



**SAMSON**



# **SPECIAL PRINT**

**Anti-surge Valves**

**SAMSON RINGO Types 3595 and 3599**

**SMART IN FLOW CONTROL**

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

# Anti-surge Valves SAMSON RINGO Types 3595 and 3599

### Application

Anti-surge protection is crucial for both centrifugal and axial compressors in order to prevent detrimental effects. Compressor surge occurs when there is a sudden decrease in downstream process flow demand, such as during emergency shutdowns, leading to a rapid increase in downstream pressure and a shift in the compressor's operating point.

When the compressor is unable to maintain the required pressure ratio, a change in flow direction occurs. This temporary collapse in pressure ratio triggers another alteration in flow direction. Unless the root cause is addressed, this cyclical behavior, known as compressor surge, persists. As a consequence, severe vibration and rapid temperature escalation can ensue, potentially resulting in significant or catastrophic damage to the compressor.

Anti-surge protection is ensured through the utilization of a control valve, which has the capability to either exhaust the gas or vapor from the compressor into the atmosphere or recirculate it back to the compressor inlet.

**At SAMSON RINGO**, we specialize in the design and manufacturing of high-quality globe and axial control valves specifically designed for this critical application. Our valves are engineered to provide precise control and reliable operation, ensuring effective anti-surge protection for centrifugal and axial compressors in various industrial settings.

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

### Key features of SAMSON RINGO anti-surge valves

#### Fast stroking time:

In order to effectively prevent surge conditions, control valves need to be able to fully open within a short time frame, typically ranging from one to two seconds.

SAMSON RINGO understands the criticality of actuation time and offers a comprehensive range of control valve accessories that meet even the most stringent requirements for fast stroking time. Our solutions are suitable for valves of various sizes, including large valve sizes, ensuring efficient and timely response to surge conditions.

SAMSON RINGO takes full responsibility for instrumentation and hook-up selection, design, assembly, and testing to achieve the necessary fast opening times in emergency situations.

Furthermore, our designed instrumentation solutions are not limited to emergency situations. They also enable our valves to perform regulation with fast and precise stroking times, ensuring optimal control and efficiency in various operational scenarios.



Fig. 1: Example of an anti-surge control panel

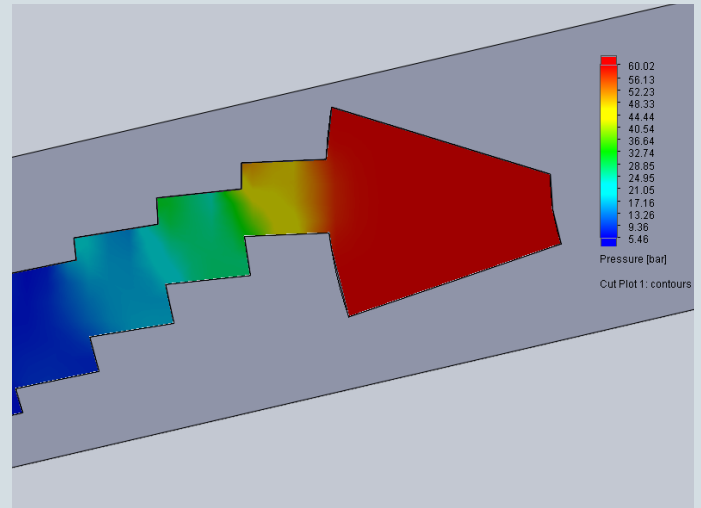


Fig. 2: Multi-staged pressure distribution to control velocity in the vena contracta below sonic conditions

#### Anti-noise and velocity control solutions:

Extreme flow conditions in anti-surge applications can lead to significant noise generation if proper design considerations for noise attenuation are not considered. At SAMSON RINGO, we understand the importance of reducing noise levels to acceptable standards.

Our anti-surge valves feature cage-guided, multi-staged solutions and compact silencers, specifically designed to mitigate and reduce the noise generated by the valve. By employing advanced engineering techniques and materials, we ensure that the noise levels are kept within acceptable limits during operation.

