VOITH

Way Valve

Type: WSR-D16212

Instruction Manual

Version 3.0

ATTENTION!
Please make sure to read this instruction manual prior to transport, installation, commissioning, operation, etc. and keep it for further use!

Should you have any questions concerning the way valve, please contact Voith Turbo GmbH & Co. KG, Crailsheim, After-Sales Service of Product Group Electronic Drive Systems in Crailsheim, indicating the article number and the serial number of the way valve.

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This instruction manual describes the design standard of the way valve type WSR-D16212 with delivery as of 2010/01.
Alterations or modifications after delivery are not considered in this instruction manual.

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Revised: 2010 / 01
Order No.: 918 3626 018870 en
Version: 3.0

Printed in Germany

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Instruction Manual

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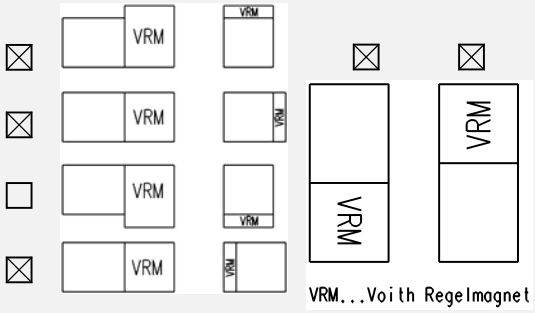
1 Technical Data

Way Valve Type	WSR-D16212	
Article number	9 1868590	
Instruction Manual No.	918 3626 018870	
CE Ex marking[1)]	CE Ex II 2G IIC T4	
Protection	IP 65 as per EN 60529	
Ambient temperature T_A at T4	-30 ... +60	°C
Ambient temperature (storage)	-40 ... +90	°C
Installation conditions	☒ Indoor installation ☐ Outdoor installation ☐ Offshore ☒ Industr. atmosph.	
Hydraulic Data		
Supply pressure P		
Nominal pressure	90	bar
Maximum pressure	120	bar
Return pressure T	-0.05 … 0.2	bar
Flow rate at ΔP=20bar P -> A,B->T	45	l/min
Operating medium		
Type	☒ Hydraulic oil to DIN 51524 ☒ Turbine oil to DIN 51515 ☐ High-flash point fluid[3)]	
Oil temperature during operation	+10 … +60	°C
Cleanliness grade (ISO VG 4406)	- / 16 / 13	
Viscosity (DIN 51519)	ISO VG 32 … ISO VG 46 Class 7 as per NAS 1638	
Leakage (T_{oil} = 50 °C and nom. pressure)	< 5	l/min
Mechanical Data		
Design of way valve	☐ 3/3 ☒ 4/3	
Installation positions		
Sealing material	☒ FPM[1)] ☐ Special design[3)] ☒ NBR[2)]	
Weight	approx. 15	kg

1) Fluor-caoutchouc

2) Acrylnitril-Butadien-caoutchouc

3) According to customer requirements or especially for high-flash point fluids

Electrical Data		
Supply voltage	24 (+10% / -15%)	V DC
Current consumption	1 A, max. 3 A for t < 1 sec	
Electrical connection	See Chapter 10	
Control Parameters		
Setpoint w for stroke 0% … 100%	w = 4.0 … 20.0 (load 100 Ω)	mA
Actual value input for stroke 0% ... 100%	20…4 (load 332 Ω)	mA
Actual value remote indication for stroke 0% … 100%	4…20 (load 400 Ω max.)	mA
Magnetic force switch-off at	w < 2	mA
Magnetic force switch-on at	w ≥ 3	mA
Input configuration ☒ E432 Electronics ☐ E524 / Electronics	 Applied, related to GND Isolated (500 kΩ)	
Setpoint limitation ☒ E432 Electronics ☐ E524 Electronics ☐ E530 Electronics	 w > 35 w > 20.2 w > 21	 mA mA mA

2 Safety Information

2.1 Definition of symbols and warnings

Symbol	Damage/harm to ...	Signal word	Definition	Consequences
	Persons, property	EX-PROTECTION !	Indication for Ex-protection	Explosion hazard
	Persons	DANGER!	Imminent danger	Fatal or most serious injuries (crippling)
	Persons	WARNING!	Dangerous situation possible	Fatal or most serious injuries possible
	Property	ATTENTION!	Dangerous situation possible	Possible damage to - the product - its environment
	–	Note! Information!	Application details and other useful information	Efficient in operation

2.2 Proper use

The way valve serves to transform an electric position set signal, e.g. 4 - 20 mA into a flow rate variable in direction and size. This allows, for example, remote-controlled infinitely variable adjustment of a hydraulic positioning cylinder for positioning of control valves on turbo machinery.

2.3 Important information

The following information refers to the entire instruction manual and is to be observed in addition to the individual instructions.

Accident prevention

- It is imperative to observe the requirements of the relevant standards and regulations when connecting a way valve in explosion-proof design.
- There must not be any potentially explosive atmosphere during all works performed, such as e.g. transportation, storage, installation, electrical connection, commissioning, test run, maintenance and servicing!

- Operating medium leaving/leaking from the way valve may get in contact with hot machine parts, posing a risk of fire.

- On commissioning or operation of the way valve, spraying hydraulic oil may get into the eyes causing blindness. Wear protective glasses for all works performed on the way valve.
- The way valve module is a hydraulic unit. In case of non-observance, operating medium being under pressure may leak out. Any improper use may lead to the leakage of operating medium under pressure, posing a risk to the health and life of the operating staff. Prior to performing any work on the way valve, switch off the hydraulic supply system.
- During operation, the outer surfaces of the way valve and the hydraulic connecting lines may become hot due to the operating medium. Any contact may cause injuries by burning. Prior to performing any work on the way valve, let the way valve cool down.
- On commissioning or operation of the way valve, the end of the piston rod directly or indirectly driven by the way valve may move uncontrolled in case of a failure of the hydraulic or electric energy, due to malfunctions in the master control or on the way valve. The movement of the piston rod may pose a risk to individuals and property. Prior to performing any work on the way valve, switch off the hydraulic and electric auxiliary energy.

