

# Electrohydraulic Steering

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The right components take your  
concept onto the road



# Electrohydraulic Steering

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Steer-by-Wire opens up new opportunities in vehicle design and the implementation of custom steering solutions compared with traditional steering systems. Examples include additional functions and features for steering, as well as maximum freedom of design for installation space concepts, which also allows for flexible positioning of the steering wheel.

This brochure presents the steering valve solutions from Bucher Hydraulics and specific potential applications in steering systems. These individually designed steering systems can be implemented perfectly with our partner for steering,

MOBIL ELEKTRONIK, and meet the core requirements, such as ISO 26262 and EN 13849-compliant development as well as the highest safety levels up to ASIL D or PL e.





Focus on the  
customer

# Solution Variants According to Customer Requirements

Systems engineering involves planning and designing custom solutions in the form of control blocks. These are predominantly used in mobile tools for agriculture, the municipal sector and for road and construction machinery, but also in renewable energy systems such as wind turbines and solar power plants. The control blocks made of steel or aluminum deliver maximum functionality in a very confined space.

## Steering axle in the control block

The electrohydraulic spool axis from our sectional valves can now also be integrated into aluminum blocks. This means you can combine the steering functions with the operating functions in one housing and take advantage of the proven benefits of a customized control block solution, such as compact design and low weight.

## Characteristics:

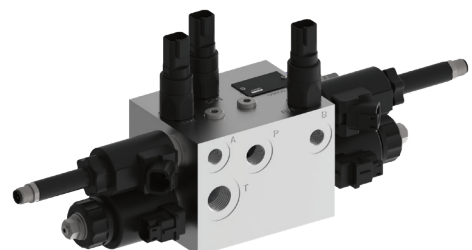
- Optimal use of installation space
- Custom valve arrangements
- Choice of material to suit application
- Modular control block concept customized to application requirements

## Benefits:

- Electrohydraulic steering can be combined with additional functions, as required
- Maximum functionality in a very confined space
- Low weight thanks to aluminum base body
- High level of corrosion protection
- Control block design is freely configurable
- Can be extended with additional functions, as required

## Technical data

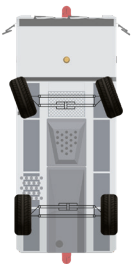
Flow rate max. l/min	Actuator pressure max. bar	Power supply VDC	Rated power W
2...60	210	12/24	17



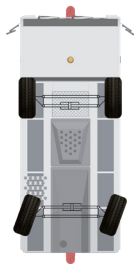
## 6/4-way steering mode valve

This control block with its unique 6/4-way valve function for optimum control of different steering modes has been developed for two-axle vehicles. Vehicle users therefore have four steering modes available, so they can choose the best steering mode for the application.

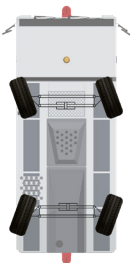
Front-axle steering  
„VL“



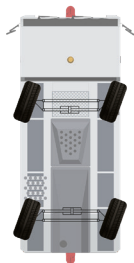
Rear-axle steering  
„HL“



All-wheel steering  
„AL“



Crab steering  
„HG“



### Technical data

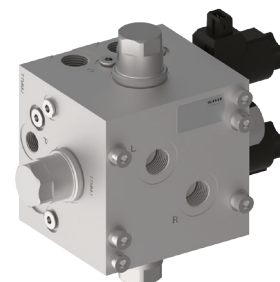
Flow rate max. l/min	Actuator pressure max. bar	Power supply VDC	Rated power W
40	300	12/24	17

### Key features

- For two-axle vehicles, for steering the front or rear axle, both axles or for „crab steering“
- Extremely small steering angle deviation thanks to very low leakage
- Low energy consumption as only two actuators are controlled (17 W)
- High corrosion resistance due to zinc-nickel plating

### Benefits:

- Selection of the steering mode best suited to the application
- Low wear of steering mechanism and tires
- Highly reliable functionality and very robust
- Maximum functionality in a very confined space
- Minimized pipework and installation effort





Precise and reliable

# Steering Cylinders

Our steering cylinders are used in the hydraulic steering systems of various vehicles, such as material handlers. In addition to high reliability against leakage, the cylinders have a visually appealing and robust design. Our economical manufacturing means you get a cost-effective, long-lasting product.