With SAMSON RINGO's anti-noise solutions, you can experience improved working conditions by minimizing noise pollution in your facility. Our valves provide effective anti-surge protection without compromising on the comfort and safety of the surrounding environment.

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

### Valve types

#### **Type 3595 Globe Valve: modular cage guide construction**

The Type 3595 Globe Valve, featuring a modular cage-guided construction, offers flexibility and adaptability to different process conditions. The cage and plug components can be customized and combined in various configurations to meet specific application requirements. Each modular cage and plug combination offer unique possibilities, allowing for a comprehensive range of solutions with modular components.

Furthermore, the Type 3595 Globe Valve offers the advantage of a multi-stage internal design solution as described before. This means that the valve can incorporate multiple stages of cages and plugs, providing enhanced

control and pressure drop capabilities. The multi-stage configuration allows for precise flow modulation and improved throttling performance ensuring non-sonic conditions in all the flow path, making it particularly suitable for applications with high flow rates and challenging pressure drop conditions which otherwise will lead to high noise levels.

Additionally, the Type 3595 Globe Valve provides a wide selection of materials for both the body and internal components. This ensures compatibility with a variety of process fluids and environments, allowing for optimal corrosion resistance and longevity.

For further information, refer to Data Sheet T 8079.

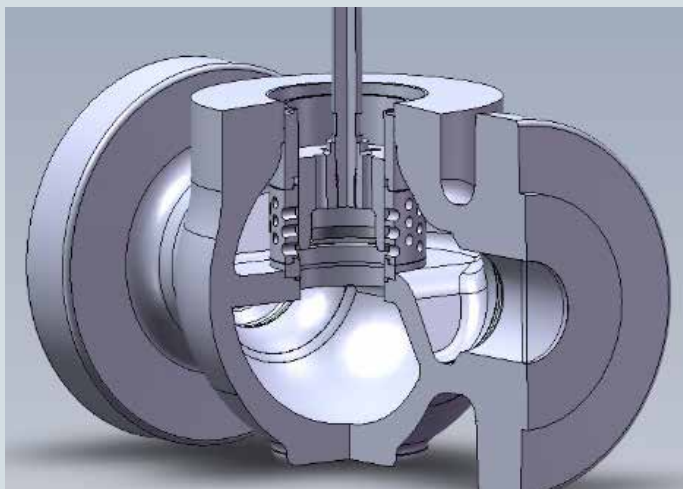


Fig. 3: Cage-guided Type 3595 Valve. The cage component can be changed without changing any other parts to provide different solution for different service conditions.

#### **Type 3599 Axial Valve for high rangeability and capacity**

In addition to SAMSON RINGO Type 3595 Globe Valves for anti-surge service, SAMSON RINGO offers a complete range of axial flow anti-surge valves that provide high rangeability values and are the perfect solution for high-capacity requirements of the surge conditions.

Axial flow valves are valves designed with a streamlined body configuration where the flow passes through a path between the inner and outer body, while the plug moves in the same axial direction as the flow.

Axial flow valves possess unique advantages due to their aerodynamic shape, allowing for higher  $C_v/K_v$  values compared to globe valves of the same size. This makes them an ideal solution for large-sized anti-surge valves that operate under medium to high-pressure drop conditions while ensuring fast stroking times. For the most critical cases, multi-staged trims are used.

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

The Type 3599 Axial Flow Valve has a linear to rotary type transmission system that reduces actuator size requirements. This, together with their compact design, allows installation in limited spaces and easily achieves fast acting times for huge range of controllable flow rates. Additionally, the compatibility with standard quarter-turn actuators simplifies the selection and integration process, providing a cost-effective solution for anti-surge applications.

With axial flow anti-surge valves in our product range, we provide a complete spectrum of options to meet diverse anti-surge application needs together with the Type 3595 Globe Valve.

For further information, refer to Data Sheet T 8080.

