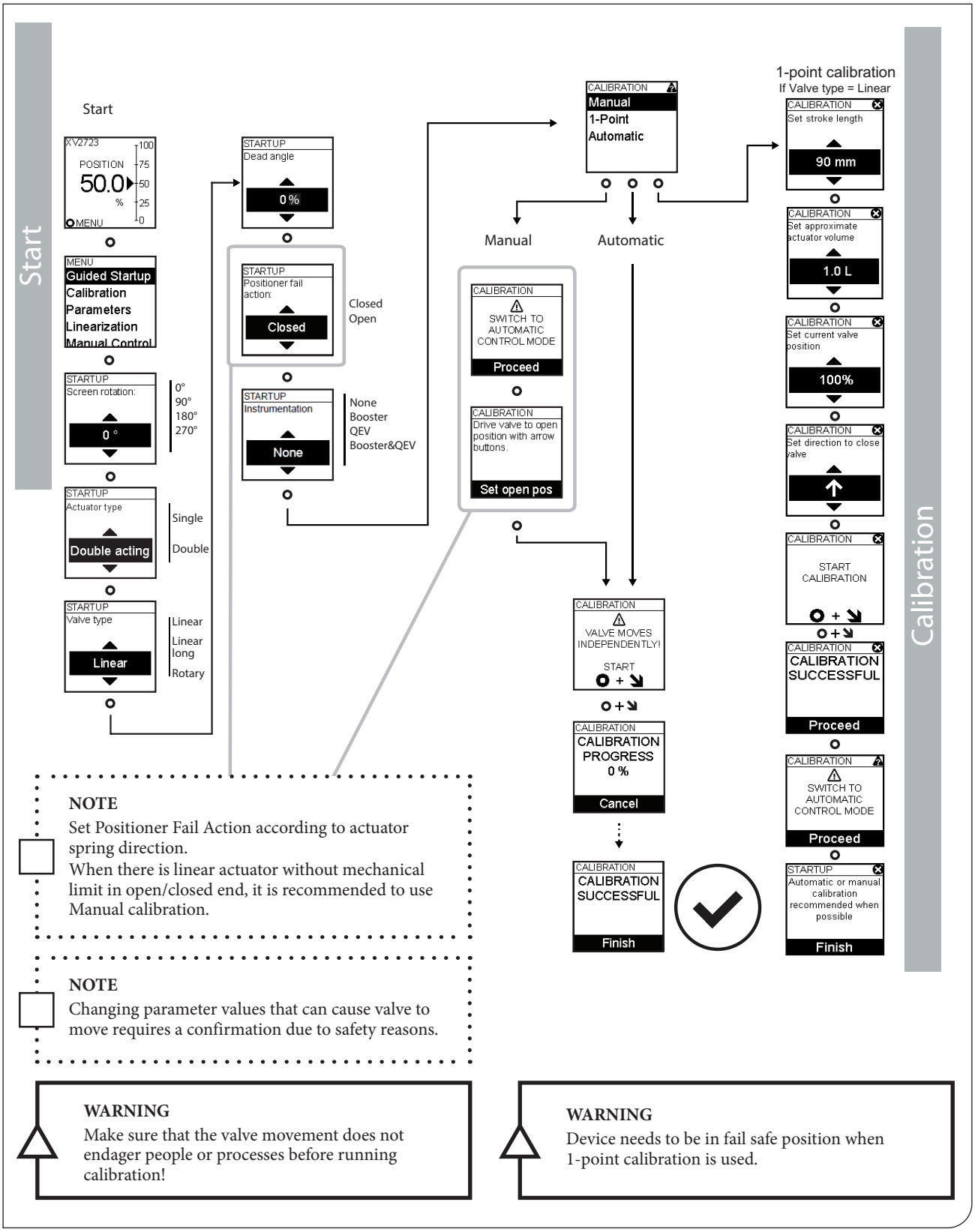


Fig. 52.

LOCAL USER INTERFACE (LUI)

Calibration

To open the main menu, press menu button (if PIN code is activated, PIN code will be asked when something is tried to change). Select Calibration and press enter to open Calibration menu.
There are three different calibration options in the device:

- Manual Calibration
- 1-point Calibration
- Automatic Calibration

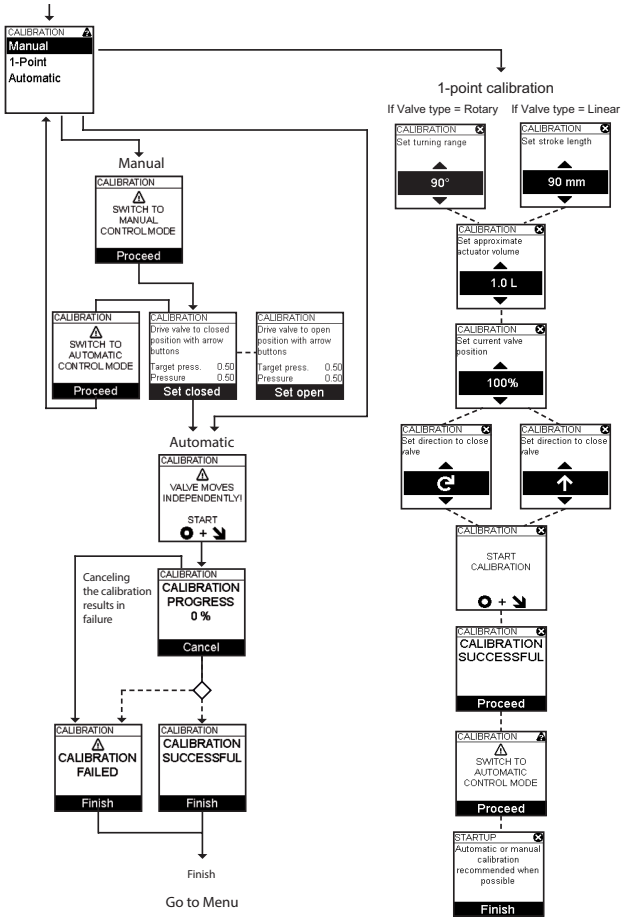
During the calibration the device searches for optimum internal control parameters for the valve position control. Also it defines open and close ends. After the calibration sequence is finished, press enter to get back to the menu view. You may interrupt the calibration sequences at any time by pressing back button. then device returns to calibration menu display. Calibration parameters will not be changed if calibration is cancelled or failed. Always when calibration is done, it is added to event history which can be checked with DTM. Also, if calibration is failed, there is more detailed reason for failure in the event history.

For some reason if calibration fails, device shows that in the display and event log.

NOTE
If there is no mechanical limit in the actuator or if it's not allowed to drive the valve into a fully open or closed position for some reason, manual calibration is required.

WARNING
Automatic calibration drives the valve against the mechanical open and closed travel limits of the valve actuator assembly. Make sure that these procedures can be safely executed.

Manual Calibration
After selecting the Manual calibration from the menu, press enter. Switch the device to manual control mode pressing enter. Next drive valve manually into open or close end (depends on installation). After defining end position with enter there is a warning about automatically moving valve before tuning part will start. If it is safe to continue, press enter and arrow keys at the same time as shown in the display. Display shows progress of the calibration.
After calibration the display shows CALIBRATION SUCCESSFUL text. Device returns to menu by pressing enter or automatically to monitoring view after 60 seconds.



1-point Calibration
1-point calibration is useful in cases in which the valve controller needs to be changed but it is not possible to run the normal calibration. For example the valve is not allowed to change position because the valve is active.
Before starting 1-point calibration check that the valve is mechanically locked.
Set turning range or stroke length depending on the valve type.
Set approximate actuator stroke volume. Always round your estimation to a smaller value.
Set current valve position.
Set direction to close valve.
After defining correct settings confirm them and start the calibration by pressing enter and arrow keys at the same time. Canceling the calibration at this point will cancel all the settings you have made.
After calibration the display shows CALIBRATION SUCCESSFUL text. Press enter to proceed.
After successful calibration the display asks to Switch to automatic control mode. Ensure that valve is not mechanically locked anymore and it's safe to move the valve before proceeding. Press enter to proceed.
Finally the display reminds to run automatic or manual calibration as soon as possible. Press enter to finish.

LOCAL USER INTERFACE (LUI)

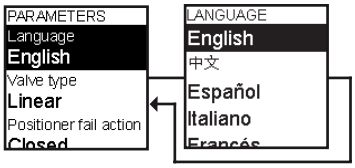
Automatic calibration

After selecting the Automatic calibration from the menu, press enter. There is a warning about automatically moving valve before calibration will start. If it is safe to continue, press enter and arrow keys at the same time as shown in the display. Display shows progress of the calibration. After calibration the display shows CALIBRATION SUCCESSFUL text. Device returns to menu by pressing enter or automatically to monitoring view after 60 seconds.

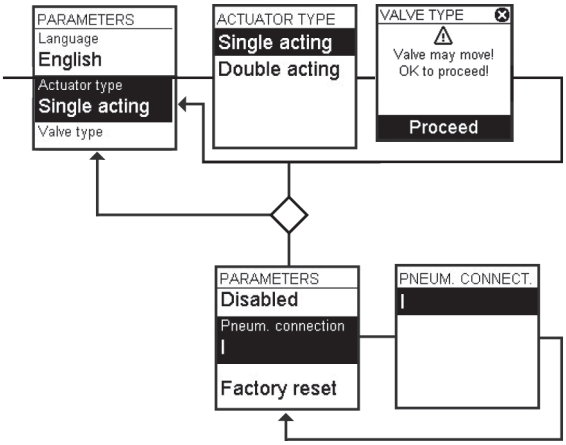
Parameters

To open the main menu, press menu button. Select Parameters and press enter to open Parameters menu.
In this menu the most important assembly related parameters can be configured and also there are some user interface modification parameters available.See actuator and piping related parameter settings in Figure 40 (page 33).

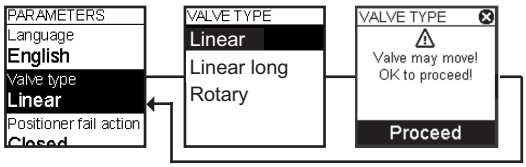
- **Language**
  - Display language can be changed, available languages are English, Chinese, Spanish, Italian, French, Korean, German, Turkish, Dutch, Portuguese.
  - Once Language is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.



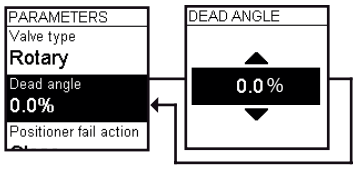
- **Actuator type**
  - This parameter defines if actuator is single acting (spring return) or double acting.
  - Once Actuator type is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.
  - If single acting actuator is selected, Pneumatics Connection -parameter is always I.
  - Once Pneumatics Connection is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.



- **Valve Type**
  - This parameter defines if device is mounted on a linear valve or rotary valve. In the main menu there is different position indicator depending on which valve type is selected.
  - If device has an option for linear long stroke (stroke length 120-220 mm), it will show in the menu.
  - Once Valve type is selected, press enter to edit the setting. Change setting with arrow keys and confirm that with enter.



- **Dead angle**
  - This setting compensates for the inherent “dead angle” (a0) which is the amount of rotation without flow within rotary valves. The entire signal range is then used to control the effective valve opening, 90 - a0). Use 0 % as the “dead angle” for the valves not mentioned in the table below.
  - Once Dead angle is selected, press enter to edit the value. Change value with arrow keys and confirm that with enter.



LOCAL USER INTERFACE (LUI)

Table 8. Dead angle in percentage

SIZE		Valve series																ZX	
DN	IN	Q-D1 Q-D2 QLM-D1 QLM-D2 Q-	XMBV Q-XG Q-XM	T5 Q-T5 QA-T5	T25 Q-T25	9000	XMBV XG XM	7000 5300 5150 4000	XMBVR	E	Q2G	Q2GH	Q2GT5 Q2GHT5	RE RA Segment valves			FL	Trim	Dead Angle [%]
		Dead angle, %																	
15	1/2							8,1						Seat				L001	
20	3/4							8,3						S&A	1S	T2		L003	18,6
25	1			20,6		17,8	14	11,7		17,78				15,8	14,2	26,8		L011	
25/1	1/1												C005	11,4		17,9	11	L025	
25/2	1/2												C015	11,4		17,9	11	L060	
25/3	1/3												C05	11,4		17,9	9,8	E043	
25/4	---												C15	11,4		17,9		B020	
32	1 1/4							12,2										B050	16,7
40	1 1/2			20,6		17,8	12	9,4		9,4				13,2	10,3	20,7		L030	
50	2	18,9	12	20,6	20,6	17,8	12	8,3		8,3	17,8	17,78		18,6	12,7	23,4		L070	
60	2 1/2													14	11,8	18,7		B130	
80	3	15,6	9,6	15	15	14,4	9,6	9,4	8,1	9,4	14,2	14,22	23,33	9,9	8,7	15,7		E022	17,3
100	4	15,6	9,1	15	13,9	14,4	9,1	10,6	8,9	10,6	13,3	14,22	22,22	9	7,8	15,7		E011	
125	5																	L180	9,9
150	6	12,2	10,8	13,9	11,1	12,2	10,8	11,1	12,11	10,6	14,1	14,11	20,22	7,8	6,	13,6		E460	
200	8	10	9,3	11,1		10	9,3	10,8	11,56		11,8	14,11	15,78	6,9	6,6	12,7		L550	9,2
250	12	8,9	8,1	11,1	11,1	8,9	8,1	8,3			10,4	11,89	17,78	6,8	6	10,8		L350	
300	12	8,9	7	11,1	11,1	8,9	7	8,9			8,9	10	13,22	6,2	5,6	10		B130	
350	14	7,8	6,8	11,1		8,9	6,8	7,8			8,9	8,9	10,44	5,8	6,	9,6		B280	
400	16	7,8	6,4	11,1		8,9	6,4	7,8			8,4	8,9	10,44	5,7	4,9	9,1		L700	10,4
450	18	8,9						8,9			8,9	8,9						L1150	
500	20	6,7						6,7			8,9	8,9		4,9	4,9	7,9		E540	
600	24	6,7									8,9	8,9			6,6			E800	
700	28	7,8									8,9	8,9			7			E320	
750	30	6,7									8,9	8,9						B280	
800	32	6,7									8,9	8,9						B520	
900	36	5,6									8,9	8,9						E260	
																		L120	14,2
																		L310	
																		E090	
																		L150	14,8
																		E115	

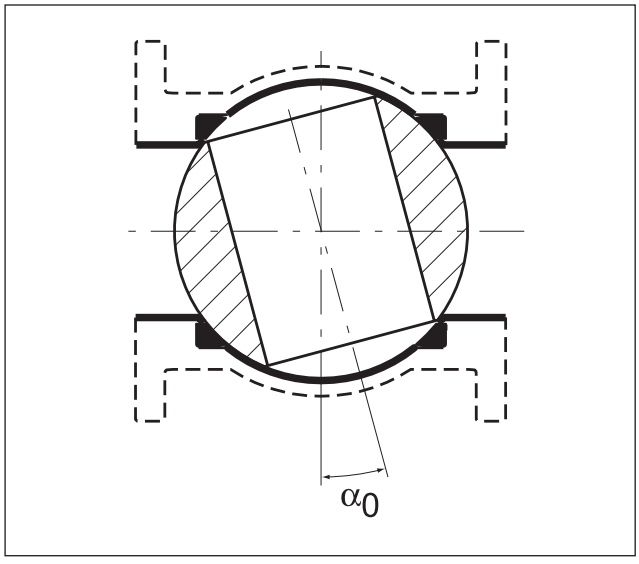


Fig. 53.

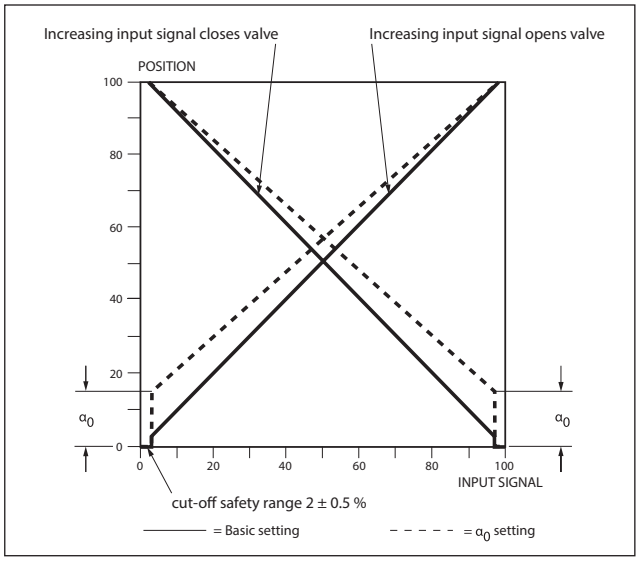
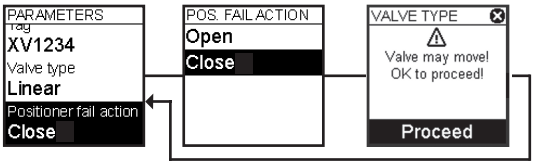


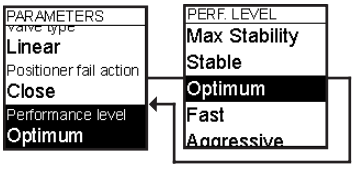
Fig. 54.

LOCAL USER INTERFACE (LUI)

- **Positioner fail action**
  - Positioner fail action will take place in case of signal or supply pressure failure or when the controller software discovers a fatal device failure. For single acting actuators set value in the spring direction. This means that changing this parameter will not change actual fail action, this parameter tells the device which is the actual fail action direction defined by the actuator.
  - Once positioner fail action is selected, press enter to edit the parameter. Select or change value with arrow keys and confirm that with enter.



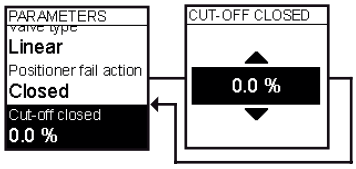
- **Performance level**
  - This parameter defines the performance level for the valve control.
  - Following performance level options can be selected: Max Stability, Stable, Optimum (factory default), Fast, Aggressive, Max Stability FO, Stable FO, Optimum FO, Fast FO, Aggressive FO. PSA1 (Opt), PSA2 (Fast) and PSA3 (Aggr).



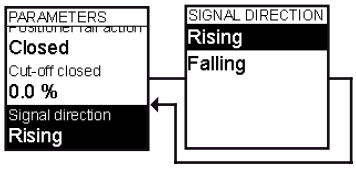
  - Max Stability: Slowest response to signal changes and no overshoot. Trying to keep the valve position as stable as possible.
    Stable: Fairly slow response to signal changes and no overshoot.
    Optimum (factory default): Optimum performance controlling the valve regarding response time and valve speed when signal changes. There is typically no overshoot.
    Fast: Fast response to signal changes but may also have small overshoot.
    Aggressive: Fastest possible response to signal changes and typically some overshoot.
  - FO = Fast Open; The reaction time to setpoint change will be faster when recovering from the cut-off position.
  - Max Stability FO, Stable FO, Optimum FO, Fast FO, Aggressive FO: Similar behavior than in above mentioned performance levels respectively, but always faster recovering from cut-off than above because of fast open (FO) function.
  - Once Performance level is selected, press enter to edit the parameter. Change value with arrow keys and confirm that with enter.
  - PSA modes where fastest possible setpoint tracking is optimized. Small pressure will remain in the actuator when valve is closed to reduce the delay on opening and have minimum possible opening time. Optimum, Fast and Aggressive options in PSA modes are similar to explained above.

LOCAL USER INTERFACE (LUI)

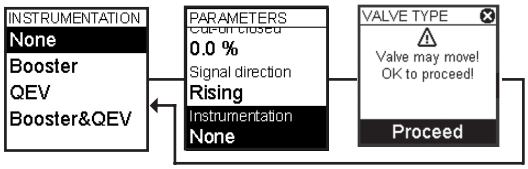
- **Cut off closed**
  - Cut off closed is used with valves that require great torque to be closed. It is used to ensure that the valve is fully closed at a 4-mA input signal.
  - When this value is exceeded, the valve is forced to a 0 % position. This is called the tight cut-off feature. If, for example, the value is 2 %, tight shut-off starts when the input signal goes below 2 %, then valve is closed with full actuator force.
  - Once Cut-off closed is selected, press enter to edit the parameter. Change value with arrow keys and confirm that with enter.



- **Signal direction (HART only)**
  - This parameter defines opening and closing direction of the valve with rising current loop signal. The value Rising signifies the increasing mA signal to open the valve and Falling means the decreasing mA signal to open the valve.
  - Once signal direction is selected, press enter to edit the parameter. Select or change value with arrow keys and confirm that with enter.



- **Instrumentation**
  - This parameter defines additional instrumentation for the fast valve opening and/ or closing.
  - Following instrumentation options can be selected: None, Booster, QEV, Booster&QEV The default value is None meaning that there are no additional instrumentation in the valve assembly. If there is a volume booster in the assembly, select Booster. If there is a quick exhaust valve in the assembly, select QEV. If there is a combination of volume boosters and quick exhaust valves in the assembly, select Booster&QEV.
  - Once instrumentation option is selected, press enter to edit the parameter. Change value with arrow keys and confirm that with enter.



LOCAL USER INTERFACE (LUI)

- **Configuration with Volume Boosters**
  - Note: 10 mm piping shall be used
  - Select Booster from the Instrumentation-menu
  - Start by opening the by-pass valve fully
  - Run Calibration (see chapter 12.7.2 Calibration)
  - Check the valve performance
  - If the performance is insufficient,
    - Adjust Performance Level –parameter
    - If needed, adjust the by-pass valve and recalibrate
  - Adjust Symmetry-parameter if the symmetry for the opening/closing speed needs to be changed

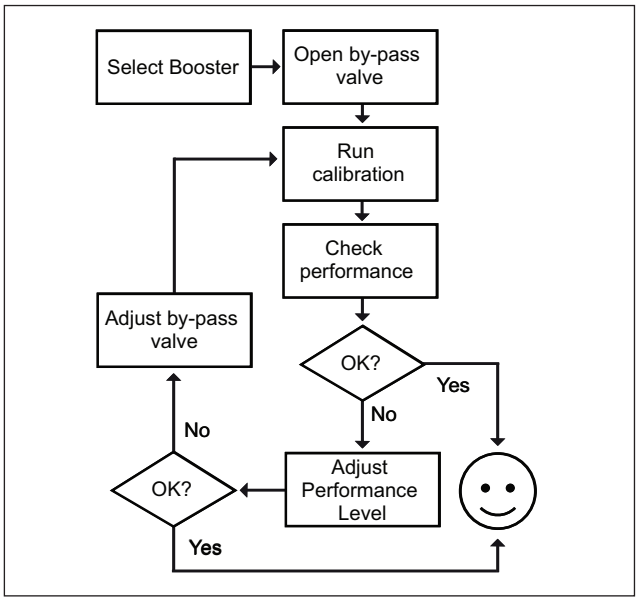


Fig. 55.

- **Configuration with Quick Exhaust Valves**
  - Ensure that QEV by-pass flow is large enough
  - Select QEV from the Instrumentation-menu
  - Run Calibration (see chapter 12.7.2 Calibration)
  - Check the valve performance
  - If the performance is insufficient, adjust Performance Level –parameter
  - Adjust Symmetry-parameter if the symmetry for the opening/closing speed needs to be changed

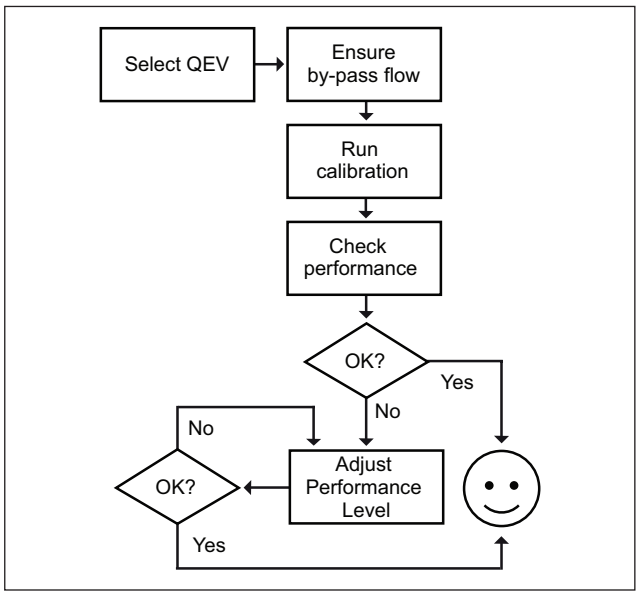
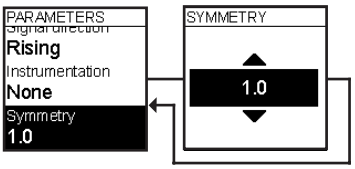


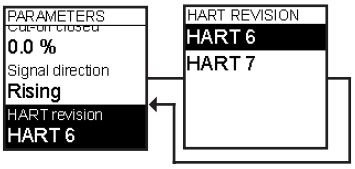
Fig. 56.

LOCAL USER INTERFACE (LUI)

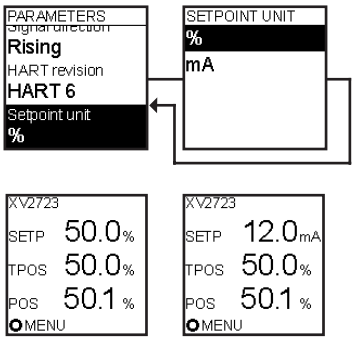
- **Symmetry**
  - This parameter defines the symmetry for the valve opening and closing speeds
  - The range for the symmetry parameter value is 0.0 ... 2.0
  - Once Symmetry parameter is selected, press enter to edit the parameter
  - Default value is 1.0 and it means that the valve opening and closing speeds are symmetrical. Values lower than 1.0 mean that the valve closing direction is boosted and is faster than the valve opening direction. If the value is bigger than 1.0 the valve opening direction is boosted and is faster than the valve closing direction.
  - Change value with arrow keys and confirm that with enter.



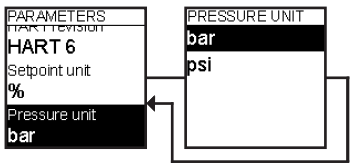
- **HART revision (HART only)**
  - Select if device is used as HART 7 or HART 6 device. As default device is HART 7 device.
  - Once HART revision is selected, press enter to edit the parameter. Select or change value with arrow keys and confirm that with enter.
  - Device needs to be rebooted after change.



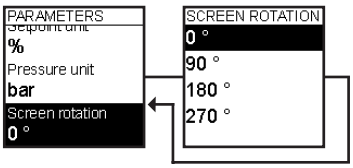
- **Setpoint unit**
  - It is possible to define if setpoint unit will be in % or in mA in one of the main views.
  - Once Setpoint unit is selected, press enter to edit the parameter. Select correct unit with arrow keys and confirm that with enter.



- **Pressure unit**
  - Pressure units can be selected between Bar and Psi.
  - Once Pressure unit is selected, press enter to edit the setting. Select correct setting with arrow keys and confirm that with enter.

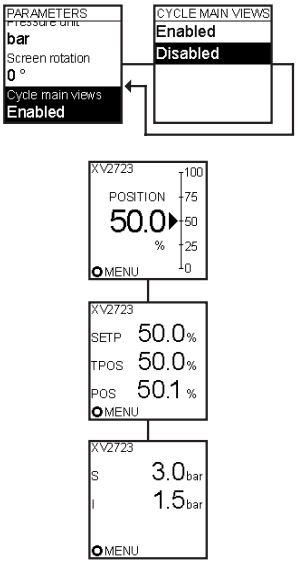


- **Screen rotation**
  - Screen orientation can be changed so the LUI will be correct no matter what orientation the device is mounted.
  - Once screen rotation is selected, press enter to edit the setting. Select correct setting with arrow keys and confirm that with enter.



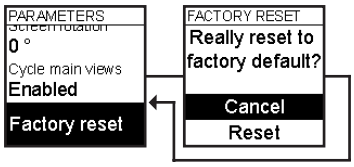
LOCAL USER INTERFACE (LUI)

- **Cycle main views**
  - It is possible make device to scroll automatically three main views on the display.
  - If Cycle main views is disabled (default setting), then view which is selected by the user, will remain on the display.
  - If Cycle main views is enabled, then device will automatically scroll views on the display every five seconds. If user doesn't touch the display in 60 seconds, device goes to main view and starts to scroll.
  - Once Cycle main views is selected, press enter to edit the setting. Select correct setting with arrow keys and confirm that with enter.



