Well-established technology
Electro-hydraulic I/H converters and WSR way valves are the ideal economic solution for controlling hydraulic positioning cylinders. This enables a valve to regulate the mass flow (e.g. steam) in a precise and highly dynamic manner.

A current input signal (0/4 – 20 mA) in the I/H converters or WSR way valves is proportionally converted into an output pressure or an oil flow.

Outstanding reliability
The electro-hydraulic I/H converters and WSR way valves design is a simple one:
- Control magnet with integrated electronics
- Hydraulic component

This simple and compact design serves to ensure high operational reliability coupled with availability of the components, and your system.

All the world’s our home
We are a reliable partner to manufacturers and operators of turbo machines in all international markets.

Voith Turbo actuator technology has established itself 10,000 times over in power plants across the globe and ensures economic operation of turbines and compressors.
I/H converters

Voith Turbo I/H converters convert a 0/4–20 mA current input signal quickly and precisely into proportional output pressure.

Design
A Voith I/H converter is an electrically-controllable pressure regulating valve, consisting of force-controlled solenoid and a hydraulic component.
Simple design and well-established operating principle

Function

Solenoid-force control generates a magnetic force of $F_{\text{Mag}}$ in a 24V d.c. solenoid. This magnetic force is proportional to the 0/4–20 mA input signal ($w$), the limits are configured using the X0 and X1 parameters. The electronic control, magnetic flux measurement, engineering design of the magnet and the hydraulic pilot control together form a dynamic functional unit that is practically free of hysteresis.

The control magnet applies the force $F_{\text{Mag}}$ to the control piston. This in turn counteracts hydraulic force $F_{\text{Hyd}}$ as generated by the pressure at output A over the cross-sectional area of the control piston (pressure regulator).

As a result of this regulation, the output line of the actuator always receives the exact required pressure and the oil quantity for positioning the steam or fuel valves.
Versatile application made possible by robust design and maximum precision

Technical data and characteristics

- Supply voltage 24 VDC
- Current consumption 1.0 A
- Input signal 0/4 – 20 mA
- Type of protection IP 65
- Input pressure up to 70 bar
- Ambient temperature -20 to +80 °C for standard design
- Explosion-proof design
  EEx d IIC T4 available

<table>
<thead>
<tr>
<th>Type</th>
<th>Maximum input pressure [bar]</th>
<th>Control range for output pressure [bar]</th>
<th>Flow rate [l/min] at Δp = 1 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSG-B03XXX</td>
<td>40</td>
<td>0 – 3</td>
<td>30</td>
</tr>
<tr>
<td>DSG-B05XXX</td>
<td>40</td>
<td>0 – 5</td>
<td>30</td>
</tr>
<tr>
<td>DSG-B05X48</td>
<td>20</td>
<td>0 – 5</td>
<td>100</td>
</tr>
<tr>
<td>DSG-B07XXX</td>
<td>40</td>
<td>1 – 7</td>
<td>30</td>
</tr>
<tr>
<td>DSG-B10XXX</td>
<td>40</td>
<td>0 – 10</td>
<td>30</td>
</tr>
<tr>
<td>DSG-B30XXX</td>
<td>70</td>
<td>0 – 30</td>
<td>30</td>
</tr>
<tr>
<td>DSG-B35XXX</td>
<td>70</td>
<td>10 – 35</td>
<td>30</td>
</tr>
</tbody>
</table>

System-specific data must be taken into consideration when defining a suitable I/H converter. When selecting an I/H converter, please make full use of our comprehensive knowledge. Our experienced sales staff will be only too glad to be of assistance.

Selection table

Voith Turbo I/H converters to a 300 MW steam turbine
Customer benefits

Outstanding reliability and availability
- Well-established operating principle
- Dirt-resistant and robust design

Dynamic and precise positioning of the output pressure
- Reproducibility < 0.1 %
- Almost no hysteresis
- Temperature compensation
- No drifting
- Input pressure at least 0.5 bar higher than maximum output pressure
- Fast response time

Simple installation and initial startup
- Device inspected and configured at factory (plug & play)
- Min. and max. output pressures can be changed simply using parameters X0 and X1 (potentiometers)
- Turbine lubricating oil can frequently be used as an operating medium
- Depending on the model in question, adapter plates, flushing plates and connecting cables are available

Voith Turbo I/H converters to a 3.4 MW steam turbine
(Photo: AG KK&K – www.agkkk.de)

Explosion-proof design (left) and standard design
WSR way valves

Voith Turbo WSR way valves with integrated positioner convert in combination with an hydraulic cylinder a 4–20 mA current input signal quickly and precisely into a proportional stroke. 3/3-WSR way valves or 4/3-WSR way valves can be used to position hydraulic cylinders in a highly dynamic manner.

Design

A Voith Turbo WSR way valve (fuel-quantity positioner) is an electrically-controllable directional control valve, consisting of force-controlled solenoids and a 3/3-WSR way valve hydraulic unit for single-acting cylinders or 4/3-WSR way valve hydraulic unit for dual-acting cylinders.
Integrated control electronics for dynamic and high-precision changes in flow rate