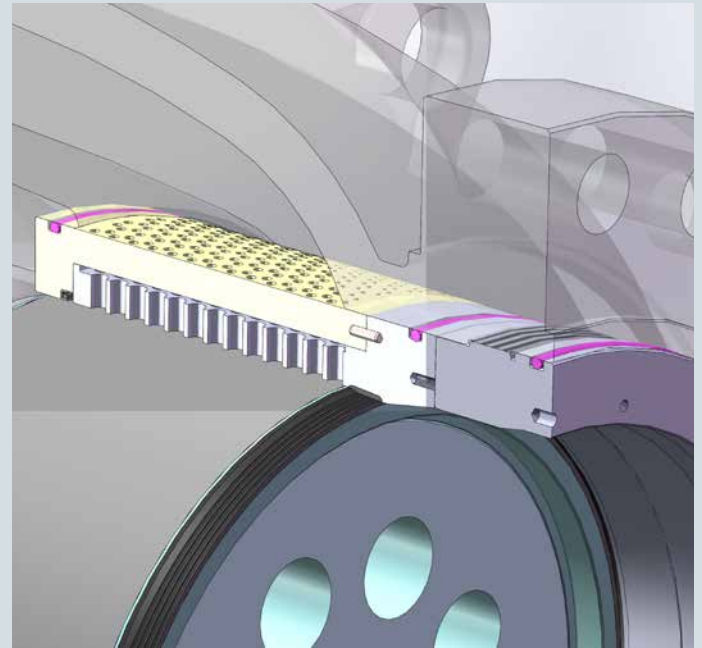


Fig. 5: Type 3599 Valve with multi-stage cage, up to 200 bar pressure drop

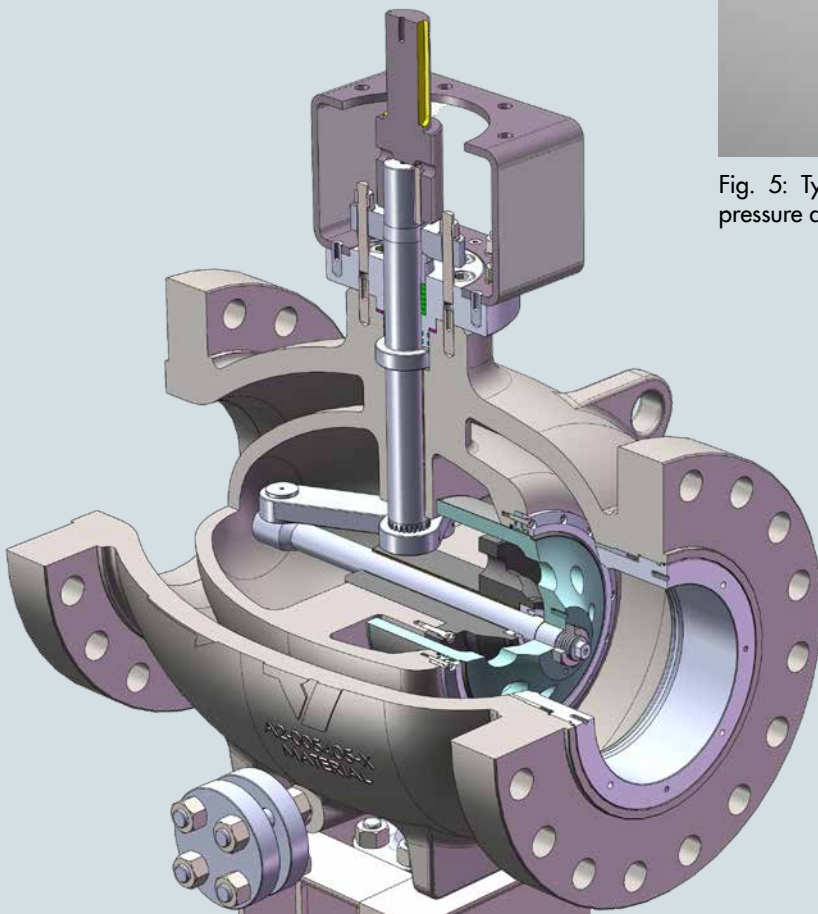


Fig. 4: Cutaway view of Type 3599, rotary to linear system

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

### Anti-surge applications

Various reference applications where Types 3595 and 3599 Valves valves are used are listed below:

