

Technical Manual

Relay card TLC-B1

ZEPRO
Tel.: +46 (0)10-459 05 00
Email: zeprotech@hiab.com | zepro.com

78498TL
2021-11-12



Contents

1 Technical description TLC-B1	4
1.1 General.....	4
1.2 Outputs (U0-U7)	5
1.3 Inputs	5
1.4 Voltage supply and main fuse.....	6
1.5 Operating information.....	7
1.6 Warning lights	8
1.7 Supply voltage.....	9
1.8 Power consumption.....	9
1.9 Autotilt	10
1.10 Analogue/digital converter - ADC	10
2 Functional description	11
2.1 Cylinder models	11
2.2 Models - Configurations	11
2.3 TLC-B1.1S - Config. 100.....	12
2.4 TLC-B1.1S - Config. 000.....	15
2.5 TLC-B1.1 - Config. 010.....	18
3 Electrical and hydraulic diagrams	21
3.1 Z / ZU / ZL / ZLU / ZN / ZNU 45/75.....	21
3.2 Z / ZU / ZL / ZLU / ZN / ZNU 45/75 autotilt	22
3.3 Z / ZL 1500/2000, ZN 2500, ZDK 250 MA.....	23
3.4 Z / ZL 1500/2000, ZN 2500, ZDK 250 MA Autotilt.....	24
3.5 Z / ZL 1500/2000, ZN 2500, ZDK 250 MA Autotilt with ADC	25
3.6 ZS MK2	26
3.7 ZS MK2 Autotilt.....	27
3.8 ZT MK2	28
3.9 ZT MK2 Autotilt	29

1 Technical description TLC-B1

1.1 General

All lift functions are controlled via the relay card. The card has a number of inputs and outputs for connecting the tail lift solenoid (hydraulic pump), valves, sensors and control devices. The card also has LED indicators that give the status of the system.

- Outputs
- Inputs (Control devices, VDHH, Sensors)
- LED indicator fuse output
- LED Status for outputs
- Voltage supply
- Main fuse
- LED indicator fuse inputs
- LED Status of inputs

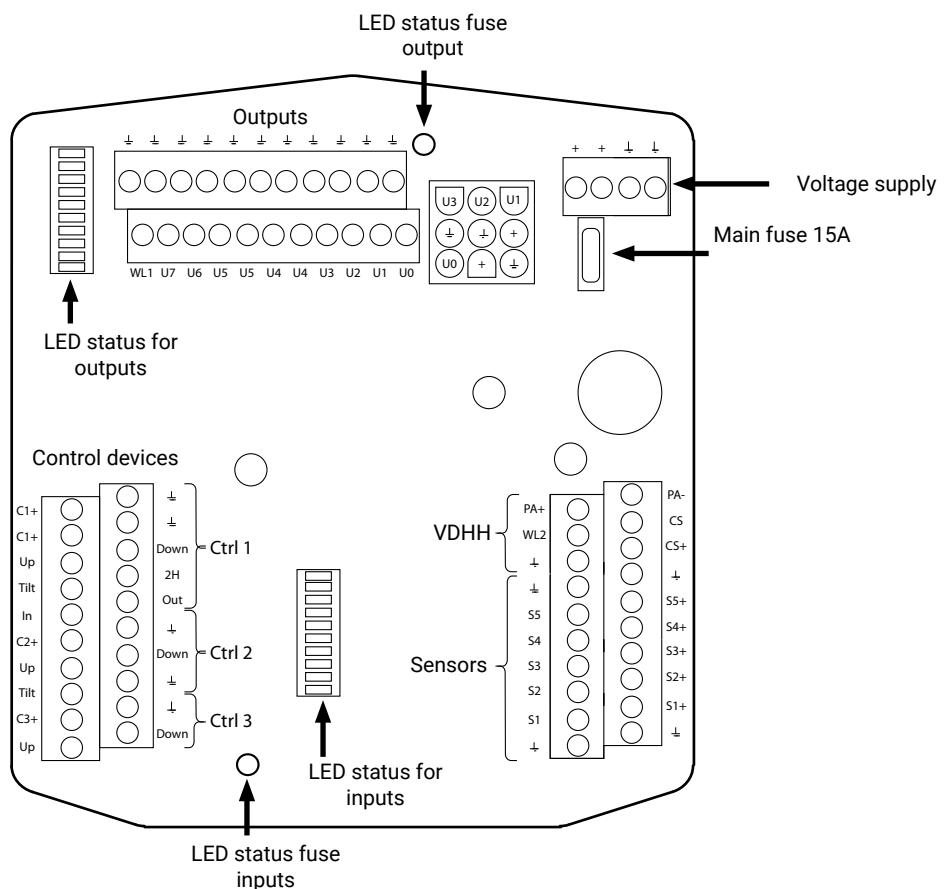


Fig 1. Control card TLC-B1

1.2 Outputs (U0-U7)

The hydraulic system's solenoid and valves are connected to the outputs of the relay card. The solenoid controls starting and stopping of the hydraulic pump, the valves control the flow of hydraulic oil to the various lift functions. The function of the outputs and which outputs are used varies depending on the model of tail lift.

NOTE!

The ground cable must always be connected to the ground connection that is opposite the relevant output.

1.3 Inputs

1.3.1 Control devices

It is possible to connect a primary control device, Ctrl 1, and two secondary control devices, Ctrl 2 and Ctrl 3, to the relay card. Primary control device Ctrl 1 must always be connected, secondary control devices are optional. The control devices that are recommended for the relevant connection are described separately in the tail lift's installation instructions.

Two-hand operation

Sensor S3 determines requirements for two-hand operation or not. The required angle is determined by the angle sensor connected to S3. The image below shows examples of operation with 3+1 button.

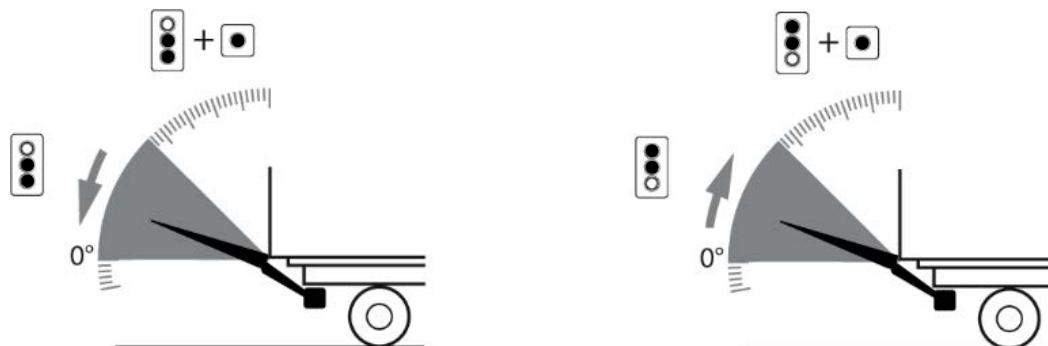


Fig 2. Two-hand operation

1.3.2 VDHH

- CS Voltage Off/On for the control card.
- CSPWR Voltage out to power CS/VDHH when needed.
- PA+ Voltage out when sensor S4 is activated.
- PA- Ground when sensor S4 is activated.

ZEPRO recommends using PA- to connect an open platform warning LED.
See wiring diagram for relevant lift.

1.3.3 Sensors

The control card has 5 inputs for sensors S1-S5.

- S1 Angle sensor that activates sensor S5 (**NOTE!** Not indicated on LED status inputs).
- S2 Angle sensor for autotilt up stop. (The tilt function stops and switches to Up function)
- S3 Angle sensor for regulating requirements for 2-hand operation.
- S4 Pressure sensor for alarm about open platform.
- S5 Pressure sensor for autotilt down to detect when the platform reaches the ground. Signal is required from S1 for S5 to work.

NOTE!

Always connect the sensor ground cable to the ground connection closest to the other connections for the relevant sensor.

1.4 Voltage supply and main fuse

The relay card is powered via this connection. The control card is protected by the main fuse (15A) which is mounted next to it.

1.5 Operating information

The relay card is equipped with two LED bars that indicate the status of inputs and outputs and 2 LEDs that indicate if any of the internal fuses have tripped.

NOTE! The voltage must be above the approved level in order to indicate.

1.5.1 I/O LED status

LED status for outputs

The indicator lights red when the output is active, i.e. when there is voltage at the output. Provided that the built-in fuse has not tripped. The bottom LED lights up when the control card is turned on.

LED status for inputs

The indicator lights up green when the input is active, i.e. when there is voltage at the input. Provided that the built-in fuse has not tripped.

1.5.2 Fuse LED status

LED status fuse output

LED lights up green when there is voltage to outputs. Unlit LED means a short circuit or the relay card is switched off.

LED status fuse input

LED lights up green when there is voltage to the respective input current output (+). Unlit LED means a short circuit or the relay card is switched off.

