Technical Manual

Z3N

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ZEPRO

Contents

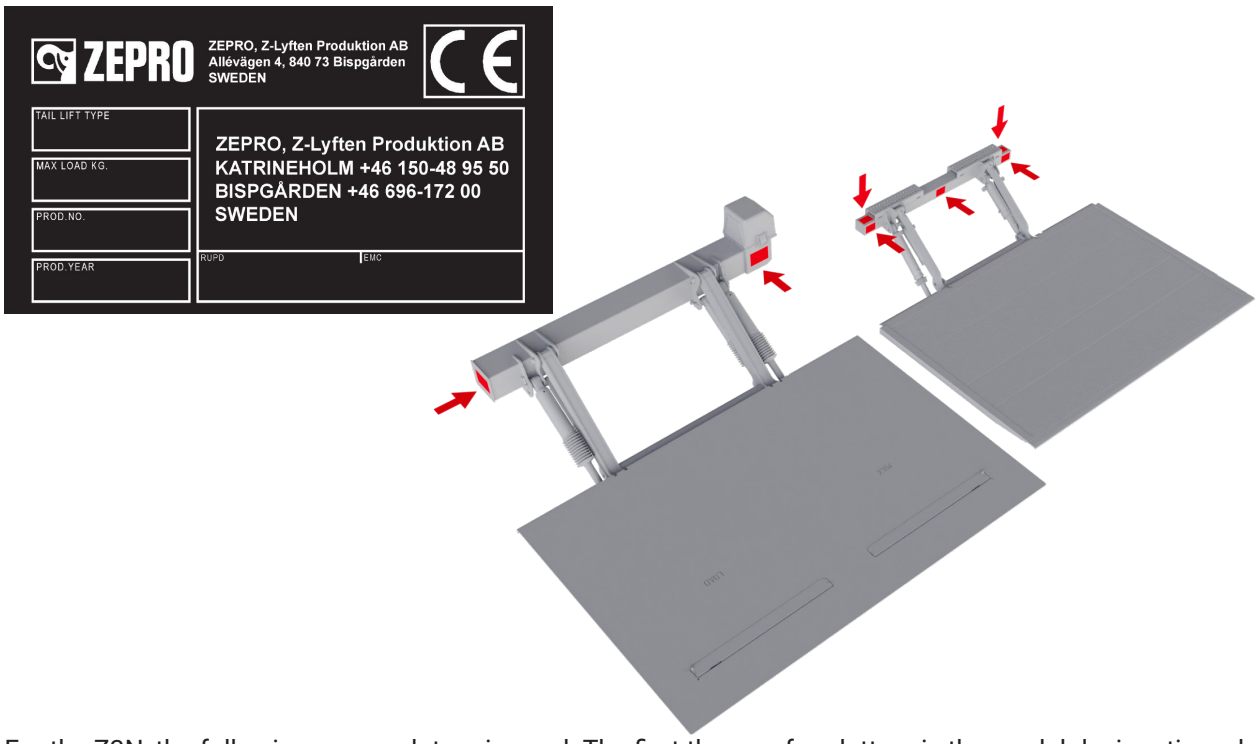
1 Product overview

1.1 Product variants and identification

1.1.1 The type sign

The Zepro Z3N product family consists of the Z3N tail lift and its variants such as the Zepro Z3NW and Z3NN. These products are available in a number of different variants with varying levels of functionality. The control systems, cylinder configurations, available control units and sensors can vary between the variants. It is therefore crucial to first identify the variant at hand to be able to find the correct technical information for it.

The first step in the process of identifying the variant is locating the type sign and reading the information in the tail lift type-field. The location of the typesign varies between different tail lift models but it is always riveted onto the support beam of the lift with the most common location being shown on the figure below. There should also be a sticker showing the same information in the users manual and on the door sill on the drivers side of the vehicle.

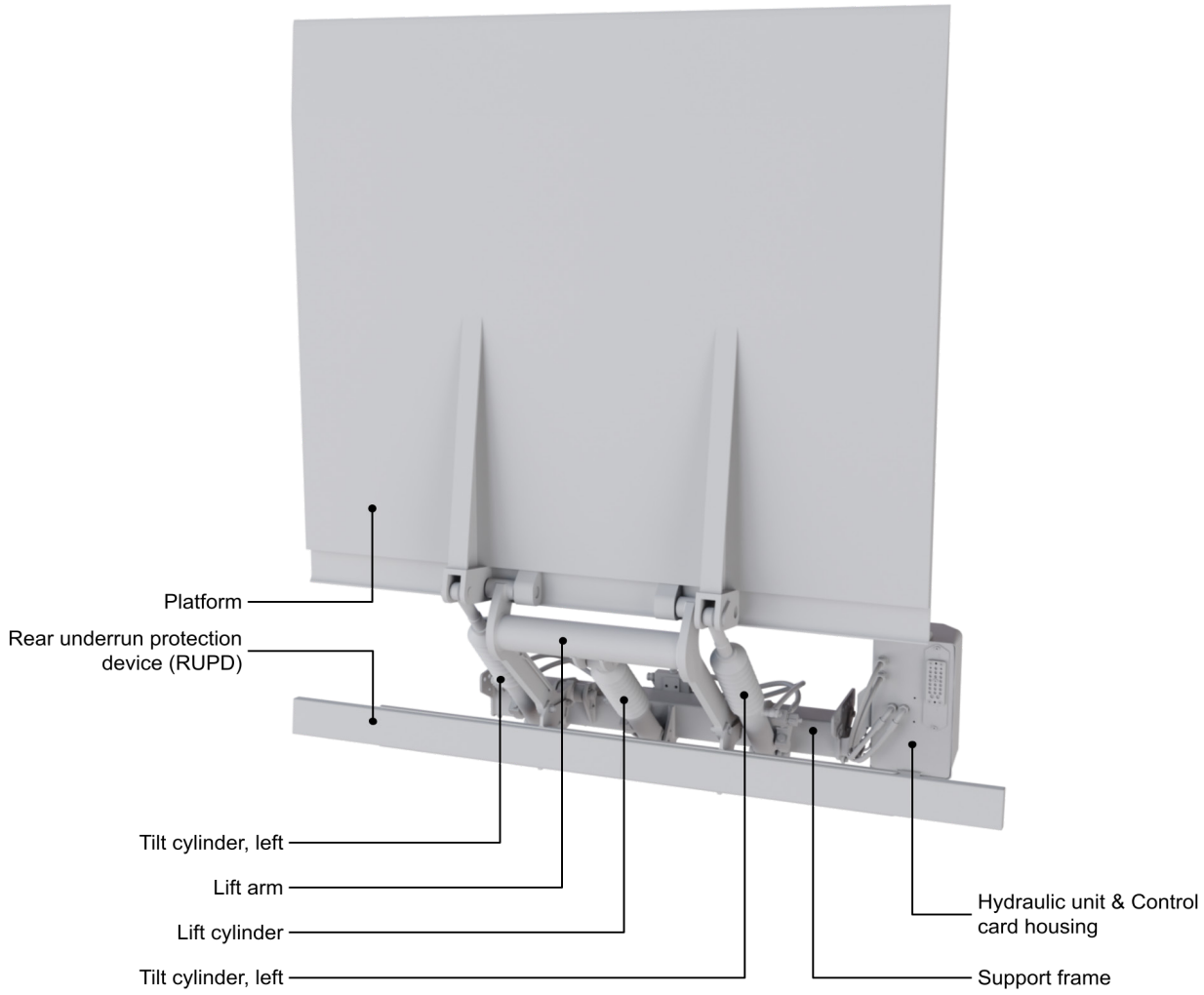


For the Z3N, the following nomenclature is used. The first three or four letters is the model designation where the Z3N is the standard model, the Z3NN is a model with a narrow support frame and the Z3NW is a model with a wide support frame. If the tail lift is equipped with an underrun protection devices, the letter "u" is added after the model designation. The two digit number denotes the lifting capacity of the lift, in kilograms, and the three digit number that follows is the approximate maximum lifting height of the lift in centimeters. The lifting height is followed by the cylinder configurationand the system voltage.

	Model	RUPD	Capacity	Lifting height	Cylinder configuration	System voltage
ZEPRO	Z3N / Z3NN / Z3NW	U	75	-100	MA	12V

1.1.2 Main components

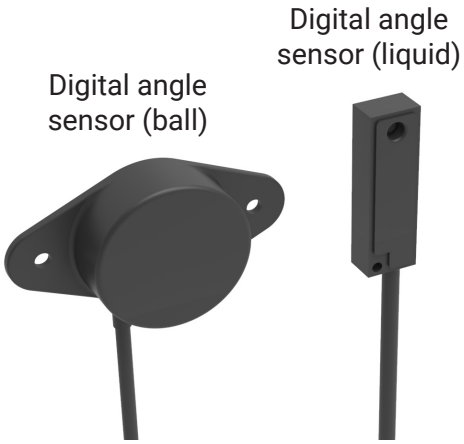
All variants of the Z3N model family consist of the same main components shown in the figure below.



1.1.4 Auto tilt

A tail lift equipped with auto tilt functionality automatically tilts the platform down when the platform reaches the ground and then tilts is back up to horizontal without any additional input from the user other than keeping the lower/raise button pressed throughtout the motion. The Z3N can be equipped with an electrical auto tilt system based on a digital auto tilt sensor located on the platform.

Whether the tail lift is equipped with auto tilt functionality or not cannot be determined by reading the information on the type sign. Instead the type and number of sensors installed on the platform should be checked. If there is only a ball-based angle sensor installed, the tail lift isn't equipped with auto tilt functionality. If there is both a ball-based and a liquid-based angle sensor installed, the tail lift is equipped with digital auto tilt.



1.1.3 Control cards

The control card converts the inputs from the user and the sensors into outputs to the motor solenoid and the valves which accomplish the desired motion. The Z3N can be equipped with one of two models of control cards, depending on market and required functionality. The first control card is the ZePRO1 control card which is an advanced processor based circuit card. The second is the simpler TLC-B1 card which is based on solid state relay technology.

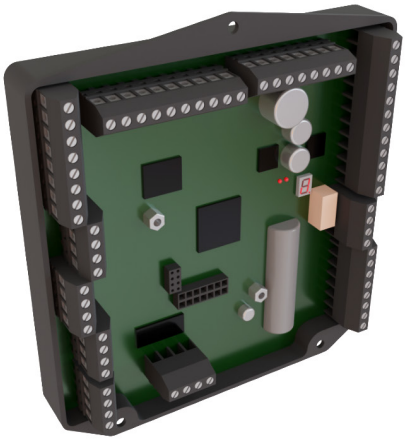


Fig 1. ZePRO1

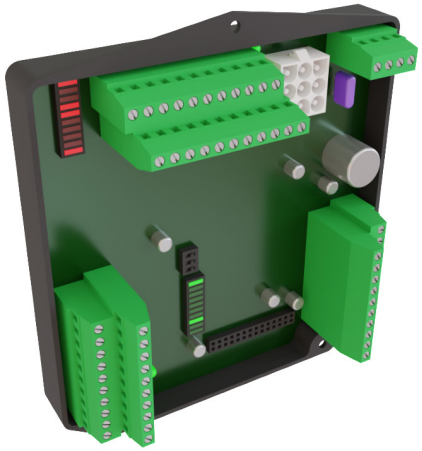
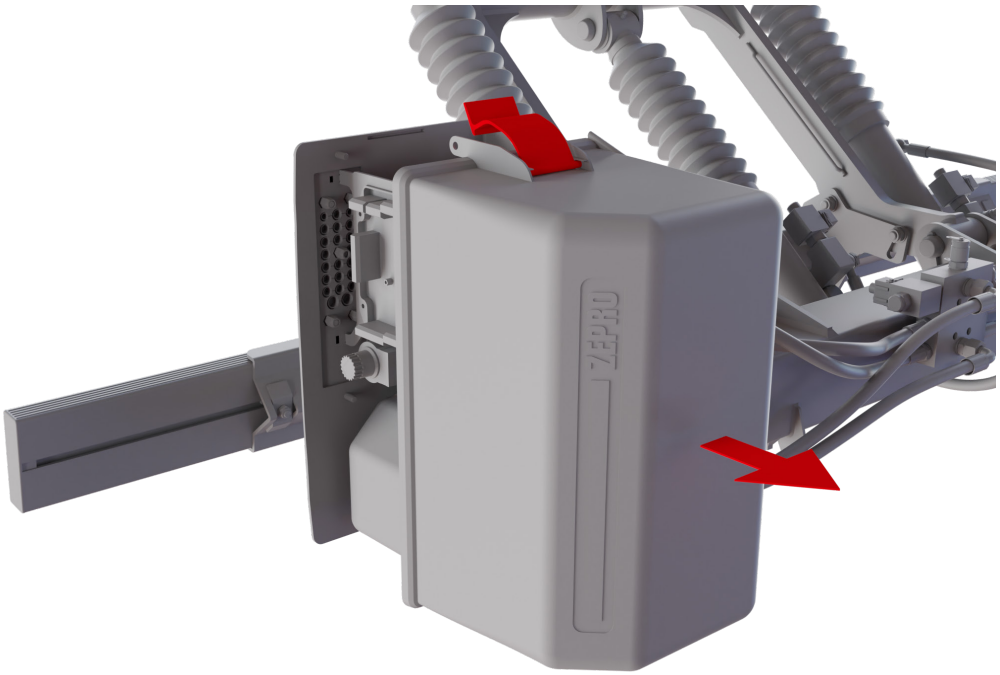


Fig 2. TLC-B1

The tail lift model, its cylinder configuration and the auto tilt functionality or lack there of has an impact on the software configuration of the control card required to operate the tail lift. Using a software configuration not meant for a particular cylinder configuration can lead to the tail lift nor functioning properly or in some cases, not functioning at all. Every card has a decal showing its configuration. On the ZePRO1 circuit card the configuration is also displayed every time the card is powered on, see "Startup sequence" for details. On the TLC B1 card the configuration can be determined by examining the position of the three switches on the block in the middle of the card, see "2.2.6 Card configuration" for details. The Z3N used Configuration 9 on the ZePRO1 card and configuration 000 on the TLC-B1 card.

1.2 Accessing the card and the hydraulic unit

The control card and the hydraulic unit are housed inside the box located on the right side on the tail lift. They are accessed by unlatching the two latches on the top and the bottom on the plastic cover and removing the cover.

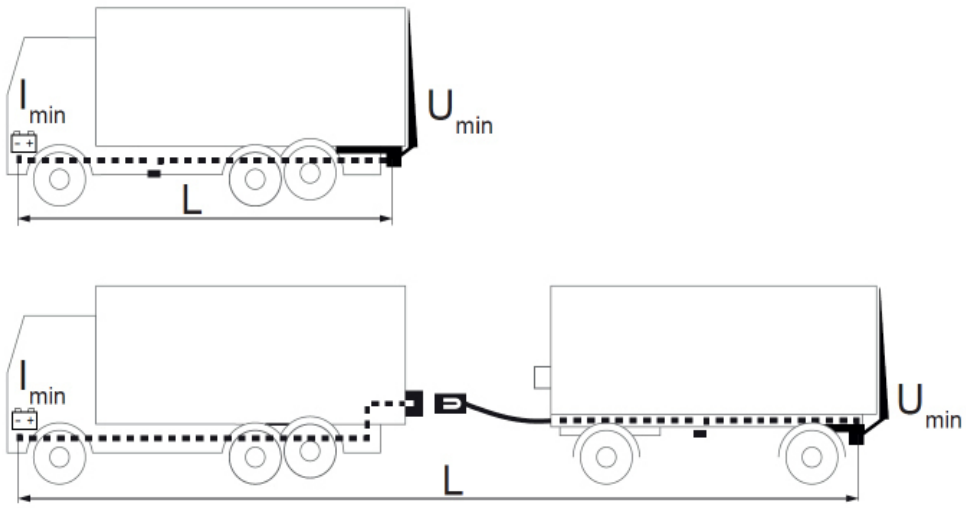


1.3 Battery and cable requirements

For proper function of the tail lift the electrical system needs to be sized per the following:

Item	12V	24V
Minimum battery capacity (I_{min})	140Ah	N/A
Minimum voltage during operation (U_{min})	9V	N/A
Cross sectional area of power cable, length up to 8m	25mm^2	N/A
Cross sectional area of power cable, length 8-15m	35mm^2	N/A
Cross sectional area of power cable, length over 15m	N/A	N/A

The given cross sectional areas are valid for copper cables. If other conductor material is used proper conversion needs to be made in order to properly size the connection. The total length of the cable is measured according to the following figure.



Some vehicle models have restrictions regarding the amount of current the lift can access from the existing battery. Some vehicle models do not fully charge the battery. It may therefore be necessary to switch to a battery and sometimes also to a charger with a larger capacity.

2 Control cards

2.1 ZePRO1 circuit card

2.1.1 Overview

The ZePRO1 control card can be split into different functional sections as shown in the following figure. In-depth explanations of each section are contained in the following chapters.

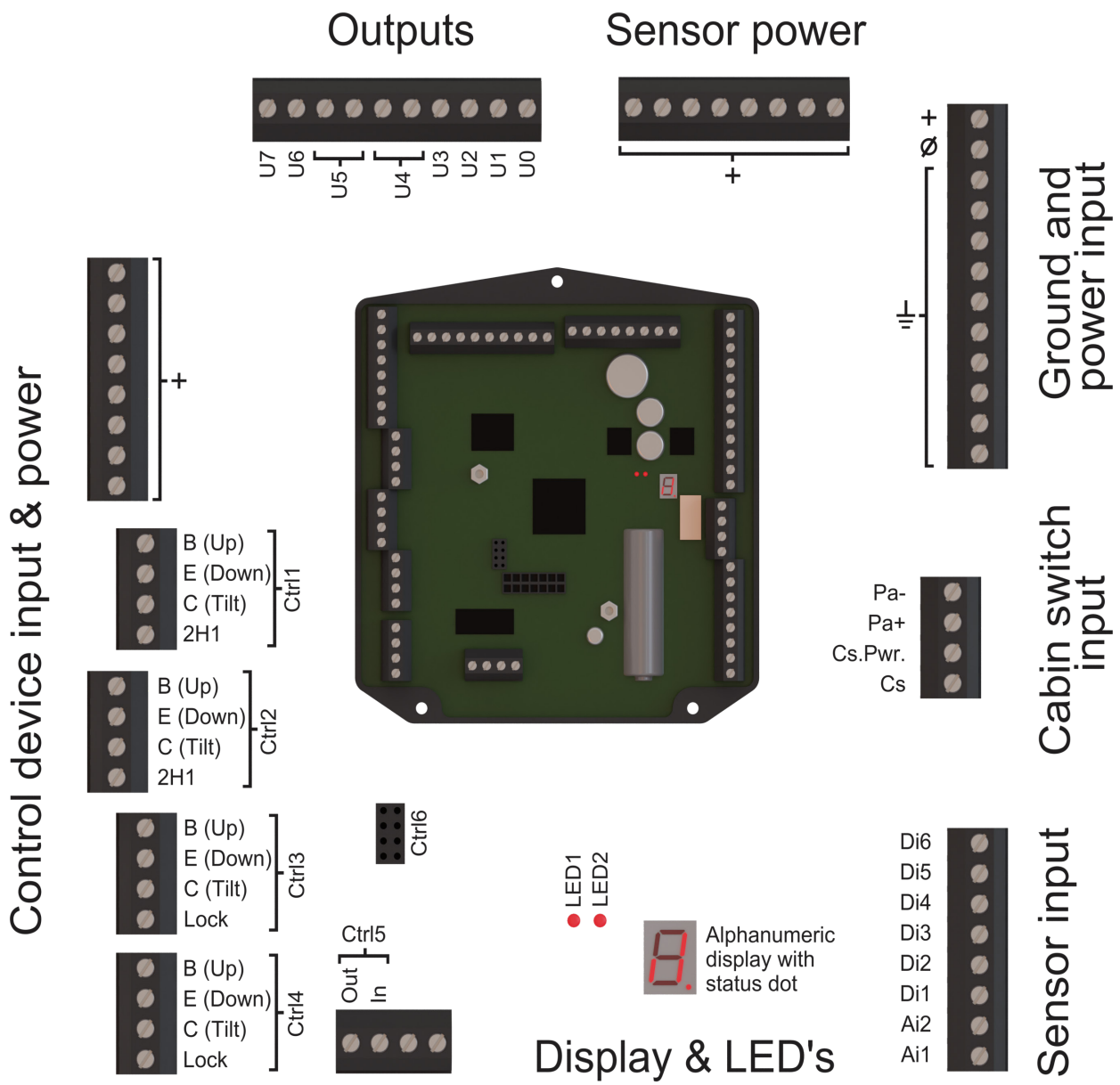
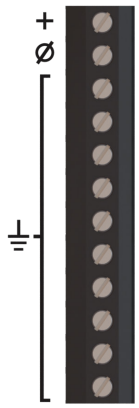


Fig 3. ZePRO1 control card

2.1.2 Ground and power input

The top pin of the ground and power input section is where the power supply for the card is located. The cable that is connected to this pin is secured by a 10A (24V models) or 15A (12V models) fuse and is drawing power from the motor solenoid. Without power to this pin, the card will not power on. The second pin is not used for anything and the remaining ten pins are all ground points used for sensors and control devices.

