

*Quality products for  
demanding applications*



**WANDFLUH MOBILE**

“ We want to inspire our customers around the world with high-quality products and get engaged as a valuable partner in the development of technically demanding hydraulic systems. ”

————— Hansruedi Wandfluh and Matthias Wandfluh —————

# WANDFLUH MOBILE

High power density and reliability in all weather conditions have always been important requirements for the use in the mobile sector. In order to carry out heavy work with large machines efficiently and yet also precisely, hydraulics that are well-adapted to the machine are required. Precise proportional technology with the corresponding electronics and software is the key to this.

## FOCUS

Components for the mobile sector meet a broad spectrum of requirements. In addition to being suitable for all weather conditions, they must have a high power density and show a high robustness against external influences. Depending on the requirements, explosion protection and/or corrosion protection executions of the valves are also available. The quality of the valves and electronics generally becomes apparent once they are used on a daily basis in mobile devices and machinery, where shocks, vibrations and high temperature fluctuations are a part of everyday operations. The focus at Wandfluh is on these factors, when developing valves and electronics for the mobile sector. The specific design of hydraulic components has led to a significant increase of the reliability and availability of a mobile machine in numerous projects.

...designed to ensure **high power density** and **robustness**



**MOBILE**

## APPLICATION EXAMPLES

- Brake systems and couplings
- Port crane control
- Construction machinery
- Forestry machinery
- Salt spreader vehicles
- Fan drives
- Machinery with lifting functions (forklift truck, lifting platform, etc.)

## CHARACTERISTICS

- High volume flows
- Sensitive control characteristics
- Low hysteresis
- Low weight
- Robust construction
- Secure against vibrations and other external influences
- Hydraulically efficient valve technology
- Smart control by means of electronics developed in-house via a bus system
- Corrosion protection valves (up to stainless steel)
- Explosion protection valves including electronics
- Individual customer-specific adaptations
- Worldwide customer service



# APPLICATION FORKLIFT

High speed and safety are important aspects in the efficient lifting and lowering of heavy loads, especially for devices with a high lifting height. The high lifting and lowering speed requires a soft acceleration and deceleration characteristic of the hydraulics to ensure precise and safe operation. All these properties can be adapted to the respective application by appropriate construction of the hydraulic valve.

## FUNCTION

An electric high mast lifttruck is a typical example of a hydraulic lifting and lowering application. Lifting is usually performed directly via the built-in hydraulic pump, as the load counteracts the direction of movement. For a controllable and smooth lowering function, appropriate hydraulic valves are used that allow the oil to flow back into the tank in a controlled manner via a bypass. In simple systems, this task is performed by a classic poppet valve. For more complex applications with increased requirements, pressure compensated proportional valves or pressure compensated flow controllers are used. Due to the construction of the valve, the lowering speed is kept constant, independent of the load. In addition, these valves are also available in a seat tight execution. This ensures that the fork remains in its position when deenergised and does not sink slowly due to leakage.



## COMPONENTS

Various valves are available for the lowering movement:

- Soft-switching poppet valve S2206-S1841
- Proportional throttle valves DNPPM22 (25LPM) and DNPPM33 (63LPM)
- Load compensated flow control valves QNPPM22 and QNPPM33
- Seattight flow control valves QSPPU10 and QSPPM33  
These All-In-One valves control the lowering speed independent of the load and are tight when deenergized. The fork remains in position.



## SPECIALITIES

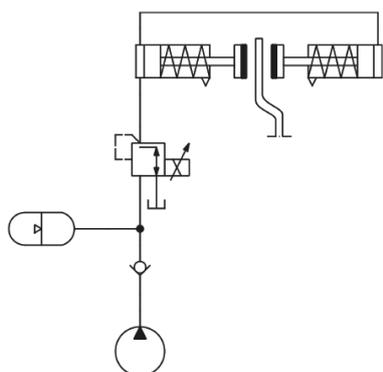
- With heavy loads, the system can tend to oscillate (bouncing effect), this can be absorbed and corrected with internal valve adaptations.
- For forklift trucks in explosion-hazard areas, valves in Ex d execution are available.
- Valves with integrated electronics and connection to fieldbus systems.
- Large valves in M42 execution can control flows up to 200 l/min.

# APPLICATION BRAKE SYSTEMS

Safety, stability and reliability are the most important requirements for a brake system. The areas of application can be very different. Whether for low-floor vehicles such as trams or regional trains, for all types of cable winches, for large dump trucks or cable cars, being able to precisely regulate the smallest pressures is an indispensable prerequisite for any brake system.

## FUNCTION

By means of the proportional pressure reducing valve, the cylinder pressure is adjusted to the required braking force. The output pressure of the control valves is independent from the input pressure. Such systems are often used for the accumulator unloading operations in order to ensure as long standstill intervals of the motor pump units as possible. In the case of proportional control valves, only low leakages must occur. Passive brake systems require an inverse valve function.



