

Technical information

# Demo kit PVED-CLS



**Revision history**

*Table of revisions*

<b>Date</b>	<b>Changed</b>	<b>Rev</b>
November 2019	First edition	0101

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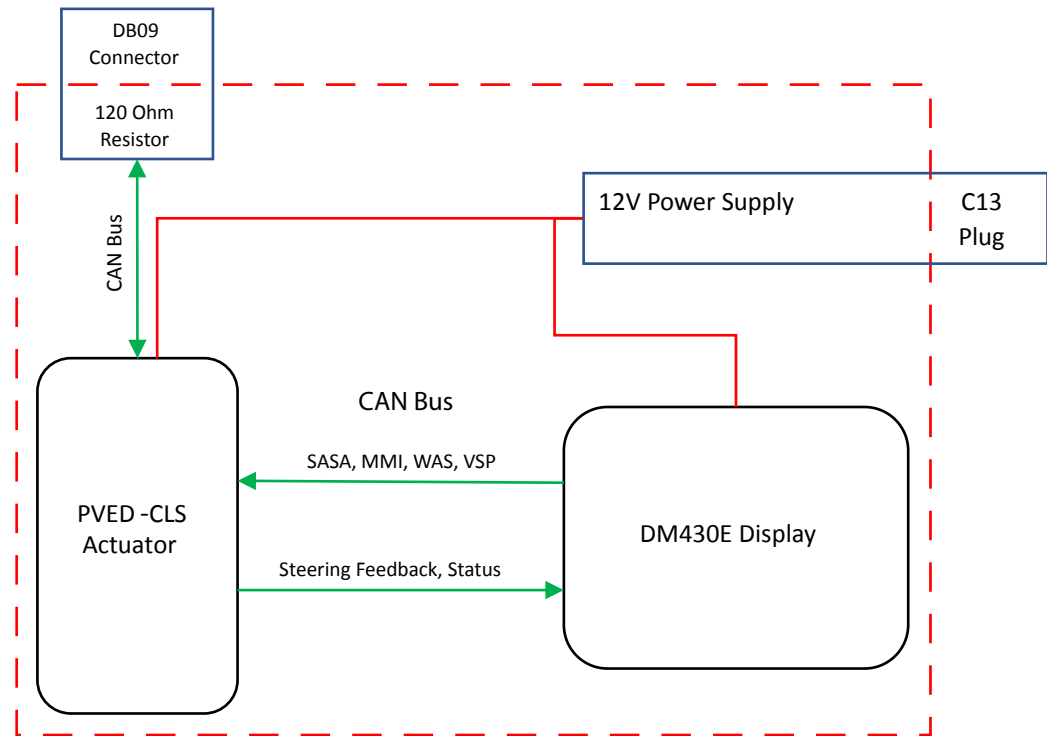
**General information**

**Demo kit components and ordering**

Included in the kit:

- PVED-CLS actuator
- DM430E display (with Steering Simulation PLUS+1® program)
- 3D printed case
- DB09 9 pin CAN port access with 120 ohm resistor
- Internal 12V, 5.0A power supply (C13 power cable not included)

*Block diagram*



*Ordering information*

Description	Material number
PVED-CLS demo kit	11235004

**PVED-CLS demo kit warranty**

The PVED-CLS demo kit is not covered by warranty. Danfoss is not liable for any damages to any component in the PVED-CLS demo kit.

For more information, contact your Danfoss representative.

## General information

### Glossary

AUX	Auxiliary
CAN	Controller Area Network
DM430E	A Danfoss Display Controller
EH	Electro-hydraulic
FMI	Failure Mode Identifier
GPS	Global Positioning System (auto-guidance command)
HMI/MMI	Human Machine Interface/Man Machine Interface
PVED-CLS	Proportional Valve Electronic Digital - Closed Loop Steering (CLS for short)
SASA	Steering Angle Sensor - Absolute
SPN	Suspect Parameter Number
VSP	Vehicle Speed
WAS	Wheel Angle Sensor

### PVED-CLS literature references

For other PVED-CLS documentation (including certificates), please visit the product's webpage: [PVED-CLS](#).