- Electric components are integrated in the way valve which may be destroyed, e.g. during electric welding near the way valve. Prior to performing electric welding near the way valve, remove all electric connecting lines.

Environmental protection

- On assembly, disassembly or improper use of the way valve, operating medium may leak out. Operating oil getting into the sewage system or open soil causes severe environmental damages. Collect leaking operating medium and dispose of it in accordance with the national statutory provisions.

Instruction Manual

- The instruction manual contains important information regarding proper handling of the way valve. Prior to installation and commissioning of the way valve, carefully read the entire instruction manual and make sure you fully understood its content.
- Keep the instruction manual in a place constantly accessible to the operating staff.
- In addition to this instruction manual, have the rules governing accident prevention and environmental protection available and observe the same.

Staff qualification

- Only trained and instructed personnel are allowed to work on the way valve. These personnel must be sufficiently trained, instructed and authorized to properly mount, operate and maintain the way valve in accordance with the safety standards.

- Installation, commissioning and operation have to be performed by a certified electrician with experience and knowledge in the field of explosion protection.

Physical modifications

- ➢ Mounting work and structural modifications are not permitted.
- ➢ The screw fitting of the cable entry on the control magnet (VRM) is protected against distortion. Do not distort or slacken the screw fitting.

2.4 Warranty

The terms and conditions mentioned in the General Terms and Conditions of Sale for Industrial Engineering of Voith Turbo GmbH & Co. KG, Crailsheim, shall apply. Warranty claims are excluded if these are due to one or several of the following causes:

➢

- Improper transportation, storage, installation, connection, commissioning, operation, maintenance and repair of the way valve.
- Failure to observe the operational and product safety regulations included in this instruction manual.
- Use of spare parts not approved by Voith Turbo, Crailsheim.

- ➢ During the warranty period, repairs to the way valve are only to be performed with the approval of Voith Turbo GmbH & Co. KG, Crailsheim.

3 Function

Design

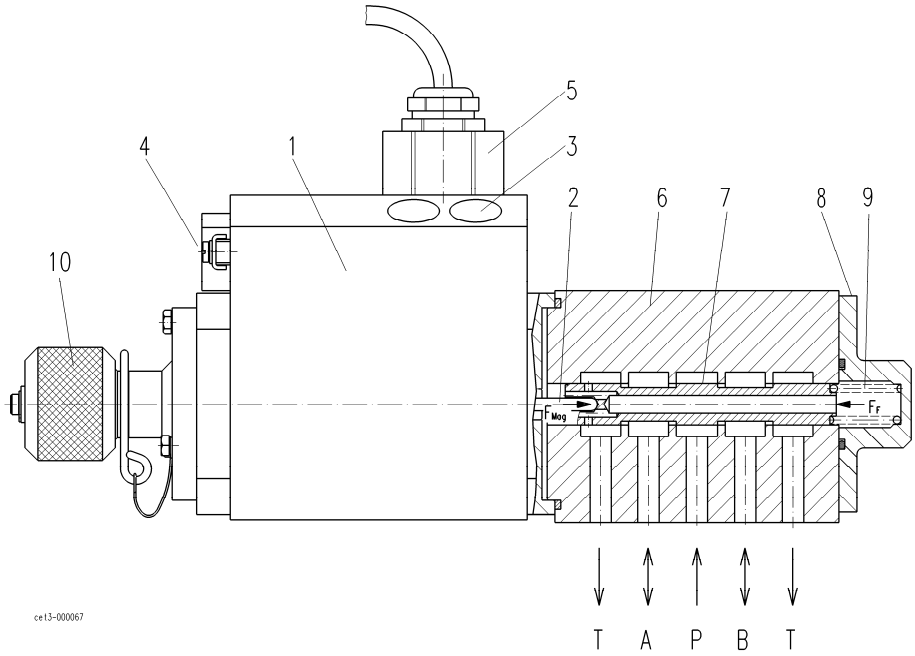


Fig. 1 Sectional view of way valve

The way valve comprises the main functional units:

1.	Control magnet	P	- input pressure
2.	Tappet for power transmission	A, B	- outputs
3.	Potentiometers X0, X1, KPU, KP	T	- tank return line
4.	Potentiometer SF		
5.	Electrical connection		
6.	Control housing	F_{Mag}	- magnetic force
7.	Control piston	F_F	- spring force
8.	Cover		
9.	Control spring		
10.	Manual operation knob		

Block diagram - way valve

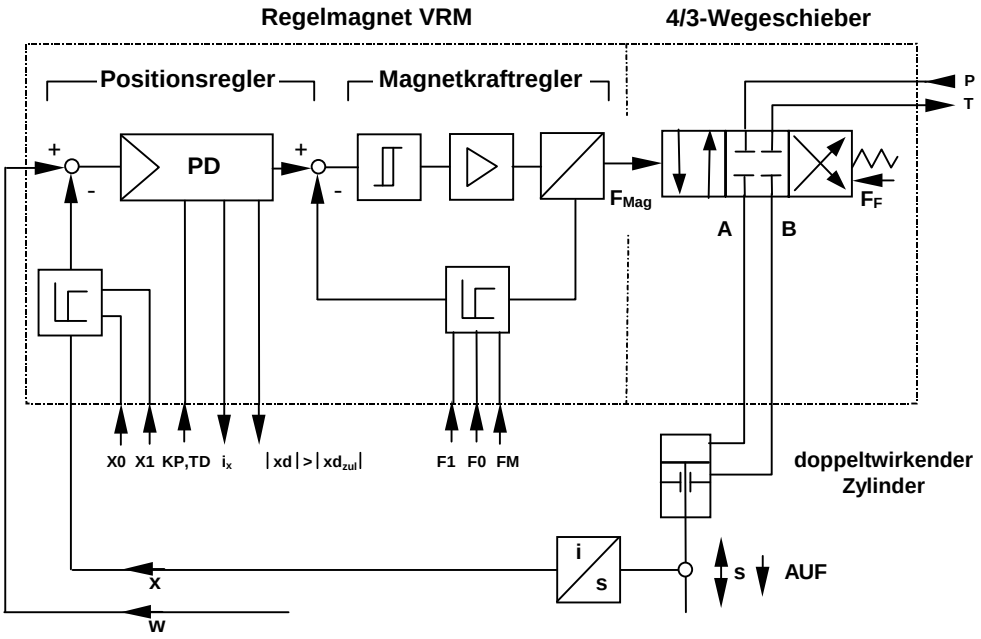


Fig. 2 Block diagram of way valve

P	Supply pressure	
A,B	Outputs	
T	Tank return line	
w	Setpoint for position s	4..20 mA ~ 0..100 %
x	Actual value feedback	20..4 mA ~ 0..100 %
ix	Actual value remote indication	4..20 mA ~ 0..100 %
Adjusting parameters		X0, X1, KP, FM and TD F0 and F1 are set at the factory