## Steering cylinders

Operating a steering axle with a hydraulic linear drive is quite simple when it comes to design. That is why many working vehicles of this type have four-wheel steering, which allows even very large and heavy machinery to turn on an astonishingly small turning circle. If your requirements do not match the product solutions already developed, we will also find the best solution for your application.

## Technical data

Piston diameter mm	Rod diameter mm	Stroke length mm	Operating pressure bar
60...125	28...70	500	300

## Optionally available:

- Integral linear position measurement system
- Version available for low-temperature use
- Rod options: induction-hardened and hard-chrome-plated to size or nickel-chrome plated

## Benefits:

- Double-acting cylinder with high reliability against -leakage
- Can be used under the harshest conditions thanks to robust design
- Long bearing life
- Highly economical for the customer



Modular system  
with sectional valves

# Steering via Sectional Valves

High functionality, precision and energy efficiency are the key challenges for hydraulics and significant factors when it comes to creating powerful mobile machinery that meets market requirements. Whether tractors, self-propelled harvesters, municipal or special vehicles, such as snowcats, Bucher Hydraulics cleverly combines the various benefits of hydraulics and control in its proportional directional valves. The valves therefore meet high requirements for the precise control of working positions and for automatic steering.

## LCV

LCV series proportional directional control valves have been developed for use in tractors and similar applications. The high level of integrated functionality combined with the ability to parametrize the valve characteristics provide the basis for enhanced system solutions. The outstanding dynamics and stiffness of the valve's stepper-motor operation ensure first-rate control of the actuators. Flexibility within the sections themselves, and supplementary functions in bolt-on plates, open the door to optimized solutions. Achieve maximum productivity with reduced energy consumption.

## Technical data

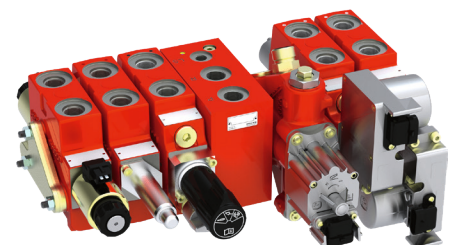
Flow rate max. l/min	Consumer flow rate max. l/min	Inlet pressure max. bar	Actuator pressure max. bar	Return pressure max. bar
180	120	250	250	40

## Characteristics:

- Compensating control spool
- Low hysteresis
- High positioning accuracy
- Float position
- Integrated seat tightness
- Lockable emergency actuation
- Working hydraulics and steering functions combined in one control block

## Benefits:

- Suitable for electrohydraulic steering functions
- Upstream and downstream compensators
- With integral seat valves
- With integral float position
- Optionally with stepper motor
- No pilot oil circuit needed
- Stable, hysteresis-free spool position
- Hitch valve can be integrated





### LVS08 / 12

The design uses the concept of pressure compensators integrated in the control spool to achieve very low pressure loss. This feature, together with the downstream system for flexible parallel actuation and the high degree of modularity, makes this proportional directional valve suitable for very adaptable application in mobile machines. The additional functions that can be incorporated, the high power density combined and the possibility of combining two different valve sizes in one control block round off the LVS08 / LVS12 proportional directional valves, as a flexible and compact modular valve system.