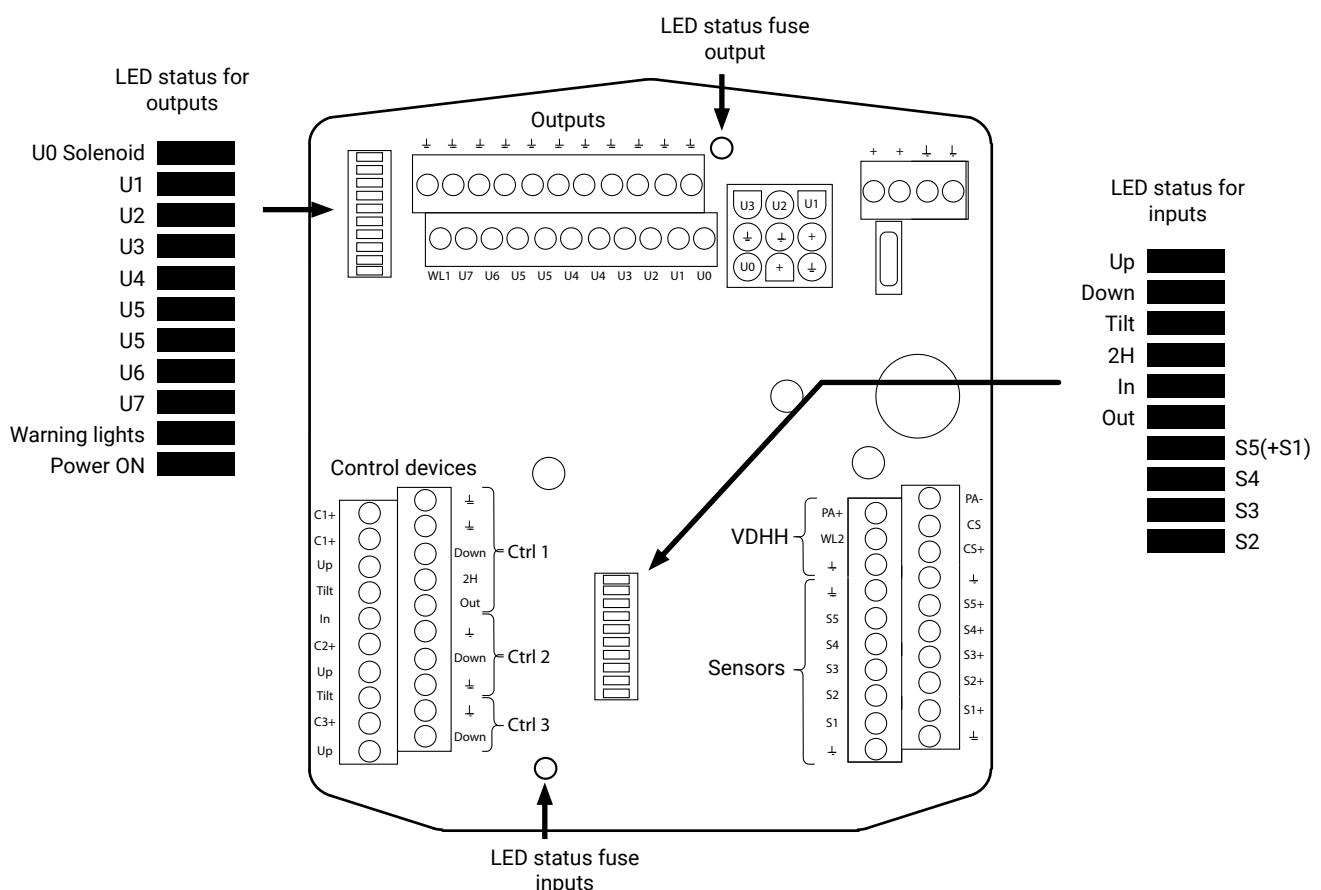


Fig 3. The control card is equipped with two LED bars and two LEDs

1.6 Warning lights

The relay card has two different connections for warning lights, WL1 and WL2. The function of the lighting depends on which connection is used. Always connect the ground cable to the nearest ground connection.

1.6.1 WL1

When connected to WL1, the warning light illuminates if the following conditions are met:

- Cab switch (CS) must be "On".
- S3 or S4 activates warning lighting.

1.6.2 WL2

When connecting to WL2, the warning light illuminates if the following conditions are met:

- Cab switch (CS) does not affect the warning lighting.
- Only S4 activates warning lighting.

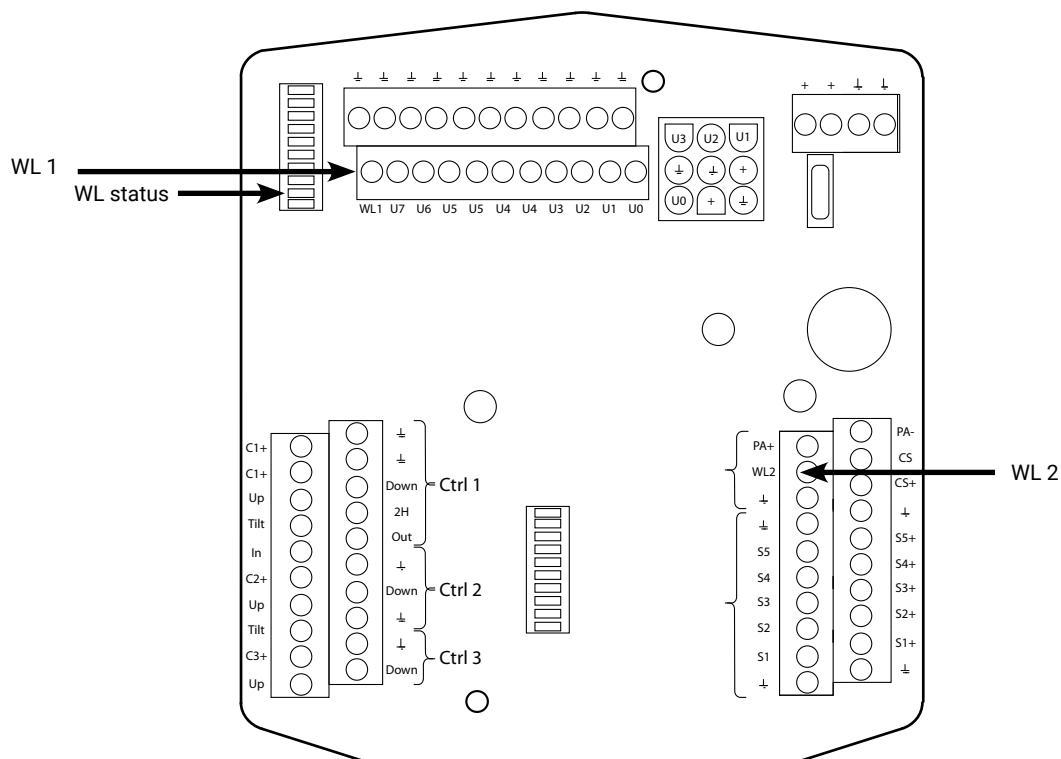
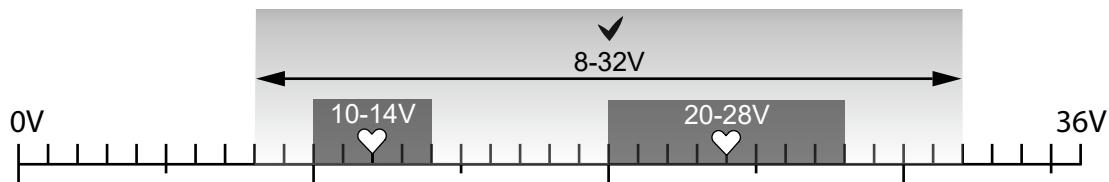


Fig 4. Options for connecting warning lighting

1.7 Supply voltage

The illustrations below show the desired supply voltage for 12V and 24V systems. Specified voltage refers to voltage when the lift is operated.

- ✓ The lift is working, but the voltage range outside the 'heart-marked' area is only recommended for operation for short periods.
- ♡ The lift is working within the voltage range for optimum function and service life.



1.8 Power consumption

The relay card draws <60mA (depending on accessories) when the lift is in operation. When the power is turned off with CS, the control card draws <4mA (open platform alarm still works).

1.9 Autotilt

Four different generations of the autotilt function are available. The TLC-B1 relay card can control generation 2. It can also control generation 4 if it is equipped with an analogue/digital converter (ADC).

Autotilt	TLC-B1	TLC-B1 + ADC	ZePRO1	Description
Generation 1			✓ *	Hydraulic autotilt
Generation 2	✓		✓ *	Electric autotilt with Tilt switch (IFM)
Generation 3			✓ *	Electric autotilt with inclinometer and automatic setting of autotilt angle
Generation 4		✓		Electric autotilt with inclinometer and manual setting of autotilt angle

* Depending on the control card configuration. Different configurations support different generations of autotilt.