- **Simulate enable (FF only)**
  - Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.
  - Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

- **Factory reset (HART only)**
  - Factory reset returns all default parameters to the device. After factory reset device needs to be calibrated.
  - Once Factory reset is selected, press enter to edit the setting. Select Cancel or Reset with arrow keys and confirm with enter.



Linearization

Linearization can be used for linear valves when linkage geometry needs to be corrected by valve controller. Linearization can be done with 3 points (and end points). Linearization will be done in positions 25 %, 50 % and 75 %.

NOTE

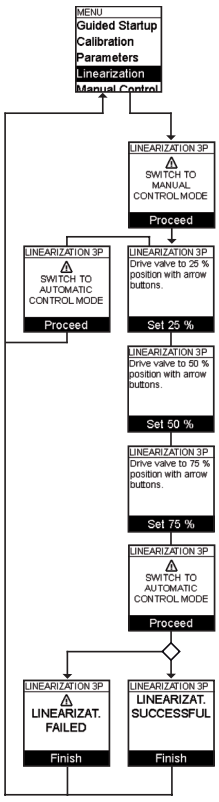
There must be external position measurement in linear valve that you can compare actual position and given position.

Perform the Valve travel calibration (auto or manual) before linearization.

Linearization:

- Select linearization from the menu and press enter.
- Device warns that device goes to manual control mode and does not follow the setpoint. Press enter to continue.
- Drive valve position manually with the arrow buttons to 25 %.
- When required position is reached (according to position measured by external measurement) press enter.
- Repeat this in 50 % and 75 %
- After last point device warns that device goes back to automatic mode and valve position may jump when it starts to follow setpoint.

For linearization it is necessary to enter the manual control mode. In manual mode the controller will not follow the setpoint given by the mA or fieldbus signal.



LOCAL USER INTERFACE (LUI)

Manual control

Position control

During this mode the valve position may be controlled manually by using the arrow keys.

The manual control starts from the current position of the valve after the manual mode is activated.

Valve position may jump when going back to auto mode and device starts to follow setpoint.

CAUTION

In Manual mode the controller will not follow the setpoint given by the mA or fieldbus signal.

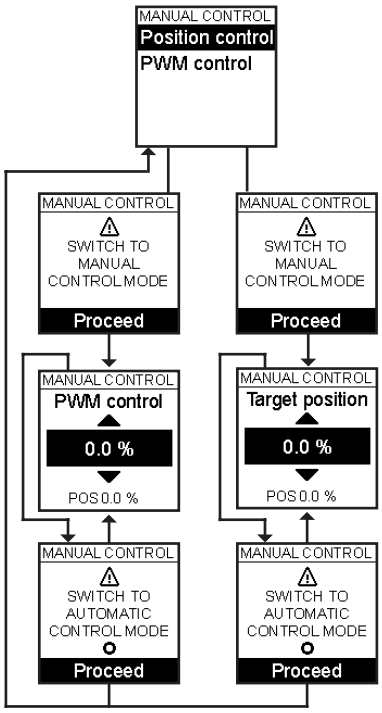
PWM control

Control directly PWM signal to the prestage.

By pass position measurement

Can be used for identifying if problem is in positioner or if the valve/actuator is stuck

Valve position may jump when going back to auto mode and device starts to follow setpoint



User Guide

Here you find QR code for our product web pages and support material.

Scan QR code with QR scanner on your mobile phone or tablet.

About

Here you find device version information.

DEVICE TYPE MANAGER (DTM)

DEVICE TYPE MANAGER (DTM)

Introduction to DTM

Neles Device Type Manager (DTM) is part of an open solution for field device management that provides the best possible support during the commissioning, operation and maintenance of your site. The DTM, with which Valmet adheres to Field Device Tool Specifications, provides a user interface for configuration, monitoring, calibration, diagnostics, and testing of the device.

Field Device Tool

FDT stands for Field Device Tool. It is an open industry specification which provides plug-and-play integration of DTMs (Device Type Managers) for various vendors' devices into a single tool. FDT is promoted and supported by many vendors of automation devices and systems.

DTMs are device-specific and vendor-specific software applications for the configuration, calibration and diagnostics of devices. They can be compared to a printer driver in a Windows environment, for example. DTMs exist for both field devices and communication devices. DTMs for communication devices represent the communication protocol driver of the devices.

Because communication protocol management is encapsulated into DTMs and the communication between DTMs is protocol-independent, FDT allows the management of multiprotocol field networks with a single tool.

FDT Functions

FDT functions include the functions listed below. These functions are realised in various ways in FDT Frame Applications.

- User management and administration
- Device inventory management
- DTM management
- Automatic bus scanning
- Uploading or downloading of device configuration
- Loading of device-specific views into the user interface
- Execution of device-specific functions
- Parametrization of devices when DTM is connected
- Parametrization of devices when DTM is disconnected
- Storage of device configuration
- Printing or print preview of device documentation
- Multi-language support
- Data logging for troubleshooting purposes and technical support

For More Information on the FDT Standard

For more information on the FDT standard, you can refer to websites such as the following:

- www.fdtgroup.org

Getting started

Software requirements

- A frame application that supports FDT 1.2 and published addendum
- Windows 7 or newer Microsoft operating system
- Microsoft .NET Framework 3.5
- Administrator privileges for installing the software

ActiveX Technology

Valmet software is in accordance with FDT/DTM 1.2 standard, which is based on ActiveX software components with known security risks. These risks apply to all FDT 1.2 host systems, FDT 1.2 communication DTM's and FDT 1.2 device DTM's. By installing the Valmet software you acknowledge and accept these security risks and release Valmet from any and all liabilities related thereto.

Installing DTM

To install DTMs, perform the following steps:

1. Download the latest device DTM setup package from www.valmet.com/flowcontrol/valves/valve-software/
2. Close all programs.
3. Execute the setup program and follow the instruction of the setup wizard.
4. Launch the FDT frame application and update the DTM Catalog, if it is not updated automatically.

Updating DTM installation

To update your DTM Installation, perform the exact same steps as when installing the DTM package for the first time.

Note that DTM is backward compatible with older Neles DTM revisions.

CAUTION

Changing the critical parameters (the parameters set in the guided startup) may cause faulty operation and unanticipated stroking of the valve. Damage to the process and injury may result.

Changing the critical parameters remotely through DTM or EDD is not recommended. Note that the download all function in the DTM may change critical parameters!

WARNING

During automatic or manual calibration the valve operates between open and closed positions. Make sure that the operation does not endanger people or processes!

DEVICE TYPE MANAGER (DTM)

User Interface Information

Figure below shows the DTM user interface. The user interface elements indicated by numbers are explained in more detail below.

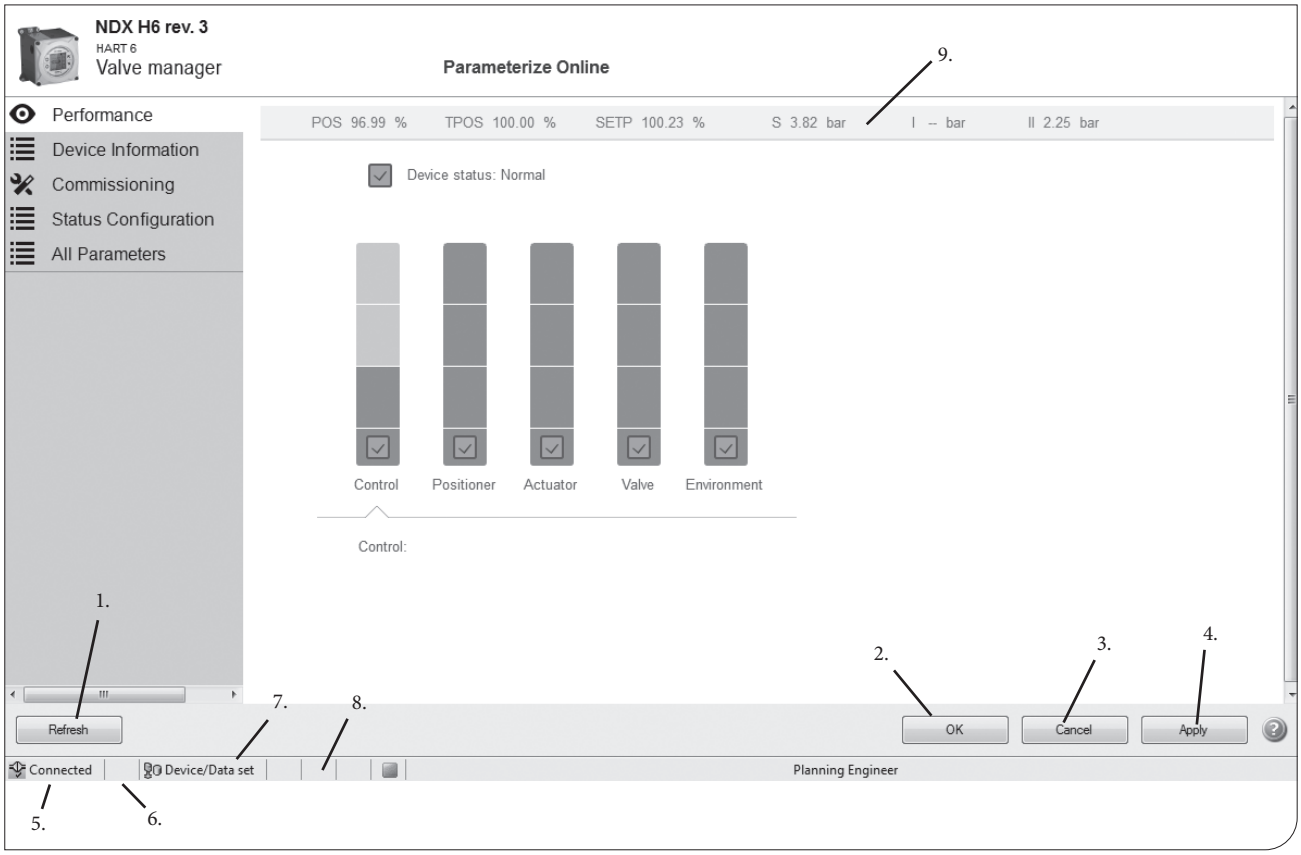


Fig. 57.

1. Refresh button reloads the active view from the device. This button can be used to cancel any modification made to the local parameters.
2. OK button sends all modifications to the device and closes the window.
3. Cancel button cancels all the local changes and closes the window.
4. Apply button sends all local changes to the device.
5. Connected status shows, if connection to the device is established, or if the DTM is in disconnected (offline) mode.
6. Green arrow icon is displayed, when the DTM is sending or reading parameters from the device.
7. Parameter set state. Device parameters are stored to the device and also in the local database. This icon shows, if the information shown in the DTM is updated with the device, only saved to the local database.
8. Pencil icon is shown, when there are local modifications to the device parameters, which are not saved to the device.
9. Device variables are available in all views when device connected online. Parameters shown are: Valve Position (POS), Target Position (TPOS), Setpoint (SETP), Supply Pressure (S), Actuator Pressure I and II.

DEVICE TYPE MANAGER (DTM)

Using DTM

This section introduces standard DTM functions and explains how to perform them efficiently. Note that after installing DTM, you must update DTM Catalog in the frame application before you can use the DTM.

DTM settings

Neles DTM setup package installs an additional utility, which provides global DTM configuration options. It allows changing DTM language and save data folder. The configurator utility can be started from Start menu → All Programs → Neles Device DTM → Neles NDX DTM → NDX DTM Configurator.

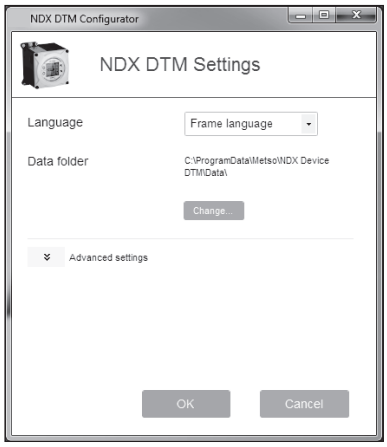


Fig. 58.

Frame application functions

Here is an example of a FDT frame application menu structure, which provides access to different DTM functions:

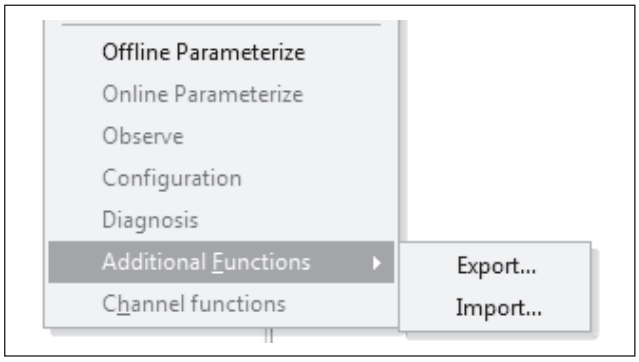


Fig. 59.

The example is showing, where Import/Export functionality can be found and how to access Offline/Online parameterization and Diagnosis functionality.

DEVICE TYPE MANAGER (DTM)

Import/Export

The Export function of DTM allows you to save device configurations on your computer or local computer network for later use or as a backup file. The Import function allows you to load previously saved configurations into the DTM for use in device configuration. Exported configurations are saved in .xml file format.

Location of the Import and Export functions depends on the FDT frame application used. Usually there is a menu (or context-menu with right mouse click), which provides a set of standard actions, for example "Online Parameterize". In this same menu should be a section called "Additional Functions". Under the Additional Functions menu are the Import and Export functions.

Printing

Printable report from a device via a DTM instance is available through the frame application functions.

NDX DTM

Neles DTM provides three different user interfaces, each for very distinct purpose:

1. Parameterize Offline window
2. Parameterize Online window
3. Diagnosis window

These views are available from the FDT frame application menu structure.

Parameterize Offline

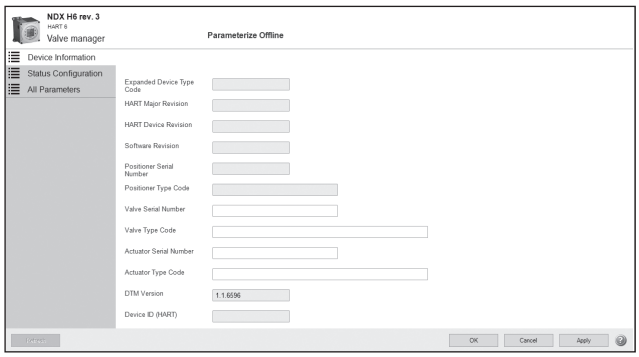


Fig. 60.

Following DTM views are available when device is in offline mode:

NDX_H_ (HART)
Device Information
Status Configuration
All Parameters

NDX_F_ (FOUNDATION fieldbus)
Device Information
Extended Diagnostics
Diagnostics Limits
All Parameters

Please see the chapter Parameterize Online for detailed information on each view.

Parameterize Online

This window gives tools for quickly checking the state of the device, perform guided commissioning process and configure the behavior of the device.

Performance

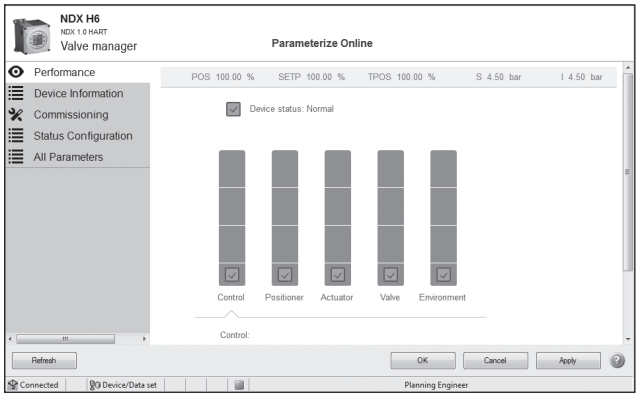


Fig. 61.

Device Status is determined based on the most acute active status that exists in the device. Device status is classified according to NAMUR recommendation NE 107. There can be multiple active statuses in the device at the same time.

Status icons in the DTM are as follows:

- Normal
- Info
- Maintenance required
- Off specification
- Function check
- Device failure

NDX_H_ (HART)
Single statuses can be enabled/disabled and classified to certain NAMUR class in DTM's Status Configuration view. Related events in the event log are listed in the same chapter.

NDX_F_ (FOUNDATION fieldbus)
Performance view shows Field Diagnostics as defined in Foundation Fieldbus specification. In addition it can give more detailed status info as specified in Extended Diagnostics view.
NAMUR classes can be configured either with FF configuration tool or with EDD but not with DTM.
In addition NDXFF has Extended Diagnostics view, which is more extensive list of available statuses in NDX positioner. These statuses can be isabled/enabled in DTM.
Note, if status is disabled from device in Extended Diagnostics view, it is also disabled in Field Diagnostics and therefore won't activate in Performance view.

DEVICE TYPE MANAGER (DTM)

Device Information

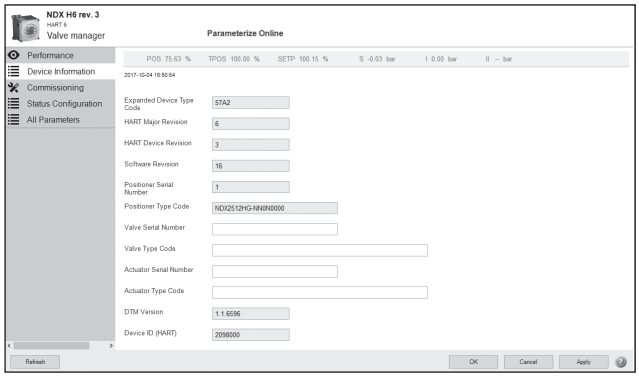


Fig. 62.

Device information view contains information on valve controller, actuator and valve. If NDX is delivered on top of the valve package the valve and actuator data is pre-filled.

Table 9. Device information view of NDX HART DTM

Parameter name	Description	Default value
Expanded Device Type Code	Read expanded device type code.	-
HART Technology Version	Read HART technology version of the device (6 or 7 as default).	-
NDX Device Revision	Read NDX device revision.	-
Firmware Revision	Read firmware revision of the device.	-
Firmware Build Revision	Read firmware build revision of the device.	-
Positioner Serial Number	Read positioner serial number of the device.	Positioner Serial Number
Positioner Type Code	Read positioner type code of the device.	Positioner Type Code
Valve Serial Number	Write the valve serial number here.	Valve Serial Number
Valve Type Code	Write the valve type code here.	Valve Type Code
Actuator Serial Number	Write the actuator serial number here.	Actuator Serial Number
Actuator Type Code	Write the actuator type code here.	Actuator Type Code
DTM Version	Read DTM version number.	-
Device Type ID (HART)	Read HART device type ID number.	-

Table 10. Device Information view of NDX FF DTM

	Description	Default value
PD Tag	Physical device tag	
Device ID	Unique device ID	
Manufacturer	Positioner manufacturer	
Model	Positioner model	
Device revision	Device revision	
ITK version	ITK version	
NDX FW Revision	NDX firmware revision	
Software Revision	commModule software revision	
Hardware Revision	commModule hardware revision	
commScripter Revision	commScripter revision	
commScript Content Revision	commScript content revision	
Positioner Serial Number	Serial number of positioner	
Positioner Type Code	Type code of positioner	
Valve Serial Number	Serial number of valve	
Valve Type Code	Type code of valve	
Actuator Serial Number	Serial number of actuator	
Actuator Type Code	Type code of actuator	
DTM version	Installed DTM version	

Commissioning

DTM has a guided start-up to help you with commissioning of the device.

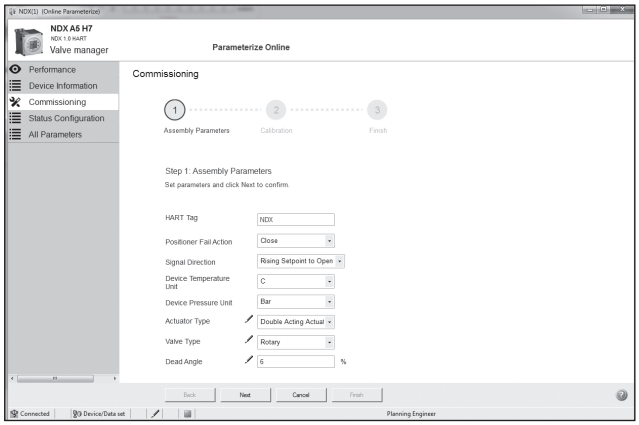


Fig. 63. **Step 1**. Assembly Parameters
Set assembly parameters and click Next to confirm.

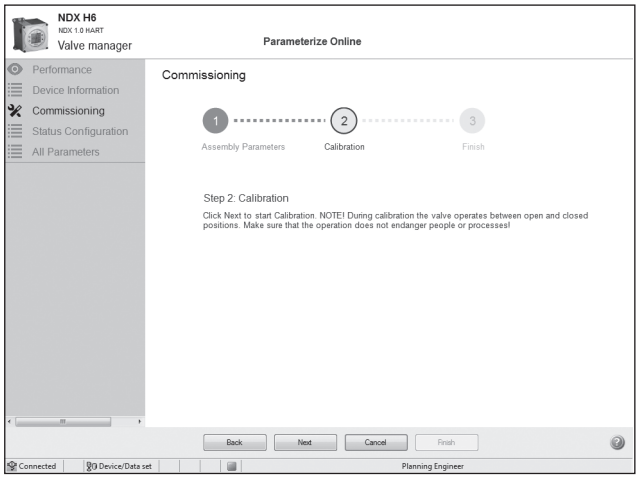


Fig. 64. **Step 2.** Click Next to start Calibration.

DEVICE TYPE MANAGER (DTM)

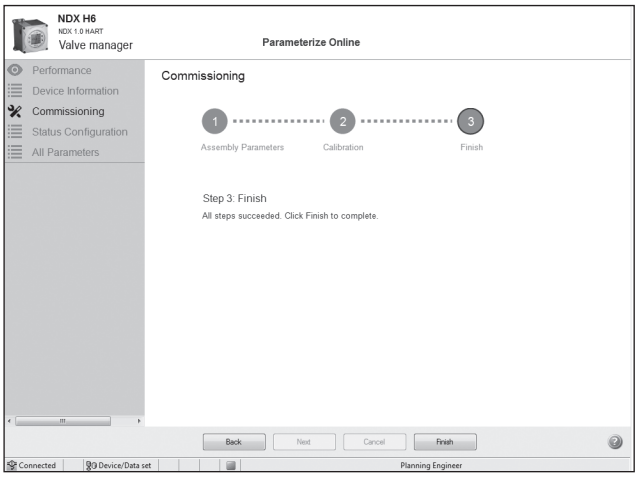


Fig. 65. **Step 3.** Click Finish to complete.

Status Configuration

Available statuses can be either disabled or classified to a certain NAMUR class in Status Configuration view. Status limits and current value is shown in the same view when applicable.

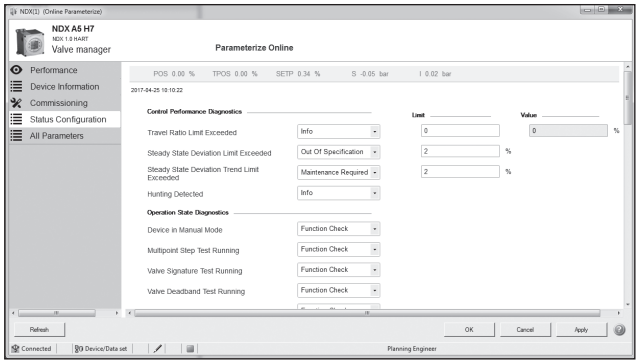


Fig. 66.

Following table lists all statuses and related events in the event log that are available from the device. Description, proposed actions and default NAMUR classification are also described in the table.
Status configuration view is also available in offline mode. To send offline parameterization to the device, open the DTM GUI in online mode and send modifications by clicking Apply button.

Table 11. Control Performance Diagnostics

Status	Related events in the event log	Status description	Proposed actions	Default NAMUR classification
Travel Ratio Limit Exceeded	Travel Ratio Limit Exceeded Travel Ratio back to normal	Valve travel/valve reversals	Check if process conditions have changed. Evaluate if limit is correctly set.	Info
Steady State Deviation Limit Exceeded	Steady State Deviation Limit Exceeded Steady State Deviation Back to Normal	Increased friction in valve or actuator, leakage in pneumatics or insufficient supply pressure.	Inspect steady state deviation trend to determine if there have been any recent significant increases. Evaluate if limits and latch time are correctly set. Check previous alarms for prior conditions. Check actuator for pneumatics leakage and that valve is able to move in whole operating range. Run calibration if needed (calibration will help to compensate changed operating conditions) and check performance. Check valve at next maintenance opportunity	Out of Specification
Hunting Detected	Hunting detected Hunting recovery	Improper selection of position control performance level. If there are boosters, the hunting may be caused by those.	Check position control performance level, possibly change to less aggressive to stabilize valve. Try to open booster bypass valve. The correct way to tune the boosters is commonly to adjust those so that boosters are not active if you make step change less than 5 percent and if step size is larger than 5 percent boosters will be active. Check valve at next maintenance opportunity.	Info

DEVICE TYPE MANAGER (DTM)

Table 12. Operation State Diagnostics

Status	Related events in the event log	Status description	Proposed actions	Default NAMUR classification
Device in Manual Mode	Device set in manual mode Device set in auto mode	Device is locally (LUI) set to manual mode. Device is not following mA setpoint.	If mA setpoint shall be followed set device in auto mode with LUI.	Function Check
Multipoint Step Test Running	Multipoint Step test started Multipoint Step test completed Multipoint Step Test failed Multipoint Step Test cancelled	Device functional test is running.	Check the test result from DTM/EDD Event Log.	Function Check
Valve Signature Test Running	Valve signature test started Valve signature test completed Valve signature Test failed Valve signature Test cancelled	Device functional test is running.	Check the test result from DTM/EDD Event Log.	Function Check
Valve Dead Band Test Running	Valve signature test started Valve signature test completed Valve signature Test failed Valve signature Test cancelled	Device functional test is running.	Check the test result from DTM/EDD Event Log.	Function Check
Partial Stroke Test Running	Partial Stroke test started Partial Stroke test completed Partial Stroke test failed Partial Stroke test cancelled	Device functional test is running.	Check the test result from DTM/EDD Event Log.	Function Check
Calibration Running	Automatic calibration started Manual calibration started 1-point calibration started Calibration successful Calibration failed Calibration failed in tuning Calibration failed due to incorrect magnet installation. Calibration cancelled Calibration start failed	Device calibration is running.	Check the result from DTM/EDD Event Log.	Function Check

DEVICE TYPE MANAGER (DTM)

Table 13. Positioner Diagnostics

Status	Related events in the event log	Status description	Proposed actions	Default NAMUR classification
Total Operation Time Limit Exceeded	Total operation time limit exceeded Total operation time limit recovered	User-defined limit exceeded.	Review the device performance. If performance is adequate, increase value of Total Operation Time Limit in DTM/EDD Status Configuration view.	Maintenance Required
Supply Pressure Sensor Failure	Supply Pressure Sensor Failure Detected Supply pressure sensor recovered	Supply pressure measurement is faulty. Control performance is reduced.	Change the printed circuit board module to a new one during next maintenance activity. Follow instructions in User Guide.	Failure
Setpoint Sensor Failure	Setpoint sensor failure detected Setpoint sensor recovered	mA measurement failed.	Change the printed circuit board module to a new one and calibrate device. Follow instructions in User Guide	Failure
Prestage Short-circuit	Prestage short-circuit error Prestage short-circuit recovered	Short-circuit in the prestage unit. Device will go to Failsafe position	Change Prestage unit and calibrate device. Follow instructions in User Guide	Failure
Position Sensor Failure	Position sensor failure detected Position sensor recovered	Position measurement faulty.	Change the printed circuit board module to a new one and calibrate device. Follow instructions in User Guide	Failure
Prestage Open circuit	Prestage open circuit error Prestage open circuit recovered	Prestage wire is cut or connector is loose.	Change Prestage unit and calibrate device. Follow instructions in User Guide	Failure
Position Transmitter Not Connected	-	Position transmitter is available. External supply voltage is not connected.	Connect external supply voltage or disable status in DTM/EDD Status Configuration view.	Out of Specification
Missing Position Feedback Magnet	Position Feedback Magnet Missing Position Feedback Magnet Found	Position feedback magnet is missing.	Check magnet installation. Calibrate the device.	Failure
Actuator Pressure Sensor Failure	Actuator Pressure Sensor Failure Detected Actuator pressure sensor recovered	Actuator pressure sensor has failed. Control performance is reduced.	Change the printed circuit board module to a new one during next maintenance activity. Follow instructions in User Guide.	Failure
Electronics Problem	Parameter storage failure Statistics storage failure Factory settings storage failure	Electronics problem in the device.	Replace printed circuit board module. Follow instructions in User Guide.	Failure
Failsafe activated	Failsafe activated Recovered from fail-safe	Linear magnet not detected. Setpoint sensor or position sensor has failed.	Check position feedback magnet and recalibrate the device. Replace printed circuit board module. Follow instructions in User Guide.	Failure