#### Technical data LVS08

Flow rate max. l/min	Consumer flow rate max. l/min	Inlet pressure max. bar	Actuator pressure max. bar	Return pressure max. bar
180	50	250	280	200

#### Technical data LVS12

Flow rate max. l/min	Consumer flow rate max. l/min	Inlet pressure max. bar	Actuator pressure max. bar	Return pressure max. bar
180	180	300	320	50

### L.8S

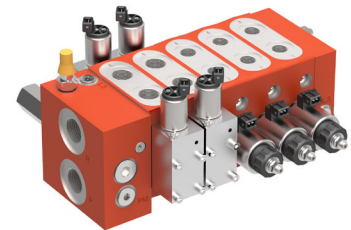
The L.8S valve series was developed for mobile applications. The valves are distinguished in particular by their robust design and small external dimensions, and they offer a wide variety of additional functions that can be integrated. The L.8S is a flexible modular system with elements that can be combined to form a valve block that complies fully with the requirements of the application.

#### Technical data L.8S

Flow rate max. l/min	Consumer flow rate max. l/min	Inlet pressure max. bar	Actuator pressure max. bar	Return pressure max. bar
150	90	315	315	40

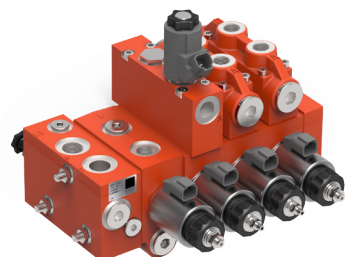
#### Benefits:

- Suitable for electrohydraulic steering functions
- Downstream pressure compensators
- Low pressure losses thanks to valve design
- Modular system, combining LVS08 & LVS12
- Extended functions can be optionally integrated as intermediate sections
- Optionally with on-board electronics
- Bolt-on plates for extended functions such as seat valves and load-control valves



#### Benefits:

- Suitable for electrohydraulic steering functions
- Optionally with stepper motor
- Upstream pressure compensator
- Modular, flexible and compact building-block system
- Extended functions can optionally be integrated
- Low pressure losses thanks to the valve design
- Bolt-on plates for extended functions such as seat valves and load-control valves



# Electrohydraulic Steering Systems

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When designing electrohydraulic steering systems with approval for public roads, Bucher Hydraulics works closely with the application specialists from MOBIL ELEKTRONIK.

## Comprehensive system solutions

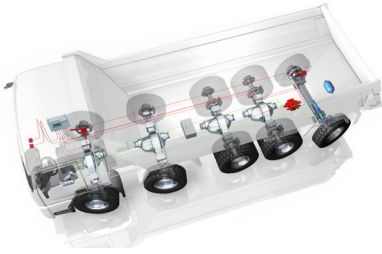
MOBIL ELEKTRONIK provides comprehensive system solutions for steering main/auxiliary steering axles. These highly available, fail-operational steering systems are the basis for operating autonomous trucks, buses and special vehicles on public roads.

These customizable systems from MOBIL ELEKTRONIK and Bucher Hydraulics meet key requirements, such as those for ISO 26262- and EN 13849-compliant development as well as the highest safety levels up to ASIL D or PL e.

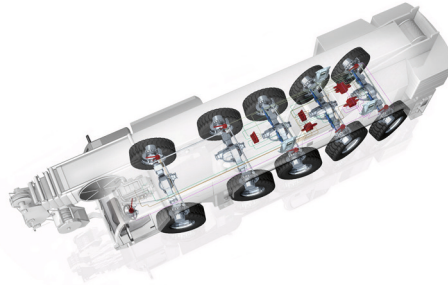
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## Complete automation solutions for special vehicles

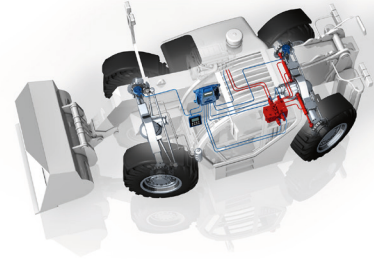
- Construction machinery
- Industrial trucks
- Harbor vehicles
- Agricultural machinery
- Airport vehicles
- Heavy-duty vehicles