1.10 Analogue/digital converter - ADC

The relay card can be equipped with an analogue/digital converter (ADC) that enables autotilt generation 4, i.e. the use of an inclinometer to control the autotilt function and manual setting of the autotilt angle.

1.10.1 Status

The analogue/digital converter (ADC) has four LEDs that show the current status of the converter and any faults. The table below shows the most common types of status.

LED	Colour	Function		Description
All	Green-Red-Off	Start-up		The system starts up
	Green-Off x 4 (Flashes 4 times)	Save S2		S2 Angle saved correctly
	Red-Off x 4 (Flashes 4 times)	Save S2		S2 Angle reset to factory setting (0 degrees, i.e. horizontal plane) because the angle was outside the permitted range

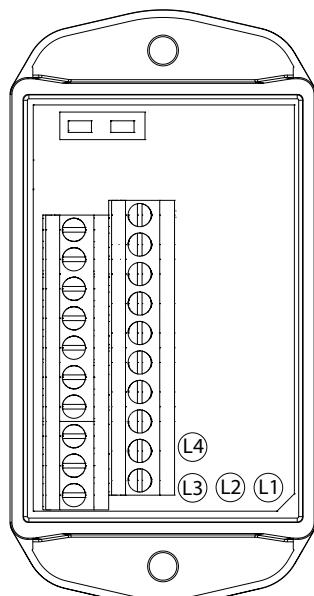


Fig 5. Analogue/digital converter (ADC)

2 Functional description

2.1 Cylinder models

L = Double-acting tilt with limited stroke - Single-acting lift

DL = Double-acting tilt with limited stroke - Double-acting lift

MA = Double-acting adjustable tilt - Single-acting single-speed lift

DA = Double-acting adjustable tilt - Double-acting single-speed lift

S = Double-acting single-speed tilt - Single-acting single-speed lift

SA = Single-acting single-speed adjustable tilt - Single-acting single-speed lift

2.2 Models - Configurations

Model	Configuration	Side
Z 45/75	TLC-B1.1S - Config. 100	12
Z / ZL 1500/2000/250		
ZDK 250	TLC-B1.1S - Config. 000	15
ZN 2500		
ZS MK2, ZT MK2	TLC-B1.1 - Config. 010	18

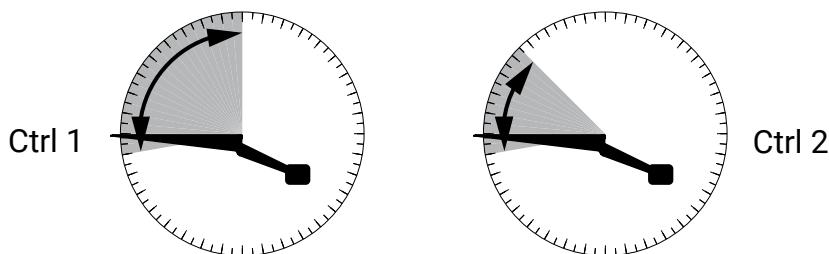
2.3 TLC-B1.1S - Config. 100

The configuration of the relay card can be read from the label on the relay card.

2.3.1 Sensors/Inputs

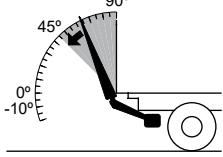
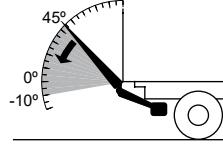
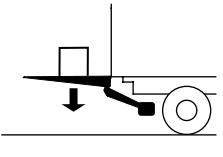
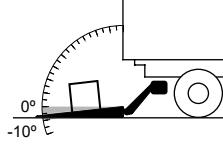
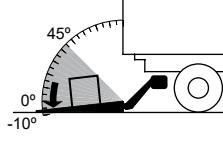
Designation	Position (standard)	Function	Description
S1			Not used on this lift model and must not be connected.
S2			Not used on this lift model and must not be connected.
S3	Platform	Angle sensor	Non-actuated S3 disables Tilt up/down with the secondary control device, so that the operator has to use the two-hand button - 2H along with the primary control device to continue to maintain the tilt up function.
S4	Tilt cylinder	Open platform alarm	Pressure sensor for falling pressure connected to +side of tilt cylinder. In the actuated state, returns the connection signal (+) to S4 and resulting in output signal (-) at Pa-. Also phase (+) signal out at Pa+.
S5			Not used on this lift model and must not be connected.
Cs	Cabin	Activation	No signal in at Cs means that the control card is shut down, except for the open platform alarm (S4). Signal to Cs usually comes from the cabin switch.
2H	Control devices	Two-hand button	Activated in connection with opening and closing of vehicle body.

2.3.2 Restriction in use of control device (Tilt up/Tilt down and Open/Close)



*Fig 6. Use of Ctrl 1 is not restricted by the angle of the platform.
Use of Ctrl 2 is restricted by the angle of the platform (Angle sensor S3).*

2.3.3 Function diagram

Function	Input signal		Output signal	Comment	Control devices	Image
Open	1	Tilt Down 2H	S1 S2 S3 S4 S5 U0 ✓ U1 U2 ✓ U3 U4 ✓ U5 (U6)* U7	Open from vehicle body down to about 45°	✓ Ctrl 1 Ctrl 2 Ctrl 3	
	2	Tilt Down	S1 ✓ S3 S2 S4 S5 U0 ✓ U1 U2 ✓ U3 U4 ✓ U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	
Lower	1	Down	S1 S2 S3 S4 S5 U0 ✓ U1 ✓ U2 ✓ U3 ✓ U4 U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
	2	Down	S1 S2 S3 S4 S5 U0 ✓ U1 ✓ U2 ✓ U3 ✓ U4 ✓ U5 U6 U7	Autotilt	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
Tilt down	Tilt Down	S1 ✓ S3 S2 S4 S5 U0 ✓ U1 U2 ✓ U3 U4 ✓ U5 U6 U7			✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	

* Output active but not connected on this model.

Function	Input signal		Output signal	Comment	Control devices	Image
Tilt up	Up Tilt		S1 S2 ✓ S3 S4 S5 U0 U1 U2 ✓ U3 U4 U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	
Lift	1	Up	S1 S2 S3 S4 S5 U0 U1 U2 ✓ U3 U4 U5 U6 U7	Autotilt	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
	2	Up	S1 S2 S3 S4 S5 U0 U1 U2 ✓ U3 U4 U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
Tilt up	Up Tilt		S1 S2 ✓ S3 S4 S5 U0 U1 U2 ✓ U3 U4 U5 U6 U7	Tilting up to approximately 45°	✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	
Close	Up Tilt 2H		S1 S2 S3 S4 S5 U0 U1 U2 ✓ U3 U4 U5 U6 U7	Close against vehicle body	✓ Ctrl 1 Ctrl 2 Ctrl 3	

* Output active but not connected on this model.

2.4 TLC-B1.1S - Config. 000

The configuration of the relay card can be read from the label on the relay card.

2.4.1 Sensors/Inputs

Designation	Position (standard)	Function	Description
S1			Not used on this lift model and must not be connected.
S2			Not used on this lift model and must not be connected.
S3	Platform	Angle sensor	Non-actuated S3 disables Tilt up/down with the secondary control device, so that the operator has to use the two-hand button - 2H along with the primary control device to continue to maintain the tilt up function.
S4	Tilt cylinder	Open platform alarm	Pressure sensor for falling pressure connected to +side of tilt cylinder. In the actuated state, returns the connection signal (+) to S4 and resulting in output signal (-) at Pa-. Also phase (+) signal out at Pa+.
S5			Not used on this lift model and must not be connected.
Cs	Cabin	Activation	No signal in at Cs means that the control card is shut down, except for the open platform alarm (S4). Signal to Cs usually comes from the cabin switch.
2H	Control devices	Two-hand button	Activated in connection with opening and closing of vehicle body.