3/3-WSR way valve for single-acting hydraulic cylinders

4/3-WSR way valve for dual-acting hydraulic cylinders

Function

The specific system deviation (nominal value \( w \) - actual value \( x \)) and the set control gain \( \text{KPU resp. KPD} \), yields a reference variable \( U_{\text{Mag}} \) for the solenoid force control. The magnetic force \( F_{\text{Mag}} \) generated in the magnet system is monitored indirectly through measurement of the magnetic flux over \( U_{\text{Hall}} \) and sent back to the controller. \( F_{\text{Mag}} \) acts via the tappet on the control piston of the hydraulic pilot control. This is deflected against the control spring until the travel-specific spring force \( F_s \) balances out against the force \( F_{\text{Mag}} \). This results in a volumetric flow that can be changed in both direction and size, and which can adjust the stroke \( s \) of an externally mounted hydraulic cylinder. The actual position is monitored by means of a position pick up sensor and sent to the positioner integrated into the WSR way valve. The adjustment of hydraulic cylinder occurs position controlled.

\[ \begin{align*}
A, B & \quad \text{Consumer terminals (outputs)} \\
T & \quad \text{Tank connection} \\
P & \quad \text{Oil supply terminal (input)} \\
X0, X1 & \quad \text{Parameters for stroke adjustment (potentiometers)} \\
\text{KPU, KPD} & \quad \text{Control gains (potentiometers)} \\
w & \quad \text{Position nominal value (4 – 20 mA)} \\
x & \quad \text{Position actual value (4 – 20 mA)} \\
F_{\text{Mag}} & \quad \text{Magnetic force} \\
F_s & \quad \text{Force for control spring} \\
U_{\text{Hall}} & \quad \text{Hall voltage} \\
U_{\text{Mag}} & \quad \text{Reference variable for solenoid force} \quad F_{\text{Mag}} \\
U & \quad \text{Voltage} \\
s & \quad \text{Stroke} \\
i & \quad \text{Position pick up sensor current signal}
\end{align*} \]
Large flow rates and maximum accuracy enable versatile application

Technical data and characteristics

- Supply voltage 24 VDC
- Current consumption 1.0 A
- Input signal 4 – 20 mA
- Remote display 4 – 20 mA
- Type of protection IP 65
- Input pressure up to 160 bar
- Ambient temperature -20 to +80 °C for standard design
- Explosion-proof design EEx d IIC T4 available

<table>
<thead>
<tr>
<th>Type</th>
<th>Maximum input pressure [bar]</th>
<th>Flow rate [l/min] at Δp = 1 bar</th>
<th>Flow rate [l/min] at Δp = 2 bar</th>
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</thead>
<tbody>
<tr>
<td>WSR-C25XXX</td>
<td>200</td>
<td>P → A: 17, A → T: 62</td>
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<tr>
<td>WSR-C45XXX</td>
<td>up to 40</td>
<td>P → A: 22, A → T: 75</td>
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</tr>
<tr>
<td>WSR-C60XXX</td>
<td>up to 40</td>
<td>P → A: 35, A → T: 150</td>
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<tr>
<td>WSR-E60XXX</td>
<td>up to 40</td>
<td>P → A: 30, A → T: 350</td>
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<tr>
<td>WSR-E80XXX</td>
<td>up to 40</td>
<td>P → A: 50, A → T: 600</td>
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</tr>
<tr>
<td>WSR-K120XXX</td>
<td>25</td>
<td>P → A: 600, A → T: 600</td>
<td></td>
</tr>
</tbody>
</table>

System-specific data must be taken into consideration when defining a suitable WSR way valve. When selecting a WSR way valve, please make full use of our comprehensive knowledge. Our experienced sales staff will be only too glad to be of assistance.
Customer benefits

Outstanding reliability and availability
- Well-established operating principle
- Dirt-resistant and robust design

Dynamic and high-precision control
- Resolution < 10 µm
- Almost no hysteresis
- Temperature compensation
- Load shedding < 300 ms can be realized

Simple installation and initial startup
- Device inspected and configured at factory (plug & play)
- The stroke range and control response of the working cylinder can be easily changed and optimized using the potentiometers (X0, X1, KPU, KPD)
- Turbine lubricating oil can frequently be used as an operating medium

Voith Turbo WSR way valves to a 40 MW steam turbine (photo: MAN Turbo)

Standard version, explosion-proof version optional
Redundant actuator technology – maximum availability

I/H converter module = 2 x I/H converter
+ maximum selection

Function

Dual-channel conversion of electrical actuating signals into a hydraulic pressure with maximum selection:
The two electrical actuator signals $w_1$ and $w_2$ (4 – 20 mA) of a redundant turbine controller are each converted separately by a well-established Voith I/H converter into a proportional hydraulic pressure $p_{A1}$ and $p_{A2}$. Both pressures act on a hydraulic maximum selection. The higher pressure is switched through (A). The hydraulic function can be continuously monitored with the aid of additionally-integrated pressure sensors under normal operating conditions through ramp-shaped lowering of the turbine controller’s nominal value. This pressure variation enables diagnosis of each sub-system to be conducted during operation. Each I/H converter receives an electronic monitoring circuit which serves to ensure that in the event of any malfunction the I/H converter then regulates towards minimum output pressure. The output pressure of the correctly operating I/H converter is switched through. The process then continues smoothly. The faulty device can be replaced during operation.
Tandem WSR way valve = 2 x control magnet + hydraulic component

Function

Both control magnets are given a separate nominal value (w₁ and w₂) and a separate position pick up sensor (x₁in and x₂in) is connected to each control magnet. The control magnet 1 armature moves the control piston of the hydraulic pilot control via the control magnet 2 armature. If control magnet 1 is active then control magnet 2 is inactive, although switched on. In the event of a malfunction, the control magnet 1 is switched off and control magnet 2 is activated over the nominal value (w₂) using a specific transit time ("warm redundancy"). The switching logic is located externally in the control engineering and it monitors the control magnets (position pick up sensor displays x₁in and x₂in). It also generates the switchover signals. Tandem WSR way valves are also available as 3/3 and 4/3 versions.