The positioner and the magnetic force controller are integrated in the control magnet VRM. The main control parameters can be adjusted at the VRM from the outside via potentiometers, thus allowing optimum adjustment of the control for various cylinders and allocation of the required stroke range to setpoint w.

Control deviation w-x is multiplied by KP gain in the positioner. The actuating variable hereby generated acts as setpoint for the subordinate magnetic force controller. A power range for F_{Mag} is allocated the actuating variable range via parameters F0 and F1 by means of which the control piston can be moved towards the control spring in defined final positions. The final positions correspond to the biggest throughflow cross sections of P $\rightarrow$ A, B oder von A, B $\rightarrow$ T.

The position of the control piston marked in Fig. 1 is designated as hydraulic center in which the throughflow cross sections are virtually zero and the cylinder has taken a constant position s. To avoid a generation of the magnetic force, that is required for the hydraulic center, by a system deviation, a magnetic force offset is set with parameter PM so that the system deviation becomes zero and the setpoint w becomes equal to the actual value s or x.

Function of manual operation knob:
Instead of the magnetic force F_{Mag}, a force can be set that is transmitted to the control piston via the tappet.
This way, the control piston can be moved without electric connection and to connect output A with P or T.
Thus, the piston rod on a cylinder connected on output A can be moved to the corresponding final position. It is not possible to set to any position s.

4 Packing, Storage and Transportation

Packaging

The way valve is supplied in special packaging. All hydraulic connection openings are sealed with protective plugs.

Storage and preservation

A galvanic corrosion protection will be applied to the outer surfaces of the way valve. On delivery, the inner parts of the way valve which are not surface-coated are moistened with preservation oil.

- Within Europe, this preservation is sufficient as corrosion protection for about 8 months, provided the way valve is stored in a dry location.

If it is intended to store the way valve for a longer period of time, special precautions have to be taken. Coordinate such precautions for each individual case with Voith Turbo GmbH & Co. KG, Crailsheim.

- The ambient conditions for storage must be within the limits indicated in Chapter 1.

Transportation

- It is not allowed to transport the way valve in an explosive atmosphere! This also applies to the transportation of spare parts!

- Improper transportation or lifting of the way valve may cause damage to property and personal injuries.
- Observe, in particular, that constraining forces do not act on the cable entry of the control magnet (VRM) and that the connecting line is not damaged.
- For transportation purposes, it is not allowed to keep the way valve connected to the connecting line.

5 Installation

- Installation and operation of the way valve is only allowed for the conditions stated in Chapter 1.
- Do not install the way valve in an explosive atmosphere!
- During operation, explosive atmosphere may get into the way valve via the tank. Therefore, the hydraulic tank must not be set up in zone 0.

- Only personnel satisfying the qualifications according to Section 2.3 are allowed to work on the way valve.

- Improper installation of the way valve may cause malfunctioning and premature failure of the way valve.
- Cleanliness is imperative during both installation and connection. Prevent any impurities (dust, metal chips, etc.) from getting into the interior of the way valve or into the piping system. Any such impurities may cause damage to the way valve.

- During the installation period, cover and protect the way valve and, in particular, the electric and hydraulic connections.

5.1 Mounting

- All work may only be performed in de-energized condition and with the oil supply system switched off. During installation, the oil and power supply for the way valve has to be secured against unintentional switching-on.

- Mount the way valve according to the permissible installation position.

Recommended fastening bolts

- 2 socket head screws M12, ISO 4762, property class 8.8. Tightening torque MA = 80 Nm, thread oil-moistened. Select the screw length according to the installation situation

5.2 Hydraulic connection

- Wear protective glasses when connecting the way valve hydraulically.
- Pay attention to the correct pressure stage when selecting pipes, flexible tubes, unions and flanges.
- Immediately replace any damaged pipes and flexible tubes.

When assembling the pipes, ensure that they are not fastened to any moving equipment, but rather to fixed structures free from vibration.
Alterations in length caused by temperature variations must not apply constraining forces to the way valve.

- Fixing and hydraulic connection to a connecting flange is made via the hydraulic part. Kant seal rings are used for sealing. The customer's connecting flange must correspond to Ra ≤ 1.6 µm and Rmax ≤ 6.3 µm.
- Residual oil (up to 0.3 l) may leak when removing the screw plugs. Collect the oil in a suitable container and dispose it off properly.
- Do not use fibrous or hardening sealing compounds, such as hemp or mastic to seal the connections and pipe unions.

Prior to installation, clean pipes from dirt, cinder, sand, chips, etc.
Pickle welded pipes. Clean and flush carefully the pipes and the whole hydraulic system before installing the way valve.

5.3 Electrical connection

- Only a certified electrician with experience and knowledge in the field of explosion protection is allowed to connect the servomotor electrically in accordance with the electro-technical rules and legal provisions of the country of manufacture.

- Signal and supply lines provided by the customer to the way valve need to be screened and laid separately from each other.
- When connecting the customer's lines, please avoid parallel running of way valve lines with the lines of the current converter assemblies.
- Poor connecting points do not guarantee a reliable operation of the way valve.

Connect the way valve according to the connection diagram (see Chapter 10, annex).

6 Commissioning

➢ Prior to delivery, the way valve has been tested and adjusted at Voith Turbo GmbH & Co. KG. The settings are documented in the supplied test report. It must be ensured that the signal of the position pickup coming from the cylinder is falling, i.e. 0%...100% stroke correspond to 20 mA...4 mA.