2.4.2 Restriction in use of control device (Tilt up/Tilt down and Open/Close)

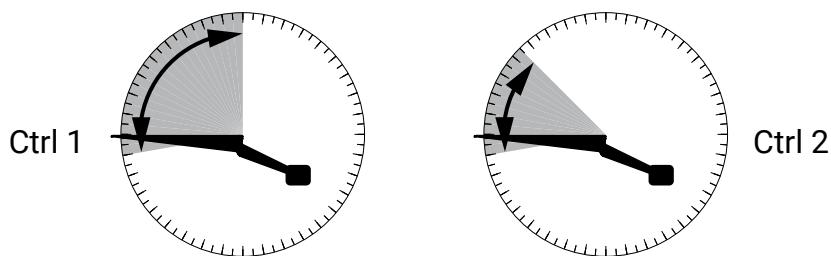
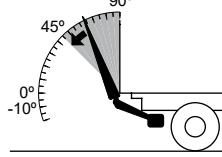
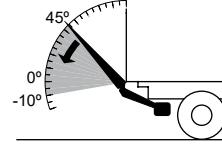
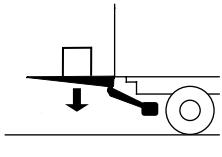
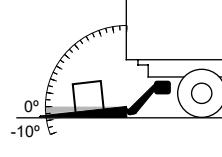
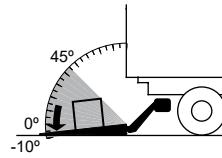


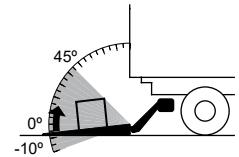
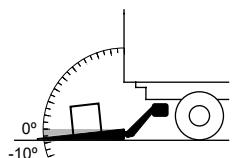
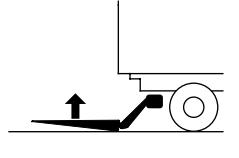
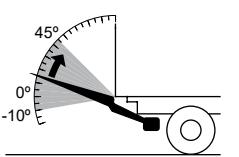
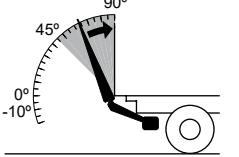
Fig 7. Use of Ctrl 1 is not restricted by the angle of the platform.

Use of Ctrl 2 is restricted by the angle of the platform (Angle sensor S3).

2.4.3 Function diagram

Function	Input signal	Output signal	Comment	Control devices	Image
Open	1 Tilt Down 2H	S1 S2 S3 S4 S5 ✓ U0 ✓ U1 U2 ✓ U3 U4 ✓ U5 (U6)* U7	Open from vehicle body down to about 45°	✓ Ctrl 1 Ctrl 2 Ctrl 3	
	2 Tilt Down	S1 ✓ S3 S2 S4 S5 ✓ U0 ✓ U1 U2 ✓ U3 U4 ✓ U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	
Lower	1 Down	S1 S2 S3 S4 S5 U0 ✓ U1 ✓ U2 U3 ✓ U4 U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
	2 Down	S1 S2 S3 S4 S5 U0 ✓ U1 ✓ U2 ✓ U3 ✓ U4 ✓ U5 U6 U7	Autotilt	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
Tilt down	Tilt Down	S1 S2 ✓ S3 S4 S5 ✓ U0 ✓ U1 U2 ✓ U3 U4 ✓ U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	

* Output active but not connected on this model.

Function	Input signal		Output signal	Comment	Control devices	Image	
Tilt up	Up Tilt		S4 S2 ✓ S3 S4 S5 S6 S7	✓ U0 U1 U2 ✓ U3 U4 U5 U6 U7	✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3		
Lift	1	Up	S4 S2 S3 S4 S5	✓ U0 U1 U2 ✓ U3 U4 U5 U6 U7	Autotilt		
	2	Up	S4 S2 S3 S4 S5	✓ U0 U1 ✓ U2 U3 U4 U5 U6 U7			
Tilt up	Up Tilt		S4 S2 ✓ S3 S4 S5 S6 S7	✓ U0 U1 U2 ✓ U3 U4 U5 U6 U7	Tilting up to approximately 45°	✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	
Close	Up Tilt 2H		S4 S2 S3 S4 S5 S6 S7	✓ U0 U1 U2 ✓ U3 U4 U5 U6 U7	Close against vehicle body	✓ Ctrl 1 Ctrl 2 Ctrl 3	

* Output active but not connected on this model.

2.5 TLC-B1.1 - Config. 010

The configuration of the relay card can be read from the label on the relay card.

2.5.1 Sensors/Inputs

Designation	Position (standard)	Function	Description
S1			Not used on lift without Autotilt and must not be connected. Bridged on lift with Autotilt
S2			Not used on this lift model and must not be connected.
S3		Jumper	
S4	Tilt cylinder	Open platform alarm	Pressure sensor for falling pressure connected to +side of lift cylinder. In the actuated state, returns the connection signal (+) to S4 and resulting in output signal (-) at Pa-. Also phase (+) signal out at Pa+.
S5			Not used on lift without Autotilt and must not be connected. On lift with Autotilt connected to pressure sensor on lifting cylinder, senses when the platform touches the ground.
Cs	Cabin	Activation	No signal in at Cs means that the control card is shut down, except for the open platform alarm (S4). Signal to Cs usually comes from the cabin switch.
2H	Control devices	Two-hand button	Not used on this lift model and must not be connected.

2.5.2 Restriction in use of control device (Tilt up/Tilt down and Open/Close)

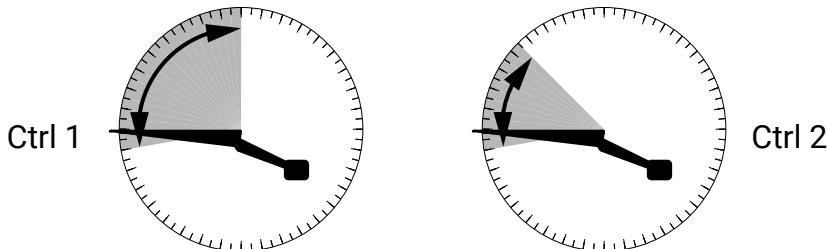
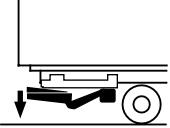
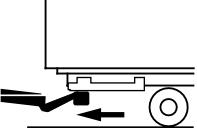
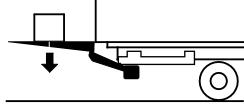
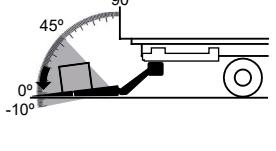
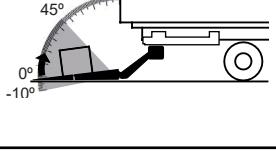
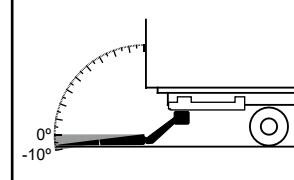
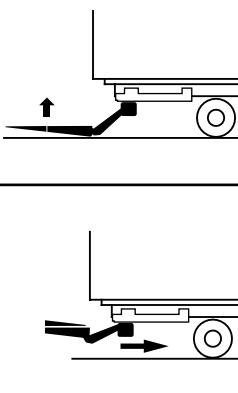


Fig 8. The use of control devices connected to Ctrl 1 is not limited by the angle of the platform.
The use of control devices connected to Ctrl 2 is not limited by the angle of the platform (Angle sensor S3).

