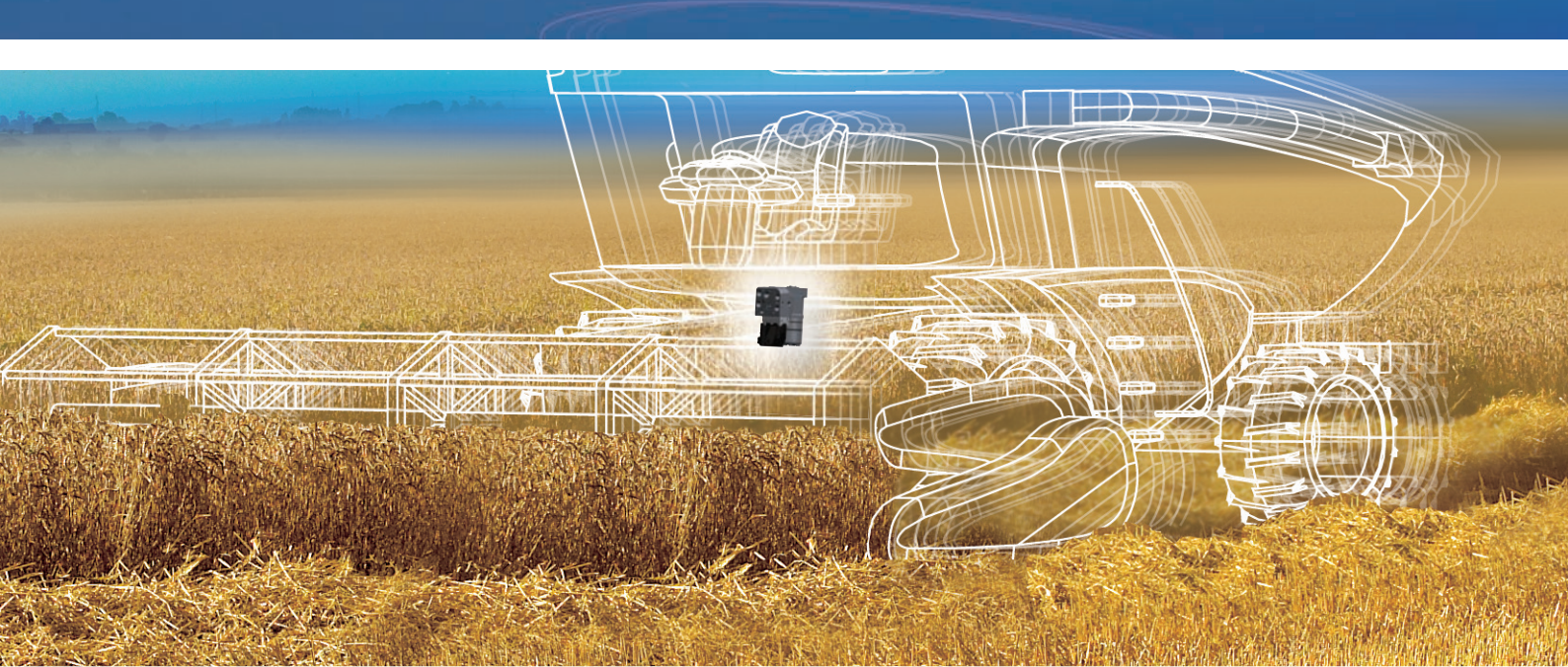


# OSPE Electrohydraulic Steering Units



Rapid Response – Complete Control







- **Compact steering unit with electrohydraulic interface**
- **Optimized for automatic steering (GPS)**
- **Designed to meet new safety legislation**
- **'Quick steering' dynamic steering ratio adjustment**
- **Selectable reactive and non-reactive steering modes**

# Meeting the Demands of Safety and Performance

Today's vehicles require versatile solutions that increase productivity, reduce operator fatigue and provide a safe, comfortable working environment. Our new OSPE steering unit introduces a range of innovative features that not only improve vehicle performance and operator comfort, but also facilitate compliance with the safety demands of Machinery Directive 2006/42/EC. With selectable reactive and non-reactive steering modes, a 'safe state' option, variable steering ratio, and Load Sensing and Open Center options, all integrated in a single, compact steering unit, you can offer your customers the flexible solutions they demand. OSPE – meeting the demands of safety and performance.

