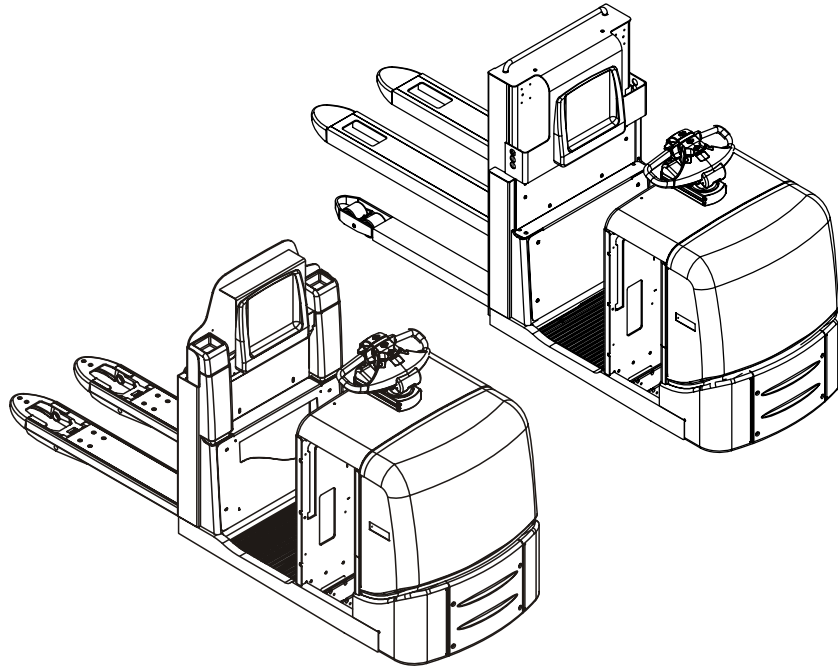


Service Manual

en



7LOP12, 7LOP12P, 7LOP25, 7LOP25P

Valid from serial number: 932596-

Order number: 232371-040

Issued: 2007-03-30 ITS

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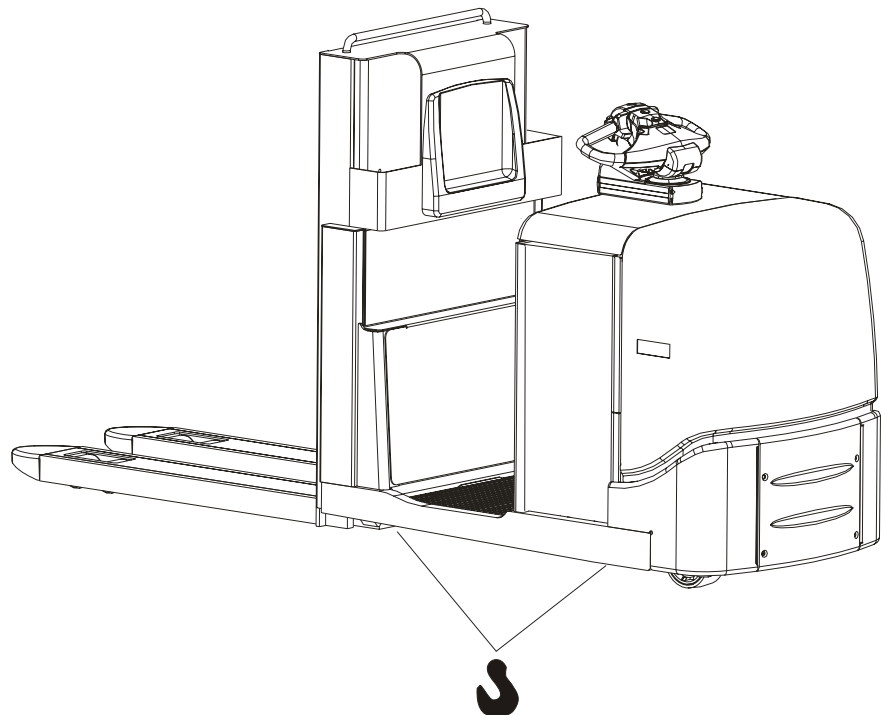
Order number 232371-040	Date 2007-03-30	Valid from serial number 932596-	T-code 649, 783
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2-Technical data

