

Black Bruin



**Operation manual
CTR101 control system**

Contents

1	General instructions.....	4
1.1	About the manual.....	4
1.2	Intended use.....	4
1.3	Warranty.....	4
1.4	Product identification.....	4
1.5	Revision comments.....	5
2	Safety instructions.....	6
2.1	Warning symbols.....	6
3	Product description.....	7
3.1	Operating modes.....	7
3.2	Driving mode.....	7
3.3	Driving mode with HDC function (Hill descent control) (option).....	8
3.4	Freewheeling mode.....	8
4	User interface.....	10
4.1	User interface options.....	10
4.1.1	Display.....	11
4.1.2	Operating panel.....	12
5	Getting started.....	14
5.1	Power up the control system.....	14
5.2	Menu.....	16
6	Main view elements.....	20
6.1	Main view at the initial state.....	20
6.2	Alarms and warnings.....	21
6.3	Tractive power and HDC level indication.....	22
6.4	Operating mode indication.....	23
7	Operating functions.....	26
7.1	Drive-control modes.....	26
7.2	Tractive power level selection.....	27
7.3	Driving and freewheeling functions in the manual drive-control mode.....	29
7.4	Driving and freewheeling functions in the automatic drive-control mode.....	32
7.5	Braking in driving mode without the HDC.....	36
7.5.1	Operation during braking.....	37
7.5.2	Operation after releasing the brake.....	38
7.6	Braking in driving mode with the HDC function.....	38
7.6.1	Operation during braking.....	38
7.6.2	Operation after releasing the brake.....	40
7.7	Assisting traction control (ATC).....	41
7.8	Auxiliary valve control (AUX) (option).....	43
7.9	Keypad lock.....	44

8	Setup.....	46
8.1	User parameters.....	46
8.2	Automatic freewheeling conditions.....	50
8.3	Setting the values for the automatic freewheeling.....	51
9	Troubleshooting.....	53
9.1	Display status indicator LED.....	58
9.2	Control device segment-display.....	59

1 General instructions

1.1 About the manual

This manual contains the instructions for the operation of Black Bruin CTR101 control system. Obey these instructions when you use the product.

Black Bruin CTR101 control system is part of the On-Demand Drive System transmission solution. The On-Demand Drive System product manual describes the design and installation instructions of the transmission solution.

All information is based on information that was available at the time that this manual was written. The manufacturer reserves the right to change the content of this manual without further notice.

Please visit www.blackbruin.com/downloads for the most recent version of this manual. The product datasheets and the 3D-models are available from the manufacturer by request.



Note:

If there are differences between the English text and its translation, the English text is always the most accurate. This document is written in Simplified Technical English (ASD-STE100).

1.2 Intended use

Black Bruin On-Demand Drive System is a transmission solution for tractor-driven trailers and working equipment.

On-Demand Drive System is very applicable for equipment that periodically requires additional power and is towed without hydraulics.

On-Demand Drive System is designed for off-road driving and it must be powered off when you drive in road traffic.

Black Bruin CTR101 control system is only applicable to use together with the freewheeling Black Bruin motors.

1.3 Warranty

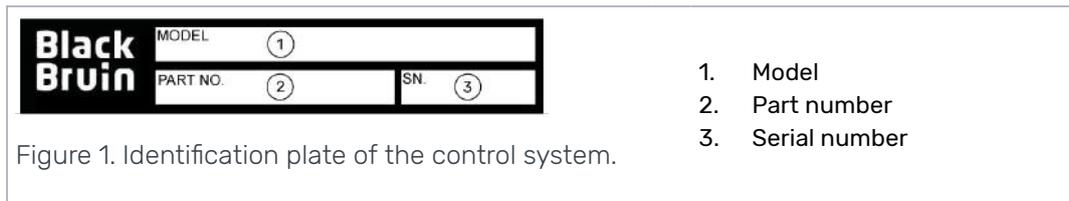
Check the package and the product for transport damage when receiving goods. The package is not meant for long term storage; protect the product appropriately.

Do not dismantle the product. The warranty is void if the product has been disassembled.

The manufacturer is not responsible for damages resulting from misinterpreted, non-compliance, incorrect, or improper use of the product that goes against the instructions given in this document.

1.4 Product identification

The product has an identification plate. The identification plate has the information that follows:



1.5

Revision comments

06.06.2024 (Software version 04.01.00) - This manual is published.

2 Safety instructions

The instructions that follow apply to all procedures related to the product. Read these instructions fully and follow them carefully.

- Use necessary personal protective equipment when you do work with the product.
- Use correct support with the product. Make sure that the product cannot accidentally fall or turn.
- Use only appropriate equipment and attachments when you lift and move the product.
- Make sure that it is not possible to pressurize the hydraulic lines during product installation and maintenance procedures.
- During the operation the product temperature can be over 60 °C (140 °F). Hot surfaces can burn you. Be careful of hot hydraulic fluid when you disconnect the hydraulic connections.

2.1 Warning symbols

The following symbols are used in this manual:



Note:

Useful information.



Danger:

Danger of death or injury.



Attention:

May cause damage to the product.

3 Product description

3.1 Operating modes

The Black Bruin On-Demand Drive System can use hydraulic motors in the operating modes that follow:

- Driving mode
- Driving mode with HDC function (Hill descent control) (option)
- Freewheeling mode.

The chapters that follow give the working principles of these modes.

3.2 Driving mode

In this mode the motors help the vehicle to move in the direction of travel. You can adjust the tractive power level to the driving conditions. The power level stays constant also if the speed changes. When the vehicle brakes the system reduces the working pressure to the minimum level and the hydraulic motors do not have tractive power.

Motors with 2-speed function extend the working speed range. The function works in the same manner as the gear shifting:

- The highest torque is available in the low-speed range.
- The high-speed range makes it possible to drive at higher speeds with the same hydraulic flow rate. The available torque is lower than in the low-speed range.

If the vehicle wheels slip, the assisting traction control ATC increases the torque on the wheels that have more traction.

Typical situations to operate in the driving mode are:

- Driving up steep slopes



- Moving rearward on steep slopes



- Going across obstacles



- Driving on slippery or soft surfaces.



3.3 Driving mode with HDC function (Hill descent control) (option)

The HDC function helps when you drive the vehicle down on steep slopes, in both forward and reverse driving modes. HDC is active when the tractor brakes.

When the HDC function is active, the wheel motors resist the wheel movement to the driving direction. You can adjust the HDC power level during the operation.

Typical situations for the use of the HDC function are:

- Driving down steep slopes
HDC function off, vehicle accelerates.



- Driving down steep slopes
HDC function on, function helps the vehicle to maintain the speed.



- Moving rearward on steep slopes
HDC function off, vehicle accelerates.



- Moving rearward on steep slopes
HDC function on, function helps the vehicle to maintain the speed.



3.4 Freewheeling mode

In the freewheeling mode you can freewheel the motors without energy loss or overheating problems (stationary cylinder block - no centrifugal forces), even at high speeds. You can engage the drive again during movement when the speed is in the working range.

If the pressure level is not sufficient due to increased driving speed, the control system automatically switches to freewheeling. This protects the motor from overloading.

The operator can also manually change the mode to freewheeling.

Typical situations to operate in the freewheeling mode are:

- **When you drive on road**
- When you do work above the maximum working speed range
- When the working conditions are easy.

4 User interface

This manual includes all different CTR101 control system options.

When the information in the section relates to an option, the icons that follow are used:

4WD	Four-wheel drive
HDC	Hill Descent Control
SPD	Speed and direction sensors
DISPLAY	System that has a display as the user interface
PANEL	System that has an operating panel as the user interface

4.1 User interface options

The system is available with the user interface options that follow:

- The display without the operating panel.
- The operating panel without the display. *Not available for a system with speed sensors.*
- The operating panel together with the display.

DISPLAY You can operate all system functions from the display. It also gives full information of the system state. You can change system parameters from the display.

PANEL You can operate the driving functions from the operating panel. The panel has indicator lights that give information of the system state. You cannot see or change the system parameters from the operating panel.



Danger:

For safety, it is necessary that the user interface does work correctly. Stop the system use if the display and/or the panel has a malfunction, too much wear or the functions do not work correctly.

4.1.1

Display

DISPLAY

The functions of the **F1 - F4** buttons change together with the view and the mode. The icons that show at the bottom of the display refer to the related functions of the **F1 - F4** buttons.

The background color of the icon shows if the mode of the function is **ON** or **OFF**. In the figure below the function **AUX** for button **F1** is **ON**. The background color of the icon is grey.

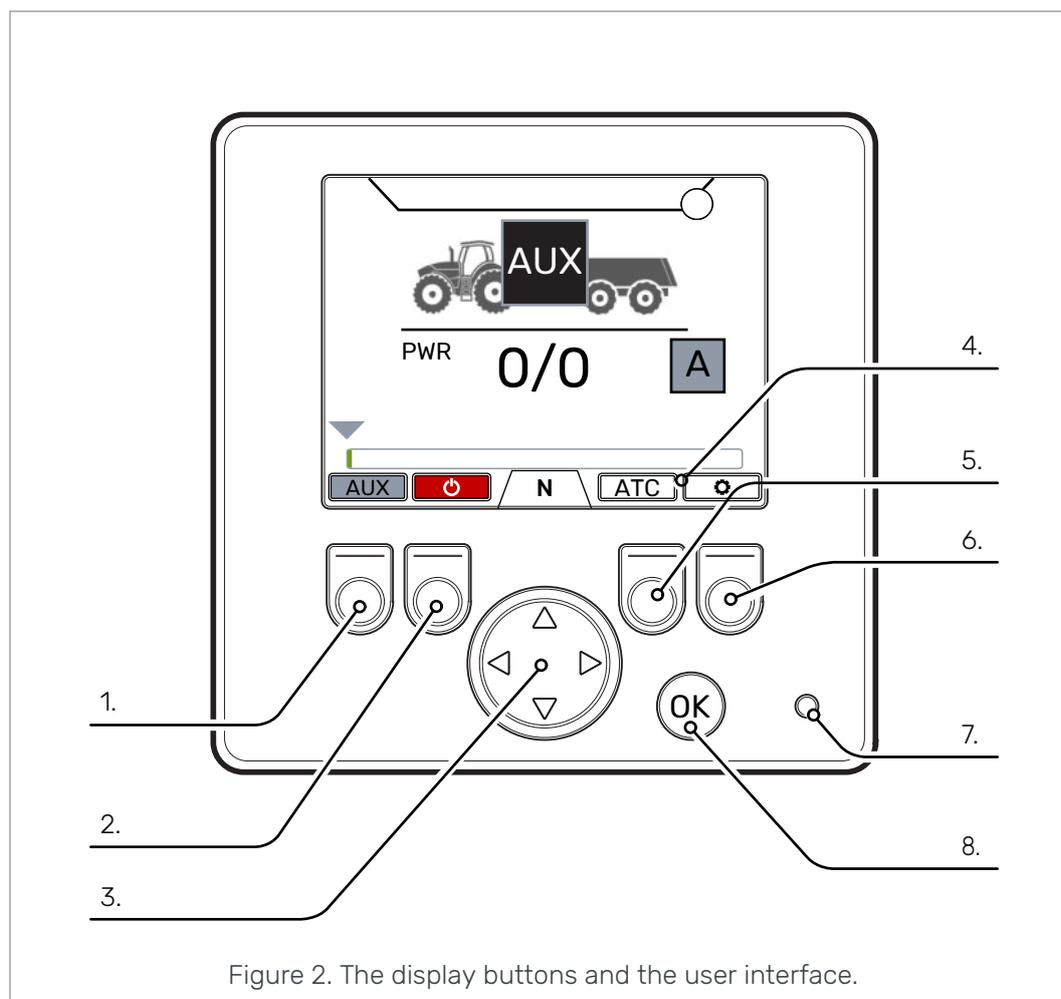


Figure 2. The display buttons and the user interface.

1	F1	2	F2
3	Selection arrows (left, right) Selection arrows (up, down)	4	Function icons for F1 - F4 buttons
5	F3	6	F4
7	Status indicator light	8	OK

4.1.2 Operating panel

PANEL

The operating panel has buttons **L1 – L3**, **R1 – R3** and a control **Knob** with a **Segmented LED ring**.

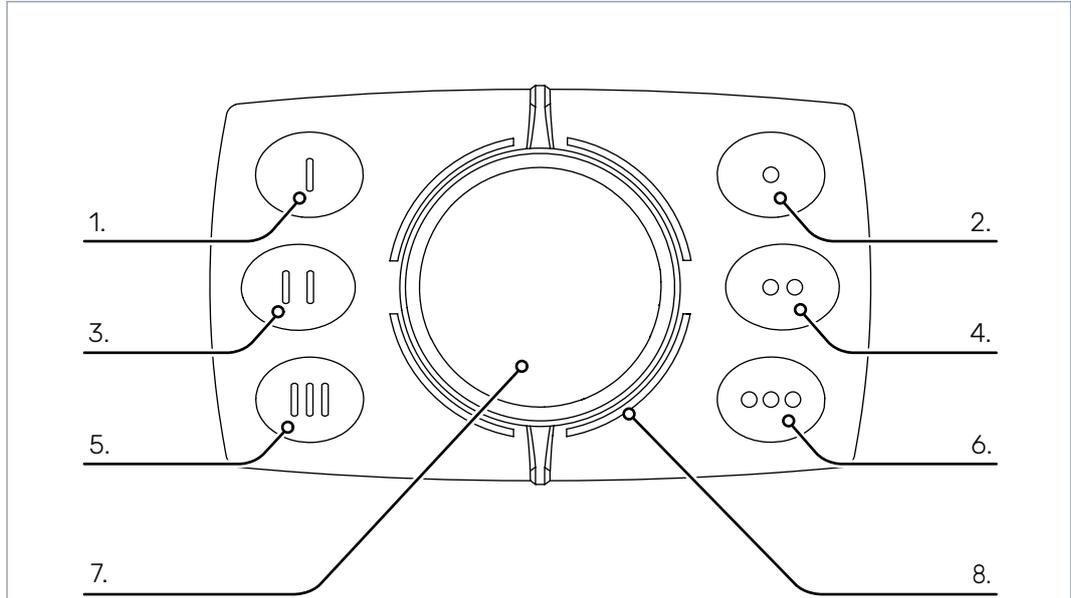


Figure 3. The operating panel elements.

1	L1: Forward	2	R1: D2 (two-speed function)
3	L2: Neutral / AUX	4	R2: ATC
5	L3: Reverse	6	R3: • Push – Alarm / Warning reset • Push and hold – Panel key lock / unlock
7	Knob	8	Segmented LED ring

Knob

The functions of the knob are as follows:

- The rotary function for level adjustment
- The up / down tilt function for drive commands
- The pushbutton function to disengage the drive (neutral).

Segmented LED ring

The segmented LED ring around the knob shows the set level of a function. It also shows the warnings and alarms.

Button backlight indications

Buttons (L1, L2, L3, R1, R2 and R3) have multicolor illumination. The button backlight color tells the operating status of the system and the functions that are in operation.

The colors and their functions are as follows:

Off Function is not available

Dim white	Backlight, function is not on or is not selected
Green	Function is on or is selected
Blue	Alternative function is on
Yellow	Warning
Red	Alarm

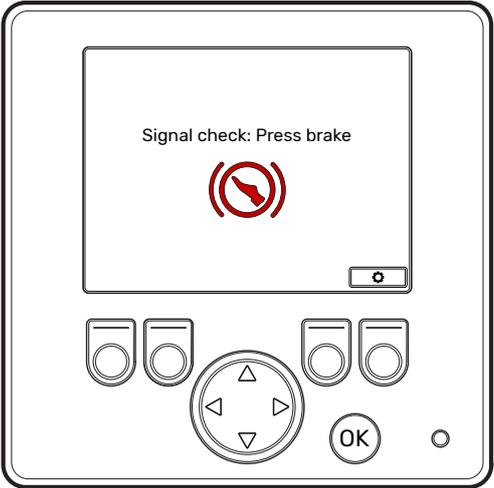
5 Getting started

5.1 Power up the control system

The brake-signal check activates at each power-up, after which the system is in the freewheeling (N) mode.

Operating functions are not available until you press the brake and the system detects the brake signal.