**EHLA STANDARD**  
Rear-axle steering for multi-axle trucks/buses

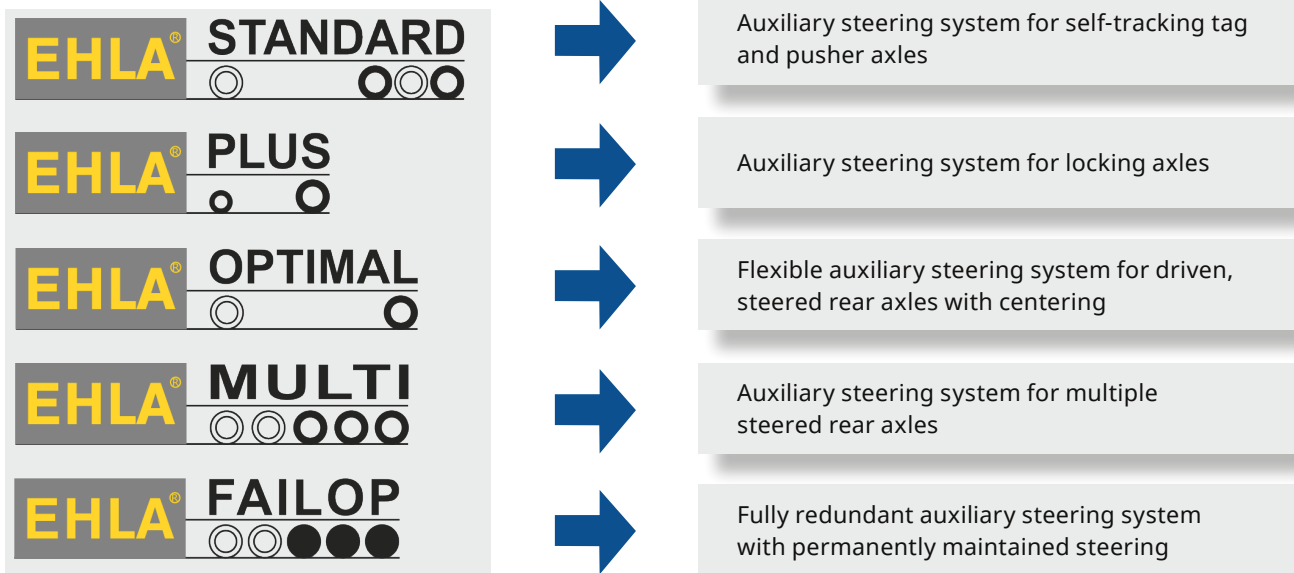


**EHLA FAILOP**  
Rear-axle steering for multi-axle crane vehicles



**EHLA PLUS**  
Rear-axle steering for two-axle vehicles

## EHLA<sup>®</sup> SYSTEMS at a glance



### Features

- Different system solutions for steering the rear axle, matched to the vehicle
- From simple, fail-safe tag axles to multi-axle, fail-operational steering systems
- All systems can be approved for public road traffic as per Annex 6 of ECE-R79
- Different steering programs are available, such as all-wheel steering or diagonal drive (crab steering)
- Speed-dependent steering angle adjustment is possible
- Simulations to support development

# The Steering System – More Than the Sum of its Parts

The EHLA® System can be used for applications for simple, fail-safe tag axles, as used on agricultural trailers, through to multi-axle, fail-operational auxiliary steering systems. Every conceivable application can be created using a modular system with a practically limitless number of possible combinations.