## COMPONENTS

Direct operated pressure valves of various sizes are used in brake systems. The pressure reducing valves of the valve series with M16 screw-in thread (MDPPM16, MGPPM16) are constructed very compact. The larger valves (MDPPPU10, MQPPM22), which can process oil flows of up to 20 l/min or 40 l/min, are suitable for larger brake cylinders. Brake systems can also be constructed with pressure relief valves (BDPPM, BSPPM) or throttle valves (DNPPM, DOPPM).



## SPECIALITIES

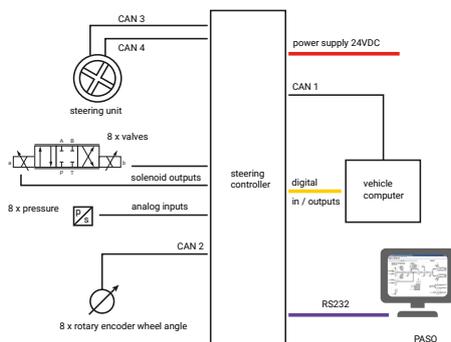
- Smallest minimum pressures adjustable
- Fast step response times for immediate braking
- Very low leakage values, < 25 ccm/min
- Low temperature executions
- Different corrosion protection classes

# STRADDLE CARRIER APPLICATION

In a globalised world where container ships with several thousand containers call at the world's largest ports, the loading and unloading of ships is supported by fully automated systems. The containers are stacked by self-propelled lifting cranes, so-called Straddle Carriers, in an intermediate storage facility in the port area. The hydraulics and electronics installed in the Straddle Carrier are often in use 24 hours a day and a system failure would cause very high costs.

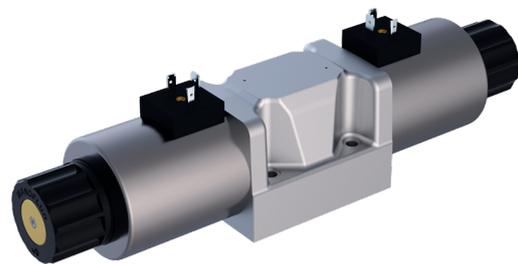
## FUNCTION

Several Stradle Carriers are controlled from one control room. The dispatcher simply indicates the desired end position to the vehicle, everything else is managed independently by the vehicle. Due to its high payload, a Straddle Carrier has six to eight axes that are individually controlled, regulated and monitored hydraulically via proportional valves. For safety reasons, similar to aircraft construction, the entire hydraulics, including the control electronics and the axes control, is kept redundant. In addition to increased security, the system thus gains in availability. System failures and the associated time delays in 24-hour port operation are thus practically eliminated.



## COMPONENTS

The heart of the system is the SIL2-capable steering controller. Via a redundant CANbus system, the steering unit transmits the values to the controller that compares and regulates the positions with robust angle sensors. Through the proportional amplifier electronics, the proportional spool valves and the steering angle of the axes are then controlled. All components are adjusted to each other, allowing easy commissioning and controlled operation.



## SPECIALITIES

- Manual vehicle steering and various driving modes integrated
- Various safety functions additionally expandable
- Parameterisation software for commissioning and maintenance
- Completely aligned system. Hydraulics and electronics from one provider

# APPLICATION HARVESTER

Harvesters are automated wood harvesting machines that have been used since the beginning of the 1980s for the felling and preparing of trees without heavy manual labour. The so-called harvester head, at the front of the machine's boom, is responsible for marking, gripping and felling the trees. These are then fully automatically delimited, debarked and cut to length for removal in accordance with the specifications.

## FUNCTION

An automated wood harvesting machine is usually used in rough terrain, far away from modern civilization. It is exposed to extreme weather conditions in the forests and is designed for temperatures ranging from very warm to extremely cold. The wood harvesting head on the boom of the machine is very exposed and therefore constructed extremely solid. Nevertheless, it must be possible to control the many moving components with high precision and reliability.

The dimensions and execution of the harvester head and the hydraulic components used in it are largely determined by the size of the trunk and the type of wood to be harvested. The hydraulic system is used to control the feed rolls or feed rollers, the measuring devices, the chain saw drive including chain tensioner, the chain lubrication, the sword feed as well as the delimiting knives and the colour marking unit. Thanks to high precision, robustness and reliability, proportional or mechanically adjustable pressure reducing valves and flow control valves from Wandfluh have been used for many years for this demanding work.



## COMPONENTS

On a harvester, common standard valves are used, such as the MVPPU10 pressure relief valve to control the feed roll and the delimiting knife, or the BDIPM22 pressure reducing valve to control the saw-bar. On the other hand, numerous customer-specific special valves are adapted to the respective harvester head, for example for pilot control.



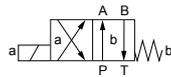
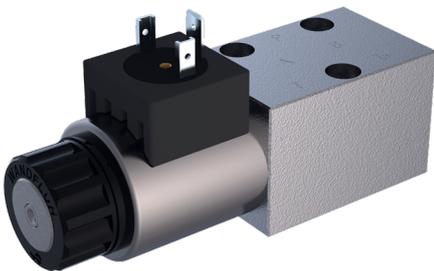
## SPECIALITIES

- Pressure relief valves with fast response time and low hysteresis
- Pressure reducing valve with fast response time for pressure build-up and unloading
- Valves with high contamination and water resistance
- Special solenoid coils for use in warm climatic conditions

# SWITCHING VALVES

Hydraulic systems are used to steer and move vehicles. The mounted functions such as lifting and swivelling arms, supports and brakes are also operated hydraulically. They move loads and hold them in the desired position for a long time. Switching valves control directions of movement, tightly close lines and limit pressures and flows to manually adjusted values.

