

ENGINEERING  
TOMORROW



Danfoss Power Solutions presents

# **E-book** Steering Portfolio

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START HERE



## SOLUTIONS

### **H** Hydraulic steering

#### **A wide range of off-road steering components**

Made to control small and large steering forces, where operator comfort and safety demand are high.

### **F** Flex-Steer™

Steer-by-Wire

#### **Free to steer**

Complete Danfoss subsystem solution that replaces the orbitrol steering wheel with joystick or electric steering wheel, for best design flexibility, productivity and comfort.

### **M** MultiAxis-Steer™

All-wheel steering

#### **Unleash the full maneuverability**

An outstanding system with individual axle control for greater productivity and installation savings.

### **A** Auto-guidance (GPS)

#### **Auto-guided steering system**

Optimized to work with GPS, row, vision or laser sensors with high accuracy.

### **Q** Quick Steering

#### **Flexible steering ratio**

Adapt steering performance to specific working requirements

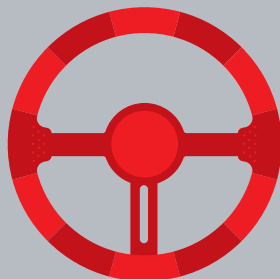
# Get the **complete steering system** overview

With a comprehensive range of hydraulic and electrohydraulic steering components and systems, Danfoss provides dedicated solutions applicable for all types of applications.

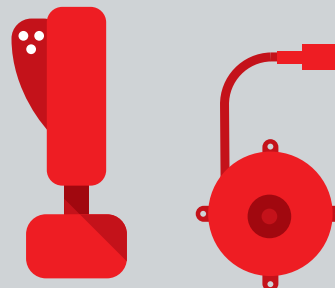


## COMPONENTS

### Hydraulic steering components



### Electrohydraulic steering components



## APPLICATIONS





# Solutions



**Hydraulic steering**



**Flex-Steer™**  
Steer-by-wire



**MultiAxis-Steer™**  
All-wheel steering



**Auto-guidance**



**Quick steering**



# Hydraulic steering

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## Hydraulic steering solution

Danfoss subsystem solution with orbitrol steering unit and priority valve.

Hydraulic steering with enhanced comfort and greater operator experience. Easy compliance to current safety standards with reduced installation costs. Available for many applications for both new and existing vehicles.



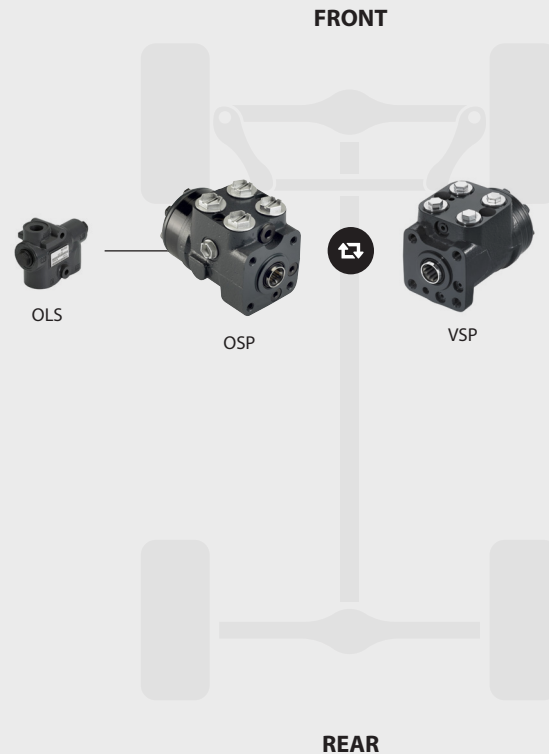
### OEM value

- ✓ Maximum compatibility with existing and proven technology
- ✓ Reduced installation cost
- ✓ Easy compliance to current safety standards



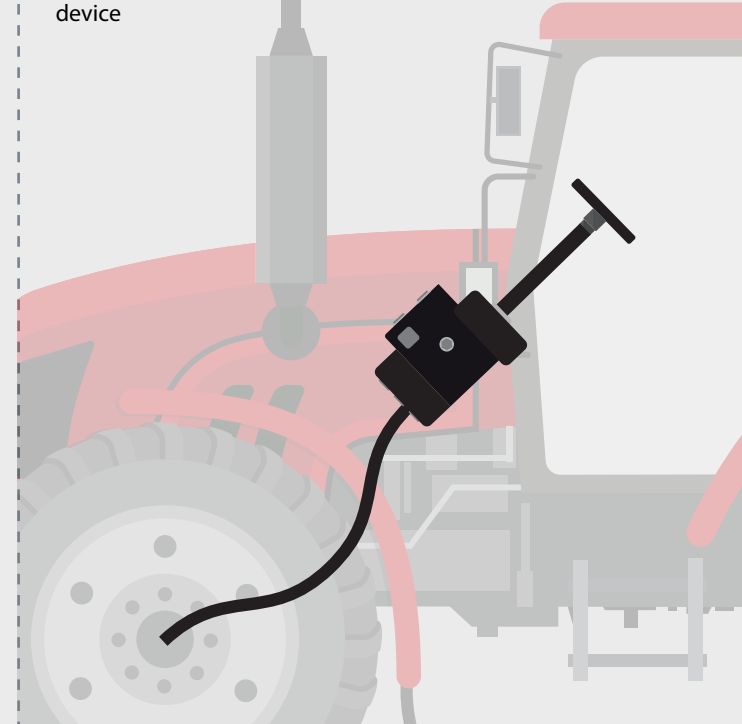
### Operator value

- ✓ Enhanced comfort
- ✓ Increased productivity
- ✓ Better handling and control



## Hydraulic steering

Steering column with a steering unit as steering input device

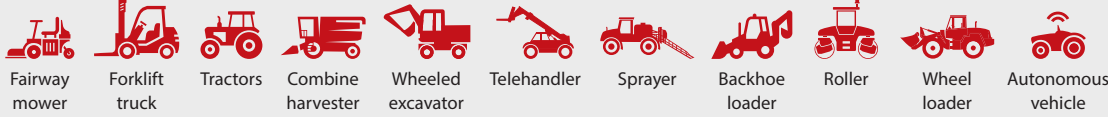




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# F

## Flex-Steer™ Steer-by-wire



### Feel the road without mechanical link

Complete Danfoss subsystem solution that replaces the orbital steering wheel with joystick or electrical steering wheel.

Flex-Steer™ allows to rethink operator stations, allowing for much more design flexibility in the cabin as well as on the vehicle. The EHi with integrated steering and safety controller is developed to fit many different applications for both new and existing vehicles.



#### OEM value

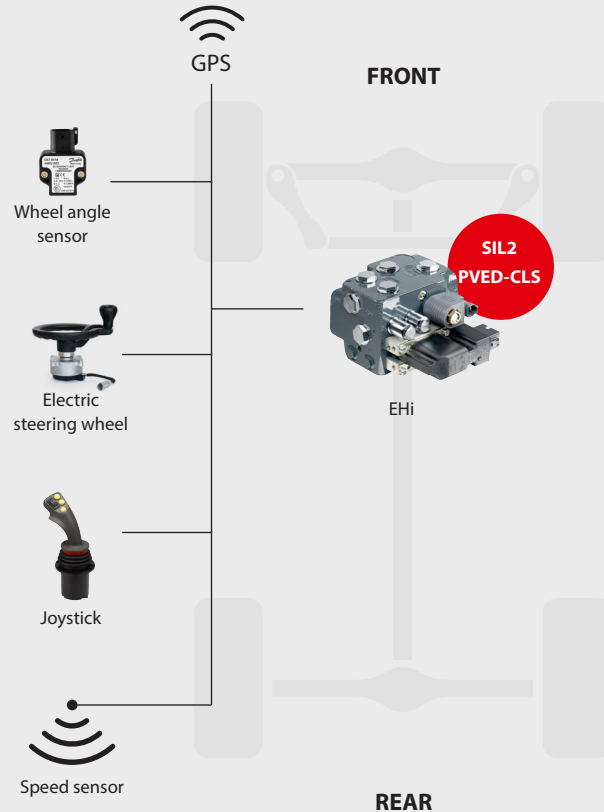
- ✓ Increased design flexibility
- ✓ Reduced installation cost
- ✓ Auto-guidance (GPS)



#### Operator value

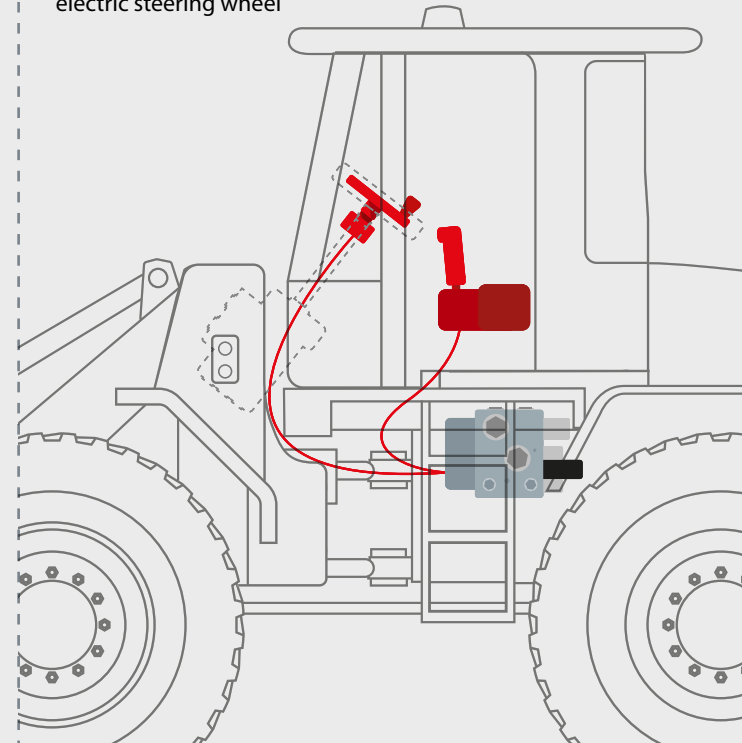
- ✓ Up to 65% reduced muscle activity\*
- ✓ 6% increased productivity\*
- ✓ Better handling and control
- ✓ Reduced cabin noise

\*Compared to conventional steering



#### Flex-Steer™

Eliminates steering column with either joystick or electric steering wheel





# M

## MultiAxis-Steer™

All-wheel steering



Tractors



Telehandler



Sprayer



Roller



Autonomous vehicle

> VISIT WEBSITE

### Unleash the full maneuverability

An outstanding safe electrohydraulic steering system with maximum maneuverability and flexibility.

By integrating the MultiAxis-Steer™ solution with EHi valve on the rear axle, operators have a new way to control their machine. Sprayer operators, for example, can eliminate the tracks from the rear wheels, reducing the vehicle's footprint to maximize crop yields.



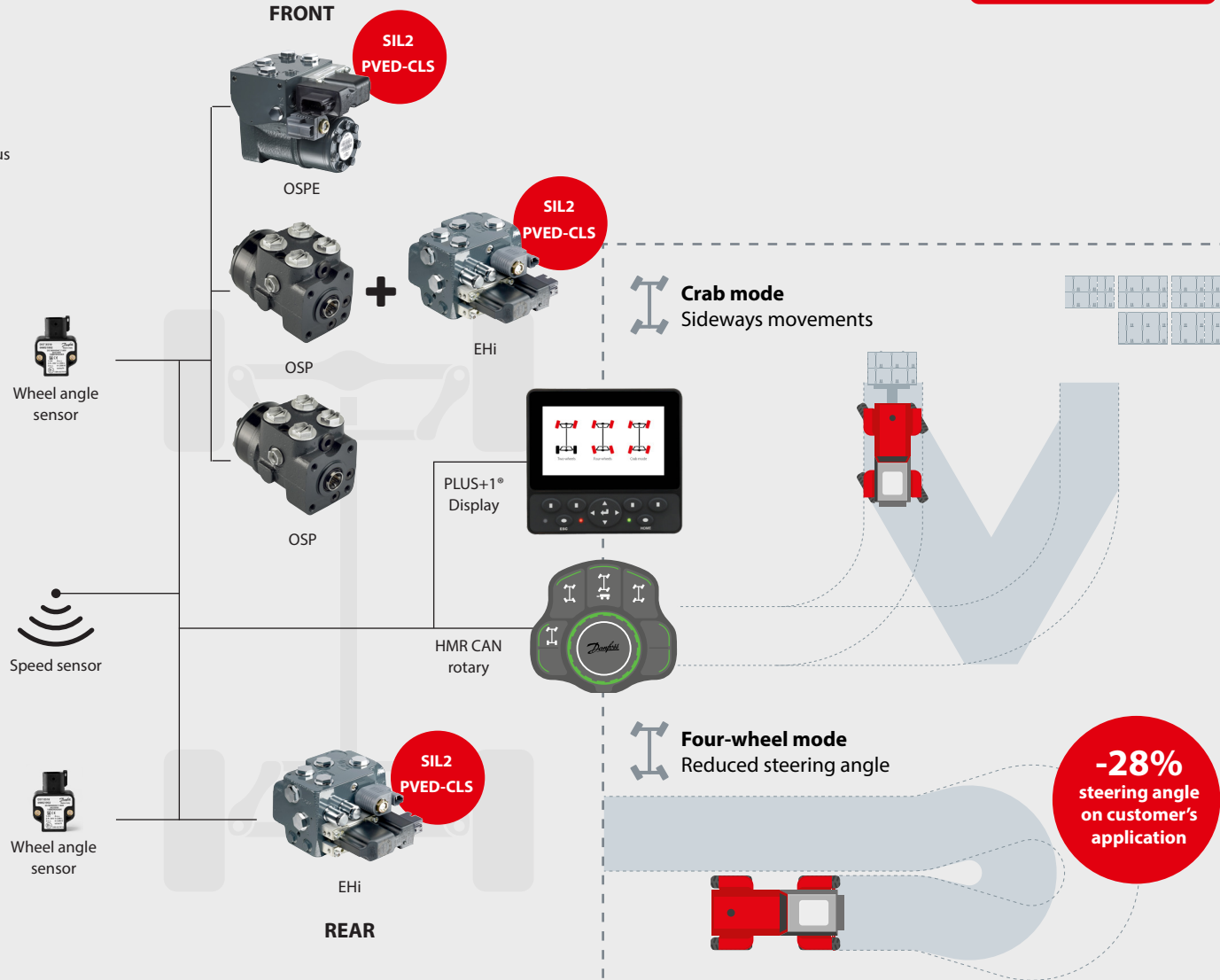
#### OEM value

- ✓ SIL2 certified PVED-CLS steering and safety controller
- ✓ Increased design flexibility
- ✓ Reduced installation costs and complexity



#### Operator value

- ✓ Fast and smooth transition between steering modes during driving
- ✓ Increased productivity
- ✓ Improved comfort





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# Auto-guidance

GPS

# A



Fairway mower



Tractors



Combine harvester



Sprayer



Roller



Autonomous vehicle

## Boost your machine productivity

The optimum electrohydraulic steering system to perform auto-guidance with improved productivity, precision and efficiency.

Our electrohydraulic steering components are optimized to work with GPS, row, vision or laser sensors. In order to facilitate the high-tech farming necessary to feed our ever-growing population.



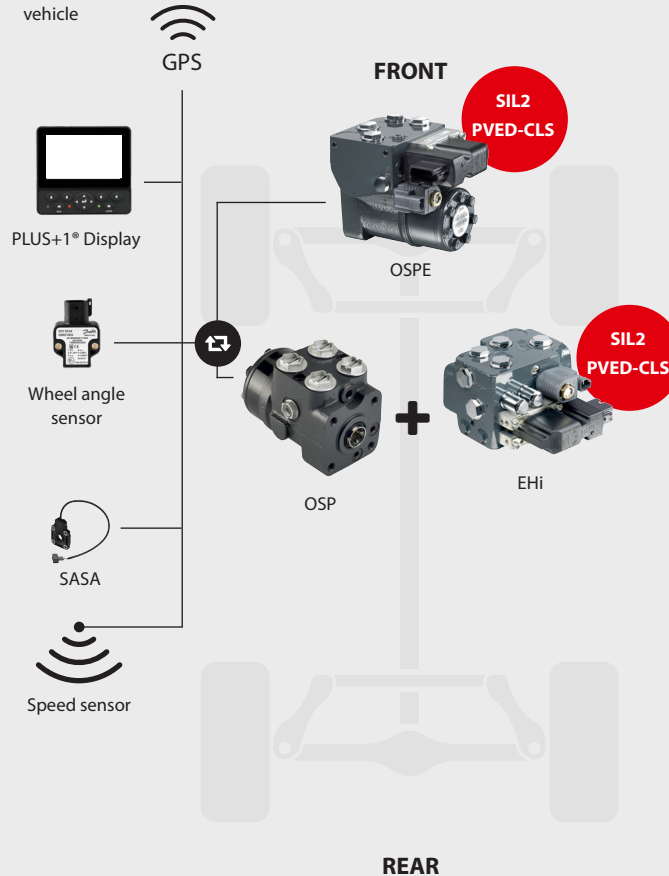
### OEM value

- ✓ Precision farming
- ✓ SIL2 certified PVED-CLS steering and safety controller
- ✓ Design flexibility



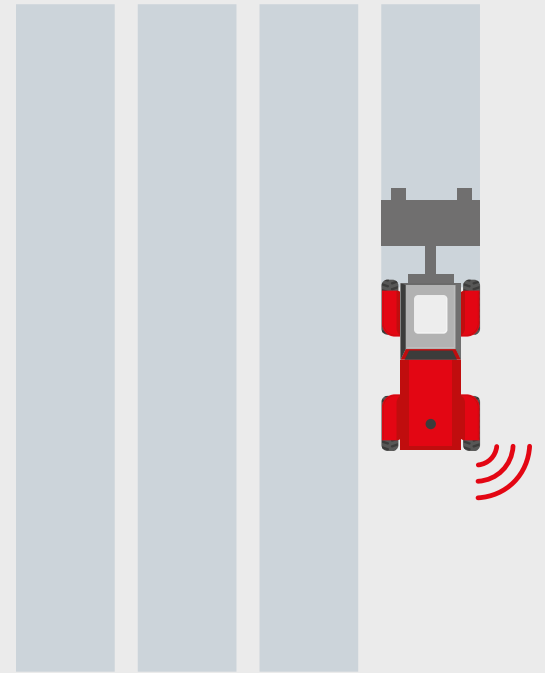
### Operator value

- ✓ Up to 17% increased productivity
- ✓ Improved comfort
- ✓ Greater fuel efficiency



## Auto-guidance

Improved productivity, precision and accuracy







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# Quick steering

# Q



## Fine-tune steering performance

The ability to adjust machines steering ratio, gives operators added precision while keeping them in ultimate control. With the PVED-CLS steering controller and SASA steering sensor, the Danfoss OSPE or EHi steering valves enable you to fine-tune steering performance. E.g. two turns lock-to-lock for accurate high-speed driving, and five turns lock-to-lock for precise, stand-still or slow speed maneuverability, these steering modes are automatic depending on the speed of the machine.