For more information, please contact your Danfoss representative.

## General information

### Demo kit purpose

The PVED-CLS demo kit provides tools that serve a variety of purposes.

The demo kit allows the user to:

- Simulate steering behaviors
- Demonstrate functional safety features of PVED-CLS
- Troubleshoot
- Train

*Steering simulation in action*



## Modes and features demonstration

### On-road and off-road modes

The on-road and off-road modes represent specific operating conditions.

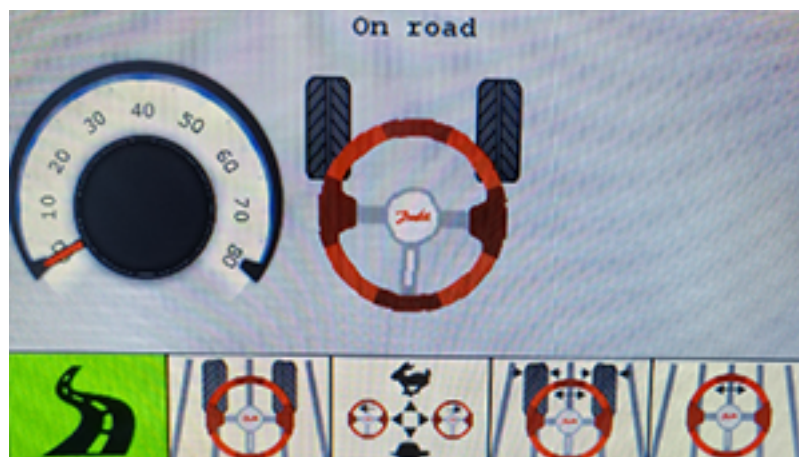
**Off-road mode** Operating condition when the PVED-CLS allows to transition electrical steering inputs (such as GPS or joystick command).

**On-road mode** Operating condition when only the hydraulic input from the steering column will be allowed to control steering.

*Off-road mode*



*On-road mode*



### Steering wheel and auxiliary programs

The PVED-CLS can store steering wheel and auxiliary programs in its memory. These are profiles that determine the sensitivity of steering devices at different vehicle speeds.

These profiles adjust the number of turns it takes to steer from left end-stop to right end-stop (or lock to lock). This safety feature allows faster wheel turning at slow vehicle speed and limit wheel turning speed at high vehicle speed. Changing the speed value (up and down arrows) will change the lock to lock value shown on the right side of the screen when in this mode.

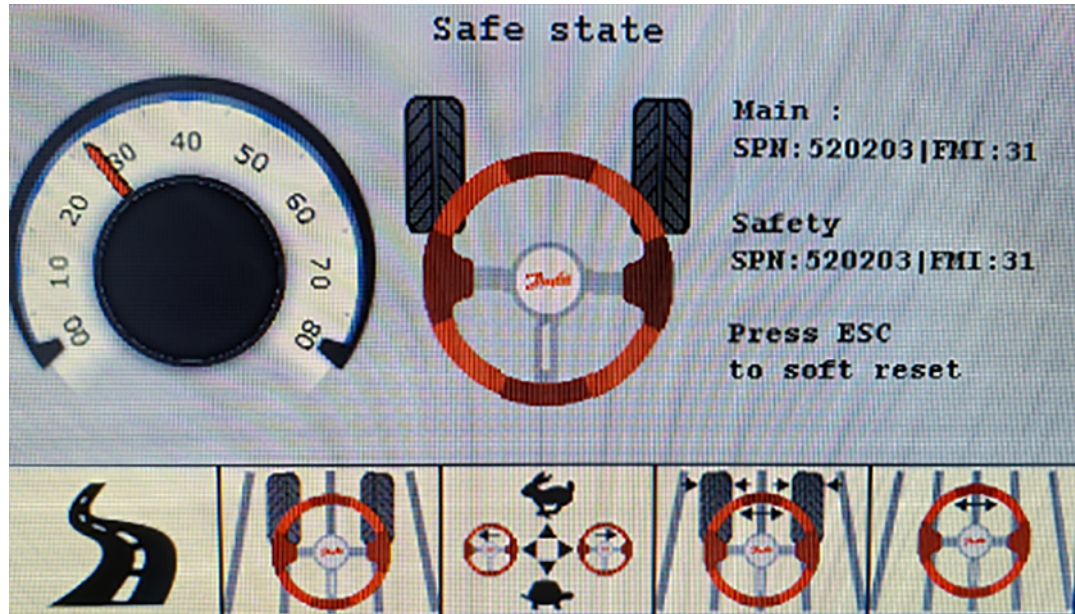
## Modes and features demonstration

### Safe state

This mode will appear if necessary CAN messaging is lost, or vehicle speed exceeds safety limits set in the CLS.