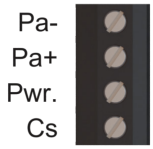


2.1.3 Cabin switch input

For countries where the EN 1756-standard is in effect, the tail lift shall be equipped with a system to prevent any unauthorized operation in the absence of the operator. This can be achieved by locking and unlocking with a code or an On/Off switch inside lockable driver's cab.

The Zepro solution consists of a cab switch, which when active, sends power to the CS pin in the cab switch section of the card. When the switch is in its "Off" position any inputs are disregarded and the tail lift is efectively locked.

On installations where the use of a cab switch is not possible due to absence of a driver's cab, the CS pin is powered directly from a power source through a 2-3A fuse and the tail lift is disabled by other means, a lockable power switch on the main battery cable for example.

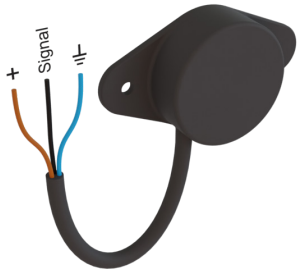
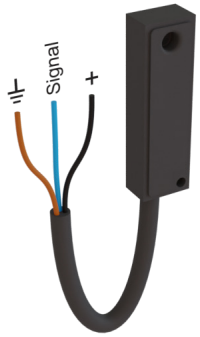
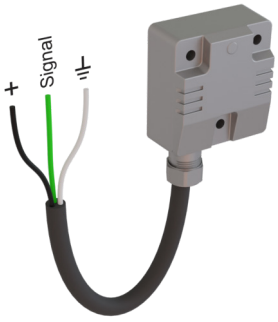
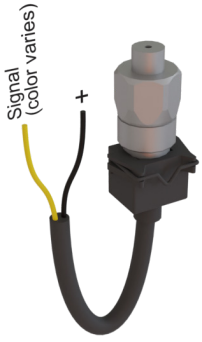


2.1.4 Sensor input

Sensors are used to provide added functionality when certain conditions are met, or limit certain functionality for safety reasons. The ZePRO1 control card has input pins for up to 6 digital sensors, Di1 through Di6, as well as 2 analog sensors, Ai1 and Ai2. The card can accomodate the sensors shown in the table. Different variants of the Z3N use different types and number of sensors, see the functional descriptions and schematics chapter for more information.

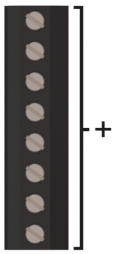
2.1.5 Sensor input

Sensors are used to provide added functionality when certain conditions are met, or limit certain functionality for safety reasons. The ZePRO1 control card has input pins for up to 6 digital sensors, Di1 through Di6, as well as 2 analog sensors, Ai1 and Ai2. The card can accomodate the sensors shown in the table. Different variants of the Z3N use different types and number of sensors, see the functional descriptions and schematics chapter for more information.

Type	Picture	Explanation
Digital angle sensor (ball type)		An angle sensor that uses an articulating ball to output an On/Off signal for certain angle ranges. Usually mounted on the platform and used to control the two hand safety requirement.
Digital angle sensor (liquid type)		A sensor that uses a fluid to measure the angle and outputs an On/Off signal for certain angle values. More accurate than the ball type sensor. Mounted on the platform on tail lifts equipped with digital auto tilt on which it is used to stop the auto tilt up motion of the platform when it reaches horisontal level.
Analog angle sensor (Inclinometer)		Advanced analog angle sensor that outputs 0-4,5 V depending on angle. Mounted on the platform on tail lifts equipped with analog auto tilt with angle setting function on which it is used to stop the auto tilt up motion of the platform when it reaches desired angle. It also controls the two hand safety requirement.
Pressure sensor		Outputs an On/Off signal if the pressure exceeds (rising pressure sensor) or falls below (falling pressure sensor) a predetermined value. It is most often used for the open platform alarm, in which case it is mounted on the positive hydraulic connection to the right tilt cylinder. It can also be used for the auto tilt function in which case it is mounted on the positive hydraulic connection to the right lift cylinder.

2.1.6 Sensor power

The sensor power block consists of 8 pins that output voltage to drive the sensors connected to the card.



2.1.7 Control device input and power

The control devices are connected to the control device input section and powered by the control device power section of the control card. They are used to input user comands into the control card so that they can be interpreted and executed. The control devices can be grouped into two groups depending on their functionality: primary and secondary devices. Primary devices can operate all functions of the tail lift including those that require two-handed operation for safety reasons. Secondary devices do not offer the possibility of two-handed operation and therefore unable to operate certain functions. The most common primary control devices for the Z3N are shown below.

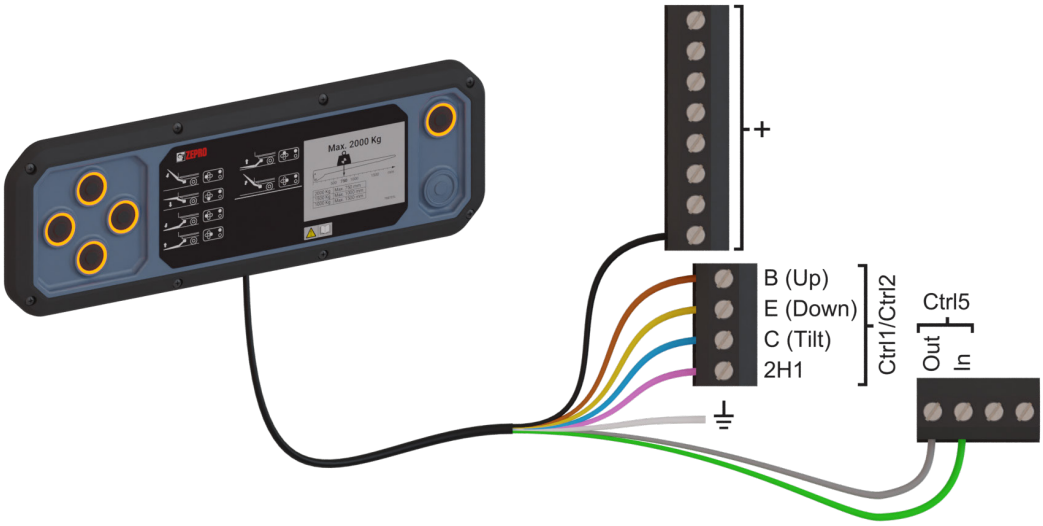


Fig 4. CD 19

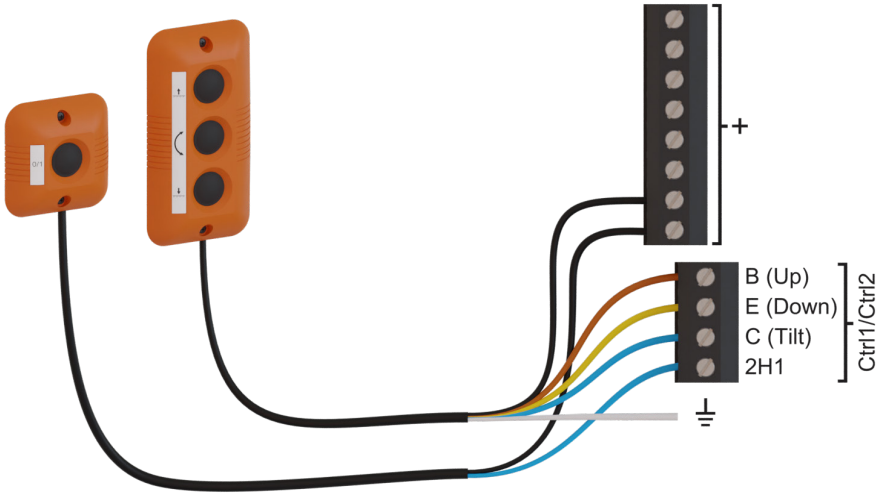


Fig 5. CD 1

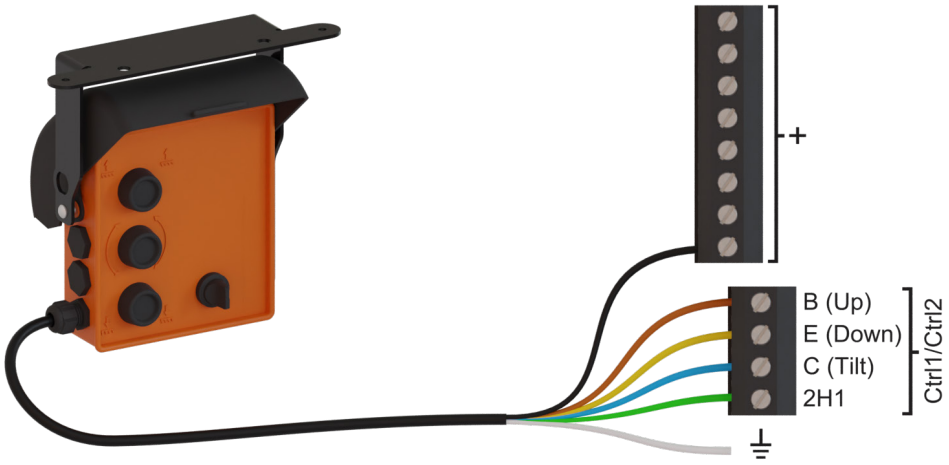


Fig 6. CD 3

The ZePRO1 control card has six control device inputs Ctrl 1 through Ctrl 6.

- Ctrl 1 - Input for a primary control device. Can control all tail lift functions apart from slide in / slide out.
- Ctrl 2 - Input for a primary control device. Same functionality as Ctrl 1.
- Ctrl 3 - Input for a secondary control device such as radio control device with externally mounted receiver.
- Ctrl 4 - Input for a secondary control device such as in-box mounted device with a spiral cable.
- Ctrl 5 - Input used for the slide out / slide in functionality of sliders. Not used on the Z3N.
- Ctrl 6 - Input used for the receiver of the radio control device. Same functionality as Ctrl 3.

The most common secondary control devices for the Z3N are shown below.

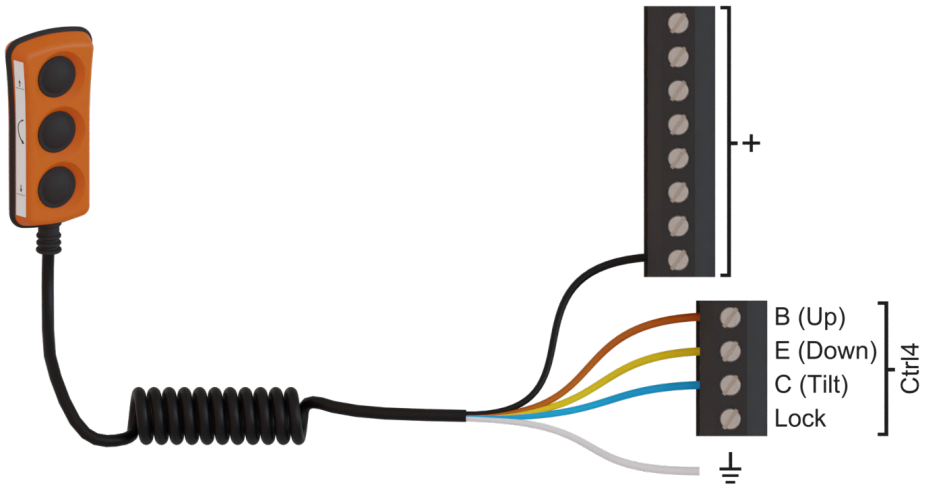


Fig 7. CD 9

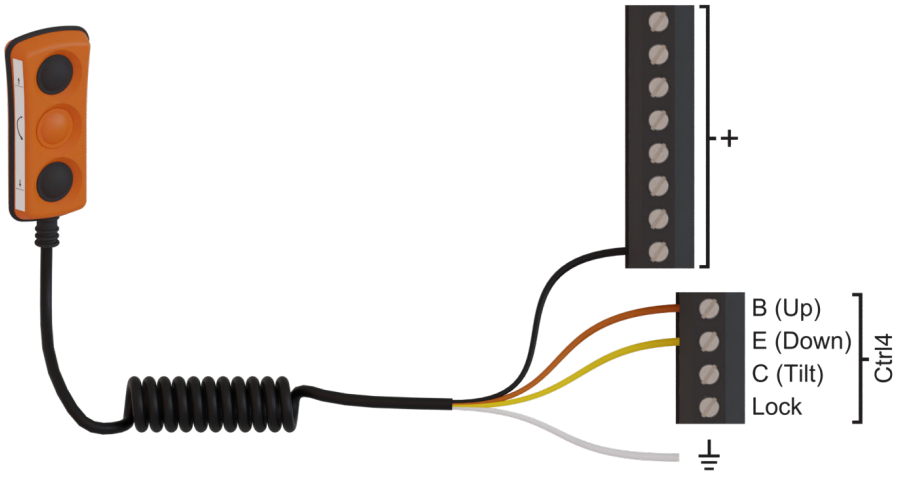


Fig 8. CD 10

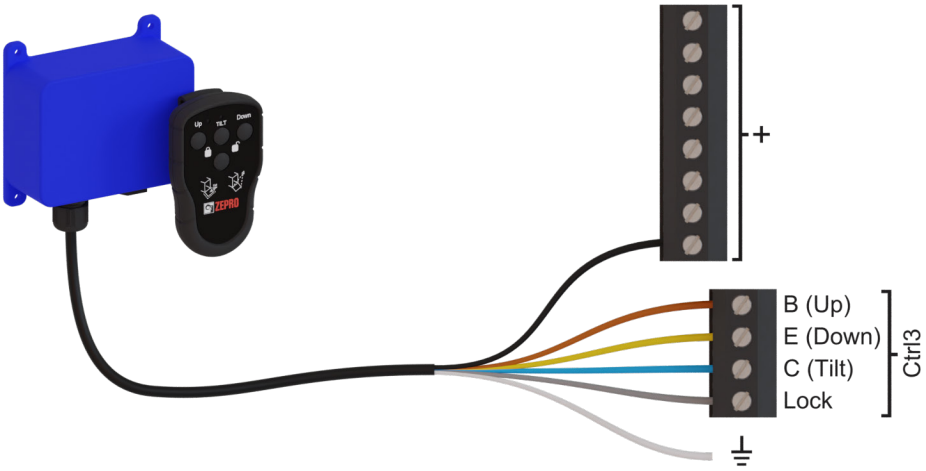


Fig 9. CD 11

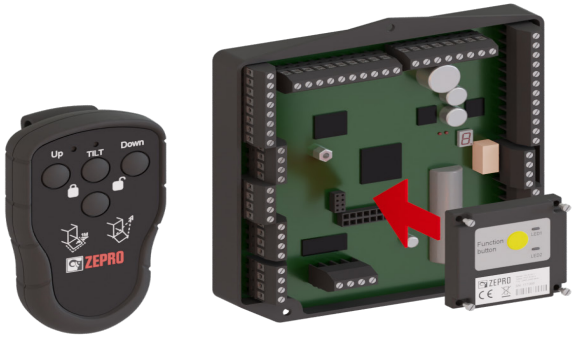


Fig 10. Receiver module is mounted directly on the control board.

2.1.8 Display and LED's

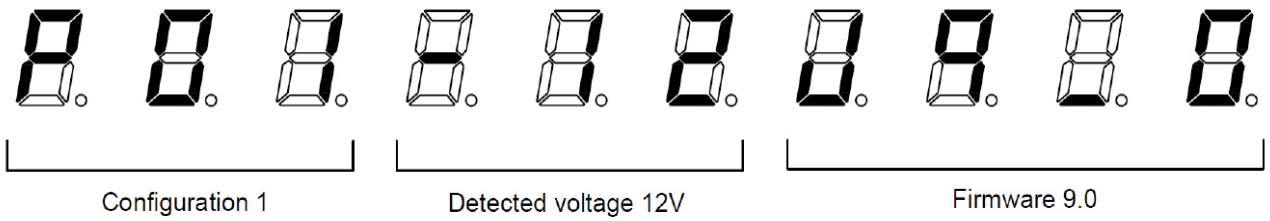
The control card is equipped with two LED's and an alphanumeric display with a status point on the lower right corner which provide useful information about the system.

- The status dot has three states:
- Off: no supply voltage to control card.
- On: supply voltage is available but the cabin switch is switched off.
- Flashing: supply voltage is available and the cabin switch is switched on. The card is awaiting input signal.

When a button press is being registered by the card, LED1 is lit and when the signal from the control device and sensors is registered and approved by the card, LED2 is lit to indicate an active output.

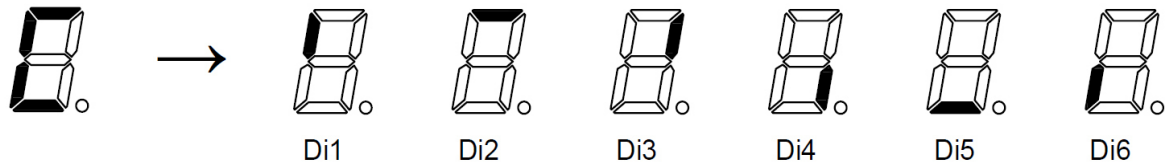
Startup sequence

Every time the card is switched on, either by turning the cabin switch off and then back on or by cutting the power to the lift and turning it back on, a startup sequence is displayed on the display. The software configuration is displayed first, followed by the detected voltage and the firmware version number. It is crucial that the software configuration is the correct one for the tail lift it is installed on, see the software configurations chapter for more information.



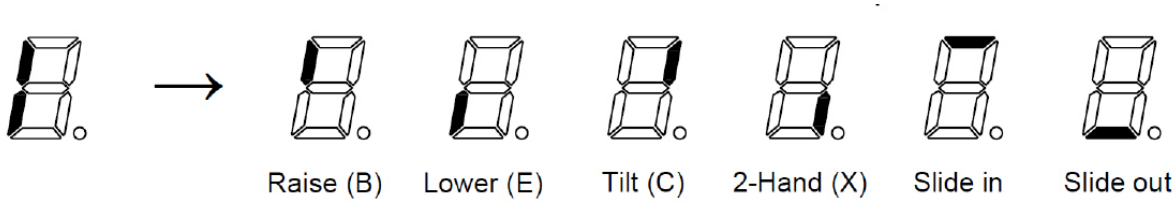
Sensor input indication

As long as no buttons are pressed and no faults are detected, the display will show the sensors that are active at the time. This is displayed by the letter “C” followed by lit sector(s) corresponding to a sensor input as shown below. Note that more than one sensor can be active at the same time in which case more than one sector will be lit at the same time.



Control unit input indication

When a button is pressed on a control unit this is indicated on the display. The active control unit (1-6) is shown first, followed by the active button according to the figure below. If more than one button is pressed at the same time, the sectors denoting all pressed buttons will lit up at the same time.



Once a button has been released, the control system for the current control device is locked for a while to ensure that no other person operates the lift from another control device. The current control device number (1-7) will flash on the display while the control system is locked to it. This primarily applies to radio and coil control devices, as other control devices have such a short locking period that there is hardly time to see the indication.

The number will stop flashing when one of the current control device buttons is pressed. If the control card has been without voltage and receives the voltage again when the CS (cabin switch) is switched on, “7” will flash on the display and the control card is locked until the Off/On on the CS is operated.

Fault indication

When the ZePRO1 control card detects a fault, it displays a fault code on the display to assist troubleshooting. The fault code consists of a letter followed by a two digit number. The letter indicates the type of fault and the number provides additional information about the fault.

If the card detects several faults, they are prioritised in the following order: L/H, E, F, U and A. When the cabin switch is turned off, the system scrolls through a list of the last five errors detected before the display turns off after approx. 5 minutes when the control card goes into sleep mode.

All fault codes can be reset manually by switching the cabin switch (if present) off and then back on again.

A - Internal fault
Fault code A is displayed when the control card has detected an internal fault. In some cases the tail lift can be used as normal when this code is displayed as long as it functions correctly. If the lift is not functioning correctly however, the control card needs to be replaced.

E - System locked
Fault code E is displayed when the control card is locked by a control device equipped with a locking function, most commonly a radio control device or a spiral cable control device. The number following the letter identifies the card input that the device used to lock the system is connected to. For example E1 indicates Ctrl1, E2 indicates Ctrl2 and so on.