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## Road steering mode

- For use on public roads
- Optimized for low tire wear with maximum maneuverability

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## Field steering mode

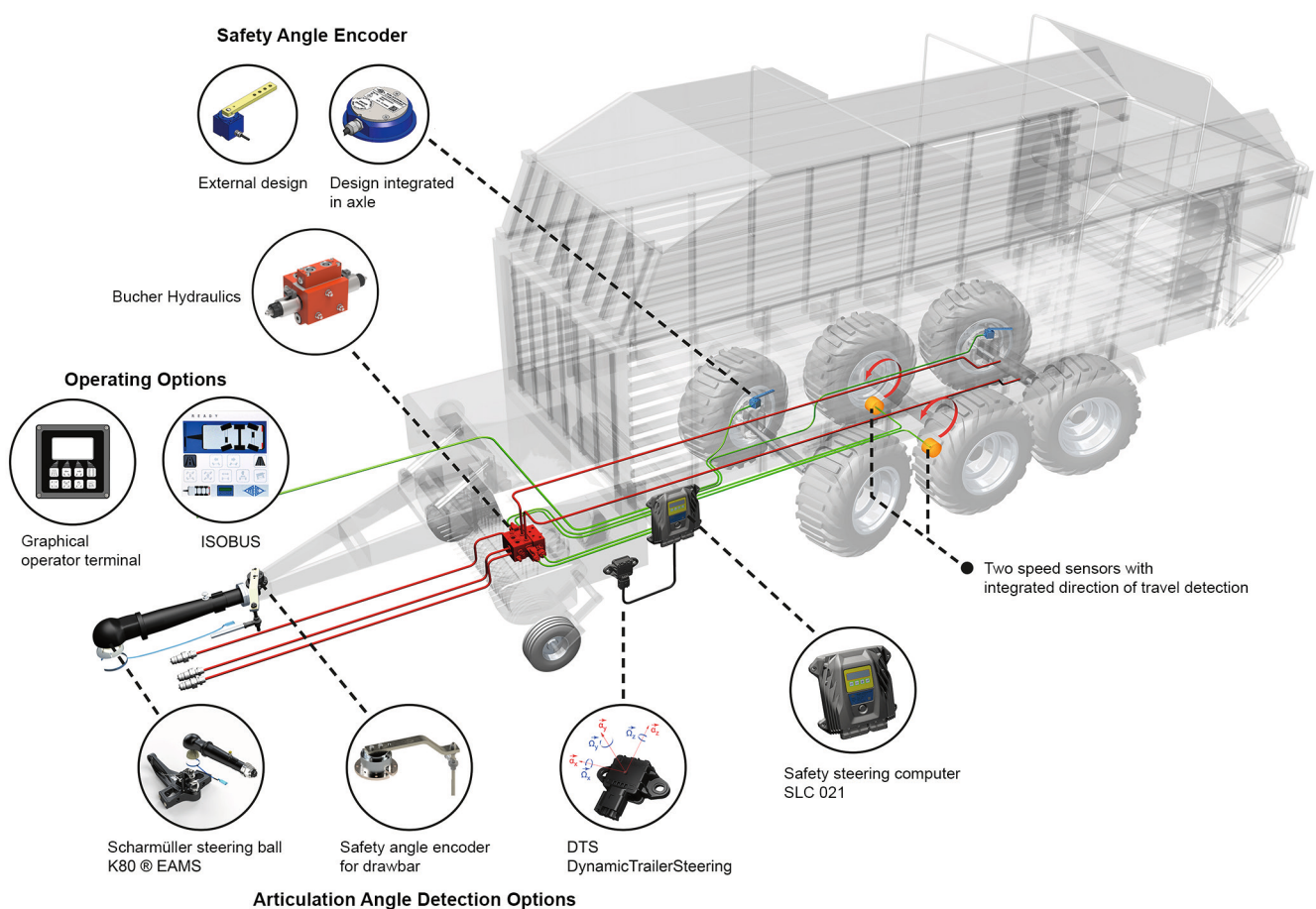
- Manual steering
- Diagonal steering (crab steering)
- All-wheel steering
- Offset steering (for driving on slopes)