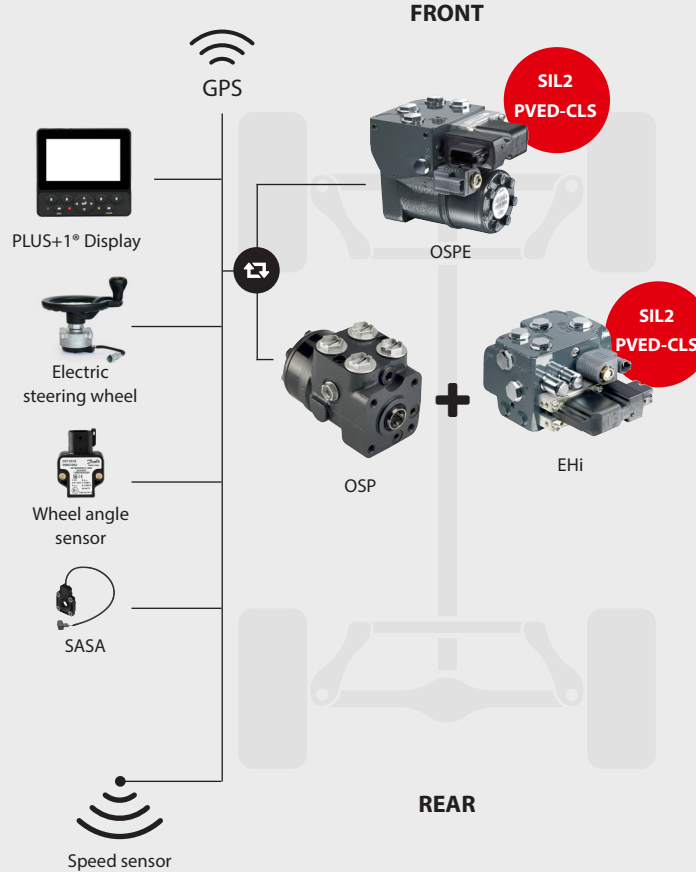
### OEM value

- ✓ Complete system solution
- ✓ Reduced design complexity
- ✓ Pre-programmed steering settings

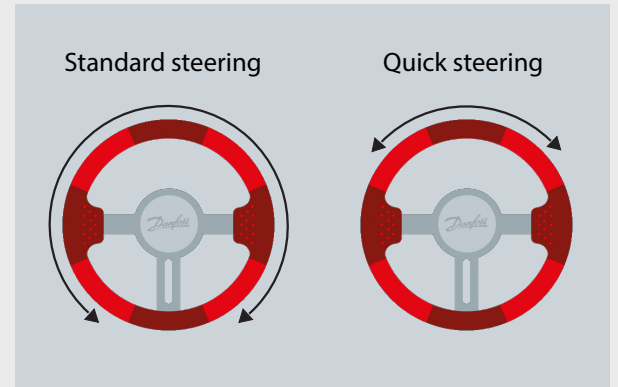


### Operator value

- ✓ Increased productivity
- ✓ Improved comfort
- ✓ Seamless and smooth transition while changing vehicle speed



## Quick steering Variable steering ratio



5 selectable programs with individual lock-to-lock settings and speed depending steering





# Applications



Fairway mower



Sweeper



Forklift truck



Tractors



Combine harvester



Wheeled excavator



Telehandler



Sprayer



Backhoe loader



Roller



Wheel loader



Dump truck



Autonomous vehicle



# Fairway mower

Hydraulic steering







Electrohydraulic steering





# Fairway mower

## Hydraulic steering

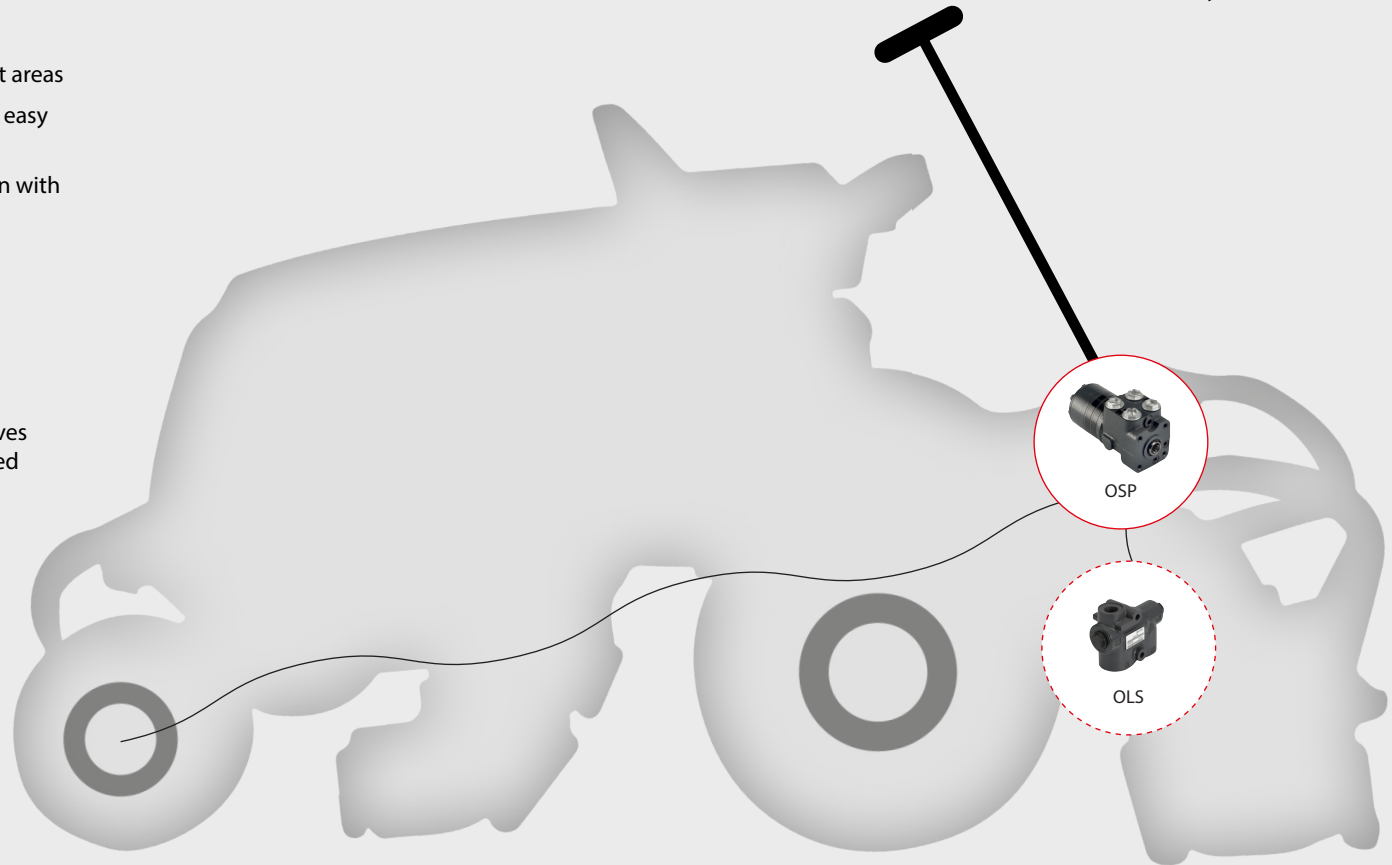
- Alternative configuration 
- Available for selected configurations 
- Mechanical link 
- Hydraulic link 

### OSP series

- Safe and high performing solution that fits into tight areas
- Best in class integration due to compact design and easy connectivity
- Ensures a repeatable high performance and precision with low slippage and steering torque

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP + OLS are designed to match

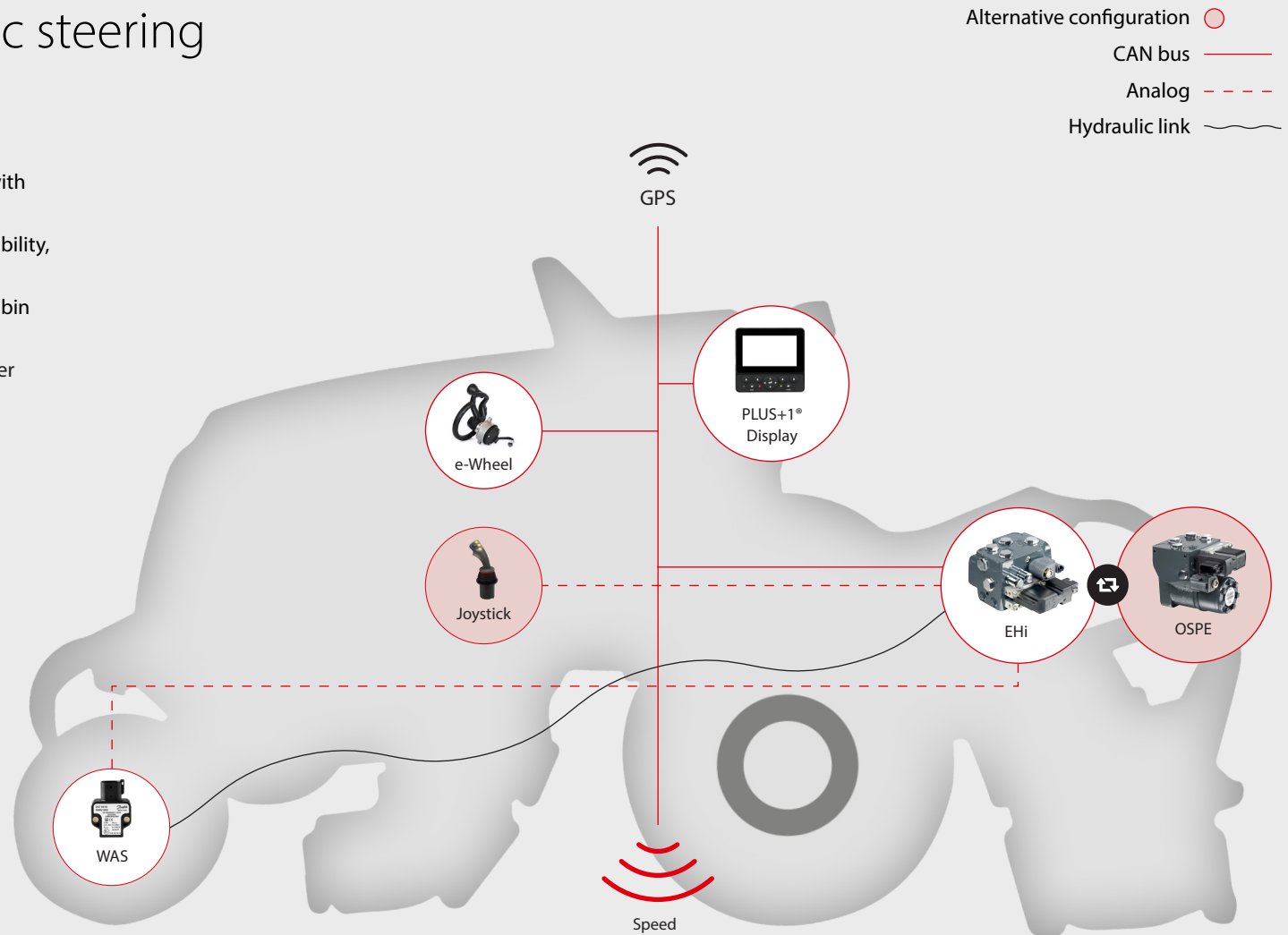




# Fairway mower

## Electrohydraulic steering

- Auto-guidance (GPS) ensures a high precision job with increased productivity and efficiency
- Quick steering with EHi allows for easier maneuverability, increased productivity and comfort
- Joystick and electric steering wheel for improved cabin flexibility, visibility and ergonomics for operator
- SIL2 certified PVED-CLS steering and safety controller





# Sweeper

Hydraulic steering





Electrohydraulic steering





# Sweeper

## Hydraulic steering

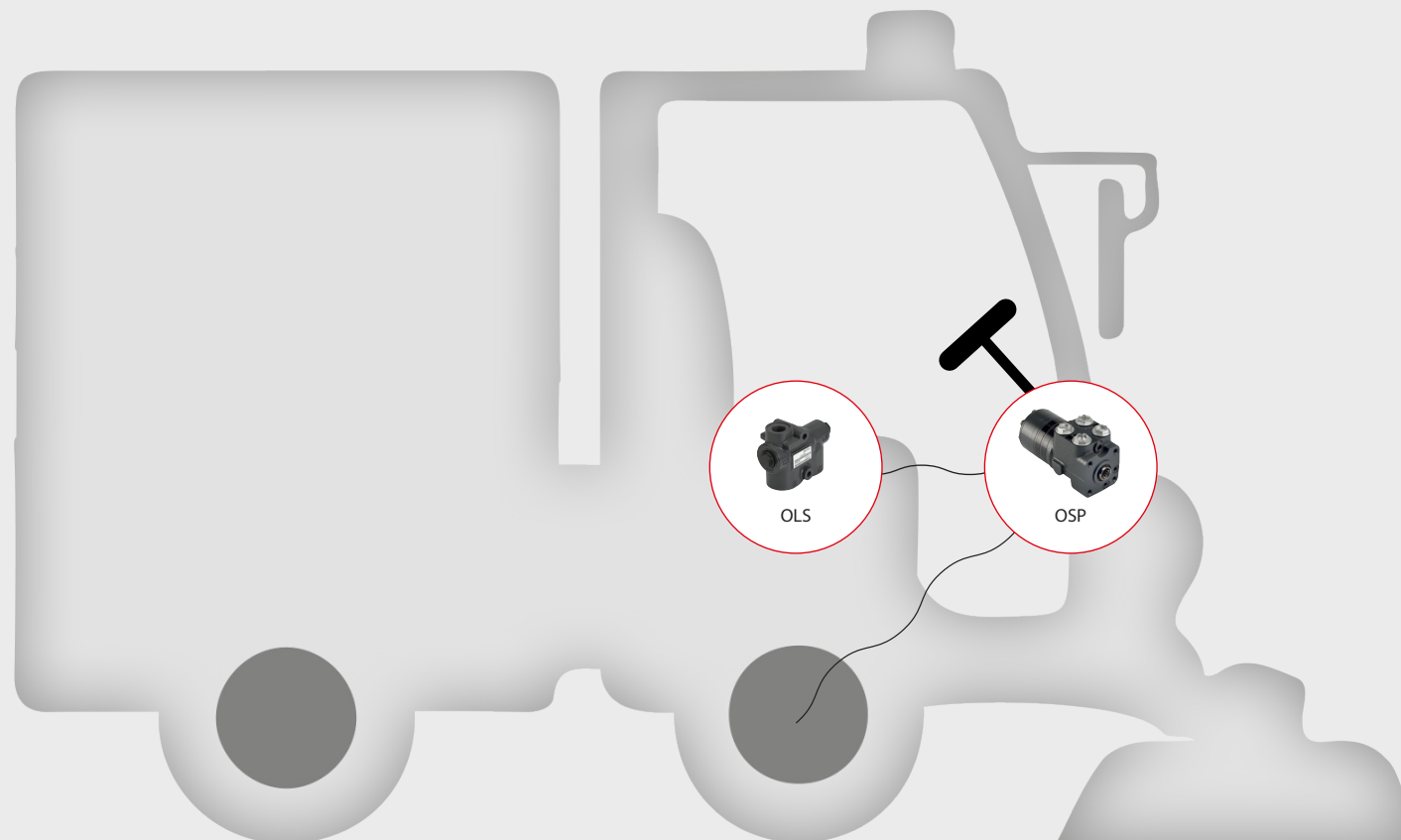
Mechanical link   
Hydraulic link 

### OSP series

- High performance and safety
- Robust and proven in use design
- Low noise and good steering controllability

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP + OLS are designed to match



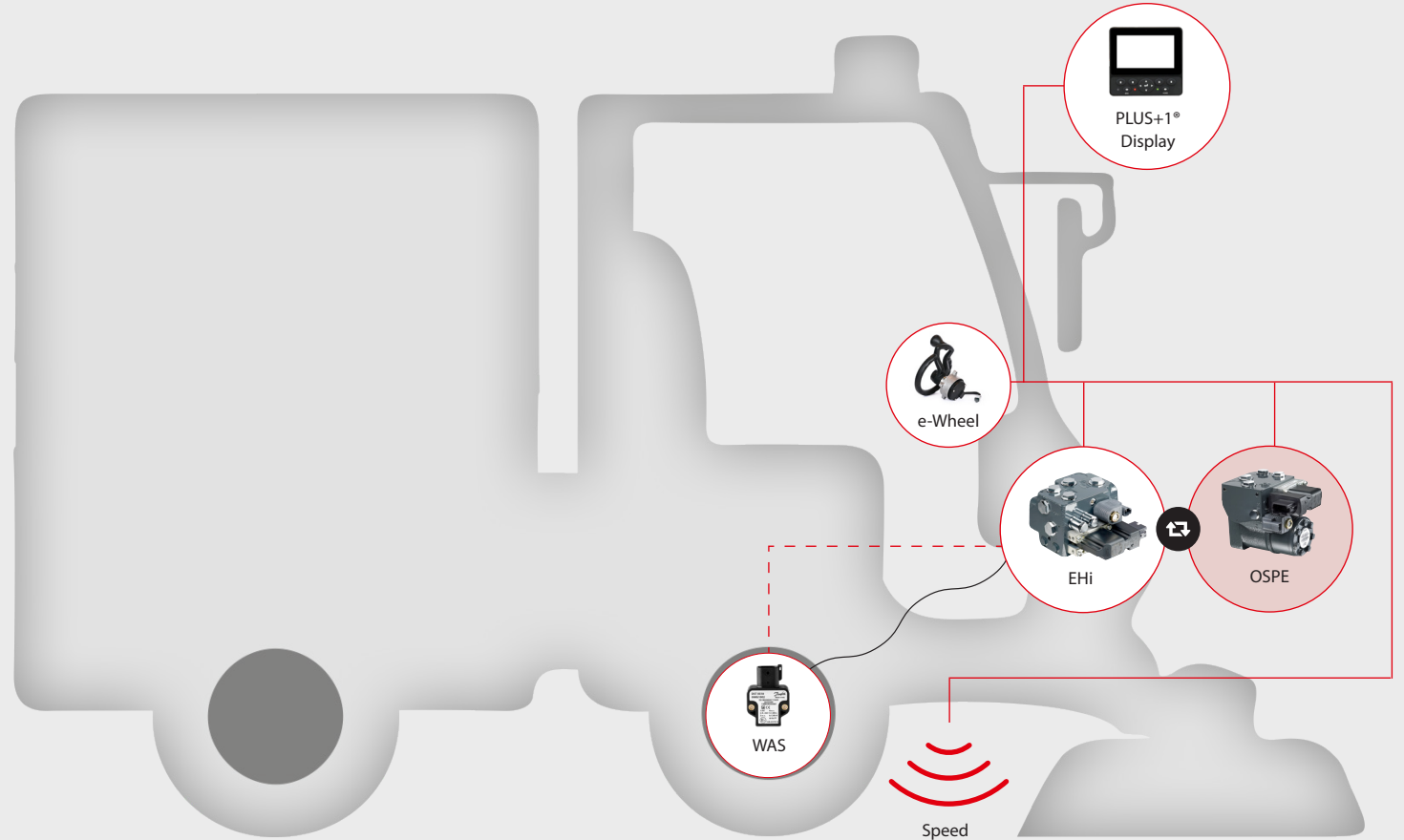


# Sweeper

## Electrohydraulic steering

- Quick steering with EHi or OSPE allows for easier maneuverability and increased productivity
- Electric steering wheel for improved visibility and ergonomics for operator
- SIL2 certified PVED-CLS steering and safety controller

Alternative configuration ○  
CAN bus ———  
Analog - - - -  
Hydraulic link ~~~~~







# Forklift truck

Hydraulic steering



Electrohydraulic steering





# Forklift truck

## Hydraulic steering

- Alternative configuration
- Available for selected configurations
- Mechanical link
- Hydraulic link

### OSP series

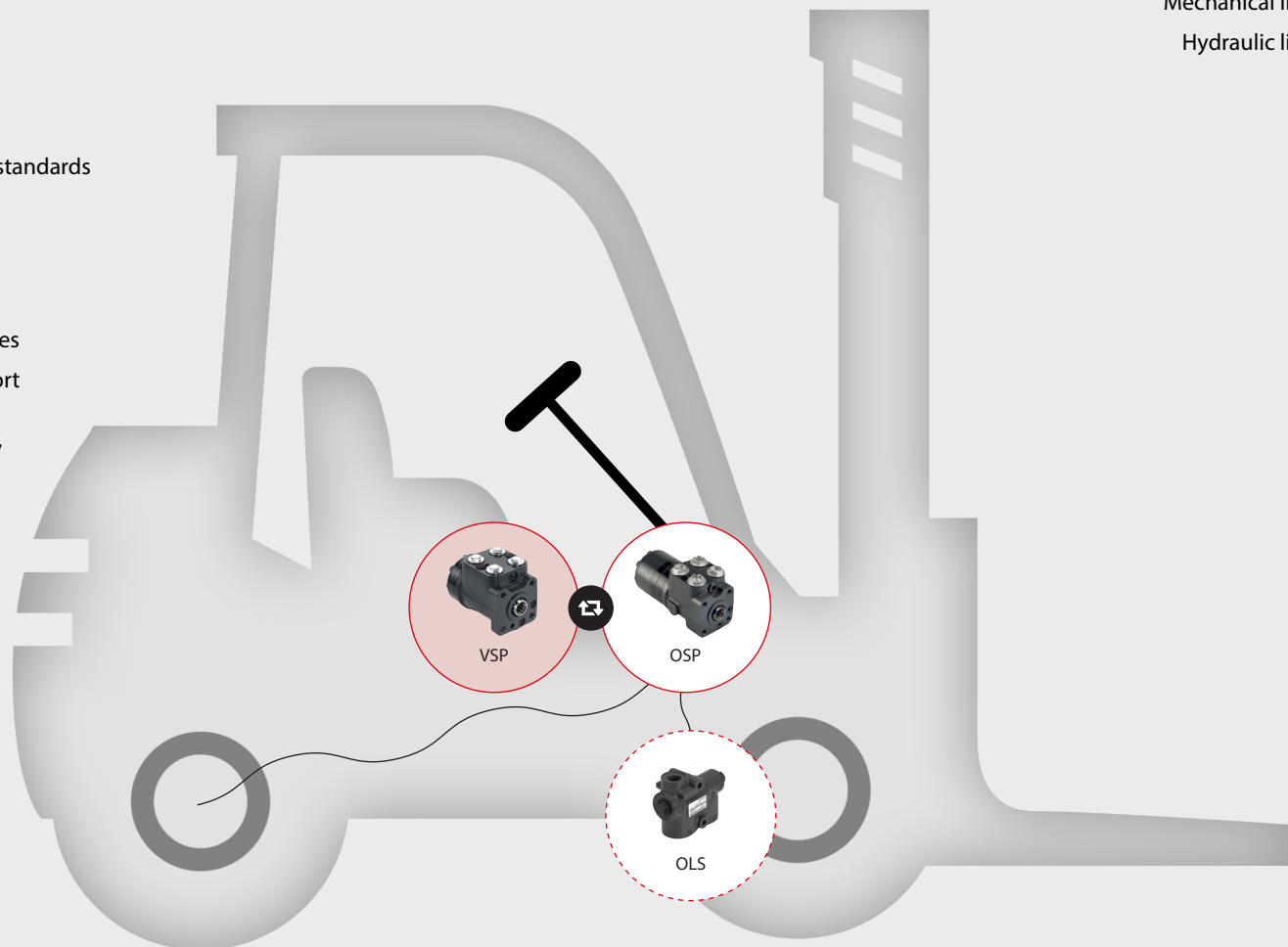
- High performance and safety
- Emergency steering compliance to current safety standards
- Low noise and good steering controllability