Table 14. Actuator Diagnostics

Status	Related events in the event log	Status description	Proposed actions	Default NAMUR classification
Total Actuator Travel Limit Exceeded	Total actuator travel limit exceeded Total actuator travel limit recovered	User-defined limit exceeded.	Review the device performance. If performance is adequate, increase value of Total Actuator Travel Limit in DTM/EDD Status Configuration view	Maintenance Required
Total Actuator Reversals Limit Exceeded	Total actuator reversals limit exceeded Total actuator reversals limit recovered	User-defined limit exceeded.	Review the device performance. If performance is adequate, increase value of Total Actuator Reversals Limit in DTM/EDD Status Configuration view	Maintenance Required

DEVICE TYPE MANAGER (DTM)

Table 15. Valve Diagnostics

Status	Related events in the event log	Status description	Proposed actions	Default NAMUR classification
Total Valve Travel Limit Exceeded	Total valve travel limit exceeded Total valve travel limit recovered	User-defined limit exceeded.	Review the device performance. If performance is adequate, increase value of Total Valve Travel Limit in DTM/EDD Status Configuration view.	Maintenance Required
Total Valve Reversals Limit Exceeded	Total valve reversals limit exceeded Total valve reversals limit recovered	User-defined limit exceeded.	Review the device performance. If performance is adequate, increase value of Total Valve Reversals Limit in DTM/EDD Status Configuration view	Maintenance Required
Valve Position Above High Limit	Valve position above high limit High valve position recovered	Valve position is above high limit.	Check that valve is able to move in whole operating range and reason why range is exceeded. Run calibration if needed (calibration will help to compensate changed operating conditions) and check performance.	Maintenance Required
Valve Position Below Low Limit	Valve position below low limit Low valve position recovered	Valve position is below low limit.	Check that valve is able to move in whole operating range and reason why range is exceeded. Run calibration if needed (calibration will help to compensate changed operating conditions) and check performance.	Maintenance Required
Maximum Stiction Too High	Maximum stiction high limit exceeded High maximum stiction recovered	Maximum stiction is above high limit. Valve or actuator static friction has increased. This may cause accuracy problems and ultimately prevent valve from moving.	Review the device performance. If performance is adequate, increase value of Maximum stiction high limit in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	Maintenance Required
Minimum Stiction Too Low	Minimum stiction low limit exceeded Low minimum stiction recovered	Minimum stiction is below low limit. Valve or actuator static friction has decreased. This may indicate problems such as intensive wear or shaft break.	Review the device performance. If performance is adequate, increase value of Minimum stiction low limit in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	Maintenance Required
Load For Opening Too High	Load for opening high limit exceeded High load for opening recovered	Load for opening is above high limit.	Review the device performance. If performance is adequate, increase value of Load for opening high limit in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	Maintenance Required
Load For Opening Too Low	Load for opening low limit exceeded Low load for opening recovered	Load for opening is below low limit.	Review the device performance. If performance is adequate, increase value of Load for opening low limit exceeded in DTM/EDD Status Configuration view. Check valve at next maintenance opportunity.	Maintenance Required

DEVICE TYPE MANAGER (DTM)

Table 16. Operating Condition Diagnostics

Status	Related events in the event log	Status description	Proposed actions	Default NAMUR classification
Control Ratio Limit Exceeded	Control Ratio Limit Exceeded Control ratio back to normal	Valve reversals/ Setpoint reversals	Check if process conditions have changed. Evaluate if limit is correctly set.	Info
Temperature Above High Limit	Temperature High Limit Exceeded High temperature recovered	Positioner has detected that the temperature is above specification limits.	Inspect the positioner and operating conditions.	Out of Specification
Temperature Below Low Limit	Temperature Low Limit Exceeded Low temperature recovered	Positioner has detected that the temperature is below specification limits.	Inspect the positioner and operating conditions.	Out of Specification
Supply Pressure Above High Limit	Supply Pressure High Limit Exceeded High supply pressure recovered	Positioner diagnostics have detected that instrument air pressure to positioner is above acceptable limits.	Check supply pressure level.	Out of Specification
Supply Pressure Below Low Limit	Supply Pressure Low Limit Exceeded Low supply pressure recovered	Positioner diagnostics have detected that instrument air pressure to positioner is below acceptable limits.	Check supply pressure level and supply pressure capacity.	Out of Specification
Calibration Recommended	Previous calibration was cancelled, calibration recommended	Previous calibration was cancelled.	Run position calibration.	Maintenance Required
	Single point calibration is used, calibration recommended	Single point calibration is used.	Run position calibration.	
	Any of the following Assembly Related Parameter was changed: Actuator type, Valve type, Positioner fail action, Pneumatic connection. Calibration recommended	Assembly Related parameter was changed.	Run position calibration.	
	Device is unable to detect magnet in whole position range, calibration recommended	Device is unable to detect magnet in whole position range.	Check that magnet is installed according to User Guide and re-calibrate device.	
	Factory default parameters was taken in use, calibration recommended	Factory default parameters were taken in use.	Run position calibration.	
Calibration Required	-	Calibration required prior to use	Device needs to be configured and calibrated before it is switched to automatic control mode. Follow the instructions on the LUI first screen and proceed to guided start-up.	Info
Supply Pressure Too Low for Single-Acting Actuator	Supply pressure too low for single acting actuator Supply pressure too low for single acting actuator recovered	Instrument air pressure to positioner is too low to drive valve for whole operation range.	Check supply pressure level and supply pressure capacity.	Out of Specification
Cover is open	Cover is opened Cover is closed	Cover is opened	Check that cover is not left open by accident.	Info

Table 17. Software Limit Switches

Status	Related events in the event log	Status description	Proposed actions	Default NAMUR classification
Limit Switch Closed	-	Limit switch is closed	-	Info
Limit Switch Open	-	Limit switch is opened	-	Info

DEVICE TYPE MANAGER (DTM)

Diagnostics limits are listed and explained in following tables.

Table 18. Control Performance Diagnostics Limits

Parameter name	Description	Default value	Limits/options
Travel Ratio Limit	Set travel ratio alert limit. If a value is lower than the limit, a status is activated for the device and an event is generated.	0 %	0-100 %
Steady State Deviation High Limit	Set steady state deviation high alert limit. If a measurement exceeds the limit, a status is activated for the device and an event is generated.	5 %	0-100 %

Table 19. Positioner Diagnostics Limits

Parameter name	Description	Default value	Limits/options
Date For Total Operation Time Alert	Select date for next alert.	25 years after first start up	0-100 years

Table 20. Actuator Diagnostics Limits

Parameter name	Description	Default value	Limits/options
Total Actuator Travel Limit	Set the Total Actuator Travel alert limit. Counter increases by 1 whenever the valve has travelled one full stroke, or 100 % of the valve movement. The valve is considered to have moved when the valve position changes +/- 0.5 % E.g. when the valve moves 10 %, the counter increases by 0.1	1000 0000	0-10 0000 0000
Total Actuator Reversals Limit	Set the Total Actuator Reversals alert limit. This counter increases by 1 whenever the direction of valve movement changes.	1000 0000	0-10 0000 0000

DEVICE TYPE MANAGER (DTM)

Table 21. Valve Diagnostics Limits

Parameter name	Description	Default value	Limits/options
Total Valve Travel Limit	Set the Total Valve Travel alert limit. Counter increases by 1 whenever the valve has travelled one full stroke, or 100 % of the valve movement. The valve is considered to have moved when the valve position changes +/- 0.5 % E.g. when the valve moves 10 %, the counter increases by 0.1”	1000 0000	0-10 0000 0000
Total Valve Reversals Limit	Set the Total Valve Reversals alert limit. This counter increases by 1 whenever the direction of valve movement changes.	1000 0000	0-10 0000 0000
Valve Position Above High Limit	Set valve position high alert limit. If a measurement exceeds the limit, a status is activated for the device and an event is generated.	120	-20 – 120 %
Valve Position Below Low Limit	Set valve position low alert limit. If a measurement goes below the limit, a status is activated for the device and an event is generated.	-20	-20 – 120 %
Maximum Stiction Too High Limit	Set maximum stiction high alert limit. If a measurement exceeds the limit, a status is activated for the device and an event is generated.	16 bar	0 – 16 bar
Maximum Stiction Too Low Limit	Set maximum stiction low alert limit. If a measurement goes below the limit, a status is activated for the device and an event is generated.	0 bar	0 – 8 bar
Load For Opening Too High Limit	Set load for opening high alert limit. If a measurement exceeds the limit, a status is activated for the device and an event is generated.	10 bar	0-10 bar
Load For Opening Too Low Limit	Set load for opening low alert limit. If a measurement goes below the limit, a status is activated for the device and an event is generated.	0 bar	0-10 bar

Table 22. Operating Condition Diagnostics Limits

Parameter name	Description	Default value	Limits/options
Control Ratio Limit	Set control ratio alert limit. If a value exceeds the limit or falls below 1/limit, a status is activated for the device and an event is generated.	10	1-100
Temperature Above High Limit	Set temperature high alert limit. If a measurement exceeds the limit, a status is activated for the device and an event is generated.	85 C	-40 - +85 °C
Temperature Below Low Limit	Set temperature low alert limit. If a measurement goes below the limit, a status is activated for the device and an event is generated.	-40 C	-40 - +85 °C
Supply Pressure Above High Limit	Set the supply pressure high limit at the actuator’s maximum pressure rating. Since the maximum pressure rating for the NDX positioner is 8 bars this should be the highest limit if the actuator has a higher rating. If a measurement exceeds the limit, a status is activated for the device and an event is generated.	8 bar	1.4 - 8 bar
Supply Pressure Below Low Limit	For the supply pressure low limit, the spring rating of a spring return actuator can be used. For double acting actuators, the low limit can be set at the minimum air pressure that will allow the actuator to provide sufficient torque to operate the valve. If a measurement goes below the limit, a status is activated for the device and an event is generated.	1.4 bar	1.4 - 8 bar

Table 23. Software Limit Switches

Parameter name	Description	Default value	Limits/options
Limit Switch Closed	Set the value for limit switch closed. When the set value is reached a status is generated.	1 %	-20 – 120 %
Limit Switch Open	Set the value for limit switch open. When the set value is reached a status is generated.	95 %	-20 – 120 %

DEVICE TYPE MANAGER (DTM)

All parameters

This view lists all configurable device parameters. In offline mode, All parameters view is the view, which is opened from the frame application “Offline parameterize” menu option for parameterizing the device beforehand before going to online mode or before the device is available.

All parameters view provides a central place to parameterize the whole device in one place.This allows seasoned service personnel to quickly configure the device from the ground up. This view also allows separate configuration phase and commissioning phase in places, where DTM instances are configures before there is the physical device network available. To send offline parameterization to the device

1. Apply changes in DTM
2. Use frame applications “Send to device” function. It will create device connection and send saved configuration to device.

For safety reasons, assembly related parameters which can cause valve to move, are not included in the offline parameterization set which is sent to device.

Those parameters need to be set during commissioning and calibration phase.

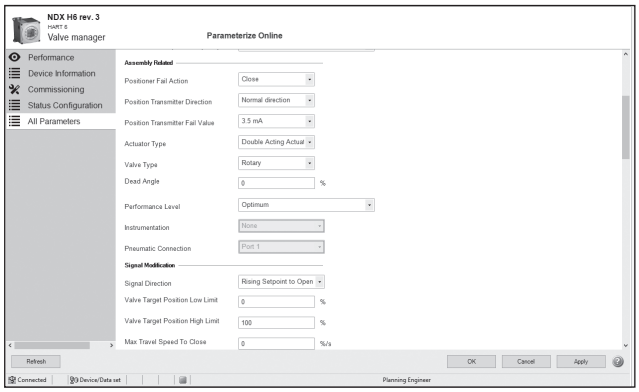


Fig. 67.

Table 24. Device Information (HART only)

Parameter name	Description	Default value	Limits/options
HART Tag	8 characters	NDX	-
Device Date	Enter a date, e.g. the date when you installed the device.	31.03.2016	-
Description	Enter a description of the device (max. 16 characters)	NDX	-
Message	Enter any other relevant information (max. 32 characters)	NDX	-
HART Long Tag	32 characters, case sensitive, allows consistent implementation in Host Applications for the longer tag names demanded by industry users	NDX	-
HART protocol (restart required)	Restart required after changing the HART protocol.	HART 7	HART 7 HART 6

Table 25. Assembly Related

Parameter name	Description	Default value	Limits/options
Positioner Fail Action	Set Positioner Fail Action according to actuator spring direction. If you change the value of this parameter, calibrate the device. When there is linear actuator without mechanical limit in open/ closed end, it is recommended to use Manual calibration.	Close	Close Open
Position Transmitter Direction (HART only)	Set position transmitter signal direction. Normal direction: Output rises when valve angle rises	Normal direction	Normal direction Reverse
Position Transmitter Fail Value (HART only)	Position transmitter output when the NDX has a fatal error or is powered off.	3.5 mA	3.5 mA 22.5 mA
Actuator Type	Select actuator type Select single acting or double acting parameter, depends on actuator type. If you change the value of this parameter, calibrate the device.	Single Acting	Single Acting Actuator Double Acting Actuator
Valve Type	Select valve type. Defines if device is mounted top of the linear valve or rotary valve. Dead angle and Beacon position menu are visible if Rotary is selected as valve type. If you change the value of this parameter, calibrate the device.	Linear	Rotary Linear
Dead Angle	This setting is made mainly for segment and ball valves. The entire signal range is then used for effective valve opening 90° - α0. Refer to device user guide for proper dead angle value for your valve type.	0 %	0-100 %

DEVICE TYPE MANAGER (DTM)

Parameter name	Description	Default value	Limits/options
Performance Level	If you want to change the tuning of the valve position control, performance level selection is available. Max Stability: Slowest response to signal changes and no overshoot. Trying to keep the valve position as stable as possible. Stable: Fairly slow response to signal changes and no overshoot. Optimum (factory default): Optimum performance controlling the valve regarding response time and valve speed when signal changes. There is typically no overshoot. Fast: Fast response to signal changes but may also have small overshoot. Aggressive: Fastest possible response to signal changes and typically some overshoot. Fast Opening (FO) = The reaction time to setpoint change will be faster when recovering from the cut-off position. Max Stability FO, Stable FO, Optimum FO, Fast FO, Aggressive FO: Similar behavior than in above mentioned performance levels respectively, but always faster recovering from cut-off than above because of fast open (FO) function. PSA modes where fastest possible setpoint tracking is optimized.	Optimum	Maximum Stability Stable Optimum Fast Aggressive Maximum Stability, Fast Opening Stable, Fast Opening Optimum, Fast Opening Fast, Fast Opening Aggressive, Fast Opening PSA Optimum PSA Fast, PSA Aggressive, PSA
Instrumentation	Select if there are instrumentation components in use.	None	None Booster QEV Booster and QEV
Pneumatic Connection	For double acting versions of NDX only. For single acting actuators only. Select which pneumatic port is connected to the actuator.	Port 1	Port 1 Port 2

Table 26. Signal Modification

Parameter name	Description	Default value	Limits/options
Signal Direction (HART only)	Defines the opening and closing direction of the valve with rising current signal.	Rising Setpoint to Open	Rising Setpoint to Open Rising Setpoint to Close
Valve Target Position Low Limit	Sets the lower limit for the working range of the valve.	0 %	0-100 %
Valve Target Position High Limit	Sets the upper limit for the working range of the valve.	100 %	0-100 %
Max Travel Speed To Close	Describes the percentage of change per second in the setpoint as the valve changes from OPEN state to CLOSED state.	0 %/s (Disabled)	0-1000 %/s
Max Travel Speed To Open	Describes the percentage of change per second in the setpoint as the valve changes from CLOSED state to OPEN state.	0 %/s (Disabled)	0-1000 %/s
Cut-off Closed	Setpoint Cut-off is used with valves that require a large force to be closed. It is used to ensure that the valve is fully closed. When this value is exceeded, the valve is forced to a 0% position. This is called the tight cut-off feature. If, for example, the value is 2%, tight shut-off starts when the input signal goes below 2%.	2 %	0-100 %
Cut-off Open	Setpoint Cut-off is used with valves that require a large force to be open. It is used to ensure that the valve is fully open . When this value is exceeded, the valve is set to a 100% position. This, however, does not guarantee that the valve reaches 100%. If, for example, the value is 98%, controller input is set to 100% when input signal is over 98%.	100 %	0-100 %
Split Range Low	Split Range configuration sets the input signal range for full valve travel range. Note that the difference between the Split Range High and Low limits must be 20% or higher. Split Range Low is the lower limit of the input signal range in percent.	0 %	0-100 %
Split Range High	Split Range configuration sets the input signal range for full valve travel range. Note that the difference between the Split Range High and Low limits must be 20% or higher. Split Range High is the upper limit of the input signal range in percent.	100 %	0-100 %

DEVICE TYPE MANAGER (DTM)

Parameter name	Description	Default value	Limits/options
Bypass Signal Modifications	Defines whether Signal Modification parameters are applied or not. Affects following parameters: • Signal direction • Cut-off closed • Cut-off open • Cut-off type • Valve Target Position Low Limit • Valve Target Position High Limit • Dead angle • Split Range Low • Split Range High • Max Travel Speed To Close • Max Travel Speed To Open • Characterization Type • Shape Factor • Flow Modification	0 %	Yes (Signal modifications are discarded.) No (Signal modifications are applied to original setpoint, and the control module then follows the modified setpoint.)

Flow Modification

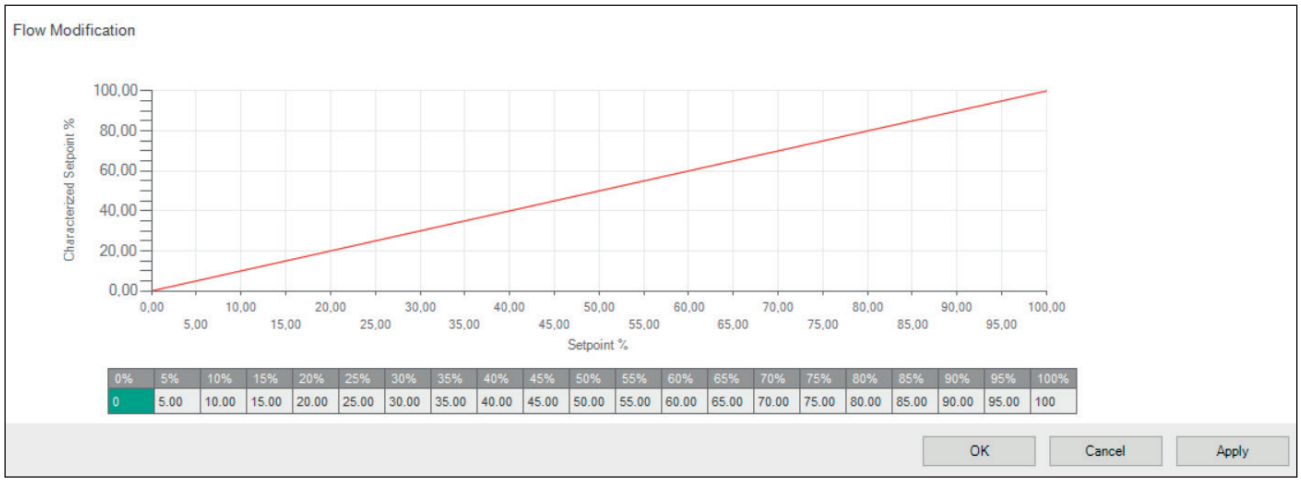


Fig. 68.

Table 27.

Parameter name	Description	Default value	Limits/options
Characterization Type	Linear: Flow Modification is not used Shape Factor: Flow Modification is used. If you select this option, enter a Shape Factor value. User Curve: You can create a custom table. If you select this option, manually edit the Values as necessary.	Not Used (Linear)	Not Used (Linear) Shape Factor User Curve
Shape Factor	Shape Factor describes the nearest approximate or the exact shape of the valve characterization transfer function based on the following hyperbolic function: f(x) = x/(S+x(1-S)) where S = Shape Factor x = normalized (0-100%) Setpoint value f(x) = an intermediate calculation of the Target Position. If Shape Factor is between 0 and 1, a quick opening transfer function is applied. If Shape Factor is 1, a linear transfer function is applied. If Shape Factor is larger than 1, an equal percentage transfer function is applied.	1	0.01 – 100

DEVICE TYPE MANAGER (DTM)

Table 28. Localization

Parameter name	Description	Default value	Limits/options
Local User Interface Language	Select the desired language to be used in local user interface.	English	English Chinese Spanish Italian French Korean German Turkish Dutch Portuguese
Device Temperature Unit	Select the desired temperature units for various device variables. The device sends the variable's value and unit according to this selection.	C	C F
Device Pressure Unit	Select the desired pressure units for various device variables. The device sends the variable's value and unit according to this selection.	Bar	Bar Psi

Table 29. Event Latch Times and timeouts

Parameter name	Description	Default value	Limits/options
Supply Pressure Latch Time	Set wait time for triggering the supply pressure status and event in case supply pressure high or low limit is exceeded.	30 s	0-36000 s
Steady State Deviation Latch Time (Advanced diagnostics)	Set wait time for triggering the steady state deviation status and event in case steady state deviation high or low limit is exceeded.	30 s	0-36000 s
Device Temperature Latch Time	Set wait time for triggering the device temperature status and event in case device temperature high or low limit is exceeded.	0 s	0-36000 s
Valve Position Latch Time	Set wait time for triggering the valve position status and event in case valve position high or low limit is exceeded.	30 s	0-36000 s
Steady State Deviation Timeout (Premium diagnostics)			

Table 30. Access Permissions

Parameter name	Description	Default value	Limits/options
Local User Interface Lock	Select Local User Interface Lock option. Cover Lock: Detaching the main cover will unlock the for LUI editing. When the cover is re-attached, LUI is again locked to read only mode. Pin Code: PIN code is required to unlock editing mode. PIN lock automatically re-locks after one minute of inactivity and at the same time LUI returns to monitoring view. Cover Lock and Pin: Detach the cover and after that enter the PIN code to enable the editing mode. One minute of inactivity enables PIN lock and re-attaching the cover locks the Cover lock.	Cover Lock	Cover lock Pin Code Cover Lock and Pin
Device Write Protection (HART only)	Device Write Protection allows you to lock and unlock the device. It also prevents write commands from another primary or secondary HART master.	Off	Off On
PIN Code	Set Local User Interface PIN Code. If Local User Interface Lock option PIN Code is selected, enter PIN code to edit or start a function in Local User Interface.	1234	0000-9999

DEVICE TYPE MANAGER (DTM)

Table 31. Reset Diagnostics

Parameter name	Description	Default value	Limits/options
Diagnostics	Reseting following diagnostics data is possible: - Positioner counters - Valve counters - Actuator counters - Valve position histogram all - Valve position histogram months - Trends	None	None Reset Positioner Counters Reset Valve Counters Reset Actuator Counters Reset Valve Position Histogram All Reset Valve Position Histogram Months Reset Trends

Table 32. Digital Output Triggers (HART only if DO option in use)

Parameter name	Description	Default value	Limits/options
Digital Output 1 Digital Output 2	Depending on the device type selected, there can be up to two outputs. Digital output can be configured to be activated several different ways. It can operate as NAMUR limit switch or any any status information shown in the list.	Always Off	Always Off Limit Switch Closed Limit Switch Open Any device status
NAMUR Output Function	Defines digital output normal state.	Normally Closed	Normally Open Normally Closed

Note: These parameters may not be available. It depends on the device hardware configuration.

Table 33. Dynamic Variables (HART only)

Parameter name	Description	Default value	Limits/options
Primary Variable Secondary Variable Tertiary Variable Quaternary Variable	HART device variables can be defined to the corresponding Dynamic Variables (Primary, Secondary, Tertiary and Quaternary)."	Target Position Valve Position Supply Pressure Actuator Pressure I	Valve Setpoint mA Signal Target Position Valve Position Position Transmitter Output Controller Output Temperature Supply Pressure Actuator Pressure I Actuator Pressure II Deviation

DEVICE TYPE MANAGER (DTM)

Diagnosis

This window provides tools for quickly checking the device state and all diagnosis information and tools. This window provides real-time information of the device, measured performance data, historical data and possibility to run self-diagnostics in the form of offline tests. This window also has event log, which shows a log of events and actions, which has occurred earlier to the device.

NOTE

Some of the features are available only in Premium Diagnostics version of NDX.

Performance

See the explanation in Performance chapter under the Online Parameterize.

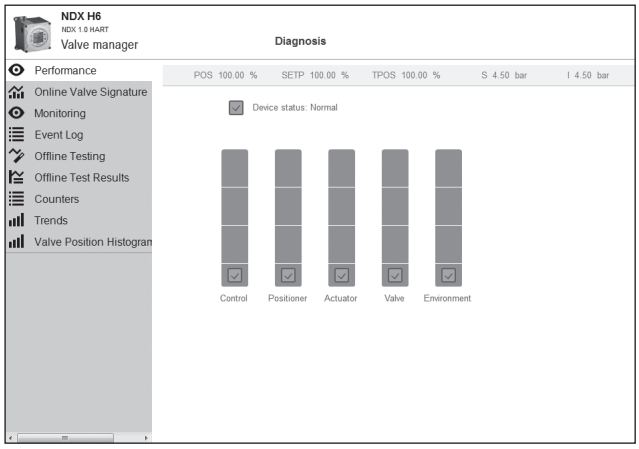


Fig. 69.

Online Valve Signature

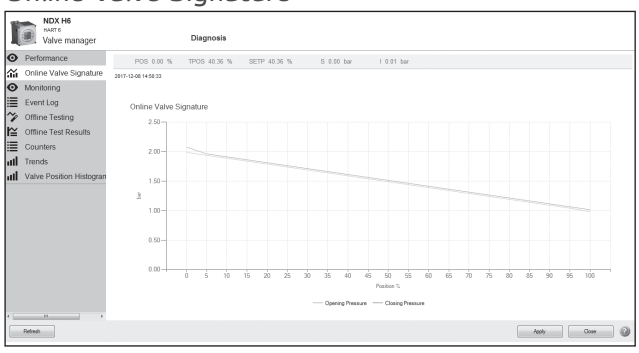


Fig. 70.

Advanced diagnostics Online Valve Signature

Online Valve Signature feature shows the friction of the control valve under normal process conditions when ever the valve is changing position.Online Valve Signature shows the amount of pressure required to move the valve in relation to the valve opening. The device data is continuously updated. To view the data in the DTM, read the data from the device. The graph shows opening and closing pressures.
When the data has been read from the device, DTM automatically saves the graph to the database.

Premium diagnostics

Comparison of two selected online valve signatures based on the time stamp is available in premium diagnostics version of NDX.

Fig. 71. Premium online valve signature

Select wanted days and read your selection.

Monitoring

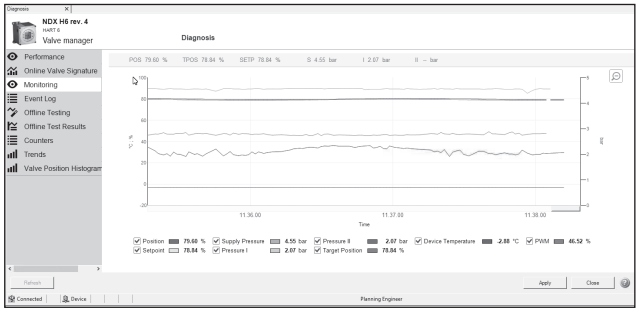


Fig. 72.

Monitoring view will automatically poll eight device variables in approximately every 1.5 seconds. All parameters are uploaded regardless the state of the checkboxes. With the checkboxes under the monitoring graphs, user can filter out unwanted information. All parameters are also automatically logged to a log file. The log file location is determined by Valmet Device DTM Configuration utility, which can be found from the Windows Start menu.

NOTE

Monitoring will be interrupted while reading trend data from the device.