Table 1: Technical data	
Drive motor	
Type	TSL160 A DS60
Power	2.5kW
Intermittence	S2, 60min
Minimum carbon brush length	11mm
Nominal commutator diameter	71mm
Minimal commutator diameter	68mm
Resistance, shunt field winding at 24°C	0.346Ω
Resistance, armature winding at 24°C	0.0098Ω
Weight	23kg
Brake	
Type	1EB46-11
Braking force	48Nm
Power	44W
Resistance, coil	12Ω
Nominal play when applied	0.25-0.38mm
Minimum thickness of brake disc	7.7mm
Thickness of new brake disc	9.7mm
Transmission/gear mechanism	
Type	2-stage angle gear
Gear ratio	14.20:1
Oil volume	1.75l
Oil type at normal temperature at temperatures < -15°C	Hypoid oil SAE 80W/90 SAE 75W

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3.4 Lifting the truck



- Only lift the truck using the indicated lifting points using a suitable lifting equipment.



WARNING!

*Risk of tipping.
The truck may tip over if it is lifted in the wrong places.
Always lift the truck in the indicated lifting points.*

- Lift the truck at its centre of gravity using another fork lift truck.
- Fasten the truck to the forks of the lifting truck.
- Lift it very carefully



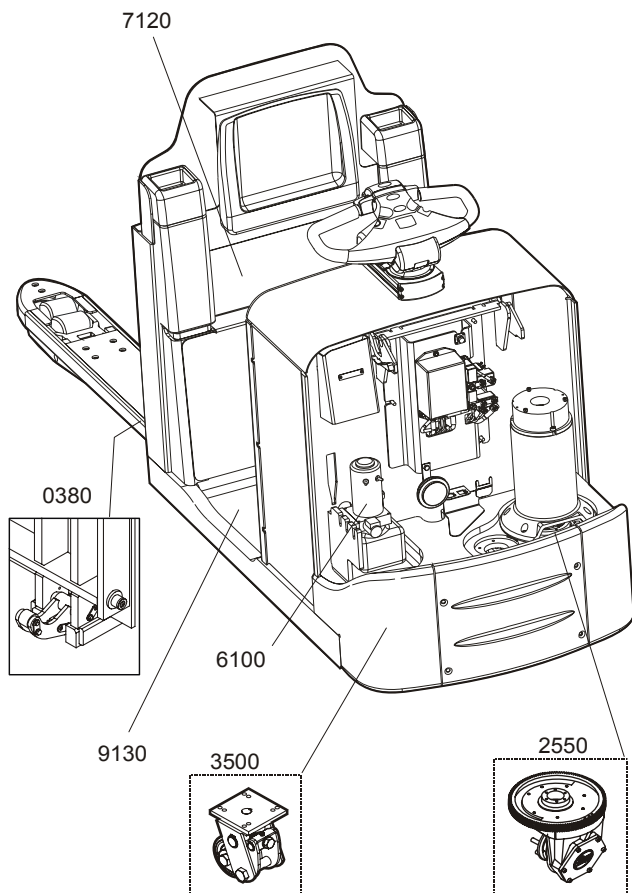
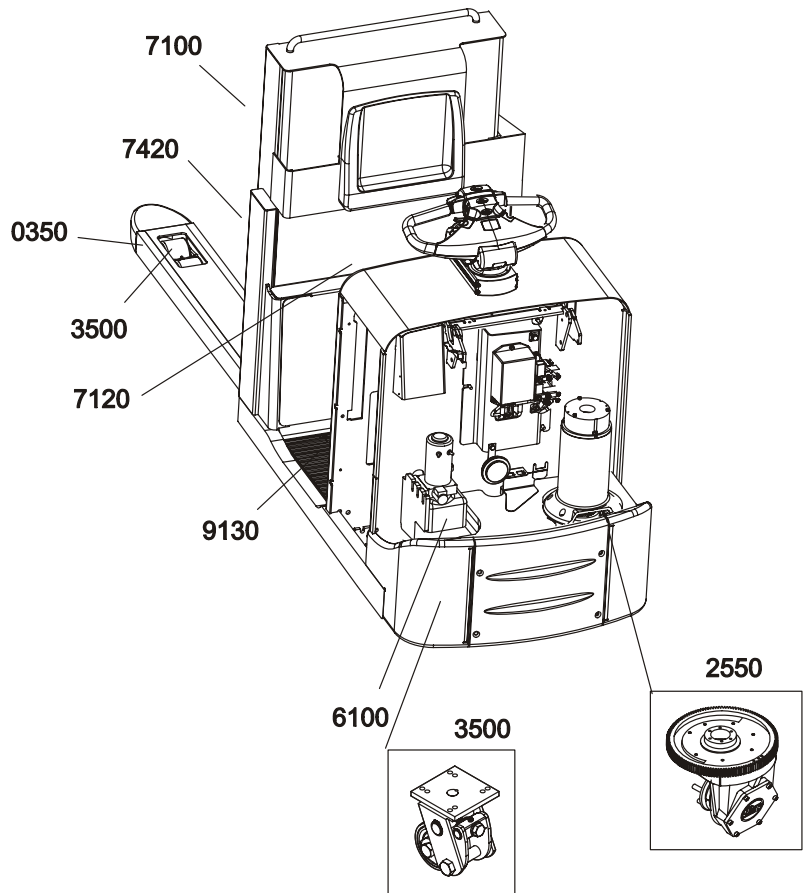
WARNING!