On commissioning, please check all connections of the hydraulic and electric supply systems. Commissioning must only be continued after ensuring that all hydraulic and electric connections have been properly wired.

6.1 Test run

➢ Make sure that there is no explosive atmosphere during the test run and the de-aeration process!

➢ Prior to the test run, please ensure that the pipes and the hydraulic system have been cleaned. The operating medium must correspond to the cleanliness grade stated in Chapter 1. Cleaning and flushing operations essential to the operating medium must not be performed with the hydraulically connected way valve. Operation of the way valve with contaminated operating medium is not permitted and may damage the way valve.

- Check the line installation, connection and flow direction to and on the way valve.
- Check the electrical connection.
- Switch on the oil supply and check the supply pressure.
- Switch on power supply.
- Predefine setpoint w = 4 mA and check the reaction of the consumer connected to output A.

➢ First, due to lacking hydraulic damping, uncontrolled stroke movements of the consumer connected to output A and B may occur.
If installed in the proper position, the air included escapes and the damping becomes effective.

How to de-aerate the hydraulic system

- Enter w = 4...20 mA and check the reaction of the consumer connected to output "A" and "B".
- Run the way vale until it has reached operating temperature and check the supply pressure.
- Enter setpoint w = 12 mA.
  Check the deviation between setpoint and actual value remote indication and, if necessary, correct the hydraulic center with parameter FM.
  See Chapter 6.2.1.
- Vary the setpoint w from 4 to 20 mA. Check the stroke setting and correct it by potentiometers X0 and X1, if necessary.
  See Chapter 6.2.2.

➢ Do not stay in the dangerous zone of the cylinder during the de-aeration process if no protective device is installed!

➢ If with the piston to be positioned a valve is adjusted, for instance, on connection it has to be ensured that in 0% position the valve stop and not the inner stop of the piston is started in the actuator.

- Preset setpoint step-change in closing direction (e.g.: 18 → 6 mA).
  Check the step-response and, if necessary, optimize
  with potentiometer KP and TD.

  See Chapter 6.2.3.

➢ During the test run, check all hydraulic connections for leaks. In case of leaks, immediately switch off the hydraulic supply and remedy the leakage.

6.2 Parameter setting

➢ Due to unintentional maladjustment of the parameters or changed operating conditions, one or both parameters may have to be readjusted. We recommend documenting the adjustment of the parameters as well as the set values.

The parameters are adjusted by means of potentiometers X0, X1, FM, KP and SF.

➢ If the cover is removed, explosion protection is no longer guaranteed. Therefore, check that there is no explosive atmosphere or may form as long as the end cover is not mounted and secured by the screws.

➢ The cylindrical part of the end cover and the housing bore form part of the flameproof enclosure for explosion protection. The cylindrical surface of the end cover and the associated surface of the housing bore must not be damaged. The corrosion protection of these surfaces needs to remain complete.

Potentiometer:	Parameter description:
FM	Setting of hydraulic center of control piston
X0	Setting of position s at setpoint w = 4 mA
X1	Setting of position s at setpoint w = 20 mA
KP	Setting of proportional gain of positioner
TD	Setting of actual value difference of positioner

- X0 must be adjusted before adjusting X1.
- Potentiometers F0 and F1 are set at the factory and must not be adjusted.

For position of potentiometer, see Chapter 10.

6.2.1 Setting the hydraulic center of control piston

To avoid a deviation between the setpoint and the actual value remote indication, a magnetic force offset is adjusted by potentiometer FM.
This offset is selected so that the control deviation is zero at setpoint w = 12 mA and the control piston is in the hydraulic center. For setpoints of w ¹ 12 mA, minor deviations to the actual value remote indication may occur.

- Run the way valve until it has reached operating temperature and check the feed pressure.
- Predefine setpoint w = 12.00 mA with a power source.
- Measure the actual value remote indication and set to 12 +/- 0.05 mA with potentiometer FM.

Effective direction of FM:
The magnetic force or actual position remote indication increases by turning the potentiometer clockwise.

Stroke setting

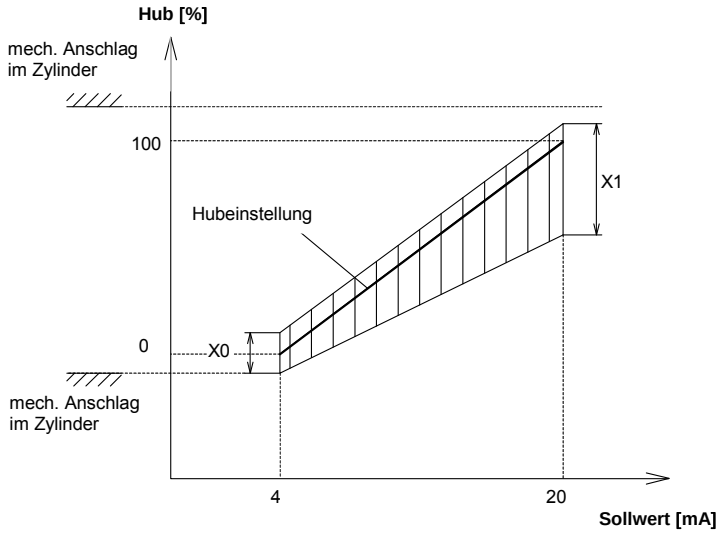


Fig. 3 Stroke setting

With potentiometers X0 and X1, an effective stroke of the piston from a hydraulic cylinder can be allocated to setpoint 4..20 mA.

The regulating ranges of the potentiometers are defined differently:

- Adjusting range X0: +/- 5 %
- Adjusting range X1: +/- 5 %

The data refer to the falling signal of the position feedback 20..4 mA ≈ 0..100 % stroke.

Stroke setting 0 %:

- Predefine setpoint w = 4.0 mA with a power source.
- Set 0 % position using potentiometer X0 and observe position x and the actual value remote indication.