The display will read out the SPN (suspect parameter number) and FMI (Failure mode identifier) for the given error. These error codes are described in detail in the [PVED-CLS user manual](#) found in each firmware release package.

#### Safe state and error reporting

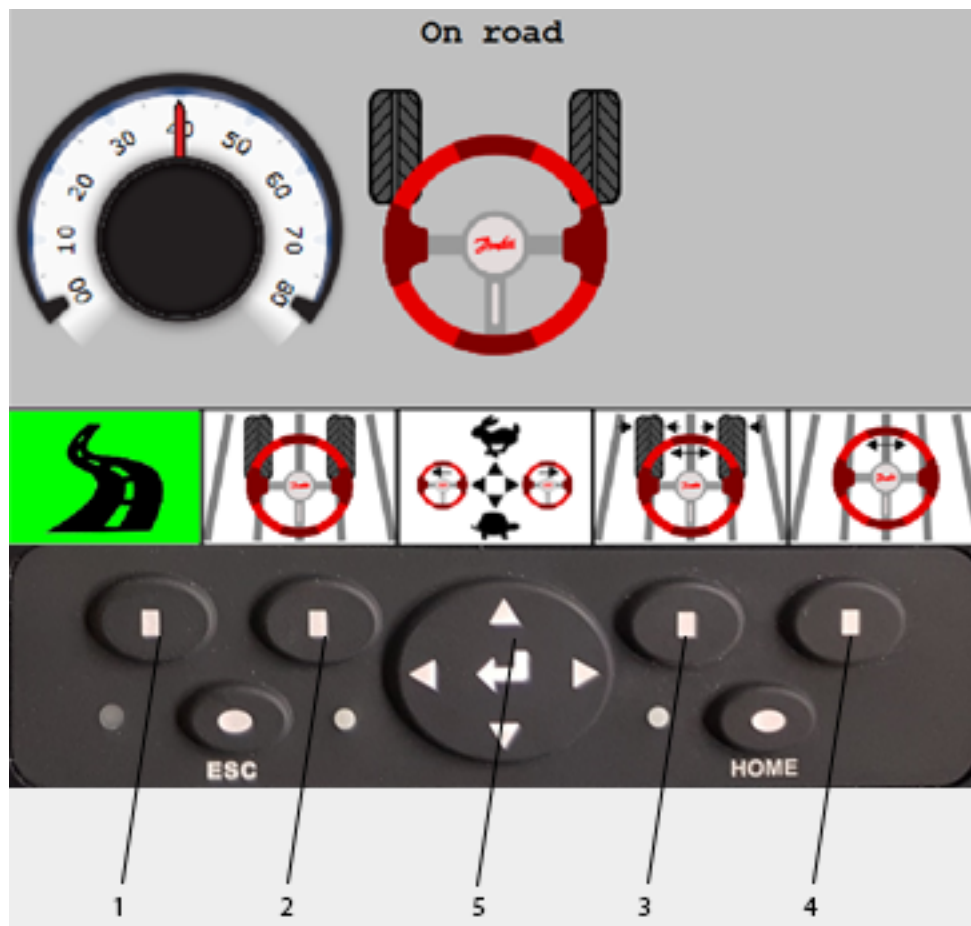


For more information on the CLS modes and transitions, refer to the state machine diagrams in the [PVED-CLS user manual](#) found in each firmware release package.





## Button interface and modes

### Buttons and icons






The selected mode will be highlighted in green.