- Natural gas processing plants: compressors are used to boost the pressure of natural gas for transportation and storage. Anti-surge protection is essential to prevent surge conditions and maintain stable operation. Due to the high flow rates and standard temperature ranges, Type 3599 is commonly used for this application.
- Refineries: compressors play a critical role in various processes within refineries, such as catalytic cracking, hydrocracking and fluidized bed processes. Surge protection is crucial to safeguard the compressor and maintain process efficiency. High temperature as well as corrosion resistance requirements led to the use of a Type 3595 Valve with bonnet extension as well as special materials for critical temperature ranges.
- Petrochemical plants: compressors are utilized in petrochemical plants for processes, such as ethylene and propylene production. Similar to refineries, Type 3595 is typically used due to its wide range of modular solutions.
- LNG (Liquefied Natural Gas) facilities: compressors are employed in LNG plants for liquefaction, storage and regasification processes. The possibility of low temperature and cryogenic options for Type 3595 makes it the perfect anti-surge valve for this LNG market.
- Power generation: gas turbines and steam turbines in power plants often require compressor protection. Surge control is necessary to prevent damage to the turbine and maintain stable power generation. High energy dissipation is normally needed for reducing the pressure and temperature of the superheated steam. The multi-staged Type 3595 with balanced plug for high temperature is the ideal solution in this case.
- Pipeline compression stations: compressor stations along natural gas or oil pipelines provide the necessary pressure to transport the fluids over long distances. Surge protection is crucial to ensure uninterrupted flow and prevent damage to the pipeline infrastructure. The high capacity of the Type 3599 is crucial for this application.
- Offshore platforms: compressor systems on offshore platforms are utilized for gas lift operations, gas compression for enhanced oil recovery and gas export. Surge protection is essential for safe and efficient operation in offshore environments. Similar to refineries, the huge range of exotic and special materials available for both Types 3595 and 3599 are a good option for these applications.
- Chemical plants: compressors are used in various chemical processes, such as ammonia production, fertilizer manufacturing and polymer production. Surge protection is critical to maintaining process stability and preventing equipment damage. Sealing surfaces which reduce the wear of parts and prevent scratching of the sealing surfaces make it essential to select a cage-guided control valve such the Type 3595 for this application.

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

### Application sample: anti-surge service - olefin complex: ethane cracking plant

In an ethane cracking plant, the compressor system plays a crucial role in the production process. These plants typically use compressors to enhance the pressure and flow of gases, such as ethane, propylene and butene, for efficient cracking reactions.

The scope of the order includes two Type 3595 Valves with an asymmetric angle body and specific dimensions engineered to replace the existing ones and meet the requirements of anti-surge service:

#### 1. Valve 1:

1. Size: 16" x 30"
2. Pressure rating: 300#
3. Body material: A352 LCB
4. Trim material: stainless steel 316 with Stellite® hard facing

#### 2. Valve 2:

1. Size: 12" x 16"
2. Pressure rating: 300#
3. Body material: A352 LCB
4. Trim material: stainless steel 316 with Stellite® hard facing

Both valves were designed and manufactured to ensure fast response times, with an opening time of 0.8 seconds for each valve. These valves have been specifically engineered to fulfill the demanding conditions of anti-surge service, including velocity control in all the flow path ensuring sonic velocity is not exceeded and the outlet velocity is controlled by different outlet size.

By fulfilling these requirements, these Type 3595 Anti-surge Valves contribute to the safe and efficient operation of the compressor system in the ethane cracking plant, safeguarding the overall plant performance and preventing damage to critical equipment.