*Risk of tipping.
The truck may tip over if it is lifted incorrectly.
Always lift the truck when it has been fastened to the forks of the lifting truck and its centre of gravity between the forks.*

Maintenance

Lubrication schedule

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5.1.3 Disassembly of the fork carriage

- Disassemble the back rest parts according to Fig. 3.

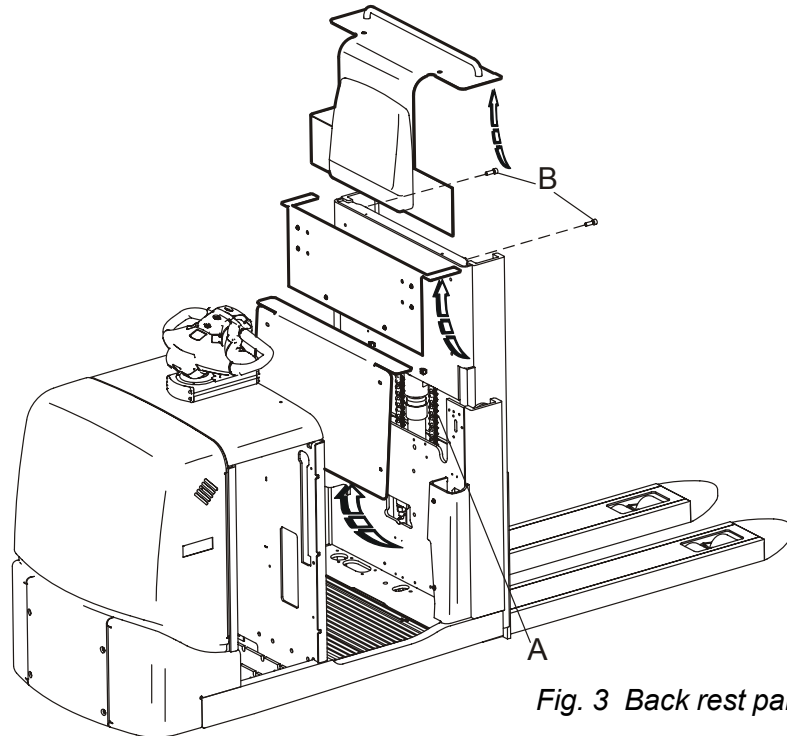


Fig. 3 Back rest parts

- Disassemble the load support from the fork carriage
- By lifting the forks approx. 30-40 cm the chain mounts can be accessed from the operator side of the mast. Fig. 3 (A)
- Disassemble the lift chain.
- Unscrew the stop screws Fig. 3 (B)
- Lift out the fork carriage.