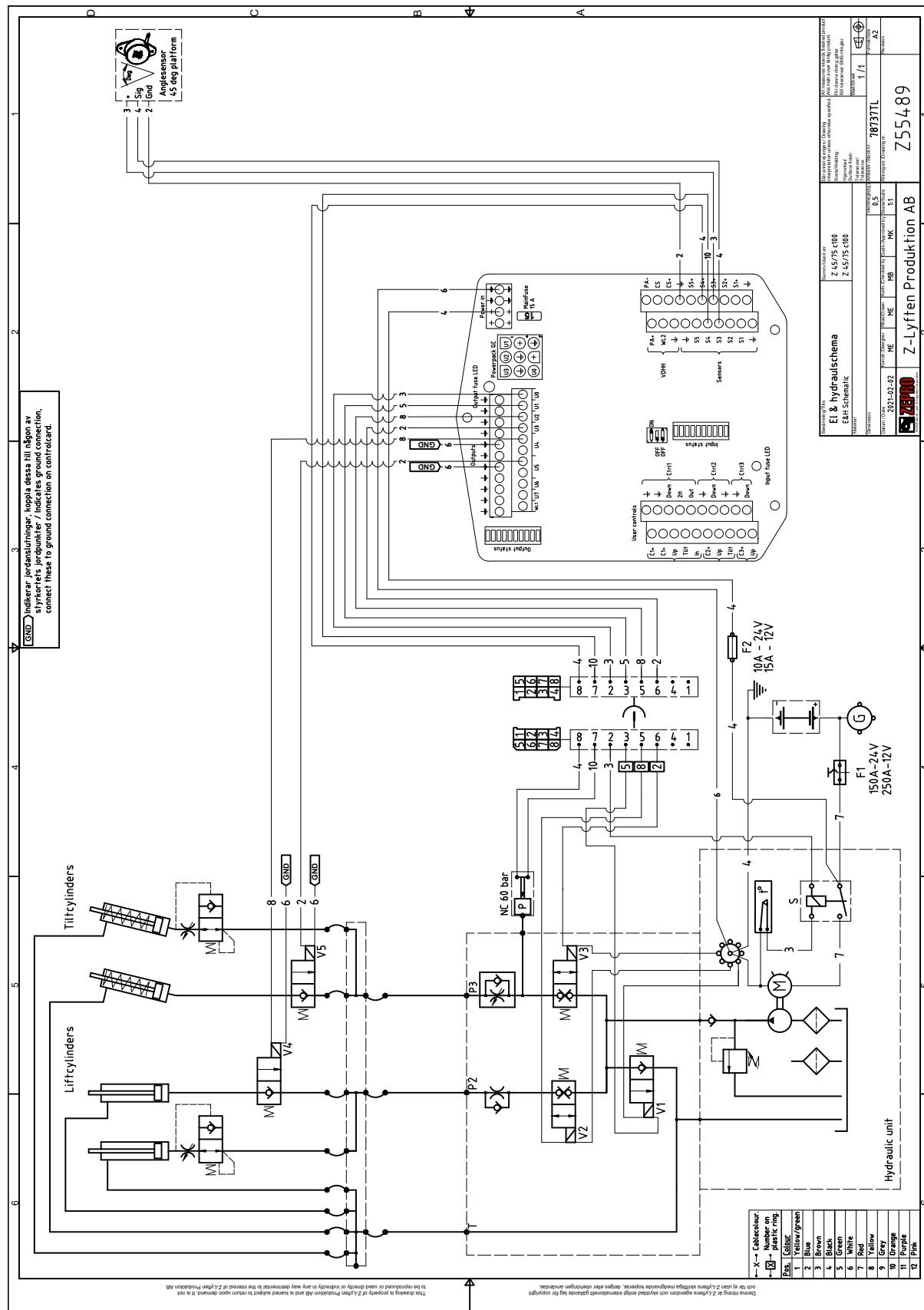
2.5.3 Function diagram

Function	Input signal		Output signal	Comment	Control devices	Image
Lower	Down	S4 S2 S3 S4 S5	U0 ✓ U1 ✓ U2 U3 ✓ U4 U5 U6 U7	Release from transport position	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
Slider out	Out	S4 S2 ✓ S3 S4 S5	U0 U1 U2 U3 U4 U5 ✓ U6 U7		✓ Ctrl 1	
Lower	1	Down	S4 S2 S3 S4 S5	U0 ✓ U1 ✓ U2 U3 ✓ U4 U5 U6 U7	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
	2	Down	✓ S1 S2 S3 S4 ✓ S5	U0 ✓ U1 ✓ U2 ✓ U3 ✓ U4 ✓ U5 U6 U7	Autotilt	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3
Tilt down	Tilt Down	S4 S2 ✓ S3 S4 S5	✓ U0 ✓ U1 U2 ✓ U3 U4 ✓ U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	
Tilt up	Tilt Up	✓ S3	✓ U0 U1 U2 ✓ U3 U4 U5 U6 U7		✓ Ctrl 1 ✓ Ctrl 2 Ctrl 3	

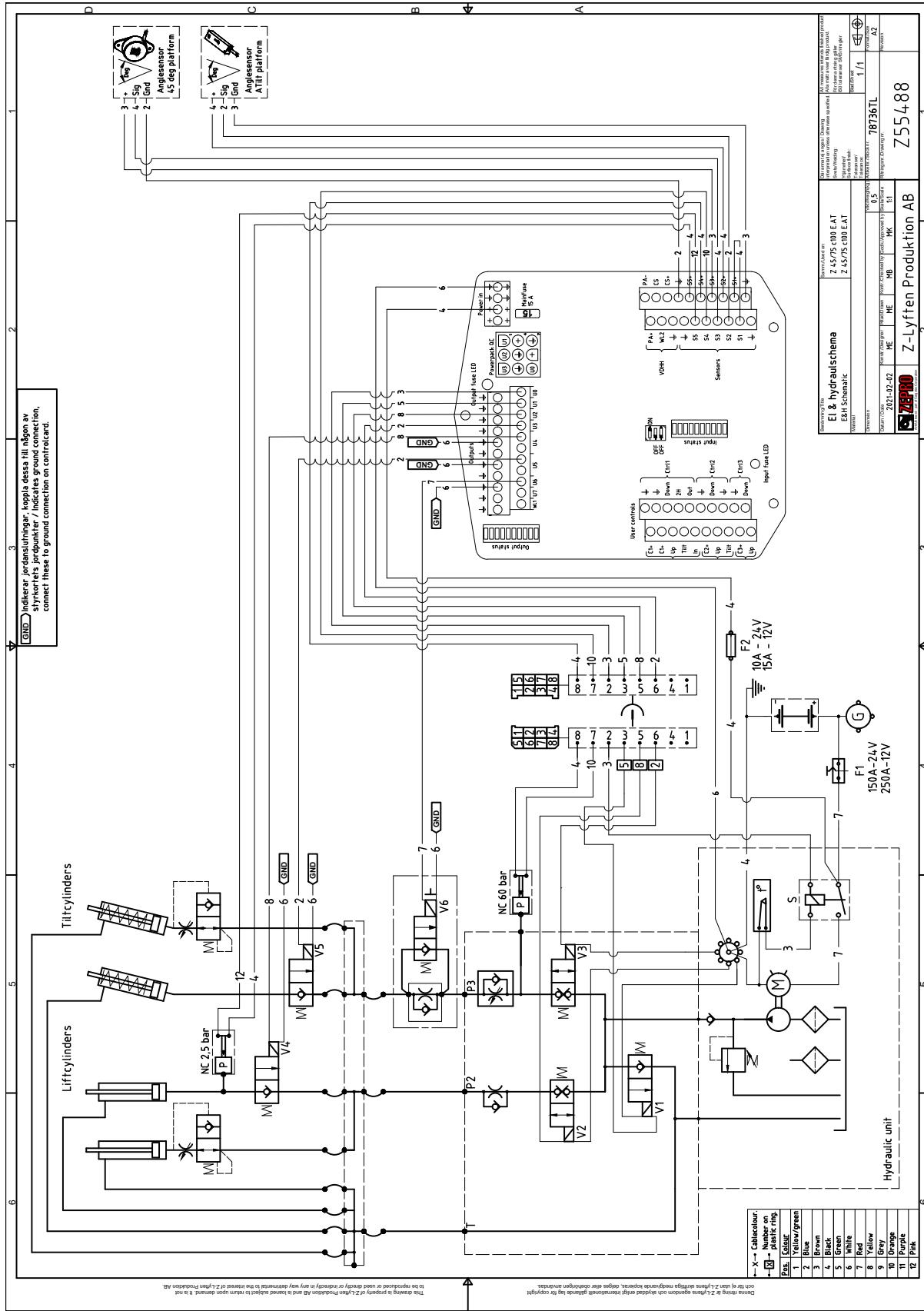
Function	Input signal	Output signal	Comment	Control devices	Image
Lift	1 Up	S1 S2 S3 S4 S5 S6 S7 ✓ U0 U1 U2 ✓ U3 U4 U5 U6 U7	Autotilt	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
	2 Up	S1 S2 S3 S4 S5 S6 S7 ✓ U0 U1 ✓ U2 U3 U4 U5 U6 U7			
Slider in	In	S1 S2 ✓ S3 S4 S5 ✓ U0 ✓ U1 U2 U6 U4 U6 U6 ✓ U7	Secure in transport position	✓ Ctrl 1 ✓ Ctrl 2 ✓ Ctrl 3	
Lift	Up	S1 S2 S3 S4 S5 S6 S7 ✓ U0 U1 ✓ U2 U3 U4 U5 U6 U7			