## SPOOL VALVES, FLANGE WDMF



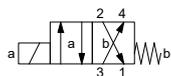
## CHARACTERISTICS

Controls the oil flow and can thus, for example, determine the direction of movement of a cylinder. The valve is screwed as a flange onto a standardised mounting interface.

## FEATURES

- Solenoid valve remotely controlled via intelligent electronics
- Direct or pilot operated
- Optionally detented, for safety in the case of power failure
- Small losses due to low leakage
- Soft switching for reduction of shocks
- Switching position monitoring
- Pressure max. 350 bar
- Flow max. 160 l/min
- Nominal sizes NG3, NG4, NG6, NG10

## SPOOL VALVES CARTRIDGE WDEP



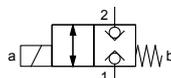
## CHARACTERISTICS

Controls the oil flow and can thus, for example, determine the direction of movement of a cylinder. The valve is screwed as a cartridge into a standardised cavity in the hydraulic bloc.

## FEATURES

- Solenoid actuation
- Direct or pilot operated
- Space-saving cartridge construction for block construction
- Pressure max. 350 bar
- Flow max. 160 l/min
- Nominal sizes U10, M33, M42

## POPPET VALVES SVSPM, SDSP



## CHARACTERISTICS

For tight closing functions, to hold loads in position or to close lines tightly.

## FEATURES

- Cartridge, flange and sandwich construction
- Solenoid actuation
- Direct or pilot operated
- Metallically sealing seat
- Detented or with spring reset
- Pressure max. 420 bar
- Flow max. 300 l/min
- All constructions and nominal sizes

## PRESSURE VALVES BDSP, BVSP



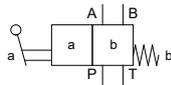
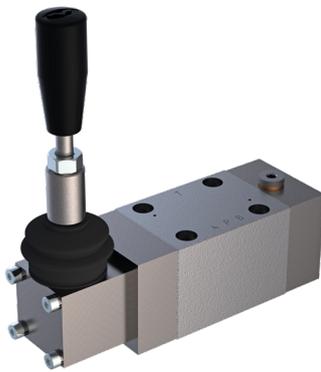
## CHARACTERISTICS

Limits the input pressure to an adjustable value. Serves to protect against overpressures of any kind in the system. A pressure reduction controls the output pressure to the adjusted value.

## FEATURES

- Manual adjustment of the desired pressure
- Direct or pilot operated
- Metallically sealing seat
- Pressure relief or pressure reducing function
- Pressure max. 420 bar
- Flow max. 300 l/min
- Nominal sizes U08, U10, M18, M22, M33, M42

## HAND LEVER VALVES AH



## CHARACTERISTICS

Manually actuated spool valve for moving a cylinder forward or backward.

## FEATURES

- Spool execution for 4/3- or 4/2-way execution
- Seat tight execution for 3/2-, 2/2- or 3/3-way execution
- Detented or with spring reset
- Pressure max. 350 bar
- Flow max. 100 l/min
- Nominal sizes NG3, NG4, NG6, NG10

## FLOW CONTROL VALVES QZSP, QDSP



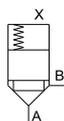
## CHARACTERISTICS

The valve is used to control the oil flow. The travel speed of a cylinder can thus be controlled to a constant, load-independent value.

## FEATURES

- 2-way or 3-way execution
- Optional as integrated non-return valve
- Pressure max. 350 bar
- Flow adjustable to min. 0.1 l/min
- Flow max. 120 l/min
- Nominal sizes M18, M22, M33, NG3, NG4, NG6, NG10

## 2-WAY SLIP-IN CARTRIDGE VALVES C\_ENXX



## CHARACTERISTICS

With a 2-way slip-in cartridge valve, very high flow rates with low  $\Delta P$  can be controlled. Control takes place via a pilot valve in the control cover.

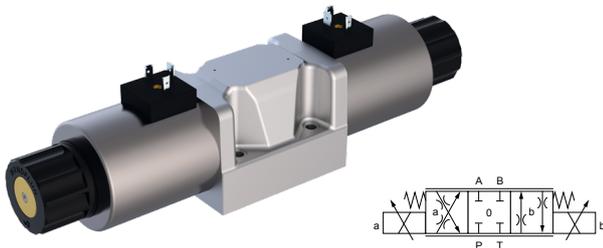
## FEATURES

- Seat tight closure
- Way and pressure functions can be implemented
- Pressures also available as proportional function
- Pressure max. 630 bar
- Flow max. 2500 l/min
- Nominal sizes NG16, NG25, NG32, NG40, NG50

# PROPORTIONAL VALVES

When hydraulic pressures or volume flows are continuously controlled, proportional hydraulics is used. The use of proportional solenoids enables a continuous and proportional control of the valve. Proportional valves are operated with an electronic control device that transforms a control signal into a corresponding solenoid current for the valve. This solenoid current ensures an optimal, sensitive and precise control of the valve.