NOTE! It is safest to lift the fork carriage at its centre of gravity. The guides and cup springs can be lost when the fork carriage is lifted free from the mast.

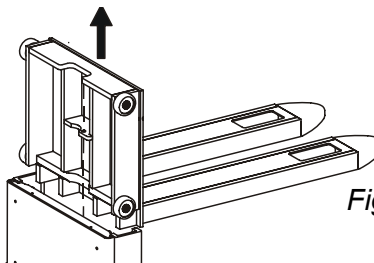


Fig. 4 Lift the fork carriage

Assembly is done in reverse.

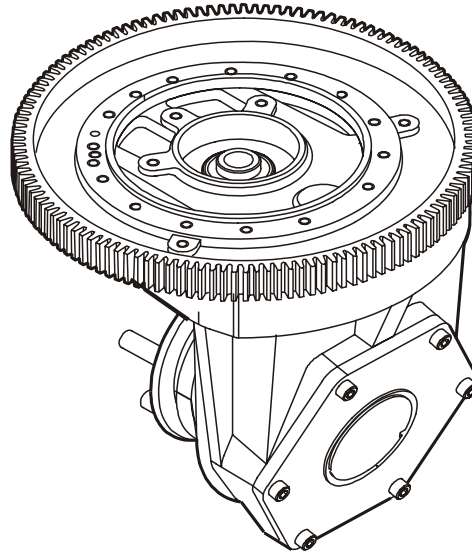
5.1.4 Roller replacement

- Remove the guide Fig. 1 (7) and the cup springs Fig. 1 (6), disassemble the groove ring Fig. 1 (5) and remove the roller Fig. 1 (4).

Assembly is done in reverse.

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7-Drive unit/gear – 2550



7.1 General

These service instructions cover descriptions of service performed at the customer site. Complete reconditioning of the driving gear must be performed in the workshop by trained technicians.

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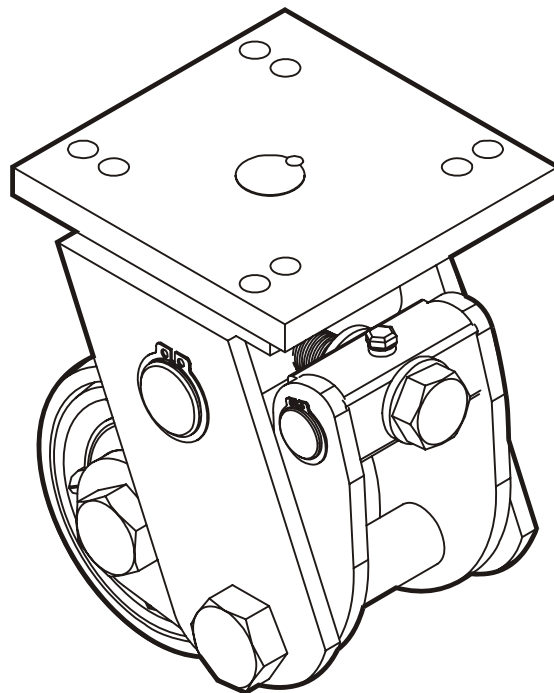
9-Swivel wheel – 3540

9.1 General

The truck has an adjustable swivel wheel assembly holding a single wheel. It is easily accessible once the front cover of the chassis has been removed.

Correct adjustment of the swivel wheel height is very important for the drive wheel pressure and the braking performance of the truck. This is why the height of the swivel wheel should be regularly adjusted at intervals of 500 operating hours because of the wear on the drive wheel.

The bearings in the swivel wheel assembly have been sealed and lubricated at the factory. The swivel wheel bearings should be lubricated at intervals of 500 operating hours.



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10.3 Adjustment

10.3.1 Reference sensor

After replacement or adjustment of the reference sensor, screw it all the way down until it makes contact with the top of the gear ring. Then screw it upwards two full turns and lock it with the nut. Calibrate the system using parameters 36 and 37.