Fig. 6: Type 3595 Valve with an asymmetric angle body for anti-surge service in an ethane compressor

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

### Application sample: anti-surge service - LNG compressor system

In LNG (Liquefied Natural Gas) applications, the compressor system plays a crucial role in liquefying and transporting natural gas. The compressor system boosts the pressure of the LNG vapor to facilitate its transportation and storage. The anti-surge valve is a critical component within the LNG compressor system, responsible for preventing compressor surge.

The different flow rates required for this application call for different sizes of Type 3595 Control Valve supplied from 8" sizes up to 20" with a wide range of process conditions to be controlled.

The instrumentation and control panel are designed to comply with the following requirements:

- Opening time: the valves must fully open within one second to ensure a swift response to surge conditions.
- Regulation time: the valves are expected to have a closing time of less than four seconds and an opening time of less than two seconds for precise regulation, facilitating efficient control of pressure and flow levels.
- Low temperature: LNG is stored and transported at extremely low temperatures. These valves are designed with materials and seals that can withstand these low temperature conditions without compromising performance.



Fig. 7: 20" anti-surge valve with pneumatic actuator and control system to ensure fast acting via solenoid (emergency condition) and via positioner (control)



## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

### Application sample: anti-surge axial valve: booster compressor station in a gas field

The purpose of a booster compressor station is to enhance the pressure and flow of natural gas or other gases within a pipeline network or gas transmission system. It serves as an intermediary station along the pipeline to increase the pressure of the gas, allowing it to continue its journey through the pipeline to reach its destination.

For the booster compressor station in a gas field project, the implementation of an anti-surge axial flow control valve is crucial to ensure the safe and efficient operation of the compressor system. The specific requirements and details for the supplied Type 3599 Axial Flow Valves in this application are as follows:

Valve specifications:

Size: 10"

Pressure ratings: 900# and 300#

Material: nickel alloy steel (A352 LC3) for low-temperature environmental conditions

The chosen valve size and pressure ratings are designed to the needs of the booster compressor station, aligning with the specific flow rates and pressures within the system. The use of LC3 material ensures excellent resistance to low temperatures, which is essential for handling the gas field's environmental conditions.



Fig. 8: Type 3599 Axial Flow Valves for anti-surge service in compressor stations

### Application sample: petrochemicals: anti-surge + hot gas bypass two-in-one Type 3595 Valves

This last application sample is an engineered Type 3595 Valve that is able to perform, as a single device, the anti-surge application described in previous examples together with hot gas bypass application.

The purpose of a hot gas bypass valve is to regulate the flow of hot gases in a process system, particularly in situations where excess heat needs to be managed. The hot gas bypass valve provides a controlled path for diverting a portion of the hot gas stream, bypassing certain equipment or processes, to maintain safe operating conditions and prevent equipment damage.



Fig. 9: 28" hot gas bypass valve and anti-surge for petrochemicals  
Emergency time <2 seconds. Control time <5 seconds without any overshoot

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

The supplied Type 3595 Valves for this project had several size ranges and pressure classes, starting from 12" up to a large 28" valve, which is able to perform both anti-surge and hot gas bypass as a single device. The high rangeability and special characteristic as well as the multi-stage trim and fast acting actuator is combined.

Opening stroking time of the 28" valve in case of emergency was measured to be less than two seconds.

### Dynamic performance testing for complete valve analysis

SAMSON RINGO offers a huge range of dynamic performance testing possibilities, enabling comprehensive evaluations of Types 3595 and 3599 Anti-surge Valves.

In addition to the standard functional test that record dead band, dead time, hysteresis, stroking time etc., our factory is prepared to perform dynamic tests using a bi-directional signal converter, allowing for the conversion of signals from the 0-10 V range to the 4-20 mA range or others. This capability enables technicians to generate and simulate a variety of signals, including step or ramp signals, and perform any hysteresis, dead band, and other measurement requirements. This versatility facilitates performance testing under various operating conditions.