## SPOOL VALVES FLANGE WDPFA



## CHARACTERISTICS

The volume flow is controlled proportionally to the solenoid current. A cylinder can thus be moved forward and backward at variable speed.

## FEATURES

- Progressive characteristic
- Good repeatability
- Direct or pilot operated
- Pressure max. 350 bar
- Flow max. 200 l/min
- Nominal sizes NG3, NG4, NG6, NG10

## SPOOL VALVES CARTRIDGE WDPFU



## CHARACTERISTICS

The volume flow is controlled proportionally to the solenoid current. A cylinder can thus be moved forward and backward at variable speed.

## FEATURES

- Progressive characteristic
- Good repeatability
- Direct operated
- Pull/push armature tube
- Compact construction through short solenoids
- Pressure max. 350 bar
- Flow adjustable 0... 28 l/min
- Nominal sizes U08, U10

## PRESSURE RELIEF VALVES BDPP, BVPP



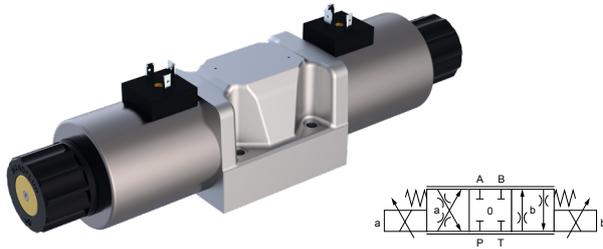
## CHARACTERISTICS

Limits the pressure in port P to the value adjusted by means of the solenoid current. Pressures and thus forces are variably adjustable.

## FEATURES

- Linear characteristic and good repeatability
- Direct or pilot operated, optional inverse function
- Pressure max. 350 bar
- Flow max. 400 l/min
- Nominal sizes M18, M22, M33, M42

## SPOOL VALVES FLANGE WDPFA



## CHARACTERISTICS

The volume flow is controlled proportionally to the solenoid current. A cylinder can thus be moved forward and backward at variable speed.

## FEATURES

- Progressive characteristic
- Good repeatability
- Direct or pilot operated
- Pressure max. 350 bar
- Flow max. 200 l/min
- Nominal sizes NG3, NG4, NG6, NG10

## FLOW CONTROL VALVES QNPP, QDPP



## CHARACTERISTICS

Controls the volume flow proportionally to the adjusted solenoid current. Changes in load are continuously compensated.

## FEATURES

- Linear characteristic and good repeatability
- 2- or 3-way execution
- Pressure max. 350 bar
- Flow max. 200 l/min
- Nominal sizes M18, M22, M33, M42, U16

## FLOW CONTROL VALVES SEATTIGHT QSP



## CHARACTERISTICS

Regulates the volume flow proportionally to the adjusted solenoid current. Any change of the load is compensated. In closed position, the valve closes seattight.

## FEATURES

- Linear characteristic and good repeatability
- 2-way or 3-way execution
- Pressure max. 350 bar
- Flow max. 200 l/min
- Nominal sizes M33, U10

## THROTTLE VALVES DNPP, DOPP



## CHARACTERISTICS

Throttling of the volume flow according to the set solenoid current.

## FEATURES

- Linear characteristic and good repeatability
- Normally open or normally closed
- Pressure max. 350 bar
- Flow max. 65 l/min
- Nominal sizes M18, M22, M33

# TYPICAL ELECTRONICS

For the control of proportional valves, electronic control devices are required. They control the solenoid current on the valve and thus ensure a very sensitive actuation of the valve. Control devices are available in a wide range of executions, in order to fulfil the requirements of different tasks in varied fields of application.

## AMPLIFIER / CONTROLLER CONTROLS MD2



### CHARACTERISTICS

Digital amplifier and controller module for use in harsh environments. With the device, there are up to 8 solenoid outputs available for control tasks of all types.

### FEATURES

- Robust and compact construction with protection class IP67
- Solenoid outputs can be used as proportional output or switching solenoid output
- Command values in the form of voltage, current, frequency, PWM
- Up to 4 analogue and 4 digital inputs
- Up to 10 digital outputs
- Optional with CANopen fieldbus
- Screw fixing of the housing

## PROGRAMMABLE CONTROLS CL-7



### CHARACTERISTICS

Micro-controller-based control with display and operating buttons including multifunctional inputs/outputs.

### FEATURES

- Functions freely programmable
- Display graphics freely configurable
- Video signal input
- High resolution display
- Monitor sizes 4,3" and 7"
- Robust housing with IP67 protection

## KEYBOARDS CL-6



### CHARACTERISTICS

Intelligent keypad for interaction with the machine operator. With integrated display and controller functions.