10.3.2 Calibration

Calibration and adjustment of the steering servo is accomplished using parameters 36 and 37.

Parameter 36

Parameter 36 calibrates the potentiometer and must be adjusted when the following components are replaced.

- complete steering servo assembly or parts of the steering servo assembly
- reference sensor
- potentiometer
- following any work on the steering unit

Detailed instructions as to the function of parameter 36 are presented in C code 5000.

Parameter 37

Parameter 37 adjusts the drive wheel centre position. The wheel can be adjusted 30 degrees to either side. Prior to adjustment of parameter 37, parameter 36 must be adjusted to ascertain the wheel's zero position.

Detailed instructions as to the function of parameter 37 are presented in C code 5000.

Electrical steering system – 4300

Replacing the inductive brake sensor

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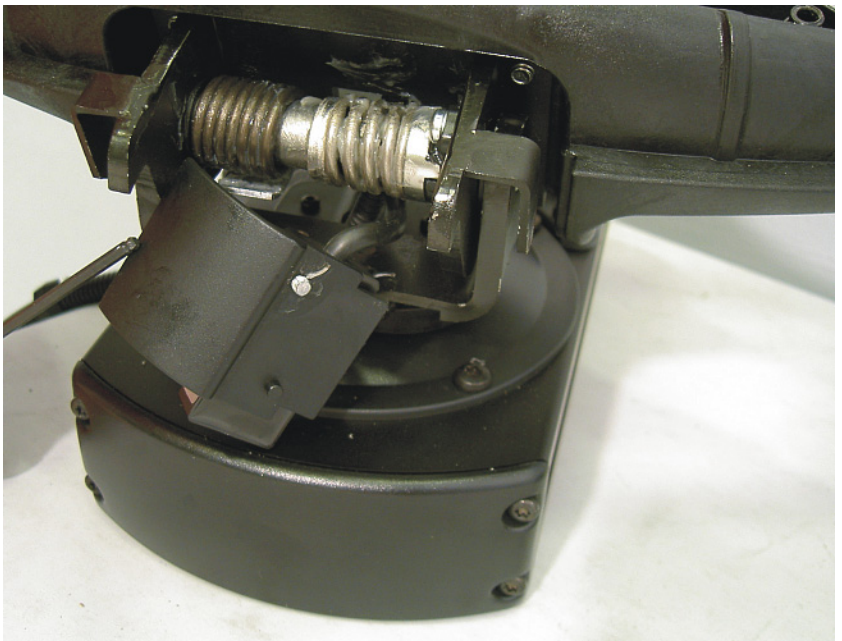
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- Loosen the screw that holds the sensor in place and lift it straight up. The sensor has a guide pin on the rear side.



- Reassemble in reverse.

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Table 7: Component designation overview