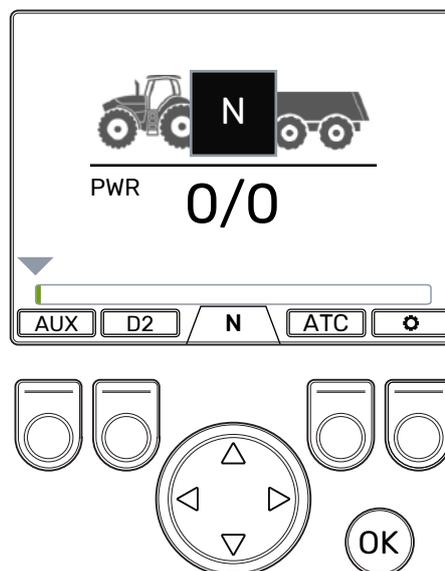
If the brake-signal check stays active when you press the brake, see chapter 9 [Troubleshooting](#).

DISPLAY	
<p>After the power-up, the display momentarily shows the start-up view before the brake-signal check comes into view.</p> <p>The version of the display software shows in the start-up view.</p>	
<p>Main menu is available in the brake-signal check view.</p> <p>When you use the control system for the first time, do a preliminary check of the settings before you use the operating functions. It is very important that you adjust the maximum pressure level first.</p> <p>You can also open the main menu from the main view. To open the main menu, push the F4 (⚙) button. See chapter 5.2 Menu.</p> <p>Press the brake pedal to continue.</p>	

DISPLAY

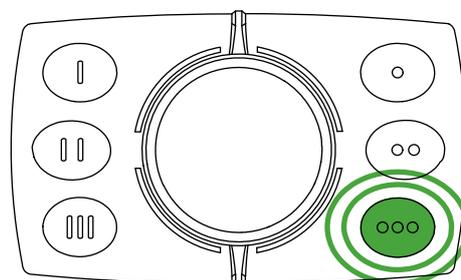
After the system detects the brake signal, the main view comes into view.

Symbols on the display may be different from the figure depending on the system configuration and options.

**PANEL**

After the power-up the backlight color of the R3 button is green and it flashes in one-second intervals. This shows that the brake-signal check is active.

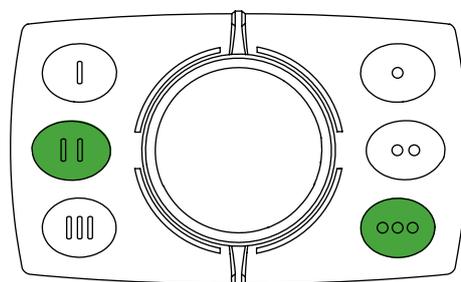
Press the brake pedal to continue.



After the system detects the brake signal, the drive commands are available.

The green backlight color of the R3 button shows that the drive system is ready to use.

The green backlight color of the L2 button shows that the system is in the freewheeling mode (N).



5.2

Menu

DISPLAY

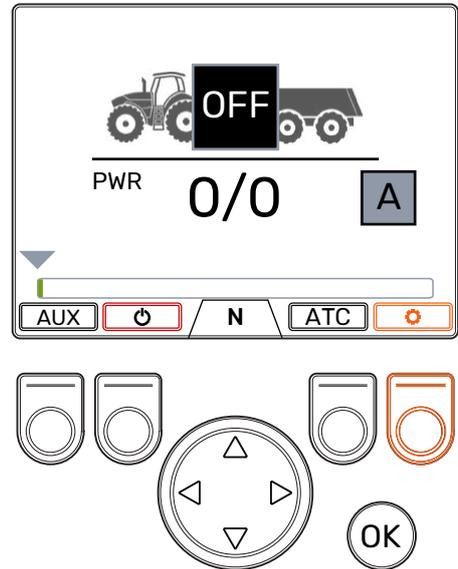
1. Main menu

To open the main menu from the main view, push the F4 button (⚙).



Note:

The main menu is available only when the system is in the free-wheeling mode.



2. Main settings

- Arrow buttons up/down: Select the value you want to adjust.
- Arrow buttons left/right: Adjust the values.

You can adjust the display brightness and change the control system language from the main menu.

The selection of language has an effect on the language of the user interface and the parameter names.

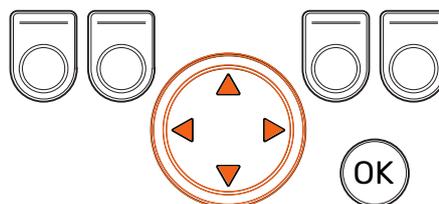
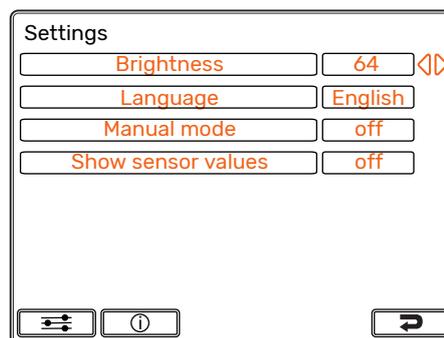
Manual mode

SPD You can change between the automatic and manual drive-control modes with the manual mode setting. A system without the speed sensors is always in the manual mode and the selection is not shown.

Show sensor values

You can activate the measurement values for the main view. Pressure values are shown below the tractor icon. The value that is farthest to the left is the working pressure A (forward). The value that is farthest to the right is the working pressure B (reverse). Unit for the pressure measurement is bar.

SPD Speed sensor measurements are also shown. Values above the trailer symbol are measured from the motors on the right side. Values below the symbol are measured from the motors on the left side. Unit for speed is km/h. The direction signal of each speed sensor is also indicated as L (low) or H (high). Left and right side direction signals should be normally opposites during movement.

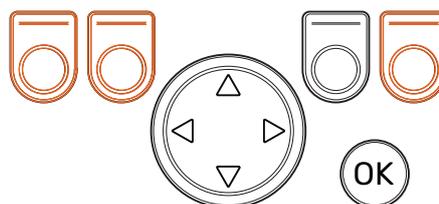
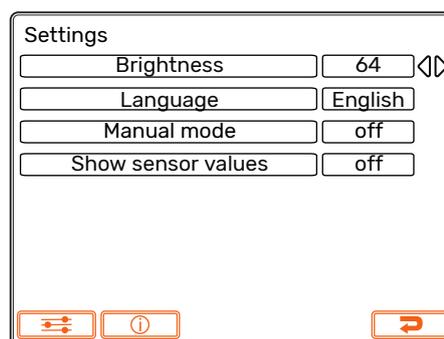


3. Parameters and system information menus

Parameters menu shows the settings related to the operation of the system. You can adjust these settings.

Information menu shows the information about the system and operations, for example the operating hours and the latest fault messages.

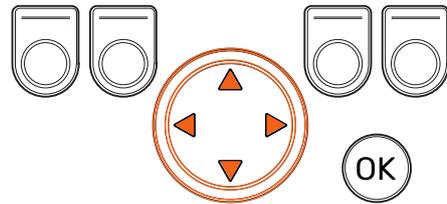
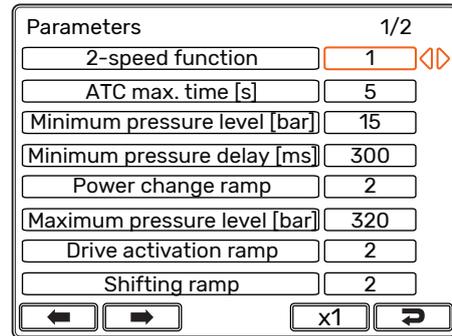
- In the main menu push the F1 button to go to the user parameters menu.
- In the main menu push the F2 button to go to the system information menu.
- Push the F4 button to exit the main menu.



4. Parameter selections

Parameter names are in the same language as the user interface. See chapter [8.1 User parameters](#) for the detailed information on the parameters and their possible values.

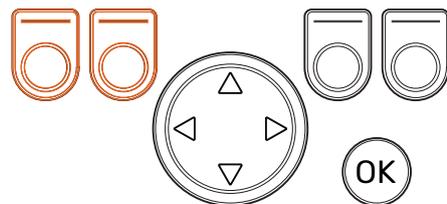
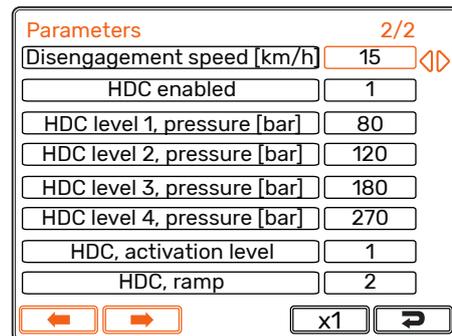
- Arrow buttons up/down: Select the parameter you want to adjust.
- Arrow buttons left/right: Adjust the parameter values.



5. Parameter selections, page scrolling

If the system has many options, the parameter list can be more than one page long. You can see the page number and the total number of pages at the top right corner of the display. Push the buttons F1 and F2 to scroll the pages.

- Previous page: F1
- Next page: F2



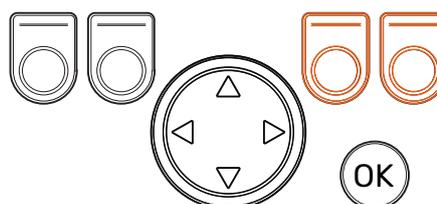
6. Parameter multiplier

The multiplier shows the step value in which you can change the parameter value. You can change the step value when you have to adjust large values. The multiplier values are x1, x10, x100 and x1000.

- Push the F3 button to change the multiplier value. The icon above the button shows the selected multiplier value.
- Push the F4 button to exit the parameter menu.

Parameters	1/2
2-speed function	1
ATC max. time [s]	5
Minimum pressure level [bar]	15
Minimum pressure delay [ms]	300
Power change ramp	2
Maximum pressure level [bar]	320
Drive activation ramp	2
Shifting ramp	2

← → x1 ↻



7. System information

In the main menu push the F2 button to go to the system information menu.

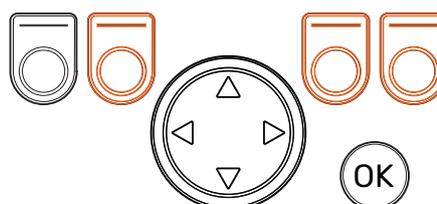
Information menu shows the information about the system and operations.

This information is necessary for example for troubleshooting and support requests.

- Model series: Control system model: CTR101
- Sw Version: Software version numbers are as follows:
 1. Control device software version
 2. Display software version
 3. **SPD** / **4WD** Auxiliary control device software version (only in 4WD and systems with speed sensors).
- Last error: Latest error message. See chapter 9 *Troubleshooting* for the list of alarm codes.
- Safestate occurred: How many times the system has been to the safe state.
- Working hours: System operating hours (the control device has been on).
- Forward: The number of times the system has been in the forward driving mode.
- Backward: The number of times the system has been in the reverse driving mode.
- TOW: The number of times the system has been in the freewheeling mode.
- Push and hold the F2 and F3 buttons at the same time to reset the counters.
- Push the F4 button to exit the information menu.

Model series	CTR201
Sw Version	03.01.05 03.01.05 03.01.05
Last error	Coil_failure_PDB
Safestate occurred	1
Working hours	41
Forward	18
Backward	3
TOW	18

↻



6 Main view elements

6.1 Main view at the initial state

DISPLAY

You can manage the operating functions from the main view.

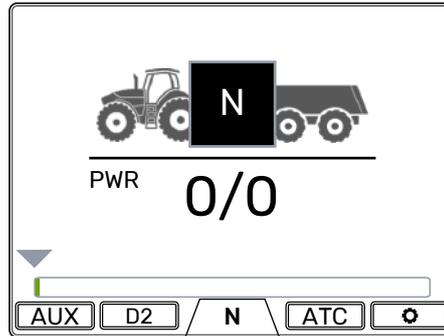


Figure 4. The main view. If the system does not have the 2-speed motors, the D2 icon does not show. If the system does not have the auxiliary valve control, the AUX icon does not show.

SPD System with speed sensors

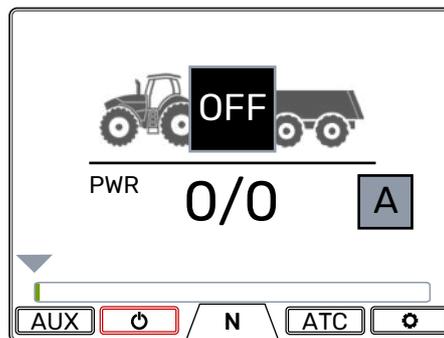


Figure 5. The main view after the power-up. The automatic drive-control mode is in the OFF state. The system is in the freewheeling mode. If the system does not have the auxiliary valve control, the AUX icon does not show.



Note:

The trailer icon can be different from the one in the figure.

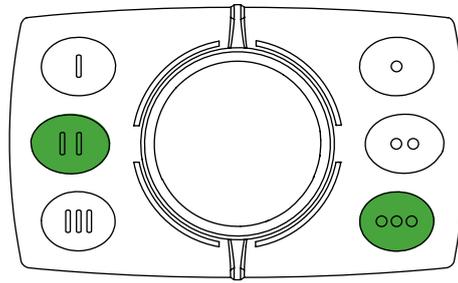
PANEL

Figure 6. Indication of the initial state in the operating panel.

SPD The operating panel does not have indication of the drive-control mode.

6.2 Alarms and warnings

DISPLAY

The status bar at the top of the main view shows all alarms and warnings.

The background color of the status bar is:

- Black for the alarms
- Grey for the warnings.

Red background color of the OK icon at the top of the main view means that you must reset the alarm before you can activate the drive. If you have removed the cause for the alarm, push the *OK* button to reset the alarm. See chapter 9 *Troubleshooting* for more detailed information on the alarms.

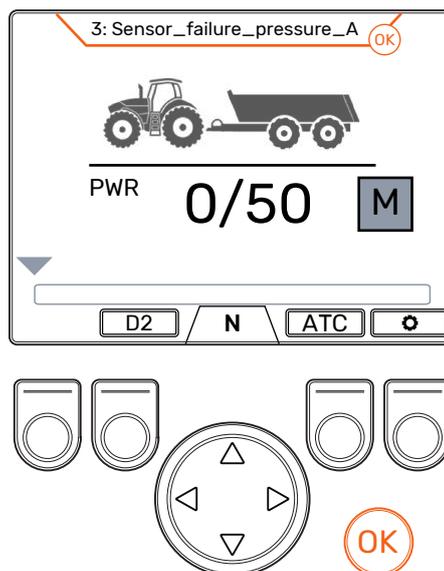


Figure 7. Status bar - Alarms and warnings.

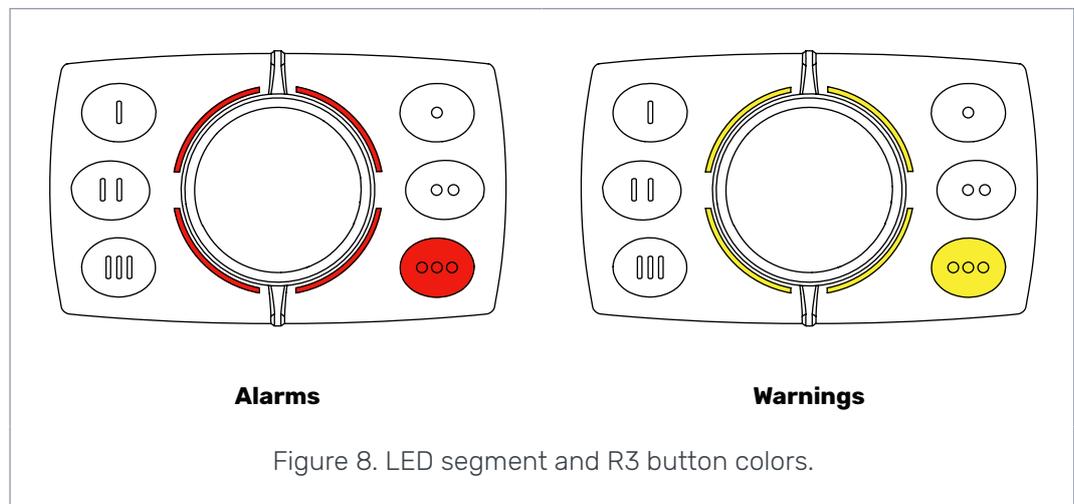
PANEL

In the control panel the backlight color of the R3 button gives the indication for an alarm or a warning.

The backlight color of the R3 button is:

- Red for the alarms
- Yellow for the warnings.