Once a spiral control device equipped with a locking function has been used, the control system is locked to the current control device until it is unlocked manually with the respective control device's unlock button. The radio control device is also equipped with a locking function. The control system can then be locked/unlocked by pressing and holding the lock/unlock button. In the event of a fault in the remote control, it can be unlocked by turning the cabin switch off and then back on.

The fault code resets automatically if the control system has not received a signal from the relevant control device for 6 minutes.

F - Output short circuit
Fault code F is displayed when the card detects an unusually high current draw through one of the outputs which implies a short circuit on that output. The number following the letter identifies the output in question with 0-7 denoting output U1 through U7, the number 8 denoting the control device output section and the number 9 denoting the sensor power output section.

The fault code is reset automatically when/if the card can detect normal current draw through the output.

H - High voltage
Fault code H is displayed when the card detects an input voltage that is higher than expected. The number following the H indicates the measured voltage. For example, H32 means that the measured voltage is 32 Volts.

The fault code resets automatically once the voltage becomes acceptable again.

L - Low voltage
Fault code L is displayed when the card detects an input voltage that is lower than expected. The number following the L indicates the measured voltage. For example, L9 means that the measured voltage is 9 Volts.

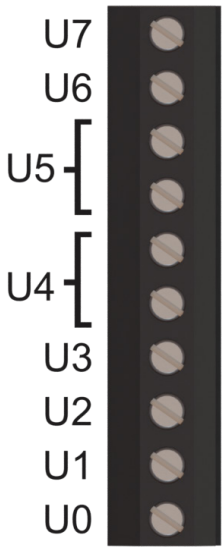
The fault code resets automatically once the voltage becomes acceptable again.

U - Output not connected
Fault code U is displayed when the card powers an output with nothing connected to it. The number 0-7 following the letter U identifies the output in question, U0 through U7.

The fault code is reset automatically when/if the card can detect normal current draw through the output.

2.1.9 Outputs

The output section is used for power delivery to the solenoid and the valve coils. It consists of 10 pins in total out of which four are interconnected in two pairs for cases where two coils need the same signal. The U0 output is reserved for the motor solenoid. U1-U3 are usualy used for valves V1, V2 and V3. U4 and U5 are usually used for the safety valves on the tilt and lift cylinders and the remaining ouput pins are used for adidional valves. See the functional descriptions and schematics chapter for more information.



2.2 TLC B1 relay card

2.2.1 Overview

The TLC B1 control card can be split into different functional sections as shown in the following figure. In-depth explanations of each section are contained in the following chapters.

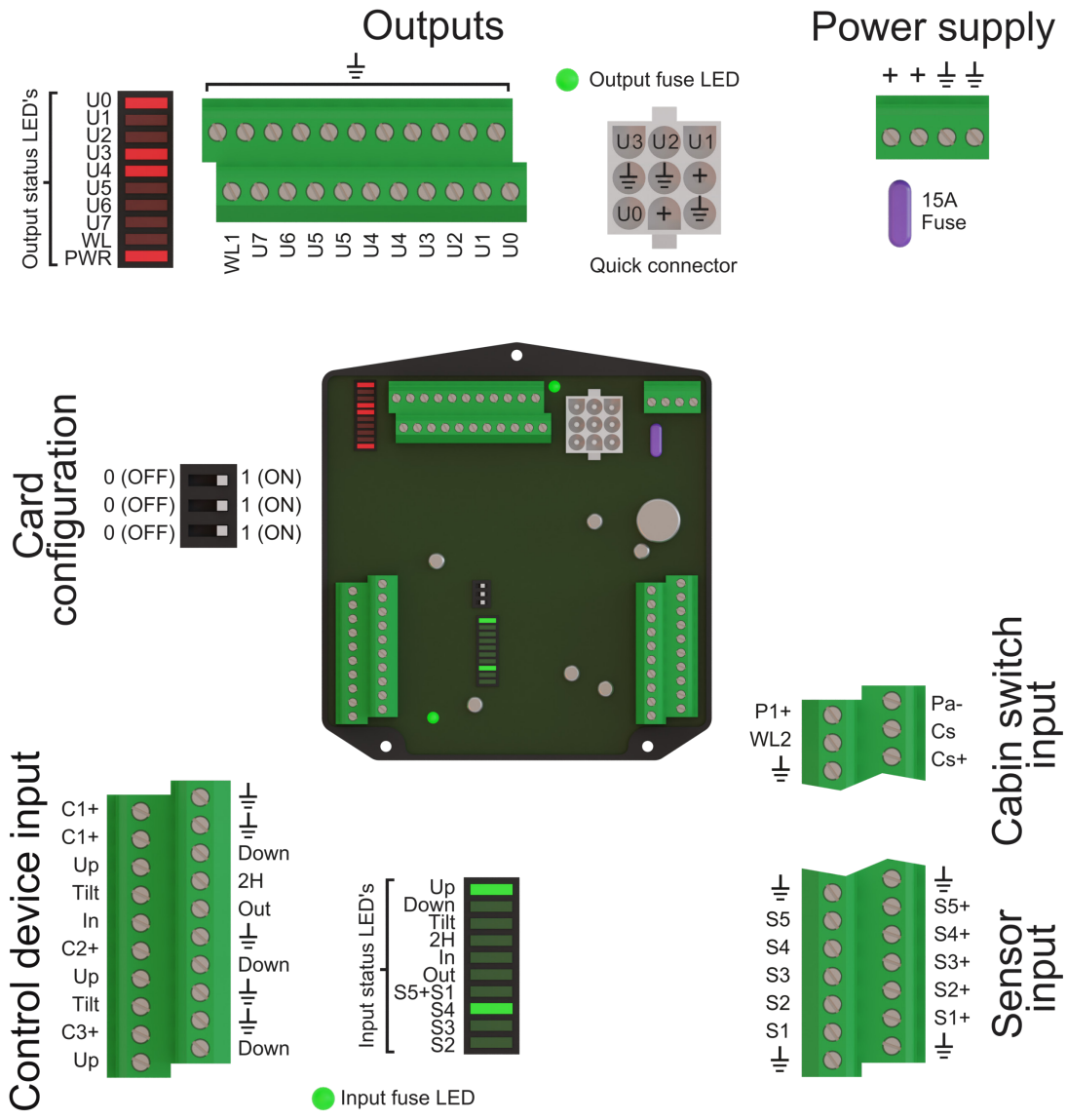


Fig 11. TLC B1 control card

2.2.2 Power supply

The control card is powered through the power supply block in the top right corner of the card and is protected by the 15A fuse right beneath it.

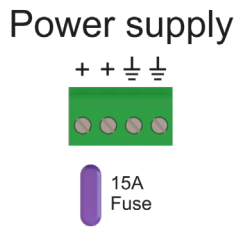


Fig 12. Supply socket protected with 15A fuse.

2.2.3 Cabin switch input

For countries where the EN 1756-standard is in effect, the tail lift shall be equipped with a system to prevent any unauthorized operation in the absence of the operator. This can be achieved by locking and unlocking with a code or an On/Off switch inside lockable driver's cab.

The Zepro solution consists of a cab switch, which when active, sends power to the CS pin in the cab switch section of the card. When the switch is in its "Off" position any inputs are disregarded and the tail lift is efectively locked.

On installations where the use of a cab switch is not possible due to absence of a driver's cab, the CS pin is powered directly from a power source through a 2-3A fuse and the tail lift is disabled by other means, a lockable power switch on the main battery cable for example.

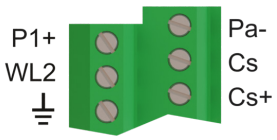


Fig 13. Supply socket for the cabin switch

2.2.4 Sensor input

Sensors are used to provide added functionality when certain conditions are met or limit certain functionality for safety reasons. The TLC B1 control card has input pins for up to 4 different sensors, S2 through S5. The S1 input is used to power the S5 so together they act as a single input. The S1+S5 input is most often used for the auto tilt functionality on some variants.

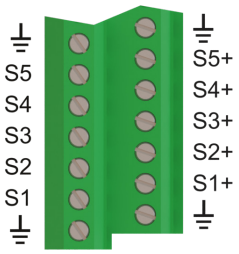
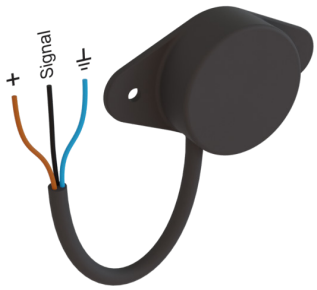
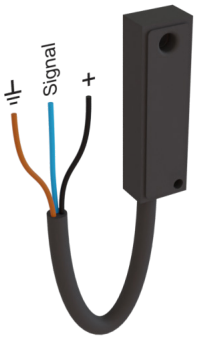
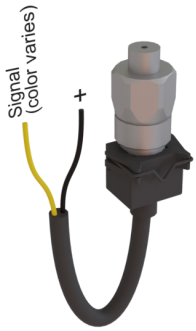


Fig 14. Supply socket for different sensors

The TLC B1 card can accomodate the sensor types shown in the table below. Different variants of the Z3N use different types and number of sensors depending on functionality. See the functional descriptions and schematics chapter for connection information.

Type	Picture	Explanation
Digital angle sensor (ball type)		An angle sensor that uses an articulating ball to output an On/Off signal for certain angle ranges. Usually mounted on the platform and used to control the two hand safety requirement.
Digital angle sensor (liquid type)		A sensor that uses a fluid to measure the angle and outputs an On/Off signal for certain angle values. More accurate than the ball type sensor. Mounted on the platform on tail lifts equipped with digital auto tilt on which it is used to stop the auto tilt up motion of the platform when it reaches horisontal level.
Pressure sensor		Outputs an On/Off signal if the pressure exceeds (rising pressure sensor) or falls below (falling pressure sensor) a predetermined value. It is most often used for the open platform alarm, in which case it is mounted on the positive hydraulic connection to the right tilt cylinder. It can also be used for the auto tilt function in which case it is mounted on the positive hydraulic connection to the right lift cylinder.

2.2.5 Control device input

The control devices are connected to the control device input section and powered by the control device power section of the control card. They are used to input user comands into the control card so that they can be interpreted and executed. The control devices can be grouped into two groups depending on their functionality: primary and secondary devices. Primary devices can operate all functions of the tail lift including those that require two-handed operation for safety reasons. Secondary devices do not offer the possibility of two-handed operation and are therefore unable to operate certain functions. The most common primary control devices for the Z3N are shown below.

Fig 15. CD 19

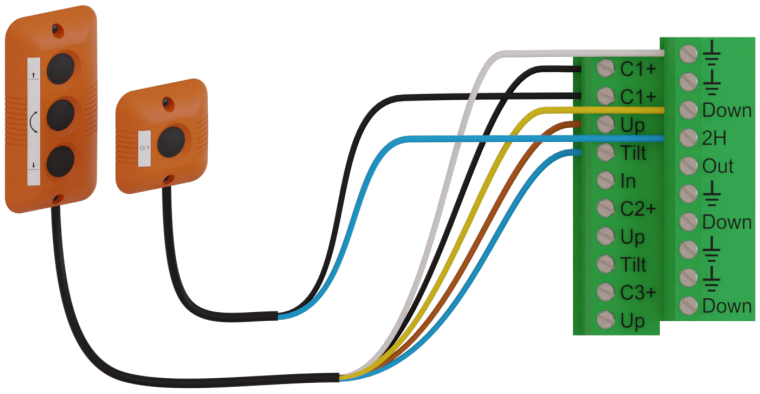


Fig 16. CD 1

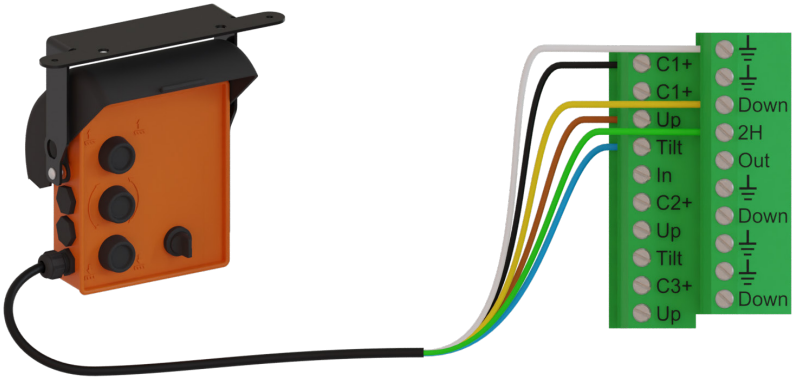


Fig 17. CD 4

The most common secondary control devices for the Z3N are shown below.

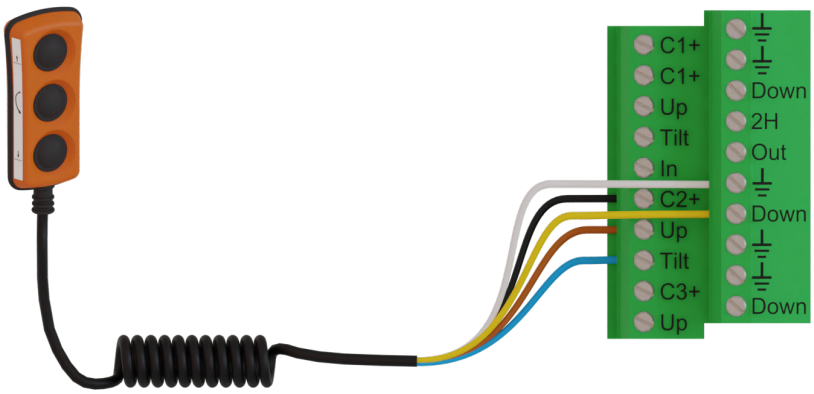


Fig 18. CD 9

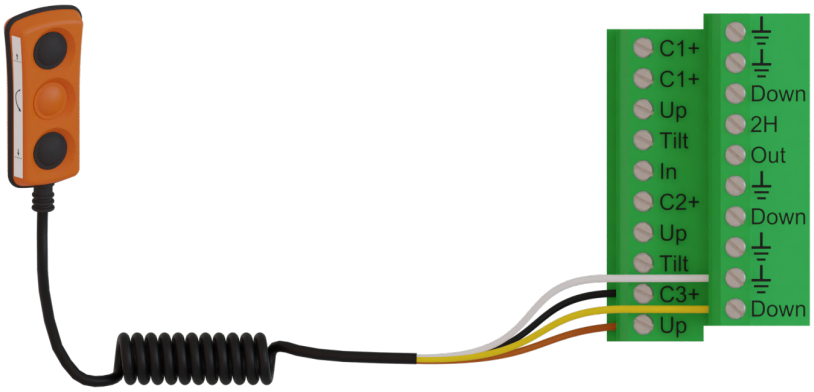


Fig 19. CD 10

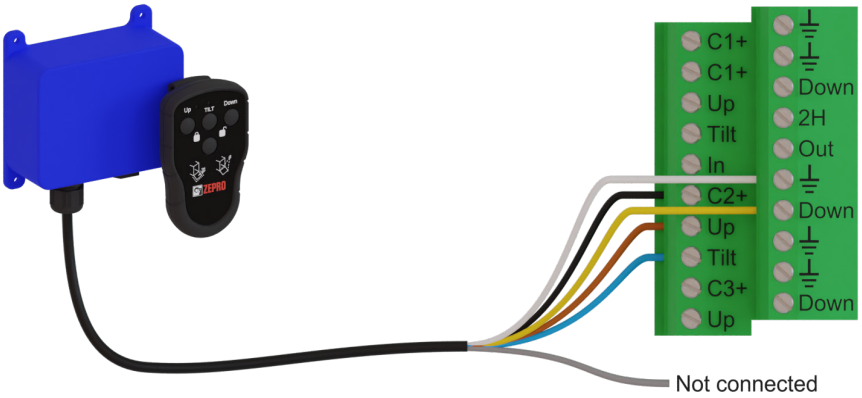
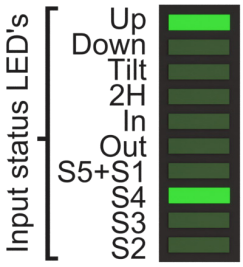


Fig 20. CD 11

Right next to the control device input block, there is a single LED and a strip with ten LED's. The single LED is the status light for the input fuse. Unlit LED means a short circuit or that the card is switched off. Lit LED means that there is voltage to the ouput section.

The LED strip indicates that the card is receiving a signal from a sensor and/or a control device. Each function has its own dedicated LED on the strip. Sensors S2 through S4 have their own dedicated LED's as well while S5 and S1 are grouped together into one LED.



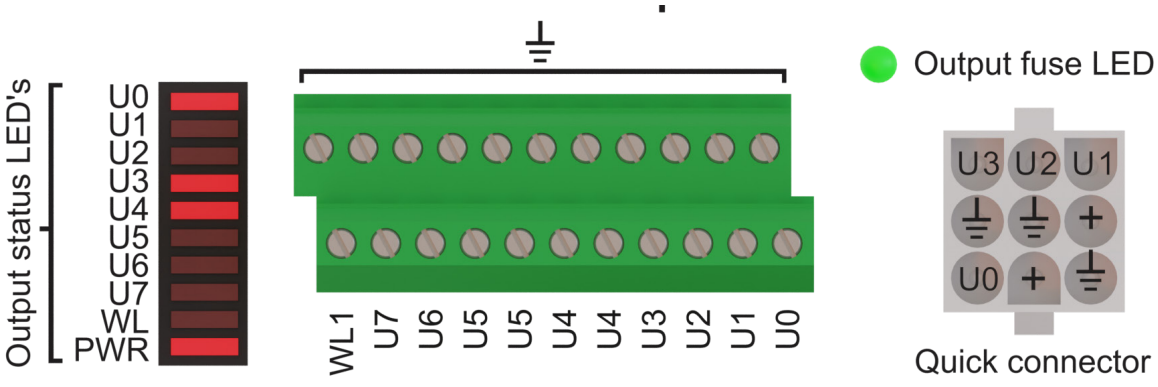
Input fuse LED

2.2.6 Card configuration

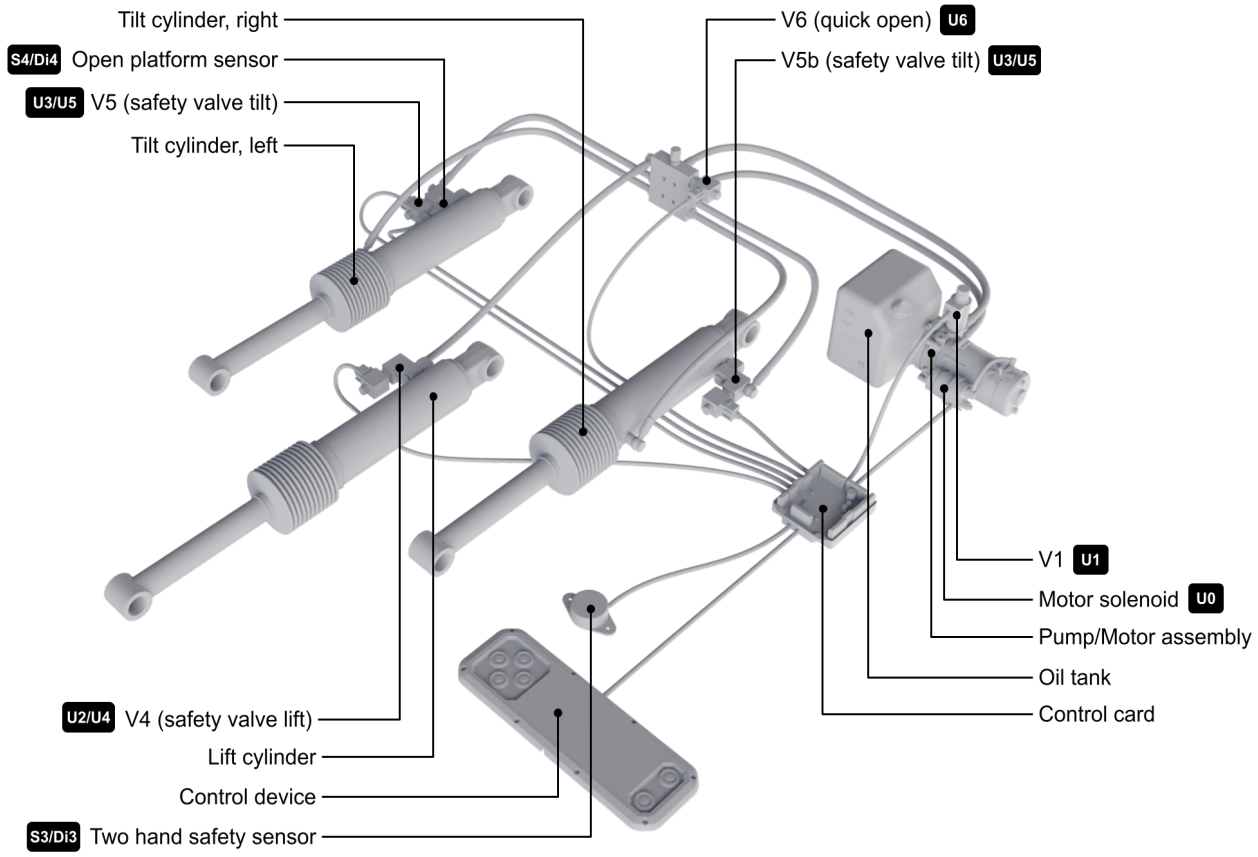
The card configuration block is a block with three two-position switches that determine the configuration of the card. A switch is in its ON-position when pushed to the right side of the slot and in its OFF-position when pushed to the left. For the Z3N tail lift family, only the 000 configuration is used which means that all three switches are in their OFF-positions as shown below

2.2.7 Outputs

The output section is used for power delivery to the solenoid and the coils that control the valves and thereby the motion of the tail lift. The output block consists of 22 pins in total split into 2 rows. The top row consists of 11 ground points used for the coils and the solenoid. Four of these pins are interconnected in two pairs for cases where two coils need the same signal. The bottom row consists of 11 pins for power delivery to the coils, solenoid and in some cases warning lights. On the right side of the output block there is a square white quick connector that is sometimes used for output to U0 through U3 instead of the output pins on the output block. To the right of the output block there is a single LED used for output fuse status indication. It lights up green when there is voltage to outputs. Unlit LED means a short circuit or that the relay card is switched off. To the left of the output block there is a LED strip with 10 LED's used for active output indication. The bottom LED lights up when the control card is powered. It should stay lit constantly during normal operation. The top 9 LED's are used to indicate active output with each output having its own dedicated LED.