## Integrated Design – Enhanced Flexibility

Featuring proven OSP steering technology and an integrated electrohydraulic

steering valve, the OSPE steering unit helps simplify hydraulic system architecture (see illustration below). A high level of integration minimizes the need for additional components and provides OEMs with a complete package, designed, developed, and tested for optimal performance. A robust, single piece casting also eliminates potential leak paths, while the compact construction of the steering unit saves space, enhancing vehicle design flexibility.

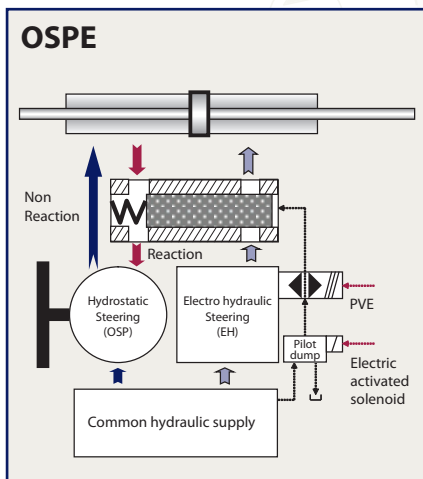
## Selectable Reactive and Non-reactive Steering

Whether driving on- or off-road, selectable reactive and non-reactive steering modes ensure that your vehicle will steer with a firm, automotive feel – thanks to the OSPE's ability to automatically return to center. And with two steering modes, the OSPE also enables reaction steering on vehicles with an auto-steering function. Furthermore, our second generation "reaction" technology, RM (Reaction Motoring), is available in Load Sensing or Open Center, and makes it

easy to 'feel' feedback when driving on-road – significantly improving operator comfort and vehicle performance.

## A 'Safe State' for Your System

To comply with revised safety legislation and new standards, for example ISO 25119, the OSPE steering unit offers a defined 'safe state'. In the event of an electronic or hydraulic system malfunction, this option, activated by an external watchdog controller, can isolate the electrohydraulic section of the steering valve in order to protect the steering system. Another safety feature ensures that, in electrohydraulic steering (non-reactive) mode, the steering ports from the OSP will not be blocked. This is achieved with an extra connection from the hydrostatic steering unit to the cylinder. In contrast to other systems, this keeps the steering wheel fully operational and the driver in complete control.



*OSPE combines proven OSP steering technology with an electrohydraulic steering valve.*







## **'Quick Steering' – No Compromise**

Together with the PVED-CL digital actuator and SASA steering sensor, the OSPE enables operators to fine-tune steering performance. The PVED-CL digital actuator incorporates steering software that has been optimized for trac-

tors and articulated vehicles, while the SASA steering sensor is used to detect the absolute position and speed of the steering wheel.

With this system, the operator can adjust the number of times the steering wheel is turned, from stop-to-stop, in order to adapt steering performance to suit specific working requirements or on-road

driving conditions. It is also possible to adjust the steering ratio automatically, dependent on the speed of the vehicle. The result is a no compromise solution that not only provides additional flexibility in vehicle system design, but also helps to reduce work-related fatigue and improve productivity.





## Seamless system integration with PLUS+1™ Compliance

Our new OSPE steering unit is compatible with PLUS+1™ microcontrollers and PLUS+1 GUIDE software – an advantage for heavy vehicles requiring electrically actuated joystick or automatic steering. PLUS+1 allows OEMs to rapidly develop and customize electronic machine control.

It opens up the future by combining machine controls and electronic diagnostics in an integrated operating network that connects the interactive control of different system components, for example valves, joysticks, sensors, pumps and motors, and – of course – steering units.

### Flexible Steering Options

*OSPE enables direct electric interface for GPS auto-steering systems, joysticks, electric mini-steering wheels, or quick steering.*

### New RM Technology

*Our next generation reaction technology, RM (Reaction Motoring), provides faster self-alignment and improved automotive feel for superior on-road steering performance.*

### Design and Installation Benefits

*Compatible with both open center and load sensing steering systems, our OSPE steering unit can be used for a broad range of machine types.*

### System Optimization

- *Integrated electrohydraulic proportional valve (up to 50 l/min [13.2 gal/min]).*
- *Integrated steering priority valve (up to 90 l/min [23.8 gal/min]).*
- *Integrated 'safe state' valve.*

# Ready to Meet New Safety Regulations

**Anticipating changes to system design and qualification, Sauer-Danfoss has developed the OSPE steering unit to meet new safety regulations.**

Recent European safety legislation has revised Machinery Directive 2006/42/EC and applies to all vehicles built in or shipped to Europe after December 29, 2009. This revision means that our OEM customers must perform and document a hazard and risk analysis for all vehicle functions according to, for example, ISO 13849 or ISO 25119.