LED segment colors around the knob identify which alarm or warning is active. Red background color of the R3 button means that you must reset the alarm before you can activate the drive. If you have removed the cause for the alarm, push the R3 button to reset the alarm. See chapter 9 *Troubleshooting* for more detailed information on the alarms

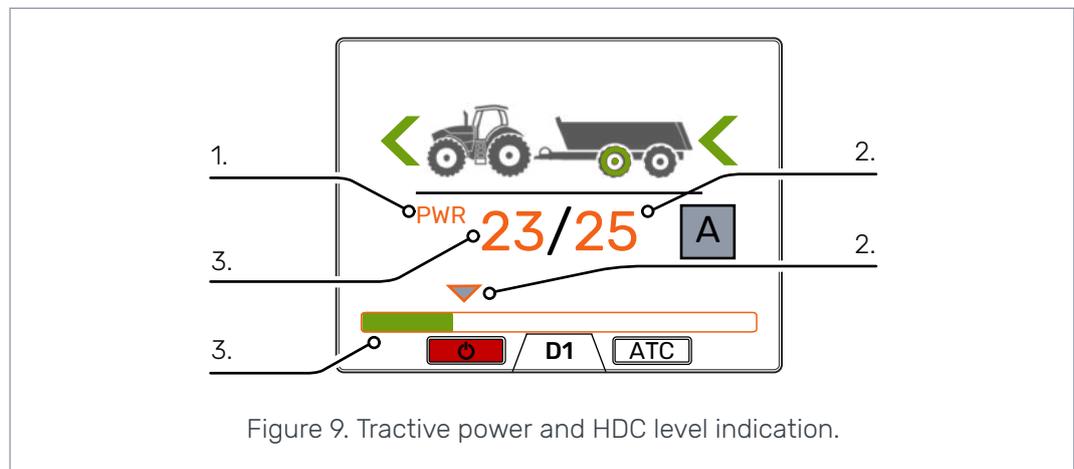


6.3 Tractive power and HDC level indication

DISPLAY

Tractive power level is shown on a scale of 0 - 100%. Full power level is related to the maximum pressure level specified in the parameters.

HDC If the system has the HDC function (Hill descent control), the HDC level is also related to the maximum pressure level specified in the parameters.



<p>1 Mode: PWR/HDC</p> <p>Shows the active mode on the display:</p> <ul style="list-style-type: none"> • <i>PWR</i>: Tractive power adjustment. The values on the display show the tractive power level. • <i>HDC</i>: Hill descent control adjustment (only in systems that have the HDC function). The values on the display show the HDC function intensity. 	<p>2 Selected level:</p> <ul style="list-style-type: none"> • The number shows the set value. • The grey arrow above the colored power bar shows the set value.
<p>3 Measured level:</p> <ul style="list-style-type: none"> • The number shows the measured value • The colored power bar below the numbers shows the measured value: <ul style="list-style-type: none"> • Green: <i>PWR</i> • Red: <i>HDC</i>. 	

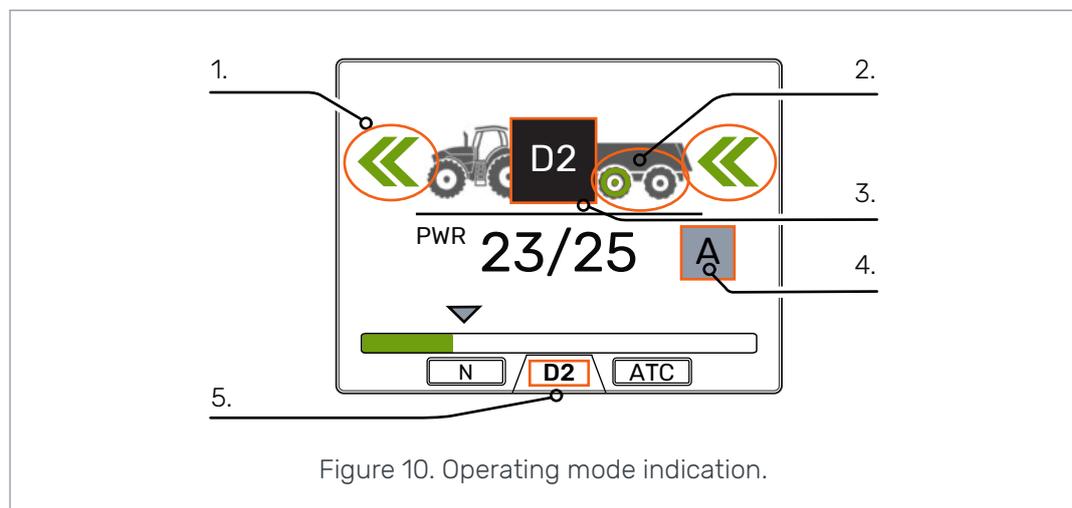
Measured and set values are percentages from the maximum pressure level that is specified in the settings (Maximum pressure level [bar]).

For example, with the numbers shown in the figure, the calculation for 200 bar system gives the pressure levels as follows:

- Selected level 25% => $200 \text{ bar} \times 25/100 = 50 \text{ bar}$
- Measured level 23% => $200 \text{ bar} \times 23/100 = 46 \text{ bar}$.

6.4 Operating mode indication

DISPLAY



1	<p>Arrows</p> <p>Show the operation and operating modes as follows:</p> <ul style="list-style-type: none"> • <i>No arrows</i>: Freewheeling • <i>Green arrows</i>: <ul style="list-style-type: none"> • Drive is active to the direction of the arrows. • The double arrows show, if the D2 gear is on. • <i>Grey arrows</i>: <ul style="list-style-type: none"> • Come into view only in the automatic drive-control mode when the OFF state is active. • Show the working speed range (gear) that is correct for the driving speed. The system uses this gear when you enable the automatic drive-control mode again (you exit the OFF state). • <i>Intermittent arrows green / grey</i>: <ul style="list-style-type: none"> • During braking • After braking before the tractive power comes back on. Only in the manual drive-control mode. • SPD When the arrows point to the opposite directions < >, the motion detection is enabled for automatic drive activation. Only in the automatic drive-control mode. 	2	<p>Color of the trailer wheels</p> <p>Show the hub motor operation modes as follows:</p> <ul style="list-style-type: none"> • 2WD The color of the front wheel icon changes. • 4WD The colors of the two wheel icons change. • <i>The wheel colors</i>: <ul style="list-style-type: none"> • <i>Grey</i>: Freewheeling • <i>Green</i>: Drive active, driving mode • <i>Red</i>: Drive active, braking active <p><i>System without HDC</i>: Tractive power reduced to minimum level</p> <p>HDC <i>System with HDC</i>: HDC function active.</p>																
3	<p>Operating mode icons</p> <p>The icons come into view to show the system mode and the mode changes:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 10%;">N</td> <td>Freewheeling is active in the manual drive-control mode.</td> </tr> <tr> <td style="text-align: center;"></td> <td>The vehicle is braking.</td> </tr> <tr> <td style="text-align: center;">AUX</td> <td>Auxiliary valve control is active.</td> </tr> <tr> <td style="text-align: center;">D1 D2 R</td> <td>The icons come into view only during the change. The icons stay out of view during the drive.</td> </tr> <tr> <td style="text-align: center;">OFF</td> <td>SPD Driving functions are disabled in the automatic drive-control mode. The system is continuously in the freewheeling mode until the functions are enabled from the display.</td> </tr> <tr> <td style="text-align: center;"></td> <td>SPD Freewheeling in the automatic drive-control mode. Driving speed is above the drive activation speed range.</td> </tr> <tr> <td style="text-align: center;"> </td> <td>SPD Motion detection is active in the automatic drive-control mode.</td> </tr> <tr> <td style="text-align: center;"></td> <td>SPD Timeout in motion detection. Press brake to activate the motion detection again.</td> </tr> </table>			N	Freewheeling is active in the manual drive-control mode.		The vehicle is braking.	AUX	Auxiliary valve control is active.	D1 D2 R	The icons come into view only during the change. The icons stay out of view during the drive.	OFF	SPD Driving functions are disabled in the automatic drive-control mode. The system is continuously in the freewheeling mode until the functions are enabled from the display.		SPD Freewheeling in the automatic drive-control mode. Driving speed is above the drive activation speed range.	 	SPD Motion detection is active in the automatic drive-control mode.		SPD Timeout in motion detection. Press brake to activate the motion detection again.
N	Freewheeling is active in the manual drive-control mode.																		
	The vehicle is braking.																		
AUX	Auxiliary valve control is active.																		
D1 D2 R	The icons come into view only during the change. The icons stay out of view during the drive.																		
OFF	SPD Driving functions are disabled in the automatic drive-control mode. The system is continuously in the freewheeling mode until the functions are enabled from the display.																		
	SPD Freewheeling in the automatic drive-control mode. Driving speed is above the drive activation speed range.																		
 	SPD Motion detection is active in the automatic drive-control mode.																		
	SPD Timeout in motion detection. Press brake to activate the motion detection again.																		

4	5
<p>System without speed sensors is always in the manual drive-control mode.</p> <p>SPD Drive-control mode indication</p> <p>Drive-control mode indication is only visible in a system with speed sensors.</p> <ul style="list-style-type: none">• A Automatic drive-control mode• M Manual drive-control mode.	<p>Current gear</p> <ul style="list-style-type: none">• N: Freewheeling• D1: Drive forward, speed range 1• D2: Drive forward, speed range 2• R: Drive reverse.

7 Operating functions

7.1 Drive-control modes

The drive-control mode has an effect on the system functions and how you can use the system. In this manual, when the information in the section relates to a driving mode, the driving mode symbols are used, as shown in the table that follows:

Table 1: Drive-control modes

Symbol	Description
M	<p>Manual drive-control mode</p> <p>Manual drive control mode is available in all CTR101 systems.</p> <p><u>The system without the speed sensors only has the manual drive-control mode.</u></p> <p>In this mode the drive activation and most of the operations are manual.</p> <p>SPD</p> <p>You can enter the manual drive-control mode on the display. See 5.2 Menu, 2. Main settings. Use the manual drive-control mode if you must have an accurate control on the driving functions. This can be useful in special situations (for example, if the vehicle is stuck).</p>
A	<p>Automatic drive-control mode</p> <p>SPD This mode is only available in systems with speed sensors.</p> <p>The automatic drive-control mode in the CTR101 control system uses speed and direction measurements from the wheel motor speed sensor. In this mode the control system can perform several driving functions automatically. Thus, it requires less operations from the user. In the automatic drive-control mode also the manual drive operations are possible while the automatic functions are active.</p>

DISPLAY The selected drive-control mode symbol is shown in the main view. The system without the speed sensors is always in the manual drive-control mode and the symbol is not shown.

PANEL Mode indication and mode selection are not available on the operating panel.

Table 2: Drive-control mode comparison

System configuration	CTR101 without speed sensors	SPD CTR101 with speed sensors	
Mode	Manual (not possible to change)	Automatic	Manual
Display symbol	No symbol	A	M
Drive activation	Manual	Automatic • When the vehicle starts to move Manual with restrictions ^{1), 2)}	Manual with restrictions ¹⁾
Drive direction selection	Manual	Automatic Manual with restrictions ²⁾	Manual with restrictions ²⁾
Switching between the speed ranges (D1/D2)	Manual	Automatic Manual shift commands also allowed.	Manual
Return to tractive power after braking	Manual	Automatic if the vehicle moves	Manual
Switching to freewheeling	Automatic if • The pressure is low.	Automatic if • The speed is high • The pressure is low.	Automatic if • The pressure is low.
Assisting traction control (ATC) modes	• Automatic, timer controlled • Continuous.	• Automatic, speed controlled • Continuous.	• Automatic, timer controlled • Continuous.

¹⁾ Drive activation is allowed when the speed is below the maximum set driving speed.

²⁾ Drive activation to the opposite driving direction is possible only at low speeds.

7.2 Tractive power level selection

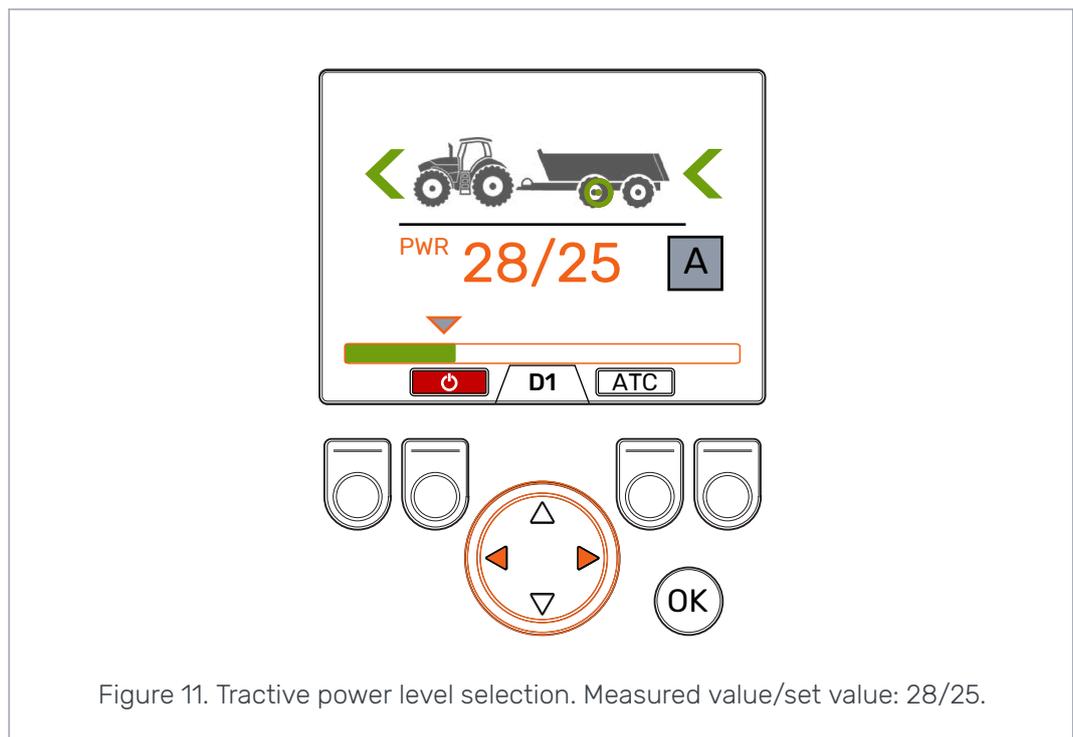
DISPLAY

You can use the arrow buttons to change the power level (*left*, to decrease the level or *right*, to increase the level). The power level changes in 25% steps of the maximum power level.

You can set the value in the freewheeling mode and change it during the driving mode.

- Decrease power: <
- Increase power: >

The green bar shows the measured value and the grey arrow above it shows the set value.



PANEL

You can rotate the knob to adjust the power level. The power level changes in 5% steps of the maximum power level.

You can set the value in the freewheeling mode and change it during the driving mode.

- Decrease power: Rotate the knob counterclockwise.
- Increase power: Rotate the knob clockwise.

Four LED segments around the knob show the selected power level. The light intensity of a LED segment gradually increases with the level setting. Each fully lit segment represents 25 % of the maximum power level.

- The backlight color is **white** during freewheeling. It shows the preselected tractive force level.
- The backlight color is **green** during driving. It shows the selected tractive force level.
- **HDC** The backlight color is **red** during HDC operation. It shows the selected HDC level.

Power level	0%	25%	50%	75%	100%
Indication on panel					

7.3

Driving and freewheeling functions in the manual drive-control mode

M



Note:

Do not activate the drive if the driving speed is above the working speed range.

SPD The system prevents this automatically.



Note:

If you drive forward, you can change directly from freewheeling to D2 speed range.



Note:

Do not activate the drive in the opposite direction when the vehicle moves fast.

SPD The system prevents this automatically.

When the vehicle moves very slowly, it is possible to activate the drive to the opposite direction.



Note:

Do not use the driving modes in road traffic.

DISPLAY

The gear indicator at the bottom of the screen shows the current mode of the drive system.

Use the *up/down* arrows and the *F2* button to change between the freewheeling (N) and the driving modes (D1, D2 and R).