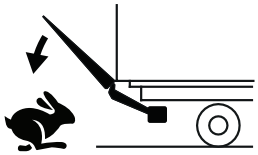


3. Functional descriptions and schematics
3.1 Z3N
3.1.1 Description
The Z3N, including variants such as the Z3NN and Z3NW, is a tail lift with two double acting tilt cylinders and a single acting lift cylinder. It is equipped with a quick opening valve that increases the opening speed of the platform. It is not equipped with auto tilt functionality.

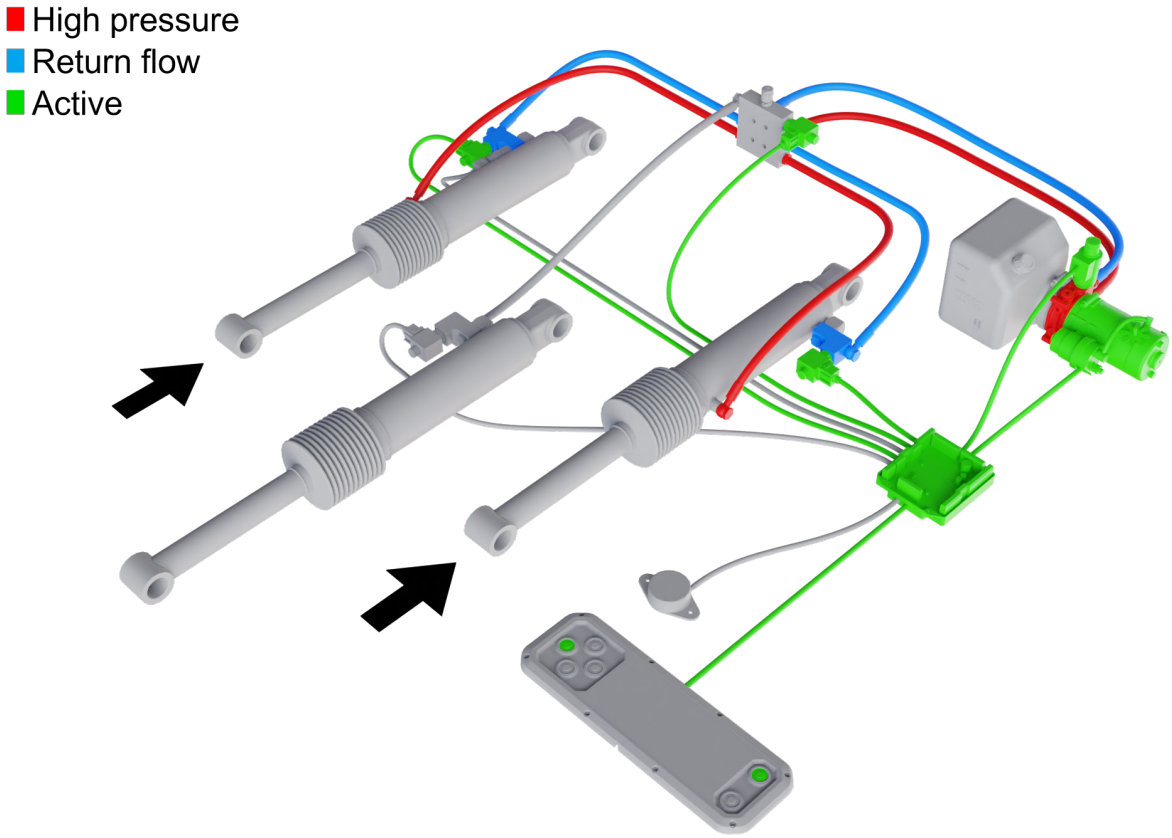


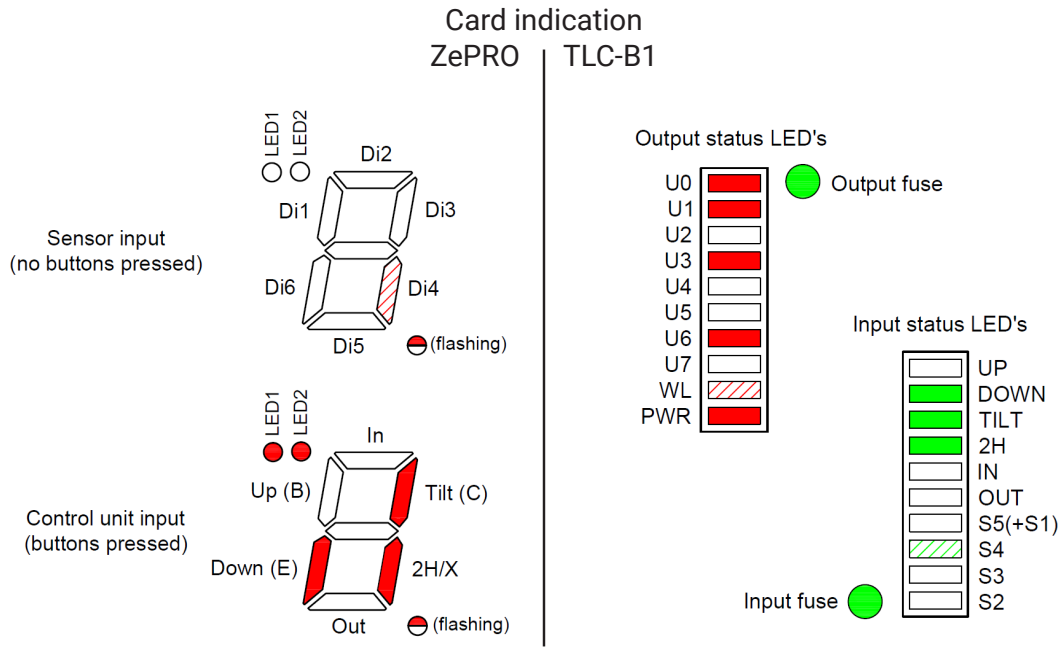
Sensors used:
Angle sensor located on the platform used for the safety requirement for two hand operation when opening and closing against the boxy body. The sensor is inactive when the platform angle is within 45 degrees from vertical and within this range the two hand control is required. If the platform is closer to horizontal, the sensor is active and the requirement is removed. This sensor is connected to Di3 on ZePRO1 and to S3 on TLC-B1.

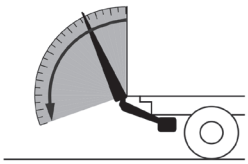
Pressure sensor located on the positive hydraulic feed to the tilt cylinder used to activate the open platform alarm. The sensor is active when the pressure drops below 20 bar which enables the Pa+ and Pa- pins on cabin switch section of the control card. This sensor is connected to Di4 on the ZePRO1 card.



Z3N
Function: quick open
Description: Quick platform opening from fully closed against box body to horizontal.
Control input: Down + Tilt + 2H. Available on primary control devices only.
Sensor input: Angle sensor on platform must be inactive at start of motion.

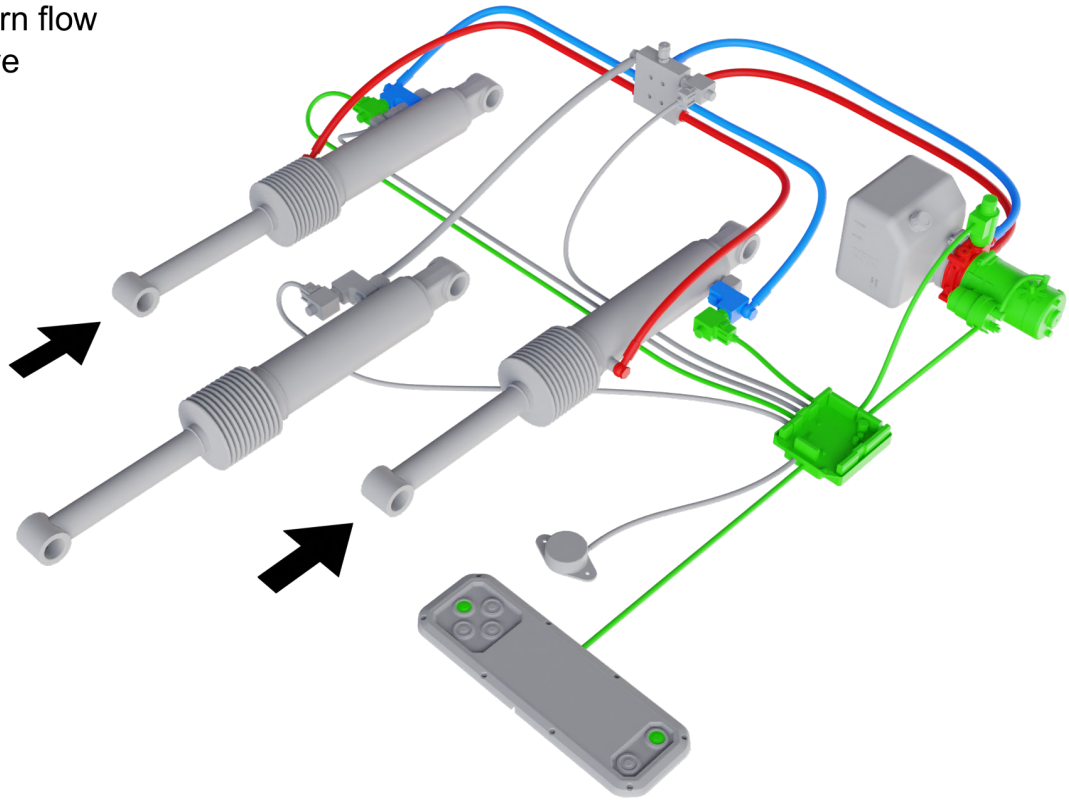




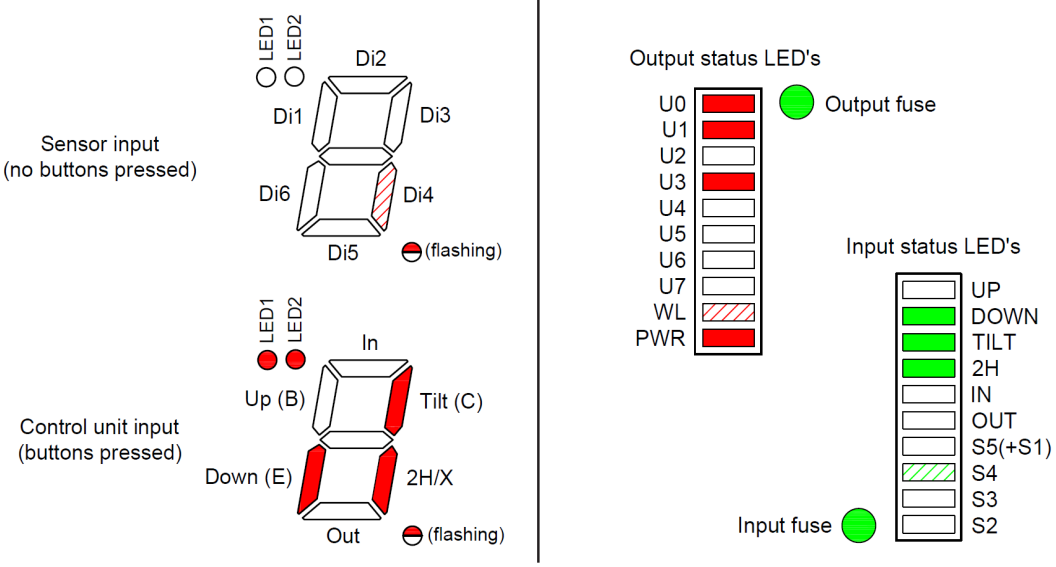


Z3N
Function: open
Description: Platform opening from fully closed against box body to horizontal.
Control input: Down + Tilt + 2H.
Sensor input: None required for function.

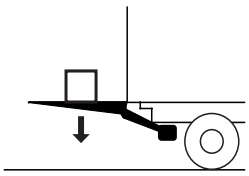
High pressure
Return flow
Active



Card indication
ZePRO | TLC-B1

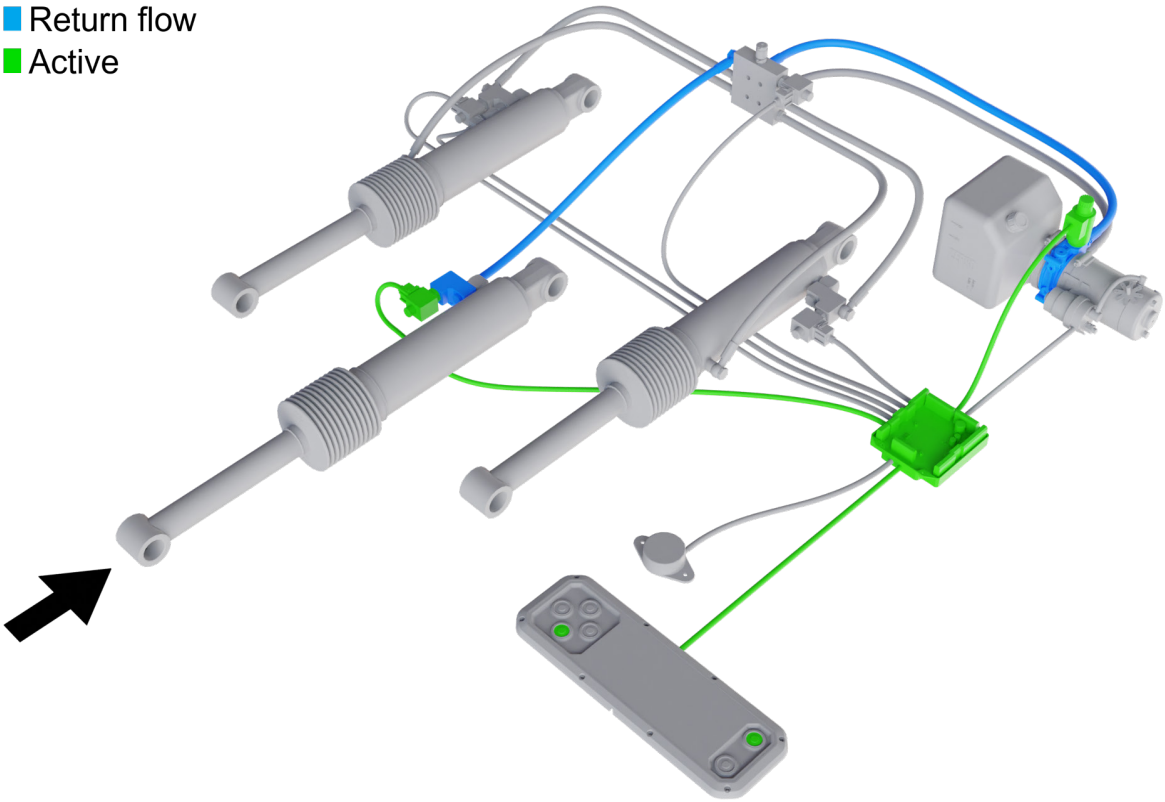


Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.

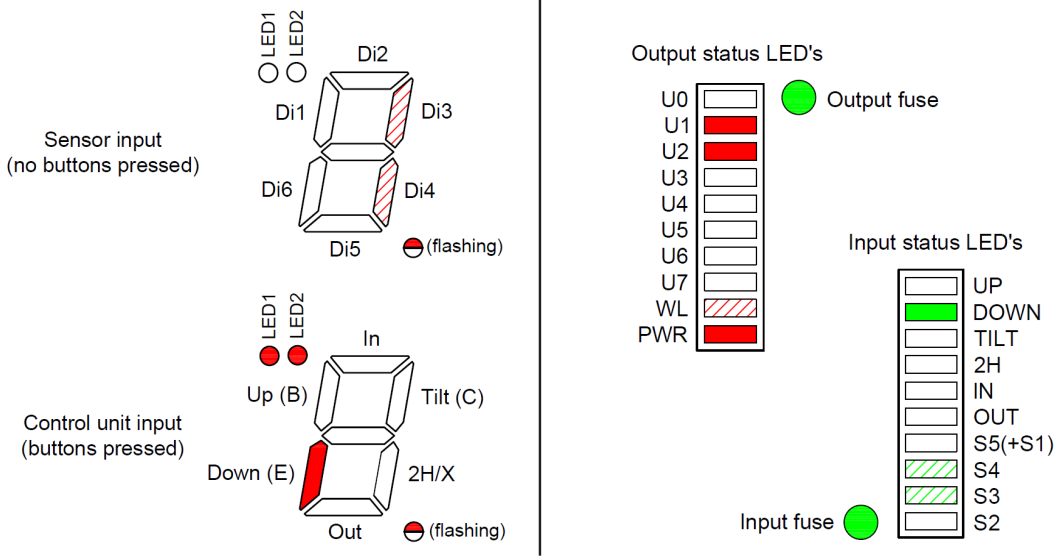


Z3N
Function: lower
Description: Vertical platform lowering.
Control input: Down. Available on all control devices.
Sensor input: None required for function.

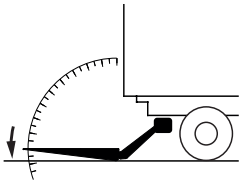
High pressure
Return flow
Active



Card indication
ZePRO | TLC-B1

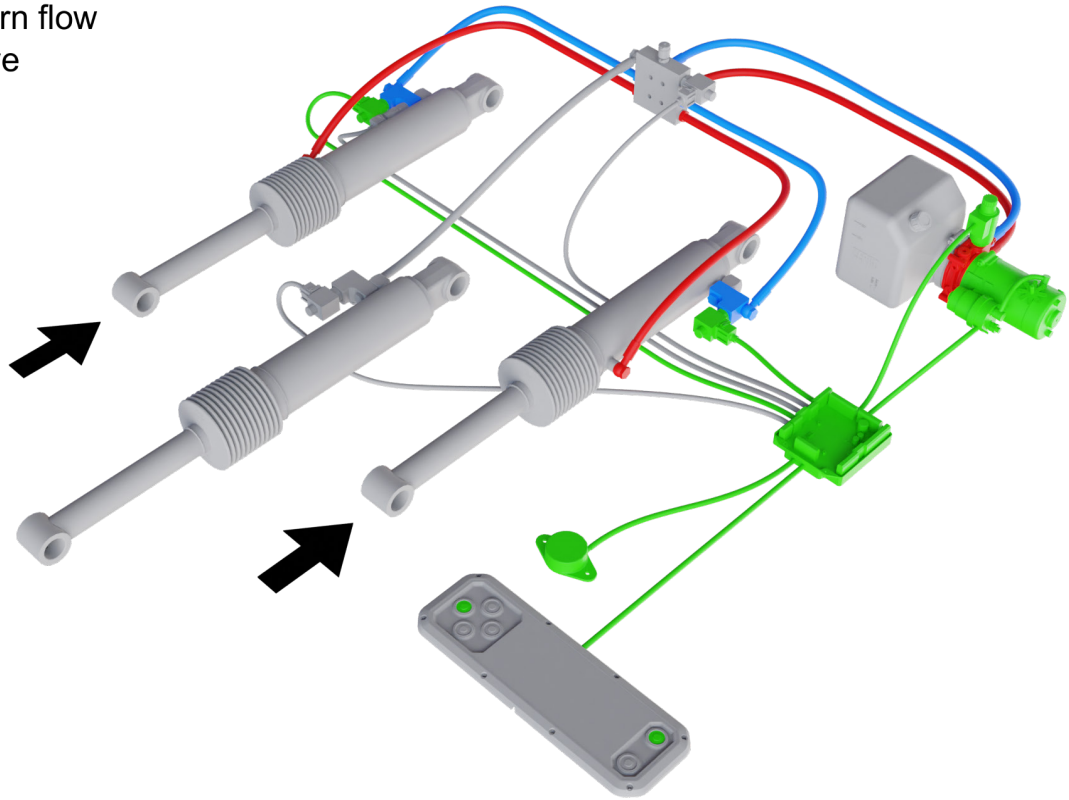


Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.