- Should the actual value remote indication increase permanently, i.e. greater than 4 mA when adjusting the potentiometer X0 counterclockwise, the lower mechanical stop (on valve adjustment usually the valve seat) is reached and the regulating range exceeded.
- In order to reach the "closed position" of a valve safely at a setpoint of 4 mA, even at thermal linear expansion or drifting of a signal, the stroke may also be adjusted at a setpoint of e.g. 4.5 mA.

Effective direction of X0:
The piston moves towards 100 % by turning the potentiometer clockwise.

Stroke setting 100 %:

- Predefine setpoint w = 20.0 mA with a power source.
- Set 100 % position using potentiometer X1 and observe position s and the actual value remote indication.

- Should the actual value remote indication increase permanently, i.e. less than 4 mA when adjusting potentiometer X1 clockwise, the upper mechanical stop is reached and the regulating range exceeded.

Effective direction of X1:
The piston moves towards 100 % by turning the potentiometer clockwise.

6.2.2 Setting the proportional gain

The control parameters on the way valve are preset by the factory.
After mounting on a cylinder, the control parameters need to be adapted on the jobsite under real operating conditions.

- Predefine setpoint step-change from 18 → 6 mA.
- Observe the time-dependent course of the actual value x in the control room.
- Vary the gain with potentiometer KP until the time-dependent course of the actual value corresponds to characteristic curve 2 in Fig. 4.

Effective direction of KP:
The proportional gain is increased by turning the potentiometer clockwise.

- Even if the closing and opening times with a KP set to a low value seem to be sufficient, nevertheless, adjust the KP according to the procedure described above.

Advantage

- Better dynamic behavior in case of minor setpoint changes and lower deviation between the setpoint and the actual position remote indication.
- After optimizing KP, repeat the adjustment of FM, X0 and X1, if necessary.

- Only trained commissioning personnel is allowed to perform optimizations with potentiometer TD.
- It is vital to observe the notes contained in Chapter 6.2 for the removal and mounting of the cover.

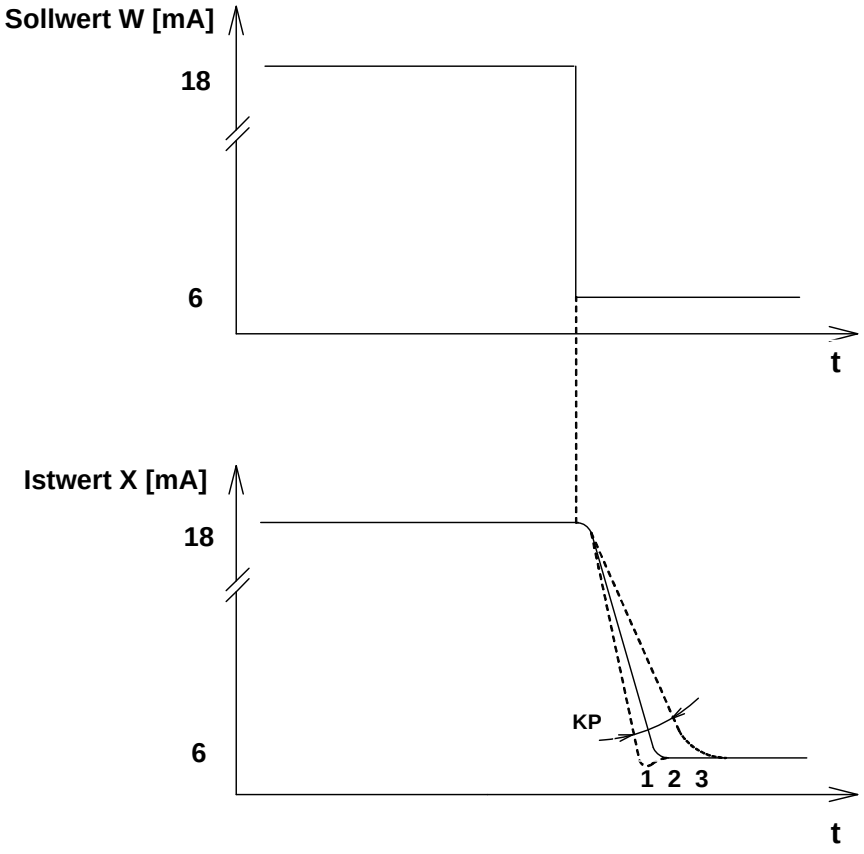


Fig. 4

7 Operation

7.1 Operation with manual operation knob

The operation with the manual operation knob enables the manual positioning of the actuator without electrical connection of the way valve.

- While operating with the manual operation knob, do not stay in the danger zone of the actuator if no protective device is mounted!

- Manual operation is only possible when the circlip was removed before. On completion of operation with manual operation knob, move the manual operation knob to its end position by turning it counterclockwise and lock it by pushing in the circlip.

Move the piston of actuator from 0% to end position 100%:

- Slowly adjust the manual operation know by turning it clockwise.
- Observe the piston. When the piston moves, stop clockwise rotation.
- The piston moves uncontrolled into 100% end position.

Move the piston of actuator from 100% to end position 0%:

- Proceeding from the above-mentioned position, slowly adjust the manual operation knob by turning it counterclockwise.
- Observe the piston. When the piston moves, stop counterclockwise rotation.
- The piston moves uncontrolled into 0% end position.

7.2 Normal operation

During normal operation, the way valve is operated with an external position setpoint.
If the way valve does not work as expected, normal operation is interrupted. To remedy the malfunction, troubleshooting activities are required.

7.3 Troubleshooting

➢ Troubleshooting must only be performed in a non-hazardous atmosphere.

➢ Prior to starting the work, make sure that the way valve was installed electrically and hydraulically according to the information provided in Chapter 5 and properly commissioned according to the information provided in Chapter 6.