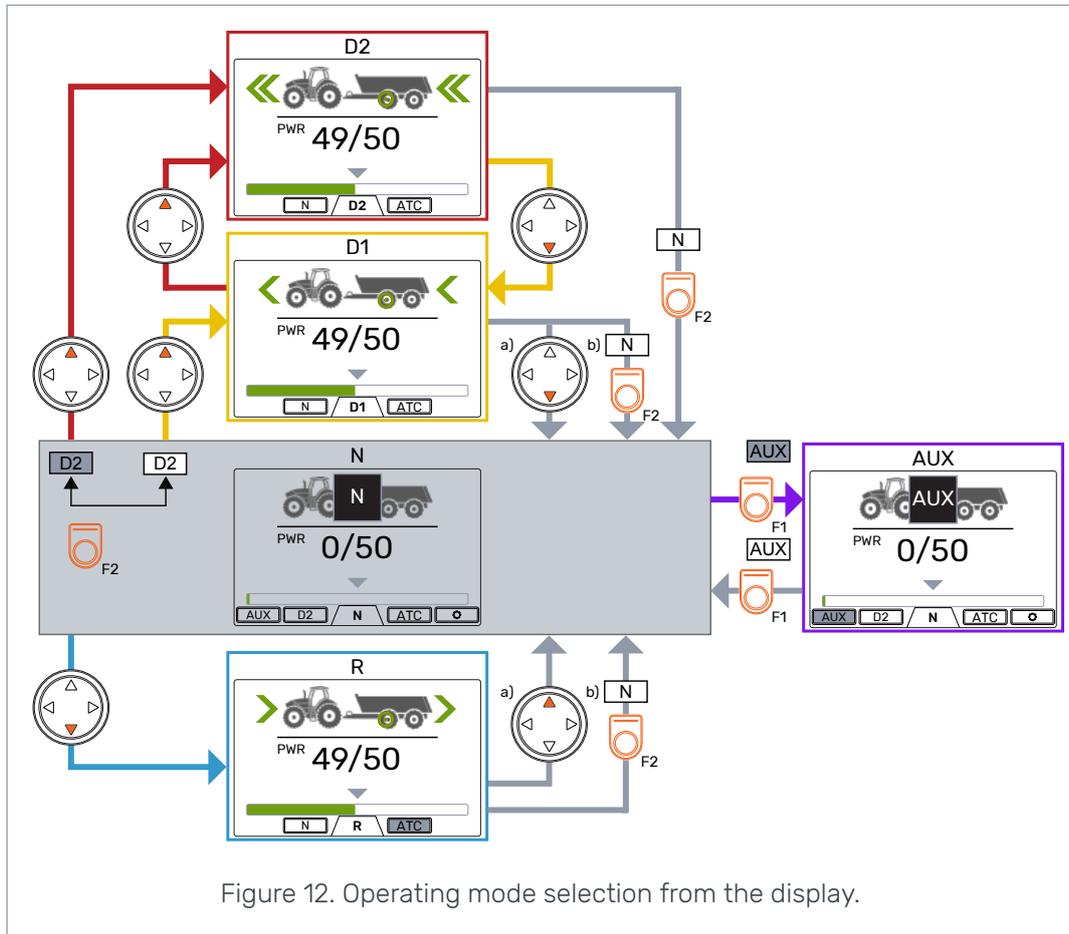


Figure 12. Operating mode selection from the display.

PANEL

On the operating panel you can change between the driving modes as follows:

- **L1 button:** Push to activate drive forward. Uses the selected speed range (R1 button).
- **L2 button:** Push to change to freewheeling mode.
- **L3 button:** Push to activate reverse driving.
- **R1 button:** Push to select between speed ranges D1 and D2:
 - Light off – D1 selected, green light – D2 selected
 - During neutral – speed range preselection for forward drive command.
 - During forward driving – shifts between speed ranges.
- **Knob:** Tilt up / down to change between the driving and freewheeling modes (D1 / D2 / N / R).
- **Knob:** Push down to activate the freewheeling mode.

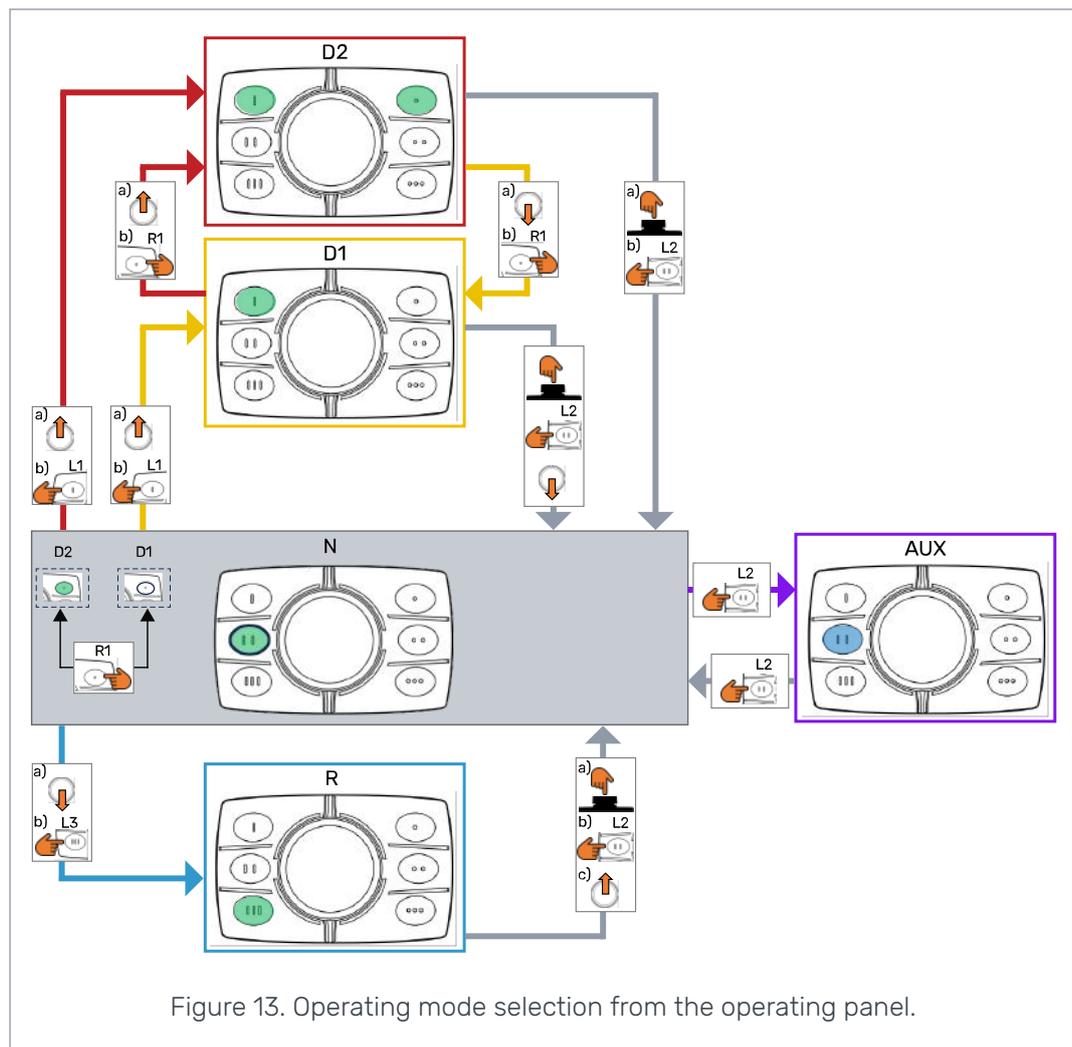


Figure 13. Operating mode selection from the operating panel.

Automatic freewheeling (N)

If the pressure level is not sufficient due to increased driving speed, the system automatically switches to the freewheeling mode.

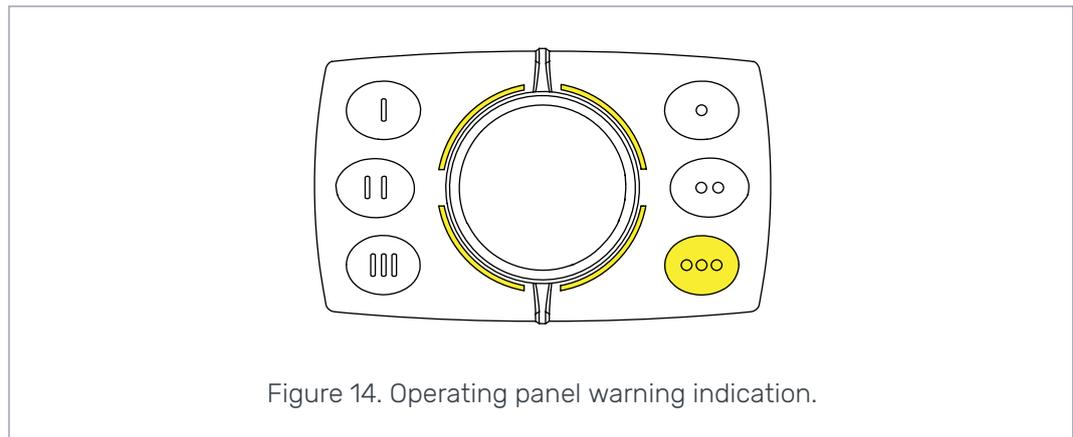
DISPLAY The status bar at the top of the main view shows the warning *Pressure_low* when the system automatically switches to freewheeling.

Push the *OK* button to remove the warning. The warning also goes out of view when the drive is activated again.

The parameter table (see chapter [8.1 User parameters](#)) gives the parameters that have an effect on the automatic freewheeling function.

PANEL When the system switches to freewheeling due to low pressure, all segments around the knob have yellow backlight. R3 button also has yellow backlight as an indication of a warning.

Push the R3 button to remove the warning. The warning also goes out of view when the drive is activated again.



7.4 Driving and freewheeling functions in the automatic drive-control mode

A

SPD

In the automatic drive-control mode the system can perform the following driving functions automatically:

- Activate the drive towards the direction of movement
- Change between the D1 and D2 gears
- Return to the same tractive power level after braking
- Switch to neutral when the machine is stopped with brakes
- Activate the assisting traction control (ATC) function at low speed.

DISPLAY

The driving mode indicator and the direction arrows show the current state of the automatic drive-control mode.

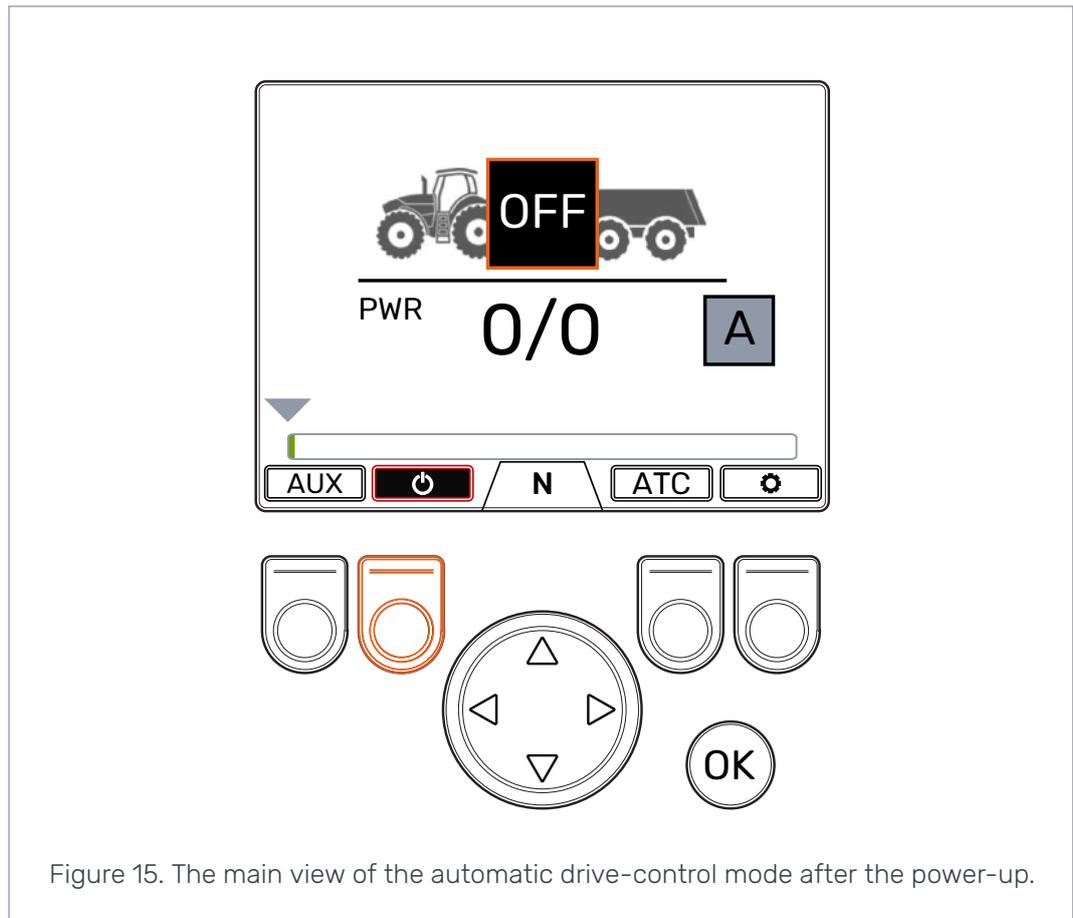


Figure 15. The main view of the automatic drive-control mode after the power-up.

Activating and deactivating automatic driving functions

Push the *F2* button to toggle the automatic driving functions **ON** and **OFF**. When the background color of the power icon is red the driving functions are enabled. When the background color of the power icon is black and the driving mode indicator shows **OFF**, the driving functions are disabled.

In the **OFF** state the motors are permanently in the freewheeling mode. Thus, the vehicle speed or direction changes do not have an effect on the mode.



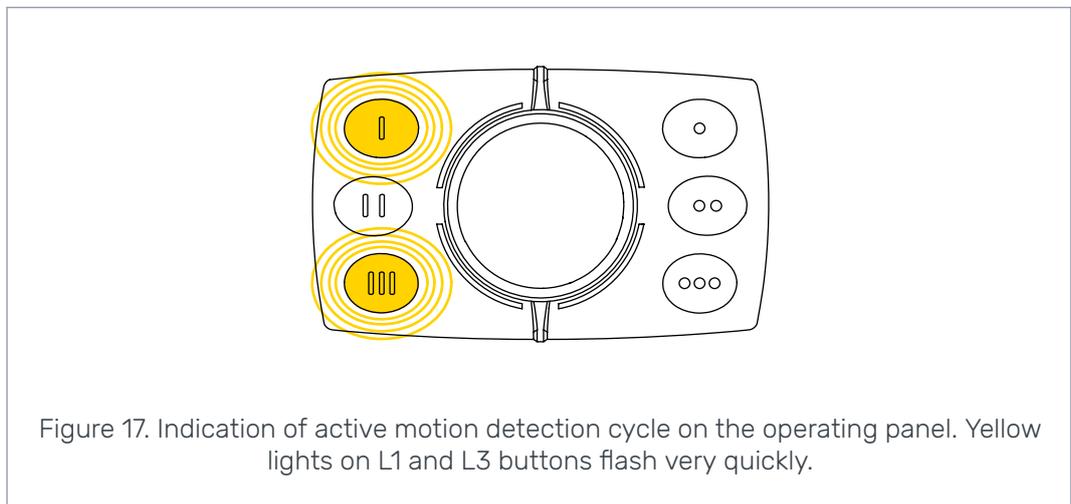
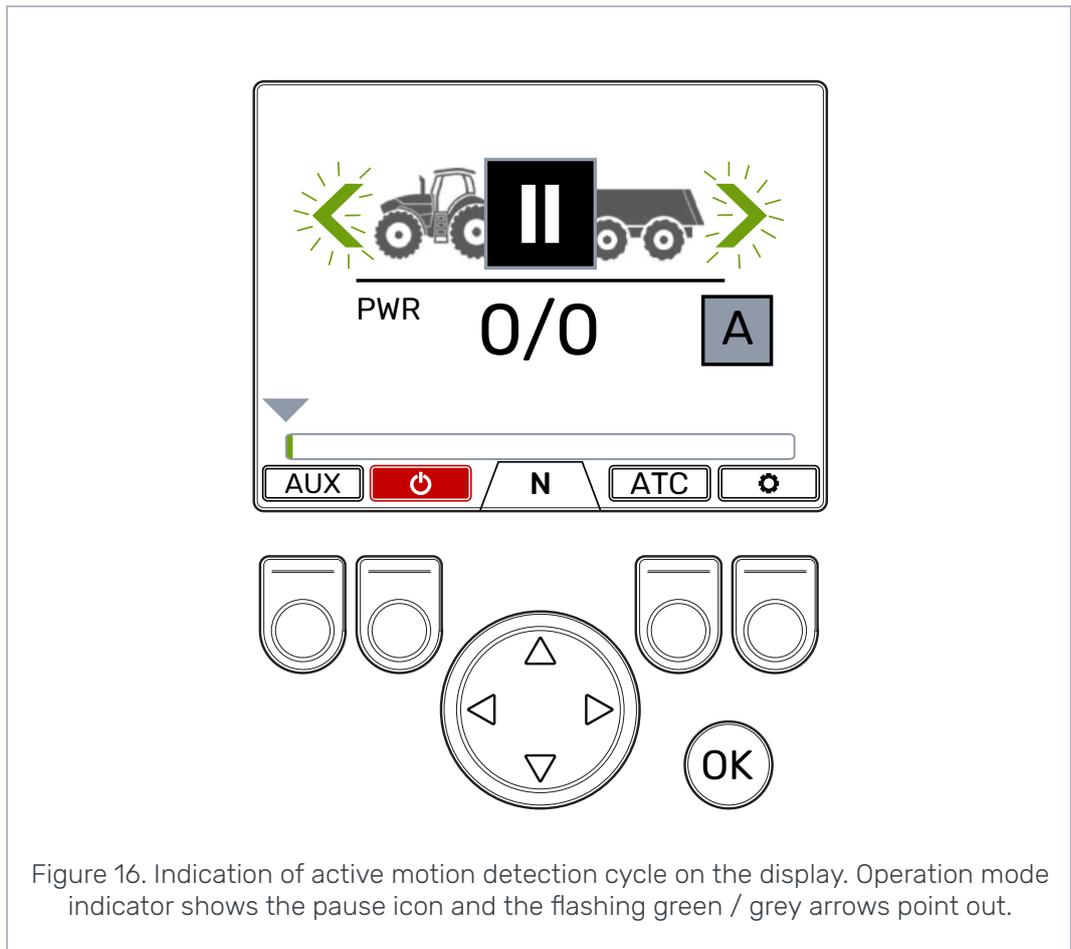
Danger:

The system **immediately** switches to the driving mode in the direction of travel when you toggle the automatic driving functions **ON** and the vehicle moves at the working speed.