### VSP series

- Good performance and manual steering capabilities
- Fulfil vehicle requirements with same high support and service
- Competitive pricing with high quality and delivery

### OLS series





- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP/VSP + OLS are designed to match



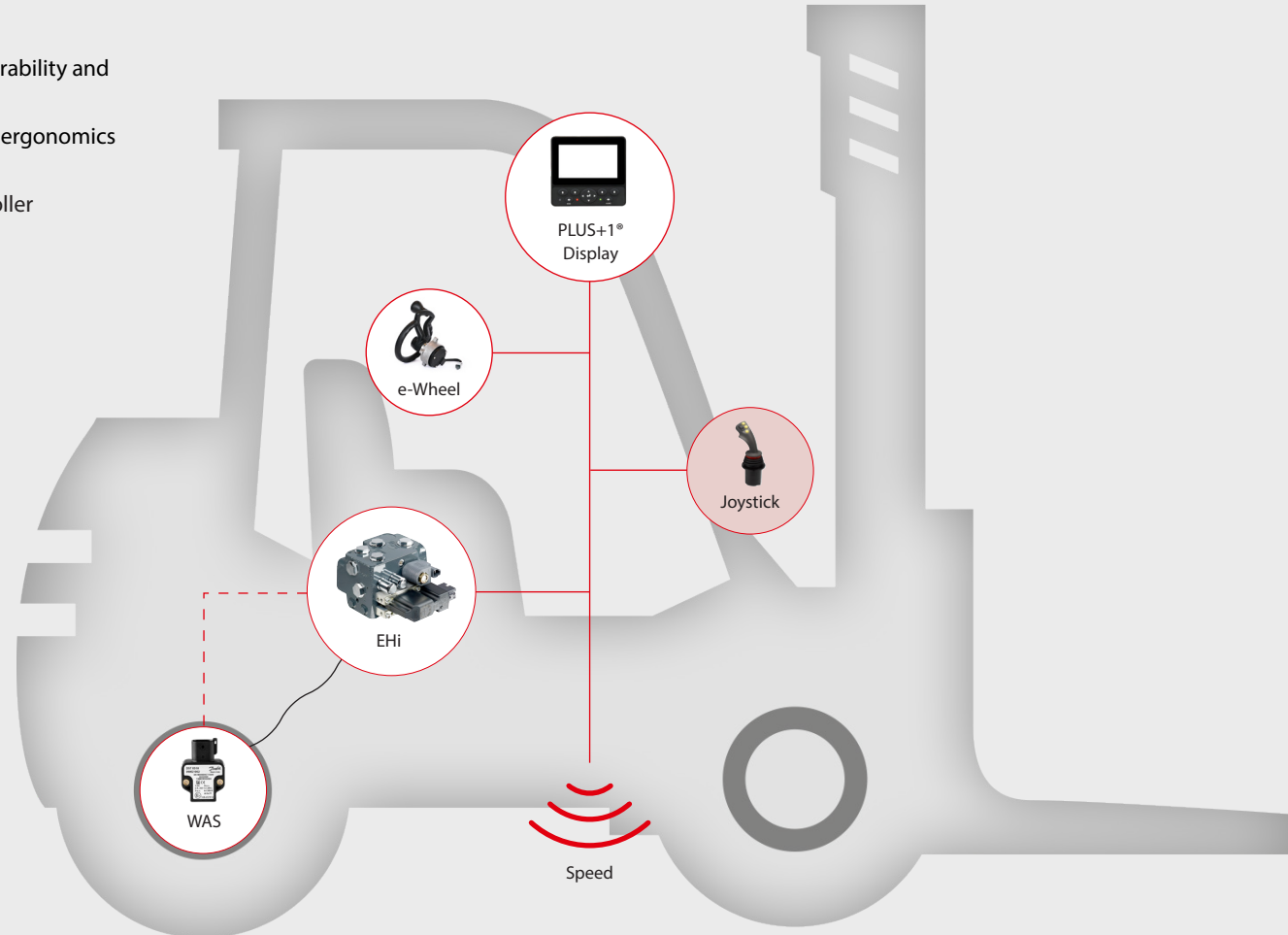


# Forklift truck

## Electrohydraulic steering

Alternative configuration   
CAN bus   
Analog   
Hydraulic link 

- Quick steering with EHi allows for easier maneuverability and increased productivity
- Electric steering wheel for improved visibility and ergonomics for operator
- SIL2 certified PVED-CLS steering and safety controller





# Tractor

Hydraulic steering



Electrohydraulic steering





# Tractor

## Hydraulic steering

### OSP series





- High performance and safety
- Emergency steering compliance to current safety standards
- Low noise and good steering controllability

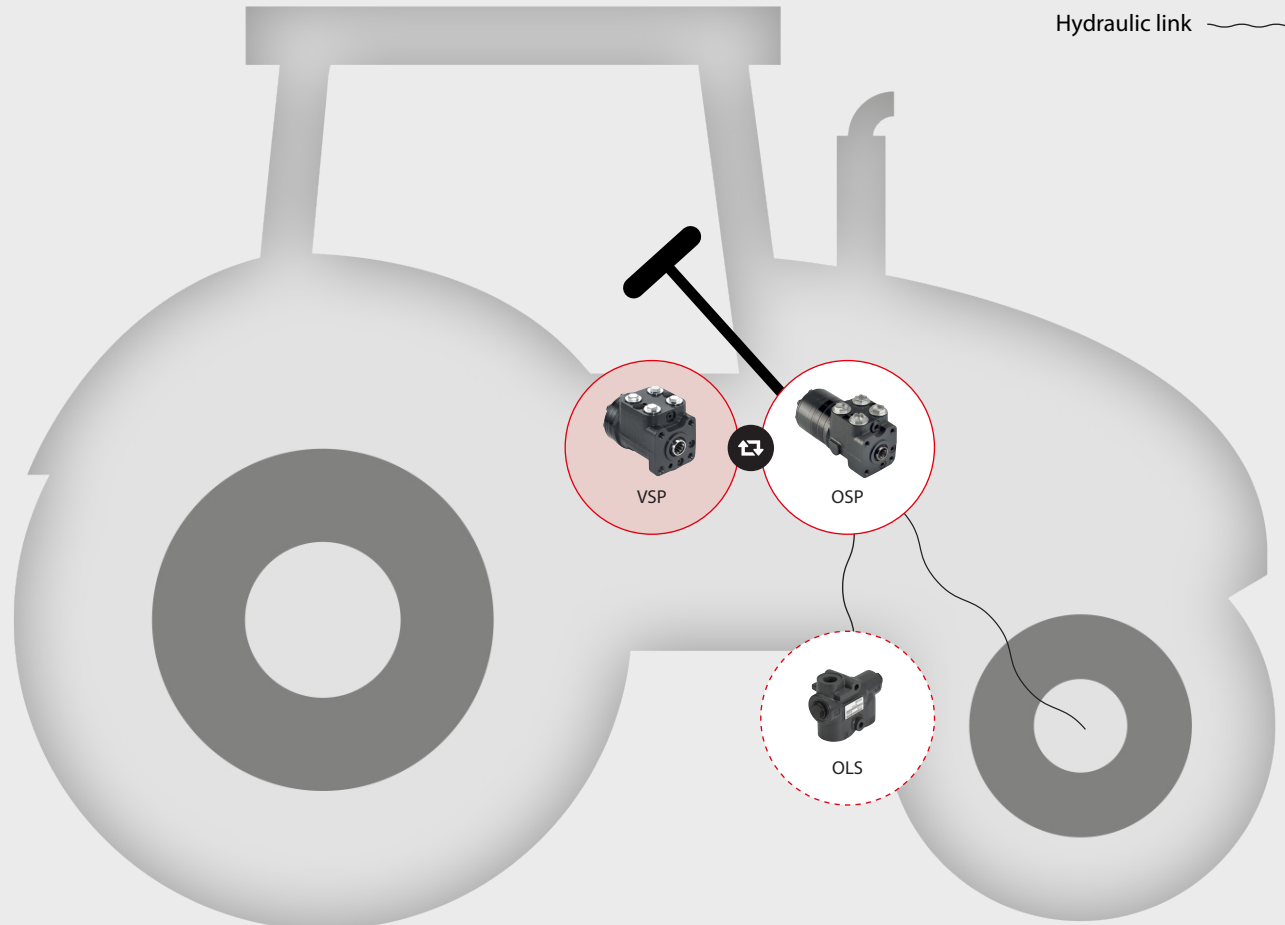
### VSP series

- Good performance and manual steering capabilities
- Fulfil vehicle requirements with same high support and service
- Competitive pricing with high quality and delivery

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP/VSP + OLS are designed to match

- Alternative configuration 
- Available for selected configurations 
- Mechanical link 
- Hydraulic link 

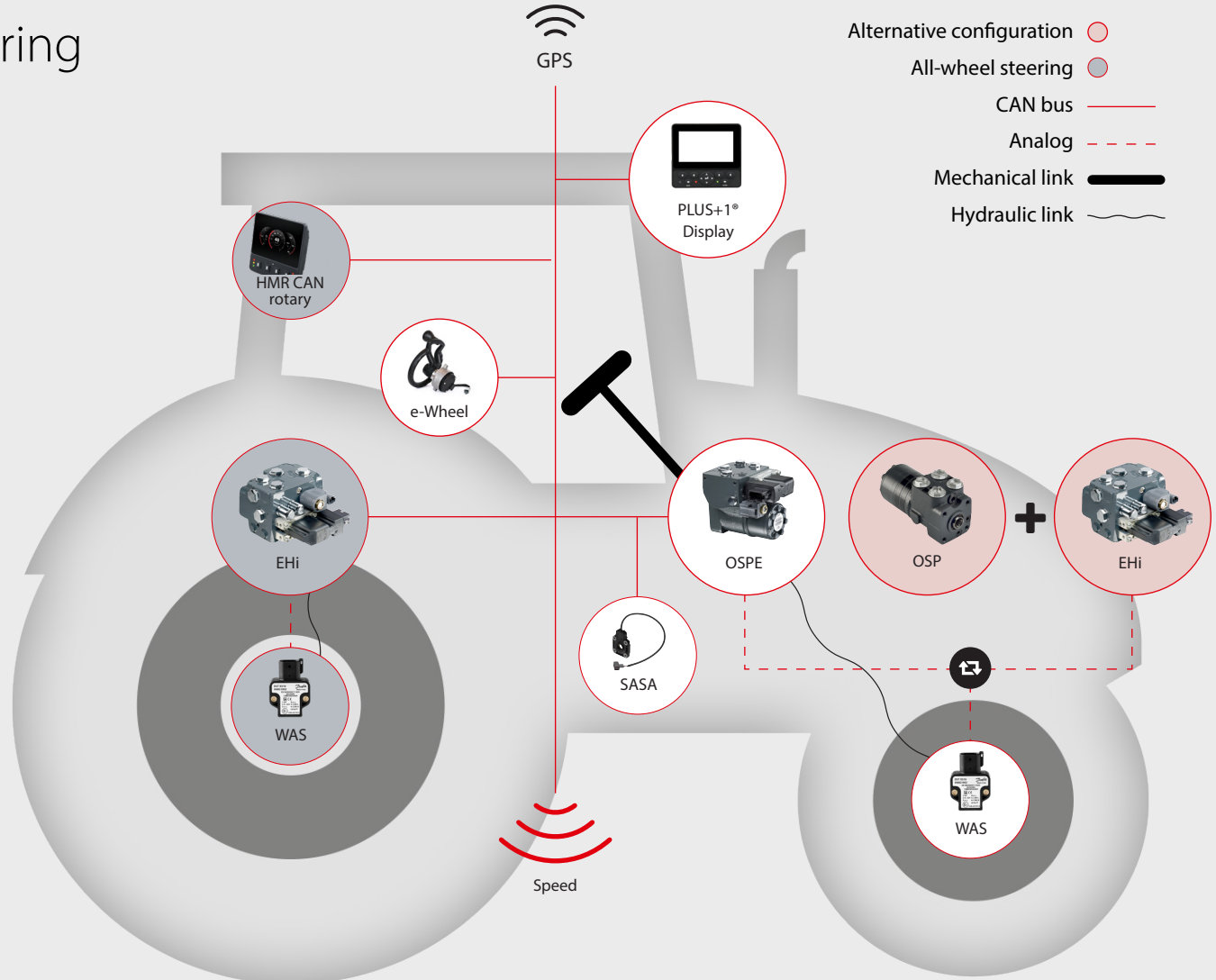




# Tractor

## Electrohydraulic steering

- Auto-guidance (GPS) ensures a high precision job and increased productivity and efficiency
- Quick steering with OSPE and EHi allows for easier maneuverability and increased productivity
- Interface to electric steering wheel for reverse steering
- All-wheel on rear axle, for increased productivity
- SIL2 certified PVED-CLS steering and safety controller





# Combine harvester

Hydraulic steering



Electrohydraulic steering





# Combine harvester

## Hydraulic steering

- Alternative configuration
- Available for selected configurations
- Mechanical link
- Hydraulic link

### OSP series

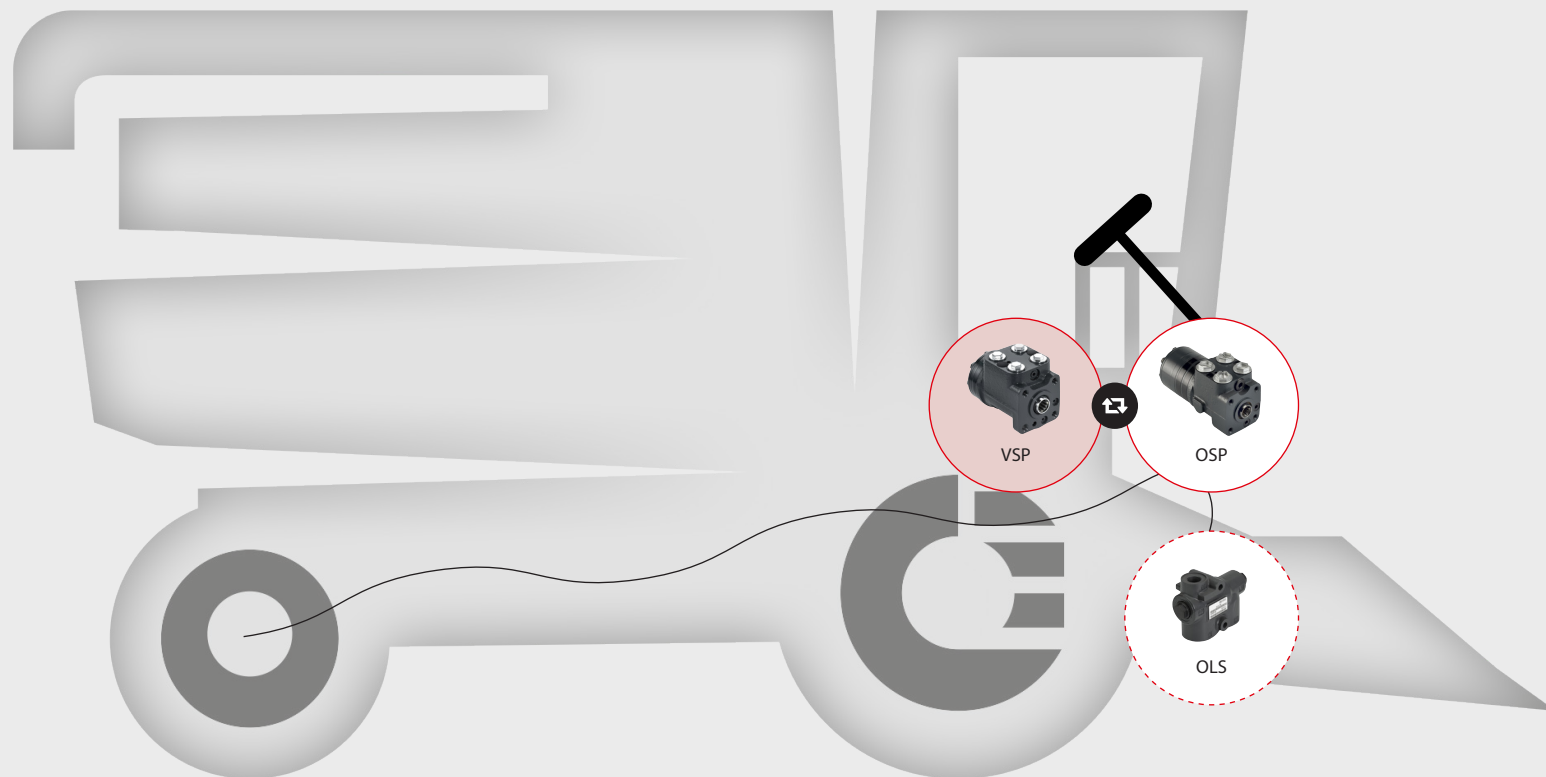
- High performance and embedded safety
- Manual steering without emergency pump
- Low noise and good steering controllability
- Improved work mode, less turns lock to lock

### VSP series

- Good performance and manual steering capabilities
- Fulfil vehicle requirements with same high support and service
- Competitive pricing with high quality and delivery

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP/VSP + OLS are designed to match



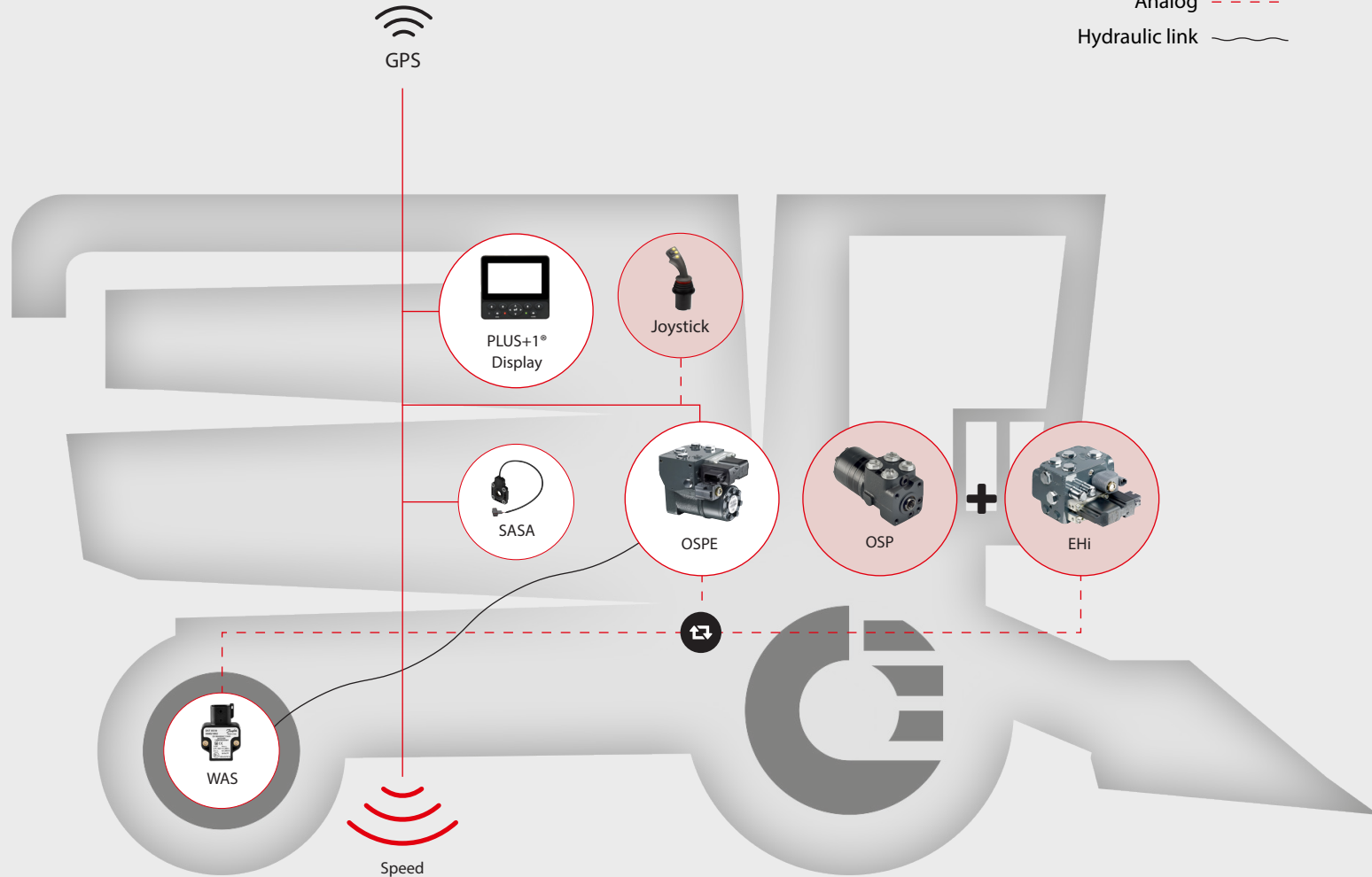
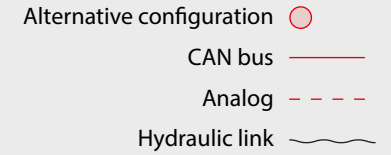




# Combine harvester

## Electrohydraulic steering

- Auto-guidance (GPS) ensures a high precision job with increased productivity and efficiency
- Quick steering with OSPE and EHi allows for easier maneuverability, increased productivity and comfort
- SIL2 certified PVED-CLS steering and safety controller