### FEATURES

- Wear-free buttons with LED displays
- Digital inputs and outputs
- Direct control of valves
- Functions freely programmable
- Robust housing with IP67 protection
- Optional customer-specific key labelling

## VALVE ELECTRONICS DSV



## CHARACTERISTICS

Digital amplifier electronics DSV (Digital Smart Valve) directly integrated in the valve for controlling a proportional valve.

## FEATURES

- Type amplifier or controller
- Controller modes selectable: pressure, position, speed
- Valve factory set
- Control via solenoid current with dither signal
- Command values as voltage or current
- 2 digital inputs and 1 output
- Parameterisable by means of PASO software
- Optional with fieldbus (CANopen, Profibus DP)
- Protection class IP67

## MINIATURE AMPLIFIER PD2, PD3



## CHARACTERISTICS

Digital amplifier module for controlling a proportional valve. PD2 is an electronics unit with cable connection. In the MPS version, it is mounted fixed on a solenoid.

## FEATURES

- IP67 housing
- Solenoid current regulated
- Command value as voltage or current
- Digital input
- Parameterisable by means of PASO software or display and buttons on the device
- Optional with fieldbus (CANopen or J1939)
- Housing with cable connections or mounted on the solenoid

## COMMUNICATION MODULES CL-T



## CHARACTERISTICS

The module allows wireless data transmission over various communication channels.

## FEATURES

- Remote diagnosis of the machine
- Tracking
- Remote control of machine functions
- Data recording of any signal
- Functions programmable
- GPS receiver for position recognition
- Communication via GSM and WiFi
- Robust housing with IP67 protection

## CAN INTERFACE

**CANopen**

**SAE J1939**

## CHARACTERISTICS

Simple communication interface for electronics controls in the mobile industry.

## FEATURES

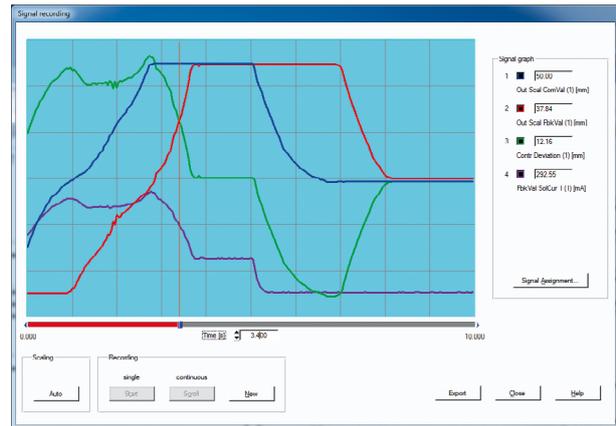
- Protocol for bidirectional data transmission
- Protocols: CANopen or J1939
- Allows status and diagnosis queries of the device
- Parameterisation via CAN
- Electronic Device Description (EDD) available

# PARAMETERISATION SOFTWARE PASO

With the PASO software, all configuration and parameterisation can be carried out via the intuitive user interface with a laptop. In addition, as all important signals can be recorded or analysed on the screen in real time, the software also provides the possibility of troubleshooting.

## FUNCTIONALITIES

Despite the multitude of application possibilities, PASO is very user-friendly and easy to operate. The functional process is displayed on the screen as a block diagram. By clicking on one of the block diagram symbols, a menu window opens in which the parameters associated with the process can be set. In addition to the connecting lines between the blocks, the feedback value being passed onto the following block is also displayed in real time. In this way, it is possible to monitor the effects of a parameter change on the entire system on the computer, allowing fine tuning to be performed quickly and precisely. The set values can then be saved in a parameter file and can also be loaded directly into a new electronic module.