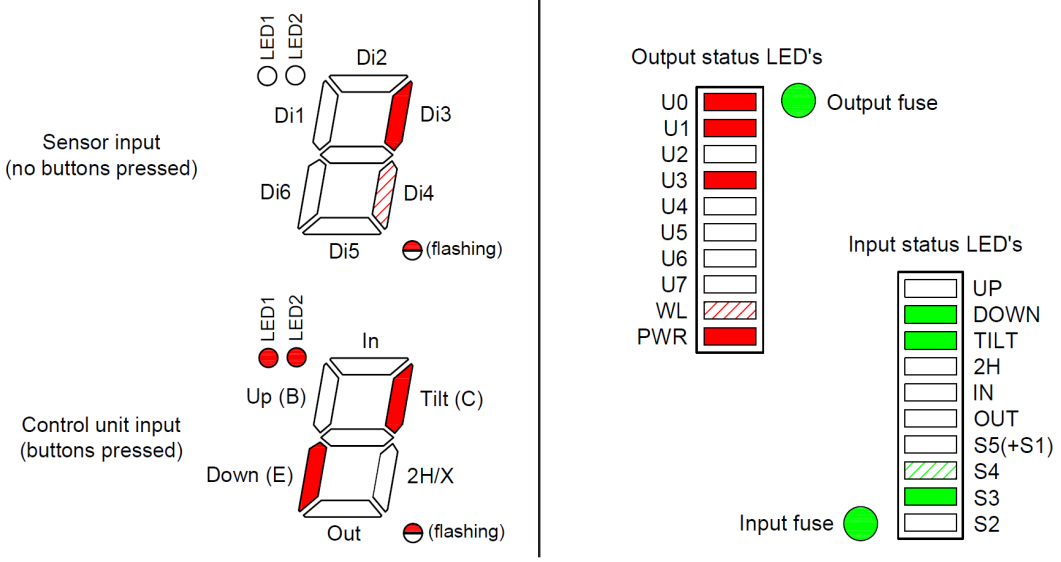


Z3N
Function: tilt down
Description: Tilting down within +45/-10 degrees from horizontal.
Control input: Down + Tilt. Available on all control devices.
Sensor input: Active angle sensor on platform.

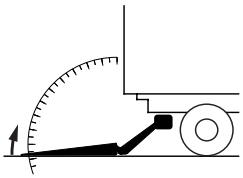
High pressure
Return flow
Active



Card indication
ZePRO | TLC-B1

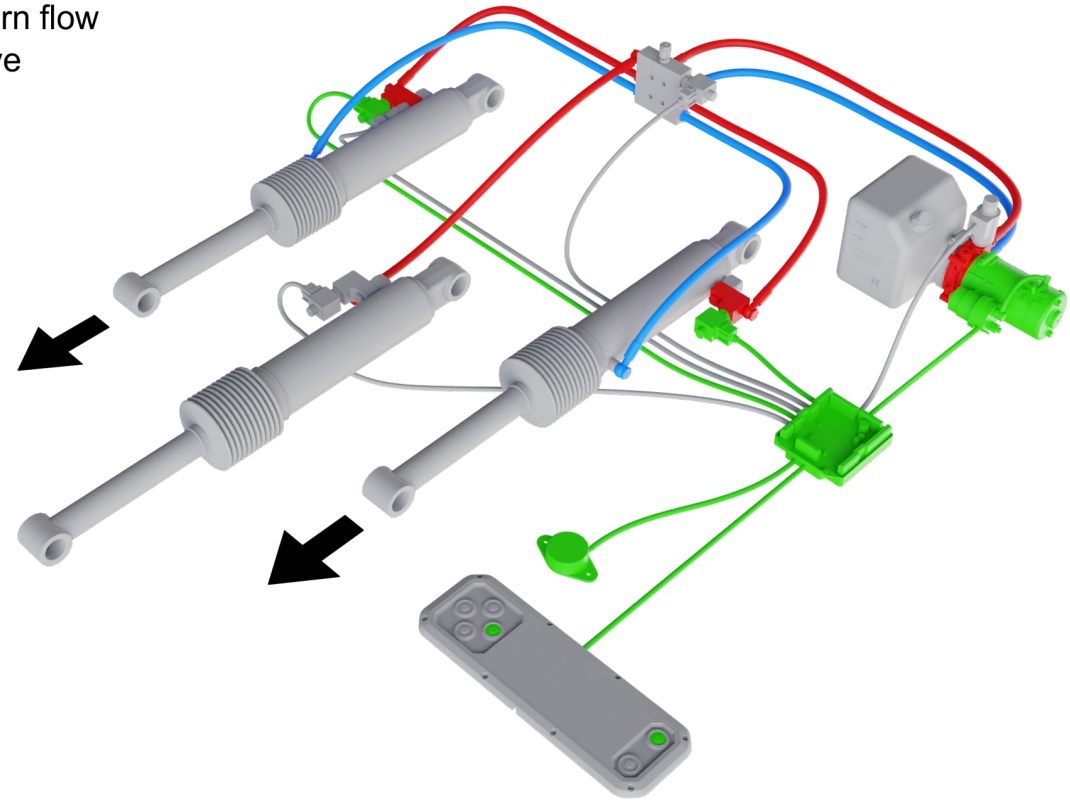


Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.



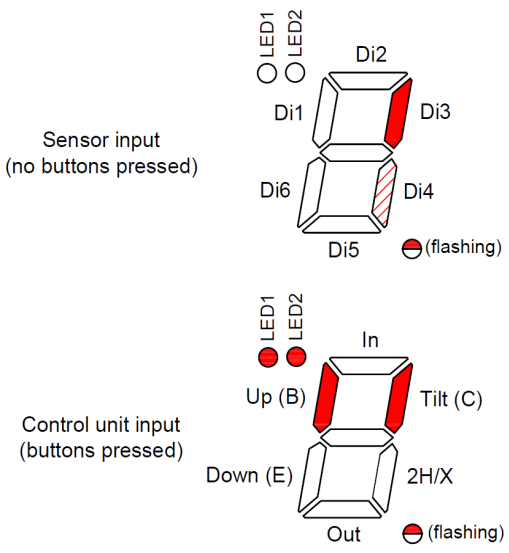
Z3N
Function: tilt up
Description: Tilting up within +45/-10 degrees from horizontal.
Control input: Up + Tilt. Available on all control devices.
Sensor input: Active angle sensor on platform.

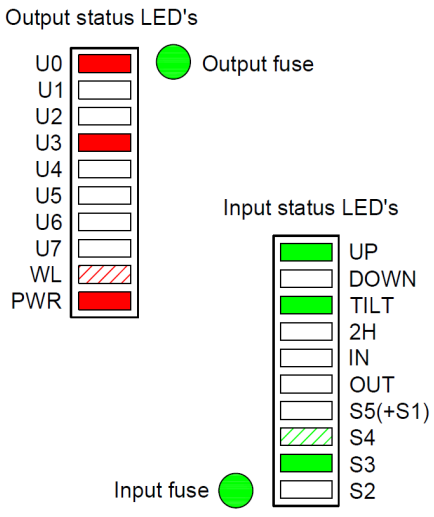
High pressure
Return flow
Active



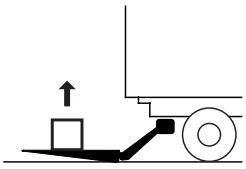
Card indication

ZePRO | TLC-B1

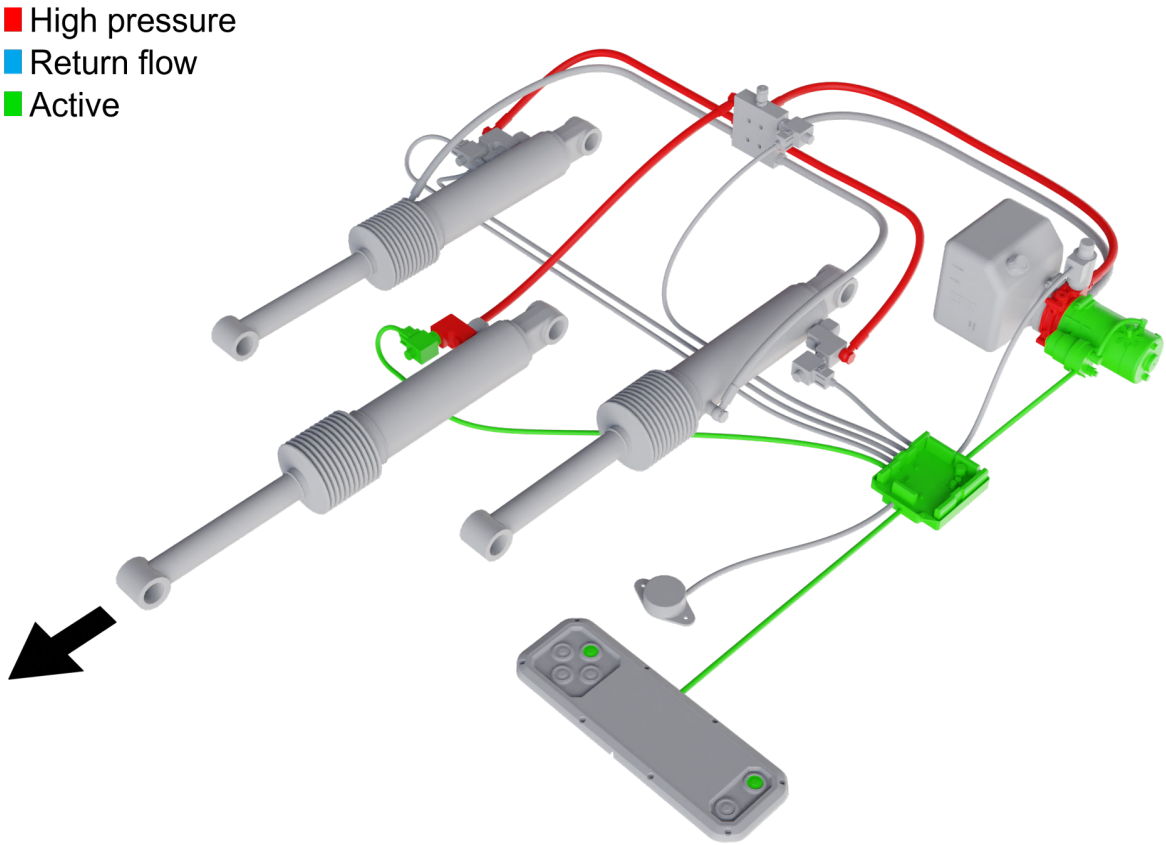


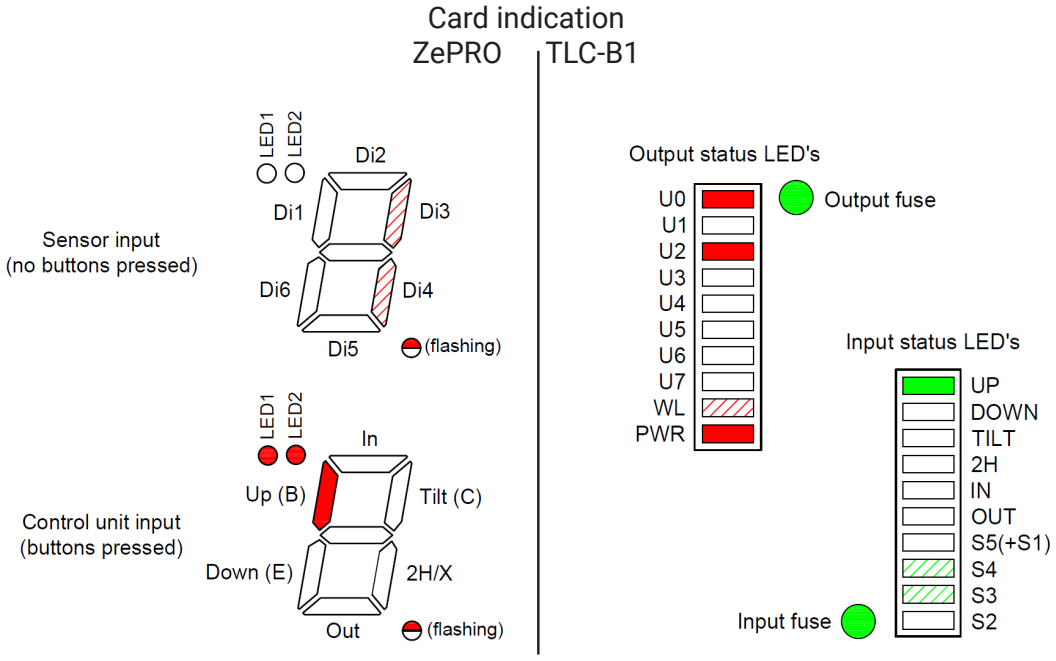


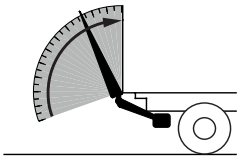
Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.



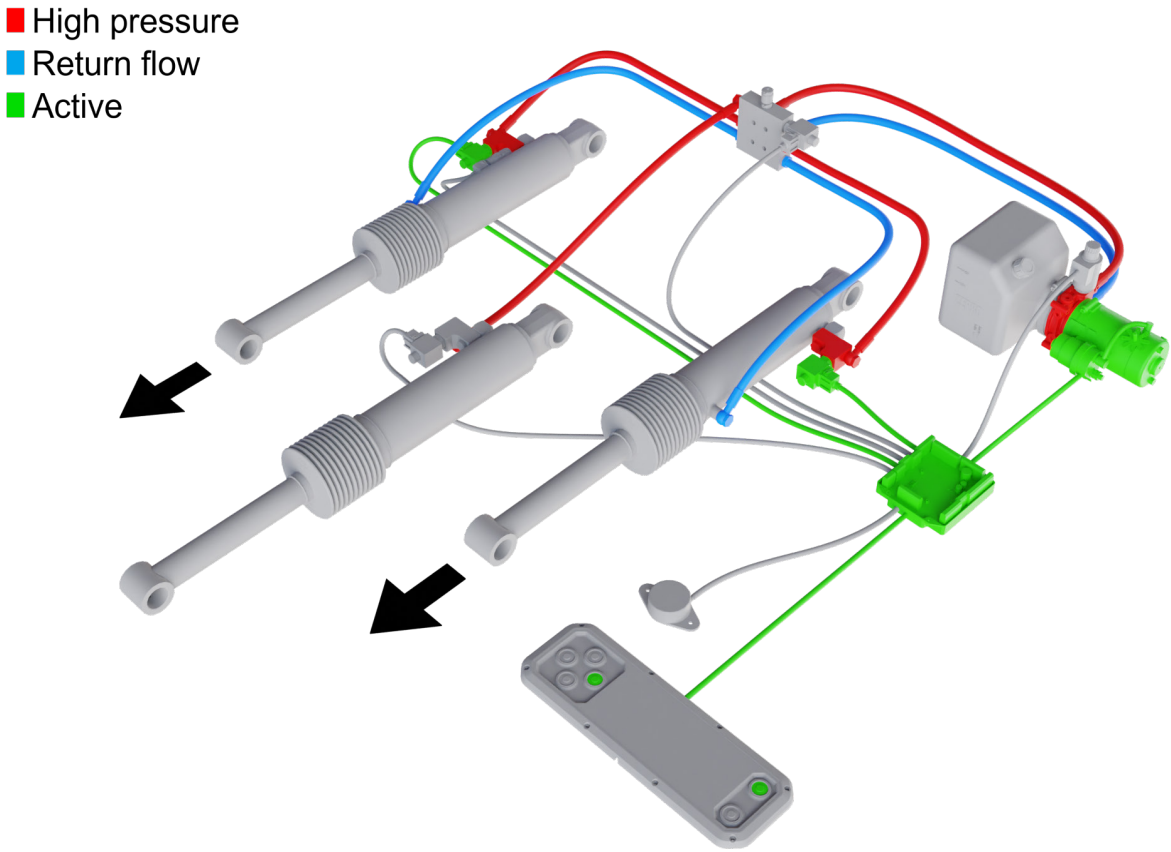
Z3N
Function: raise
Description: Vertical platform raising.
Control input: Up. Available on all control devices.
Sensor input: None required for function.

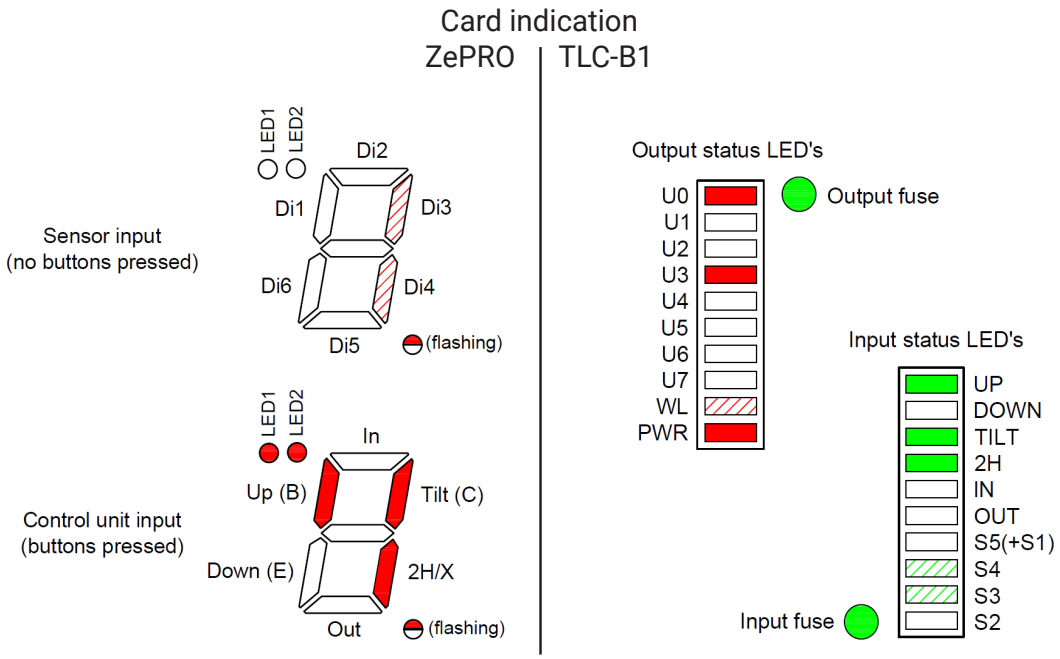






Z3N
Function: close
Description: Closing fully against the box body.
Control input: Up + Tilt + 2H. Available on primary control devices only.
Sensor input: None reqiured for function.