Malfunction	Possible cause(s)	Remedy
The piston rod shows temporary stroke variations.	Air pockets and/or lack of damping	De-aerate the way valve as per Chapter 6.1.
The piston rod shows periodical stroke variations		Precondition: Disconnect external setpoint and connect setpoint source directly to the way valve.
	Electrical fault on the connecting cable and/or vibration of the master controller	Establish precondition and enter a constant setpoint. If a stroke variation does no longer occur, check the connecting line and/or the master controller for malfunctions and/or defects.
	Proportional gain set too high	Establish precondition and realize setpoint step-changes. If this causes periodic stroke variations, readjust the gain. See Chapter 6.2.3.
	There is mechanical friction in the slide valve.	Establish precondition. Enter setpoint w 0 8 mm for t = 30 sec. Then increase the setpoint in one step to 8.5 mA and keep it constant for 30 sec. If the stroke varies in one of the two phases, ingress of dirt into the slide valve may be the cause. Open slide valve and clean interior parts. In case of damage to the control edges and surfaces, completely replace the way valve.
Piston rod shows sporadic stroke variations	Connecting fault and/or defective electric lines	Connect setpoint source directly to the way valve. If this remedies the malfunction, check the electric line.
	Defect in the Voith control magnet	Connect setpoint source directly to the way valve. If malfunctioning still continues, replace the control magnet.

Malfunction	Possible cause(s)	Remedy
Piston rod of actuator does not move to set position	Supply pressure too low	Check supply pressure.
	Counterforce of piston rod exceeds the working power of the piston rod	Enter setpoint 20 mA (0 mA) and measure the pressure on output A of the way valve. If the pressure on the output corresponds to the supply pressure, the counterforce affecting the piston rod is too high. Consult Voith Turbo.
	Defective position measuring system	In 0% position, the current signal of the position pick-up has to be approx. 20 mA. If the deviation is higher, replace the position measuring system. (Comparison with the data stated in the customer's commissioning record.)
	Defect in the hydraulic pilot control	Dirt particles (e.g. metal chips) block the control piston. Disassemble and clean the control piston. If necessary, contact Voith Turbo.
Fuse blown The upstream fuse of the way valve responds or the maximum power consumption is being exceeded	Defect in the Voith control magnet	If the piston of the actuator can be adjusted with the manual operation knob with switched off power supply, the control magnet is defective and has to be replaced.

Please kindly contact Voith Turbo if any type of malfunctioning occurs which is not included in this table.

➢ Periodic steady-state vibrations of the piston rod always mean some abnormal or even dangerous operating mode.

Vibrations supremely stress moving parts as well as bearing and sealing elements. As a consequence, increased wear and increased bearing temperatures occur. Reasons for such vibrations could be:

- Substantial change of stroke setting towards smaller stroke
- Incorrectly set control parameters
- Insufficient hydraulic damping
- Malfunction of hydraulic and/or electric supply.

Vibrations are usually identified by their effects during operation, they are, however, also observed via the stroke remote indication or by arising deviations.
In any case, analyze and remedy the cause for the vibrations. If required, contact Voith Turbo.

8 Maintenance, Servicing, and Inspections

- Any maintenance, servicing and inspection work is only allowed in non-hazardous atmosphere.

- For trouble-free and reliable operation of the way valve, inspection, maintenance and servicing are necessary and need to be performed in certain intervals.
- The intervals indicated apply to way valve operation and proper use within the permissible operating conditions. For continuous operation in extreme ranges, shortening of the intervals is recommended.

8.1 Maintenance and servicing

- Combustible dusts may cause fire or explosion.

- These inspection works may be performed by the operator's trained expert personnel provided they meet the criteria as per Chapter 2.3.

Maintenance intervals	Maintenance work
Routine inspection	Check pipes, pipe unions and connections on the way for leaks, impurities and damage. Remedy any leaks, impurities and damages detected , as required, during appropriate operating phases. Monitor the way valve operating behavior for any changes (e.g. noise). Analyze and eliminate the causes, as required, during appropriate operating phases.
Inspection after approx. 740 operating hours or 1x per month	Take an oil sample from the oil tank and check it for solid and suspended matters, water content, change of color and air bubbles. Check the oil sample for oil cleanliness. Check and change the oil, as required, during appropriate operating phases.
Inspection after approx. 8000 operating hours or 1x per year	Take an oil sample from the oil tank and analyze it chemically. Check and change the oil, as required, during appropriate operating phases. Check the electrical connections of the way valve and retighten them, if necessary.

8.2 Inspections

Inspection intervals	Inspection work
Within the scope of the regular plant inspection	Check pipes, pipe unions and connections on the way valve for leaks, impurities and damage. Remedy any leaks, impurities and damages detected , as required, during appropriate operating phases.
	Check the way valve operating behavior for any changes (e.g. noise, poor control behavior). Eliminate the causes, as required, during appropriate operating phases.

- These inspection works may be performed by the operator's trained expert personnel provided they meet the criteria as per Chapter 2.3.

Inspection works after 60,000 operating hours, 7 years after first commissioning at the latest	Remove way valve from the installation and disassemble same in an appropriate workshop. Inspect the inner parts and replace conspicuous parts. Replace all seals. Perform a text run on a suitable test stand, check and document the way valve operational behavior.

- These inspection works must only be performed by the operator's trained expert personnel in an appropriate workshop or by Voith personnel at the Voith workshop (see Chapter 2.3).

Inspection works after another 60,000 operating hours, 7 years after the last inspection at the latest	Remove way valve from the installation and have it inspected and completely overhauled at Voith Turbo, Crailsheim. All the conspicuous parts, all parts under power and the springs will be replaced. By performing a test run, the operating behavior will be checked and documented.

- Only Voith Turbo expert personnel are exclusively allowed to perform these inspection works. The operator's expert personnel will remove the way valve according to Chapter 2.3.

8.3 Spare parts information

- It is only allowed to install original Voith parts.
- The manufacturer only is able to guarantee an expert repair and/or maintenance.

- Storage of spare parts is only allowed if these are protected against corrosion. The storage area has to be dry and free from dust. Prior to installing the parts, remove the corrosion protection.
- Do not store the elastomere seals together with chemicals, solvents, fuels, acids, etc. They need to be packed airtight and protected against light with a high content of UV rays. The storage period until the way valve gets used most not exceed 6 years (for NBR) and 10 years (for FPM).

9 Decommissioning

- Make sure that there is **no** explosive atmosphere while decommissioning the way valve!