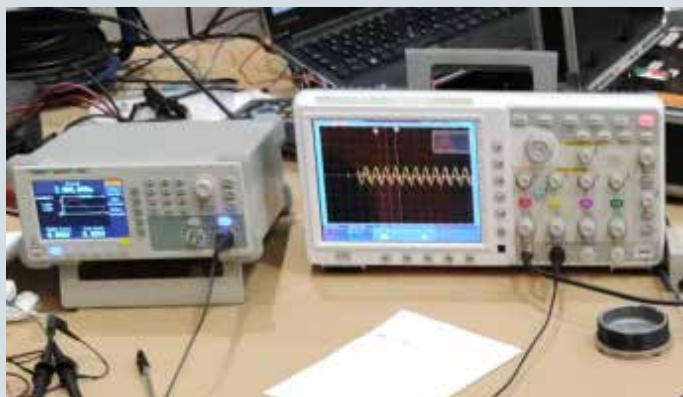


Fig. 10: Oscilloscope and signal generator to create any test and simulate real control conditions

All these tests include the monitoring and analysis of values using an oscilloscope. This capability allows technicians to observe and evaluate the generated sine-wave signals as well as the response of the valves. By examining the waveform and measuring important parameters, such as rise time, settling time and overshoot, the performance characteristics of the system can be thoroughly assessed and validated.

With the oscilloscope information, it is possible to plot and analyze Bode diagrams, which provide valuable insights into the stability of valves in closed-loop systems. This capability allows technicians to examine the gain and phase characteristics of the valve's frequency response. By studying the Bode plot, technicians can identify stability margins, resonant frequencies and potential oscillation issues. This analysis empowers them to optimize control systems, adjust parameters and enhance valve stability and performance in closed-loop operations.

With these testing possibilities offered by SAMSON RINGO, technicians can conduct dynamic performance tests effectively. It ensures that the system operates within the desired specifications, providing reliable and efficient signal conversion and valve performance in various applications.

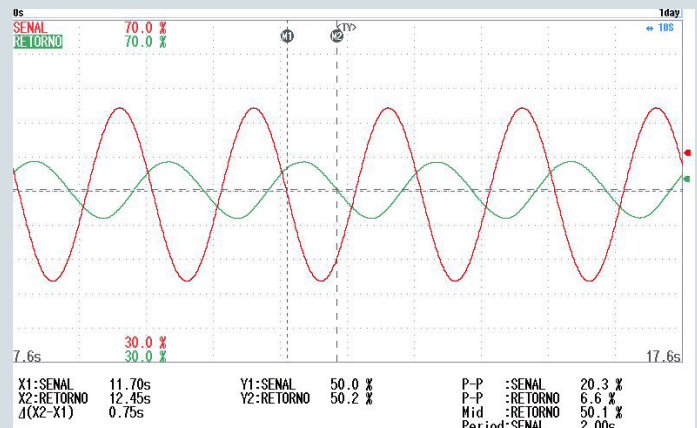


Fig. 11: Sample of sine-wave measurement for frequency test

## Anti-surge Valves

SAMSON RINGO Types 3595 and 3599

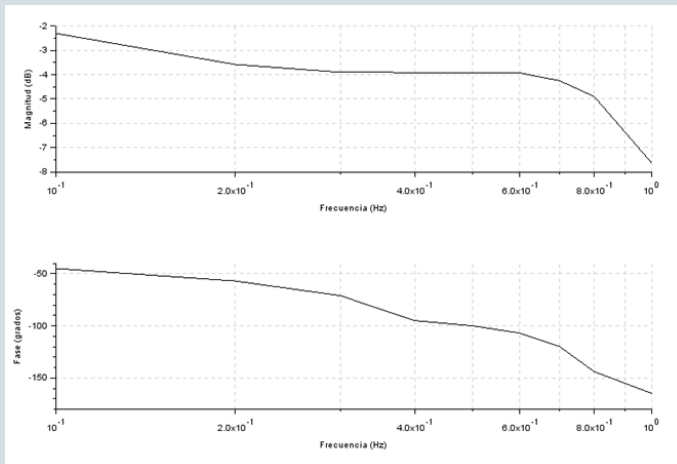


Fig. 12: Bode diagram plotted for Type 3595. Continuous decrease when phase is delaying is a sign of stable closed-loop behavior without oscillation or peak of resonant frequencies