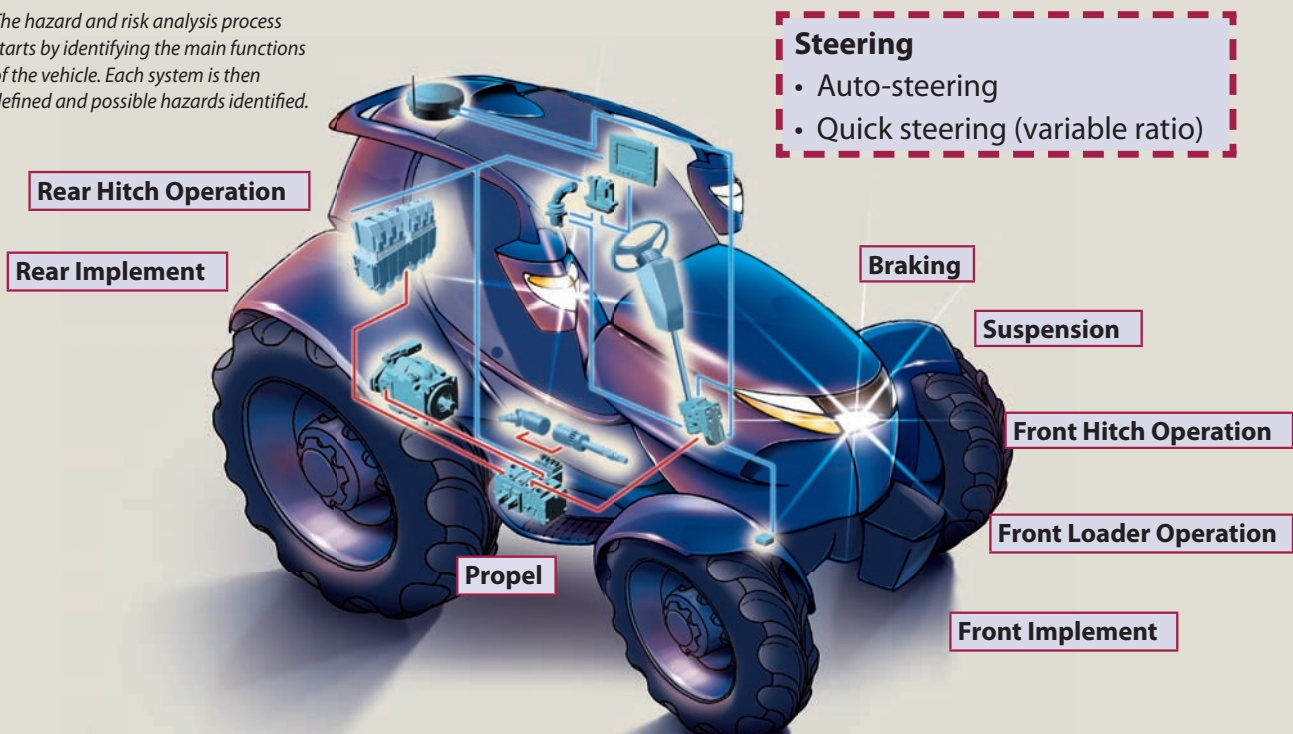
Anticipating these changes, the OSPE steering unit has been designed to comply with this new legislation and provide the basis for a 'safe state' system architecture – for example, Category 2 (ISO 25119). As a result, OEMs can speed up steering system development and certification, reduce costs, and bring vehicles to market faster.

## OEM Benefits

- Safety features designed to meet new legislation
- Easier system homologation reduces development costs
- Faster steering certification shortens time to market

## Overview of the Hazard and Risk Analysis Process

① The hazard and risk analysis process starts by identifying the main functions of the vehicle. Each system is then defined and possible hazards identified.



Risk analysis must follow a functional safety standard, for example, ISO 13849 or ISO 25119. The analysis process starts by describing the system that will be examined, in order to identify external influences and define system boundaries. A list of possible system failures, or hazards, is compiled and then evaluated in order to determine a level of risk. This incorporates an assessment of potential harm, frequency and length of exposure to a potential hazard, and the ability to control the hazardous situation.

The outcome of the analysis is the AgPLr (Required Agricultural Performance Level), or SIL rating, which is used to identify the minimum safety requirements for each vehicle function. The steering function example illustrated results in an AgPLr: d or SIL 2 rating, which indicates that a Category 2 (ISO 25119), system architecture is needed.