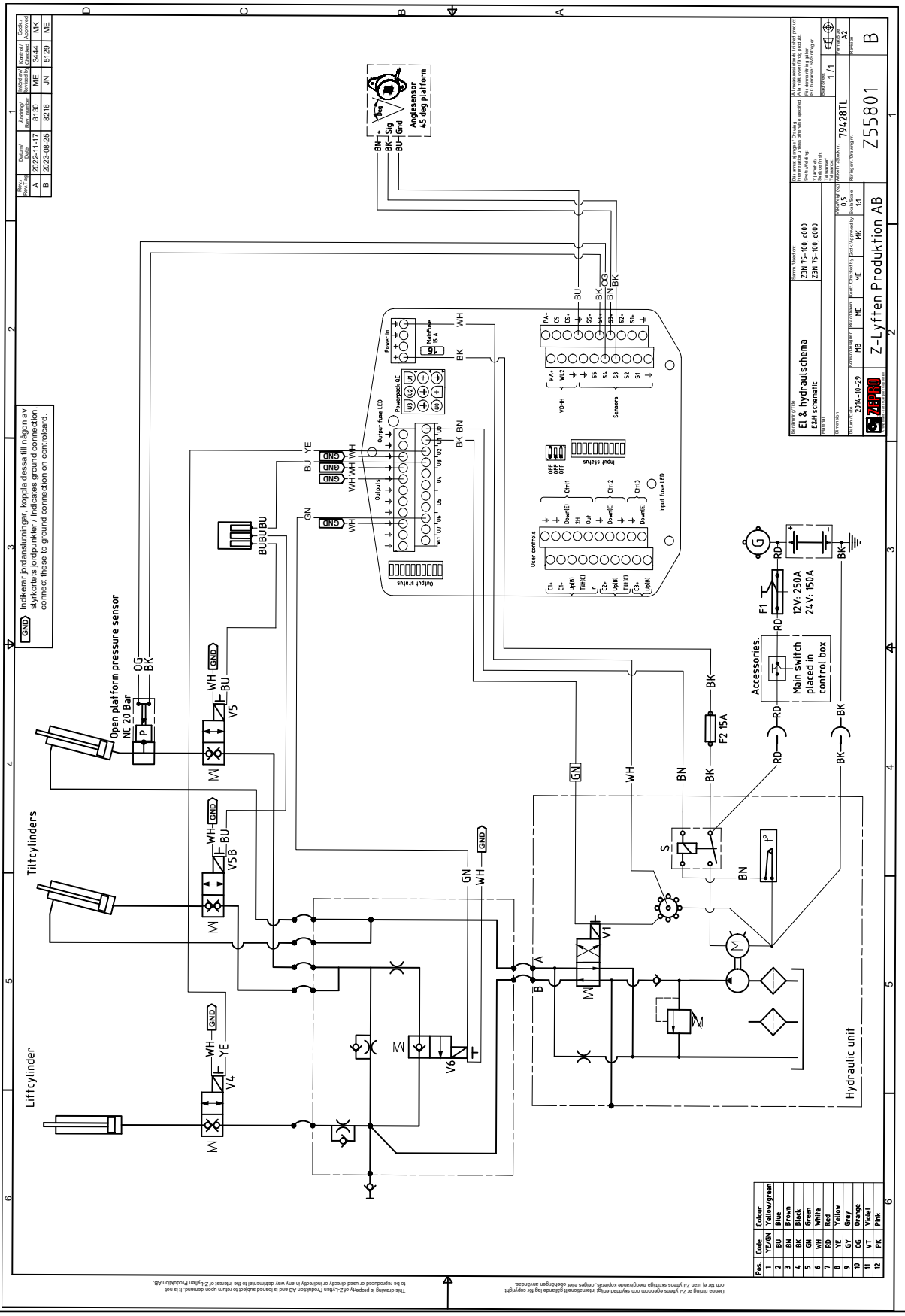
2.2.8 Summary of active valves Z3N

		Control input				Sensor input		Outputs				
		Up	Down	Tilt	2H	Two hand safety sensor	Open platform sensor	Motor solenoid	V1 valve	Safety valve, lift	Safety valves, tilt	Quick open valve
Card connection	ZePRO1					Di3	Di4	U0	U1	U4	U5	U6
	TLC-B1					S3	S4	U0	U1	U2	U3	U6
Function	Quick open		✓	✓	✓	Low[1]		✓	✓		✓	✓
	Open		✓	✓	✓			✓	✓		✓	
	Lower		✓				High[2]		✓	✓		
	Tilt down		✓	✓		High	High[2]	✓	✓		✓	
	Tilt up	✓		✓		High	High[2]	✓			✓	
	Raise	✓					High[2]	✓		✓		
	Close	✓		✓	✓		High[2]	✓			✓	

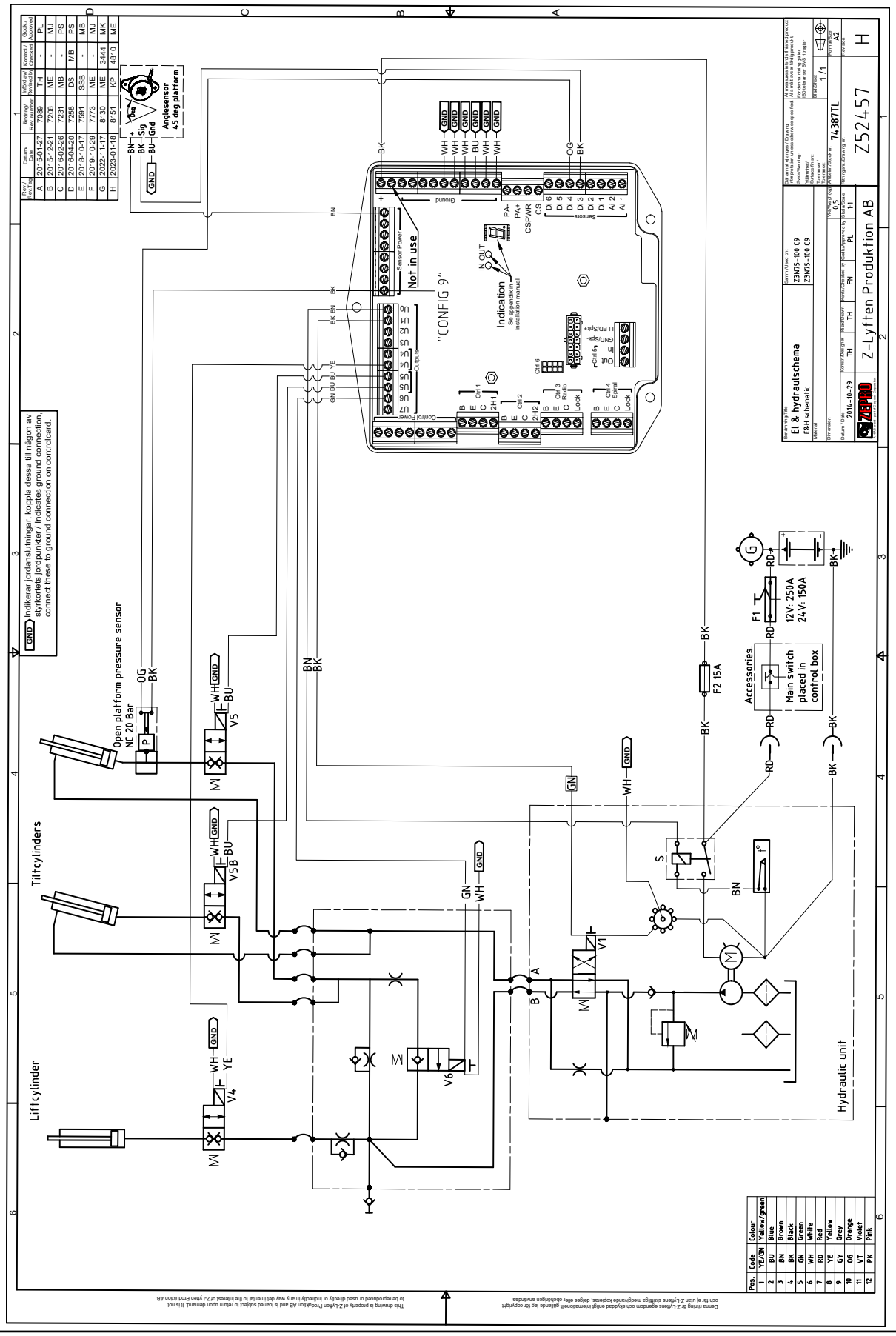
1 Required at start of function.

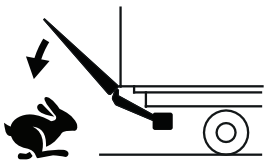
2 Only used to activate the alarm. Doesn't affect the main functions of the lift.

2.2.9 Z3N(U), Z3NN(U), Z3NW(U) 75-100 (TLC-B1)

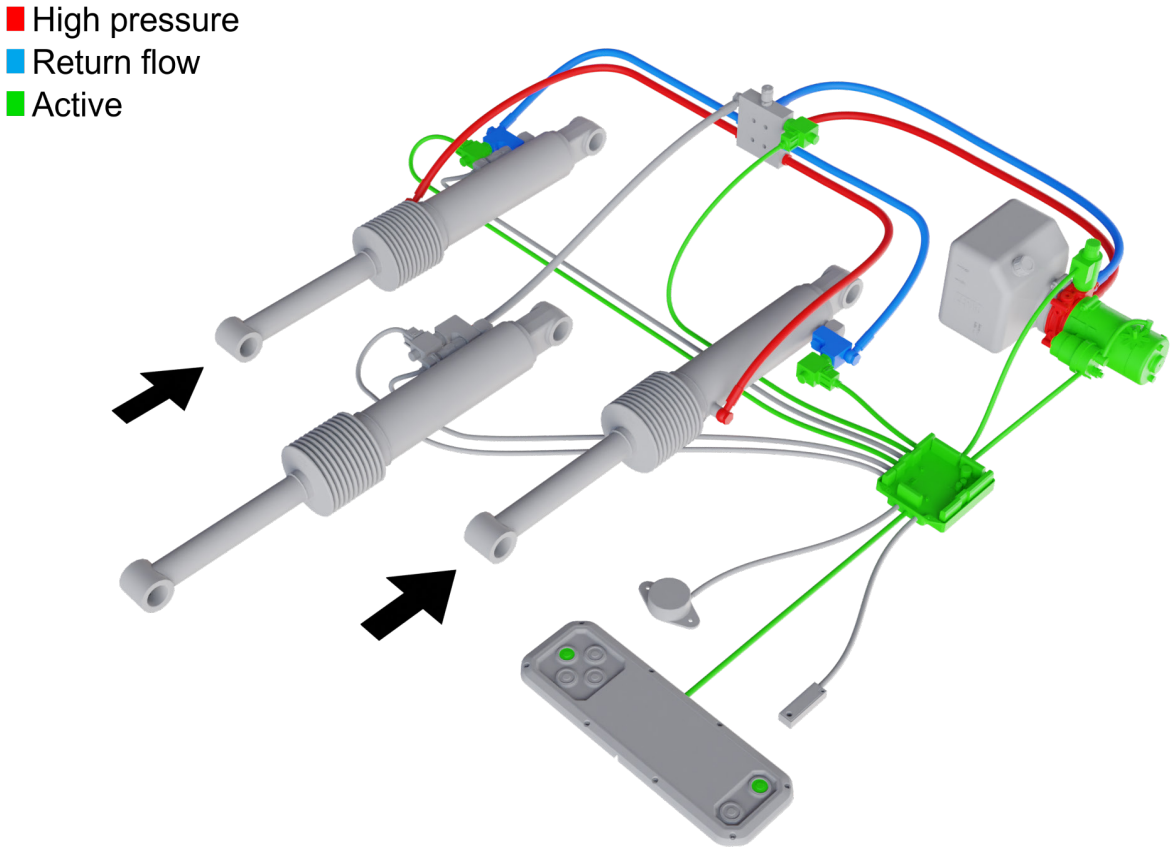


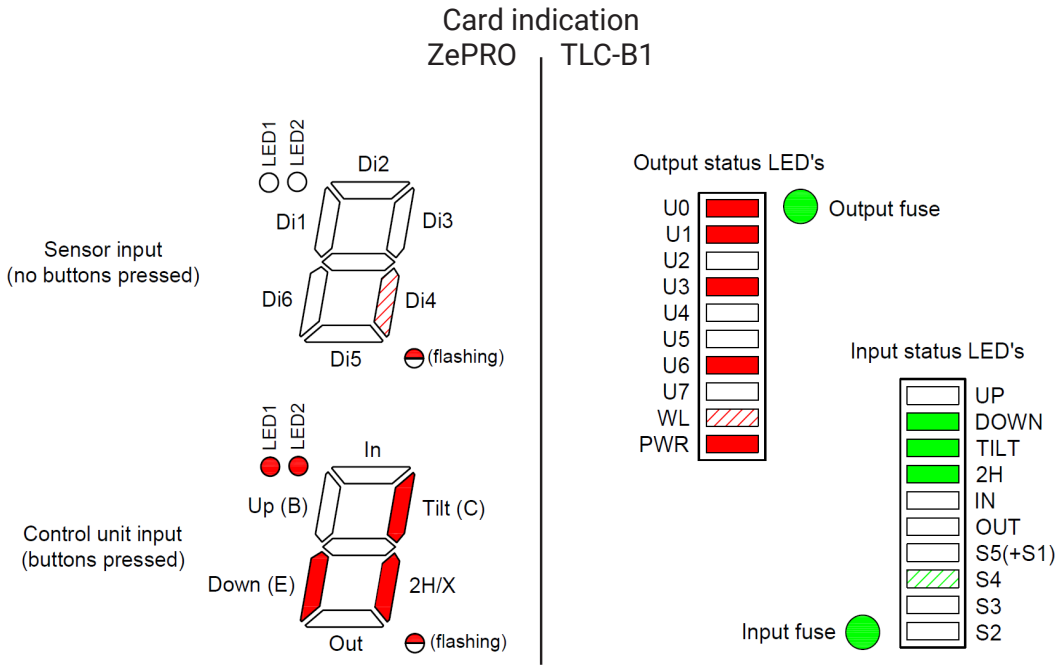
2.2.10 Z3N(U), Z3NN(U), Z3NW(U) 75-100 (ZePRO1)

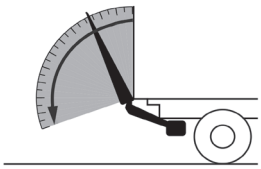




Z3N with digital auto tilt
Function: quick open
Description: Quick platform opening from fully closed against box body to horizontal.
Control input: Down + Tilt + 2H. Available on primary control devices only.
Sensor input: Angle sensor on platform must be inactive at start of motion.

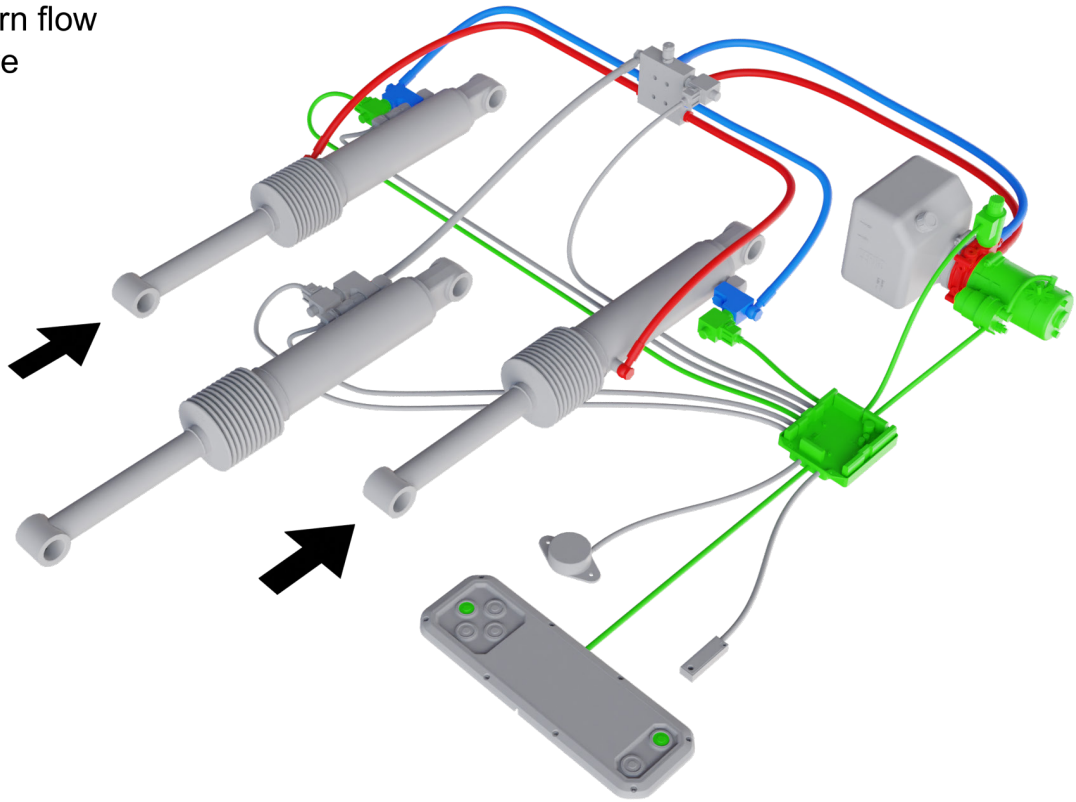




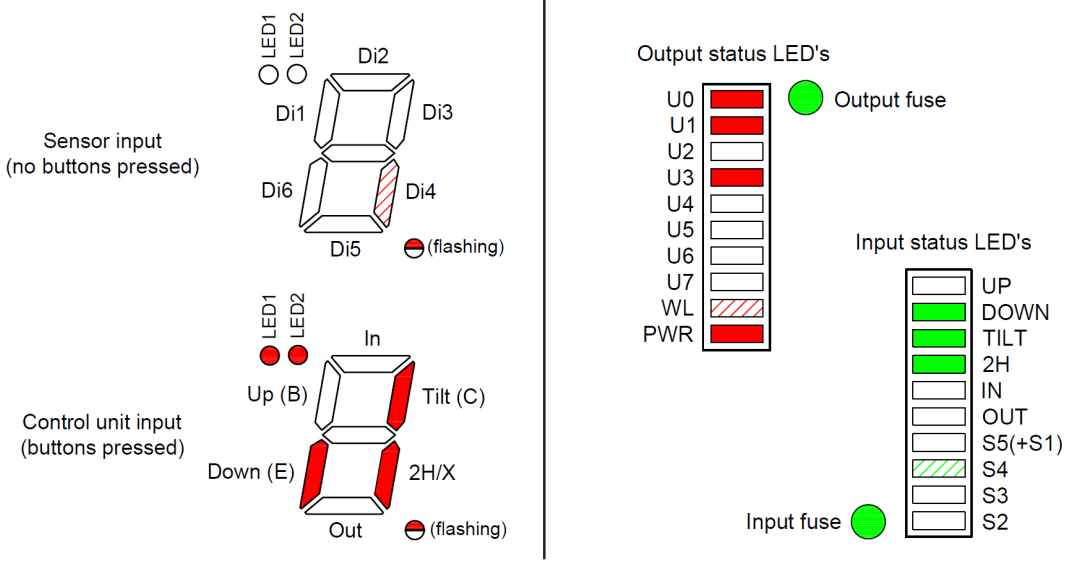


Z3N with digital auto tilt
Function: open
Description: Platform opening from fully closed against box body to horizontal.
Control input: Down + Tilt + 2H.
Sensor input: None required for function.

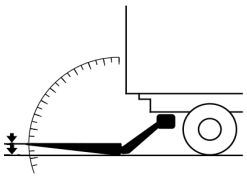
High pressure
Return flow
Active



Card indication
ZePRO TLC-B1

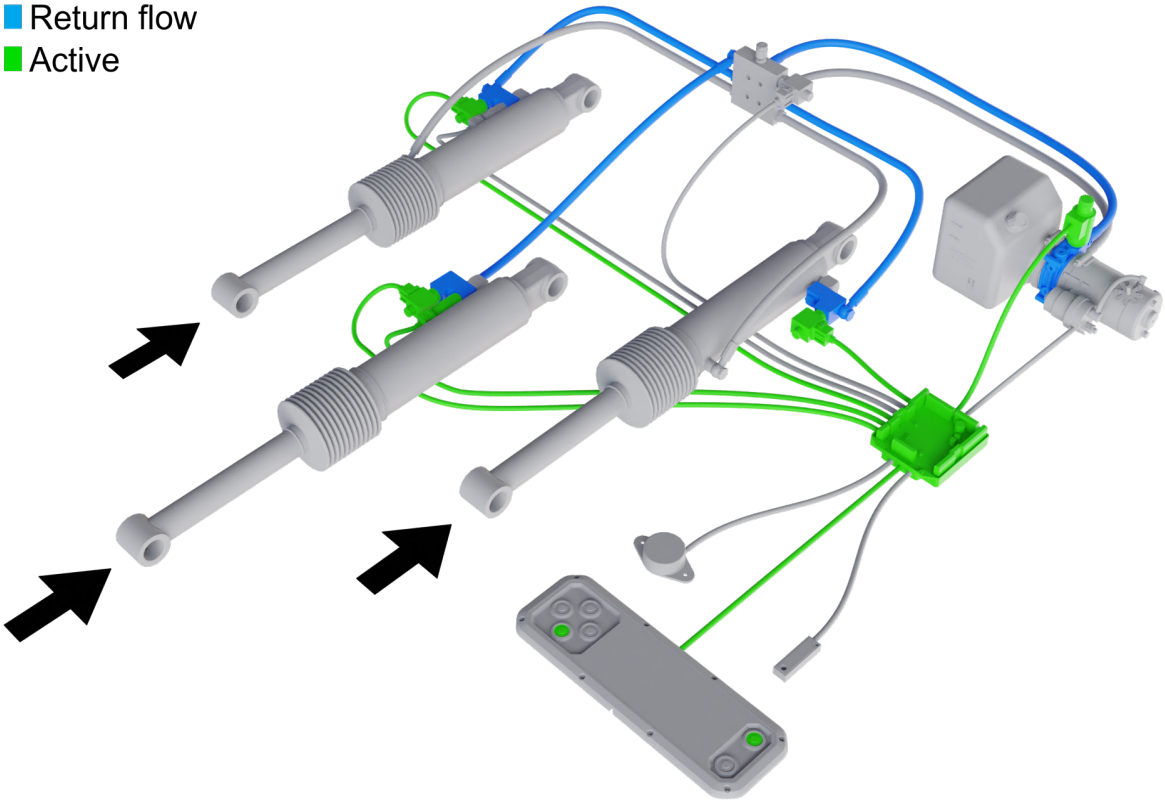


Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.