# Wheeled excavator

Hydraulic steering





Electrohydraulic steering





# Wheeled excavator

## Hydraulic steering

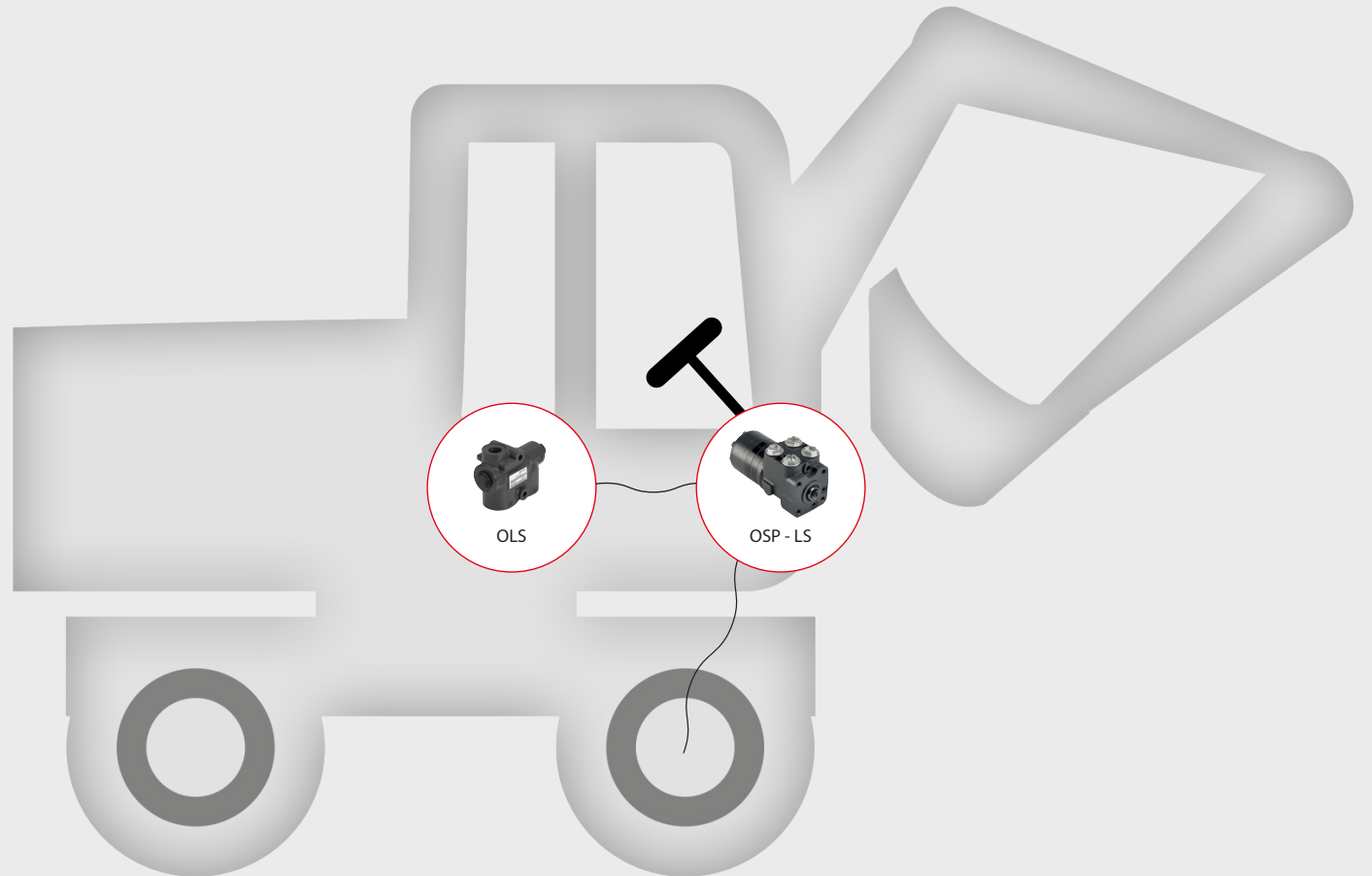
Mechanical link   
Hydraulic link 

### OSP series

- High performance and safety
- Robust and proven in use design
- Jerk dampening and good steering controllability

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP + OLS are designed to match

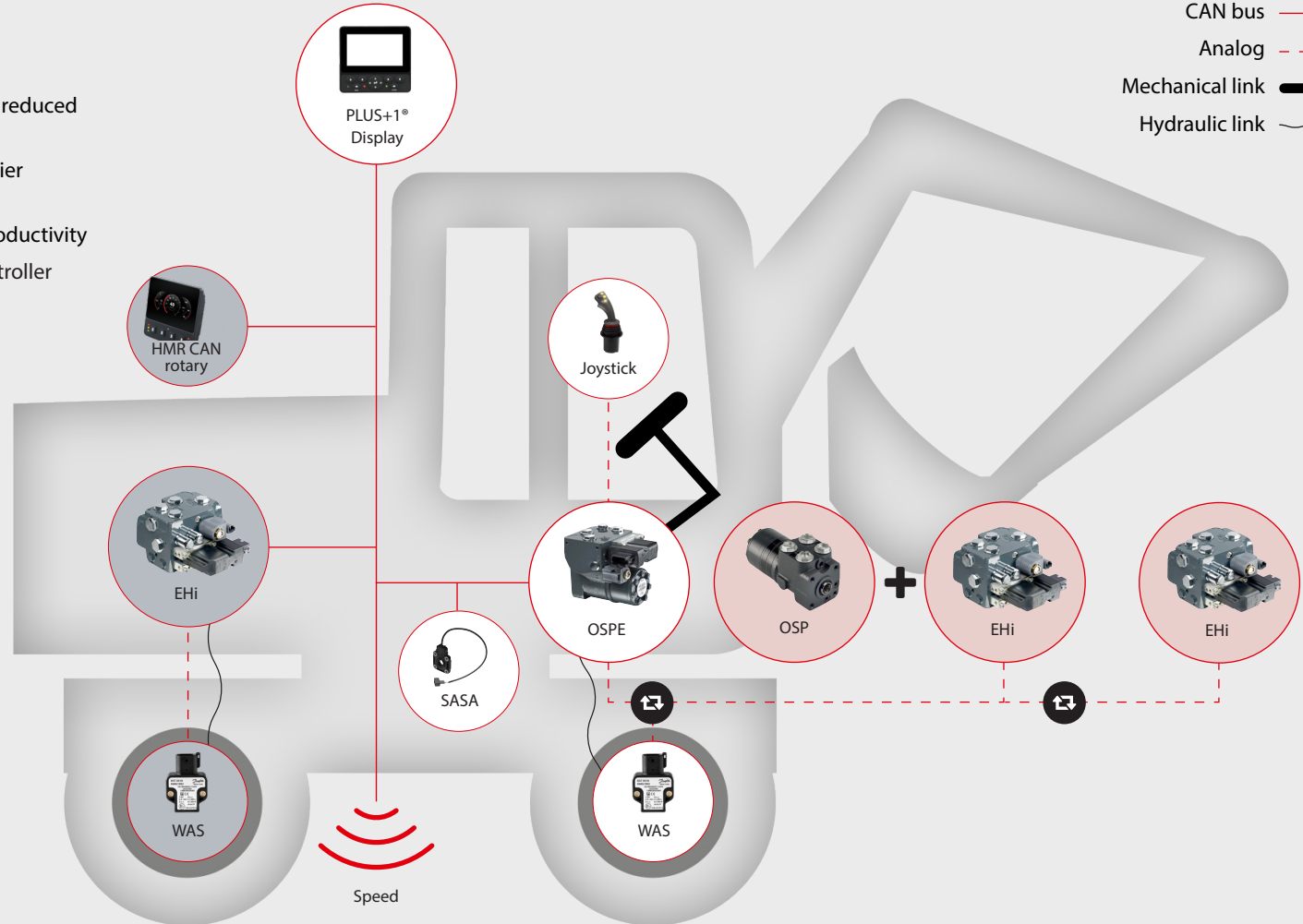
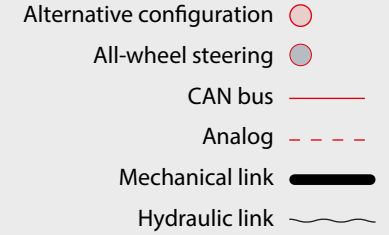




# Wheeled excavator

## Electrohydraulic steering

- Joystick steering for increased productivity and reduced operator fatigue
- Quick steering with OSPE and EHi allows for easier maneuverability and increased productivity
- All-wheel steering on rear axle, for increased productivity
- SIL2 certified PVED-CLS steering and safety controller





# Telehandler

Hydraulic steering



Electrohydraulic steering





# Telehandler

## Hydraulic steering

### OSP series

- High performance and safety
- Emergency steering compliance to current safety standards
- Low noise and good steering controllability


### VSP series


- Good performance and manual steering capabilities
- Fulfil vehicle requirements with same high support and service
- Competitive pricing with high quality and delivery

### OLS series

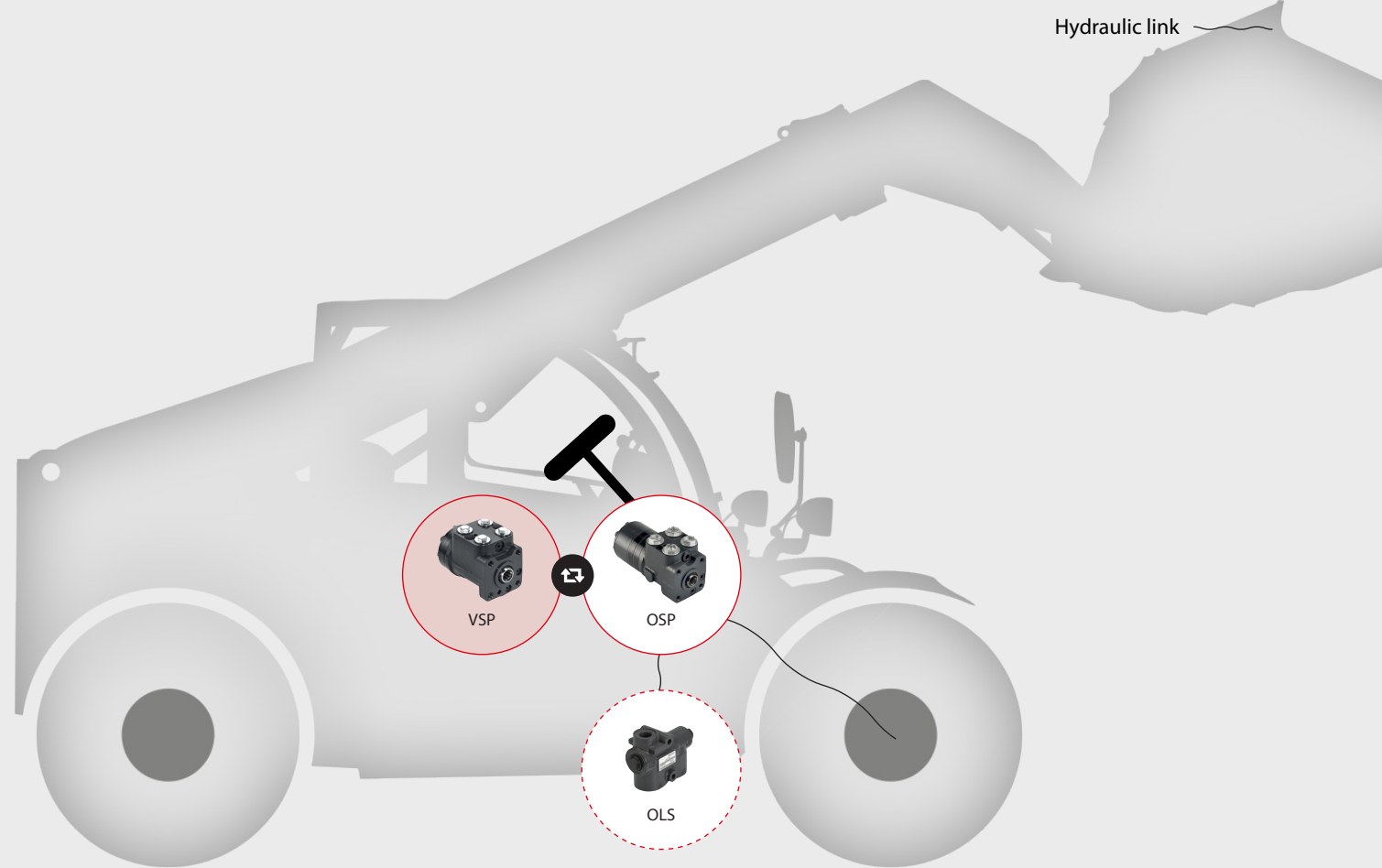
- High performance and wide flow range 40 to 320 lpm
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP + OLS are designed to match

Alternative configuration 

Available for selected configurations 

Mechanical link 

Hydraulic link 

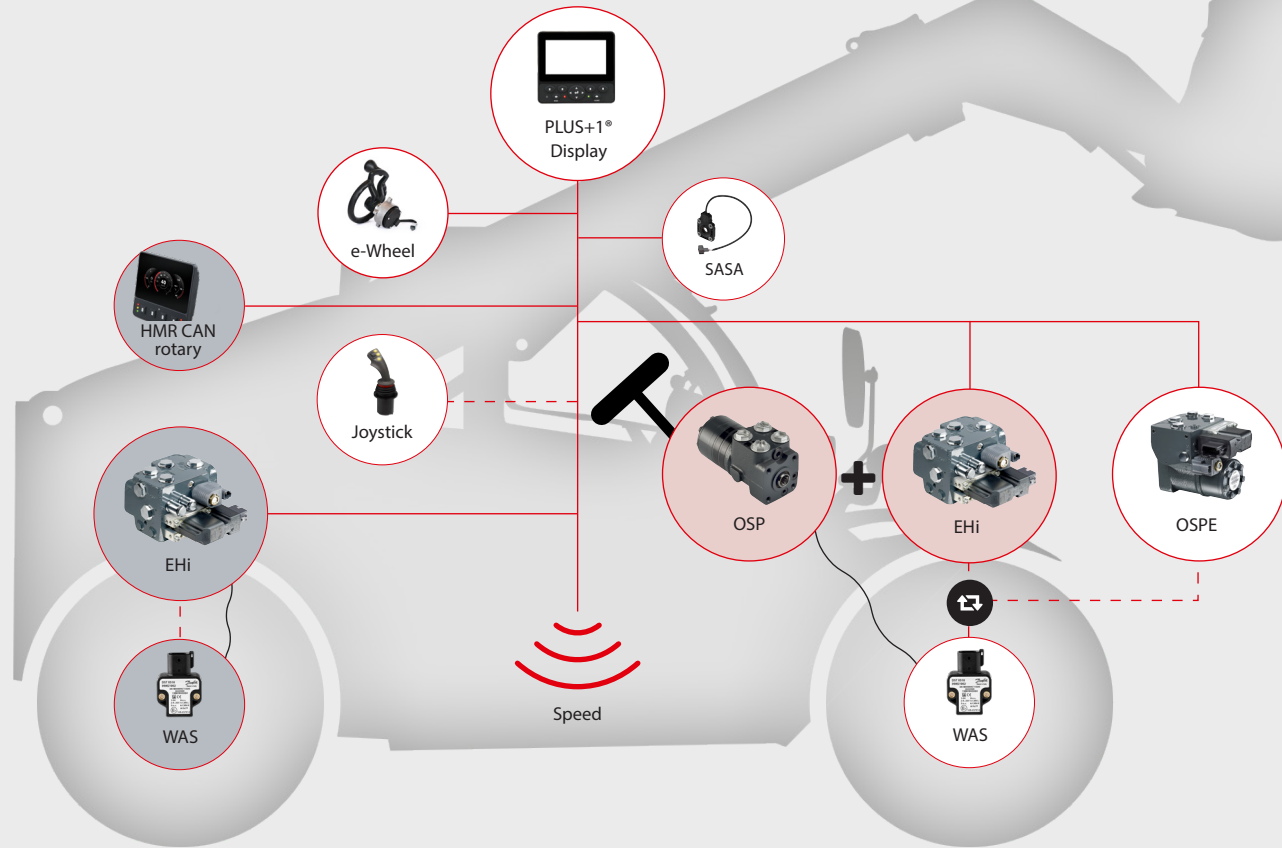
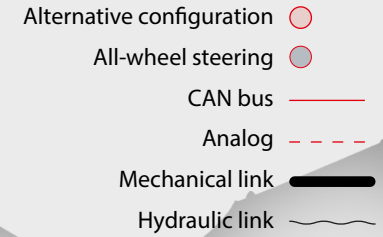




# Telehandler

## Electrohydraulic steering

- Quick steering with OSPE and EHi allows for easier maneuverability and increased productivity
- Joystick and electric steering wheel for improved cabin flexibility, visibility and ergonomics for operator
- All-wheel steering on rear axle, for increased productivity
- SIL2 certified PVED-CLS steering and safety controller





# Sprayer

Hydraulic steering



Electrohydraulic steering









# Sprayer

## Hydraulic steering

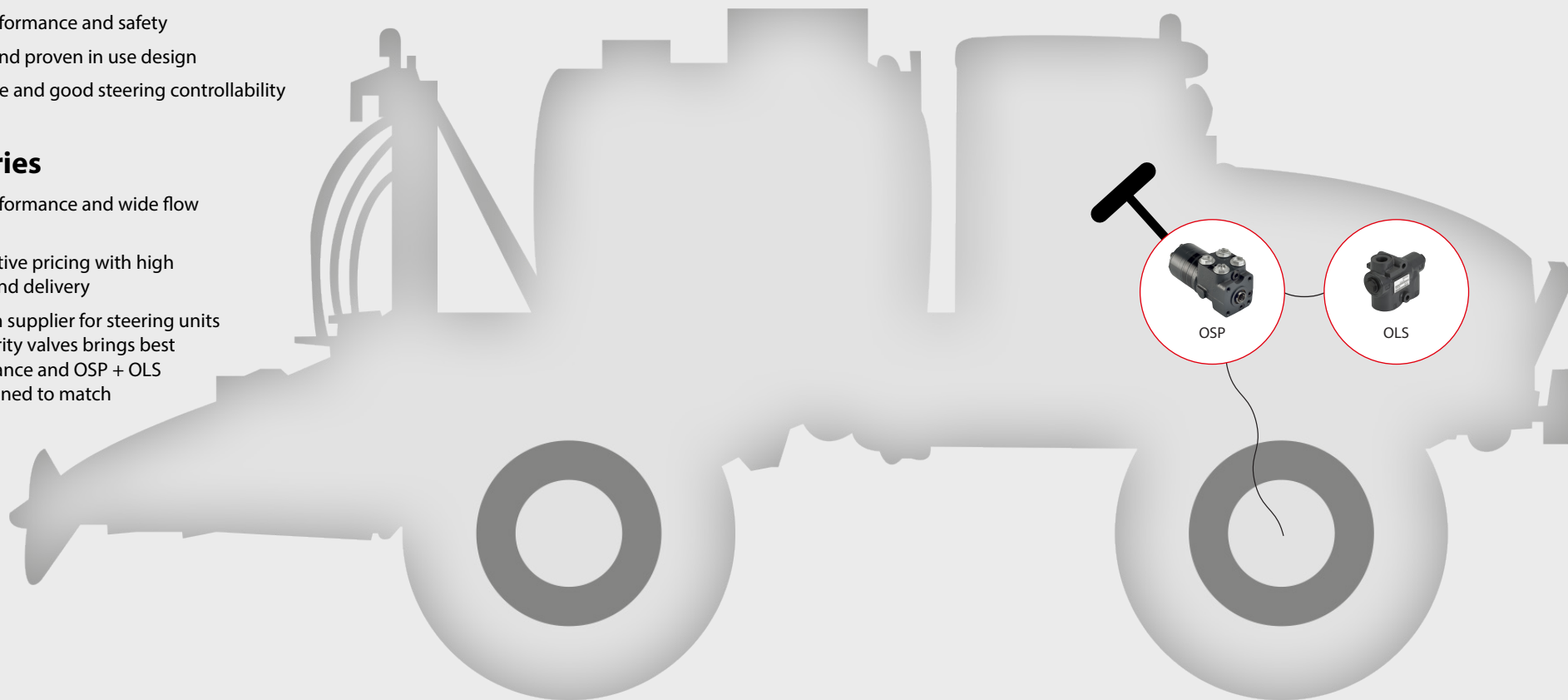
Mechanical link   
Hydraulic link 

### OSP series

- High performance and safety
- Robust and proven in use design
- Low noise and good steering controllability

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP + OLS are designed to match