Event log

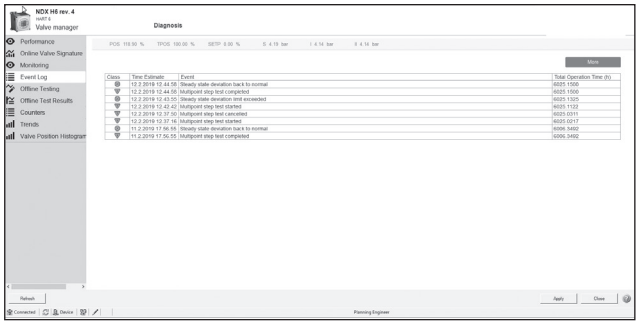


Fig. 73.

DEVICE TYPE MANAGER (DTM)

Most of the device statuses also create corresponding events in the event log. These are listed in chapter Parameterize Online/ Status Configuration.
In addition there are a few events which are only logged in the event history.

- Power on (External reset)
- Failsafe activated
  - Device position will go to fail safe position. Device is not able to follow setpoint.
  - Check additional status for reason for fail safe.

Offline Testing

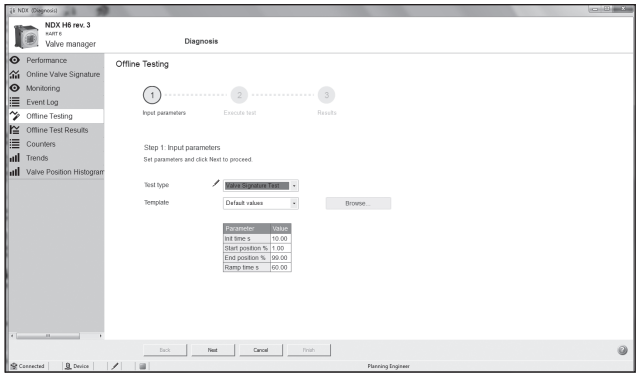


Fig. 74.

Test type defines what kind of a test will be executed. Currently there are four options: Multipoint Step Test, Valve Signature Test, Valve Deadband Test and Partial Stroke Test.
User can use the Template menu to select either default values or some predefined set of values for the execution of a test.
Test parameter grid allows entering test-specific parameters for the selected test. For example for Multipoint Step Test, user can enter up to 20 test steps by expanding the gird by clicking the round plus sign at the top-right corner of the grid.
Offline test procedure begins by clicking the Next button.

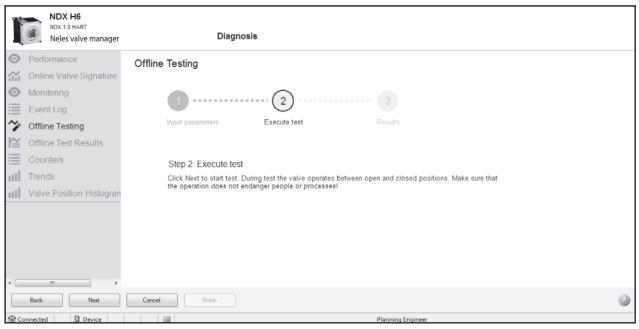


Fig. 75.

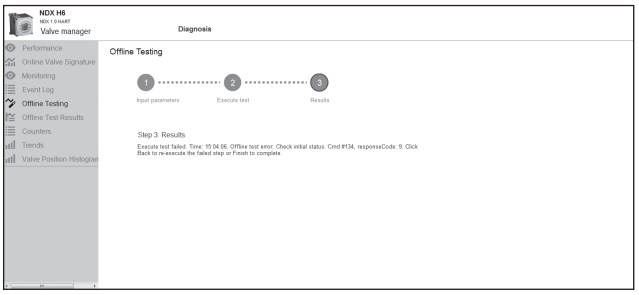


Fig. 76.

When the offline test has been executed, the test success and possible error messages are shown at the last step of the process. By clicking Finish button, user is automatically transferred to the Offline Test Results view, where test results are automatically uploaded and presented to the user.

Offline Test Results

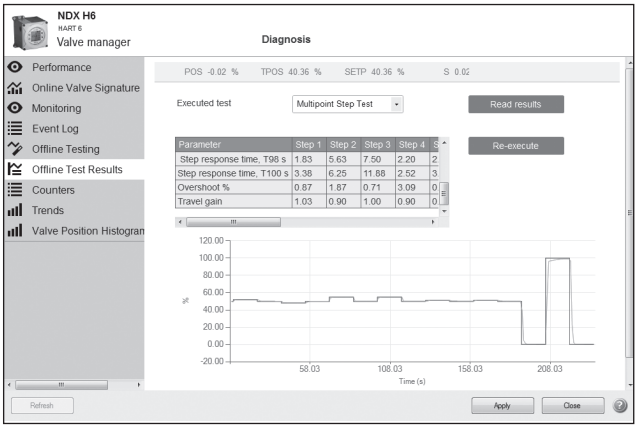


Fig. 77.

WARNING
The offline tests will cause the valve to move without any reference to the setpoint. Ensure that there is no danger to people or processes!

DEVICE TYPE MANAGER (DTM)

Counters

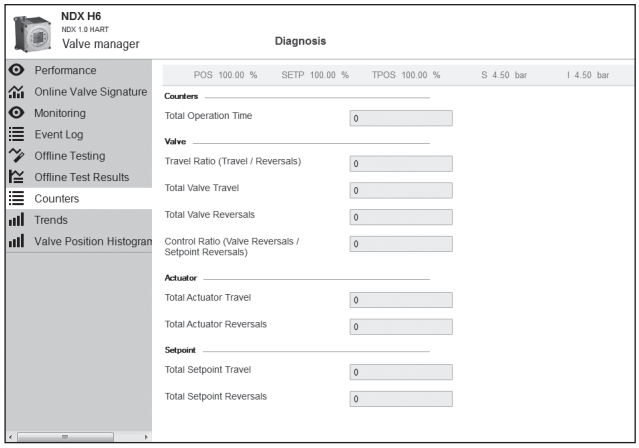


Fig. 78.

Table 34.

Parameter name	Description
Total Operation Time	Valve controller operation time, in hours.

Table 35. Valve

Parameter name	Description
Travel Ratio	Valve Travel / Valve Reversals
Total Valve Travel	This counter increases by 1 whenever he valve has travelled one full stroke, or 100 % of valve movement.
Total Valve Reversals	This counter increases by 1 whenever the direction of valve movement changes.
Control Ratio	Valve Reversals / Setpoint Reversals

Table 36. Actuator

Parameter name	Description
Total Actuator Travel	This counter increases by 1 whenever the valve has travelled one full stroke, or 100 % of valve movement.
Total Actuator Reversals	This counter increases by 1 whenever the direction of valve movement changes.

Table 37. Setpoint

Parameter name	Description
Total Setpoint Travel	This counter increases by 1 whenever the cumulative setpoint changes.
Total Setpoint Reversals	This counter increases by 1 when the direction of the setpoint changes.

Table 38. HART Diagnostics (HART only)

Parameter name	Description
Total Messages In	Total HART messages received
Total Messages Out	Total HART messages sent
HART Communication Error Rate during last hour	HART communication error rate in percentage during last hour
HART Communication Error Rate during last day	HART communication error rate in percentage during last day

Trends

Steady State Deviation Trend

Steady State Deviation is used to determine the basic control accuracy of the valve. It is updated whenever the setpoint is considered to have reached the desired position as precisely as possible.
Steady State Deviation trend is stored in the device memory. Trend shows the previous values of deviation during 24 hours, 30 full days, 12 full months, and 25 full years.
A change in the steady state deviation trend can be caused by:

- The general performance of the valve and actuator deteriorating.
- higher friction of the valve trim
- higher friction in actuator
- actuator diaphragm or piston seal damage
- change in process conditions
- supply air problem

Steady State Deviation Trend high limit can be modified by typing the value in the text box or by moving the limit line in the trend graph.

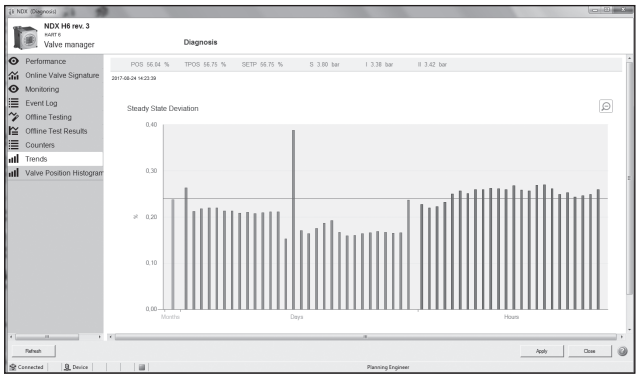


Fig. 79.

Premium Diagnostics

Following trends are available in premium diagnostics version of NDX:

- Supply Pressure
- Temperature
- Travel Ratio
- Control Ratio
- Steady State Deviation (Closed)
- Steady State Deviation (Open)
- Steady State Deviation (Control)
- Dynamic Deviation
- Pressure for Opening
- Stiction

DEVICE TYPE MANAGER (DTM)

Valve Position Histogram

Valve position histogram trend can be used to determine valve operation points. The trend shows if the valve is working as real control valve and how wide the operation area is. This information can also be used to verify valve sizing.

- The histogram is updated all the time when the device is powered
- Divided into 12 sub-ranges, 1st and 12th sub-range represent closed and open positions.
- Valve is closed if position < 1 %
- Valve is open if position > 99 %

Valve position histogram trend shows two measured valve position histograms side by side: lifetime history of the valve position and the last three months. If the valve operation point has recently changed it can be seen in three months histogram.

Valve position histogram trend is especially useful when optimizing plant operation or replacing old control valves.

- If valve operation point is 80-90 % most of the time, then the valve could be too small for current application
- If valve operation point is 10-30 % most of the time, then the valve could be too big for current application
- Under normal process conditions, the ideal control area is 30-80 % (depends on valve type). If there is a need to define more accurate min. and max. values that can be done with Nelprof.
- Real working point should be checked with the installed flow curve with Nelprof.

This trend also shows if a valve is in on/off use. This means if a valve is fully closed or fully open most of the time. If you can see that a valve has been between 50-70 % for most of the time and that counters are showing that there are a lot of travels and reversals, there might be wearing in the valve or seals and/or actuator on that position.

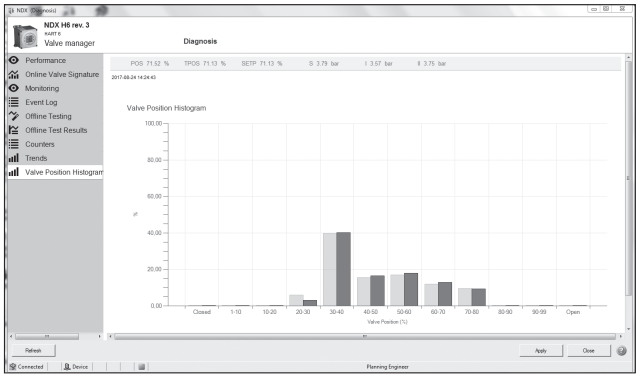


Fig. 80.

MAINTENANCE

GENERAL

The maintenance requirements for the NDX valve controller depend on the service conditions, for instance, the quality of instrument air. Under normal service conditions there is no requirement for regular maintenance.

WARNING
When maintaining the NDX, ensure that the supply air is shut off and pressure is released.

NOTE
Especially in corrosive environment like at or near sea it is recommended to use grease in aluminum housing female threads on the exterior of the device: main cover / pneumatics cover fixing screws and bracket bolts at the bottom side.
Grease with good corrosion preventive properties and washout resistance is recommended, for example Molykote BR 2 Plus has been successful in tests.

NOTE
When closing the cover, ensure that the cover seal is present in its groove.
Applies to standard and explosion proof models with a dark seal. The compact model has a white seal integrated in the cover.

NDX valve controller includes following interchangeable modules:

- Relay valve
- Prestage unit
- Local User Interface
- Electronics module (including optional PT)
- Pressure gauge block
- Main cover
- Relay cover
- Prestage cover (NDX1510_ only)
- Exhaust cover
- Prestage bottom filter assembly

ORDERING SPARE PARTS

Use the following order codes for NDX1510_:
H137041 PRESTAGE UNIT ASSEMBLY (Part number: 100)
H197244 MAIN COVER ASSEMBLY (Part number: 15)
NOTE: Please contact Valmet if device is manufacturer 2022 or earlier
H137045 RELAY COVER ASSEMBLY (Part number: 37)
H137047 PRESTAGE UNIT COVER ASSEMBLY (Part number: 42)
H137059 RELAY VALVE ASSEMBLY (Part number: 140)
H188640 LUI MODULE (Part number: 207)
H137256 SILENCERS, IP COVER 3/8" NPT WITH O-RING (Part number: 87)
H137258 PRESTAGE BOTTOM FILTER (Part number: 32)
H141371 PNEUMATIC SET (Includes e.g. prestage, filter and relay valve)
ELECTRONICS MODULE: Contact Valmet

Use the following order codes for NDX_511_:
H162178 RELAY COVER ASSEMBLY (Part number: 37)
H166049 RELAY VALVE ASSEMBLY for NDX1_ (Part number: 140)
H149515 RELAY VALVE ASSEMBLY for NDX2_ (Part number: 140)
H162063 PRESTAGE UNIT ASSEMBLY (Part number: 100)
H162064 MAIN COVER ASSEMBLY (Part number: 15)
H161999 SILENCERS IP COVER 3/8" NPT WITH O-RING (Part number: 87)
H188641 LUI MODULE (Part number: 207)
H162067 PNEUMATICS SET for NDX1511_ (Includes e.g. prestage and relay valve)
H162068 PNEUMATICS SET for NDX2511_ (Includes e.g. prestage and relay valve)
ELECTRONICS MODULE: Contact Valmet

Use the following order codes for NDX_512_:
H137045 RELAY COVER ASSEMBLY (Part number: 37)
H137059 RELAY VALVE ASSEMBLY for NDX1_ (Part number: 140)
H149515 RELAY VALVE ASSEMBLY for NDX2_ (Part number: 140)
H149508 PRESTAGE UNIT ASSEMBLY (Part number: 100)
H149509 MAIN COVER ASSEMBLY (Part number: 15)
H149512 SILENCERS IP COVER 3/8" NPT WITH O-RING (Part number: 87)
H188641 LUI MODULE (Part number: 207)
H149527 PNEUMATIC SET for NDX1512_ (Includes e.g. prestage and relay valve)
H149528 PNEUMATIC SET for NDX2512_ (Includes e.g. prestage and relay valve)
ELECTRONICS MODULE: Contact Valmet

REPLACING PARTS

Prestage

Prestage location:

- NDX1510_
  - under prestage cover with prestage symbol (Fig. 81)
- NDX_511_ and NDX_512_
  - under main cover and LUI module (Fig. 82)

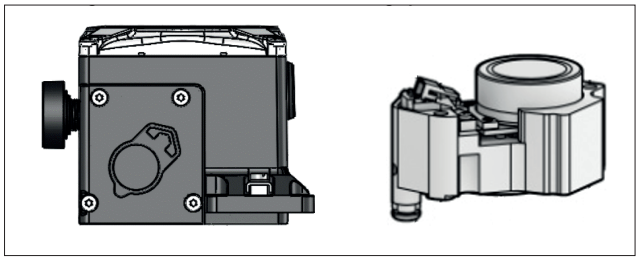


Fig. 81. NDX1510_ prestage location.

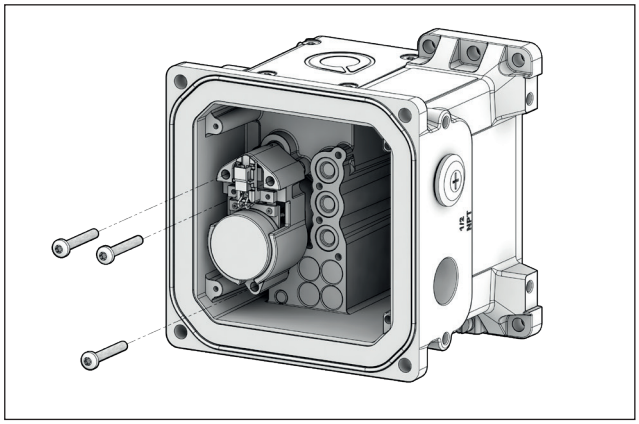


Fig. 82. NDX_511_ and NDX_512_ prestage location.

Removal of prestage

WARNING
Risk of injury. Ensure that supply pressure is shut off and actuator pressure is released prior to removal of the prestage.

MAINTENANCE

WARNING
The prestage must be handled carefully. Never touch the moving parts on the prestage and never rotate the nozzle. If the moving parts of the prestage are damaged, that may lead to reduced control performance of the device.

NOTE
It is recommended to replace both the prestage and the relay valve at the same time.

NOTE
It is recommended to also replace the filter and seal below the prestage (included in the spare parts kit). (Fig. 76)

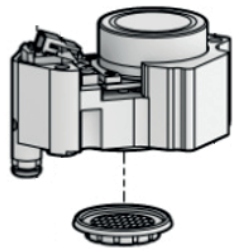


Fig. 83.

Compact version (NDX1510_):

- TX20, Pliers
  - Disconnect power from the device.
  - Shut off supply pressure and make sure that the actuator pressure is released.
  - Remove the device from the actuator mounting bracket if there is limited working space in front of the prestage cover (Disconnect the supply and actuator piping if device is needed to remove).
  - Loosen the prestage cover screws and remove the prestage cover. (Fig. 78)
  - Unplug the prestage wire connector from the prestage (Fig. 78)
  - Loosen the screws holding the prestage in place. (Fig. 78)
  - Pull out the prestage carefully. It is recommended to use pliers to grab the grooves on the sides of the prestage. Be careful not to touch the moving parts of the prestage. (Fig. 80)

Standard and explosion proof version (NDX_511_ and NDX_512_):

- PH2 (NDX_511_) or HEX6 (NDX_512_), TX8, TX20, Pliers
  - Disconnect power from the device.
  - Shut off supply pressure and make sure that the actuator pressure is released.
  - Remove the main cover by loosening 4 screws.
  - Loosen the display screws and remove display.
  - Unplug the prestage wire connector from the prestage (Fig. 79)
  - Loosen the screws holding the prestage in place. (Fig. 79)
  - Pull out the prestage carefully. It is recommended to use pliers to grab the grooves on the sides of the prestage. Be careful not to touch the moving parts of the prestage. (Fig. 81)

Installation of prestage

NOTE
Make sure there is no debris in the prestage shaft hole, eg. from the old o-ring. (Fig. 77)

Fig. 84.

NOTE
Check that the new o-ring is covered with lube to avoid damage. Use only o-ring lubes, which is delivered with the spare part set.

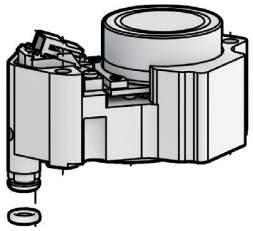


Fig. 85.

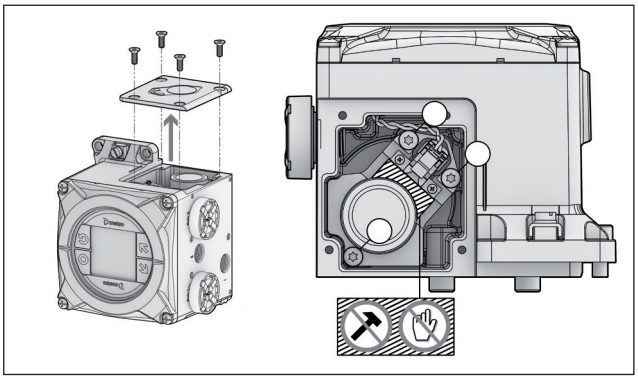


Fig. 86.

MAINTENANCE

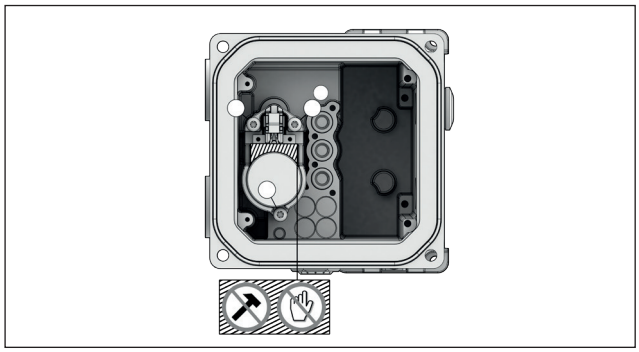


Fig. 87. NDX_511_ and NDX_512_

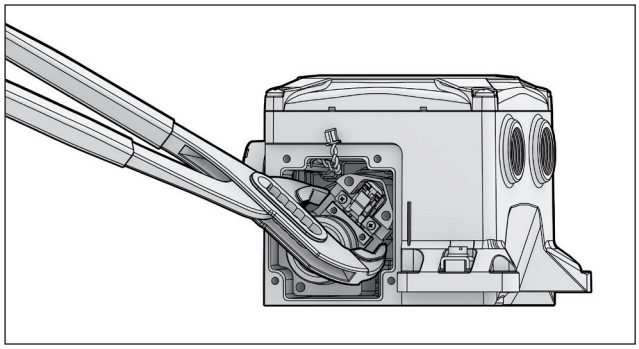


Fig. 88. NDX1510_ Pulling out prestage with pliers.

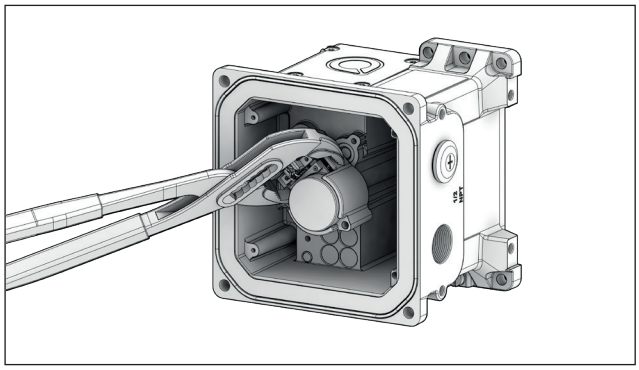


Fig. 89. NDX_511_ and NDX_512_ Pulling out prestage with pliers.

Compact version (NDX1510_):

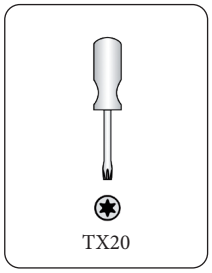
- TX20
- Press the prestage into place. Press in the marked positions mildly by hand. Do not use excessive force as this may indicate the prestage shaft is misaligned or the oring is not lubed.
  - Tighten the screws holding the prestage in place.
  - Push the prestage 2-wire connector into the socket on the prestage. The wire connector may only be fitted in the correct position.
  - Reinstall the prestage cover. Make sure the rubber seal is still in place on the cover and undamaged.
  - Tighten the prestage cover screws.
  - Turn on the supply pressure.
  - Reconnect electricity to the device.
  - When pneumatic components are replaced, device requires calibration.

Standard and explosion proof version (NDX_511_ and NDX_512_):

- TX20, TX8, PH2 (NDX_511_) or HEX6 (NDX_512_)
- Press the prestage into place. Press in the marked positions mildly by hand. Do not use excessive force as this may indicate the prestage shaft is misaligned or the oring is not lubed.
  - Tighten the screws holding the prestage in place.
  - Push the prestage 2-wire connector into the socket on the prestage. The wire connector may only be fitted in the correct position.
- Reinstall the display.Tighten the display screws.
  - Reinstall the main cover. Tighten the cover screws.
  - Turn on the supply pressure.
  - Reconnect electricity to the device.
  - When pneumatic components are replaced, device requires calibration.

Relay valve

Relay valve is located under cover with following symbol:



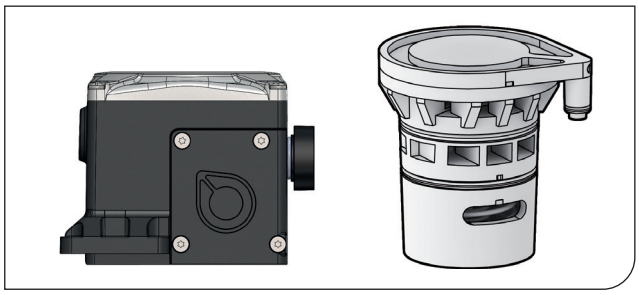


Fig. 90.

Removal of relay valve

WARNING
Risk of injury. Ensure that supply pressure is shut off and actuator pressure is released prior to opening the cover and removal of the relay valve.

NOTE
Relay valve should not be cleaned or opened. If needed, just replace relay valve with new one.

MAINTENANCE

NOTE
It is recommended to replace both the prestage and the relay valve at the same time.

- Disconnect power from the device.
- Shut off supply pressure and make sure that the actuator pressure is released.
- Remove the device from the actuator mounting bracket if there is limited working space in front of the prestage cover (Disconnect the supply and actuator piping if the device has to be removed).
- Loosen the relay valve cover screws.
- Remove the relay valve. It is recommended to use two screwdrivers as levers to crank out the relay valve.

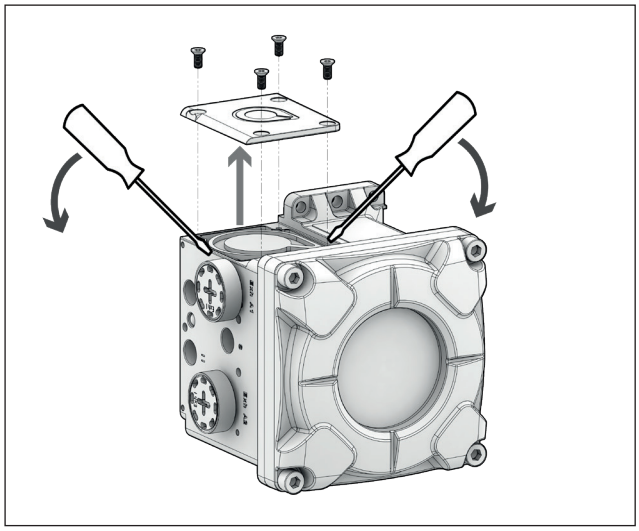


Fig. 91. NDX_512_

Installation of relay valve

NOTE
Make sure there is no debris in the small shaft hole, eg. from the o-ring of the removed relay valve. (see picture)

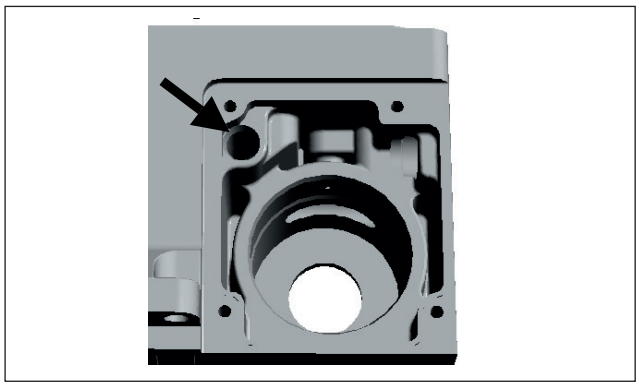


Fig. 92.

WARNING
Do not use any tools to install the relay valve. It can be pushed in place by hand.

- Align the small and large shaft in corresponding holes. Press the relay valve into the holes with a light continuous force. Do not use excessive force as this may indicate the relay valve is misaligned or the o-rings are not lubed.
- Re-install the relay valve cover. Make sure the rubber seal is still in place on the cover and undamaged.
- Tighten the prestage cover screws.
- Turn on the supply pressure.
- Reconnect electricity to the device.
- When pneumatic components are replaced, device requires calibration.

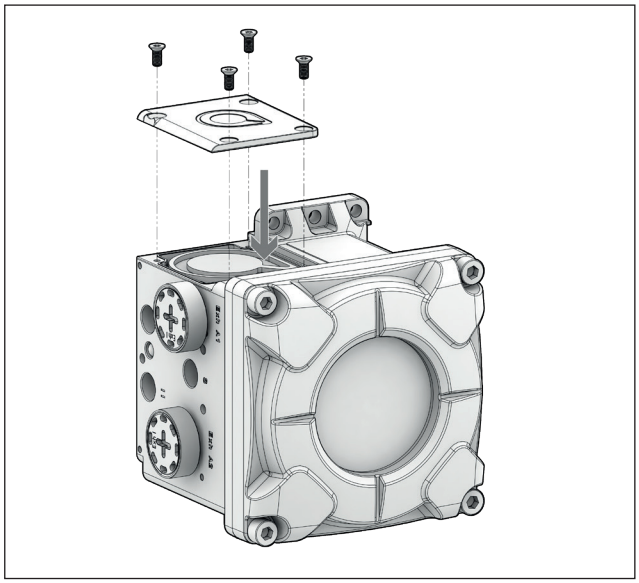


Fig. 93. NDX_512_

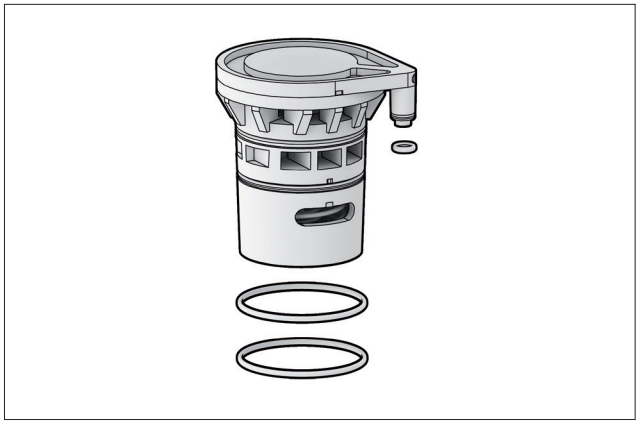


Fig. 94.