Motion detection and automatic drive activation

The automatic drive-control mode can activate the drive when it detects that the machine moves.

The automatic drive activation is available during the motion detection cycle.



If the machine does not move during the motion detection cycle, the system enters the timeout state. In the timeout state the automatic activation of the drive is not in operation. The motion detection cycle activates again when you press the brake pedal. If the machine moves during this cycle, the drive activates to the driving direction. The tractive power is always at the minimum level when the brake pedal is pressed.

The motion detection cycle is five seconds long and it activates again when you release the brake pedal. If the speed is above D1 or R range after releasing the brake, motion detection does not activate.



Danger:

When you press the brake pedal, the drive can activate again. Deactivate the automatic driving functions when you do not need to use the drive.



Danger:

Automatic drive-control mode can activate the drive. Use automatic drive-control mode only when you have full attention to driving operations.

Motion detection function activates the drive in the direction of movement.

For example, a slope or an uneven surface can cause a detectable movement. This can cause an accidental drive activation or activation in the opposite direction to what you wanted.

Always be prepared to press the brake pedal or deactivate the drive.



Danger:

Always power-off the system when you leave the vehicle.

Always change the automatic drive-control mode to **OFF** state, lock the panel and the display keypad lock, or change the control mode to manual when you use the drive system.

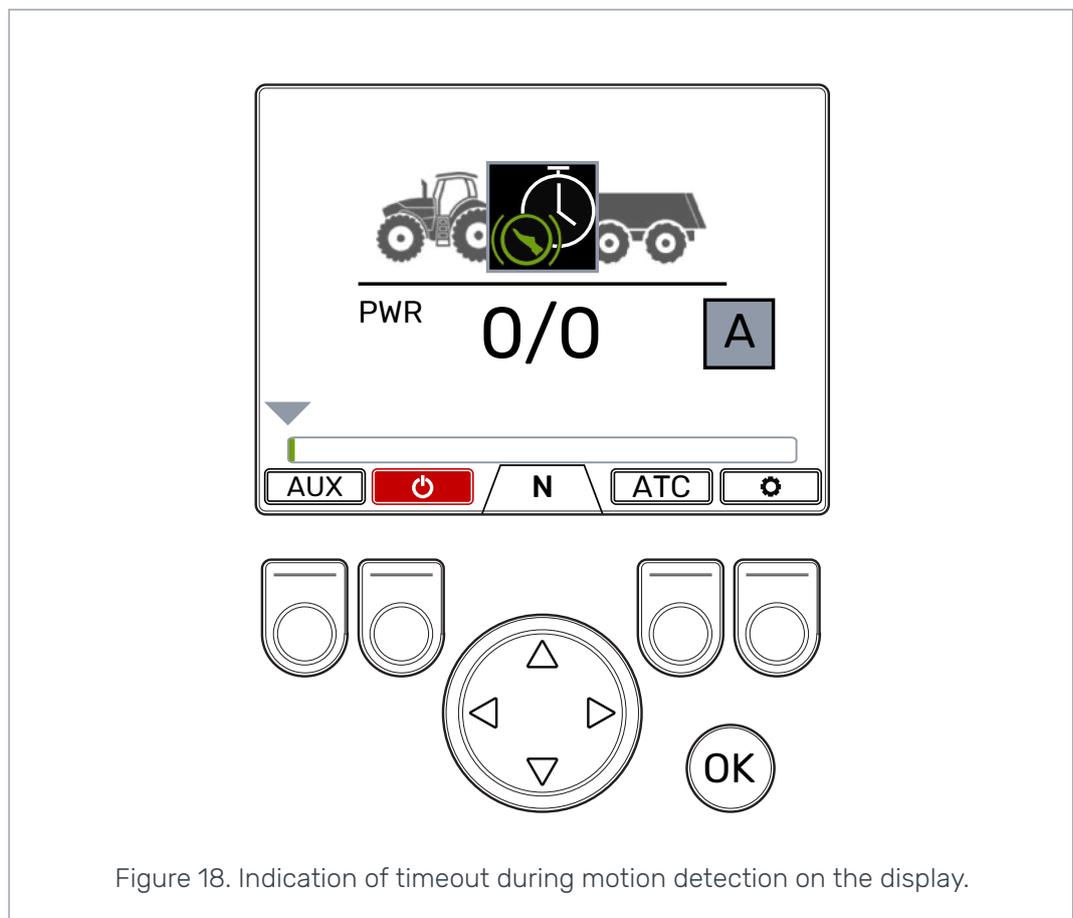
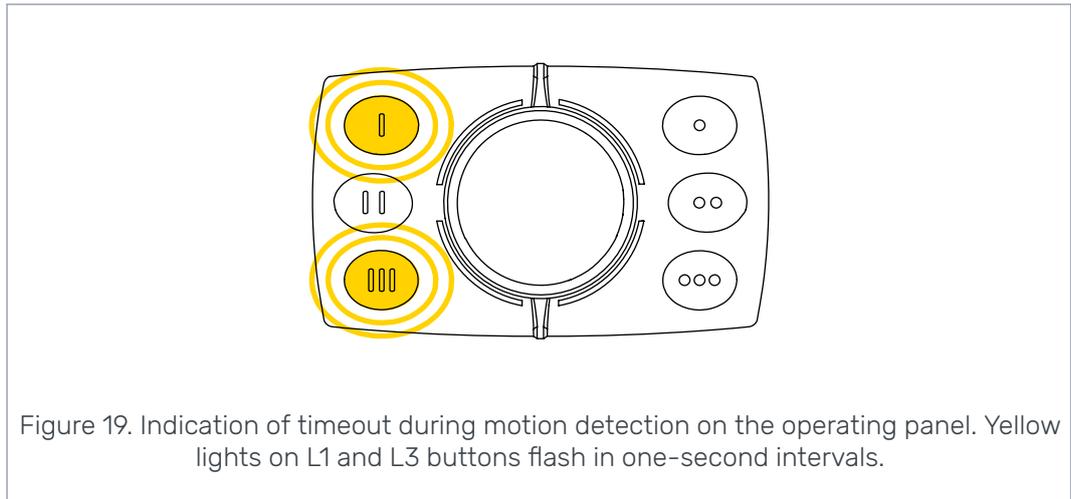


Figure 18. Indication of timeout during motion detection on the display.



Manual drive activation commands

In the automatic drive-control mode you can also manually activate the drive in the selected direction. When the state is OFF, the use of the manual drive direction selection activates the drive and switches the automatic driving functions on. The system prevents the activation of the drive if the speed is too high. Drive activation to the opposite driving direction is possible only at low speeds.

Use the manual drive commands as instructed in the manual drive-control mode instructions.

Shifting in the automatic drive-control mode

The control system switches between the D1 and D2 speed ranges based on the vehicle speed. It is also possible to manually shift between speed ranges as in the manual drive-control mode instructions. Shifting manually does not disable automatic shifting functions and the system continues to do speed related shifts.

Automatic freewheeling in the automatic drive-control mode

When the vehicle speed increases above the maximum speed limit, the system switches the motors to freewheeling.

As in the manual drive-control mode, the system can also switch to freewheeling due to too low pressure level.

When the speed is above the maximum activation speed, the speedometer icon comes into view and the state changes to OFF. You can activate the drive again when the speed is back in the working speed range:

- **DISPLAY** Change the state back to ON. (F2)
- Manually select the driving direction from the display or the operating panel.

DISPLAY See chapter [8.1 User parameters](#) for the automatic freewheeling conditions and how to set the related parameters.

7.5 Braking in driving mode without the HDC

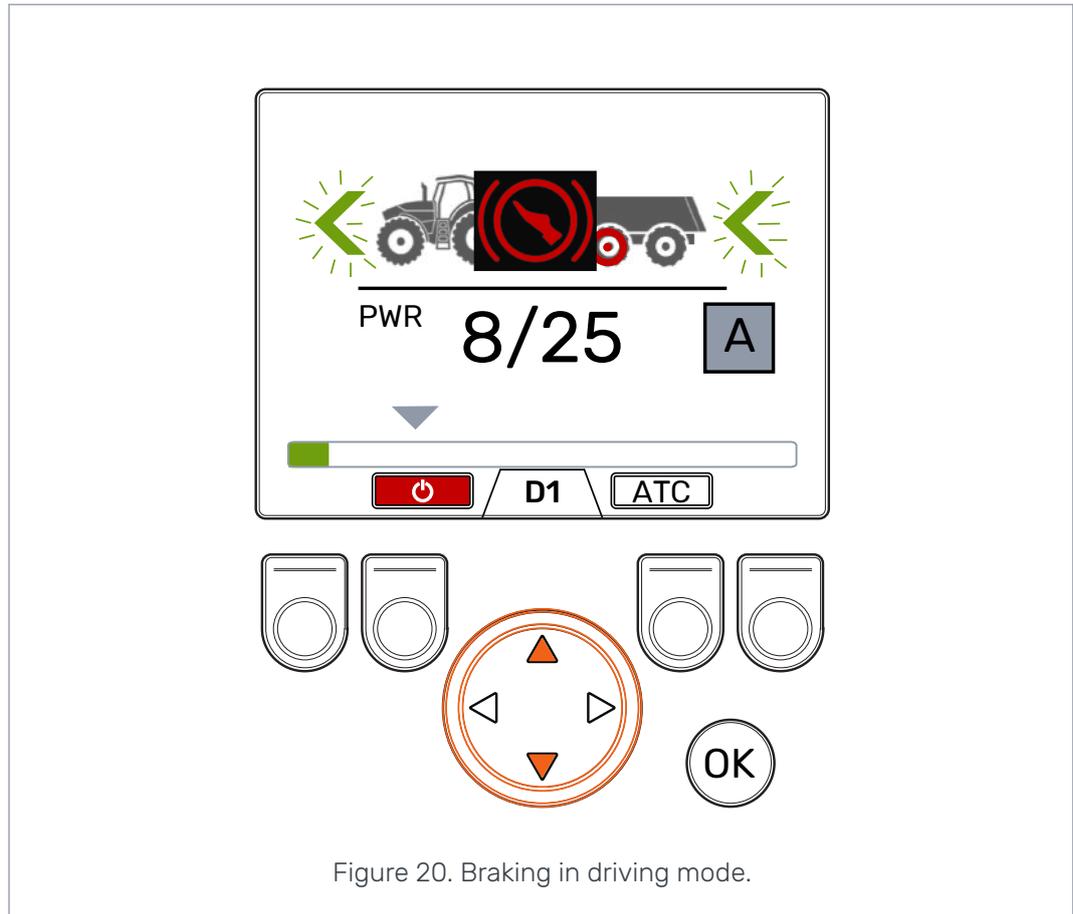
Braking function works differently in a system with the HDC. See chapter [7.6 Braking in driving mode with the HDC function](#) for the details.

7.5.1 Operation during braking

When the vehicle brakes the tractive power reduces to the lowest level.

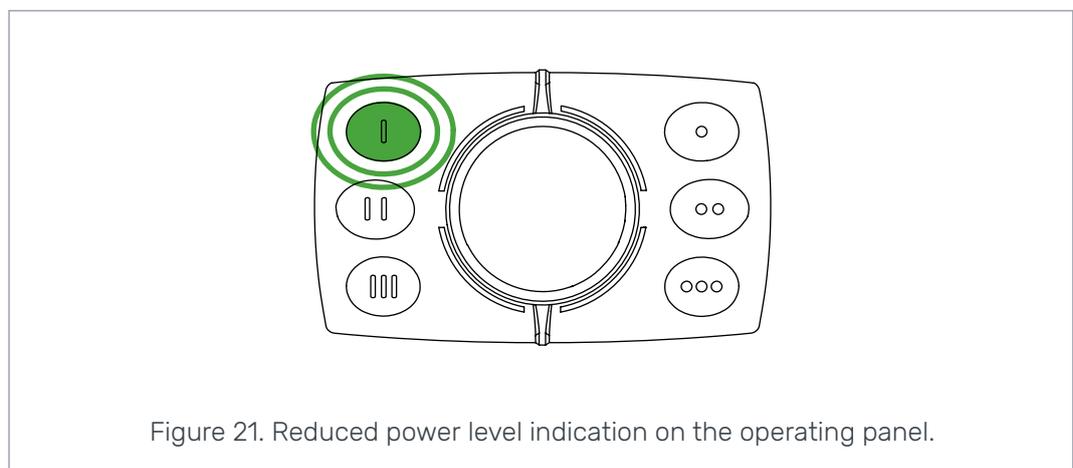
DISPLAY

The brake icon comes into view and the trailer wheel color changes to red. The direction arrows flash which is an indication that the minimum power level is in use.



PANEL

Green flashing light on the selected driving direction button (L1 or L3) is an indication of reduced power level.



7.5.2 Operation after releasing the brake



After the braking, the tractive power level stays at the minimum level. To return the tractive power to the selected level:

DISPLAY

- If the vehicle moves forward, push the arrow button up
- If the vehicle moves rearward, push the arrow button down.

PANEL

Push the flashing direction button (L1 or L3) or tilt the knob towards the selected driving direction.



After the braking, the tractive power returns to the set level unless the vehicle has come to a full stop. In case of a full stop, the system switches to freewheeling mode and starts the motion detection cycle.



Attention:

After stopping the vehicle, always make sure that the drive is switched off.

7.6 Braking in driving mode with the HDC function

HDC

7.6.1 Operation during braking

If the driving mode is either forward or reverse, the HDC function activates when the vehicle brakes.

DISPLAY

The HDC text comes into view and the power bar color changes to red.

When the HDC function operates the values shown on the display represent the intensity of the HDC function instead of the tractive power. During braking you can adjust the level with the left and right arrow buttons. There are four intensity presets and you can select their levels in the parameter menu.



Note:

DISPLAY + PANEL

If both a panel and a display are connected, you can only adjust the HDC level from the panel. Preset levels are not in operation.