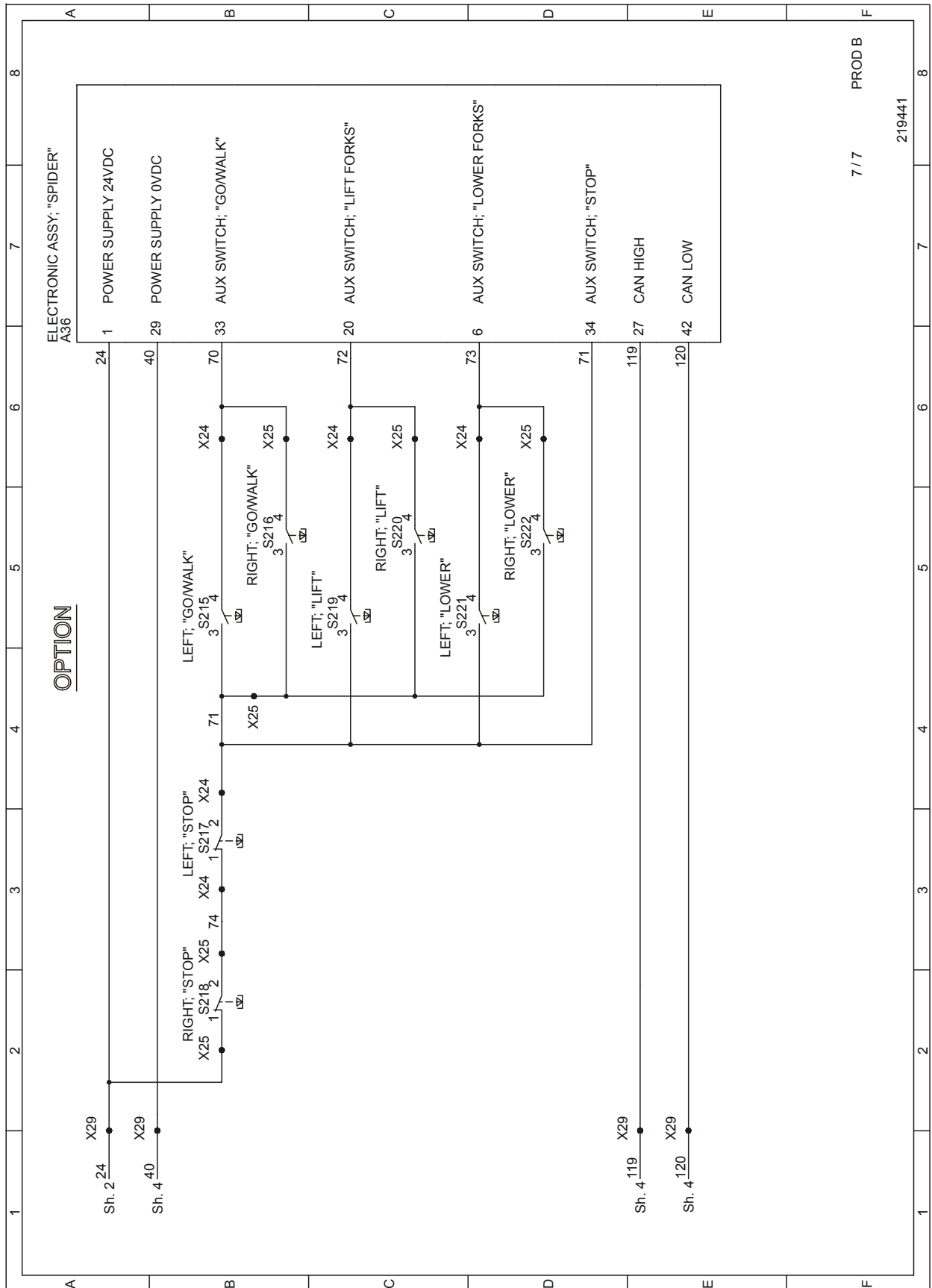
Designation	Function	Component type	Inf.
Traction			
L1	Speed control and travel direction selector (butterfly)	Hall sensors	6, 7
S19	Presence control (operator on platform)	Inductive sensor (7LOP12, 7LOP25) Contact sheet (7LOP12P, 7LOP25P)	7, 8
M1	Truck traction	Motor	
Guide			
R2	Steering angle signal	Potentiometer	
S65	Drive wheel in centre reference	Inductive sensor	
M6	Drive wheel steering	Motor	2
Lifting forks			
A2:S19	Fork lifting control	Hall sensors	5, 7
A2:S20	Fork lowering control	Hall sensors	5, 7
Y10	Fork lowering -hydraulic control	Magnetic valve	
Y45	Fork lifting/lowering -hydraulic control	Magnetic valve	7
S12	Forks > 500 mm	Inductive sensor	
S31	Fork lift limiter	Inductive sensor	7
S32	Forks < 200mm	Inductive sensor	
B10	Fork Load supervision	Pressure sensor	
K30	Fork lifting (Pump motor power switching)	Contacteur	
M3	Pump motor	Motor	
Platform lifting			
Y69	Platform lifting/lowering - hydraulic	Magnetic valve	
S103	Platform >500mm	Inductive sensor	
S107	Platform lift limiter	Inductive sensor	
S214	Activation of platform lowering (via floor contact sheet switch)	Contact sheet	8
A2: S21	Activation of platform lifting (via steering unit)	Hall sensors	5
A2: S22	Activation of platform lowering (via steering unit)	Hall sensors	5