MAINTENANCE

Local User Interface

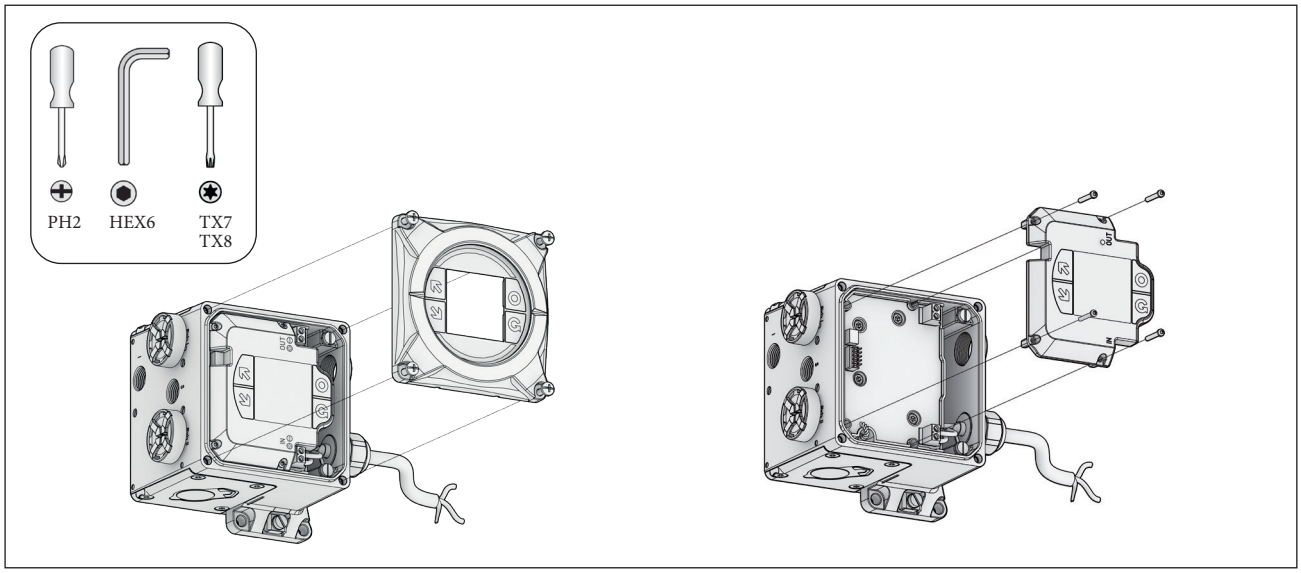


Fig. 95. NDX1510_

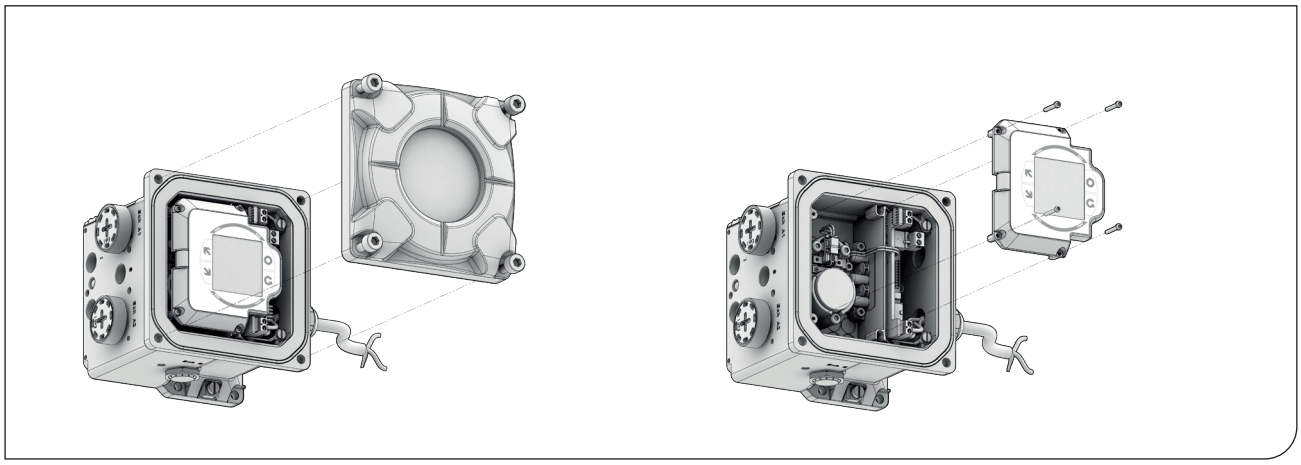


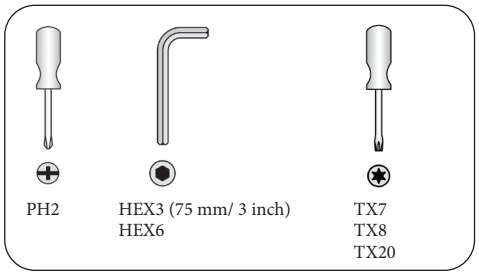
Fig. 96. NDX_511_ and NDX_512_

Tools for NDX1510_: PH2, TX7
Tools for NDX_511_: PH2, TX8
Tools for NDX_512_: HEX6, TX8

- Remove the main cover by loosening 4 screws.
- Loosen the display screws.
- Remove display. Display can be changed when power is on and device is under control. Replacing the display does not affect valve position. Note that there might be other regulations which prevents opening cover when process is running or power is connected.
- Mount new display and tighten the screws.
- Mount main cover and tighten the screws.

WARNING
(Flameproof/Explosion Proof version)
Tightening torque for the housing cover screws is 15Nm.

Electronics module



Tools for NDX1510_: PH2, TX7, TX20 (60 mm / 2,5 inch reach required)
Tools for NDX_511_: PH2, TX8, HEX3 (75 mm / 3 inch reach required)
Tools for NDX_512_: HEX6, TX8, HEX3 (75 mm / 3 inch reach required), PH2

MAINTENANCE

Disconnect power from the device

- Shut off supply pressure and make sure that the actuator pressure is released.
- Remove the device from the actuator mounting bracket if there is limited working space in front of the prestage cover (Disconnect the supply and actuator piping if device is needed to remove).
- Remove the main cover by loosening 4 screws.

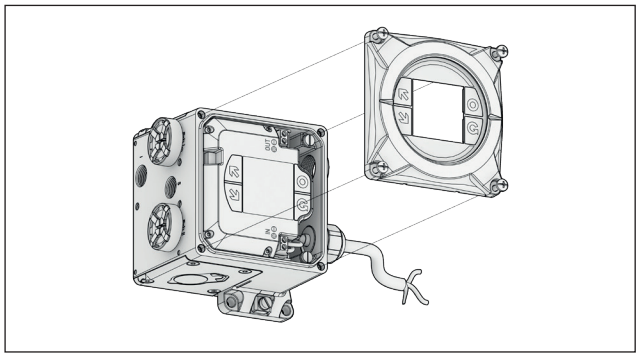


Fig. 97. NDX1510_

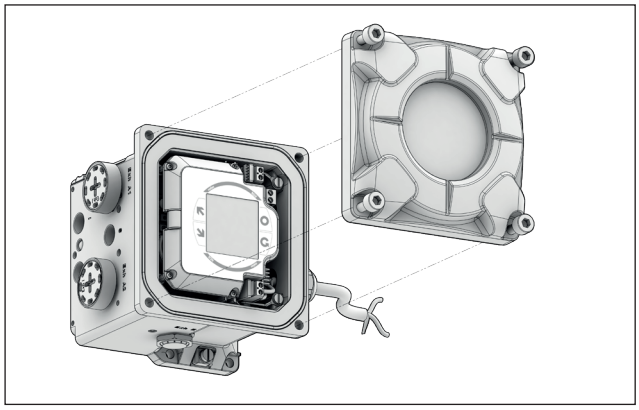


Fig. 98. NDX_511_ and NDX_512_

- Loosen the display screws and remove display. (Fig 99, Fig 100)

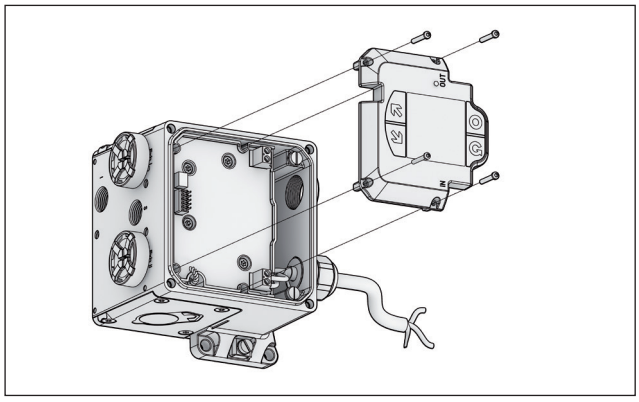


Fig. 99. NDX1510_

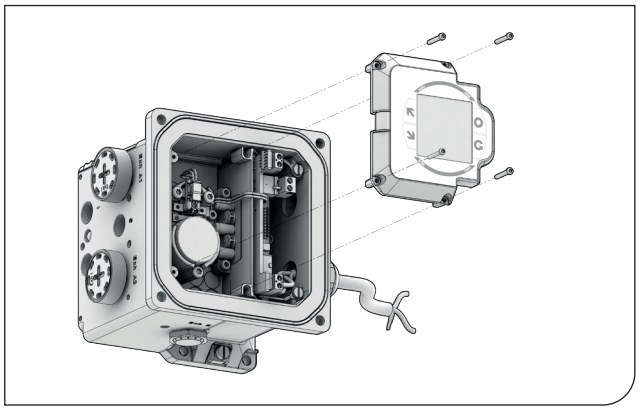


Fig. 100. NDX_511_ and NDX_512_

- Loosen the prestage cover screws and remove the prestage cover (Fig 101, applies to NDX1510_ only)
- Unplug the prestage wire connector from the prestage.

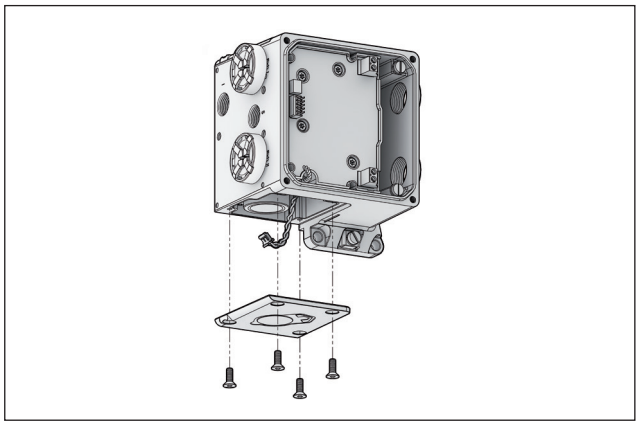


Fig. 101. NDX_510_

- Loosen the electronics module screws and grounding screws, then remove the electronics module. (Fig 102, Fig 103)

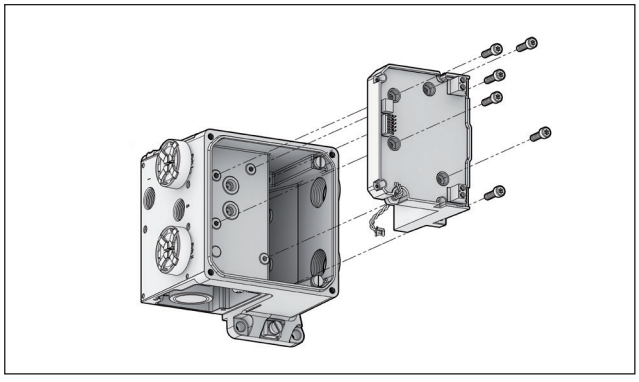


Fig. 102. NDX_510_

MAINTENANCE

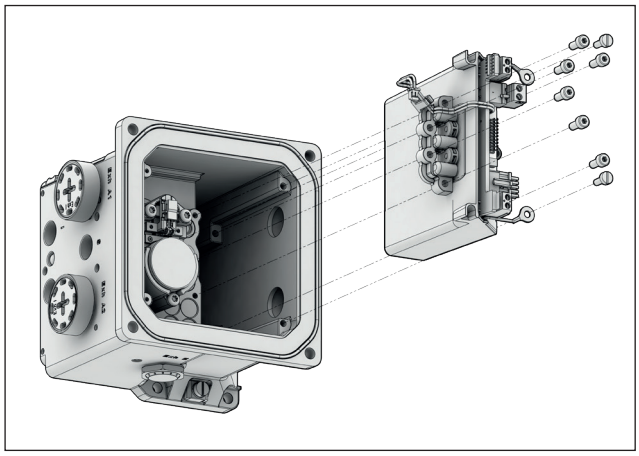


Fig. 103. NDX_511_ and NDX_512_

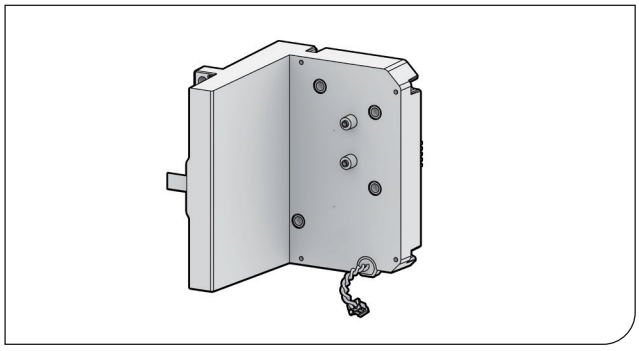


Fig. 104. Pressure sensors on the electronics module of NDX_510_.

NOTE

There are pressure sensors on the electronics module. Handle it carefully, specially the pressure sensors. (Fig 96)

NOTE (NDX_510_ only)

When installing new electronics module, install rubber gasket carefully. If there is water in supply air, this gasket prevents water access to the electronics.

- Mount new electronics module and tighten the electronics module screws and grounding screws (NDX_511_ & NDX_512_).
- Plug the prestage wire connector to the prestage.
- Reinstall the prestage cover and tighten the screws.
- Mount new display and tighten the screws.
- Mount main cover and tighten the screws.

WARNING
(Flameproof/Explosion Proof version)

Tightening torque for the housing cover screws is 15Nm.

REPLACING OPTIONS

Pressure Gauge Block

Follow instructions in chapter 11.1 Pressure Gauge Block installation.

DIMENSION DRAWINGS

NDX1510

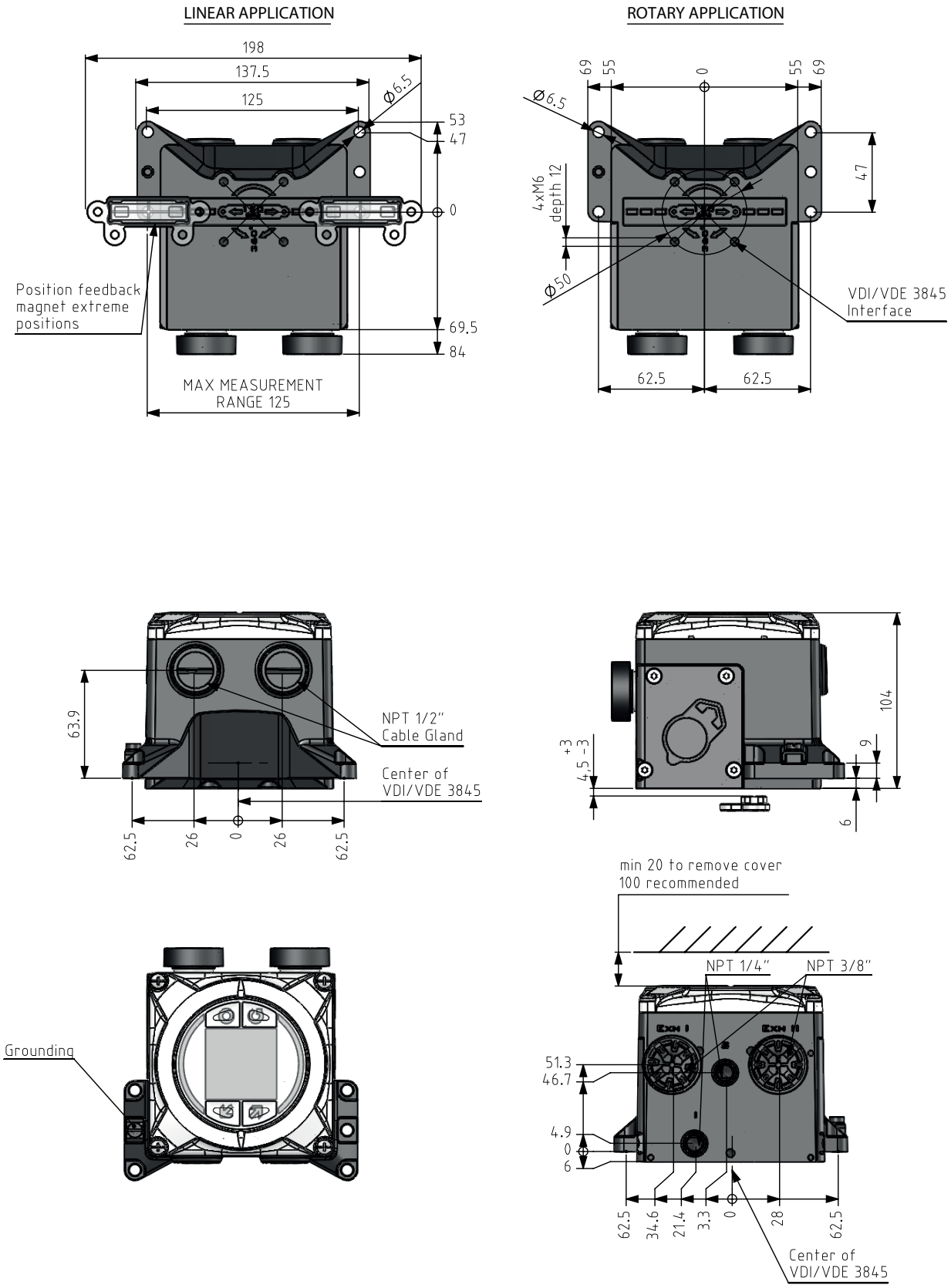


Fig. 105.

DIMENSION DRAWINGS

NDX_512_

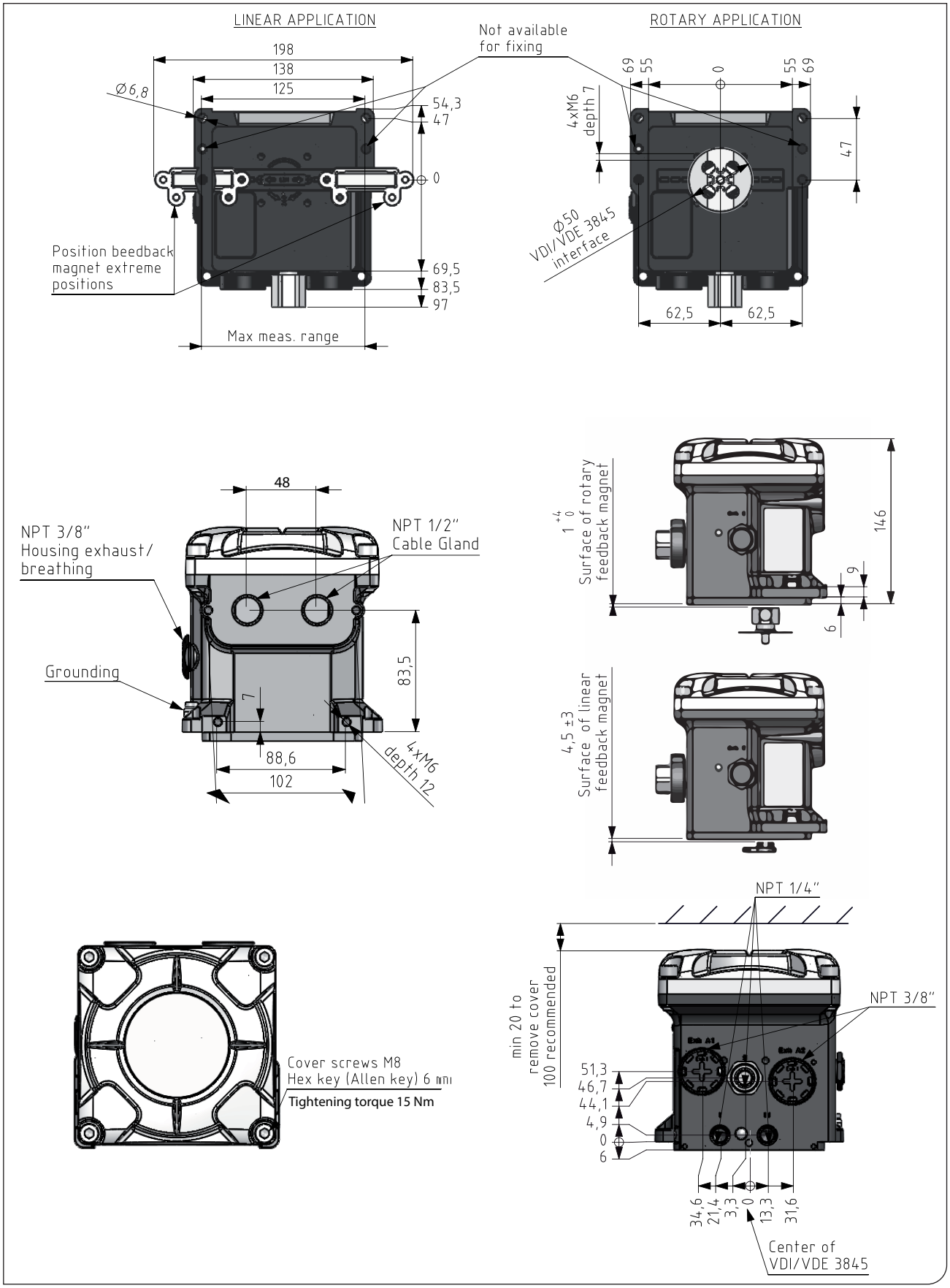


Fig. 106.