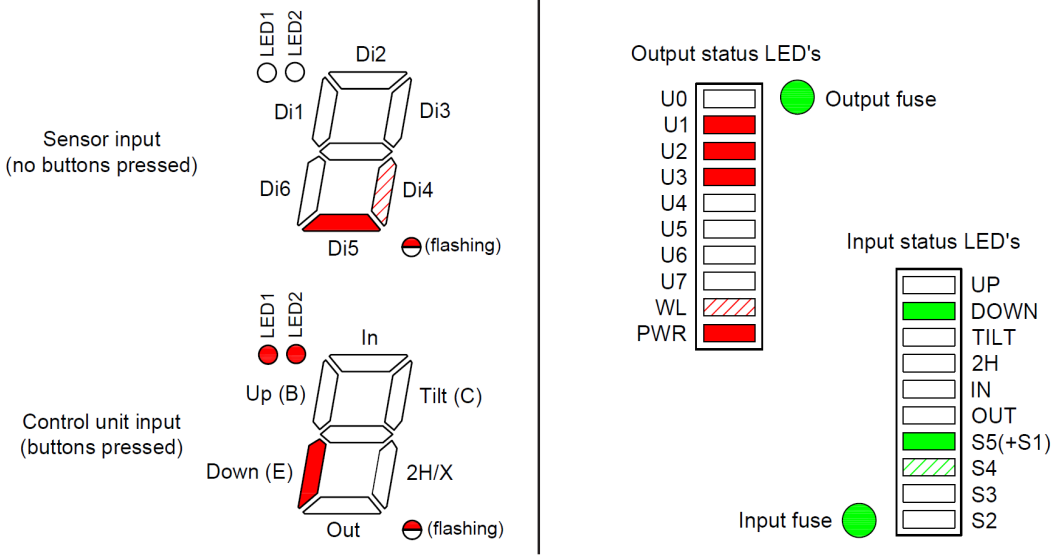


Z3N with digital auto tilt
Function: auto tilt down
Description: Automatic down tilting of the platform once gorund level has been reached.
Control input: Down. Available on all control devices.
Sensor input: Active pressure sensor on lift cylinder.

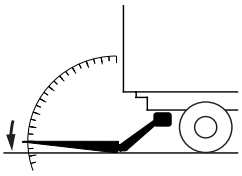
High pressure
Return flow
Active



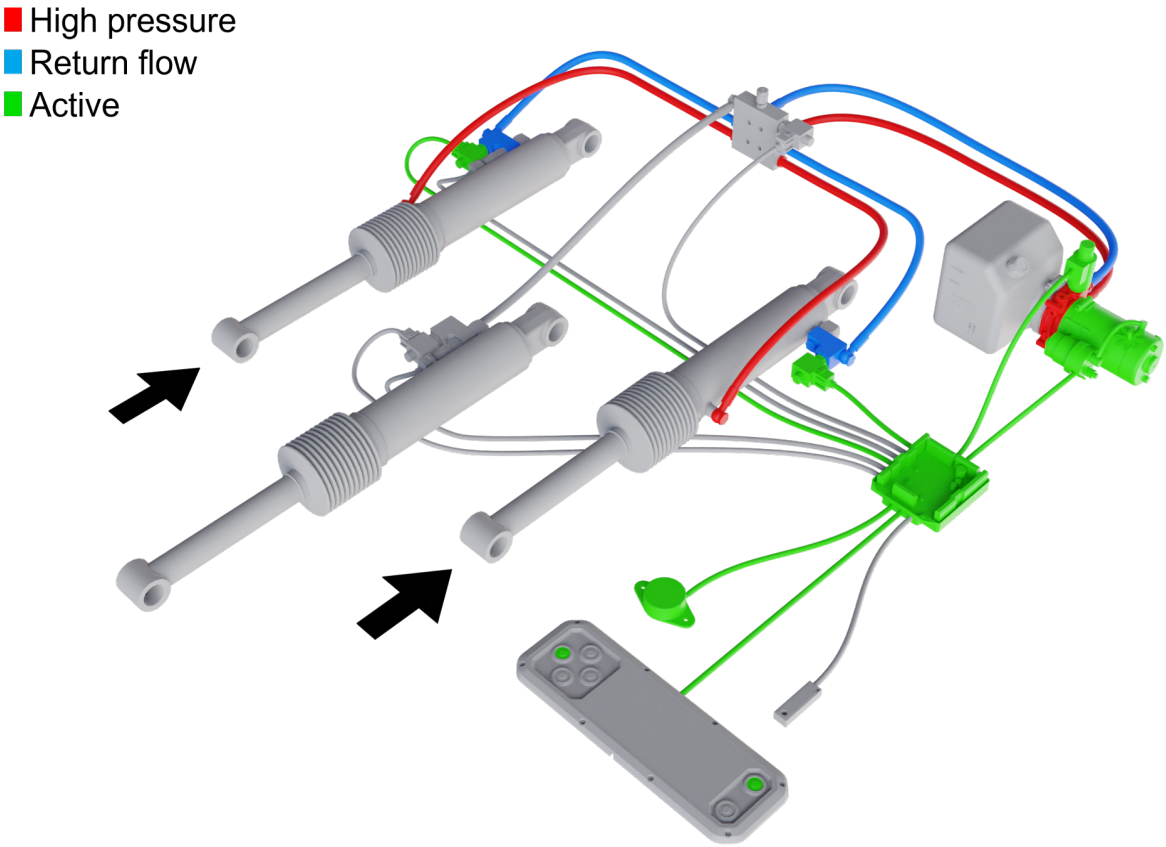
Card indication
ZePRO TLC-B1

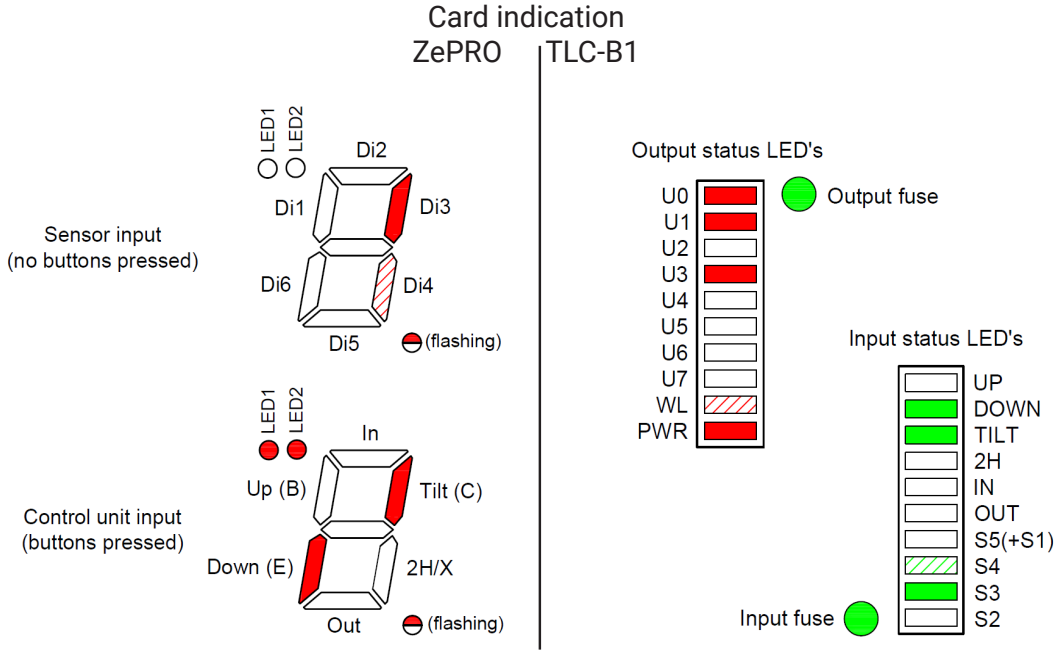


Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.

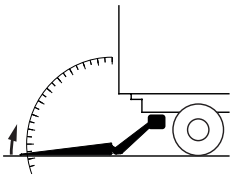


Z3N with digital auto tilt
Function: manual tilt down
Description: Tilting down within +45/-10 degrees from horizontal.
Control input: Down + Tilt. Available on all control devices.
Sensor input: Active angle sensor on platform.

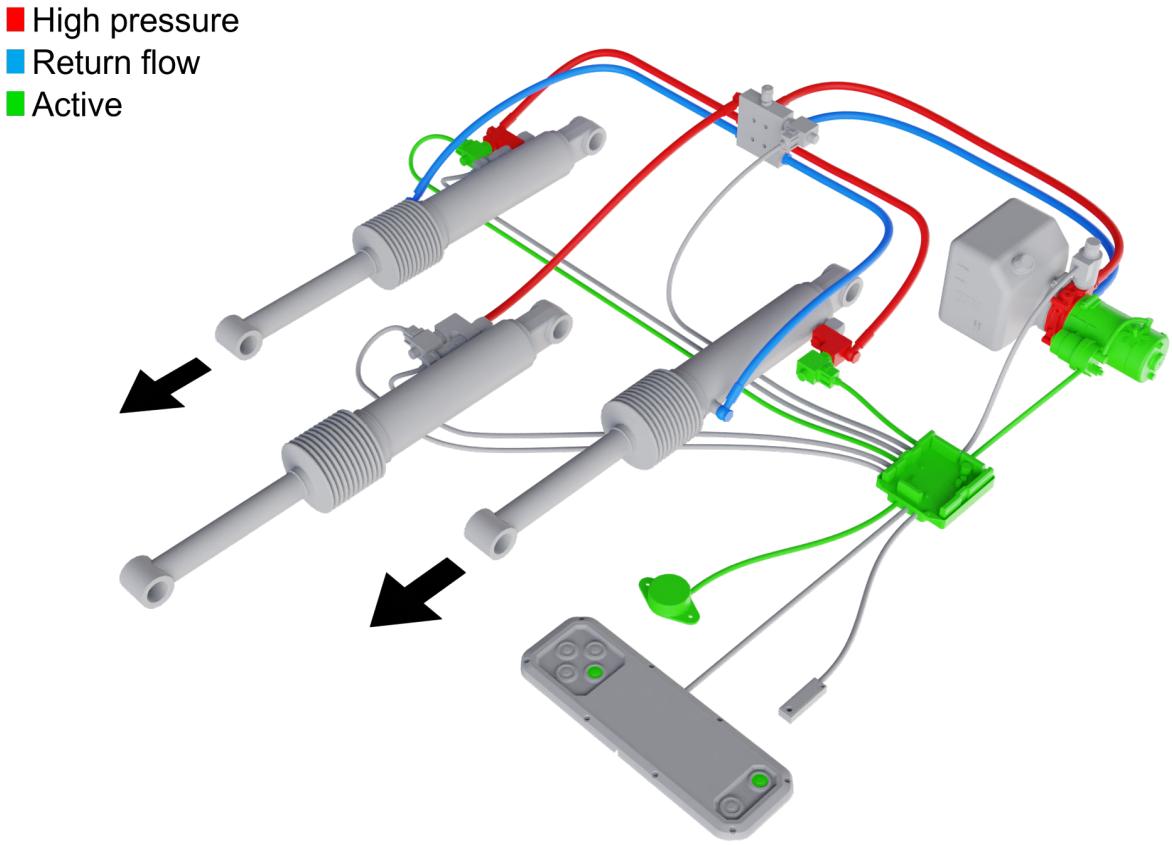


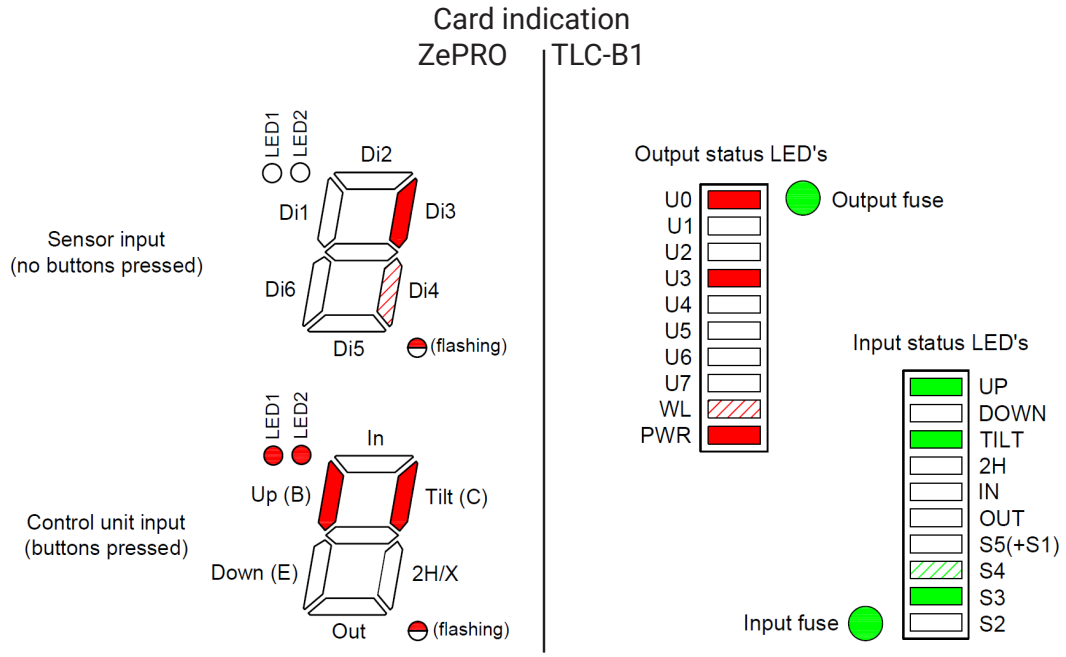


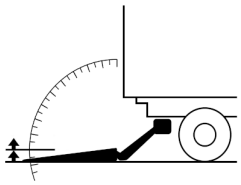
Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.



Z3N with digital auto tilt
Function: manual tilt up
Description: Tilting up within +45/-10 degrees from horizontal.
Control input: Up + Tilt. Available on all control devices.
Sensor input: Active angle sensor on platform.

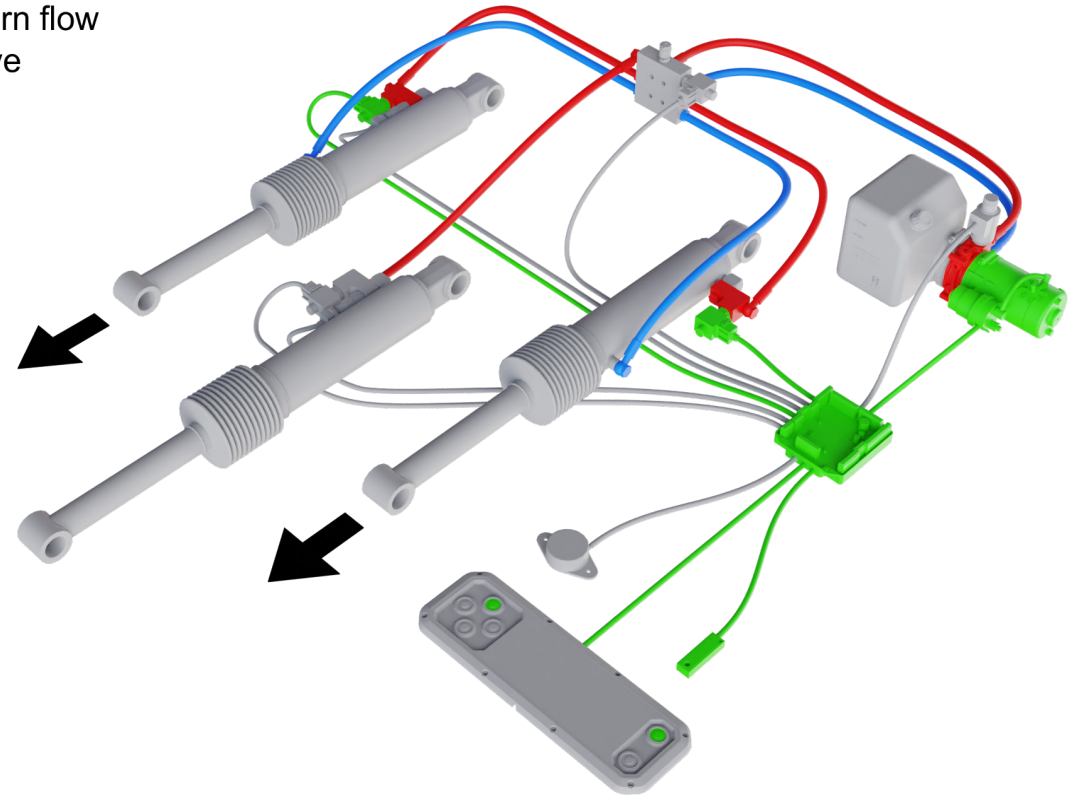




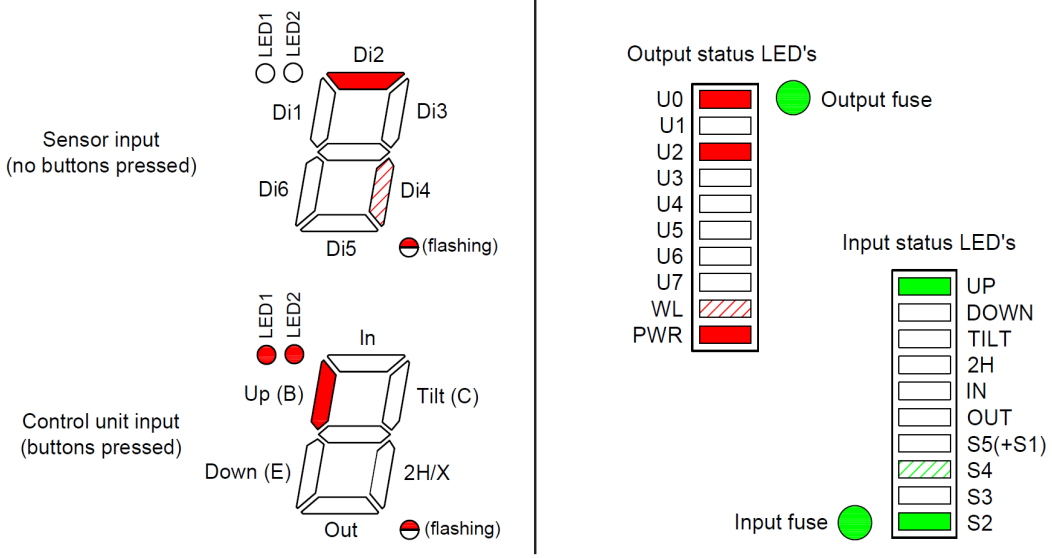


Z3N with digital auto tilt
Function: auto tilt up
Description: Automatic up tilting of the platform until it is tilted back to horizontal.
Control input: Up. Available on all control devices.
Sensor input: Active auto tilt angle sensor on platform.