## Benefits of the EHLA® System:

- Electrohydraulic steering of one or more axles
- Steering geometry customized to the vehicle or customer requirements via parameters
- Force-free decoupling of the steered axles from the movement of the drawbar
- Speed-dependent steering functions (Reduction of the maximum steering angle as speed increases)
- Improved agility by doing away with displacement cylinders/coupling rods on the drawbar
- Hydraulic centering of the axles at high driving speeds for maximum driving stability and safety
- Large number of steering programs, such as slope drift compensation, manual steering or „crab steering“ to protect the ground
- Tried-and-tested and safe system according to Annex 6 of ECE-R79, with redundant sensors and safety steering computer according to SIL-2
- Reduced tire wear



## Overview of the Modular EHLA<sup>®</sup> System für Agricultural Trailers



### DTS - articulation angle detection without mechanical sensors

Our DynamicTrailerSteering system is a novel solution that is particularly easy to use. The system does away with a drawbar angle encoder completely. The articulation angle is calculated from the dynamic driving state of the trailer using a special algorithm we have developed with one 6-DoF IMU and two single-wheel speed signals.

### Benefits:

- No mechanical linkage to detect the articulation angle between tractor unit and trailer
- Apart from power and hydraulic supply, there are no other requirements for the tractor unit
- Larger articulation angles between tractor unit and trailer are possible
- Behavior adapted to the different driving speeds and situations via parameters

Steering computer  
Sensors  
Actuators

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# Core Components of a Steering System

## Safety angle encoder on the steered axles

Depending on the type of axle used, it is possible to use a safety angle encoder mounted on the outside of the axle, which transmits the steering angle via a coupling rod, or you can use an axle-integrated design instead.

- Robust and compact design with anodized aluminum housing
- Non-contact measuring system (Hall)
- Redundant output signal for safety-related applications

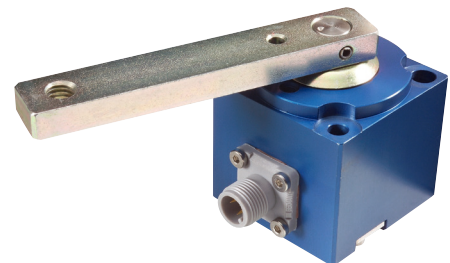
On both designs, an analog or digital CAN output signal can be used for control.

- The CAN design has the following benefits:
- Improved diagnostic depth
- Robust signal transmission
- Easy to install, because the zero point and the measuring range are defined via parameters

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## Options for angle encoder

- External design or integrated in axle
- Analog or digital output signal




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## SLC 021 safety steering computer

IP 6K9K automotive housing

- Robust die-cast aluminum
- Designed for harsh conditions (dirt, water, salt)

Developed according to ISO 26262

- Automotive-qualified components (long-term availability)
- Modular software and hardware architecture, up to ASIL-D

Improved fault diagnosis management

- Detection of errors via active monitoring (real time) of the hardware



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### ISOBUS operation

Communication between the steering system and the ISOBUS terminal in the tractor unit is via an ISOBUS gateway.

- EHLA®-steering operated via tractor-side terminal
- Via AUX, it is possible to operate on the tractor-side or other retrofit joysticks




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### EEA 092 901 Graphical Operator Terminal

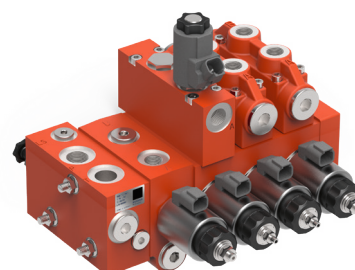
A robust solution with CAN bus interface to the safety steering computer to operate the steering system, as an alternative to ISOBUS operation




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### Hydraulic system

The movement in the steering cylinders is controlled by the proportional electrohydraulic spool axis. This can be integrated either in a wide variety of different sectional valves or in a customized control block solution. There are different control variants that contribute to the safety of the system, depending on the diagnostic option.



Your partner for Steer-by-Wire  
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# Smart Solutions. Superior Support.

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