### Button reference

Button	Icon	Function
1	<p><i>On-road</i></p> 	<p>The CLS is powered on but is locked out of EH (electrohydraulic) steering functions. Only the hydraulic simulation will take place, via steering wheel SASA input. AUX, GPS, and Variable Rate Steering are disabled.</p>
2	<p><i>Off-road non reaction</i></p> 	<p>The CLS will allow EH steering functions and the wheels are prevented from straightening due to reaction forces.</p>

## Button interface and modes

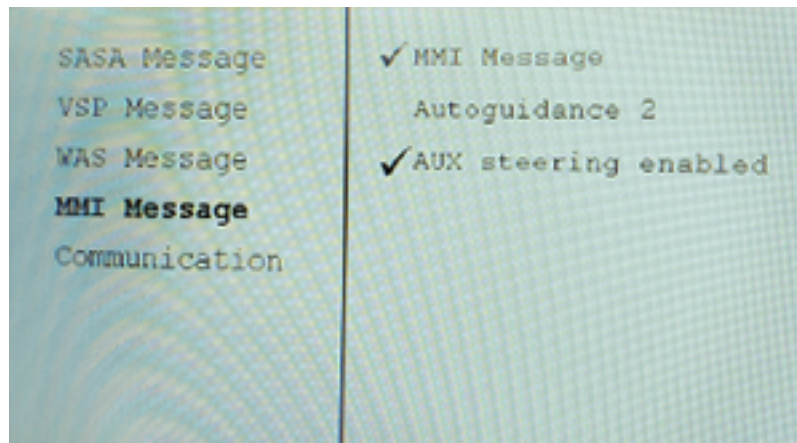
### Button reference (continued)

Button	Icon	Function
3	<p><i>Off-road reaction/auxiliary program cycle</i></p> 	<p><b>Off-road reaction:</b> The CLS will allow EH steering functions and wheels will try to straighten due to reaction forces.</p> <p><b>Auxiliary program cycle:</b> If an auxiliary steering device is enabled (via HMI message) and activated by its use, the CLS will change to the most recent Aux program it accessed; additional button 3 presses will cycle through the 5 auxiliary steering programs stored in the CLS parameters.</p>
4	<p><i>Steering wheel programs cycle</i></p> 	<p>Pressing button 4 consecutively will cycle through the 5 variable rate steering wheel programs stored in the CLS parameters.</p>
5	<p><i>Navigation keys</i></p> 	<p><b>Up and down arrows:</b> Increases (up) or decreases (down) vehicle speed per speedometer on main screen; navigate up or down menu items on the HOME menu.</p> <p><b>Right and left arrows:</b> Turns steering wheel to the right or left on the main screen; navigate right or left on the HOME menu.</p> <p><b>Enter:</b> Toggles HOME menu items on or off via check mark symbol.</p>
Escape	ESC	Issues a soft reset command to the PVED-CLS; soft reset works similarly to a power cycle and may be needed after correcting an error condition.
Home	HOME	Navigates user to a menu that controls the CAN messaging from the display controller to the PVED-CLS.

## CAN messaging

### Configuring CAN message communication

Home button menu controlling CAN messaging



All CAN messages sent from the display controller to the PVED-CLS can be toggled on and off. This allows for other devices sending equivalent messages to be placed on CAN.

[Pressing enter on the “communication” option causes the display controller to read the relevant parameters from the CLS to apply to the simulation. This should be used after making parameter changes within the PVED-CLS.](#)

### Messages coming from DM430E display controller

Message	Description
Steering Wheel Angle and Velocity (SASA)	Pressing the left and right arrow keys rotates the on-screen steering wheel.
Vehicle Speed (VSP)	Pressing the up and down arrow keys adjusts the speedometer on left side of the screen.
Human-Machine Interface (HMI/ MMI)	Requests the steering mode and enables/disables eSteering devices.
CAN based wheel angle (WAS)	Wheel Angle simulated based on SASA, AUX (auxiliary), or GPS (curvature command) steering input. The on-screen wheels represent the value generated.

[For more information, please see the CAN message content in the \*PVED-CLS communication protocol\* document found in each firmware release package.](#)

Contact your Danfoss representative to access and update the PLUS+1® display program.

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