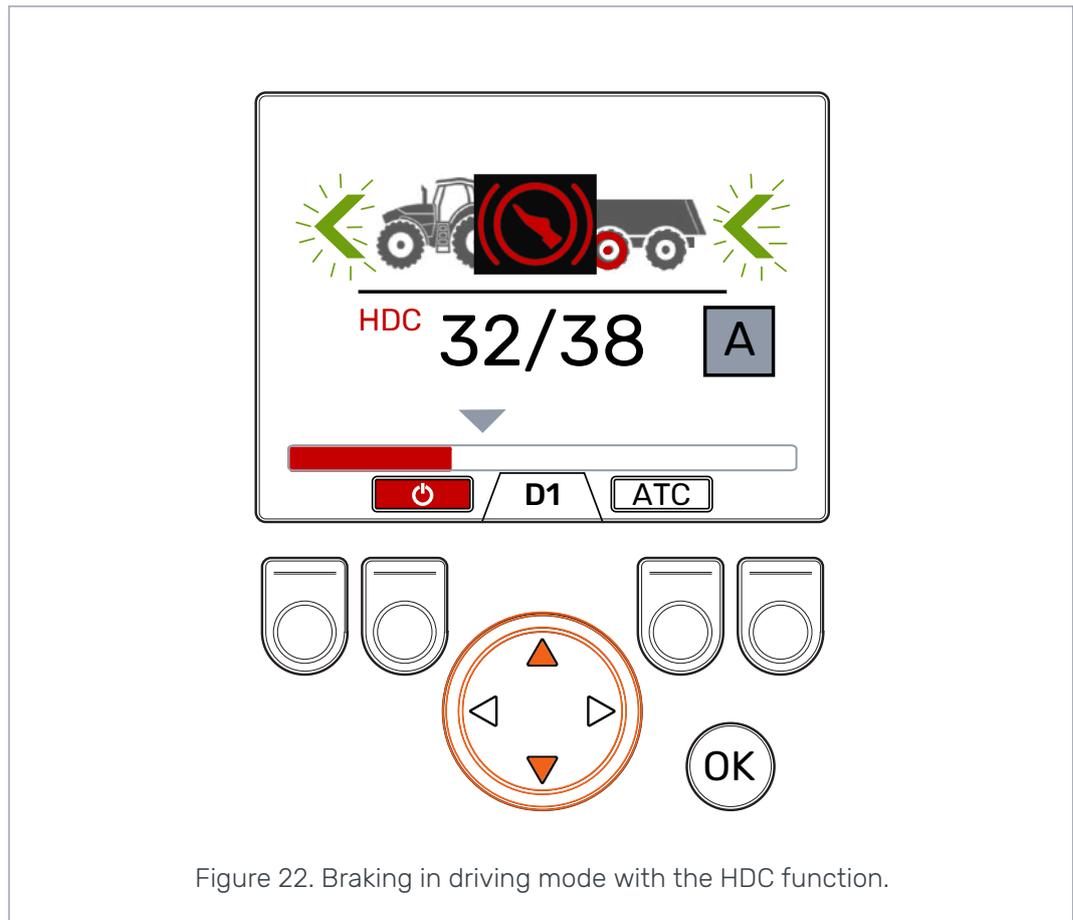


Figure 22. Braking in driving mode with the HDC function.

PANEL

Green flashing light on the selected driving direction button (L1 or L3) is an indication of reduced power level due to braking. Red LED segments show the selected intensity of the HDC. You can adjust the intensity during braking.

- Decrease level: Rotate the knob counterclockwise.
- Increase power: Rotate the knob clockwise.

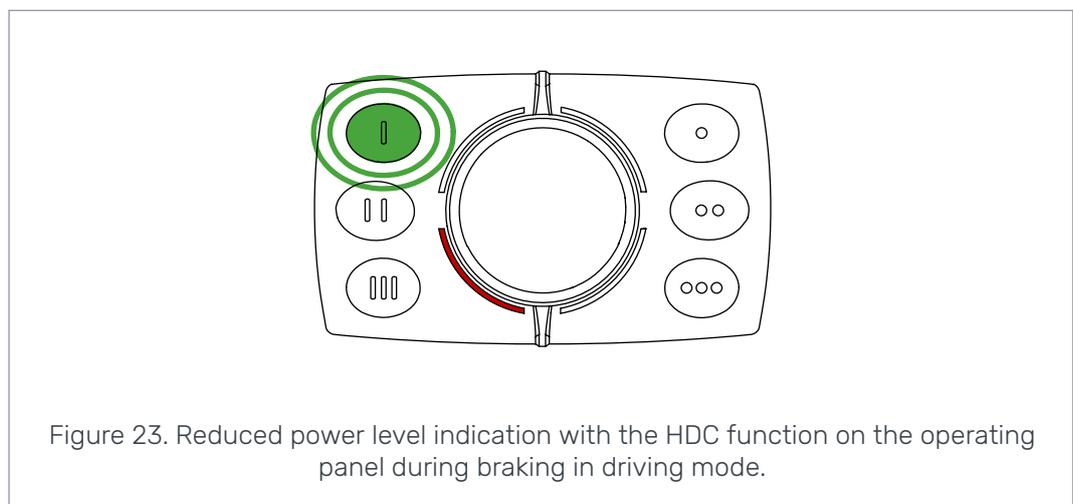


Figure 23. Reduced power level indication with the HDC function on the operating panel during braking in driving mode.

Speed range selection during HDC

You can use the HDC during all driving speeds. If the flow to the motors is not sufficient for the driving speed, the vehicle loses the deceleration power. If the speed is too high during the HDC function, the system shows a warning of the low flow level:

- **DISPLAY** *Overspeed* warning shows on the display.
- **PANEL** R3 button light and the left-side segments are yellow.

In case of the warning, decrease the speed or use D2 speed range instead of D1.

The deceleration is stronger in the D1 speed range.



Attention:

Deceleration force changes along with the speed range selection. This can have an effect on the vehicle speed and/or handling.



You can change the speed range as in the driving mode.



The system changes the speed range automatically during the HDC operation. Manual shifting is also possible.

7.6.2

Operation after releasing the brake



The HDC function stops after the braking, but tractive power stays at reduced level.

To return the tractive power to the selected level:

DISPLAY

- If the vehicle moves forward, push the arrow button up
- If the vehicle moves rearward, push the arrow button down.

PANEL

- Push the flashing direction button (L1 or L3) or tilt the knob to the selected driving direction.



The HDC function stops after the braking. After the braking, the tractive power returns to the set level unless the vehicle has come to a full stop. In case of a full stop, the system switches to freewheeling mode and starts the motion detection cycle.



Danger:

After stopping the vehicle, always make sure that the drive is switched off.



Note:

Continuous operation of the HDC function can cause the hydraulic fluid temperature to increase.

It is important to monitor the fluid temperature during operation.

7.7

Assisting traction control (ATC)

The assisting traction control (ATC) helps the vehicle to move in difficult conditions.

The ATC function restricts the flow to the wheels that do not have enough traction. This increases the torque on the wheels that have more traction.



Note:

The use of the ATC functions for long periods when the wheels have no traction can cause the hydraulic fluid temperature to increase.



Note:

You can control the ATC only for the forward drive from the system display. The mode that shows on the display does not have an effect when the vehicle moves rearward. The ATC is always continuously on when the vehicle moves rearward.



Note:

ATC gives more traction to the wheels but it does not fully prevent the wheels from slipping. Thus, it is normal that some of the wheels do slip during the ATC operation.



Note:

If the wheels slip a lot, the measured power levels that you see on the display are not necessarily correct.



Note:

If the flow is not sufficient due to, for example, low tractor-pump rotation speed, the ATC does not operate correctly. To make sure that the ATC can operate correctly, the tractor's pump (engine) speed must be sufficient.



Note:

Use the ATC when you drive on difficult terrain and on soft grounds.

M

ATC operation in the manual drive-control mode

DISPLAY

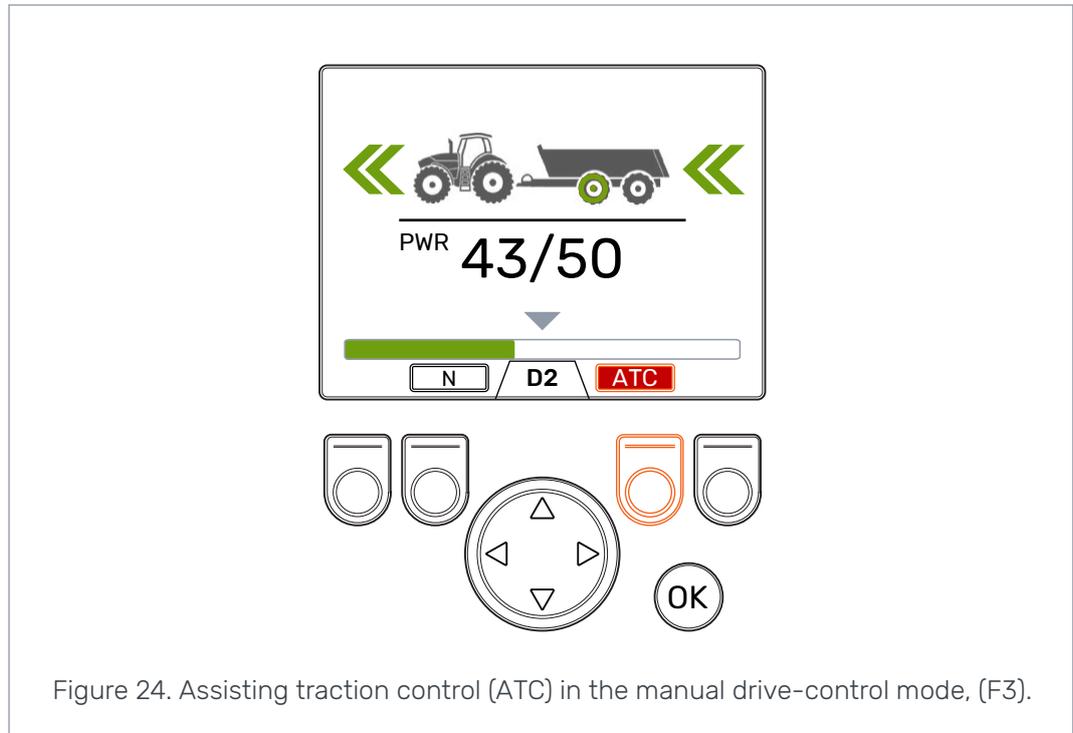
Push the *F3* button to enable and disable the assisting traction control (ATC). The ATC selection is available in all operating modes. The *ATC* icon above the *F3* button is grey when the assisting traction control is enabled.

The value of the parameter *ATC max. time [s]* has an effect on how the ATC function operates:

- Value = 0: The ATC is **ON** continuously during the drive.
- Value = 1 or greater: The automatic switch-off delay is in operation. The parameter value (1 or greater) gives the time in seconds for how long the ATC stays active. The ATC is continuously **ON** for the set time every time you activate the forward

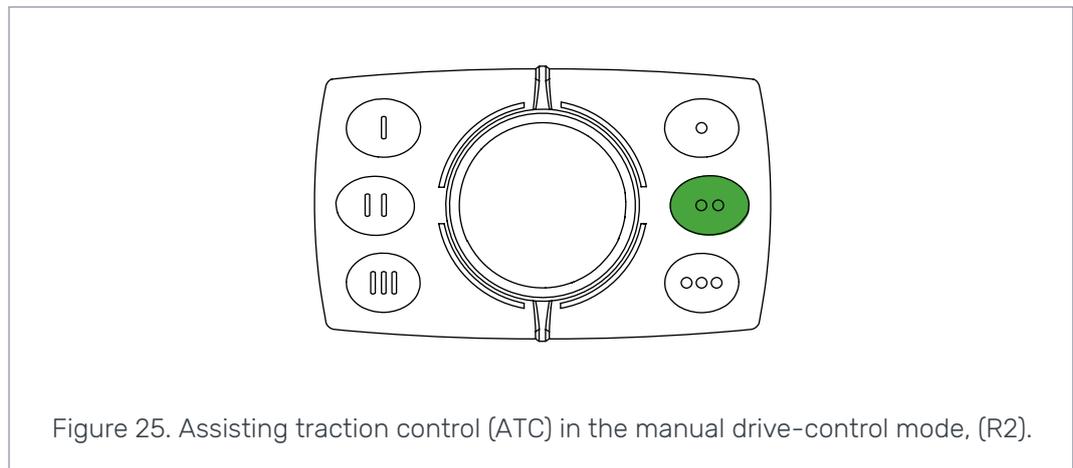
Operating functions

driving mode. When the ATC times out, the background color of the ATC icon becomes red. Push the *F3* button to switch **ON** the ATC again for the set time. When the system switches to freewheeling the switch-off delay resets. When you activate the forward driving mode again, the ATC is **ON**.



PANEL

Push the R2 button to enable and disable the assisting traction control (ATC). The ATC selection is available in all operating modes. The backlight of the R2 button is green when the assisting traction control is enabled.



A

ATC operation in the automatic drive-control mode

The assisting traction control (ATC) function is automatically enabled when the flow is sufficiently low. The ATC function operates without a visual indication on the display / operating panel.

You can also activate the continuous operation of the ATC in the automatic drive-control mode.

DISPLAY

Push the *F3* button to start the continuous operation of the ATC in the automatic drive-control mode.

ATC The ATC function is in the automatic operation mode when the background color of the function icon is black.

ATC The ATC function is in the continuous operation mode when the background color of the icon is grey.

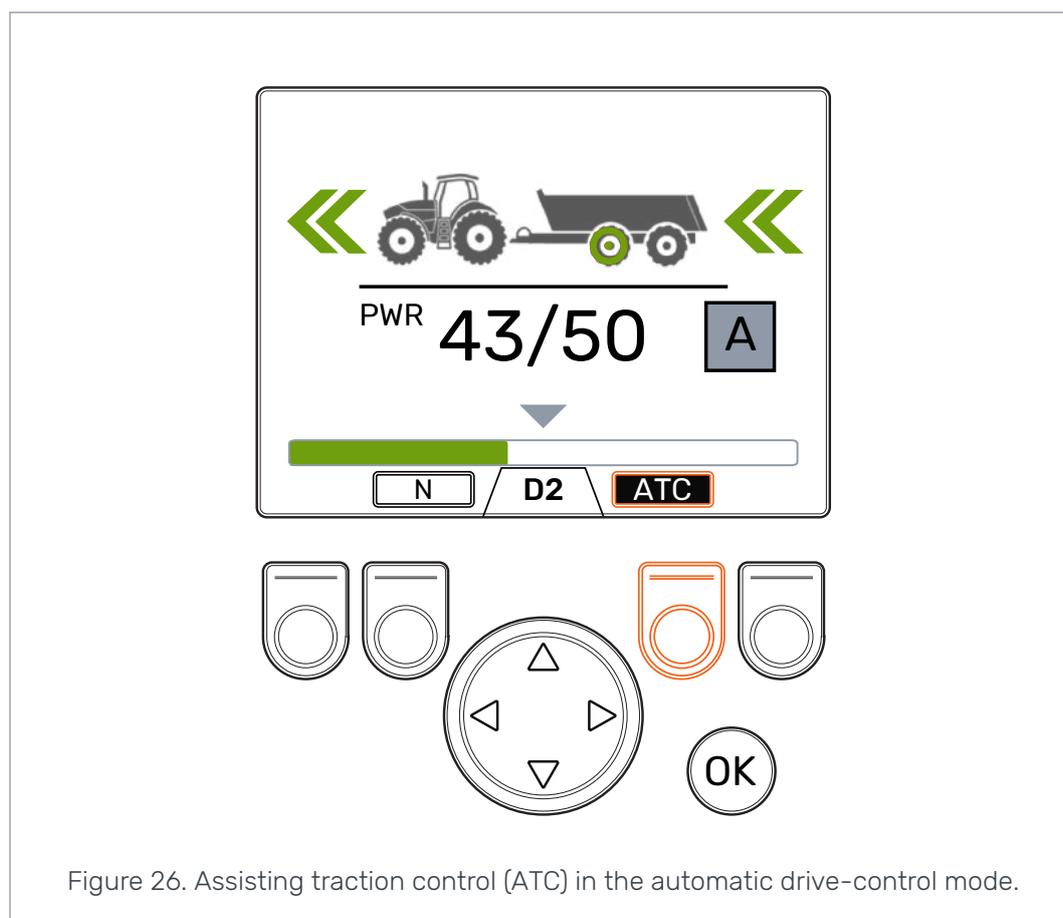


Figure 26. Assisting traction control (ATC) in the automatic drive-control mode.

PANEL

Push the R2 button to start the continuous operation of the ATC in the automatic drive-control mode. The backlight of the R2 button is green when the assisting traction control is in the continuous operation mode.

7.8

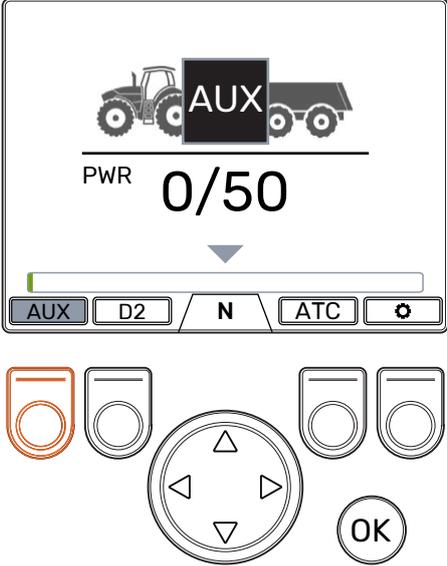
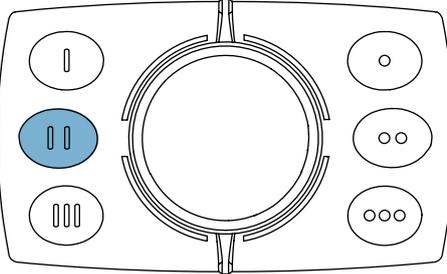
Auxiliary valve control (AUX) (option)

The AUX function is application specific. The AUX function works like a toggle switch for an external device. For example, a timber trailer can have a selector valve for the crane. In this case the AUX function activates the selector valve for crane operations.