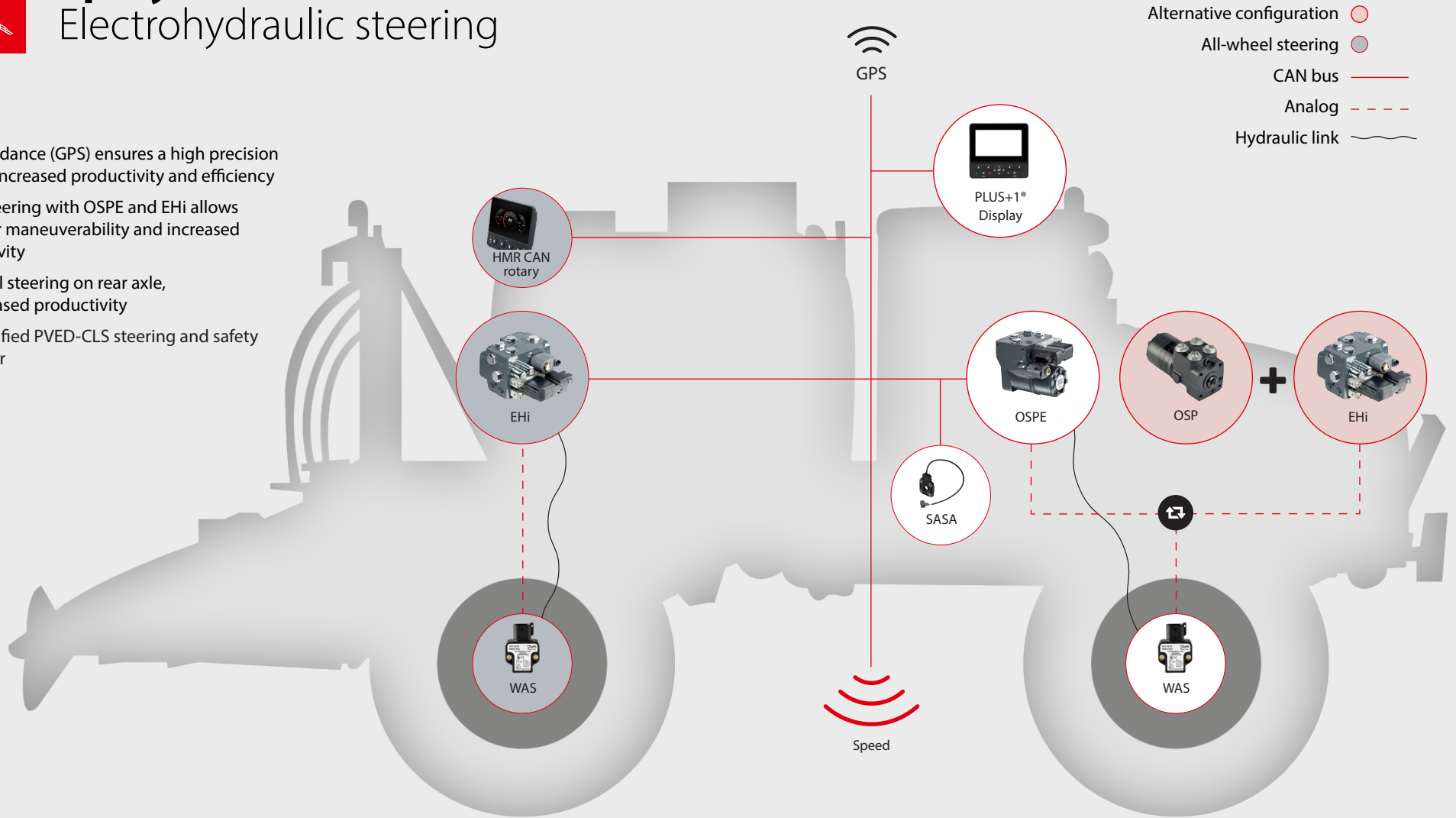




# Sprayer

## Electrohydraulic steering

- Auto-guidance (GPS) ensures a high precision job and increased productivity and efficiency
- Quick steering with OSPE and EHi allows for easier maneuverability and increased productivity
- All-wheel steering on rear axle, for increased productivity
- SIL2 certified PVED-CLS steering and safety controller





# Backhoe loader

Hydraulic steering



Electrohydraulic steering





# Backhoe loader

## Hydraulic steering

- Alternative configuration
- Available for selected configurations
- Mechanical link
- Hydraulic link

### OSP series

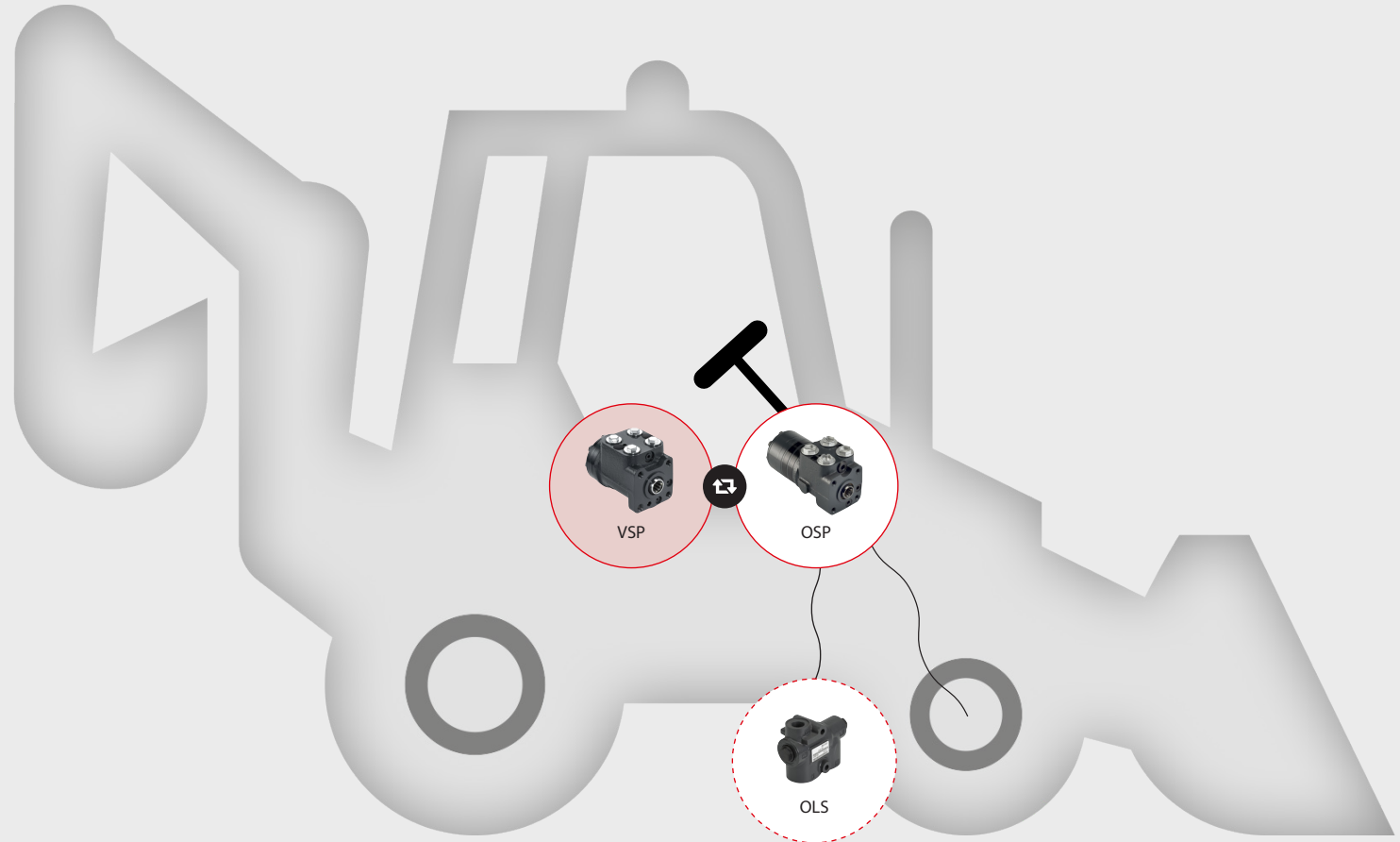
- High performance and embedded safety
- Improved work mode, less turns lock to lock
- Manual steering without emergency pump

### VSP series

- Good performance and manual steering capabilities
- Fulfil vehicle requirements with same high support and service
- Competitive pricing with high quality and delivery

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP/VSP + OLS are designed to match

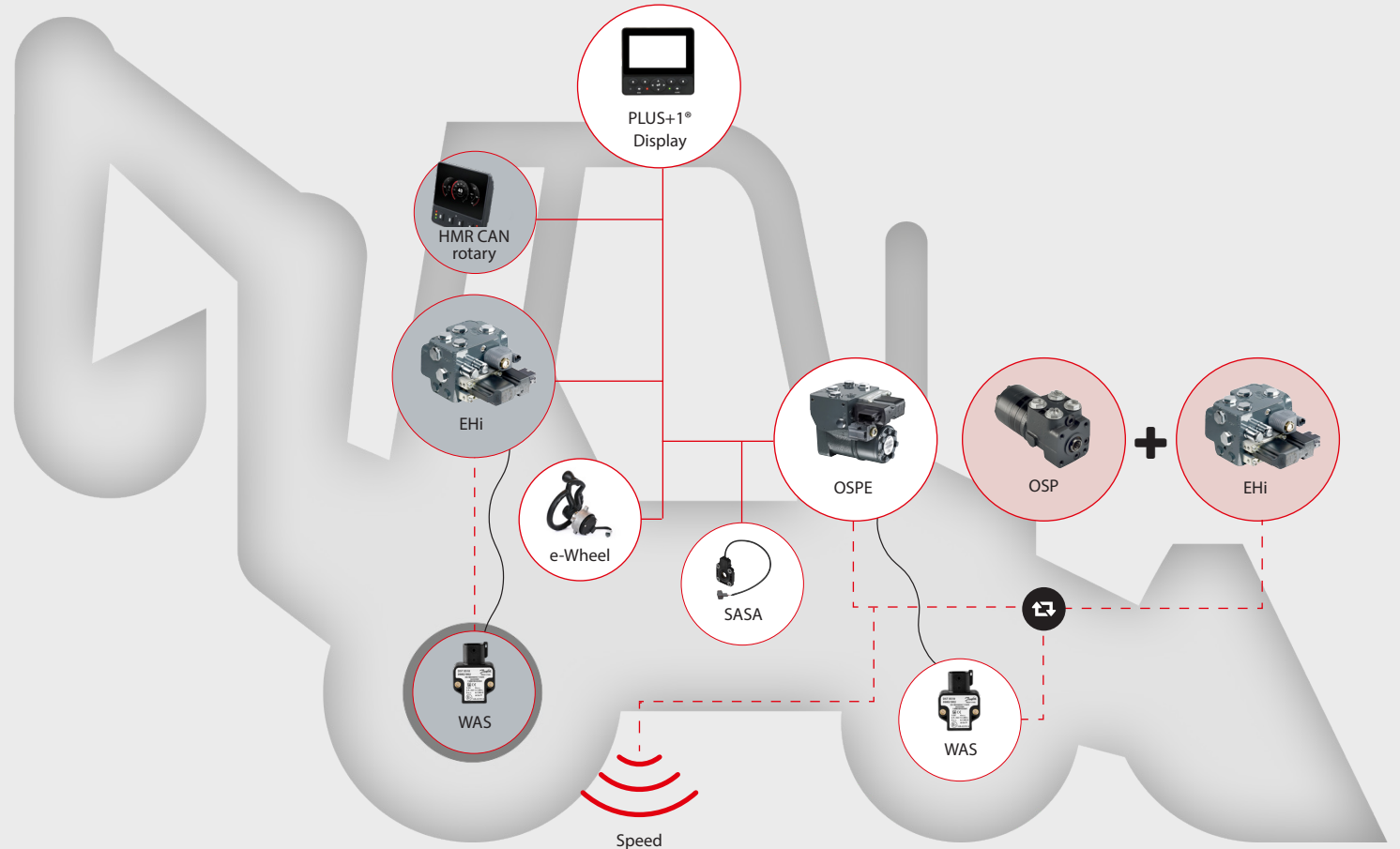
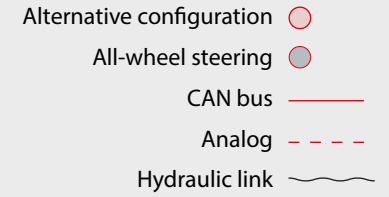




# Backhoe loader

## Electrohydraulic steering

- Electric steering wheel (e-Wheel) for precise steering
- e-Wheel allows seat rotation for increased design flexibility and productivity





# Roller

Hydraulic steering



Electrohydraulic steering



Articulated electrohydraulic steering





# Roller

## Hydraulic steering

### OSP series





- High performance and safety
- Emergency steering compliance to current safety standards
- Low noise and good steering controllability

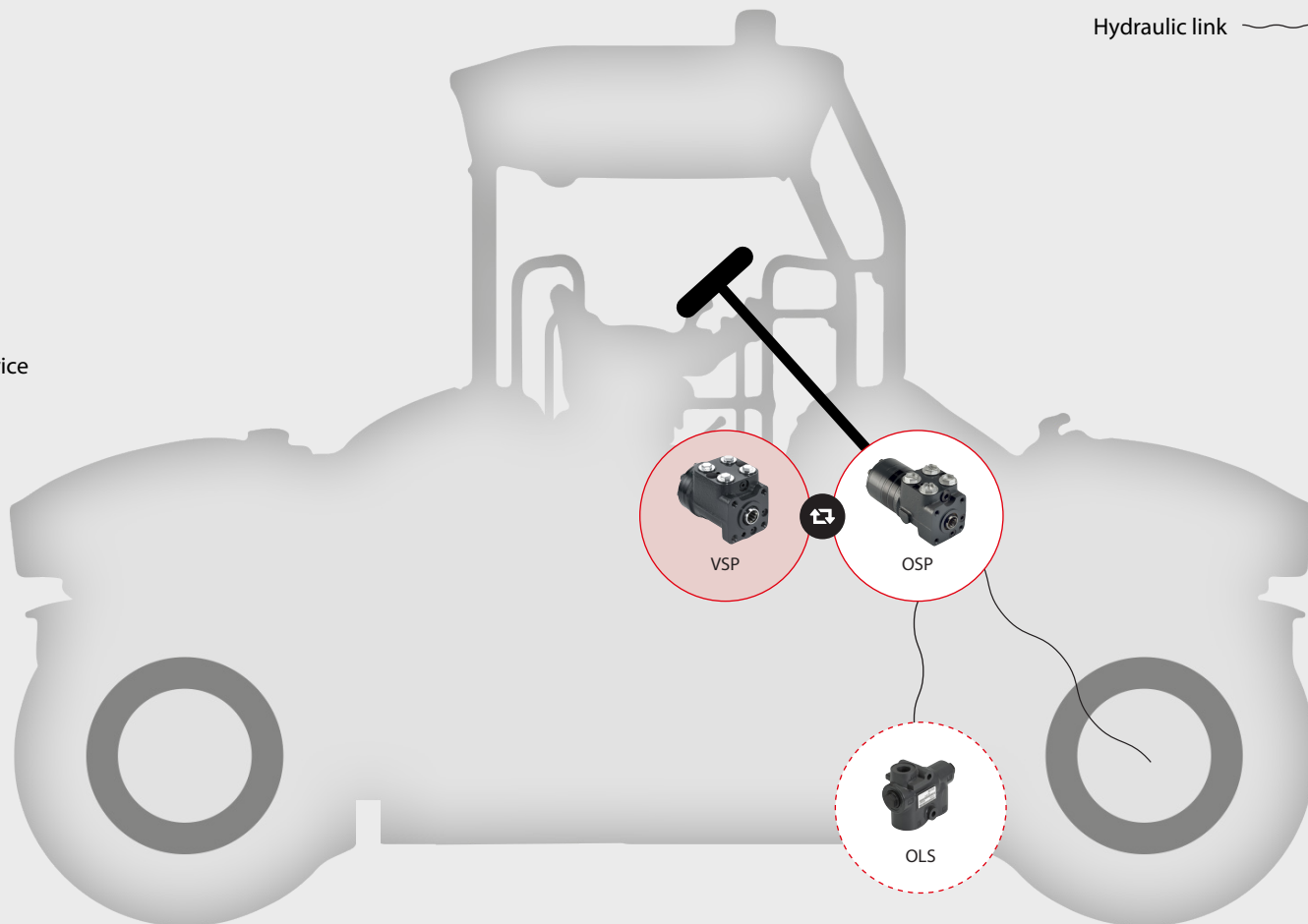
### VSP series

- Good performance and manual steering capabilities
- Fullfill vehicle requirments with same high support and service
- Competitive pricing with high quality and delivery

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP/VSP + OLS are designed to match

- Alternative configuration 
- Available for selected configurations 
- Mechanical link 
- Hydraulic link 

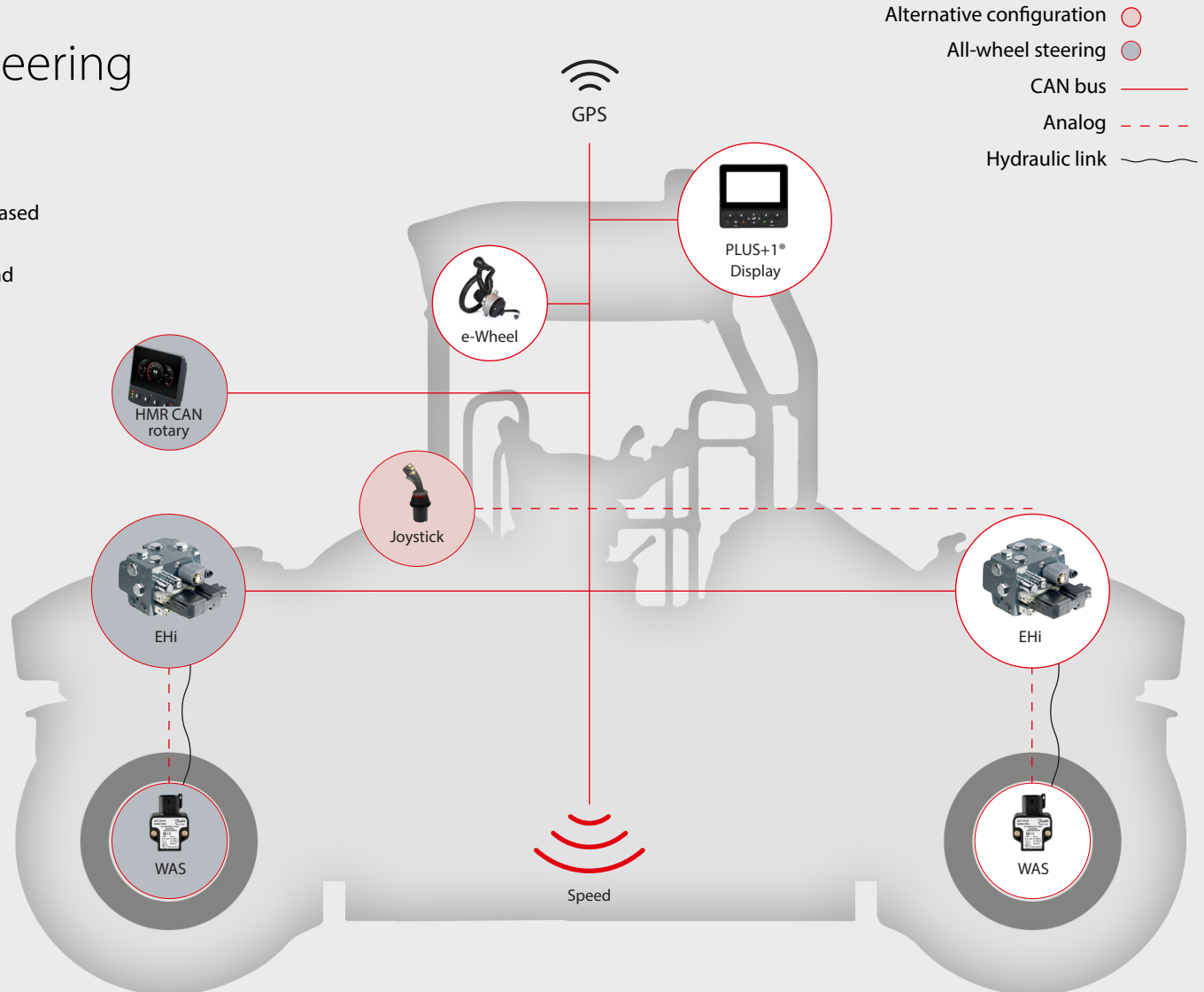




# Roller

## Electrohydraulic steering

- Auto-guidance (GPS) ensures a high precision job and increased productivity and efficiency
- Quick steering with EHi allows for easier maneuverability and increased productivity
- Electric steering wheel (e-Wheel) for Improved visibility and ergonomics for operator
- All-wheel steering on rear axle, for increased productivity
- Increased cabin design flexibility
- SIL2 certified PVED-CLS steering and safety controller