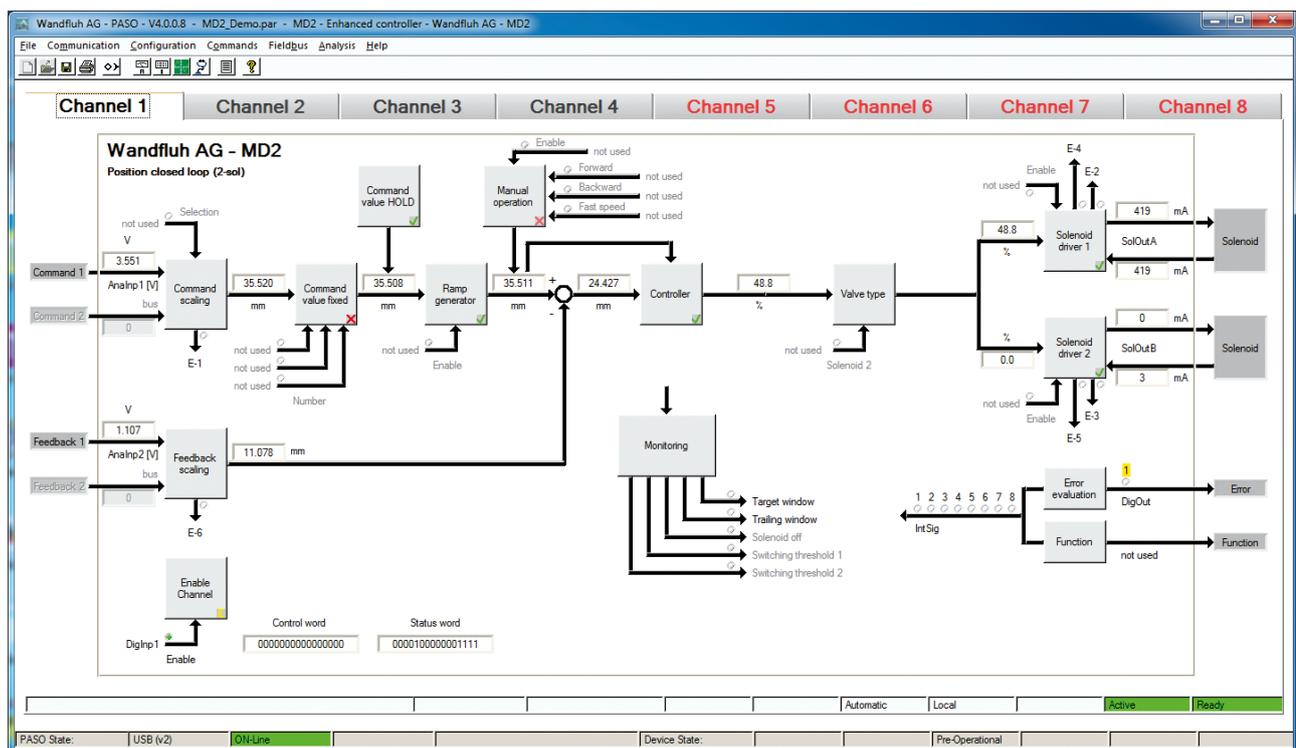


## PARAMETERISATION AND PROGRAMMING

- PC software PASO (freely available)
- Individual process data monitoring
- Integrated oscilloscope
- Remote control functions
- Fieldbus Interface

## ADDITIONAL EXECUTIONS

- Customer-specific software expansions
- Hardware expansion for additional functions
- Software for application-optimised solutions
- Flexible interface definition
- Electronics integrated in the valve



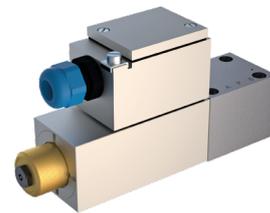
# EXPLOSION PROTECTION

Flammable gases, vapours and dust can form an explosive atmosphere when mixed with oxygen. In order to ensure a high level of safety, appropriate protective regulations exist for the various operating equipment to avoid the risk of explosion hazards. The solenoid as an electrical actuation in the valve technology must therefore demonstrate a type of protection that is in line with the explosion protection standard.

Valves that are exposed to continuous contact with salty water and atmospheres that contain salt or to harsh weather conditions demand enhanced corrosion protection in order to prolong their service life.

## DESCRIPTION

- Electrical operating equipment for all explosion hazard zones
- Solutions for valves and systems
- Optionally enhanced corrosion protection up to stainless steel executions



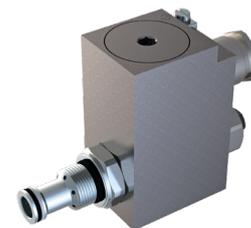
## CHARACTERISTICS

- Type of protection flameproof enclosure (Ex d) for zone 1 and 2
- Type of protection intrinsic safety (Ex i) for zone 0
- Certified solenoids for surface and mining areas
- Certificates for ATEX, IECEx, EAC, Inmetro, NEPSI, UL/CSA, Australia, MA



## FUNCTIONS

- Solenoid operated spool valves
- Solenoid operated poppet valves
- Proportional spool valves
- Proportional pressure valves (relief and reducing)
- Proportional flow valves (throttle and flow control)
- Electronics integrated into the valve for proportional functions



## TYPES OF PROTECTION FOR ELECTRICAL EQUIPMENT IN GAS EXPLOSION HAZARD AREAS

TYPE OF PROTECTION	SYMBOL	ZONE	DIAGRAM	STANDARD
increased safety	e	1		IEC 60079-7 EN 60079-7 (ATEX)
flameproof enclosure	d	1		IEC 60079-1 EN 60079-1 (ATEX)
intrinsic safety	ia	0		IEC 60079-11 EN 60079-11 (ATEX)
encapsulation	m	1		IEC 60079-18 EN 60079-18 (ATEX)

# CORROSION PROTECTION

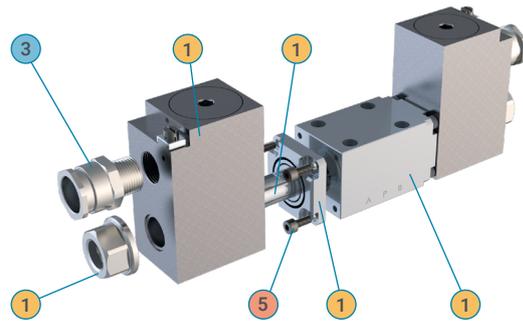
It is the constant contact with salt water and salty atmospheres which requires the use of components with enhanced corrosion protection.