- If the way valve is switched off for repair or inspection purposes, or for a system shutdown, switch off the oil supply system and release all pressure accumulators, if effective.
- Wear protective glasses when disassembling the hydraulic connection on the way valve.

- Disconnect the 24 V DC power supply and remove the lines. Remove the piping. This may result in larger oil quantities leaking out. Collect the oil in a suitable container and dispose of it properly. Close all openings. Then clean and pack the way valve.

Disposal

For way valve disposal, please observe the local applicable provisions on protection of the environment. The way valve essentially contains steel, copper, synthetic materials, electronic components and residual oil.

10 Annex

- Outline Drawing	9 1868592

The following is available as accessory:

Adapter plate	43.8346.10
Ex e-junction box	43.8539.10

VOITH
Engineered reliability.

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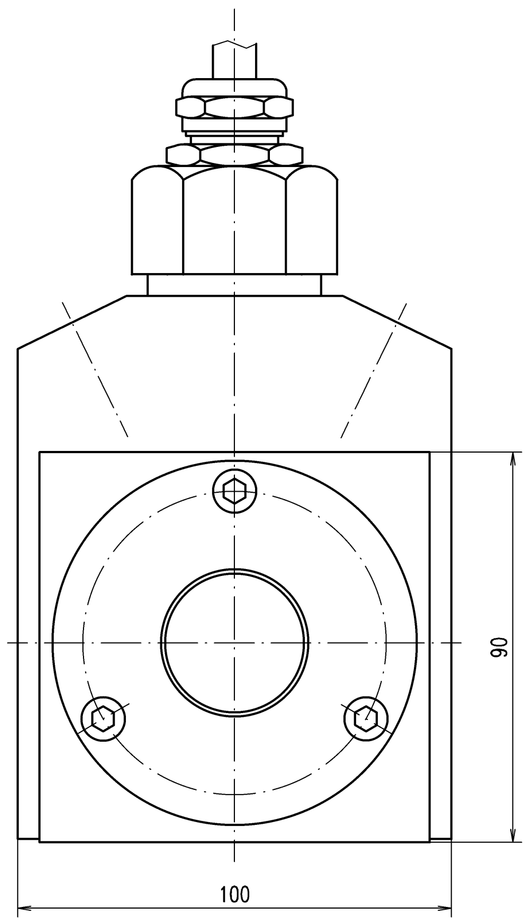
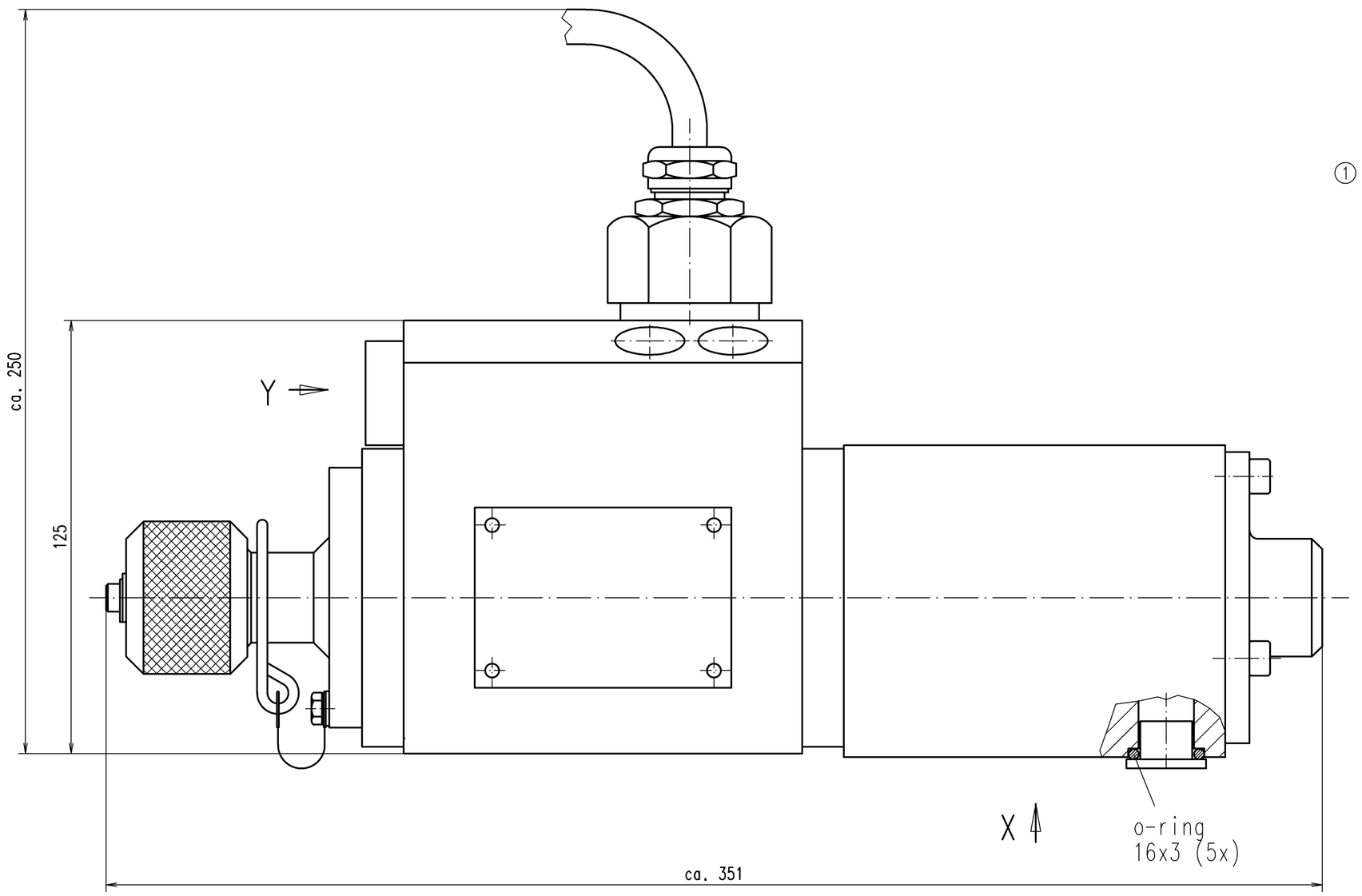
Confidential, all rights reserved DIN 34
Confidencial, reservados todos os direitos DIN 34