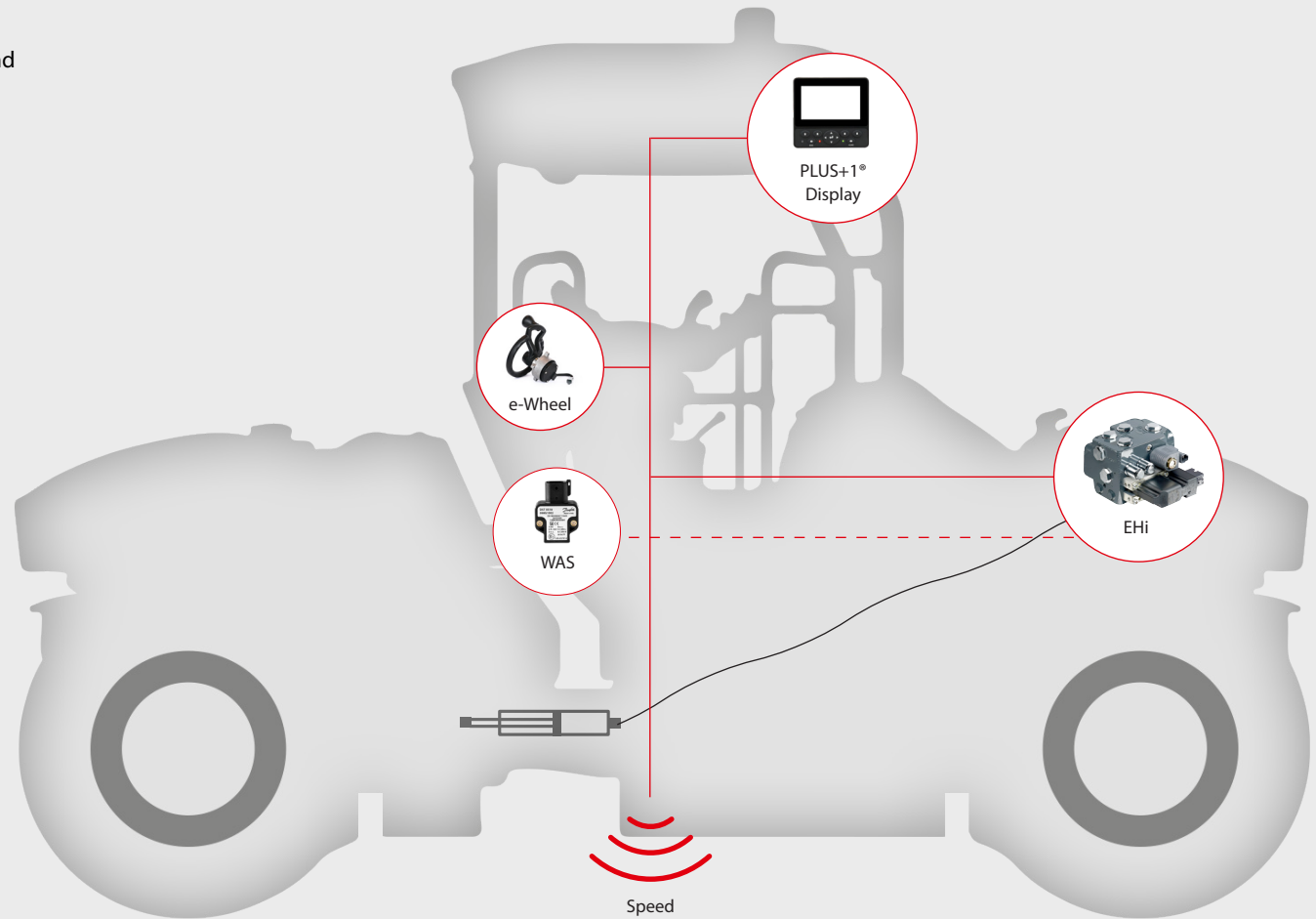
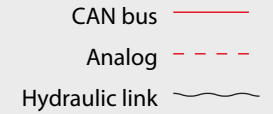




# Roller - Articulated

## Electrohydraulic steering

- Quick steering with EHi allows for easier maneuverability and increased productivity
- Electric steering wheel for improved visibility and ergonomics for operator
- Increased cabin design flexibility
- SIL2 certified PVED-CLS steering and safety controller





# Wheel loader

Hydraulic steering



Articulated electrohydraulic steering





All-wheel electrohydraulic steering





# Wheel loader

## Hydraulic steering

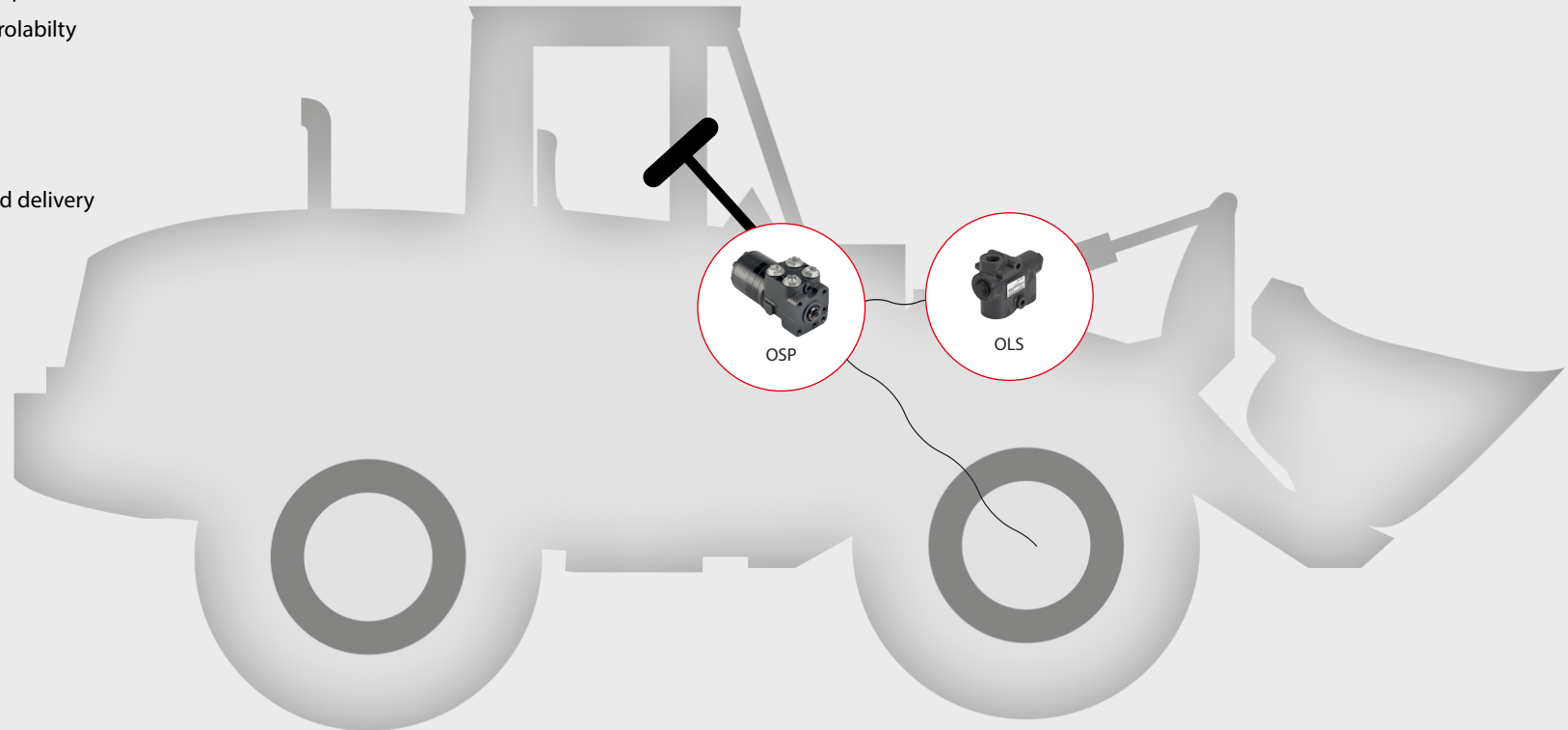
Mechanical link   
Hydraulic link 

### OSP series

- High performance and embedded safety
- Improved work mode, less turns lock to lock
- Manual steering without emergency pump
- Jerk dampening and good steering controlability

### OLS series

- High performance and wide flow range
- Competitive pricing with high quality and delivery
- Common supplier for steering units and priority valves brings best performance and OSP + OLS are designed to match

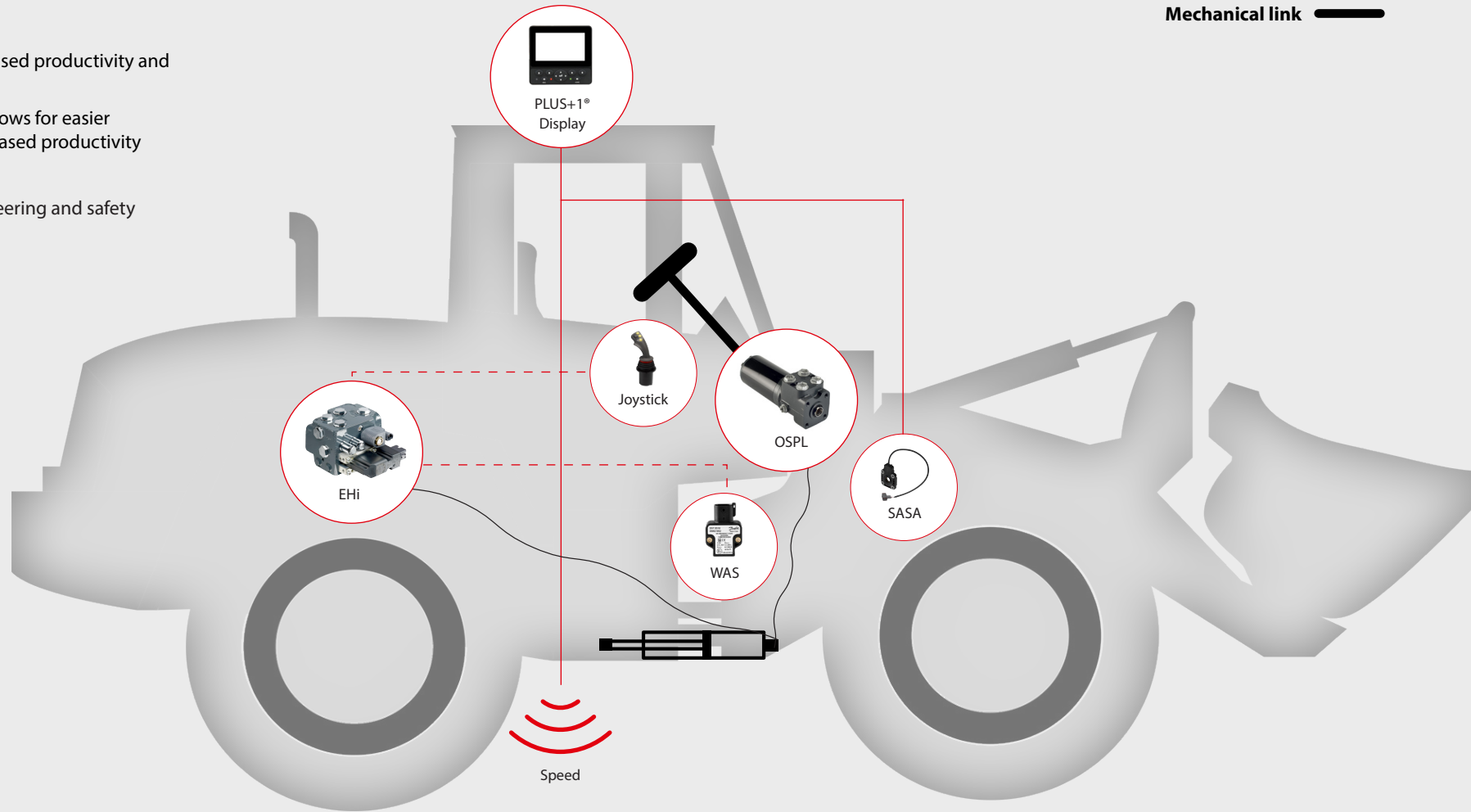
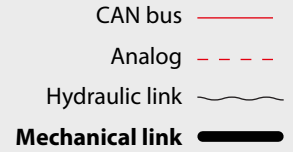




# Wheel loader

## Articulated electrohydraulic steering

- Joystick steering for increased productivity and reduced operator fatigue
- Quick steering with EHi allows for easier maneuverability and increased productivity
- Jerk dampening
- SIL2 certified PVED-CLS steering and safety controller

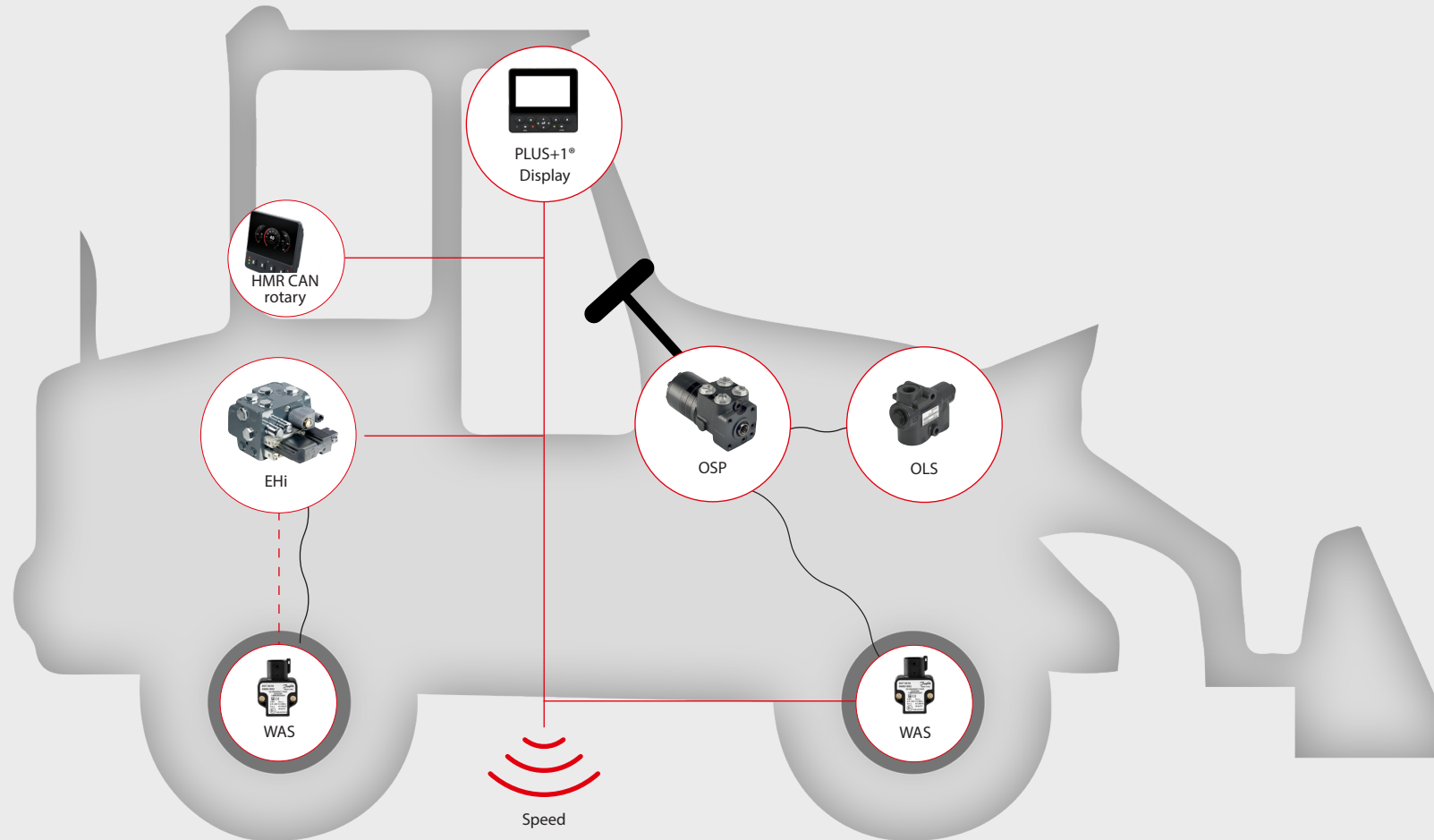
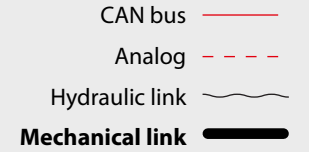




# Wheel loader

## All-wheel electrohydraulic steering

- All-wheel steering on rear axle for increased productivity
- SIL2 certified PVED-CLS steering and safety controller





# Dump truck

Hydraulic steering





Electrohydraulic steering





# Dump truck

## Hydraulic steering

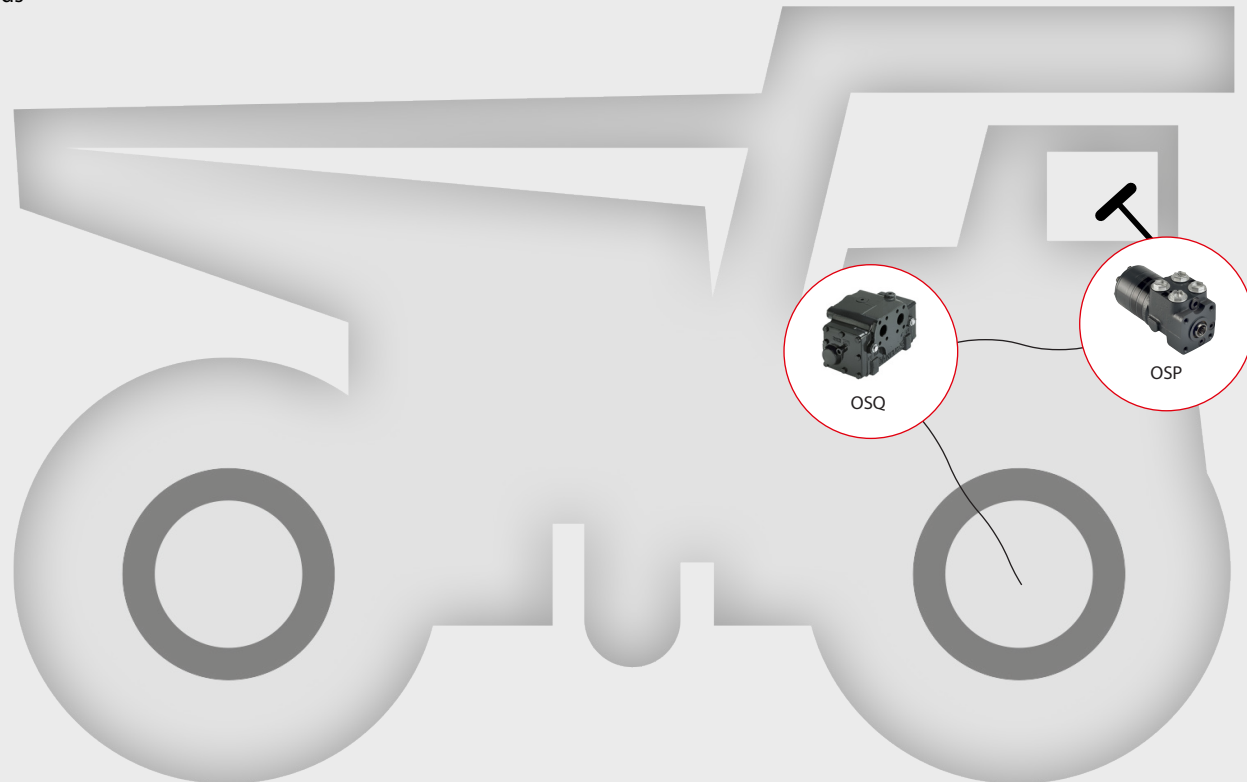
Mechanical link   
Hydraulic link 

### OSP series

- High performance and safety
- Emergency steering compliance to current safety standards
- Low noise and good steering controllability

### OSQ series

- Increasing steering application due to higher flow amplification, flow amplification factors 4, 5, 8 or more
- Optimized system efficiency and operator comfort
- OSQ with flanged priority valve with reduced installation cost due to less pipe work

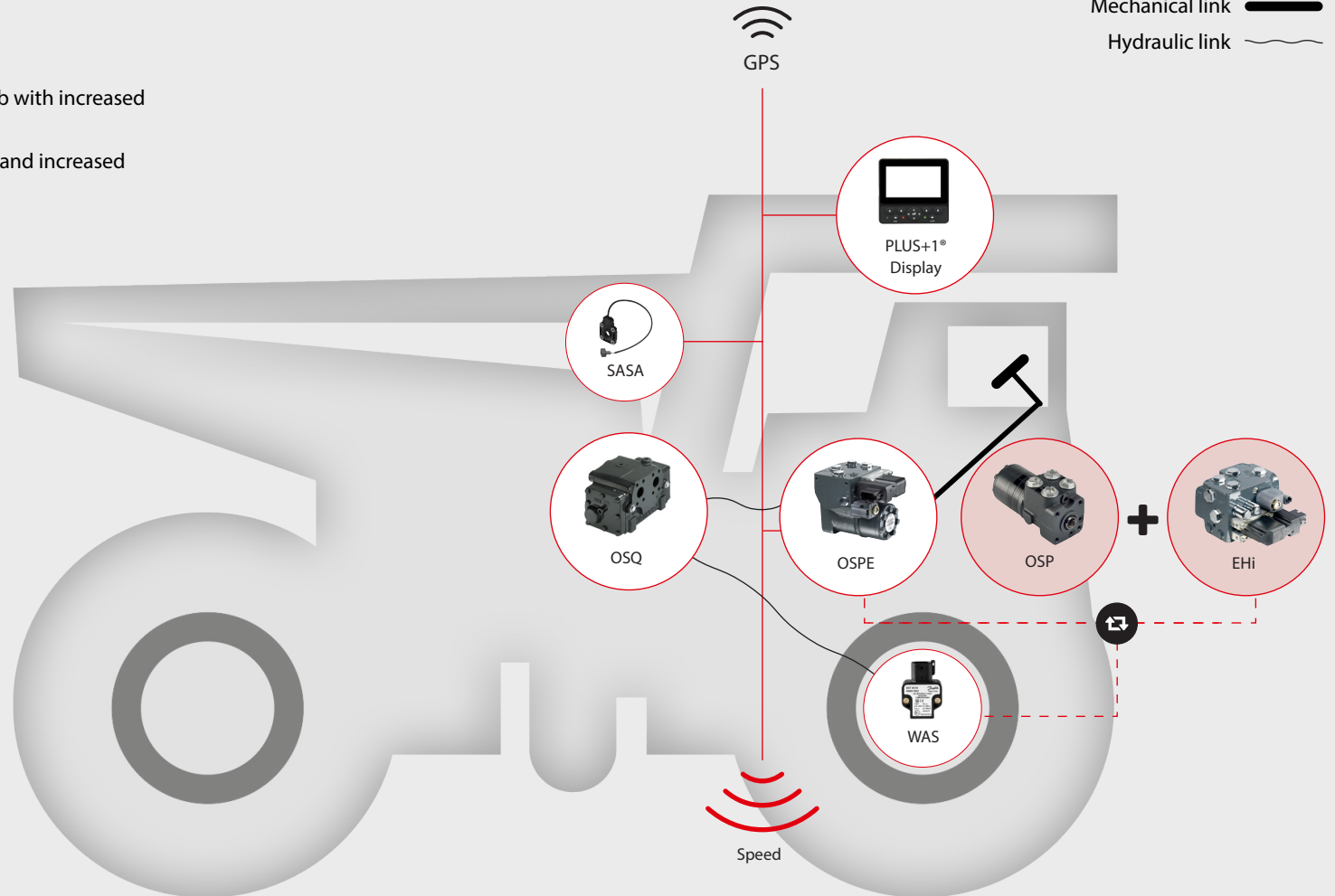
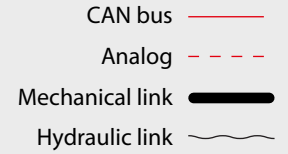