You can activate the AUX function when the system is in the freewheeling (N) mode. The driving modes are not available while the AUX function is activated.

Operating functions

The machine manufacturer sets whether the AUX output connection is energized or de-energized during function.

<p>DISPLAY</p> <p>Push the <i>F1</i> button in the main view to toggle the AUX function on and off.</p>	
<p>PANEL</p> <p>Push the L2 button to toggle the AUX function on and off.</p> <p>Blue backlight of the button is an indication that the AUX function is activated.</p>	

7.9

Keypad lock

You can lock the user interface keypad to prevent accidental operation of the system:



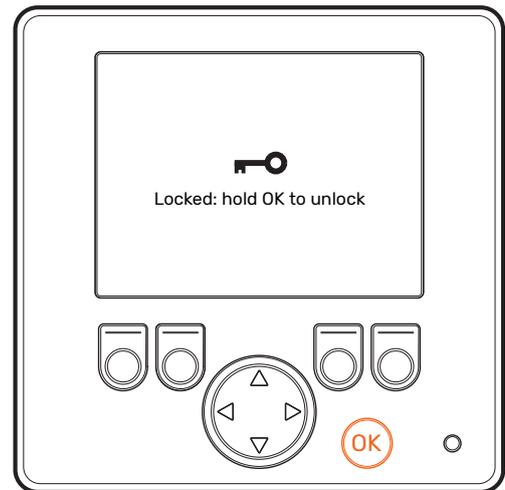
Note:

You can lock the display / panel only during freewheeling. AUX function can stay active when you lock the keypad.

DISPLAY

Push and hold the *OK* button for 2 seconds in the main view to lock and unlock the display keypad.

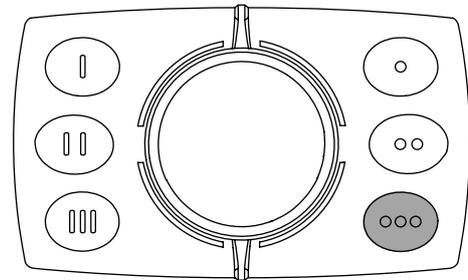
Lock screen is an indication that the keypad lock is in use.



PANEL

Push and hold the R3 button for 2 seconds in the freewheeling mode to lock or unlock the panel functions.

Dim white backlight of the button is an indication that the panel lock is in use. All other indicator lights are off.



Danger:

Make sure that you lock the keypad(s) when you drive on road.

8 Setup

8.1 User parameters

DISPLAY

You can only set the parameters from the display.

Adjust the listed parameters before you use the system for the first time.

Parameter	Description	Possible values
2-speed function	Shows if the 2-speed function is available to use (speed range selection D1 / D2).	<p>0 / 1</p> <p>0: No 2-speed function. Speed range D1 in operation during forward drive. <u>1-speed motors are connected to the system.</u></p> <p>1: 2-speed function in operation. Speed ranges D1 and D2 in operation during forward drive. <u>2-speed motors are connected to the system.</u></p>
ATC max. time [s]	Sets the automatic switch-off delay for the ATC function.	<p>0 – 120</p> <p>0: No automatic switch-off. The system does not deactivate the ATC automatically.</p> <p>1 – 120: ATC automatic switch-off delay in seconds. See chapter 7.7 Assisting traction control (ATC) for the description of ATC use.</p>
Minimum pressure level [bar]	<p>If the working pressure decreases below the adjusted value, the driving mode automatically switches to freewheeling.</p> <p> Note: <i>Minimum pressure delay [ms]</i> and <i>Disengagement speed [km/h]</i> do also have an effect on the automatic freewheeling.</p>	<p>10 – 30 bar: Minimum pressure value [bar].</p> <p>Too low pressure value can cause rattling sound before the automatic freewheeling activates.</p> <p>Too high pressure value can cause the automatic freewheeling to activate too quickly. It can also cause problems when you activate the driving mode.</p>
Minimum pressure delay [ms]	<p>Time delay that has an effect on the sensitivity of the automatic freewheeling when the working pressure decreases.</p> <p> Note: <i>Minimum pressure level [bar]</i> and <i>Disengagement speed [km/h]</i> do also have an effect on the automatic freewheeling.</p>	<p>1 – 2000 ms: Reaction time to the pressure decrease [ms].</p> <p>Too short time can cause the system accidentally switch to freewheeling during fast moves.</p> <p>Too long time can cause rattling sound from the motors during fast acceleration before the automatic freewheeling.</p>

Parameter	Description	Possible values
Power change ramp	Ramp time that has an effect on the power level adjustment from the display.	<p>0 – 4</p> <p>0: The shortest time – fastest power level change.</p> <p>4: The longest time – the smoothest power level change.</p> <p>If it is necessary to change the power level quickly during the drive, reduce the value.</p> <p>If the power level changes too quickly during the drive, increase the value.</p>
Maximum pressure level [bar]	<p>Maximum system pressure level you can adjust.</p> <p>The 100% power level you see on the display equals to the maximum pressure level of the system.</p>	<p>0 – 320 bar</p> <p>Adjust the value to the available pressure level.</p> <p>Make sure that the allowed operating pressures of other components are in this range (hydraulic motors, pump, hoses, etc.).</p> <p>If the value is low, the pressure level and the tractive power do not increase.</p> <p>If the value is too high, the system cannot get to the highest power level.</p>
Drive activation ramp	<p>Pressure level adjustment ramp time.</p> <p>It has an effect on the power level increase when you activate the drive.</p>	<p>0 – 4</p> <p>0: The shortest ramp time – sharp drive activation.</p> <p>4: The longest ramp time – smooth drive activation.</p> <p>You can change the value to smoothen or sharpen the drive activation.</p>
Shifting ramp	Shifting ramp time has an effect on the rate of the speed range change and the sharpness of the change.	<p>0 – 4</p> <p>0: The shortest ramp time – sharp change of the speed range.</p> <p>4: The longest ramp time – smooth change of the speed range.</p> <p>You can change the value to smoothen or sharpen the speed range change.</p>

SPD Parameters for the speed sensor option		
Parameter	Description	Possible values
Disengagement speed [km/h]	<p>Sets the maximum speed for the driving in the automatic drive-control mode. If the speed reaches this value, the control system automatically switches the motors to the freewheeling mode.</p> <p>If 2-speed motors are in operation, the set value is for forward driving in the D2 speed range. The system automatically calculates a lower maximum speed value for the reverse driving.</p> <p>System can also switch to freewheeling if the pressure decreases below the set pressure level (see <i>Minimum pressure level [bar]</i> and <i>Minimum pressure delay [ms]</i>).</p>	<p>1 – 30 km/h</p> <p>The flow capacity and the displacement of the motors have an effect on the applicable value. See chapter 8.3 Setting the values for the automatic freewheeling that tells you how to set the automatic freewheeling parameters.</p>
Motion delay, stop	<p>Sets the delay for the automatic disengagement when the vehicle has stopped. During the delay the drive stays switched on but the tractive power is at the minimum level.</p> <p>When the vehicle moves extremely slowly the delay can prevent not necessary disengagement of the drive.</p>	<p>0 – 4</p> <p>0: The shortest delay.</p> <p>4: The longest delay.</p> <p>Initially, use the value 2.</p> <p>Use a lower value if the delayed disengagement causes inconvenience during the driving direction changes.</p>
Motion delay, start	<p>Sets the sensitivity of the motion detection for the automatic drive-activation function.</p>	<p>0 – 4</p> <p>0: The shortest delay – the drive activates quickly when the movements are small.</p> <p>4: The longest delay – the drive does not activate if the movements are slow and short-term.</p> <p>Initially, use the value 2.</p> <p>Decrease the value if the system must react more quickly to small movements.</p> <p>Increase the value if the system is too sensitive and reacts too quickly.</p>
Wheel circumference [mm]	<p>Value is used in converting the rotational speed to ground speed (km/h).</p>	<p>Measure the distance of one wheel revolution and set the value of the measurement to the parameter.</p>

SPD Parameters for the speed sensor option		
Parameter	Description	Possible values
Disengagement speed, delay	<p>Sets the delay for the <i>Disengagement speed [km/h]</i> condition.</p> <p>Longer disengagement delay can be useful when driving in slippery conditions.</p>	<p>0 - 4</p> <p>0: The shortest delay.</p> <p>4: The longest delay.</p> <p>Increase the value if the system makes unnecessary drive disengagements when the speed changes momentarily or when the wheels slip.</p> <p>Lower value gives fast disengagement during acceleration from the driving speed range.</p>
Automatic shift up, delay	<p>Sets the delay for the speed based shifting from low to high speed range in automatic drive control mode.</p> <p>Longer shifting up delay can be useful when driving in harsh or slippery conditions.</p>	<p>0 - 4</p> <p>0: The shortest delay.</p> <p>4: The longest delay.</p>
Automatic shift down, delay	<p>Sets the delay for the speed based shifting from high to low speed range in automatic drive control mode.</p> <p>The measured speed is not always stable. The speed can change significantly when driving in difficult conditions.</p> <p>Longer shifting down delay can decrease shifting to one direction and then back again.</p>	<p>0 - 4</p> <p>0: The shortest delay.</p> <p>4: The longest delay.</p>

HDC Parameters for the HDC function (Hill descent control)		
Parameter	Description	Possible values
HDC enabled	The parameter enables and disables the HDC function.	<p>0 / 1</p> <p>0: HDC function not in operation.</p> <p>1: HDC function in operation.</p>
HDC level 1, pressure [bar]	<p>HDC power control setting, level 1 (weakest slowing power).</p> <p><i>Only has an effect in a system without the operating panel.</i></p>	<p>The minimum permitted value is 1.</p> <p>The maximum permitted value is 100 or the value of the parameter <i>Maximum pressure level [bar]</i>.</p>

HDC Parameters for the HDC function (Hill descent control)		
Parameter	Description	Possible values
HDC level 2, pressure [bar]	HDC power control setting, level 2. <i>Only has an effect in a system without the operating panel.</i>	The minimum permitted value is the value of level 1. The maximum permitted value is 150 or the value of the parameter <i>Maximum pressure level [bar]</i> .
HDC level 3, pressure [bar]	HDC power control setting, level 3. <i>Only has an effect in a system without the operating panel.</i>	The minimum permitted value is the value of level 2. The maximum permitted value is 200 or the value of the parameter <i>Maximum pressure level [bar]</i> .
HDC level 4, pressure [bar]	HDC power control setting, level 4 (strongest slowing power). <i>Only has an effect in a system without the operating panel.</i>	The minimum permitted value is the value of level 3. The maximum permitted value is 320 or the value of the parameter <i>Maximum pressure level [bar]</i> .
HDC, activation level	The value sets the power level at the start of the HDC activation. <i>Only has an effect in a system without the operating panel.</i>	1 – 3 The level for the start of the HDC activation can be level 1, 2 or 3.
HDC, ramp	Ramp time that has an effect during the HDC level change. The setting has an effect at the start of the HDC activation and when you change the HDC power setting.	0 – 4 0: The shortest ramp time – the sharpest operation. 4: The longest ramp time – the smoothest operation. If the HDC function operates too fast at the start of the activation and when you change the power level, use larger value.

8.2 Automatic freewheeling conditions

The parameters for the **low pressure condition** are the *Minimum pressure level [bar]* and the *Minimum pressure delay [ms]*. In the driving mode, the system switches to freewheeling when the pressure level stays below the set *level* parameter value for the time set in the *delay* parameter.

SPD

The CTR101 control system can use the measured vehicle speed and pressure level to automatically switch to freewheeling.

The parameters for the **speed condition** are the *Disengagement speed [km/h]* and the *Disengagement speed, delay*. In the automatic drive-control mode the system switches to freewheeling when the driving speed increases to the set value. The value of the delay parameter has an effect on the sensitivity of the speed condition. If the 2-speed motors are in operation, the set value is for forward driving in the D2

speed range. The system automatically calculates a lower maximum speed value for the reverse driving.

The *Disengagement speed [km/h]* parameter also has an effect on the automatic speed range shift and the automatic drive activation functions. Thus, it is important to set the parameter correctly.

In the manual drive-control mode the *Disengagement speed [km/h]* parameter:

- Does also have an effect on the maximum allowed drive activation speed.
- Does not have an effect if no speed information is available.

8.3 Setting the values for the automatic freewheeling

First set the parameters for the low pressure condition of the freewheeling as follows:

1. **SPD** Change the control system to the manual drive-control mode.
2. **SPD** Measure the machine (trailer) *Wheel circumference* and set the value in the parameter menu.
3. Open the menu and change *Show sensor values* to On.
4. Set the power level to 0 %.
5. Stop the vehicle.
6. Activate the drive forward.
7. If the warning *Pressure_low* shows, decrease the value of the *Minimum pressure [bar]* parameter.
8. Activate the drive again.
9. Do a check of the actual stand-by pressure from the left-side value indicator below the tractor icon in the main view.

The value is the pressure level in bars [bar].

The *Minimum pressure level [bar]* value must usually be 5 – 10 bars lower than the stand-by pressure.

10. Do the test for the freewheeling conditions as follows:
 - a. Activate the drive forward.
 - b. Increase the speed until the system switches to the freewheeling mode and the warning *Pressure_low* shows.

If the hydraulic motors make a rattling sound **before** the automatic freewheeling activates, try one of the adjustments that follow:

- Increase the *Minimum pressure level [bar]* parameter value.
- Decrease the *Minimum pressure delay [ms]* parameter value.

If the automatic freewheeling is too sensitive, try one of the adjustments that follow:

- Increase the *Minimum pressure delay [ms]* parameter value.
- Decrease the *Minimum pressure level [bar]* parameter value.

SPD

When you have set the automatic freewheeling correctly in the manual drive-control mode, you can set the automatic freewheeling for the automatic drive-control mode.

The primary condition for the freewheeling in the automatic drive-control mode is the parameter *Disengagement speed [km/h]*. The low pressure condition is for the manual drive-control mode. But if the hydraulic pump speed reduces in the

Setup

automatic drive-control mode, the low pressure condition must also activate the freewheeling.

11. In the manual drive-control mode, activate the drive forward in D2 speed range.
12. Slowly increase the speed while you monitor the vehicle speed.
13. Record the speed when the warning *Pressure_low* shows and the freewheeling activates.
14. Set the *Disengagement speed [km/h]* parameter to a value that is 2 – 3 units lower than the vehicle speed before the low pressure condition.
15. Change to the automatic drive-control mode.
16. Drive forward while you use the automatic driving functions.
17. Increase the driving speed until the freewheeling activates.

If the high speed causes the automatic freewheeling, the operating mode indicator on the display shows a speedometer icon. You can repeat the test with an increased speed parameter value to find if the use of a higher speed value is possible.

If the low pressure condition causes the automatic freewheeling, decrease the speed parameter value, and repeat the test. Make sure that you decrease the speed parameter value to a point where the speed condition reacts before the low pressure condition. Use this speed parameter value.

9 Troubleshooting

The table that follows gives the causes of the alarms and warnings, and procedures to correct them.

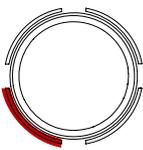
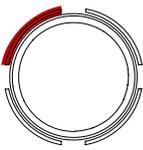
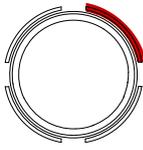
DISPLAY

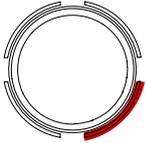
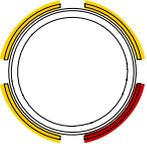
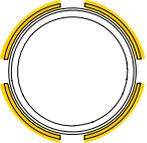
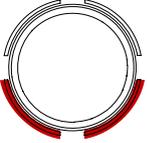
The status bar at the top of the main view indicates the active alarm or warning.

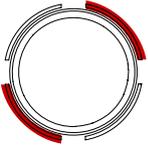
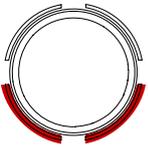
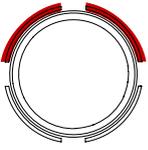
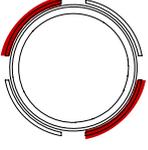
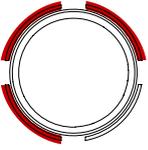
PANEL

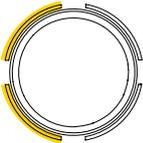
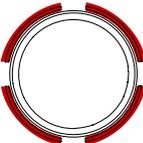
R3 button light is red in case of an alarm and yellow in case of a warning. LED segments around the knob indicate the active alarm or warning.