DIMENSION DRAWINGS

POSITION FEEDBACK MAGNETS FOR LINEAR AND ROTARY ACTUATORS

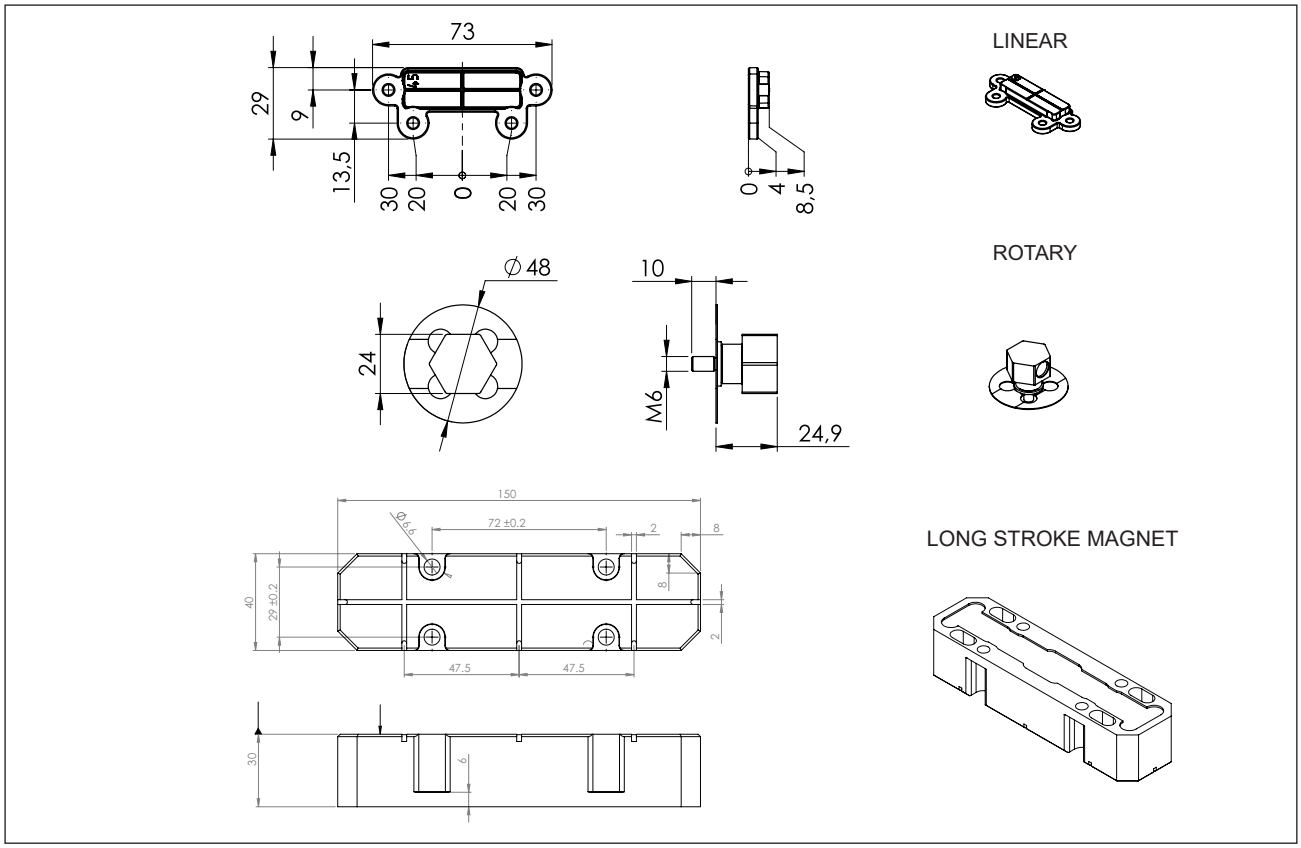


Fig. 107. NDX1510_

PRESSURE GAUGE BLOCK

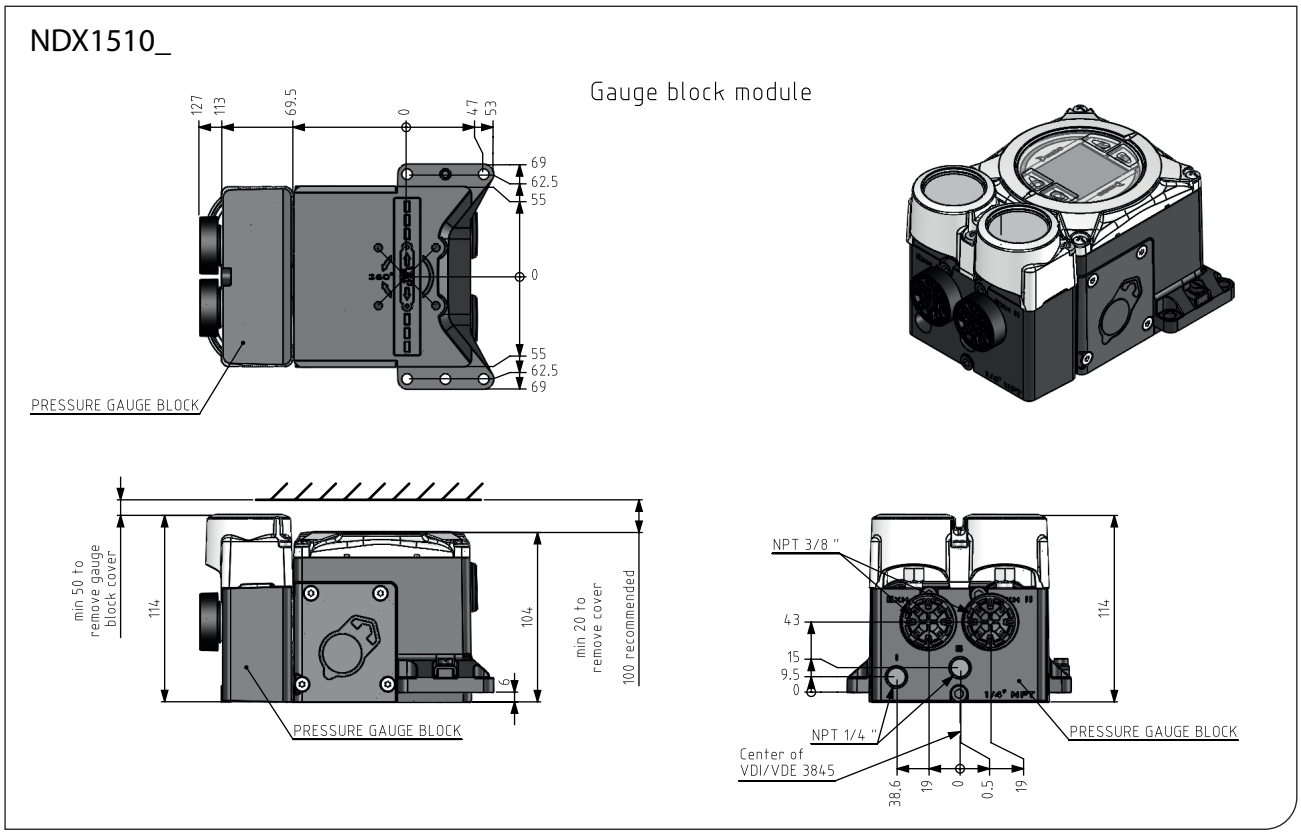


Fig. 108. NDX1510_

DIMENSION DRAWINGS

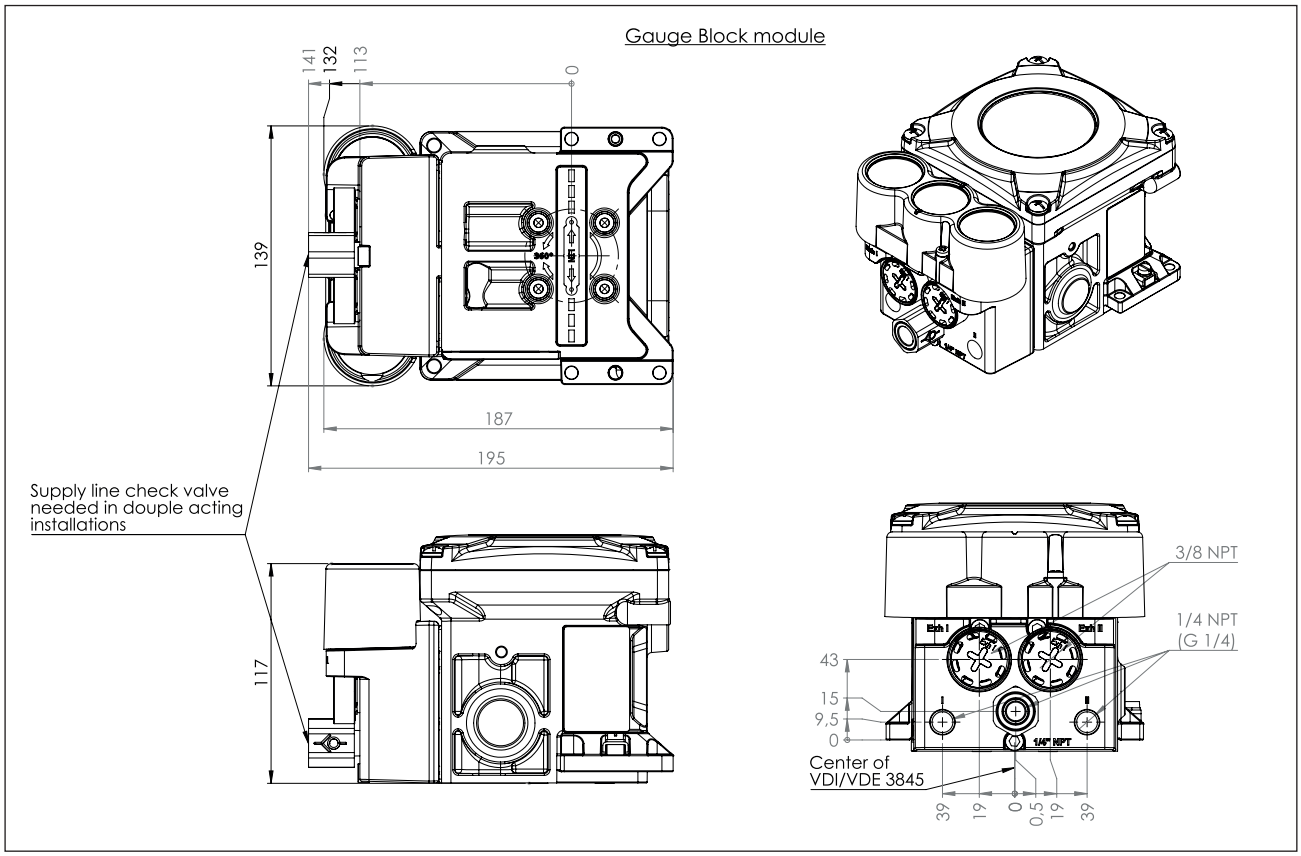


Fig. 109. NDX_511_

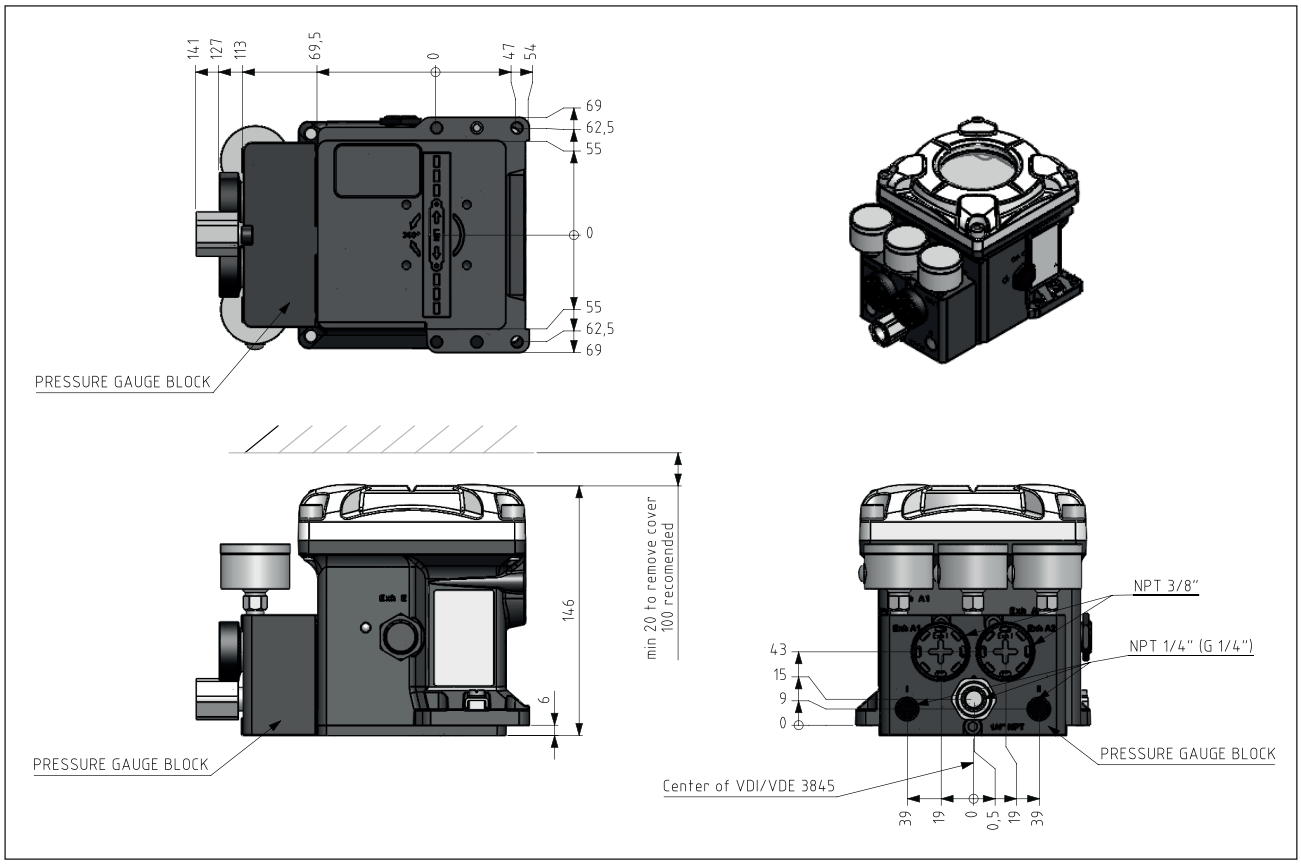


Fig. 110. NDX_512_

EU DECLARATION OF CONFORMITY

Manufacturer:
Valmet Flow Control Oy (* Neles Finland Oy)
Vanha Porvoontie 229
FI-01380 Vantaa
Finland

Product: **NELES™ NDX™ INTELLIGENT VALVE CONTROLLER**
Approvals:

Type	Approval	EC Type examination Certificate
NDX HART, enclosure options 0, 1 or 2	II 1G Ex ia IIC T6…T4 Ga II 1D Ex ia IIIC T_{200}85 °C…T_{200}115 °C Da IP66 or II 2G Ex ib IIC T6…T4 Gb II 2D Ex ib IIIC T_{200}85 °C…T_{200}115 °C IP66	EESF 21 ATEX 018X EN IEC 60079-0:2018/A11:2024 EN 60079-11:2012 IEC 60079-11:2023 Edition 7.0
	II 3 G Ex ic IIC T6…T4 Gc II 3 G Ex ec IIC T6…T4 Gc II 3 D Ex ic IIIC T85 °C…T115 °C Dc IP66	EESF 21 ATEX 019X EN IEC 60079-0:2018/A11:2024 EN 60079-11:2012 IEC 60079-11:2023 Edition 7.0 EN 60079-7:2015/A11:2024
NDX FF, enclosure option 1	II 1G Ex ia IIC T6…T4 Ga II 1D Ex ia IIIC T200 85 °C…T200 115 °C Da II 2G Ex ib IIC T6…T4 Gb II 2D Ex ib IIIC T200 85 °C…T200 115 °C Db FISCO field device IP66	EESF 24 ATEX 031X EN IEC 60079-0:2018 EN 60079-11:2012 / IEC 60079-11:2023
	II 3G Ex ic IIC T6…T4 Gc II 3D Ex ic IIIC T85 °C…T115 °C Dc FISCO field device II 3G Ex ec IIC T6…T4 Gc IP66	EESF 24 ATEX 034X EN IEC 60079-0:2018 EN 60079-11:2012 / IEC 60079-11:2023 IEC 60079-7:2015/ A1:2018
NDX HART, enclosure option 2 *	II 2GD Ex db IIC T* Gb Ex tb IIIC T85…T113°C Db T4: -40°C to +85°C T5: -40°C to +72°C T6: -40°C to +57°C IP66	Sira 17ATEX1283X EN 60079-0: 2012 (+A11:2013), EN 60079-1: 2014, EN 60079-31:2014

As the products within our sole responsibility of design and manufacture may be used as parts or components in machinery and are not alone performing functions as described in Article 6(2) in the Machinery Directive (2006/42/EC), we declare that our product(s) to which this Declaration of Conformity relates must NOT be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive.
The product above is manufactured in compliance with the applicable European directives and technical specifications/standards.
Protection from e.g. static electricity caused by the process or connected equipment must be considered by the user (EN 60079-14 §6).
The product do not possess any residual risk according to hazard analyses made under the applicable directives providing that the procedures stated by the Installation, Operation and Maintenance manual are followed and the product is used under conditions mentioned in the technical specifications.

Applicable directives:

EMC 2014/30/EU	Electrical
ATEX 2014/34/EU	Approved and Ex marked types

ATEX Notified Bodies for EC Type Examination Certificate:

SIRA (Notified body number 0518)
SIRA Certification Service
CSA Group
Unit 6, Hawarden lndustrial Park
Hawarden, Deeside, CH5 3US
United Kingdom

EESF (Notified body number 0537)
Eurofins Electric & Electronics Finland Oy
Kivimiehentie 4
FI-02150 Espoo
Finland

ATEX Notified Body for Quality Assurance:

ISO 9001:2015	Certificate No: LRQA ISO 9001 - 00040885
ATEX 2014/34/EU	Certificate No: Presafe 18 ATEX 91983Q

DNV GL Presafe AS (Notified body number 2460)
Veritasveien 3
1363 Høvik
Norway

Vantaa, 11th December 2024

Janne Jussila, Quality Manager
Authorized person of the manufacturer within the European Community

CONTROL WIRINGS

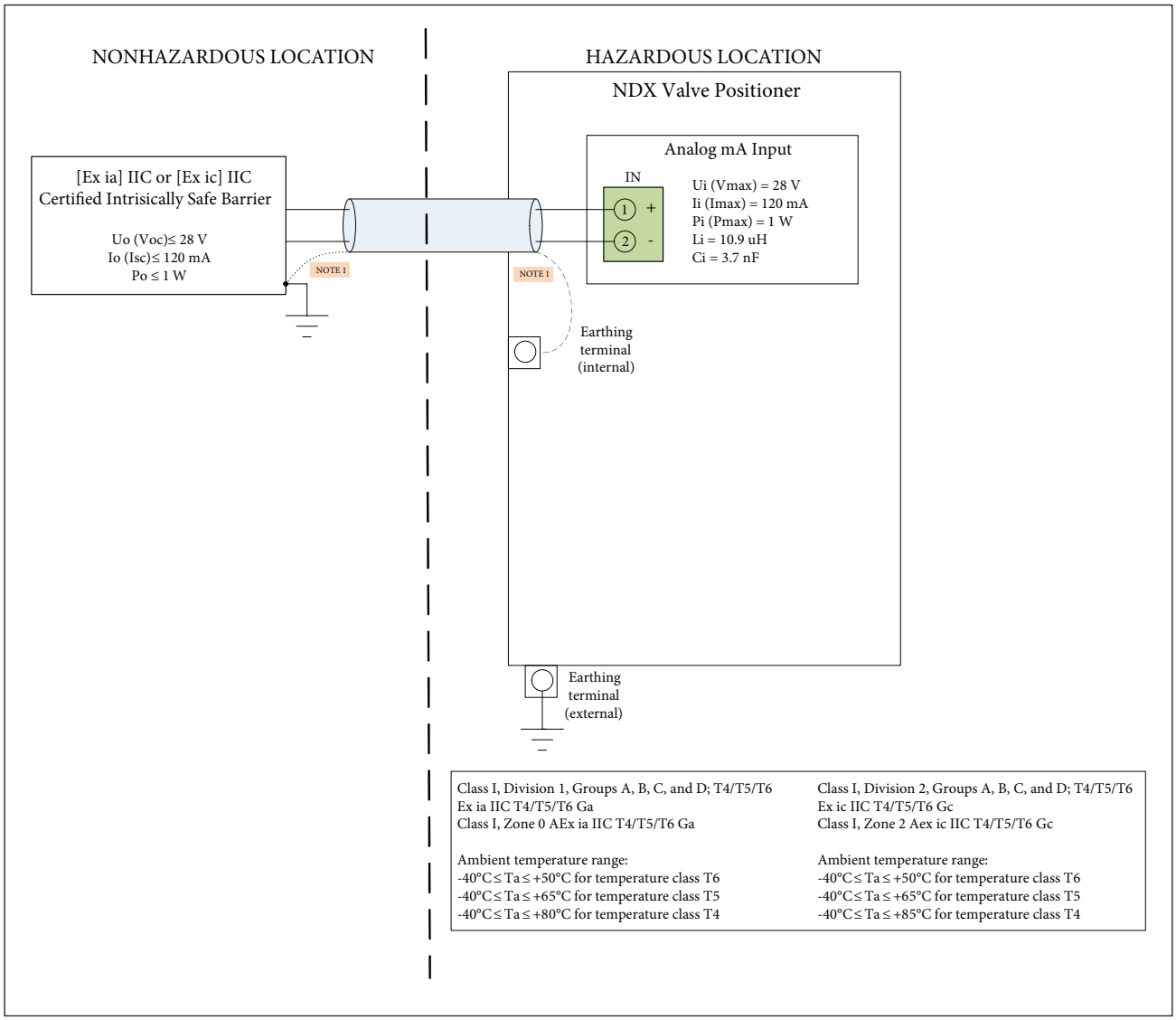


Fig. 111. Control wiring diagram F105207, NDX1510_H, Ex i

Notes

1. By default, the screen of the cable is connected to earth either at the barrier (dotted line) or at the earthing terminal inside NDX enclosure (dash line). If the screen is connected to earth at both ends of the cable, the potential equalization of the system shall conform to requirements of IEC 60079-14:2013 Clause 16.2.3.
2. For installation in accordance with this figure, the intrinsically safe barrier must be certified by an accredited agency.
3. The following conditions must be satisfied:
   Uo (Voc) <= Ui (Vmax) Co (Ca) >= Ci + Ccable
   Io (Isc) <= Ii (Imax) Lo (La) >= Li + Lcable
   Po <= Pi (Pmax)
4. Maximum non-hazardous area voltage must not exceed 250 V.
5. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
6. See user manual for installation conditions.
7. Use [Ex ia] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 1, Groups A, B, C, and D;
Ex ia IIC Ga
Class I, Zone 0 AEx ia IIC Ga

Or

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

, and use [Ex ic] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

CONTROL WIRINGS

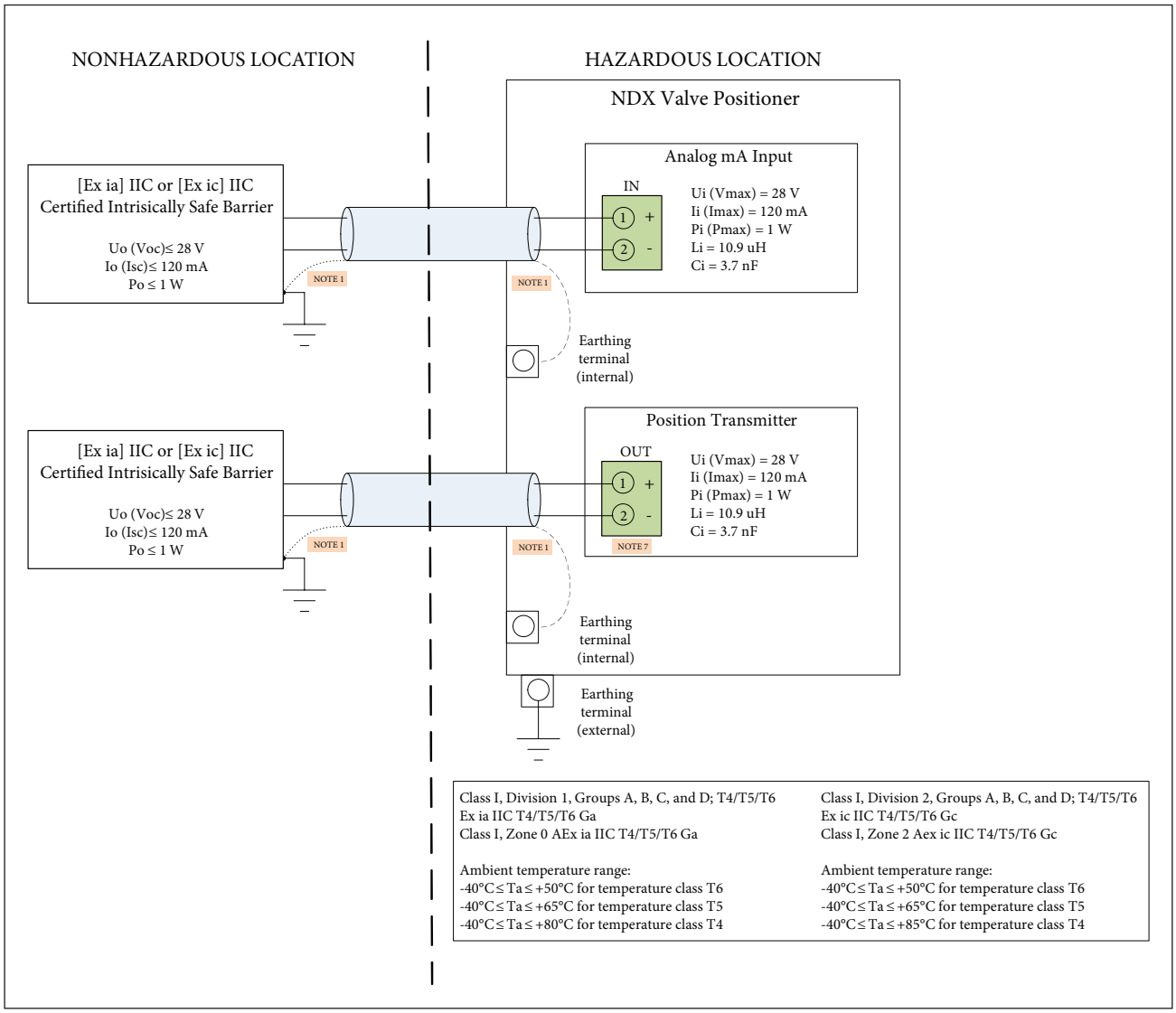


Fig. 112. Control wiring diagram F105207, NDX1510_T, Ex i

Notes

1. By default, the screen of the cable is connected to earth either at the barrier (dotted line) or at the earthing terminal inside NDX enclosure (dash line). If the screen is connected to earth at both ends of the cable, the potential equalization of the system shall conform to requirements of IEC 60079-14:2013 Clause 16.2.3.
2. For installation in accordance with this figure, the intrinsically safe barrier must be certified by an accredited agency.
3. The following conditions must be satisfied:
   Uo (Voc) <= Ui (Vmax) Co (Ca) >= Ci + Ccable
   Io (Isc) <= Ii (Imax) Lo (La) >= Li + Lcable
   Po <= Pi (Pmax)
4. Maximum non-hazardous area voltage must not exceed 250 V.
5. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
6. See user manual for installation conditions.
7. Use [Ex ia] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 1, Groups A, B, C, and D;
Ex ia IIC Ga
Class I, Zone 0 AEx ia IIC Ga

Or

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

, and use [Ex ic] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

CONTROL WIRINGS

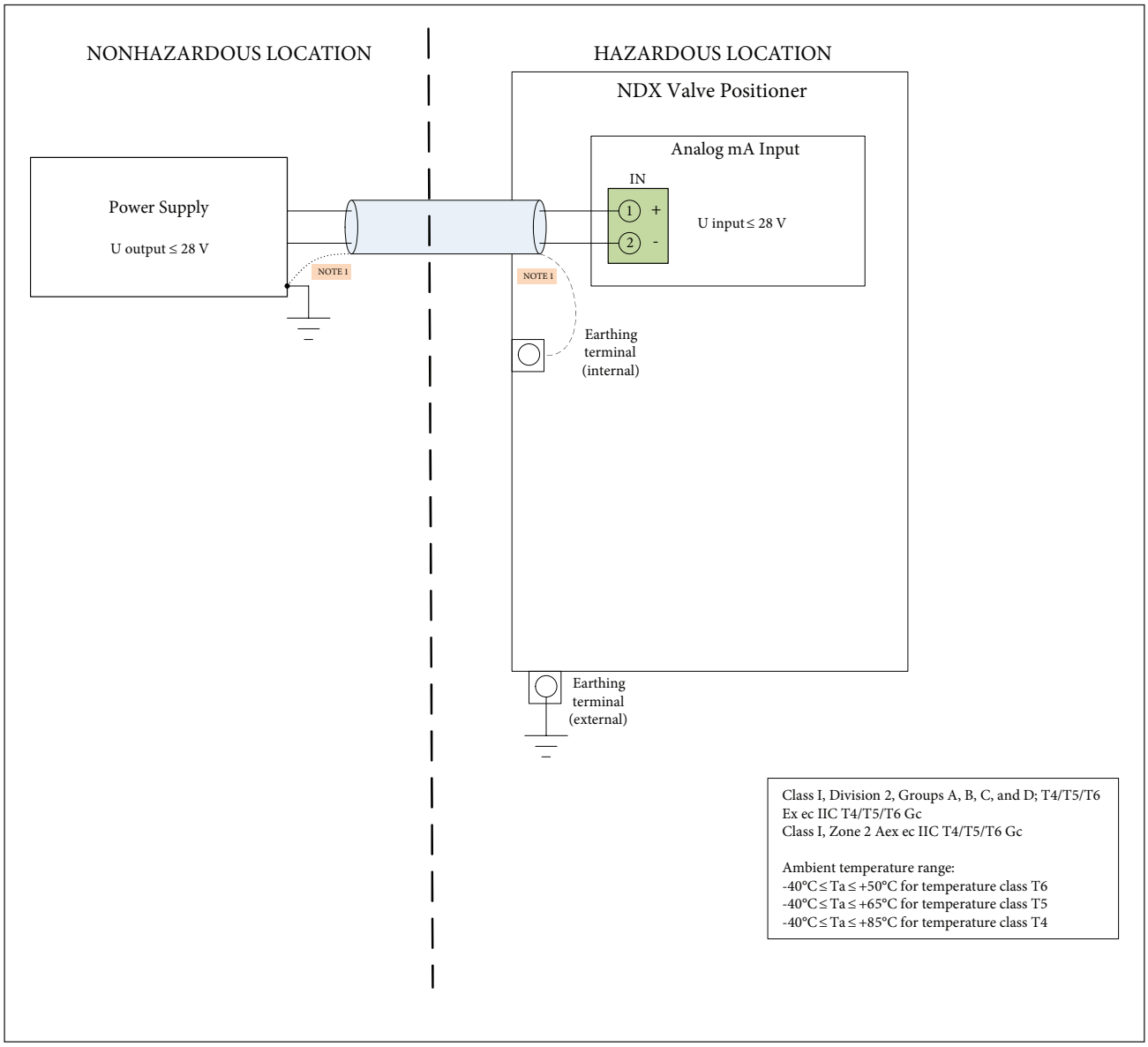


Fig. 113. Control wiring diagram F105207, NDX1510_H, Ex ec

Notes
1. By default, the screen of the cable is connected to earth either at the power supply (dotted line) or at the earthing terminal inside NDX enclosure (dash line).
2. The following conditions must be satisfied: U output <= U input
3. Maximum non-hazardous area voltage must not exceed 250 V.
4. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
5. See user manual for installation conditions.