# Dump truck

## Electrohydraulic steering

- Auto-guidance (GPS) ensures a high precision job with increased productivity and efficiency
- Quick steering allows for easier maneuverability and increased productivity
- Joystick steering for increased productivity and reduced operator fatigue
- SIL2 certified PVED-CLS steering and safety controller







# Autonomous vehicle

Electrohydraulic steering

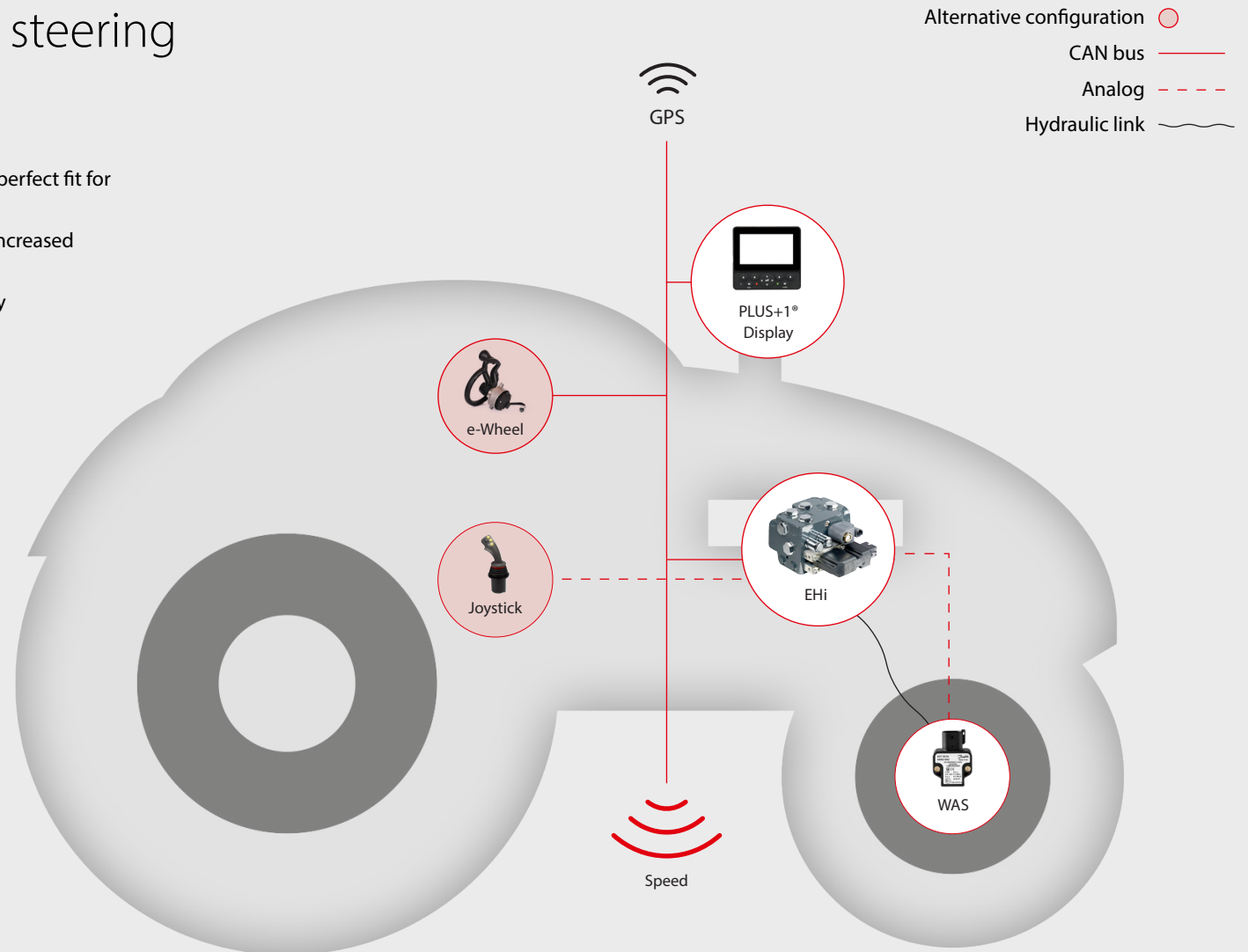




# Autonomous vehicle

## Electrohydraulic steering

- EHi with integrated steering and safety controller: the perfect fit for autonomous steering
- Auto-guidance (GPS) ensures high precision job with increased productivity and efficiency
- Electric steering wheel (e-Wheel) for improved visibility and ergonomics for operator if needed
- SIL2 certified PVED-CLS steering and safety controller





# Hydraulic steering components

## Steering units



**VSP**  
Compact for low HP



**OSPU**  
Flow amplifier and load sensing



**VSPPP**  
Compact with integrated priority valve



**OSPD**  
Double rotary meters



**OSPC / F**  
Compact for high performance



**OSPL**  
Flexible for high performance

## Flow amplifiers



**OSQ**  
Available with built-in valves

## Priority valves



**OLS**  
Flange mounting or in-line installation

## COMPONENTS



# Hydraulic Steering components

## APPLICATIONS

### OSP series

Up to 240 bar

#### Flexible and reliable

OSP hydraulic steering is the flexible product choice with its high performance and proven in use safety for more than 50 years.

### VSP series

Up to 190 bar

#### Cost effective

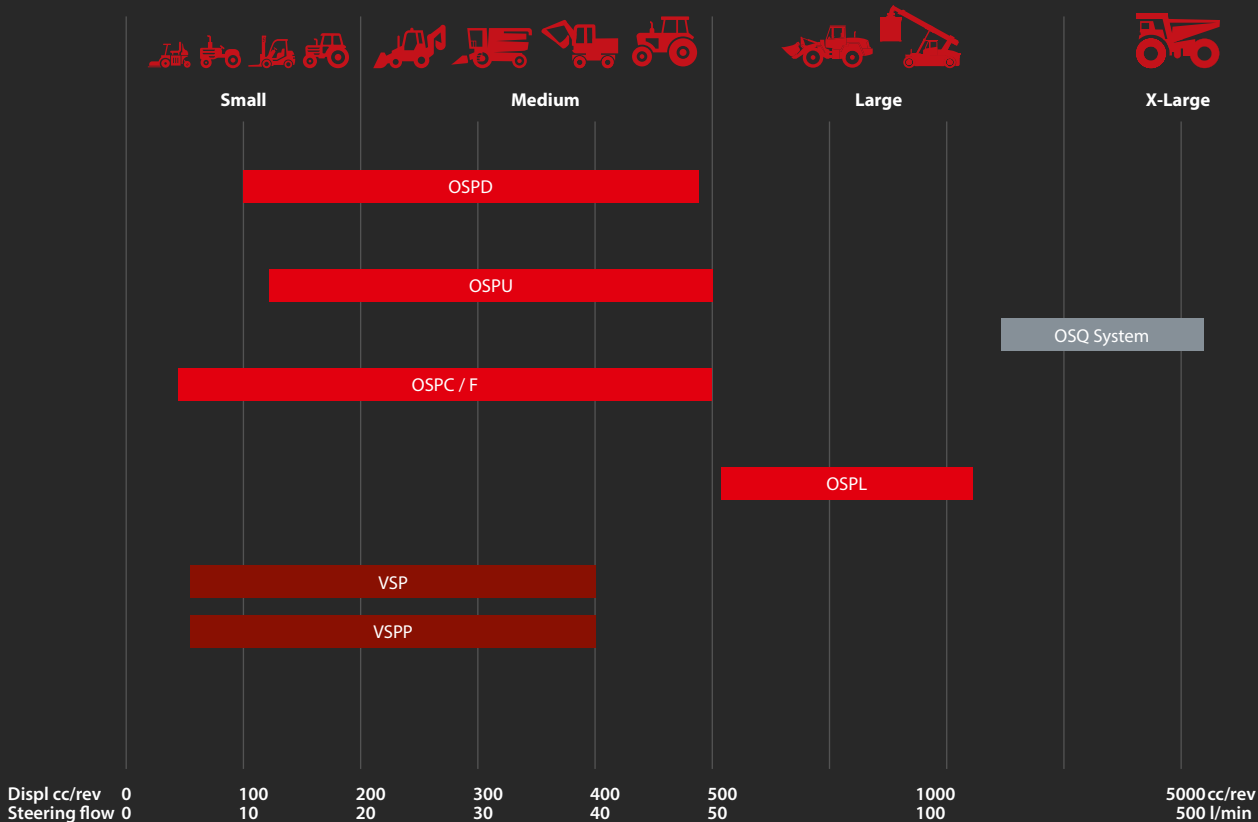
VSP hydraulic steering is the cost effective product choice. Ensures a repeatable high performance and precision.

### OSQ series

Up to 280 bar

#### Maximum steering performance

OSQ flow amplifier. Ensures a repeatable high performance and precision flow amplification.



Priority valves

- Fairway mower
- Sweeper
- Forklift truck
- Tractors
- Combine harvester
- Wheeled excavator
- Telehandler
- Sprayer
- Backhoe loader
- Roller
- Wheel loader
- Dump truck
- Autonomous vehicle



# Steering unit solutions

Open center reaction (OR) and none reaction (ON)

## APPLICATIONS



Fairway mower



Sweeper



Tractors



Combine harvester



Wheeled excavator



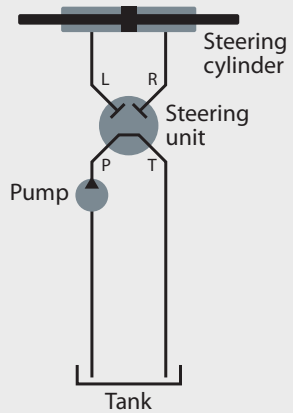
Backhoe loader



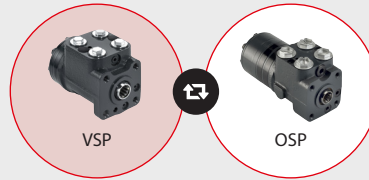
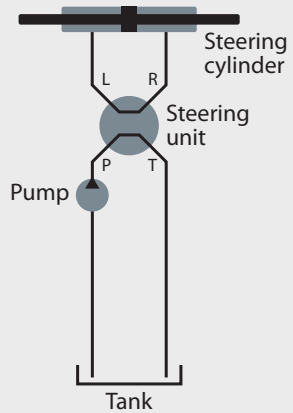
Roller



**Open center  
none reaction**



**Open center  
reaction**



Alternative configuration

Top specs configuration

[> WATCH ANIMATION](#)



# Steering unit and priority valve solutions

Load sensing dynamic (LS/LSR)

## OSP and VSP (LS/LSR) steering unit and OLS priority valve solution / VSP (LS/LSR) steering unit with integrated priority valve solution

- LS dynamic = load sensing non reaction.
- Can use common pump for steering and working.
- With "dynamic" priority valve: permanent flow in LS-line > same temperature of steering unit as entire hydraulic system, eliminates risk of thermal shock and provides better response

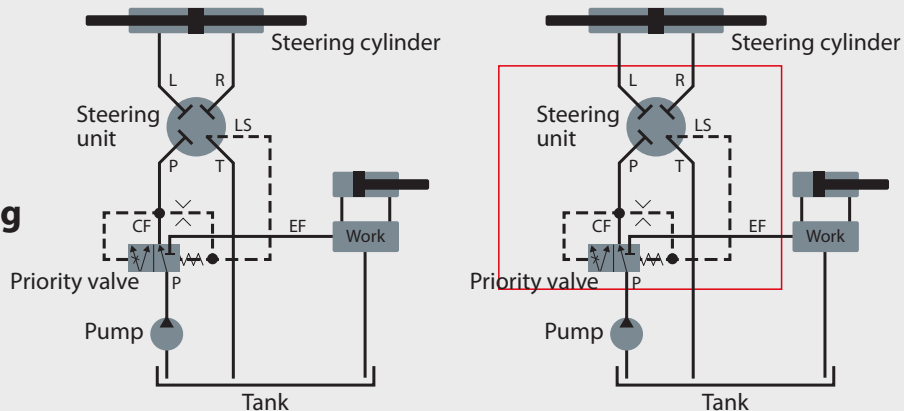


## APPLICATIONS

- Fairway mower
- Forklift truck
- Tractors
- Combine harvester
- Telehandler
- Sprayer
- Backhoe loader
- Roller
- Wheel loader
- Dump truck

# LS

## Load sensing dynamic



[▶ WATCH ANIMATION](#)



## VSP

Compact steering unit for low HP



### Redefines **steering flexibility**

- VSP for small low HP tractors, forklift trucks, backhoe loaders, telehandlers, combines or for other applications which require a basic steering unit with standard options, good performance, and manual steering capabilities. The VSP is the only steering product that combines low cost with high quality and reliable delivery.
- VSP meets vehicle requirements with the same high support and service level as any other Danfoss product. This means you can reduce vehicles costs, without jeopardizing quality, delivery and support.



**Good performance and manual steering capabilities**



**Competitive pricing with high quality and delivery**



**Compact design and easy connectivity - best-in-class integration**

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## VSPP

Compact steering unit with integrated priority valve



**43%**  
space saving  
compared to  
standard OLSA

### Redefines **steering flexibility with integrated priority valve**

- VSPP for small low HP tractors, forklift trucks, backhoe loaders, telehandlers, combines or for other applications which require a basic steering unit with standard options, good performance and manual steering capabilities. The VSPP is the only steering product that combines low cost with high quality and reliable delivery.
- VSPP meets vehicle requirements with the same high support and service level as any other Danfoss product. This means you can reduce vehicles costs, without jeopardizing quality, delivery and support.
- VSPP with integrated priority valve also available.

- ✓ **Good performance and manual steering capabilities**
- ✓ **Less connectors and hoses (with integrated priority valve)**
- ✓ **Compact design and easy connectivity - best-in-class integration even in tight areas, including an integrated priority valve**
- ✓ **Easy installation with reduced installation costs**

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# OSPC / F

Compact steering unit for high performance



## Steering **flexibility and high performance**

- OSPC for high performing vehicles such as large high-speed tractors, forklift trucks or any vehicle requiring high performance and special features. OSPC is the only steering product that offers highly specialized options to the highest performance, quality and reliable delivery level in the market, with the high support and service level surrounding Danfoss Power Solutions products. This means you can introduce real Differentiated steering features with unique performance and steering feel, which creates noticeable value for the vehicle operator.



**High performance and safety**



**Faster time to market because of reduced development time and design flexibility**



**Compact design and easy connectivity  
- best-in-class integration even in tight areas**

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# OSPU

Steering unit with flow amplifier and load sensing



## Top-quality components **minimizing life cycle costs**

- OSPU is a flow amplifying, load sensing steering unit displacement up to 500 cc/rev and amplification factors of 2x, 3x, 4x makes it possible to manual steer even large vehicles with e.g. an OSPU 80/320 and eliminates emergency steer pump which gives a very cost attractive solution.
- High efficiency emergency steering on the market, with very easy vehicle type approval and the given cost benefit
- Small and compact steering unit which gives vehicle design flexibility and saves installation cost in compact areas
- Provides linear flow curves which gives optimal road performance and a predictable steering performance
- Provides as optional progressive flow curves which gives fast steer (steering wheel rpm), improved machine productivity, comfort feature for operator, cost attractiveness and no need for electronic



**High performance and embedded safety**



**Best-in-class integration and connectivity**



**Improved work mode, less turns lock to lock**



**Manual steering without emergency pump also possible on larger vehicles**

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# OSPD

Steering unit with two rotary meters



## Steering **flexibility and safety**

- The OSPD has two rotary meters (gear wheel sets). In the case of no pump supply only one rotary meter is active for emergency steering. In normal steering situations both rotary meters are active.
- With OSPD even heavy vehicles can in many cases fulfil legislations and be steered without the emergency steering pump.
- Ratio between normal steering displacement and emergency steering displacement from factor 2 up to 7.
- Low noise: Silent gear set due to state of the art grinding technology
- Good steering controllability due to wide control range
- Low steering torque
- High back pressure possible, up to 40 bar



**High performance and safety**



**Faster time to market because of reduced development time and design flexibility**



**Emergency steering compliance to current safety standards**

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# OSPL

Steering unit for maximum performance



## Redefines **steering flexibility**

- OSPL for high performing vehicles such as large high-speed tractors, forklift trucks or any vehicle requiring high performance and special features. OSPL has the highest performance, quality and reliable delivery level in the market, with the high support and service level surrounding Danfoss products. This means you can introduce real differentiated steering features with unique performance and steering feel, which creates noticeable value for the vehicle operator.



**High performance and safety**



**Faster time to market because of reduced development time and design flexibility**



**Compact design and easy connectivity - best-in-class integration even in tight areas**

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# OLS

Flange mounting or in-line installation priority valves



## Wide range of priority valves

- Priority valves are used for systems where the steering system and working hydraulics are supplied with oil from just one pump, and where the steering system has the highest priority.
- The priority valves are available in an OLSA version for flange mounting on the steering unit and an OLS version for in-line installation between pump and steering unit.
- A wide flow range from 40 to 320 lpm with max pressure up to 350 bar. Danfoss priority valves has low pressure drop and a low noise level.
- Common supplier for steering units and priority valves brings best performance and OSP + OLS are designed to match.



**High performance and wide flow range**



**Competitive pricing with high quality and delivery**



**Best-in-class integration even in tight areas due to compact design and easy connectivity**

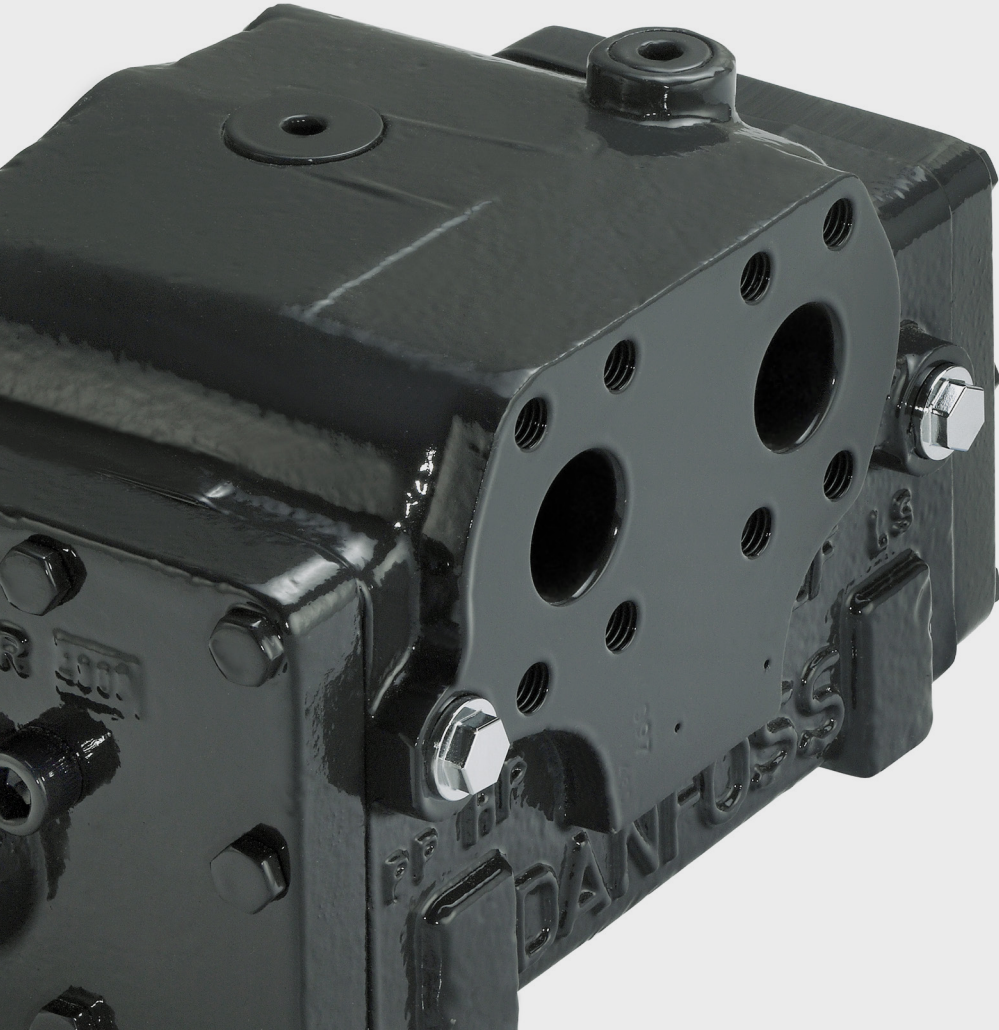
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# OSQ

## Flow amplifier



### Increasing steering applications due to **higher flow amplification**

- Danfoss hydrostatic steering components are used extensively in the vehicles and marine vessels where the operator must control high steering forces with relative comfort and safety, OSQ is the best choice when high flow amplification system is required together with a steering unit .
- Flow amplifier OSQ is for use with a steering unit to amplify the oil flow. This produces a system able to steer vehicles weighing up to several hundred tons. The steering unit sends a pilot flow to the flow amplifier. The pilot flow is amplified depending on the amplification spool selected. This avoids a large steering flow through the steering unit and thus optimizes system efficiency and operator comfort.
- The OSQ flow amplifier can be supplied with built-in valves: priority, pilot pressure relief, shock, suction and/or back-pressure valve in the tank line. The flow amplifier is available with different amplification factors: 4, 5, 8 or more.