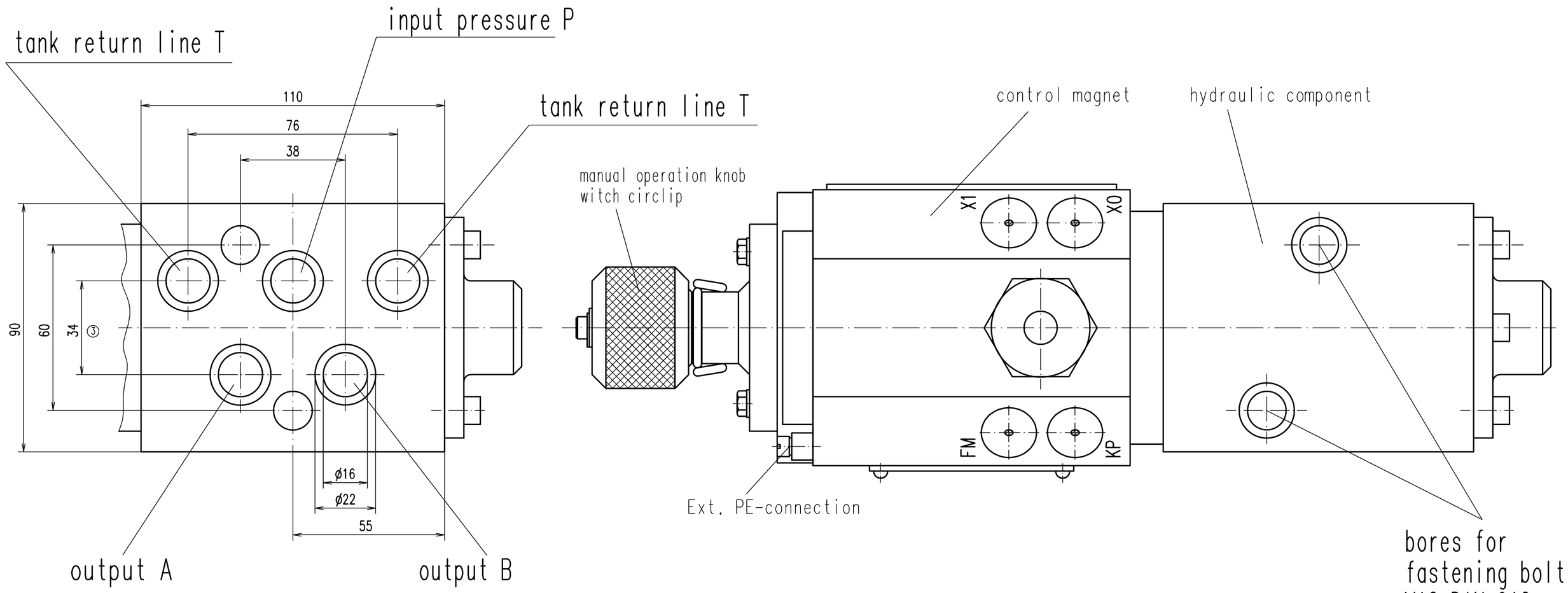


electric connection

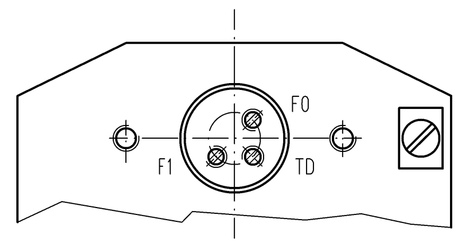
Connect 0 VDC and GND near to the power supply unit but not at a local panelboard possibly existing at the site!

	designation		core identification number
①	+24 VDC (+/-10%), 0,8 A (3A for a short time of approx. 1sec)		1
	0 VDC		2
	GND		3
	0 V-reserve		4
	+ mA input (20..4 mA=0..100% stroke)	actual position	5
	- mA input		6
	not used		7
	not used		8
	+mA input (4..20 mA=0..100% stroke)	set position	9
	-mA input		10
	+mA output (4..20 mA=0..100% stroke)	actual position	11
	-mA output	remote indication	12
	indication |xd| > |xd(perm)| / (+)	functional control	13
	indication |xd| > |xd(perm)| / (-)		14
	not used		15
	PE	equipotential bonding	16

view X



view Y



input pressure p = 120 bar (max.) ②

Art. No. 91868590

Attention: Any alteration on this drawing has to be checked by the ex-protection officer of product group aie.

installation position:
vertical, hydraulic component on top, control magnet on bottom

Rev.	Iss.	Revision-Nr.	Rev. descr. (shop and eng. info only)	Index	Date: drow.	Name	App.
04	1x	97683	Neue Ex-Kennzeichnung		10-01-12	zzokoc	cra_mley
3	1x	26298	Mass nachgetragen		05-12-08	DKg	Ochs
2	1x	A7894/04	Druck von 100 auf 120 bar geändert		04-11-02	AMa	Ochs
1	1x	A7829/03	Englischtexte im Anschlussplan berichtigt		03-08-14	AMa	Ochs

Dimension	Tolerances	Refer.	Reply for	Repl. by	

④ II 2G IIC T4
WSR-D16212

CAD | Released for microl. F

Language en

Chamfers ISO 13715	Gen. tolerances ISO 2768-mK-E	Surface quality R_a in µm	Scale of orig. 1:1 / Mass
	Tolerancing DIN 7167	ISO 1302	Material
			Pattern / Die No. / Blank-No.

	Date	Name	Doc. type Z01
Dr.	2003-07-24	IWe	Title: 4/3-way valve
Cn.	2003-07-24	Ochs	
Dept. aiet	App. met		
Stand.			

VOITH TURBO ANTRIEBSTECHNIK

Drawing No. / Docu-No. 9 186859 2

Sheet 1 of 1 Sh.

DIN A1