CONTROL WIRINGS

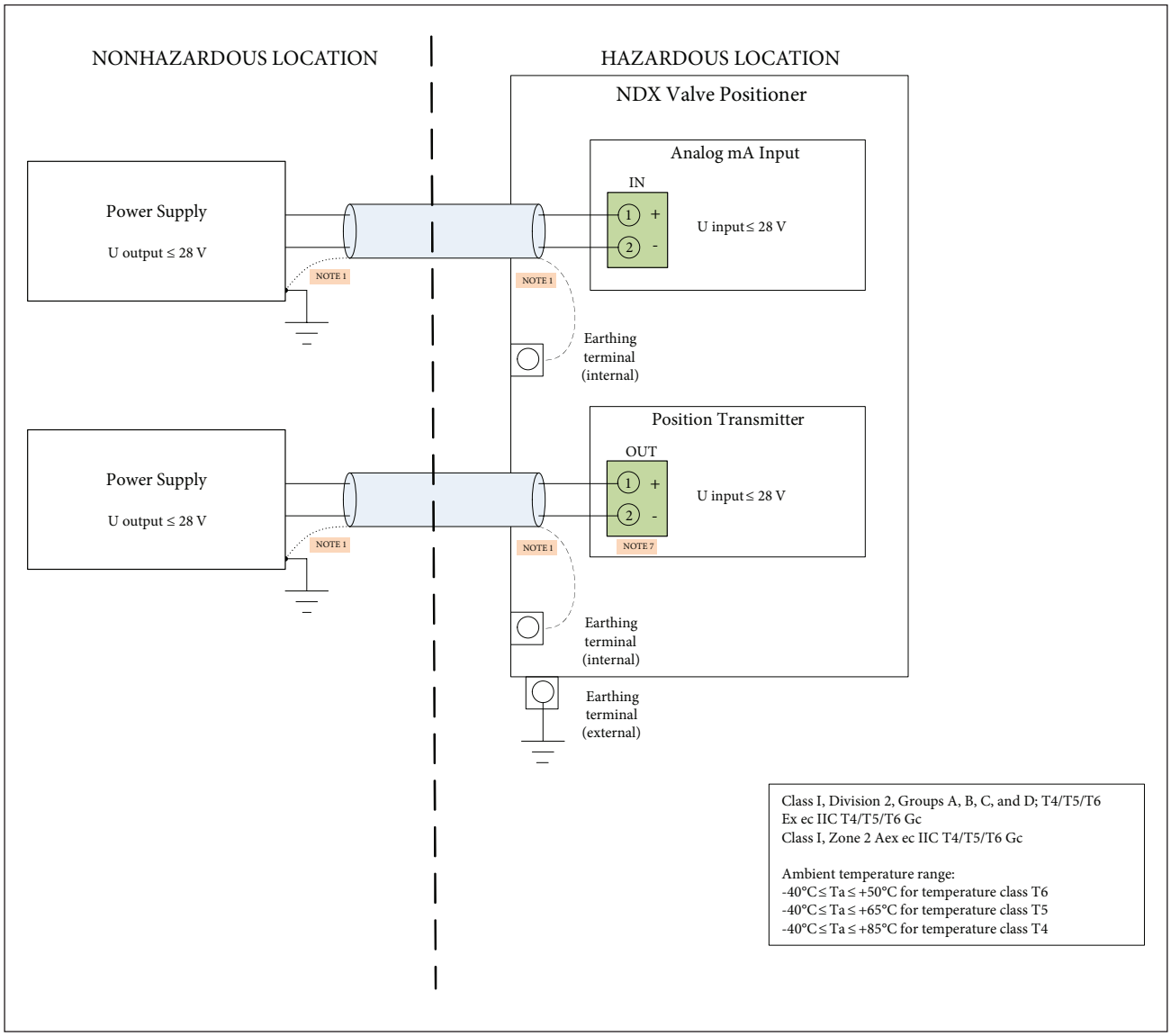


Fig. 114. Control wiring diagram F105207, NDX1510_T, Ex ec

Notes
1. By default, the screen of the cable is connected to earth either at the power supply (dotted line) or at the earthing terminal inside NDX enclosure (dash line).
2. The following conditions must be satisfied: U output <= U input
3. 3. Maximum non-hazardous area voltage must not exceed 250 V.
4. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
5. See user manual for installation conditions.

CONTROL WIRINGS

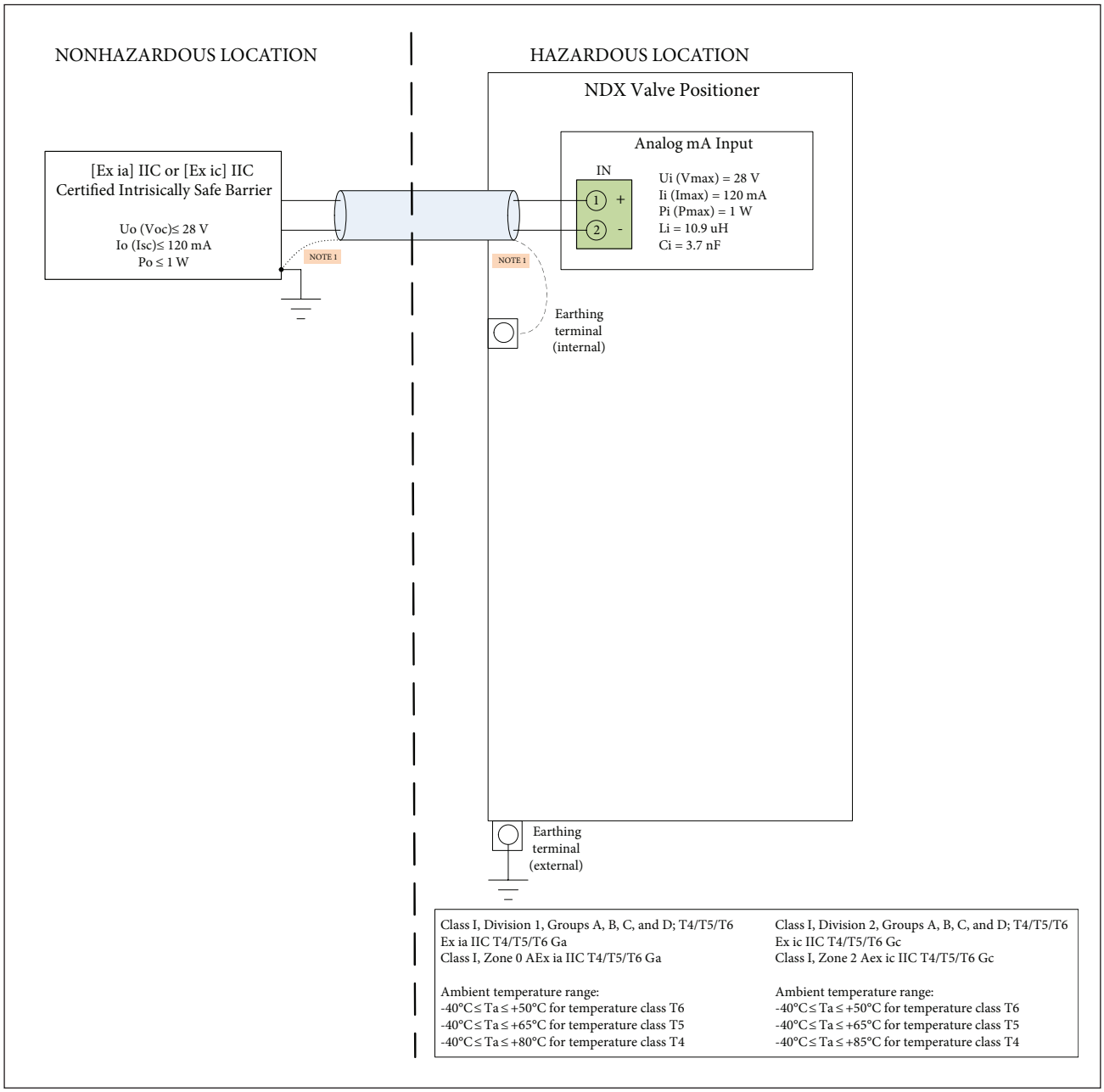


Fig. 115. Control wiring diagram F105208, NDX_511H_ and NDX_512H_, Ex i

Notes

1. By default, the screen of the cable is connected to earth either at the barrier (dotted line) or at the earthing terminal inside NDX enclosure (dash line). If the screen is connected to earth at both ends of the cable, the potential equalization of the system shall conform to requirements of IEC 60079-14:2013 Clause 16.2.3.
2. For installation in accordance with this figure, the intrinsically safe barrier must be certified by an accredited agency.
3. The following conditions must be satisfied:
   Uo (Voc) <= Ui (Vmax) Co (Ca) >= Ci + Ccable
   Io (Isc) <= Ii (Imax) Lo (La) >= Li + Lcable
   Po <= Pi (Pmax)
4. Maximum non-hazardous area voltage must not exceed 250 V.
5. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
6. See user manual for installation conditions.
7. Use [Ex ia] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 1, Groups A, B, C, and D;
Ex ia IIC Ga
Class I, Zone 0 AEx ia IIC Ga

Or

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

, and use [Ex ic] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

CONTROL WIRINGS

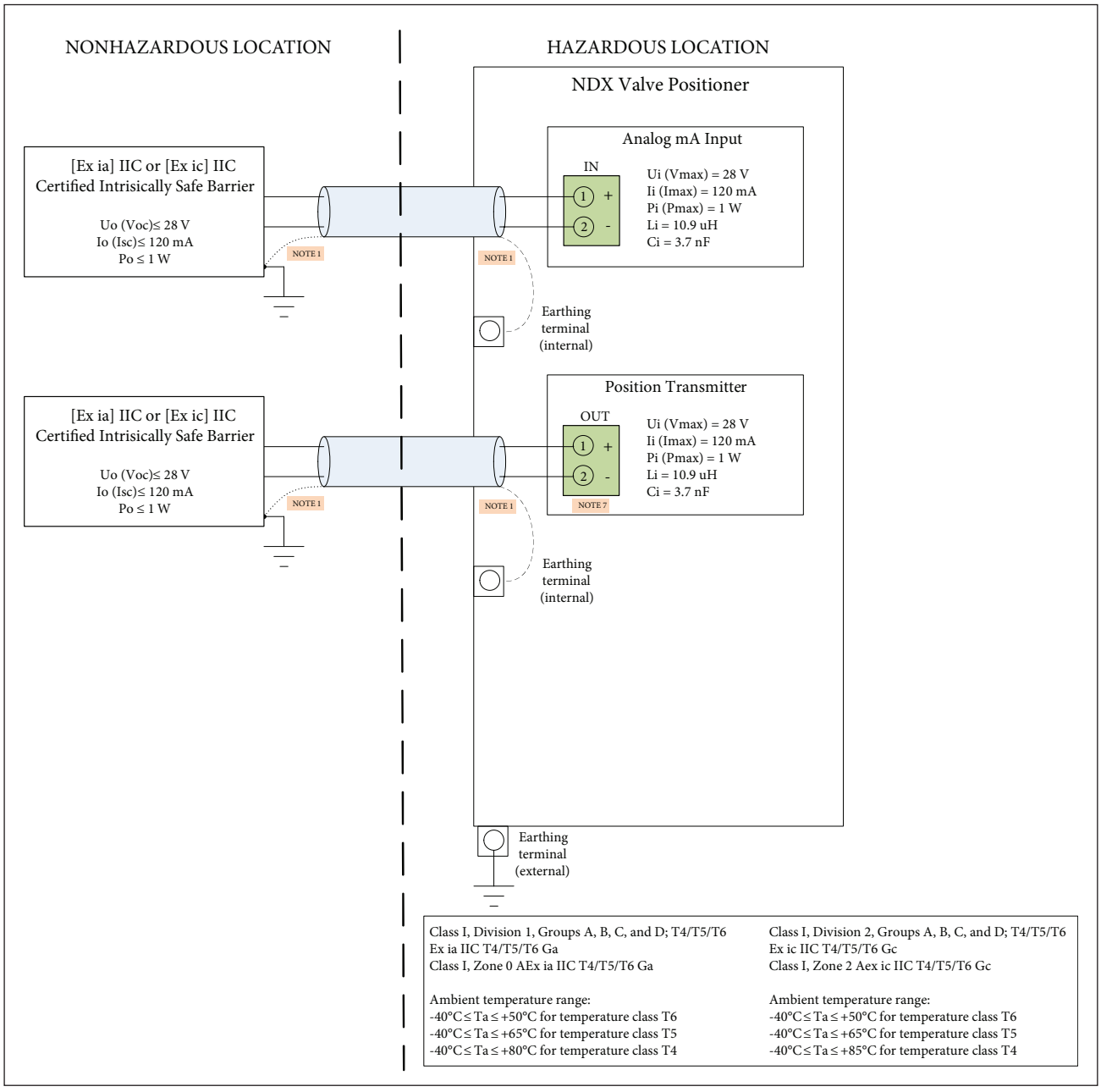


Fig. 116. Control wiring diagram F105208, NDX_511T_ and NDX_512T_, Ex i

Notes

1. By default, the screen of the cable is connected to earth either at the barrier (dotted line) or at the earthing terminal inside NDX enclosure (dash line). If the screen is connected to earth at both ends of the cable, the potential equalization of the system shall conform to requirements of IEC 60079-14:2013 Clause 16.2.3.
2. For installation in accordance with this figure, the intrinsically safe barrier must be certified by an accredited agency.
3. The following conditions must be satisfied:
   Uo (Voc) <= Ui (Vmax) Co (Ca) >= Ci + Ccable
   Io (Isc) <= Ii (Imax) Lo (La) >= Li + Lcable
   Po <= Pi (Pmax)
4. Maximum non-hazardous area voltage must not exceed 250 V.
5. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
6. See user manual for installation conditions.
7. Use [Ex ia] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 1, Groups A, B, C, and D;
Ex ia IIC Ga
Class I, Zone 0 AEx ia IIC Ga

Or

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

, and use [Ex ic] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

CONTROL WIRINGS

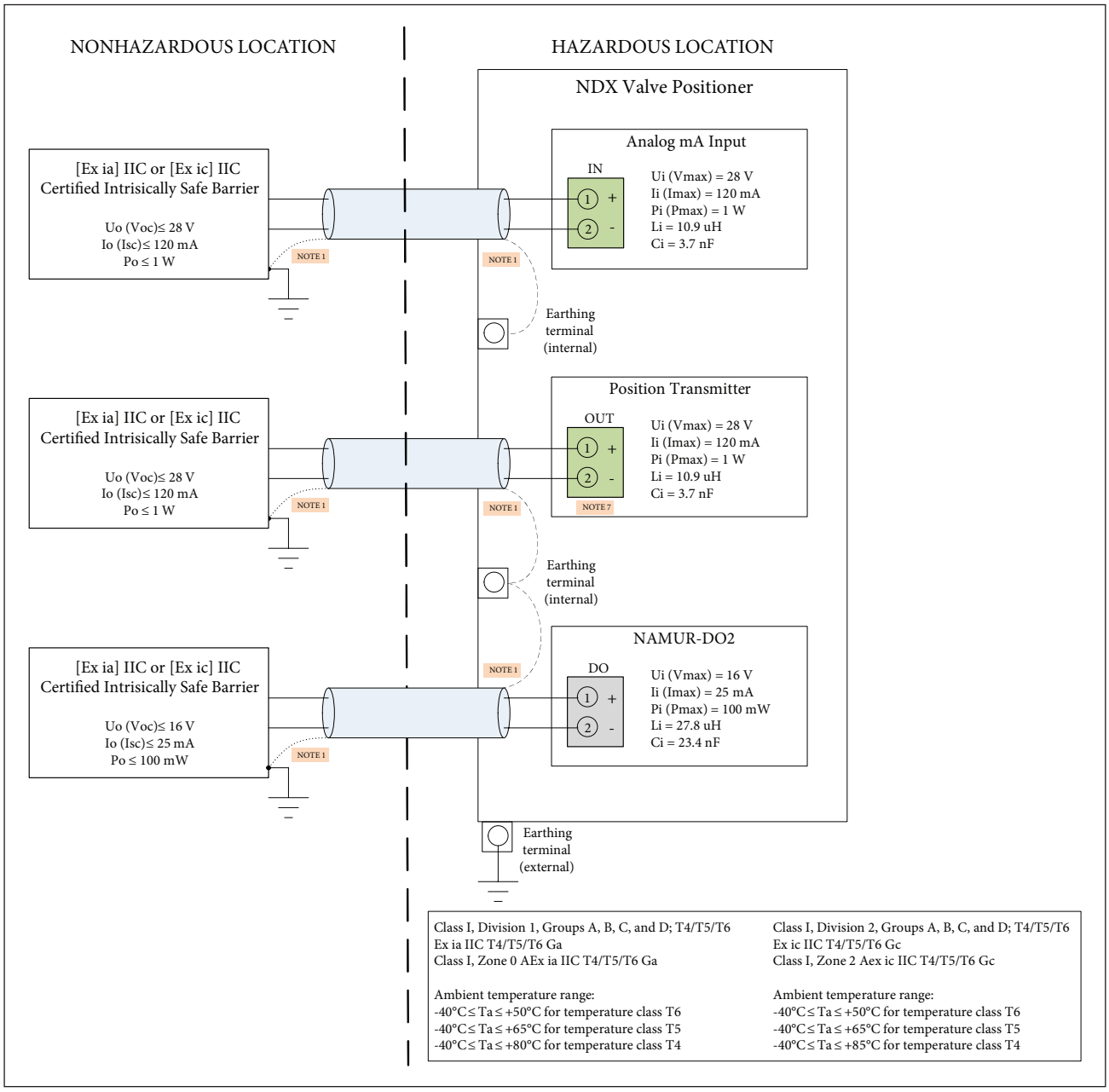


Fig. 117. Control wiring diagram F105208, NDX_511L_ and NDX_512L_, Ex i

Notes

1. By default, the screen of the cable is connected to earth either at the barrier (dotted line) or at the earthing terminal inside NDX enclosure (dash line). If the screen is connected to earth at both ends of the cable, the potential equalization of the system shall conform to requirements of IEC 60079-14:2013 Clause 16.2.3.
2. For installation in accordance with this figure, the intrinsically safe barrier must be certified by an accredited agency.
3. The following conditions must be satisfied:
   Uo (Voc) <= Ui (Vmax) Co (Ca) >= Ci + Ccable
   Io (Isc) <= Ii (Imax) Lo (La) >= Li + Lcable
   Po <= Pi (Pmax)
4. Maximum non-hazardous area voltage must not exceed 250 V.
5. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
6. See user manual for installation conditions.
7. Connector OUT is used for PT interface in variant HART with PT and DO and for NAMUR-DO1 interface in variant HART with dual DO. Connector OUT is coded by different colours in these variants to indicate different interface parameter values in PT usage and NAMUR-DO1 usage.
8. Use [Ex ia] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 1, Groups A, B, C, and D;
Ex ia IIC Ga
Class I, Zone 0 AEx ia IIC Ga

Or

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

, and use [Ex ic] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

CONTROL WIRINGS

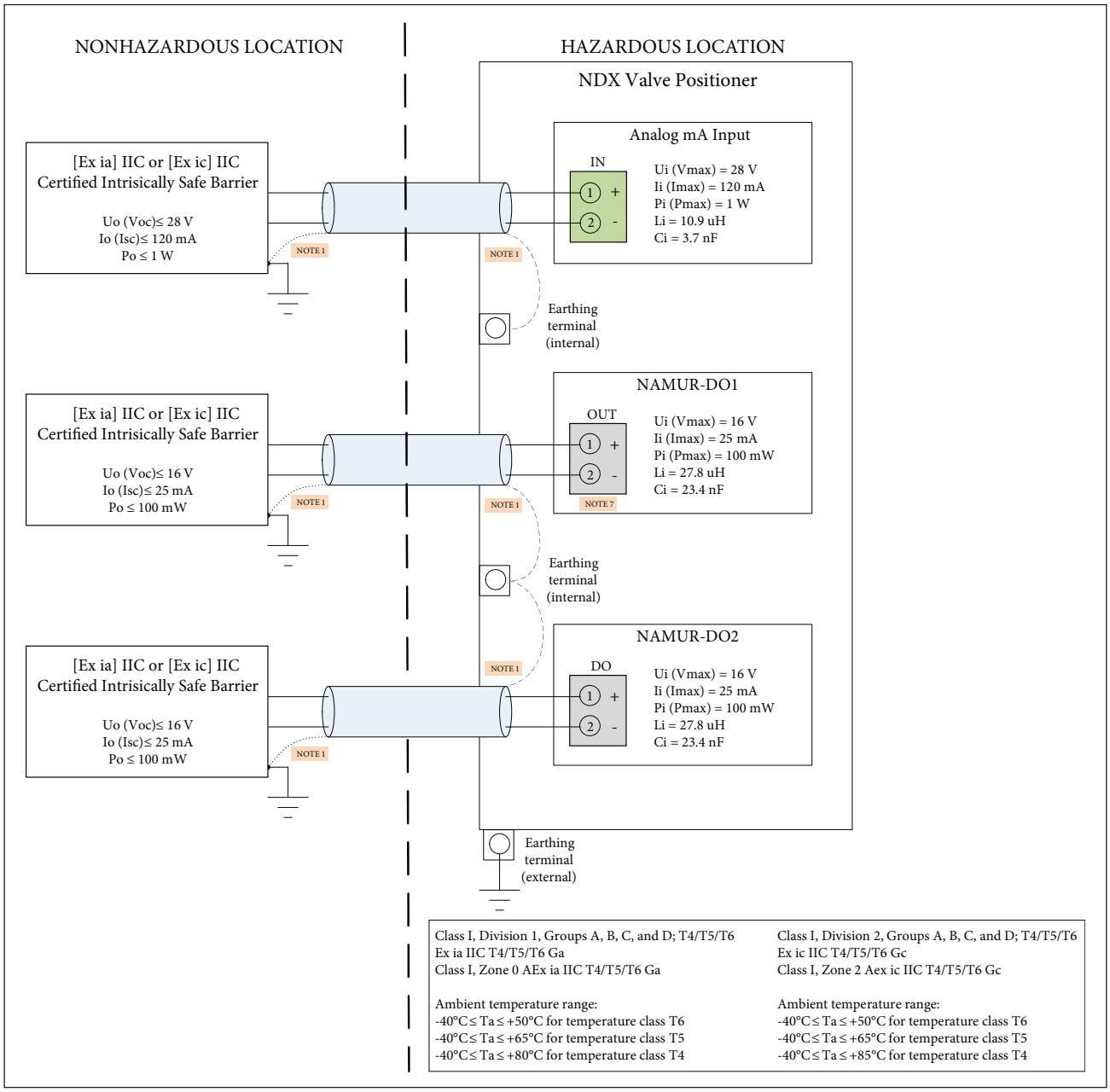


Fig. 118. Control wiring diagram F105208, NDX_511D_ and NDX_512D_, Ex i

Notes

1. By default, the screen of the cable is connected to earth either at the barrier (dotted line) or at the earthing terminal inside NDX enclosure (dash line). If the screen is connected to earth at both ends of the cable, the potential equalization of the system shall conform to requirements of IEC 60079-14:2013 Clause 16.2.3.
2. For installation in accordance with this figure, the intrinsically safe barrier must be certified by an accredited agency.
3. The following conditions must be satisfied:
   Uo (Voc) <= Ui (Vmax) Co (Ca) >= Ci + Ccable
   Io (Isc) <= Ii (Imax) Lo (La) >= Li + Lcable
   Po <= Pi (Pmax)
4. Maximum non-hazardous area voltage must not exceed 250 V.
5. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
6. See user manual for installation conditions.
7. Connector OUT is used for PT interface in variant HART with PT and DO and for NAMUR-DO1 interface in variant HART with dual DO. Connector OUT is coded by different colours in these variants to indicate different interface parameter values in PT usage and NAMUR-DO1 usage.
8. Use [Ex ia] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 1, Groups A, B, C, and D;
Ex ia IIC Ga
Class I, Zone 0 AEx ia IIC Ga

Or

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

, and use [Ex ic] IIC Intrinsically Safe Barrier for the installation in following hazardous locations:

Class I, Division 2, Groups A, B, C, and D;
Ex ic IIC Gc
Class I, Zone 2 AEx ic IIC Gc

CONTROL WIRINGS

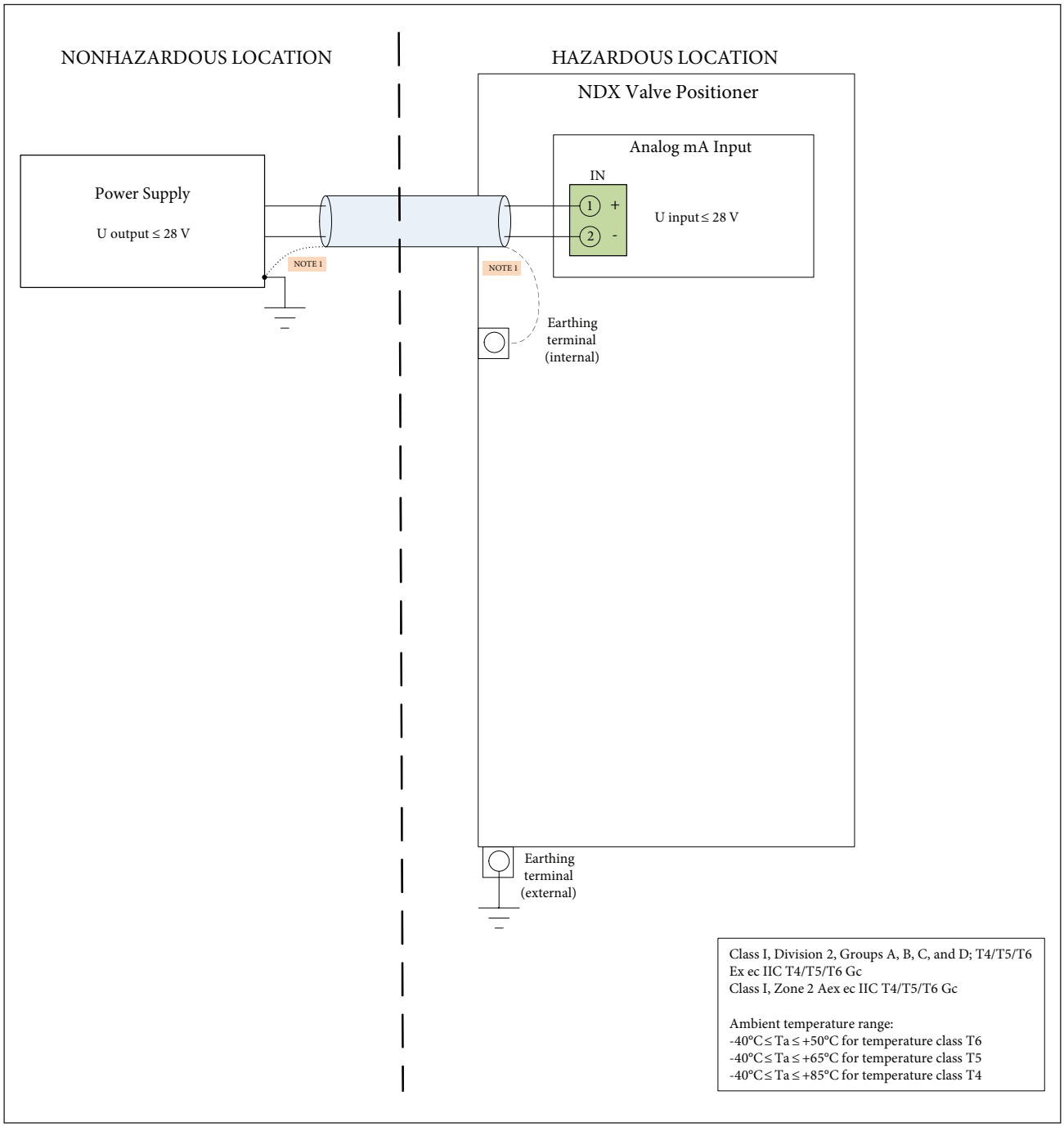


Fig. 119. Control wiring diagram F105208, NDX_511H_ and NDX_512H_, Ex ec

Notes
1. By default, the screen of the cable is connected to earth either at the power supply (dotted line) or at the earthing terminal inside NDX enclosure (dash line).
2. The following conditions must be satisfied: U output <= U input
3. Maximum non-hazardous area voltage must not exceed 250 V.
4. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
5. See user manual for installation conditions.