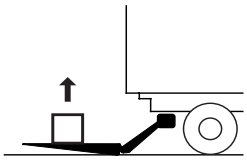
High pressure
Return flow
Active



Card indication
ZePRO TLC-B1

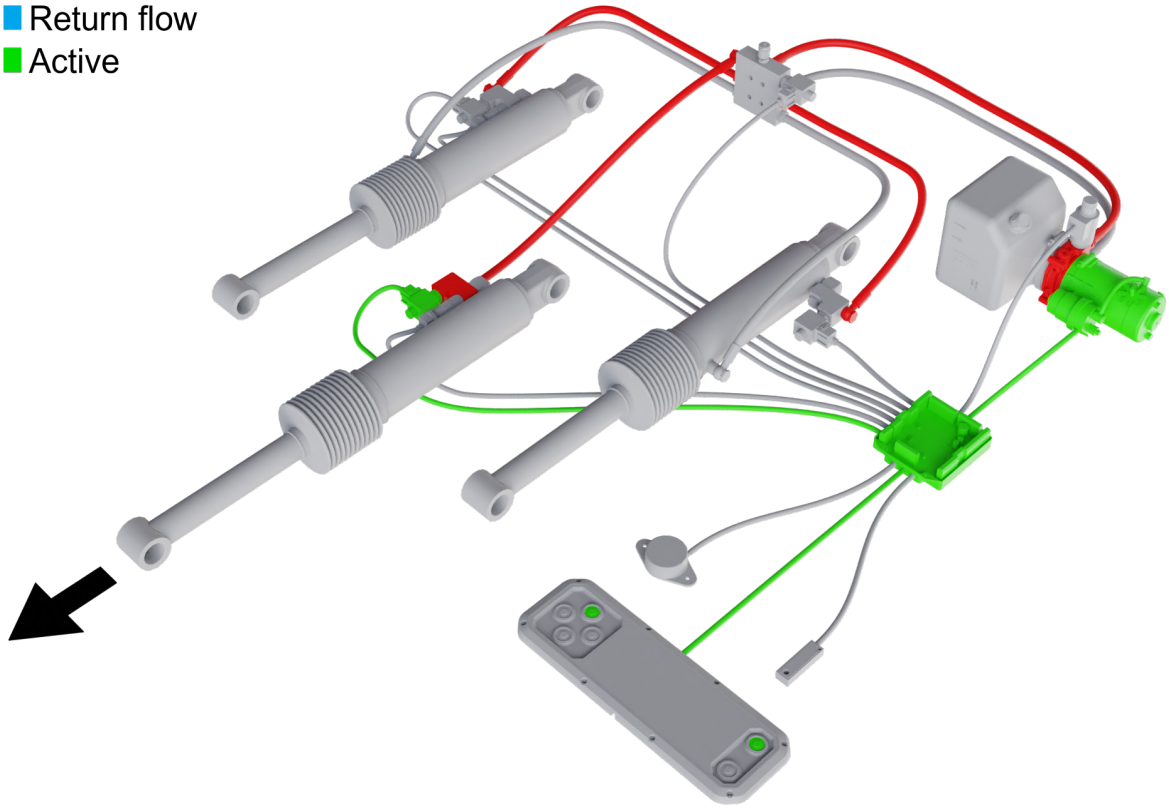


Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.

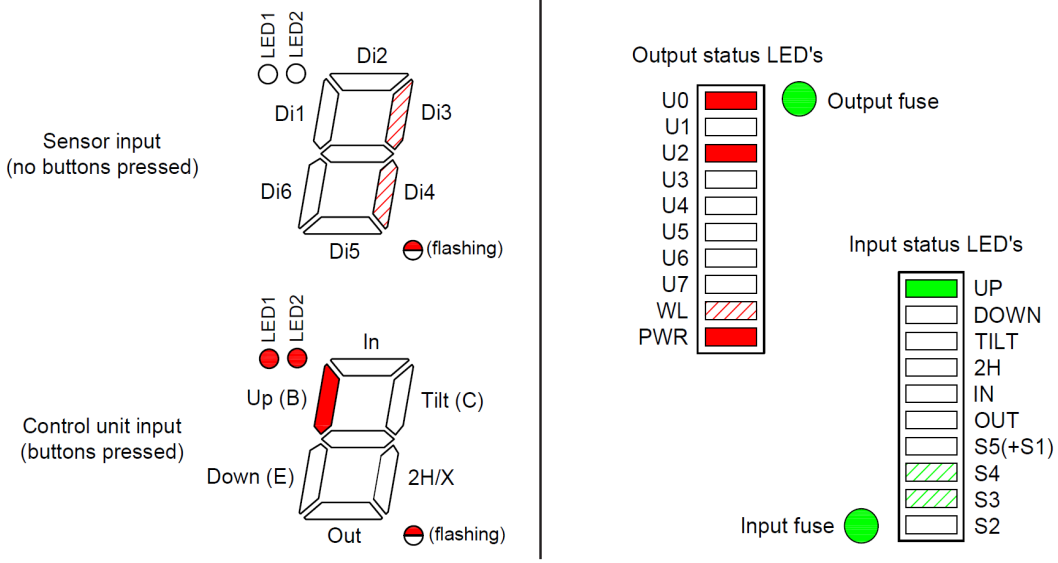


Z3N with digital auto tilt
Function: raise
Description: Vertical platform raising.
Control input: Up. Available on all control devices.
Sensor input: None required for function.

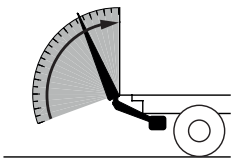
High pressure
Return flow
Active



Card indication
ZePRO TLC-B1

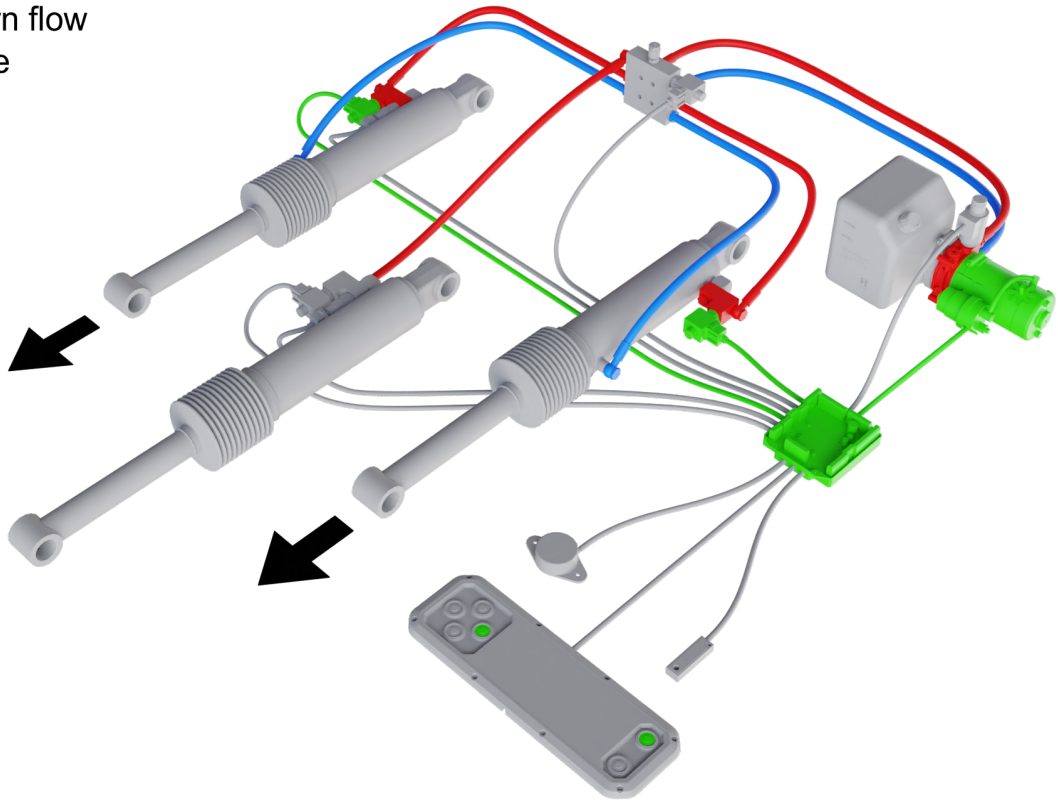


Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.

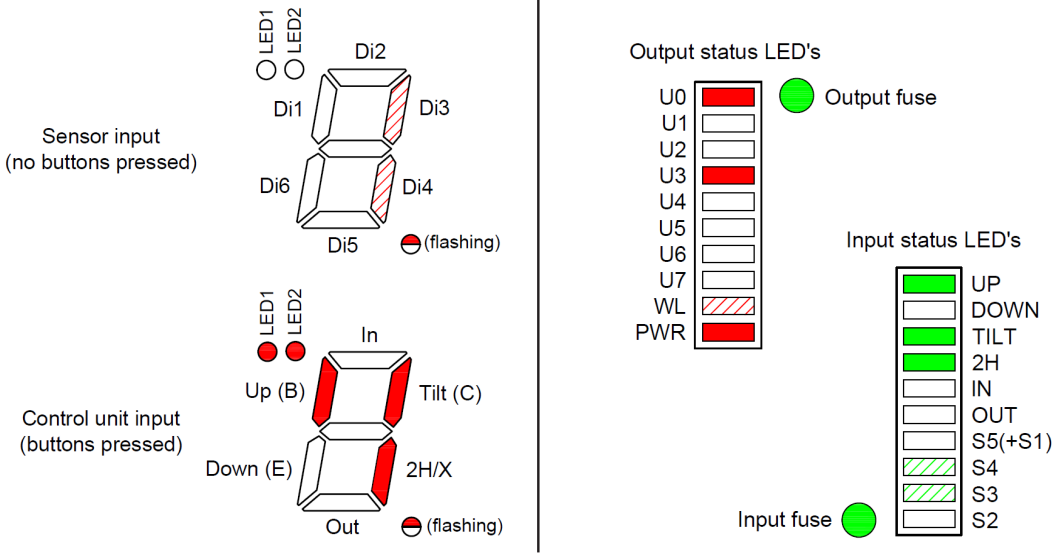


Z3N with digital auto tilt
Function: close
Description: Closing fully against the box body.
Control input: Up + Tilt + 2H. Available on primary control devices only.
Sensor input: None reqiured for function.

High pressure
Return flow
Active



Card indication
ZePRO | TLC-B1



Must be active for the function to be executed.
Must be inactive for the function to be executed.
Must be active or inactive, the function will be executed either way.

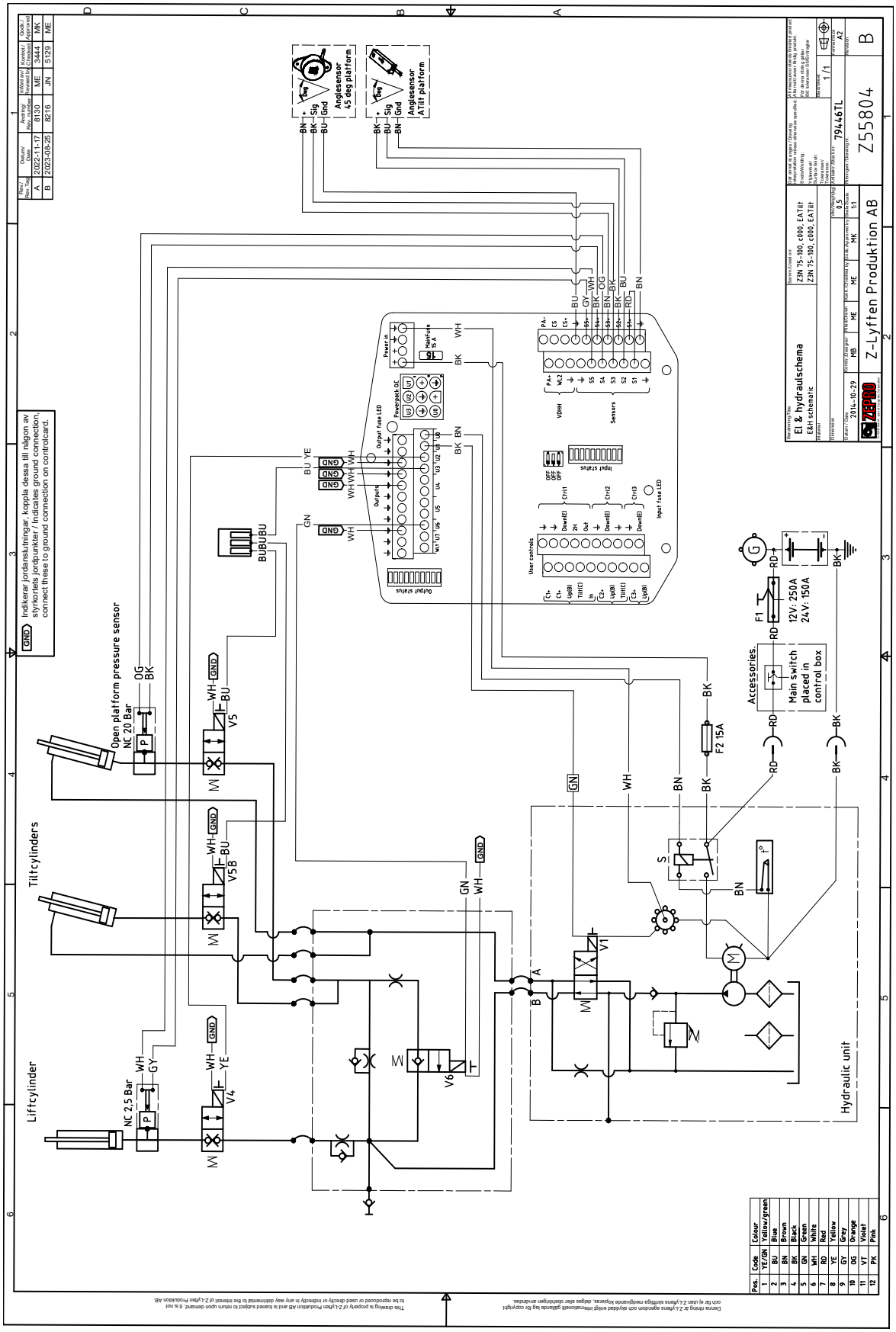
2.2.11 Summary of active valves Z3N

		Control input				Sensor input				Outputs				
		Up	Down	Tilt	2H	Two hand safety sensor	Open platform sensor	Auto tilt angle sensor	Auto tilt pressure sensor	Motor solenoid	V1 valve	Safety valve, lift	Safety valves, tilt	Quick open valve
Card connection	ZePRO1					Di3	Di4	Di2	Di5	U0	U1	U4	U5	U6
	TLC-B1					S3	S4	S2	S5	U0	U1	U2	U3	U6
Function	Quick open		✓	✓	✓	Low[1]				✓	✓		✓	✓
	Open		✓	✓	✓					✓	✓		✓	
	Lower		✓				High[2]				✓	✓		
	Auto tilt down								High		✓	✓	✓	
	Tilt down		✓	✓		High	High[2]			✓	✓		✓	
	TIlt up	✓		✓		High	High[2]			✓			✓	
	Auto tilt up							High		✓		✓		
	Raise	✓					High[2]			✓		✓		
	Close	✓		✓	✓		High[2]			✓			✓	

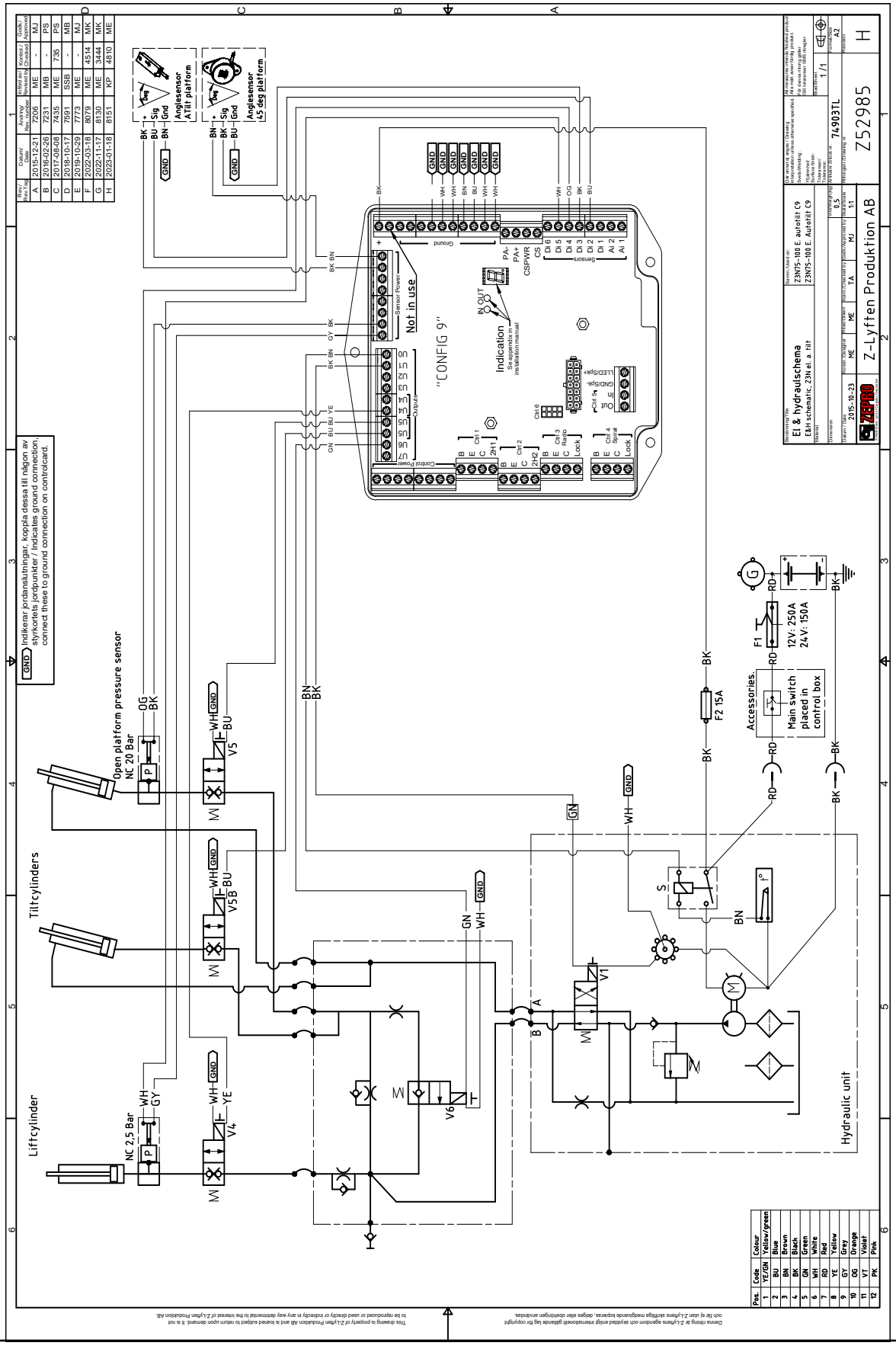
1 Required at start of function.

2 Only used to activate the alarm. Doesn't affect the main functions of the lift.

2.2.12 Z3N(U), Z3NN(U), Z3NW(U) 75-100 electrical autotilt (TLC-B1)



2.2.13 Z3N(U), Z3NN(U), Z3NW(U) 75-100 electrical autotilt (ZePRO1)



3 Troubleshooting

3.1 Causes of malfunctions

There are three categories of issues that can lead to a malfunctioning tail lift: electrical, hydraulic and mechanical. Electrical issues are fairly common and include but are not limited to damaged wiring, sensors, magnets and solenoids. Control card failures also fall in this category but are very rare in normal circumstances. Hydraulic issues include stuck or damaged valves and other oil flow obstructions or leaks within the hydraulic system. Mechanical issues include bent, seized or damaged structural components and are the least common of the three and the most easily detectable.

3.2 Troubleshooting strategy

Since the control card is a central part of the system and is responsible for turning the input signals into usable output signals which drive the desired function of the tail lift, it is the best starting point for the troubleshooting process. Following the steps listed below when troubleshooting is recommended.

Step 1: Control card power

Is the card powered on?

No: there is an issue with the power supply to the card. The fuse on the power cable to the card might be tripped or the wiring is damaged or disconnected.

Yes: the card is powered on, proceed to next step.

Step 2: Control device inputs

Is the card indicating the correct control device inputs as shown in the functional description?

No: there is an electrical issue with the control device or with the wiring between the device and the control card.

Yes: the card is receiving the correct inputs, proceed to next step.

Step 3: Sensor inputs

Is the card indicating the correct sensor inputs as shown in the functional description?

No: there is an electrical issue with a sensor or with the wiring between the sensor and the control card.

Yes: the card is receiving the correct inputs, proceed to next step.

Step 4: Outputs

Is the card indicating the correct outputs as shown in the functional description?

No: there is an issue with the control card. It might be damaged or of a wrong configuration.

Yes: the card is sending the correct ouput signals but there is

a) an electrical issue such as a damaged magnet, solenoid, motor or damaged wiring to those components,

b) a hydraulic issue such as a stuck valve, a leakage or an obstruction of the oil flow or

c) a mechanical issue such as a stuck, bent or in other way damaged structure.

Note that the troubleshooting steps listed above require the tail lift to be powered on and the cabin switch (if present) to be in the "ON" position. If the tail lift is completely dead, use a multimeter to troubleshoot the power supply starting at the tail lift and moving towards the battery. Possible causes include but are not limited to a dead battery, a tripped fuse or disconnected or damaged power and/or ground cables.

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