3 Electrical and hydraulic diagrams

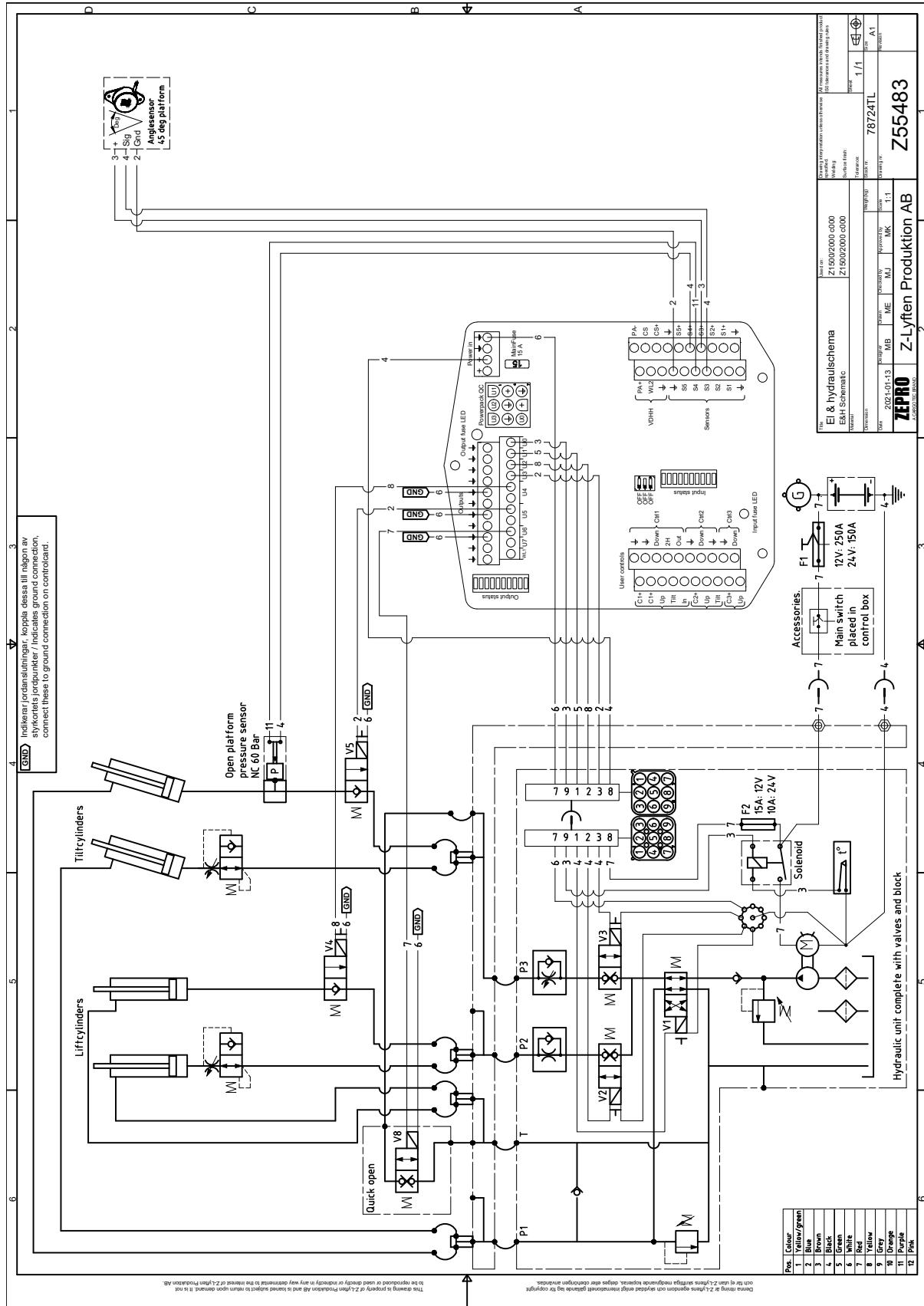
3.1 Z / ZU / ZL / ZLU / ZN / ZNU 45/75



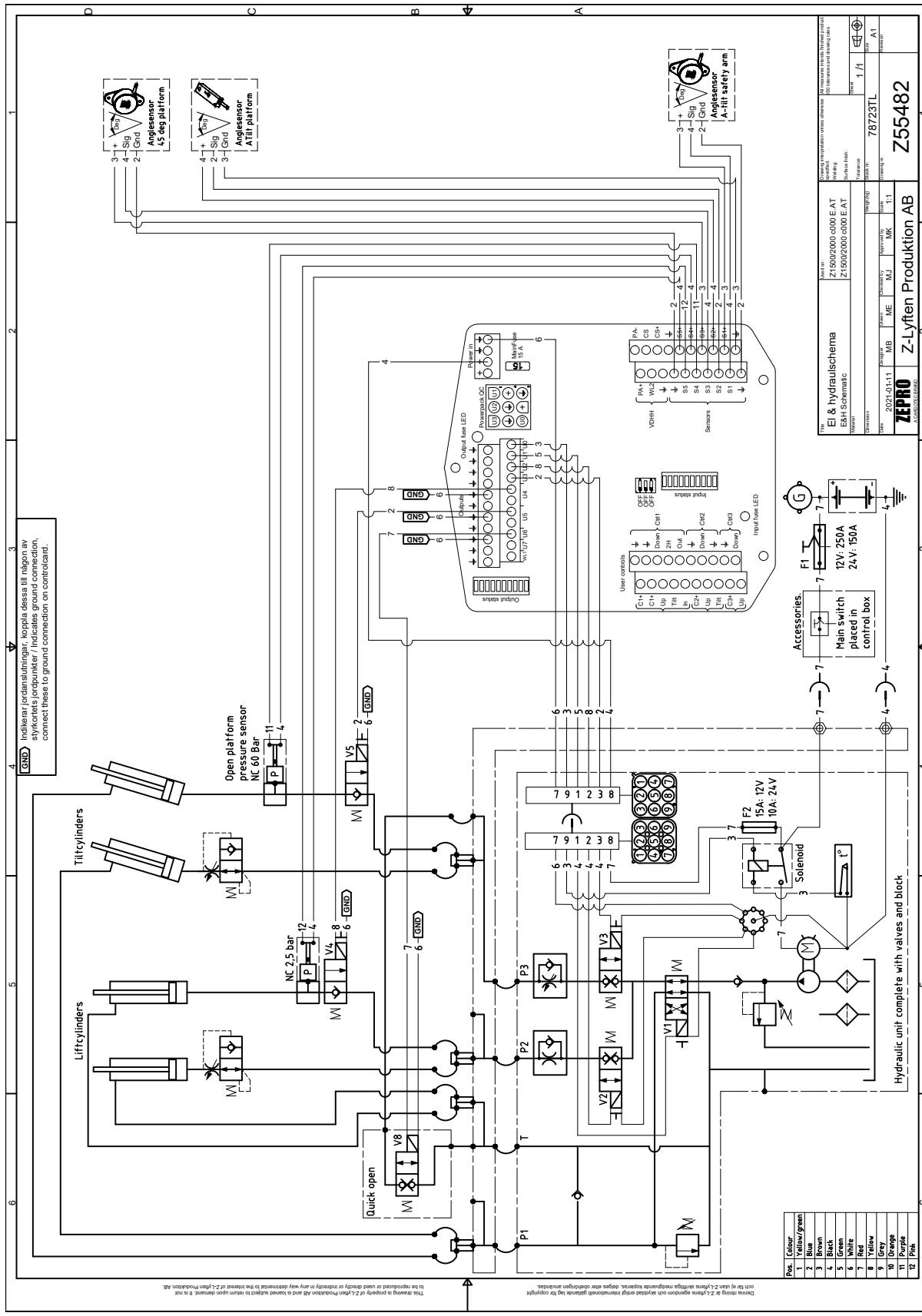
3.2 Z / ZU / ZL / ZLU / ZN / ZNU 45/75 autotilt



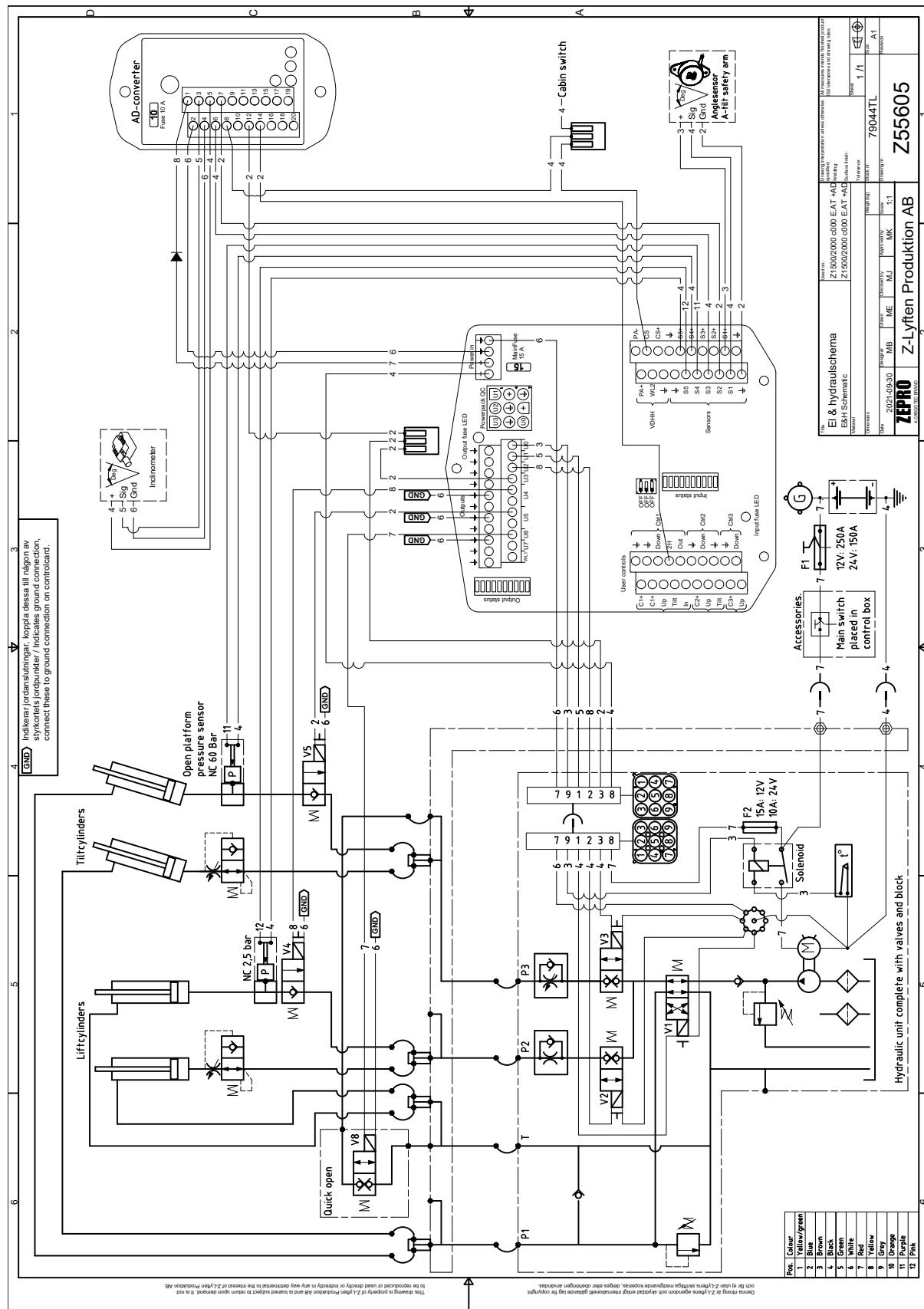
3.3 Z / ZL 1500/2000, ZN 2500, ZDK 250 MA