Table 3: Fault messages.

DISPLAY Alarm/warning message	Cause	Procedures
PANEL Segment indication		
1: Coil_failure_PDB 	Error in the control of the valve solenoid PDB.	Make sure that the valve cable connects correctly to the connector in the control device and to the valve solenoid. Make sure that the cable is not damaged. Measure the solenoid resistance:
2: Coil_failure_WV2 		
3: Sensor_failure_pressure_A 	The signal from pressure sensor A is defective.	Make sure that the pressure sensor cable connects to the pressure sensor and the cable is not damaged. To test the sensors, change the pressure sensors A and B with each other. If the alarm message changes, the pressure sensor is damaged. Replace the pressure sensor.
4: Sensor_failure_pressure_B		

<p>DISPLAY</p> <p>Alarm/warning message</p>		
<p>PANEL</p> <p>Segment indication</p>	<p>Cause</p>	<p>Procedures</p>
		
<p>5: Pressure_high</p> 	<p>The working pressure is more than the maximum system pressure, 350 bar.</p>	<p>Examine the main pressure relief valve (on the pump or as a separate valve). Make sure that it operates and is adjusted correctly.</p> <p>If you use the CVM120 valve, make sure that the DW valve has the correct setting for the pump type. Refer to the product manual.</p>
<p>6: Pressure_low</p> 	<p>The working pressure decreases below the specified minimum pressure value during the drive and the system automatically switches to the freewheeling mode.</p>	<p>The driving speed is too high for the drive. Use D2 driving mode for higher speed.</p> <p>If the warning comes on when the vehicle does not move or it comes on very easily during the drive, examine the automatic freewheeling parameters <i>Minimum pressure [bar]</i> and <i>Minimum pressure delay [ms]</i>. See chapter 8.1 User parameters.</p> <p>If the power bar does not increase at all when you activate the drive, examine the hydraulic connections.</p> <p>Make sure that the valve cables M_A and M_B connect to the correct pressure sensors. Make sure that the pressure sensors connect to the correct measuring points.</p> <p>Make sure that the P_A and P_B valve cables connect to the correct solenoids.</p> <p>The <i>Pressure_low</i> alarm is a warning and does not require the OK button reset.</p>
<p>7: Display_detached</p> 	<p>There is no connection between the system display and the control device.</p>	<p>Examine the connection of the display cable.</p> <p>Make sure that the display cable is not damaged.</p> <p>When the system display disconnects the system information is erased from the memory. Thus, you must also start the control device again after the alarm.</p>

<p>DISPLAY</p> <p>Alarm/warning message</p>		
<p>PANEL</p> <p>Segment indication</p>	<p>Cause</p>	<p>Procedures</p>
<p>8: SW_version_mismatch</p>	<p>4WD: The software versions of the primary control device and the auxiliary control device are different.</p> 	<p>Examine the software versions from the system information view.</p> <p>Replace the device that has the incorrect software version.</p> <p>Make sure that all system components have the same software version.</p>
<p>9: Coil_failure_PA</p>	<p>4WD: Error in the control of the valve solenoid P_A connected to the auxiliary control device.</p> 	<p>Do the same checks as with alarms 1 and 2.</p>
<p>10: Coil_failure_PB</p> 		
<p>11: Coil_failure_WV3</p> 	<p>4WD: Error in the control of the valve solenoid WV3 connected to the auxiliary control device.</p>	
<p>12: CAN_connection_break</p> 	<p>4WD: No CAN connection between the primary control device and the auxiliary control device.</p>	
<p>13: Coil_failure_PDB2</p> 	<p>HDC: PDB2 valve solenoid control error.</p>	

<p>DISPLAY</p> <p>Alarm/warning message</p>		
<p>PANEL</p> <p>Segment indication</p>	<p>Cause</p>	<p>Procedures</p>
<p>14: Overspeed</p> 	<p>HDC: Low working pressure during the operation of Hill descent control.</p>	<p>The flow to the motors is not sufficient because of the speed. Use the brake to decrease the speed. In forward driving, use the D2 speed range, if available.</p> <p>The <i>Overspeed</i> alarm is a warning. The message goes out of view when the pressure increases to the correct level or when the HDC function stops.</p>
<p>15: ISOBUS_error</p>	<p>This alarm is related to the CTR201 control system series.</p>	<p>This operation manual does not include the CTR201 control systems. See CTR201 Operation manual for this error.</p>
<p>16: External_alarm</p> 	<p>Alarm from an external alarm circuit.</p>	<p>The alarm activates when an external signal connects to the system.</p> <p>The device can be, for example, a temperature -, a pressure - or a reservoir level switch.</p> <p>Examine the switch and the external circuit.</p>
<p>17: SPD 1L direction sensor</p> <p>18: SPD 1R direction sensor</p> <p>19: SPD 2L direction sensor</p> <p>20: SPD 2R direction sensor</p> <p>No indication on the panel</p>	<p>Unexpected direction signal from the named sensor.</p>	<p>Examine the sensor cable connections. Use the "Show sensor values" option from the menu to verify the direction signals. See 5.2 Menu, 2. Main settings. Make sure that the left and right side have opposite direction signals. One side must be L and the other H.</p>
<p>25: 1L frequency too high</p> <p>26: 1R frequency too high</p> <p>27: 2L frequency too high</p> <p>28: 2R frequency too high</p> <p>No indication on the panel</p>	<p>Unexpected, high, speed signal from the named signal.</p>	<p>Examine the sensor cable connections. Use "Show sensor values" option from the menu to verify the speed signals. See 5.2 Menu, 2. Main settings.</p>

DISPLAY Alarm/warning message	Cause	Procedures
PANEL Segment indication		
29: 1L frequency too low 30: 1R frequency too low 31: 2L frequency too low 32: 2R frequency too low No indication on the panel	Unexpected, low, speed signal from the named signal.	Examine the sensor cable connections. Use "Show sensor values" option from the menu to verify the speed signals. See 5.2 Menu , 2. Main settings.
33: SPD 1L frequency equals zero 34: SPD 1R frequency equals zero 35: SPD 2L frequency equals zero 36: SPD 2R frequency equals zero No indication on the panel.	Speed signal from the named sensor is missing or unreliable.	Examine the sensor cable connections. Use "Show sensor values" option from the menu to verify the direction signals. See 5.2 Menu , 2. Main settings.

Table 4: Other possible faults

Fault	Cause and procedures
You cannot get to the main view from the brake-signal check-dialog view when you press the brake. The main menu does not open.	The control device does not operate correctly: <ul style="list-style-type: none"> Control device is not correctly connected. Make sure that all valve solenoids are connected. Make sure that the control device segment-display operates correctly. See chapter 9.2 Control device segment-display.
The menu or user interface does not have all the necessary texts. The user interface does not have all the necessary functions, for example, speed range change.	Disconnect and connect the display cable. To repair the system functions, power-off the system and power-up the system again.

Fault	Cause and procedures
Drive functions are not correct, for example, driving direction functions operate in the opposite direction.	<p>Examine the valve connections to the control device.</p> <p>Wiring diagrams for different systems are in the On-Demand Drive System product manual.</p>

9.1 Display status indicator LED

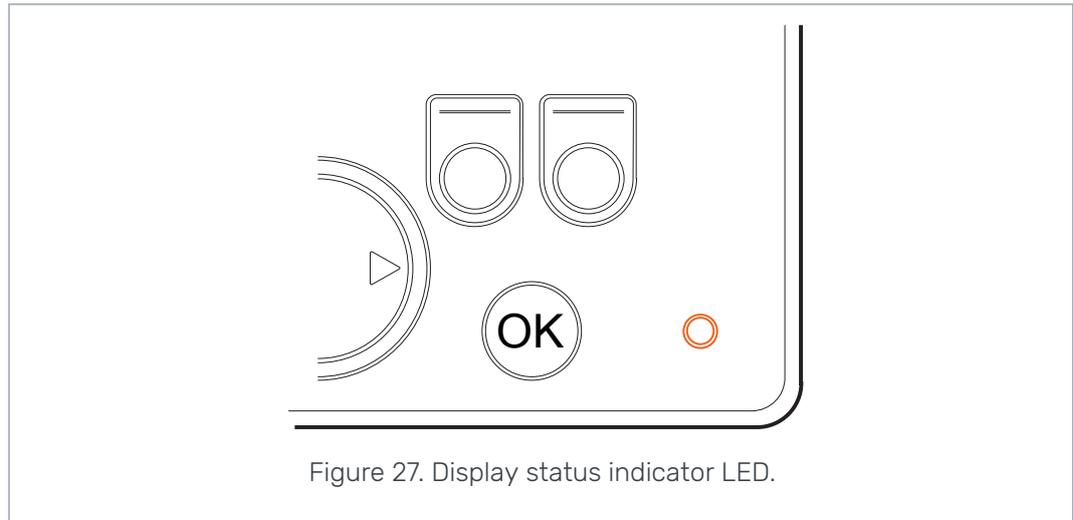
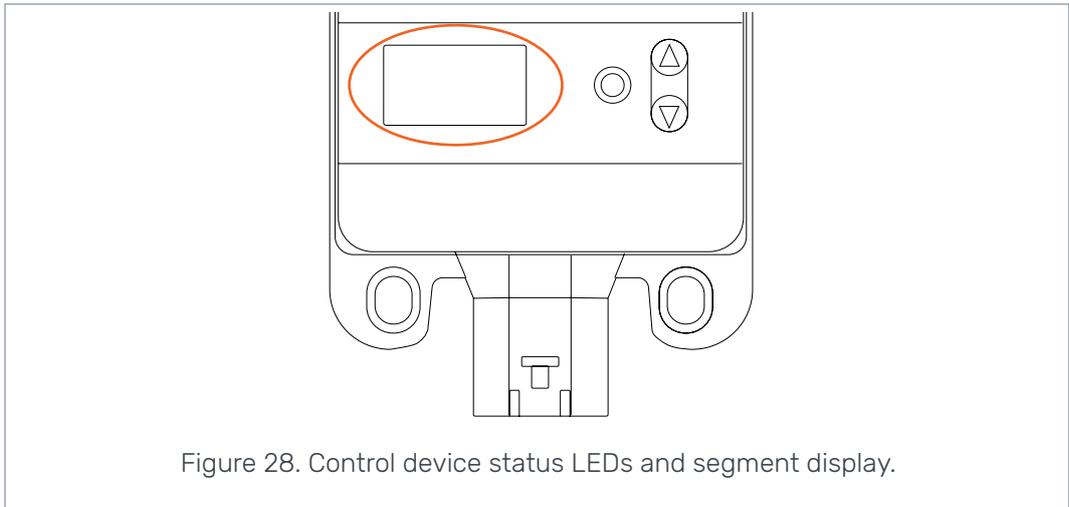


Figure 27. Display status indicator LED.

Color/status	Description
No LED	No operating voltage
Orange, 1 flash	Device starts
Green, 5 Hz	The device has no software
Green, 2 Hz	Usual status
Green, continuous	Software error
Red, 5 Hz	Too low operating voltage, software stops
Red, continuous	Dangerous device error

9.2 Control device segment-display



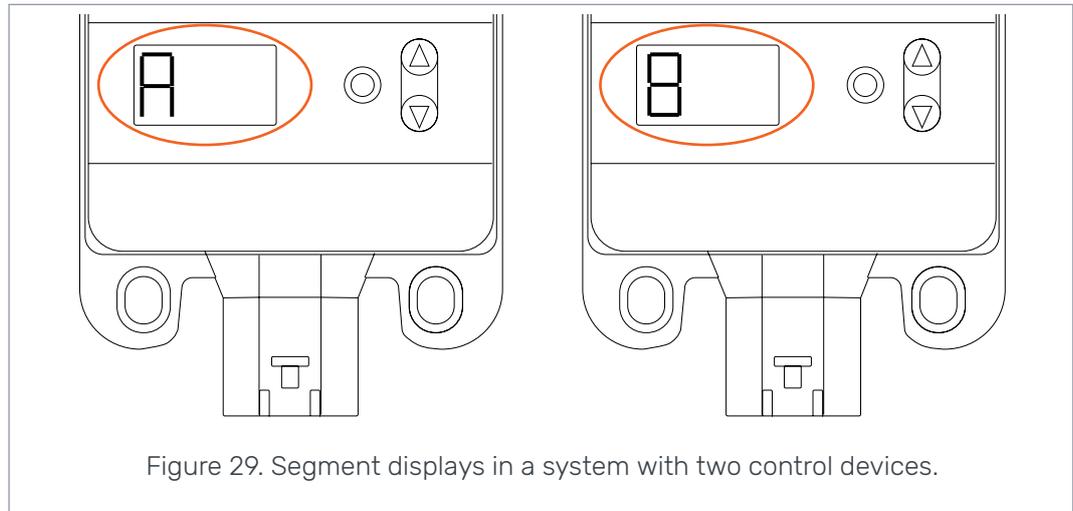
Status LED

LED/status	Description
No LED	No operating voltage
PWR + DIA, 1 flash	Device starts
PWR, 5 Hz	The device has no software
PWR, 2 Hz	Usual status
PWR, continuous	Software error
PWR, 10 Hz	Software error
Red, 5 Hz	Too low operating voltage, software stops
Red, continuous	Dangerous device error

Segment display text, a system with one control device

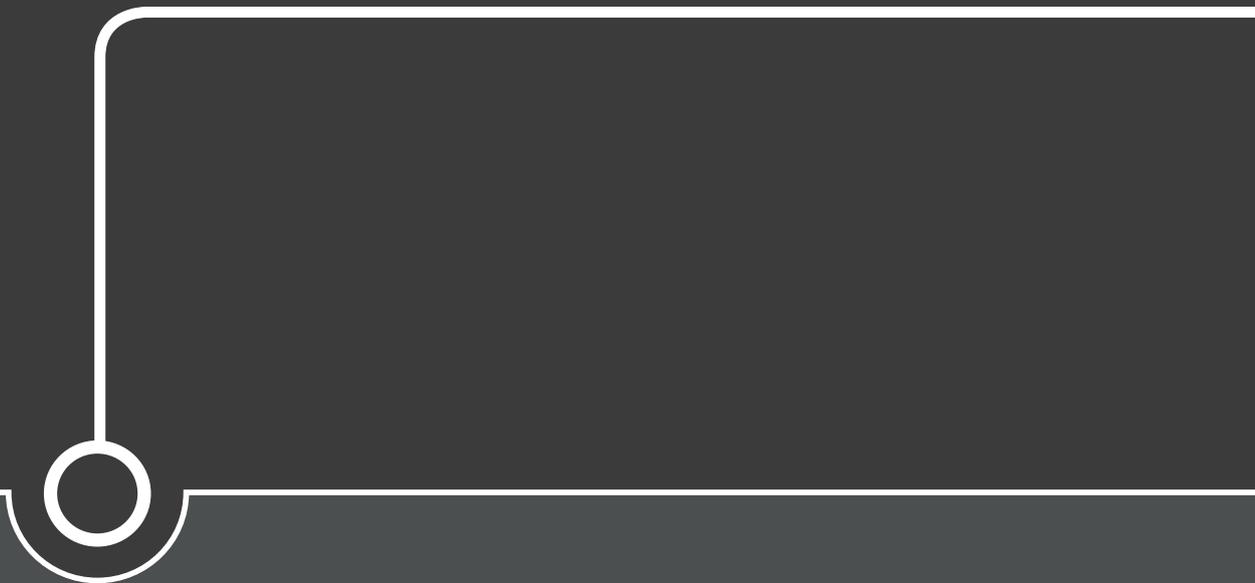
Display text	Description
Empty, no text	Ok
<i>B</i>	The connections to the device are not correct or the connections are defective. The system is not in operation.

SPD / 4WD Segment display text, a system with two control devices



Display text	Description
Empty, no text	The system does not recognize the 4WD-auxiliary control device. The system does not operate correctly.
One device "A", the other device "B"	Correct status in a system with two control devices, "A" is called master and "B" is called slave.
E1 or E2	Defective equipment connections to the control devices or connection to the operating panel is lost. The system is not in operation.

No POWER like it.



Black Bruin Inc.

+358 50 419 3484
P.O. Box 633, FI-40101 JYVÄSKYLÄ, FINLAND
www.blackbruin.com
info@blackbruin.com

All the information contained in this publication is based on the latest information available at the time of publication. Black Bruin Inc. reserves the right to make changes without prior notice.