Based on the results of our risk analysis, the new OSPE steering unit has been designed for AgPLr: d architectures. Available today – ready for tomorrow.

⑤ Example of a Category 2 system solution with OSPE as the core component.

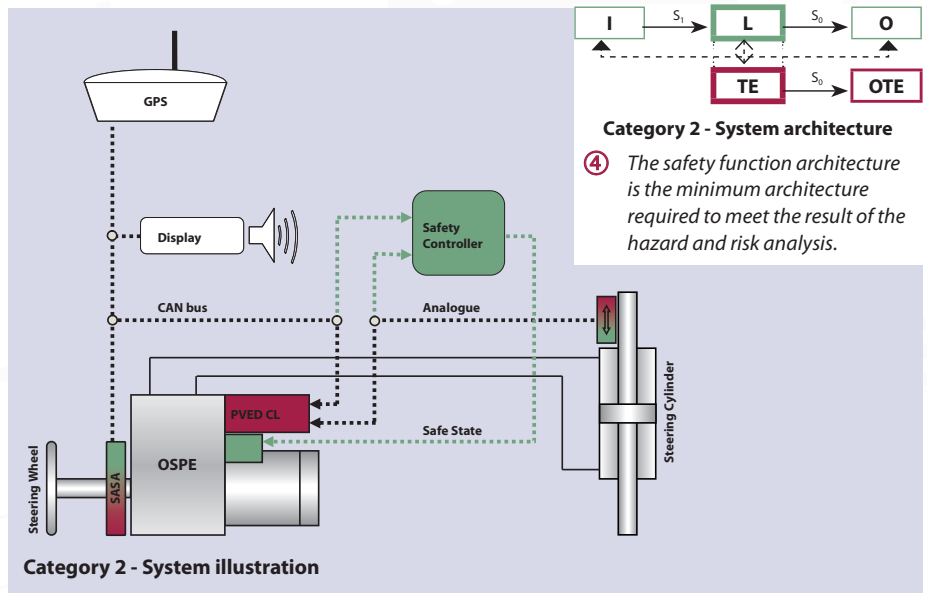
② Hazard and risk analysis example with off-road auto-steering. OEMs are responsible for conducting their own hazard and risk analysis.

Hazard and Risk Analysis						Risk Parameters			
ISO 25119						Potential harm S	Exposure E	Possibility of avoidance of harm	AgPLr
Hazard No:	Hazards and Hazardous events:	Possible hazard causes:	Hazard Effect	Risk	Mode of Operation				
H2	Unintended steering	Malfunction of valve, actuator, input device, hardware, software, external influence	- Driving path deviation - loss of steering control	Collision with vehicle	Auto-steering	2	2	3	b
				Collision with persons		3	1	2	a
				Collision with obstacles		2	2	3	b
				Risk of roll over		2	4	3	d
				Injury of bystander (service)		3	2	3	c
				Falling off a cliff, gorge		3	1	3	b

③ The outcome of the risk analysis determines the system architecture.

MTTF <sub>d</sub> = low	
MTTF <sub>d</sub> = medium	
MTTF <sub>d</sub> = high	

AgPL <sub>1</sub>					
a	1	B	B	B	B
b	2	1	B	B	B
c		2	1	1	1
d			2	2	2
e					3
	Cat B DC low	Cat 1 DC med	Cat 2 DC med	Cat 3 DC med	Cat 4 DC high



**Sauer-Danfoss** is a comprehensive supplier providing complete systems to the global mobile market. We offer our customers optimum solutions for their needs and develop new products and systems in close cooperation and partnership with them. Sauer-Danfoss specializes in integrating a full range of system components to provide vehicle designers with the most advanced total system design.

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- Gear pumps and motors
- Fan drive systems
- Closed circuit axial piston pumps and motors
- Bent axis motors
- Hydrostatic transmissions
- Transit mixer drives
- Hydrostatic transaxles
- Electrohydraulics
- Integrated systems
- Microcontrollers and software
- PLUS+1™ GUIDE
- Displays
- Joysticks and control handles
- Sensors
- Orbital motors
- Inverters
- Electrohydraulic power steering
- Hydraulic power steering
- Hydraulic integrated circuits (HIC)
- Cartridge valves
- Directional spool valves
- Proportional valves

**Sauer-Danfoss** provides comprehensive worldwide service for its products through an extensive network of Global Service Partners strategically located in all parts of the world.

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