The ranges of the materials used allow appropriate anti-corrosion protection of the external parts of the valve.

## K8: 500 -1000 H SALT SPRAY TEST

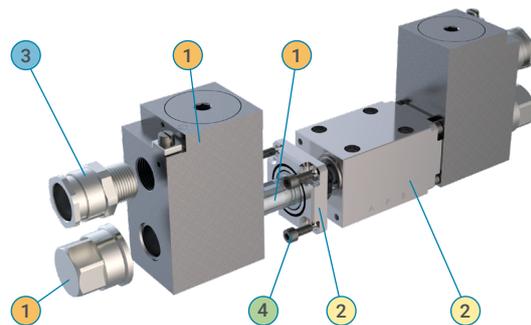
All external elements on the valve which are in contact with the environment are surface-treated with a zinc-nickel coating or are made of stainless materials. Control knobs and partially knurled nuts are made of plastic.

K8 will increasingly become the normal standard in the future. Only the valve flange bodies are painted and the screws zinc coated.



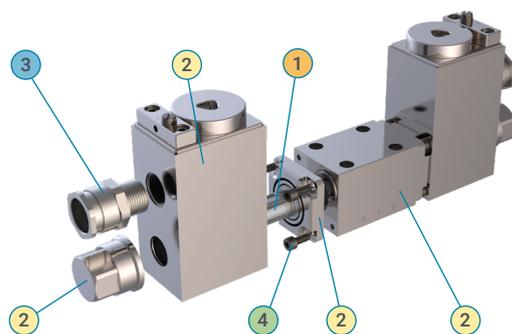
## K9: > 1000 H SALT SPRAY TEST

All external elements, apart from the solenoids, are made of stainless materials. Stainless, acid-resistant AISI 316L high-grade steels are used if feasible. The solenoids are zinc-nickel coated.



## K10: > 1000 H SALT SPRAY TEST

All external elements are made of stainless materials or coated with stainless materials. Stainless, acid-resistant AISI 316L high-grade steels are used if feasible.



Pos	Corrosion protection
1	Zinc-nickel coated
2	Stainless steel AISI 316L
3	Nickel coated brass
4	Stainless steel screws
5	Zinc coated screws

\* The **salt spray test** exposes the valve to a salt spray with a five percent NaCl solution in accordance with ISO 9227. The number of hours it takes for red rust to appear is measured.

# LOW TEMPERATURE

For extreme applications in cold environments, there are valves in two low temperature executions. They distinguish themselves in particular through the materials used that have to resist high pressures and loads even at temperatures of down to -60° C.

## CRUDE STEELS USED

The steels used in the valves were selected for use also in cold ambient temperatures. In the extreme range between -60 °C to -40 °C particularly cold resistant steels are used for the most stressed valve parts, to take account of the extreme additional loads.



## SPECIAL SEALS

For low operating temperatures, special sealing materials are used that guarantee a stable and secure long-term operation with a high level of availability, due to their low-temperature flexibility. Depending on the needs, the materials required for temperature ranges down to -40 °C and down to -60 °C are distinguished.



## LOW TEMPERATURE EXECUTIONS

Specification	Steel	O-ring	Fit
Z604 (-40 °C)	–	x	(x)
Z591 (-60 °C)	x	x	x

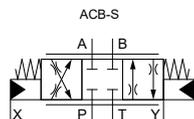
– no adaptation required  
 (x) partial adaptation necessary  
 x adaptation absolutely necessary



# INDIVIDUAL SOLUTIONS

Wandfluh valves are modular in structure and can therefore be put together very flexibly. This allows different standard functional components to be combined with one another to easily create individual solutions.

## SOFT SWITCHING VALVES



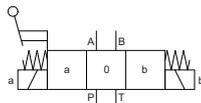
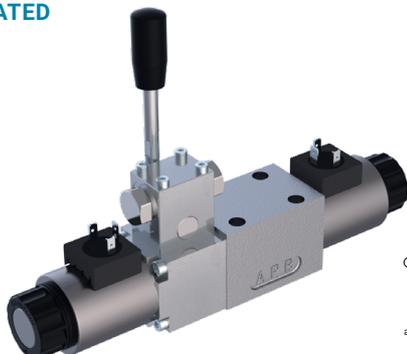
## CHARACTERISTICS

When switching a direction of travel or rotation, switching shocks place a heavy load on the mechanics and cause unpleasant impulses. The valve can softly switch high flows and thus protects the machine and the operator.

## FEATURES

- 3-way execution
- Cartridge execution
- Remotely controlled via a pressure signal
- Pressure max. 350 bar
- Flow max. 200 l/min
- Nominal size M33

## SPOOL VALVES SOLENOID AND MECHANICALLY ACTUATED



## CHARACTERISTICS

The valve can be remotely controlled by appropriate electronics or manually operated on site.

## FEATURES

- Completes the electrical actuation with a hand lever actuation for 3-way valves
- For switching and proportional valves
- In combination with standard and Ex d / Ex i solenoids

## SPOOL VALVES 6/2-WAYS



## CHARACTERISTICS

Spool valve for alternative control of two consumers.