CONTROL WIRINGS

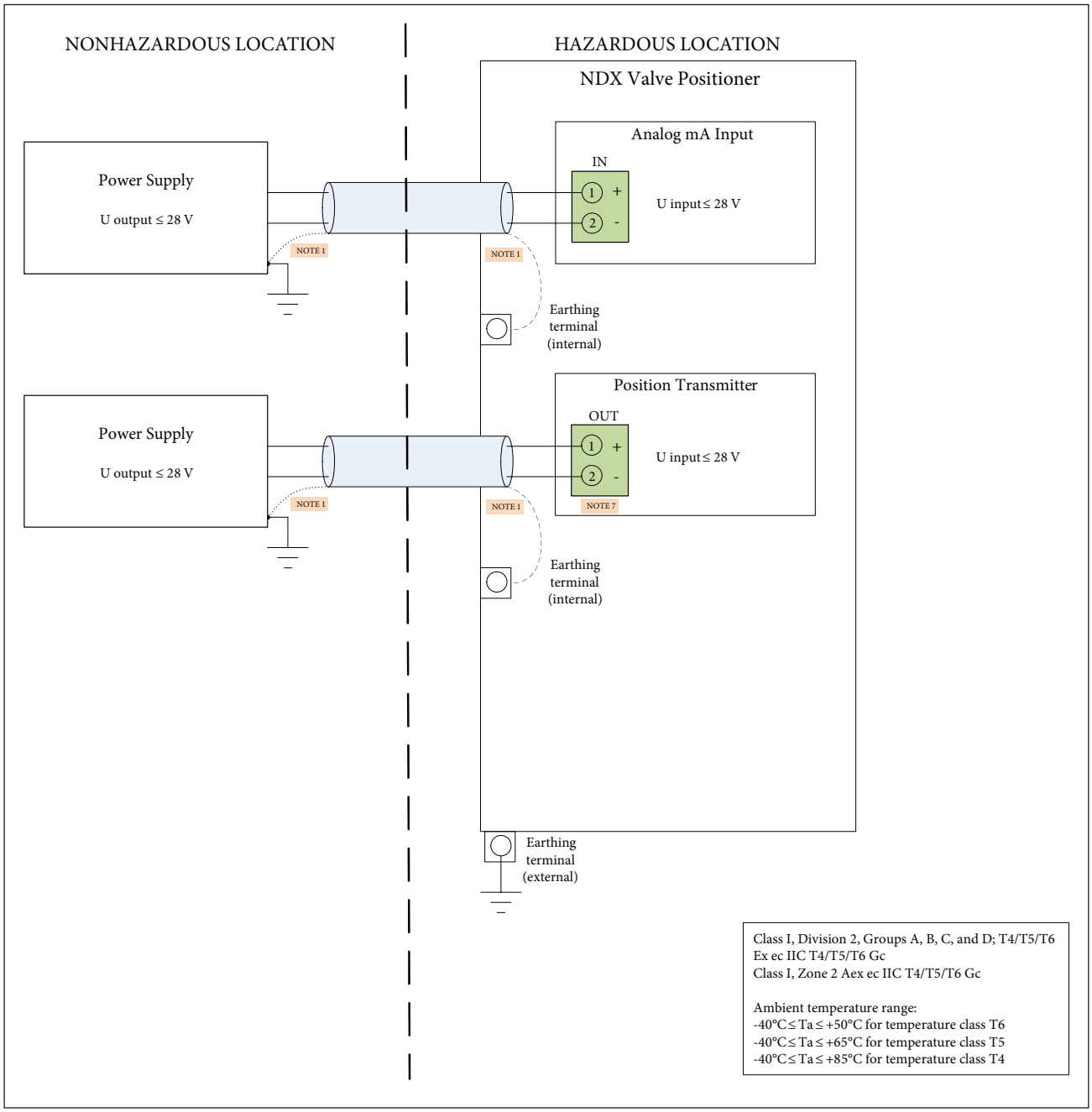


Fig. 120. Control wiring diagram F105208, NDX_511T_ and NDX_512T_, Ex ec

Notes
1. By default, the screen of the cable is connected to earth either at the power supply (dotted line) or at the earthing terminal inside NDX enclosure (dash line).
2. The following conditions must be satisfied: U output <= U input
3. Maximum non-hazardous area voltage must not exceed 250 V.
4. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
5. See user manual for installation conditions.

CONTROL WIRINGS

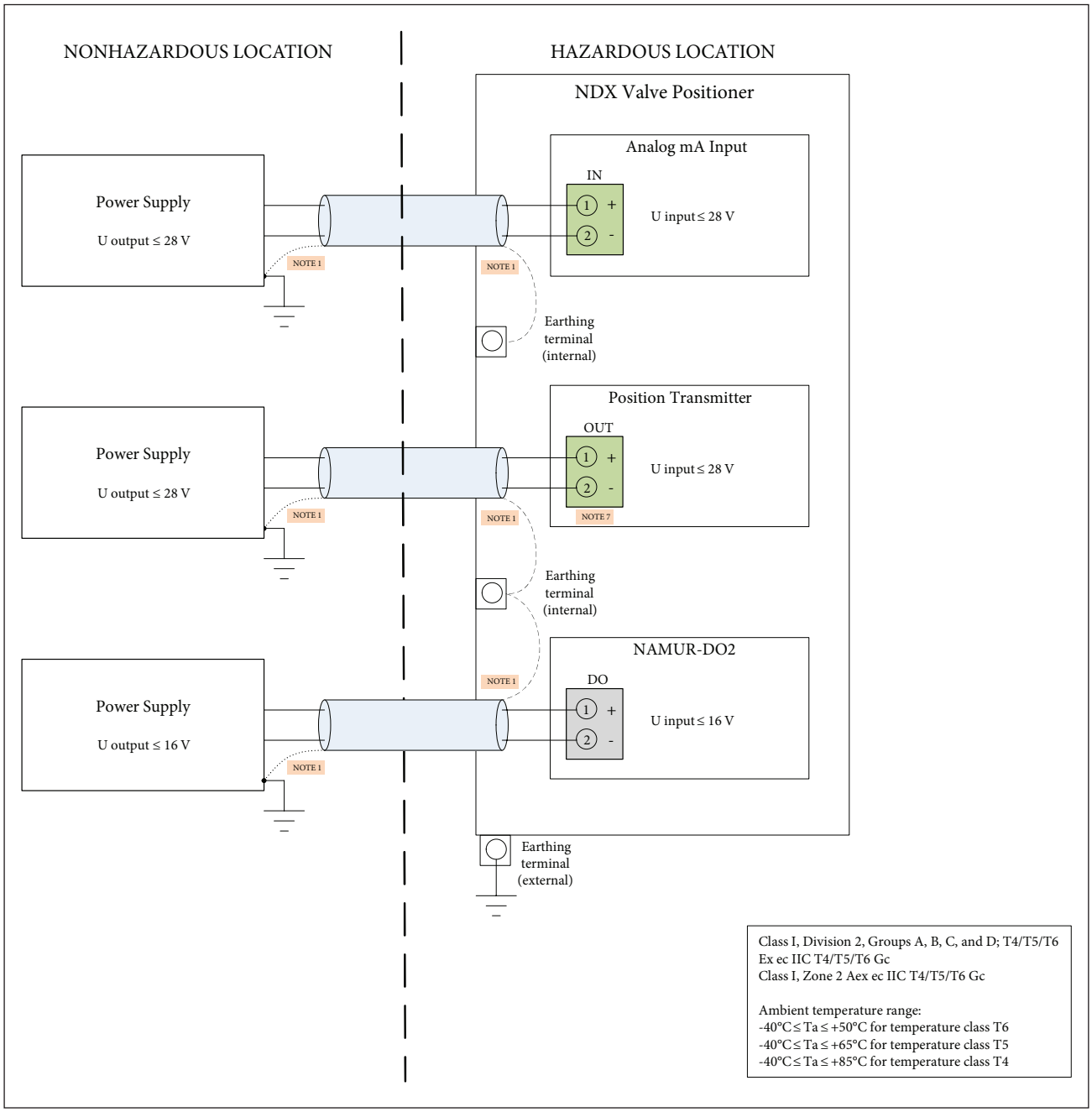


Fig. 121. Control wiring diagram F105208, NDX_511L_ and NDX_512L_, Ex ec

Notes
1. By default, the screen of the cable is connected to earth either at the power supply (dotted line) or at the earthing terminal inside NDX enclosure (dash line).
2. The following conditions must be satisfied: U output <= U input
3. Maximum non-hazardous area voltage must not exceed 250 V.
4. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
5. See user manual for installation conditions.
6. Connector OUT is used for PT interface in variant HART with PT and DO and for NAMUR-DO1 interface in variant HART with dual DO. Connector OUT is coded by different colours in these variants to indicate different interface parameter values in PT usage and NAMUR-DO1 usage

CONTROL WIRINGS

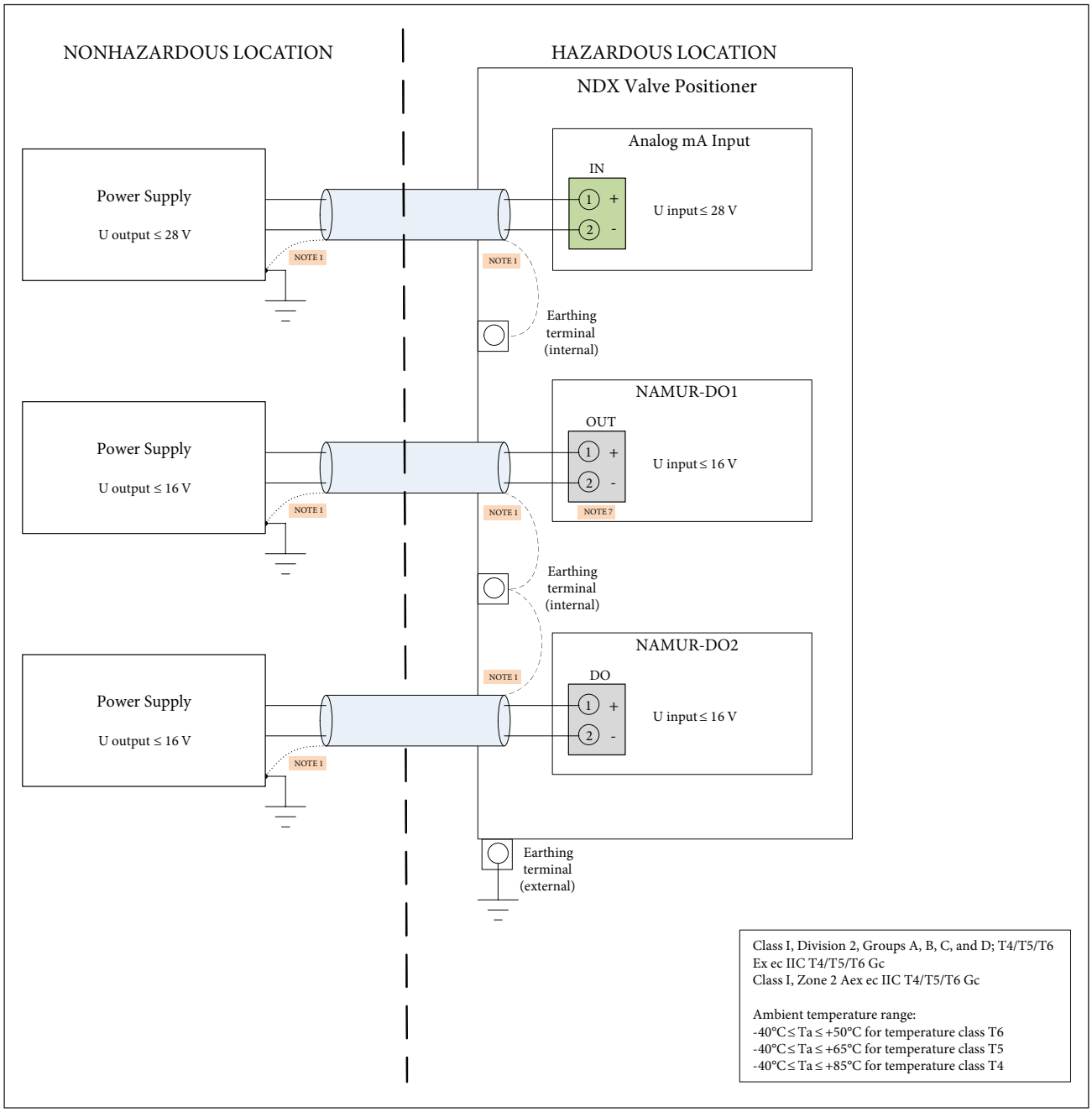


Fig. 122. Control wiring diagram F105208, NDX_511D_ and NDX_512D_, Ex ec

Notes
1. By default, the screen of the cable is connected to earth either at the power supply (dotted line) or at the earthing terminal inside NDX enclosure (dash line).
2. The following conditions must be satisfied: U output <= U input
3. Maximum non-hazardous area voltage must not exceed 250 V.
4. Canadian installations should be in accordance with Canadian Electrical Code, Part I. U.S. installations should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.
5. See user manual for installation conditions.
6. Connector OUT is used for PT interface in variant HART with PT and DO and for NAMUR-DO1 interface in variant HART with dual DO. Connector OUT is coded by different colours in these variants to indicate different interface parameter values in PT usage and NAMUR-DO1 usage

HOW TO ORDER INTELLIGENT VALVE CONTROLLER NDX COMPACT MODEL

1. sign	**PRODUCT GROUP**
	Intelligent Valve Controller Series NDX Compact Model
2. sign	**PNEUMATIC ACTION**
1	Single Acting
3. sign	**PNEUMATIC CAPACITY**
5	Normal Capacity (80 Nm^3/h)
4. sign	**FAIL ACTION**
1	Fail safe
5. sign	**ENCLOSURE** **IP66 / Type 4X 1/2 NPT conduit entry, 2 pcs**
0	Compact - Epoxy coated anodized aluminum housing with polycarbonate cover.
6. sign	**COMMUNICATION / INPUT SIGNAL RANGE**
H	4-20 mA with HART communication
T	4-20 mA with HART + PT Internal 2-wire (passive) position transmitter. Analog position feedback signal, output 4-20 mA, supply voltage 12 - 30 V DC
7. sign	**TEMPERATURE RANGE**
G	General: -40 ... +85 °C / -40 ... +185 °F
8. sign	**SHALL ALWAYS BE HYPHEN OR SLASH**
-	Default option
9. sign	**APPROVALS FOR HAZARDOUS AREAS 1** If approvals are selected for both signs 9. and 10., keep the order shown below, e.g. XC type shall be selected instead of CX type. If there is no need for dual approval, sign 9. or 10. shall be N.
N	No approval
X	ATEX and IECEx certifications: II 1 G Ex ia IIC T6...T4 Ga II 1 D Ex ia IIIC T_{200}85 °C…T_{200}115 °C Da IP66 II 2 G Ex ib IIC T6...T4 Gb II 2 D Ex ib IIIC T_{200}85 °C…T_{200}115 °C Db IP66 II 3 G Ex ic IIC T6...T4 Gc II 3 G Ex ec IIC T6...T4 Gc II 3 D Ex ic IIIC T85 °C...T115 °C Dc IP66

NDX	**1**	**5**	**1**	**0**	**H**	**G**	**-**	**X**	**N**	**0**	**N**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**SAMPLE MODEL CODE (char = 21)**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

HOW TO ORDER INTELLIGENT VALVE CONTROLLER NDX COMPACT MODEL

								9. sign												**APPROVALS FOR HAZARDOUS AREAS 1**
								U												cCSAus certifications: Class I, Division 1, Groups A, B,C,D T4/T5/T6 Class II, Division 1, Groups E, F, G T_{200}85°C to T_{200}115°C Class III Division 1 T_{200}85°C to T_{200}115°C Ex ia IIC T4/T5/T6 Ga Ex ia IIIC T_{200}85°C to T_{200}115°C Da Class I, Zone 0, AEx ia IIC T4/T5/T6 Ga Class I, Zone 20, AEx ia IIIC T_{200}85°C to T_{200}115°C Da Class I, Division 2, Groups A, B, C, and D; T4/T5/T6, Ex ec IIC T4/T5/T6 Gc Class I, Zone 2 AEx ec IIC T4/T5/T6 Gc
									10. sign											**APPROVALS FOR HAZARDOUS AREAS 2**
									N											No approval
									X											ATEX and IECEx certifications See 9. sign “X” for details
									U											cCSAus certifications: See 9. sign ”U” for details
									C											CCC Ex (China) certifications: Ex ia IIC T4...T6 Ga Ex ib IIC T4...T6 Gb Ex ic IIC T4...T6 Gc
									W											KOSHA (Korea) certifications: Ex ia IIC T6...T4, Ex iaD 22 T85 °C IP54, Applicable to 5. sign
										11. sign										**PNEUMATIC CONNECTIONS & GAUGES**
										0										Standard, 1/4 NPT, no gauges
										1										1/4 NPT, gauges (block with 1/4 NPT threads + gauges)
										2										G1/4, no gauges (block with G1/4 threads)
										3										G1/4, gauges (block with G1/4 threads + gauges)
											12. sign									**VARIANT**
											N									Neles
												13. sign								**DIAGNOSTICS**
												0								Advanced diagnostics
													14. sign							**RESERVED**
													0							None
														15. sign						**RESERVED**
														0						None
															16. sign					**RESERVED**
															0					None
																17. sign				**SHALL ALWAYS BE HYPHEN**
																	18.-20. sign			**PARTNER CODE* Characters 18 - 20 reserved for partner identification**
																	0	7	5	Partner 1
																	1	2	8	Partner 2
																	6	6	8	Partner 3
																				*) If there is no partner code, there will not be sign 17-20
NDX	**2**	**5**	**1**	**2**	**T**	**G**	**-**	**N**	**N**	**0**	**N**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**SAMPLE MODEL CODE (char = 21)**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

HOW TO ORDER INTELLIGENT VALVE CONTROLLER NDX STANDARD MODEL

1. sign	**PRODUCT GROUP**
	Intelligent valve controller series NDX standard model
2. sign	**PNEUMATIC ACTION**
1	Single acting
2	Double Acting (suitable also for single acting actuators)
3. sign	**PNEUMATIC CAPACITY**
5	Normal capacity (80 Nm^3/h)
4. sign	**FAIL ACTION**
1	Fail safe
5. sign	**ENCLOSURE** **IP66 / Type 4X 1/2 NPT conduit entry, 2 pcs**
1	Standard - Epoxy coated anodized aluminum housing with polycarbonate cover
2	Flameproof / Explosion Proof - Epoxy coated anodized aluminum housing and cover
6. sign	**COMMUNICATION / INPUT SIGNAL RANGE**
H	4-20 mA with HART communication
T	4-20 mA with HART + PT Internal 2-wire (passive) position transmitter. Analog position feedback signal, output 4-20 mA, supply voltage 12 - 30 V DC
D	4-20 mA with HART communication + 2 x DO Two digital output (DO) channels, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC.
L	4-20 mA with HART communication + PT + DO Internal 2-wire (passive) position transmitter & one digital output (DO) channel. Analog position feedback signal, output 4-20 mA, supply voltage 12 - 30 V DC. DO, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC.
F	Foundation Fieldbus, Physical layer according to IEC 61158-2 Applicable to 5. sign “1” and 9. and 10. sign “N” or “X”
7. sign	**TEMPERATURE RANGE**
G	General: -40 ... +85 °C / -40 ... +185 °F
8. sign	**SHALL ALWAYS BE HYPHEN OR SLASH** This sign is selected automatically based on the other signs. If the device is Ex approved then it will have “-“for Ex electronics module and if not then “/” for non-Ex electronics module.
-	Electronics module designed for Ex use
/	Applicable to 5. sign “1” and 9. and 10. sign “N”. Electronics module only for non-Ex applications.
9. sign	**APPROVALS FOR HAZARDOUS AREAS 1** If approvals are selected for both signs 9. and 10., keep the order shown below, e.g. XE type shall be selected instead of EX type. If there is no need for dual approval, sign 9. or 10. shall be N.
N	No approval
X	ATEX and IECEx certifications: II 1 G Ex ia IIC T6...T4 Ga II 1 D Ex ia IIIC T20085 °C…T200115 °C Da II 2 G Ex ib IIC T6...T4 Gb II 2 D Ex ib IIIC T20085 °C…T200115 °C Db II 3 G Ex ic IIC T6...T4 Gc II 3 G Ex ec IIC T6...T4 Gc II 3 D Ex ic IIIC T85 °C...T115 °C Dc Applicable to all 6. signs. FISCO field device applicable to 6. sign ”F” only.
E	ATEX and IECEx certifications: II 2GD Ex db IIC T4...T6 Gb Ex tb IIIC T85…T113°C Db Applicable to 5. sign ”2”

NDX	**2**	**5**	**1**	**1**	**H**	**G**	**-**	**X**	**N**	**0**	**N**	**0**	**0**	**0**	**0**	**-**	**1**	**2**	**8**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

SAMPLE MODEL CODE (char = 21)

HOW TO ORDER INTELLIGENT VALVE CONTROLLER NDX STANDARD MODEL

								9. sign												**APPROVALS FOR HAZARDOUS AREAS 1**
								U												cCSAus certifications: Class I, Division 1, Groups A, B,C,D T4/T5/T6 Class II, Division 1, Groups E, F, G T_{200}85°C to T_{200}115°C Class III Division 1 T_{200}85°C to T_{200}115°C Ex ia IIC T4/T5/T6 Ga Ex ia IIIC T_{200}85°C to T_{200}115°C Da Class I, Zone 0, AEx ia IIC T4/T5/T6 Ga Class I, Zone 20, AEx ia IIIC T_{200}85°C to T_{200}115°C Da Class I, Division 2, Groups A, B, C, and D; T4/T5/T6, Ex ec IIC T4/T5/T6 Gc Class I, Zone 2 AEx ec IIC T4/T5/T6 Gc
								F												Class I, Division 1, Groups B, C, and D; T6...T4 Class II, Division 1, Groups E, F and G; T6 … T4 Enclosure Type 4X Ex db IIB+H2 T6 … T4 Gb (Canada) Class I, Zone 1 AEx db IIB+H2 T6 … T4 Gb (US) Ex tb IIIC T85°C …. T113°C Db (Canada) Zone 21 AEx tb IIIC T85°C …. T113°C Db (US) Applicable to 5. sign. "2" only. Not applicable to 6. sign "F".
								C												CCC Ex (China) certifications: Ex ia IIC T4...T6 Ga Ex ia IIIC T_{200}85 °C…T_{200}115 °C Da Ex ib IIC T4...T6 Gb Ex ib IIIC T_{200}85 °C…T_{200}115 °C Db Ex ic IIC T4...T6 Gc Ex ic IIIC T_{200}85 °C…T_{200}115 °C Db Ex ec IIC T4...T6 Gc
								D												CCC Ex (China) certifications (Ex d): Ex db IIC T4...T6 Gb Ex tb IIIC T85°C...T113°C Db Applicable to 5. sign "2"
									10. sign											**APPROVALS FOR HAZARDOUS AREAS 2**
																				If approvals are selected for both signs 9. and 10., keep the order shown below, e.g. XE type shall be selected instead of EX type. If there is no need for dual approval, sign 9. or 10. shall be N.
									N											No approval
									X											ATEX and IECEx certifications See 9. sign "X" for details
									E											ATEX and IECEx certifications See 9. sign "E" for details
									U											cCSAus certifications See 9. sign "U" for details
									C											CCC Ex (China) certifications: See 9. sign "C" for details
									D											CCC Ex (China) certifications (Ex d): See 9. sign "D" for details
									J											Japan certifications: Ex d IIC T6...T4 Gb Ex tb IIIC T85°C...T113°C Db T4: -40°C to +85°C; T5: -40°C to +72°C; T6: -40°C to +57°C Applicable to 5. sign "2"
									K											KOSHA (Korea) certifications: Ex d IIC T6...T4 Ex tD A21 IP66 T* Applicable to 5. sign "2"
									W											KOSHA (Korea) certifications: Ex ia IIC T6...T4, Ex iaD 20 T85 °C IP66
										11. sign										**PNEUMATIC CONNECTIONS & GAUGES**
										0										Standard, 1/4 NPT, no gauges
										1										1/4 NPT, gauges (block with 1/4 NPT threads + gauges)
										2										G1/4, no gauges (block with G1/4 threads)
										3										G1/4, gauges (block with G1/4 threads + gauges)
											12. sign									**VARIANT**
											N									Neles
												13. sign								**DIAGNOSTICS**
												0								Advanced diagnostics
												1								Premium diagnostics
													14. sign							**RESERVED**
													0							None
														15. sign						**RESERVED**
														0						None
															16. sign					**RESERVED**
															0					None
																17. sign				**SHALL ALWAYS BE HYPHEN**
																	18.-20. sign			**PARTNER CODE*** **Characters 18 - 20 reserved for partner identification**
																	0	7	5	Partner 1
																	1	2	8	Partner 2
																	6	6	8	Partner 3
																				*) If there is no partner code, there will not be sign 17-20
NDX	**2**	**5**	**1**	**1**	**H**	**G**	**-**	**X**	**N**	**0**	**N**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**SAMPLE MODEL CODE (char = 21)**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

HOW TO ORDER INTELLIGENT VALVE CONTROLLER NDX STANDARD MODEL

Additional accessories

CONDUIT ENTRY NIPPLES	
CE10	M20x1,5 conduit entry nipples Brass 1/2NPT / M20x1,5 (H5407)
CE52	M20x1,5 conduit entry nipples AlMgSi1 Anodized 1/2NPT / M20x1,5 (H140515)

CABLE GLANDS	
CG51	1/2NPT for NDX (H142731, grey/plastic)
CG8	1/2NPT for NDX (code H6813, blue/plastic)

PRESSURE GAUGES AND CONNECTION BLOCKS	
Pressure gauges in modules GB21, GB22, GB24, GB25: scale 0-12 bar/ psi/kPa (bar/psi/ kg/cm^2), AISI304 housing, polycarbonate lens, oil filled. Temperature range -55...+85 °C / -67...+185 °F. Material of pneumatic connection block is AlSiMg, painted grey in blocks GB21, GB22, GB23, GB24, GB25	
GB21	Two pressure gauges with connections 1/4 NPT (S, C2). Use with single acting NDX and explosion proof or standard housing (NDX1512_ / NDX1511_). Gauges AISI304, block AlSiMg. H158773
GB22	Three pressure gauges with connections 1/4 NPT (S, C1, C2). Use with double acting NDX and explosion proof or standard housing (NDX2512_ / NDX2511_). Gauges AISI304, block AlSiMg. H158774
GB23	Connection block module without gauges. Converts NDX pneumatic connections to G1/4. Use with both single and double acting NDX and explosion proof or standard housing (NDX1511_ / NDX1512_ / NDX2511_ / NDX2512_). H158775
GB24	Two pressure gauges with connections G1/4 (S, C2). Converts also NDX connections to G1/4. Use with single acting NDX and explosion proof or standard housing (NDX1512_ / NDX1511_). Gauges AISI304, block AlSiMg. H158776
GB25	Three pressure gauges with connections G1/4 (S, C1, C2). Converts also NDX connections to G1/4. Use with double acting NDX and explosion proof or standard housing (NDX2512_ / NDX2511_). Gauges AISI304, block AlSiMg. H158777

DRIVER SETS FOR ACTUATORS	
DS51	Feedback set for NDX on linear actuators. Includes the magnet and a carrier for the magnet. For stroke lenghts 5-120 mm. (H137410)
DS52	Feedback set (driver set) for NDX on VDI actuators. Includes the magnet and parts needed for attachment to actuator shaft. (H142751).
DS54	Feedback set (driver set) for NDX on long stroke linear actuators. Includes the rotary-linear adapter (H243234). Requires a separate lever arm, based on the actuator stroke length. Contact Valmet for different options.
DS55	Feedback set for NDX on linear long stroke actuators. Includes the magnet and a carrier for the magnet. For stroke lengths 120-220 mm. (H243231)

MOUNTING SETS for NDX / Linear Neles VD series actuators	
Mounting sets between the NDX valve controllers and linear Neles VD series actuators, including bracket and feedback system.	
MS51	Neles VD 25, stroke length 20 mm. AISI 316. (H134414)
MS52	Neles VD 29, stroke length 20-40 mm. AISI 316. (H134388)
MS53	Neles VD 37, stroke length 20-50 mm. AISI 316. (H134392)
MS54	Neles VD 48/55_R, stroke length 40-80 mm. AISI 316. (H134368)

3RD PARTY MOUNTING SETS for NDX / Linear actuators	
Mounting sets between the NDX valve controllers and 3rd party linear actuators, including bracket and feedback system.	
MS61	Mounting set for NDX / linear actuators, attachment face according to IEC 60534-6, stroke length 10-120 mm. AISI316. (H134584)
MS62	Masoneilan 37/38 actuators, sizes 9...15. AISI316. (H138350)
MS63	Masoneilan 87/88 actuators, sizes 6...23. Stroke length 12-64 mm. AISI316. (H134156)
MS64	Fisher 657/667 sizes 30...34, stroke length 19-29 mm. AISI316. (H134202)
MS65	Fisher 657/667 sizes 40...50, stroke length 38-51 mm. AISI316. (H138348)
MS66	Fisher 657/667 sizes 70...87, stroke length 76-102 mm. AISI316. (H138349)

3RD PARTY MOUNTING SETS for NDX / Rotary actuators	
Mounting sets between the NDX valve controllers and rotary actuators, including bracket and feedback system.	
MS81	Mounting set for rotary actuators with VDI/VDE 3845 attachment face, also Neles B-series actuators B1CU/ B1JU 6...11. Attachment dimensions 80X30-20 (VDI1). (H141553)
MS82	Mouting set for rotary actuators with VDI/VDE 3845 attachment face. Attachment dimensions 80X30-30 (VDI 2). (H141561)
MS83	Mounting set for rotary actuators with VDI/VDE 3845 attachment face, also Neles B-series actuators B1CU/ B1JU 12...20. Attachment dimensions 130X30-30 (VDI3). (H141563)
MS84	Mouting set for rotary actuators with VDI/VDE 3845 attachment face. Attachment dimensions 130X30-50 (VDI 4). (H141562)

IMOs for NDX	
NDX delivery includes the Quick Guide only. The IMO is available in electronic format via www.valmet.com/ndx. If a printed IMO is required with the delivery, use the following.	
IM01	NDX IMO English. 7NDX71_EN. (H137441)
IM02	NDX IMO Chinese. 7NDX71_ZH. (H143226)

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