Author:  
Alberto Argilés  
Business Development & Control Valves Product Manager

RINGO VÁLVULAS S.L.  
Calle Romero N°6 Polígono · Industrial Empresarium  
50720 Zaragoza, Spain  
Phone: +34 976 45 49 40 (ext. 255)  
E-mail: [alberto.argiles@samsongroup.com](mailto:alberto.argiles@samsongroup.com)  
Internet: [www.samsongroup.com](http://www.samsongroup.com)

# SAMSON AT A GLANCE



## STAFF

- Worldwide 4,500
- Europe 3,600
- Asia 600
- Americas 200
- Frankfurt am Main, Germany 1,900

## INDUSTRIES AND APPLICATIONS

- Chemicals and petrochemicals
- Food and beverages
- Pharmaceuticals and biotechnology
- Oil and gas
- Liquefied Natural Gas (LNG)
- Marine equipment
- Power and energy
- Industrial gases
- Cryogenic applications
- District energy and building automation
- Metallurgy and mining
- Pulp and paper
- Water technology
- Other industries

## PRODUCTS

- Valves
- Self-operated regulators
- Actuators
- Positioners and valve accessories
- Signal converters
- Controllers and automation systems
- Sensors and thermostats
- Digital solutions

## SALES SITES

- More than 60 subsidiaries  
in over 40 countries
- More than 200 representatives

## PRODUCTION SITES

- SAMSON Germany, Frankfurt, established in 1916  
Total plot and production area: 150,000 m<sup>2</sup>
- SAMSON France, Lyon, established in 1962  
Total plot and production area: 23,400 m<sup>2</sup>
- SAMSON Turkey, Istanbul, established in 1984  
Total plot and production area: 11,100 m<sup>2</sup>
- SAMSON USA, Baytown, TX, established in 1992  
Total plot and production area: 20,000 m<sup>2</sup>
- SAMSON China, Beijing, established in 1998  
Total plot and production area: 47,000 m<sup>2</sup>
- SAMSON India, Pune district, established in 1999  
Total plot and production area: 28,000 m<sup>2</sup>
- SAMSON AIR TORQUE, Bergamo, Italy  
Total plot and production area: 27,000 m<sup>2</sup>
- SAMSON CERA SYSTEM, Hermsdorf, Germany  
Total plot and production area: 14,700 m<sup>2</sup>
- SAMSON KT-ELEKTRONIK, Berlin, Germany  
Total plot and production area: 1,100 m<sup>2</sup>
- SAMSON LEUSCH, Neuss, Germany  
Total plot and production area: 18,400 m<sup>2</sup>
- SAMSON PFEIFFER, Kempen, Germany  
Total plot and production area: 20,300 m<sup>2</sup>
- SAMSON RINGO, Zaragoza, Spain  
Total plot and production area: 19,000 m<sup>2</sup>
- SAMSON SED, Bad Rappenau, Germany  
Total plot and production area: 10,400 m<sup>2</sup>
- SAMSON STARLINE, Bergamo, Italy  
Total plot and production area: 27,000 m<sup>2</sup>
- SAMSON VDH PRODUCTS, the Netherlands  
Total plot and production area: 12,000 m<sup>2</sup>
- SAMSON VETEC, Speyer, Germany  
Total plot and production area: 27,100 m<sup>2</sup>

## SAMSON AKTIENGESELLSCHAFT

Weismuellerstrasse 3 · 60314 Frankfurt am Main, Germany  
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507  
E-mail: samson@samsongroup.com  
Internet: www.samsongroup.com