## FEATURES

- 2-way execution with 6 connections
- Option with soft switching
- Pressure max. 315 bar
- Flow max. 50 l/min
- Pipe thread connections

## PROPORTIONAL THROTTLE VALVES



## CHARACTERISTICS

Large flows can be controlled proportionally in confined spaces. The throttle valve is actuated by an external pressure.

## FEATURES

- Pilot operated with proportional pressure reducing valve
- 2-way execution
- Relatively small load dependence
- Low hysteresis
- Pressure max. 350 bar
- Flow max. 200 l/min
- Nominal size M42

## CONTROL UNIT FOR AIRCRAFT STAIRS



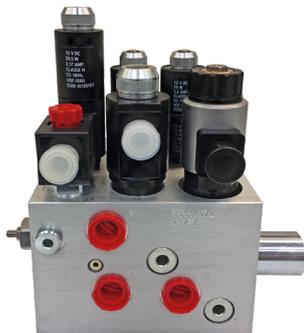
## CHARACTERISTICS

Control units in large quantities for precise docking of aircraft stairs to passenger aircraft. Easy operation and reliability are very important for this development.

## FEATURES

- Solenoid actuated valves with additional user-friendly operation by hand lever
- Extremely compact design, adapted to the installation situation of the customer
- Shut-off valve flange-mounted
- Weight-saving block made of high-strength aluminium

## CONTROL UNIT FOR PRIORITY CIRCUIT



## CHARACTERISTICS

Control units in large quantities for the safety function of a priority circuit on agricultural machines. The safety aspect and reliability are very important for this development.

## FEATURES

- Low weight
- High power density
- Flexible construction
- Block-integrated valve functions

## PME (PROGRAMMABLE MOBILE ELECTRONICS)



## CHARACTERISTICS

By using small and simple PME controls (Programmable Mobile Electronics), performance and costs can be adapted exactly to the needs, and additional flexibility can be gained for extensions.

## FEATURES

- Reduction of the cabling complexity
- The system allows extensions or optimal vehicle configurations to be added simply
- Additional functionality can be programmed quickly through the software
- Highly simplified maintenance and error detection

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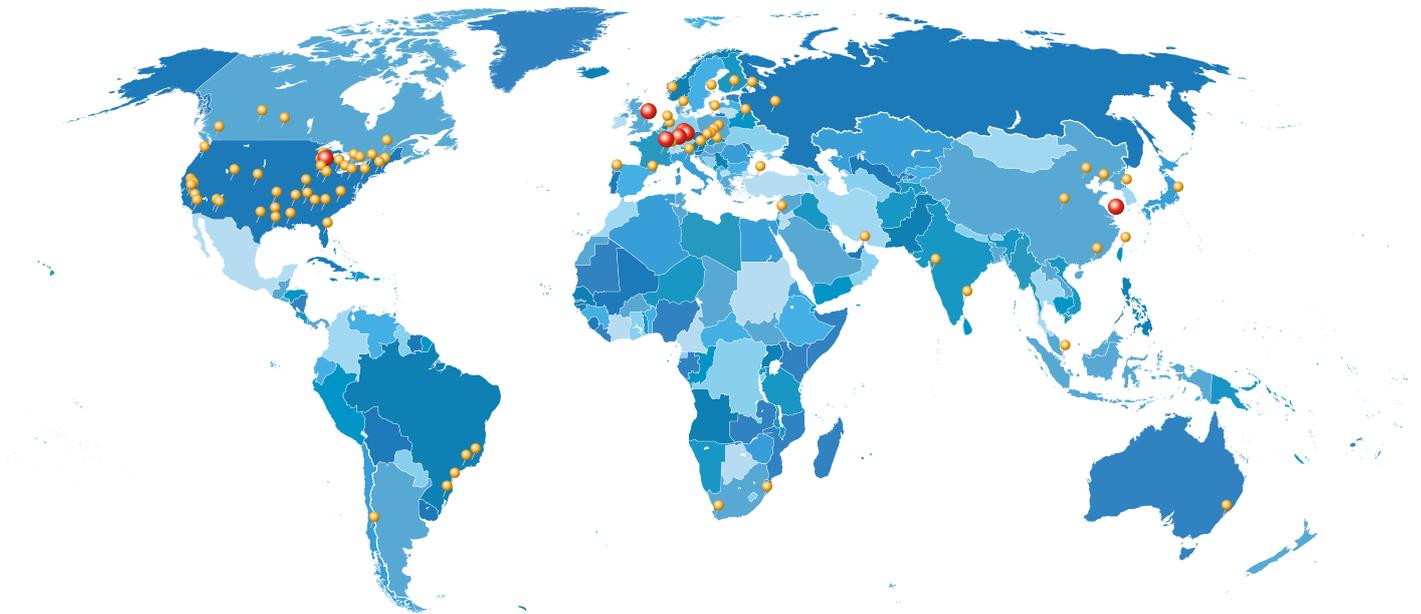
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