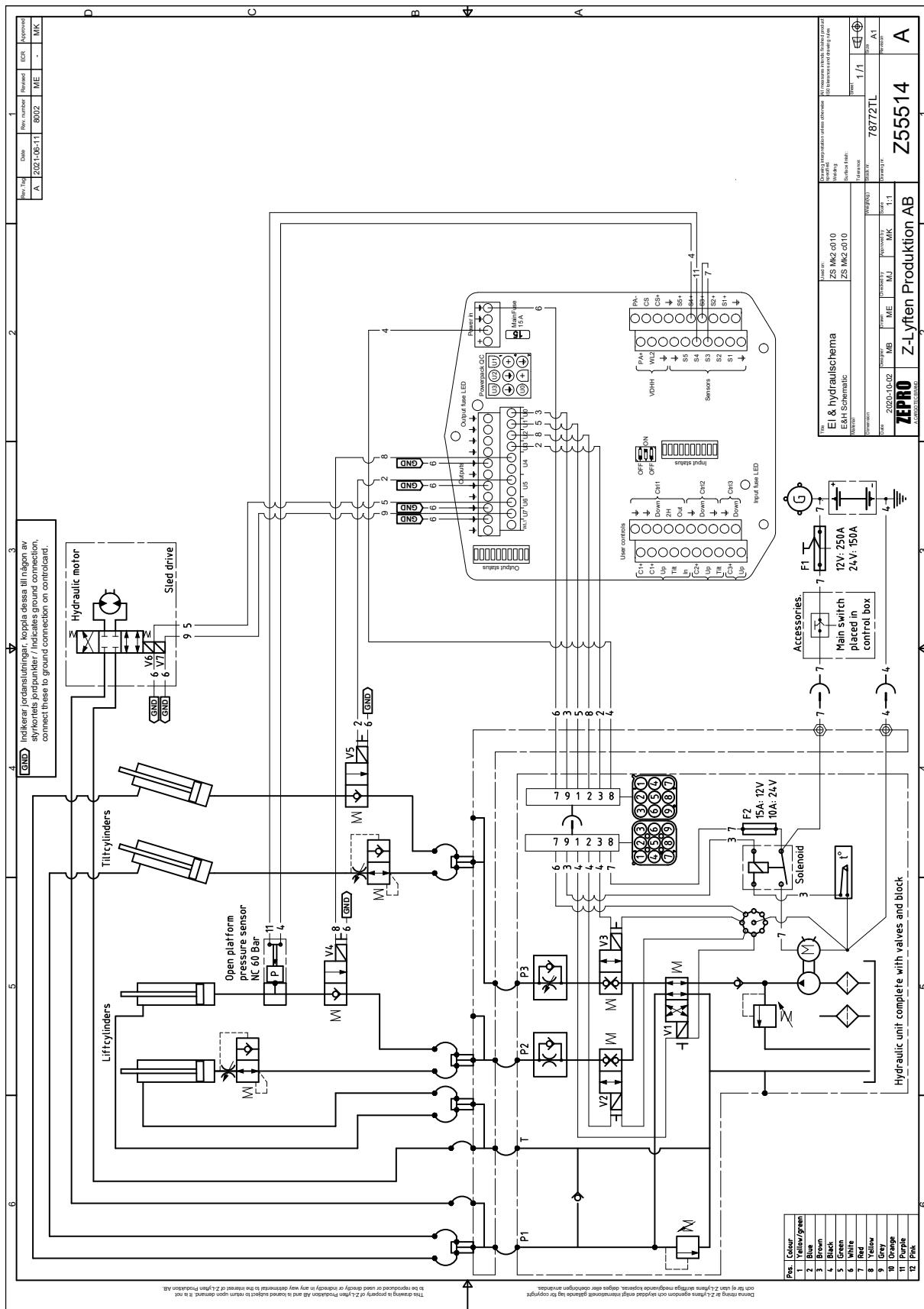
3.4 Z / ZL 1500/2000, ZN 2500, ZDK 250 MA Autotilt



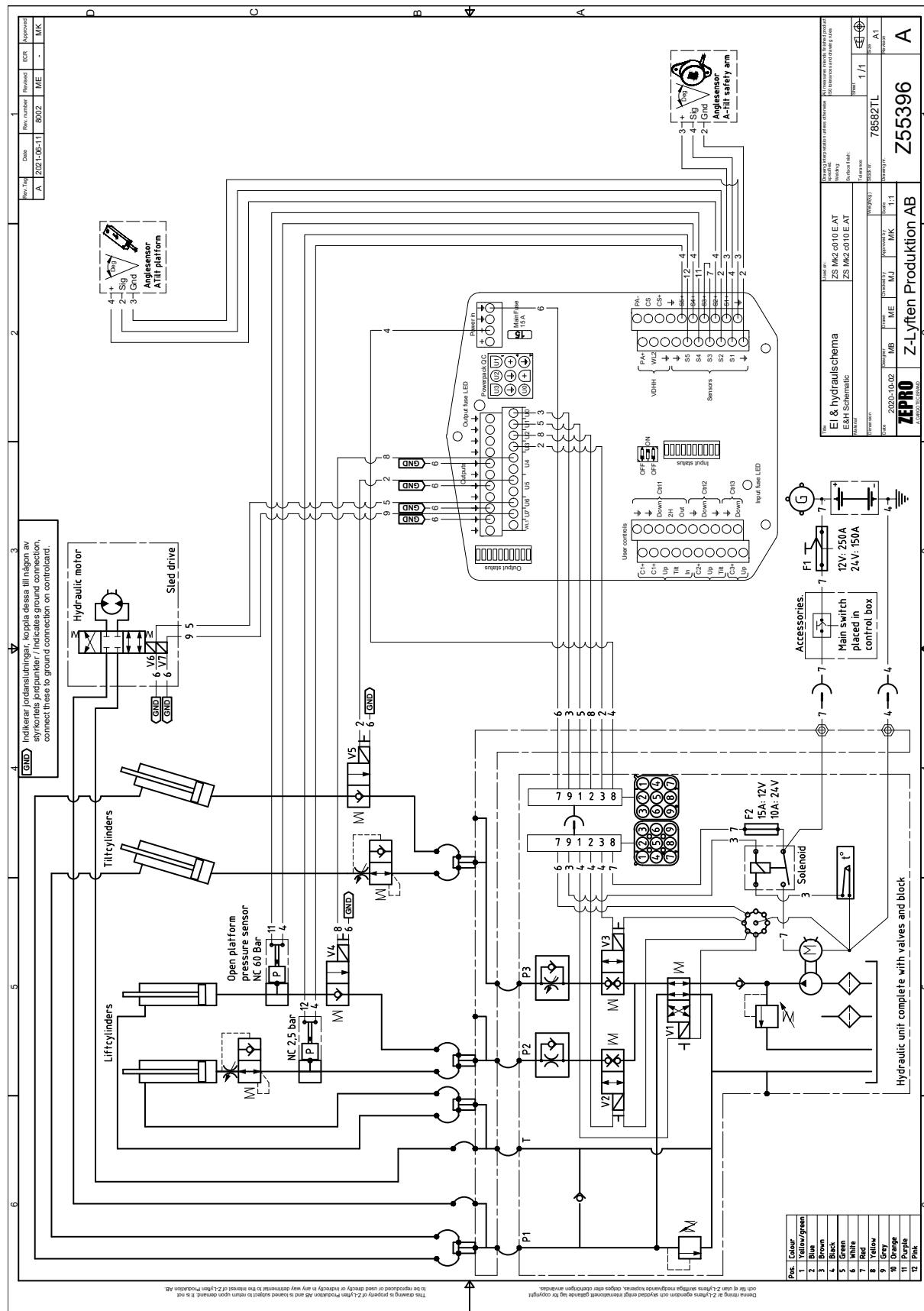
3.5 Z / ZL 1500/2000, ZN 2500, ZDK 250 MA Autotilt with ADC