**High performance and embedded safety**



**Optimized system efficiency and operator comfort**



**OSQ with flanged priority valve with reduced installation cost due to less pipe work**

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# Electrohydraulic steering components

## Steering input devices and sensors



Electric steering wheel



Joystick



PLUS+1<sup>®</sup>  
Display



HMR CAN  
rotary



SASA sensor



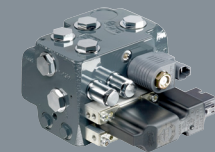
Wheel angle sensor

## Steering and safety controllers



PVED-CLS

## Steering valves



EHi



OSPE



# Electrohydraulic Steering valves

## EHi

### Redefines steering flexibility

- The optimum choice when there is limited space in the application
- With steer-by-wire technology EHi can be used by itself with joystick or mini wheel input
- Ideal for applications that must be able to steer on the rear axle (4 wheel steering)
- Eases aftermarket installation



Small



Medium



Large



X-Large

OSPE

EHi

OSPE + OSQ

EHi + OSQ

Displ cc/rev 0  
Steering flow 0

100  
10

200  
20

300  
30

400  
40

500  
50

750  
80

1000  
100

5000 cc/rev  
500 l/min

## OSPE

### A classic with maximum compatibility

- Robust one piece casting
- Supports a category 3 architecture
- Integrated priority valve
- Selectable reaction/non-reaction
- Integrated PVFC valve (LS resolver)
- Numerous configurations available



Fairway mower



Sweeper



Forklift truck



Tractors



Combine harvester



Wheeled excavator



Telehandler



Sprayer



Backhoe loader



Roller



Wheel loader



Dump truck



Autonomous vehicle





# OSPE

Electrohydraulic steering valve with orbitrol



## A classic with maximum compatibility

- Ideal for applications with steering wheel, where OSPE can be used together with joystick or electric steering wheel input device.
- Ideal for applications with auto-guidance and quick steering
- Integrated priority valve
- Selectable reaction/non-reaction
- Integrated PVFC valve (LS resolver)



**Robust one piece casting**



**High performance with TÜV certified PVED-CLS steering and safety controller – PVED-CLS compliant with current legislation and safety standards**



**Faster time to market because of reduced development time and improved design flexibility**



**Scalable design with several steering controllers to serve needs and cost point (PVES, PVED-CC, PVED-CLS)**

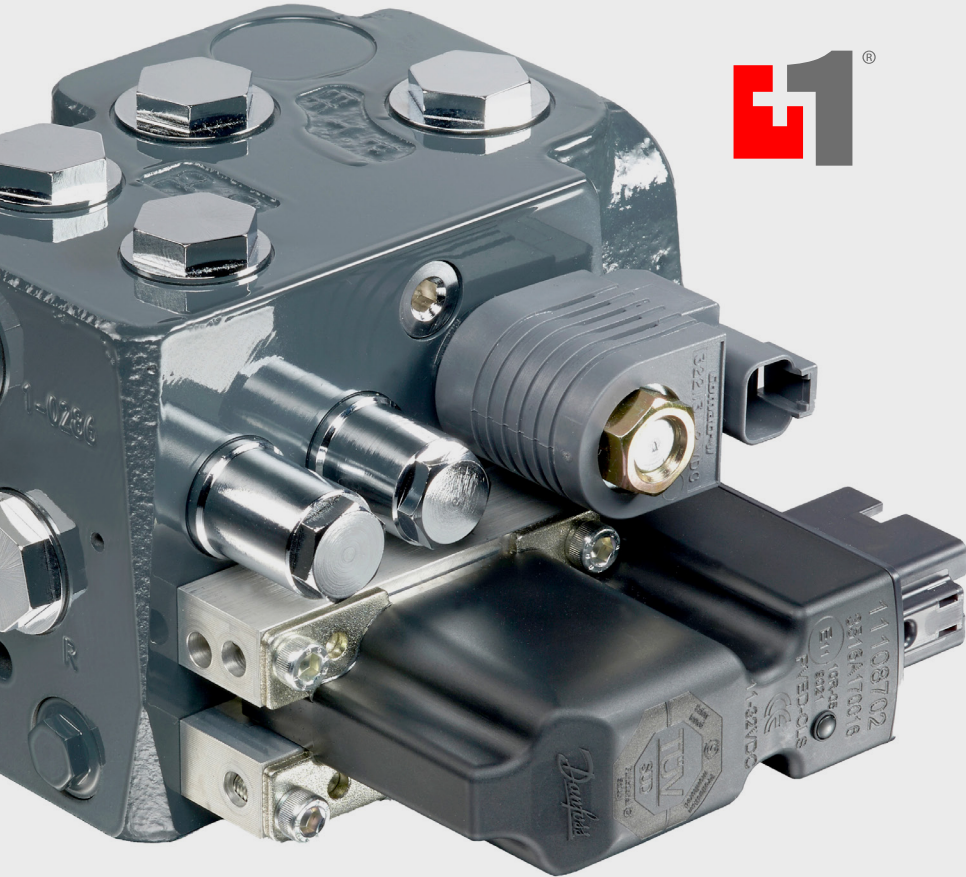
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# EHi

## Electrohydraulic steer-by-wire valve



### Redefines steering flexibility

- Ideal for steer-by-wire applications where EHi can be used with joystick or electric steering wheel input device
- Ideal for applications with auto-guidance, quick steering, autonomous steering and all wheel steering
- Eases aftermarket installation
- The optimum choice when there is limited space in the application

- ✓ **High performance with TÜV certified PVED-CLS steering and safety controller – PVED-CLS compliant with current legislation and safety standards**
- ✓ **Faster time to market because of reduced development time and improved design flexibility**
- ✓ **Scalable design with several steering controllers to serve needs and cost point (PVES, PVED-CC, PVED-CLS)**
- ✓ **All-wheel steering for increased productivity and comfort**

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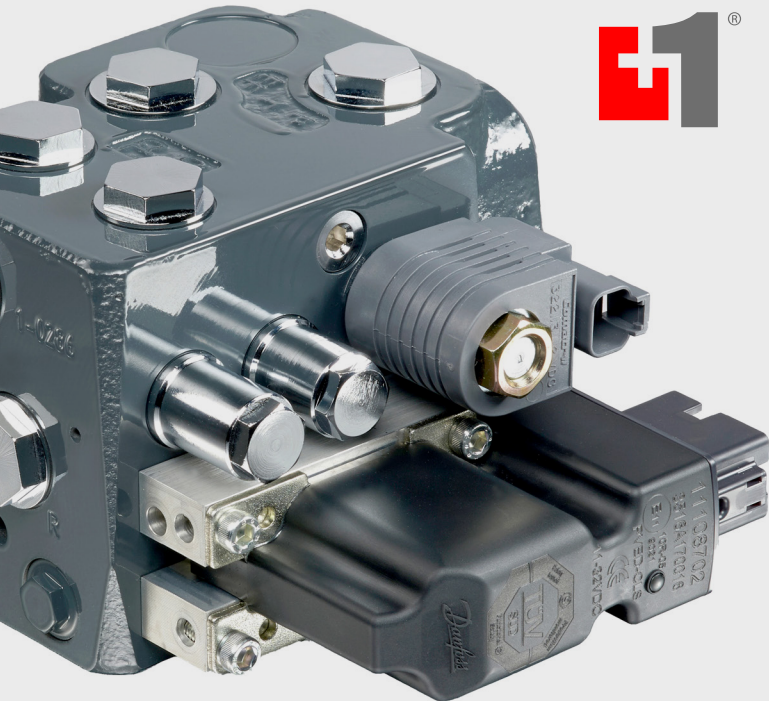


# EHi

## Electrohydraulic steer-by-wire valve



### Electrohydraulic configurations available



Configuration	OEM installation						SbW / 4WS	4WS	Universal	
	EHi-1	EHi-3	EHi-3	EHi-4	EHi-5	EHi-6	EHi-7	EHi-8	EHi-1	EHi-10
<b>Hydraulic Circuit</b>	Load Sensing	Open Center	Closed Center	Load Sensing	Load Sensing Reation	Load Sensing Reation	SbW Fail Safe / 4 Wheel Steering	Rear axle / 4 Wheel Steering	Load Sensing /static & Dynamic) With / Without Reation	Open Center With / Without Reation
EH with PVES, CC, CLS	•	•	•	•	•	•	•	•	•	•
Cut-off valve	•	•	•	•	•	•	•	•	•	•
Relief valve	•	•	•	•	•	•	•	•	•	•
Priority valve		•	•	•	•		•	•		•
Shock-suction valve					•	•	•	•	•	•
PVFC LS resolver valve	•			•	•	•			•	•
Reation Switch Valve for reation (RSV)					•	•			•	•
OSP override on RSV					•	•			•	•
LS shuttle (SbW or 2WS)								•		
EF and T internally connected				•						
Disengage without SASA (Hydraulic desengage)									•	•
Electric disengage (e.g. by SASA)	•	•	•	•	•	•	•	•		

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# PVE actuator overview

Electrohydraulic actuators



	OSPE	EHi	OSPE	EHi	OSPE	EHi
<b>Steering valve</b>						
<b>PVE actuator type</b>	PVES		PVED-CC		PVED-CLS	
Performance	•		•		•	
Flow capacity	•		•		•	
Compact size	•		•		•	
Priority valve	•		•		•	
Safe reaction switch	•		•		•	
Safe state (Block EH-flow)	•		•		•	
CAN bus			•		•	
Integrated steering controller					•	
Quick steering					•	
Auto-guidance (GPS) (ISO 11873 curvature command)					•	
Service interface						KWP2000
AUX interface (electric steering wheel/joystick)					•	
Redundant steering controller					•	
Certified steering subsystem					•	
SIL 2 - fail safe					•	

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# PVED-CLS

Steering and safety controller



## An intelligent steering sub-system

- The Danfoss PVED-CLS steering and safety controller for electrohydraulic steering solutions, is an intelligent steering sub-system to integrate all safety functionality in the valve.
- It is compliant with all current legislations and safety standards, including the Machinery Directive, and simplifies your system design, reduces development time, and accelerates your time to market with its cutting-edge connectivity, functionality, and integration.



**Shorter time to market for cost effective solutions with reliable safety functions and high robustness. Savings include:**

- **Safety architecture and software developed according to latest standards**
- **Tests conducted to pass specific performance and quality assurance tests**
- **Certification and documentation provided to meet standards**
- **No need to cover yearly certificate maintenance**



**TÜV SIL 2 certified steering and safety controller with more than 20 dedicated safety functions integrated**



**Direct interface to joystick, electric steering wheel, and auto-guidance**



**CAN bus interface**

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# PVED-CLS

Steering and safety controller



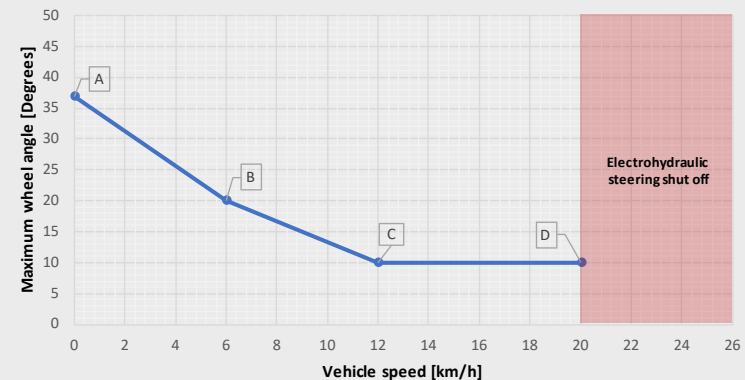
## TÜV SIL 2 certified steering controller with dedicated safety functions

- The Danfoss PVED-CLS steering and safety controller for electrohydraulic steering solutions includes more than 20 dedicated safety functions such as:
  - Vehicle speed dependent limitation of wheel angle in combination with auto guidance system
  - Vehicle speed dependent limitation of flow in combination with auto guidance, steering wheel, joystick or electric steering wheel
  - Auto-guidance and auxiliary steering disengage in combination with steering wheel and SASA sensor
  - Safe EH steering shut off
  - Safe on-road mode

### Example: Vehicle speed dependent limitation of wheel angle

It limits the maximum steered wheel angle or articulation angle proportional to the vehicle speed, when the PVED-CLS is operating in auto guidance steering mode. This secures safe steering at any speed – independent from signals coming from auto guidance system.

Maximum wheel angle and vehicle speed setpoints is customizable in PVED-CLS

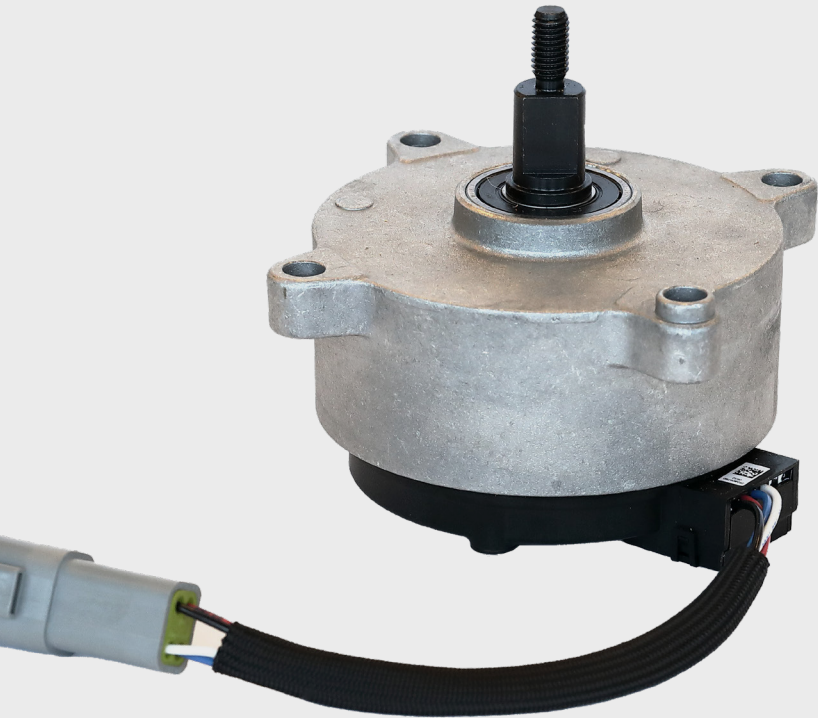


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# e-Wheel 100

Electric steering wheel



## Haptic electric steering with passive force-feedback

- The optimum choice for next generation cabin, providing flexibility in seat movements and orientation
- Plug & Play solution interfacing directly to EHi and OSPE steering valve with PVED-CLS steering controller
- End-stop control, RPM control, warning control, base torque and vehicle speed control

- ✓ **Optimized vehicle and cabin design**
- ✓ **Improved ergonomics with up to 57% reduced muscle activity**
- ✓ **Increased productivity by up to 6% compared to conventional steering**
- ✓ **SIL 2 certified**
- ✓ **Provide tactile feedback and maximum control to the operator**



\*Steering wheel not included

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# JS1-H Joystick



## Modular approach to maximize comfort and control

- The Joystick-Platform provides a new opportunity to speed up time to market. Led by continuous release of platform joysticks for heavy-duty machines, this innovative series has a modular design that makes it easier than ever to develop a customized joystick fast at reduced cost.

- ✓ **Modular designs for intelligent mobile control. Including single and dual-axis configurations and multiple mechanical like friction hold etc. incl. different electric interfaces**
- ✓ **Easy-to-use grips that match our joystick bases. Different grip types, ergonomically designed and individual customized to fit all applications with flexible setup of buttons, rollers, rockers and new technology like redundant output or capacitive operator presence switch**
- ✓ **Programmability with seamless integration to PLUS+1® environment**

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# DM series

## Displays



### Modern display line ranging from 4.3 to 12.1 inches with outdoor viewability in rugged design

- The DM family of configurable displays provides a modern operator experience with outstanding viewability, while still delivering extreme durability.
- Powered by the versatile PLUS+1® software toolchain including Vector-Based Screen Editor, integrated Service Tool and Widget Library for bringing products fast to market.

- ✓ **Modern appearance with wide viewing angles matching contemporary customer expectations for machine interfacing**
- ✓ **Make information easily accessible at all hours of the day with the displays' high brightness, optical bonding, anti-glare screen technologies and embedded light sensor**
- ✓ **IP66 and IP67 rated with wide operating temperature range**
- ✓ **Easy servicing of the entire machine through the wired and wireless interfaces, including CAN 2.0, USB High-speed, Ethernet, Wi-Fi and Bluetooth**
- ✓ **Touch display options allow interactions even while wearing gloves and during rain**

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# HMR CAN

Rotary encoder



## Intuitive machine control at your fingertips

- For operators who expect top-of-the-range comfort, safety and performance, the Danfoss HMR CAN Rotary excels on all counts. Our PLUS1® mobile machine device enables screen navigation and machine function control at the push of a button.
- Taking the best features from the automotive market, the HMR CAN Rotary minimizes the need to reach for the touch screen, buttons or dials on the display while the machine is in operation. Operators can maintain a full overview of performance by intuitive five-finger control, allowing for “blind” operation of the device.

- ✓ **Fast and intuitive screen navigation while operating machine**
- ✓ **Modern interface with ALL RGB LED lights for infinite colors**
- ✓ **Ergonomic design**
- ✓ **Customizable icons**
- ✓ **IP66 and IP67 rated and wide operating temperature range**

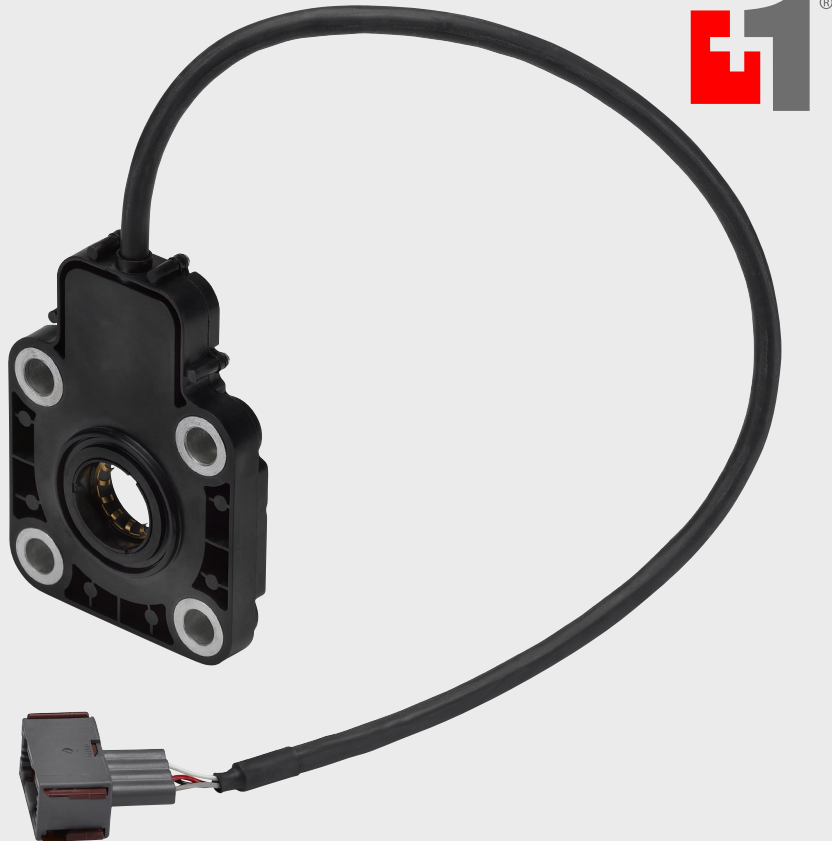
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# SASA

## Steering wheel sensor



### Programmable for extreme precision

- Detecting the absolute position and speed of the steering wheel used in application for variable steering ratio, closed loop and electrical disengage of auto-guidance
- Mounted between the steering unit and column, contributing to system compactness



**CAN bus interface for easy interfacing to PVED-CLS steering and safety controller**



**Robust design**



**High resolution output**



**PLUS+1® Compliant**

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# DST X510 and X520 series

## Wheel angle sensors



## Rotary position sensors

- Detecting the absolute wheel angle position with and without shaft, with unrivaled flexibility and scalability to meet safety and environmental regulations.

- ✓ **Contactless Hall technology**
- ✓ **Single or Redundant ranges up to 360° (±180°)**
- ✓ **Ratiometric CANopen and SAE J1939 output**
- ✓ **PLUS+1® Compliant**

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ENGINEERING  
TOMORROW