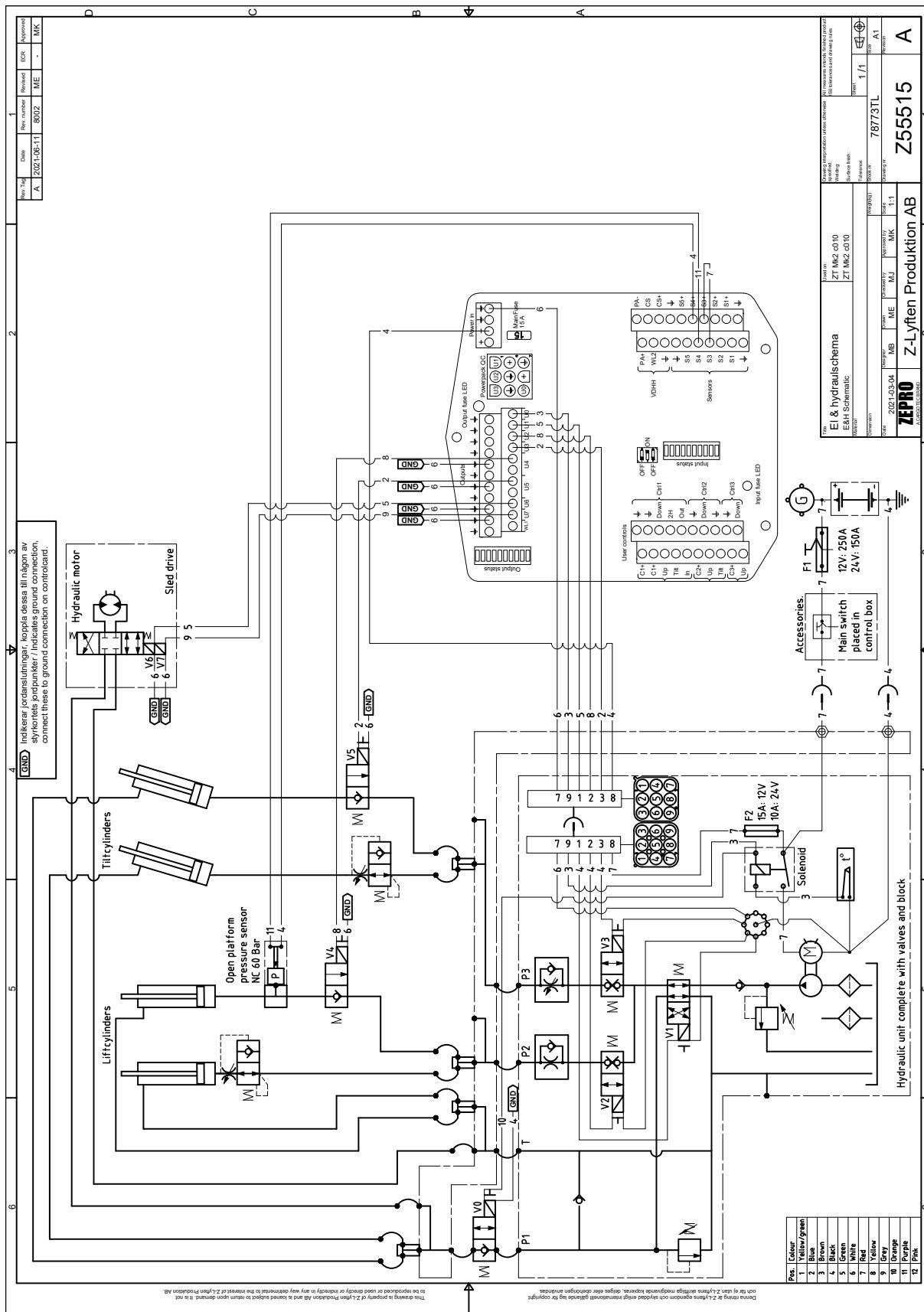
3.6 ZS MK2



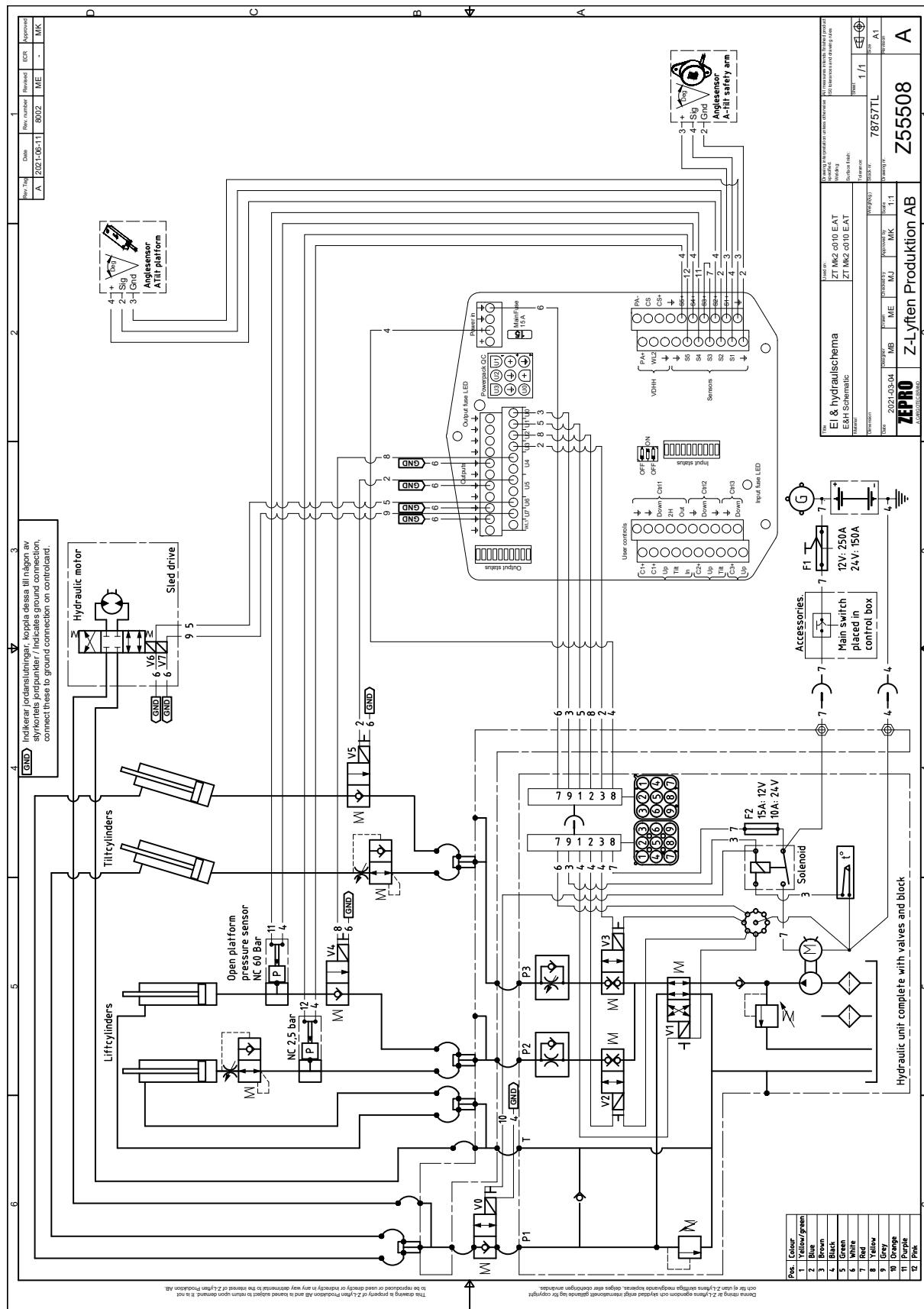
3.7 ZS MK2 Autotilt



3.8 ZT MK2



3.9 ZT MK2 Autotilt





HIAB

BUILT TO PERFORM

Zepro, Del and Walco are Hiab trade marks for tail lifts. Hiab is a world-leading supplier of equipment, intelligent services and digital solutions for on-road load handling. As an industry pioneer, our company commitment is to increase the efficiency of our customers' operations and to shape the future of intelligent load handling.