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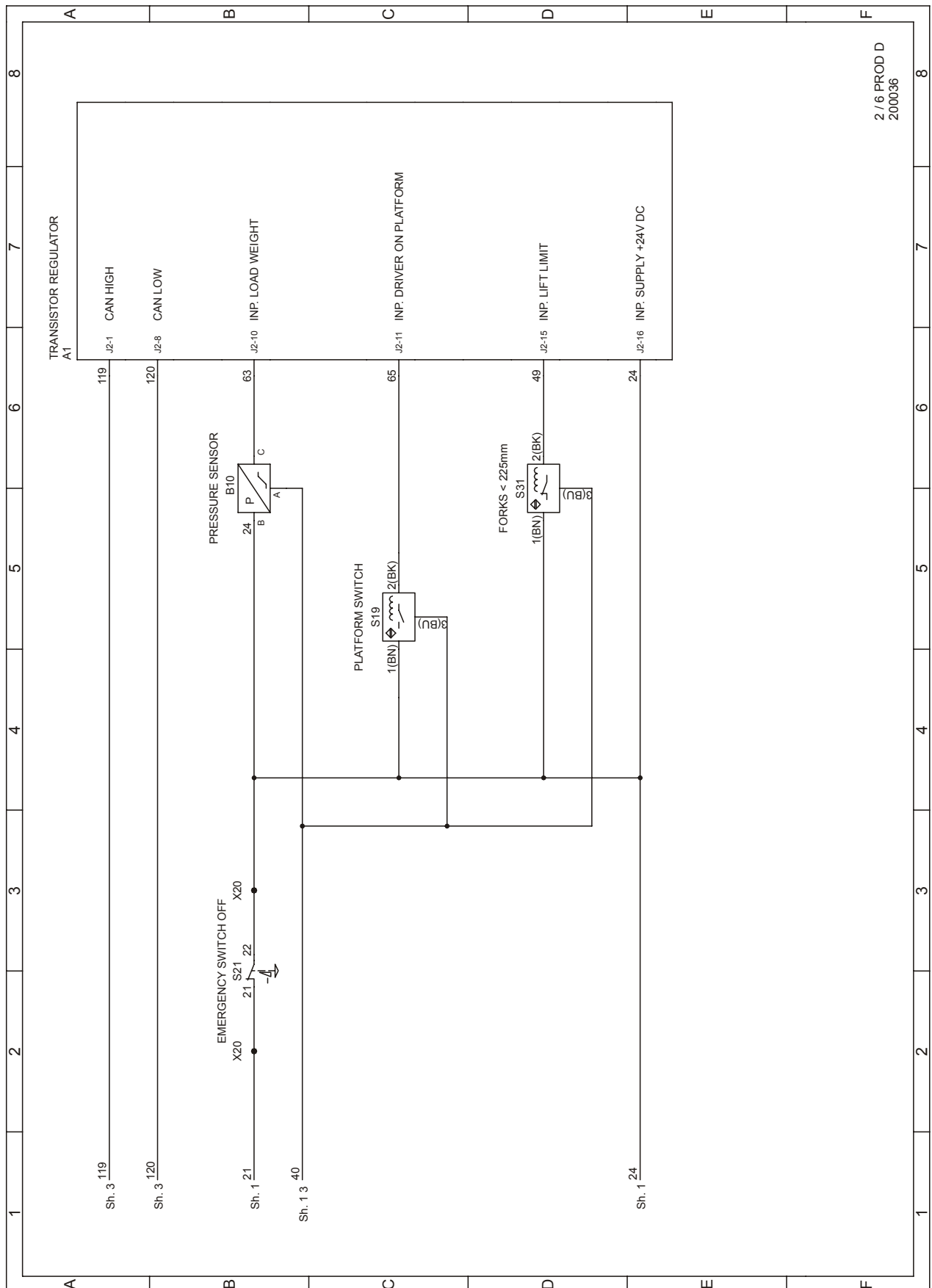


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200036

Electrical systems – 5000

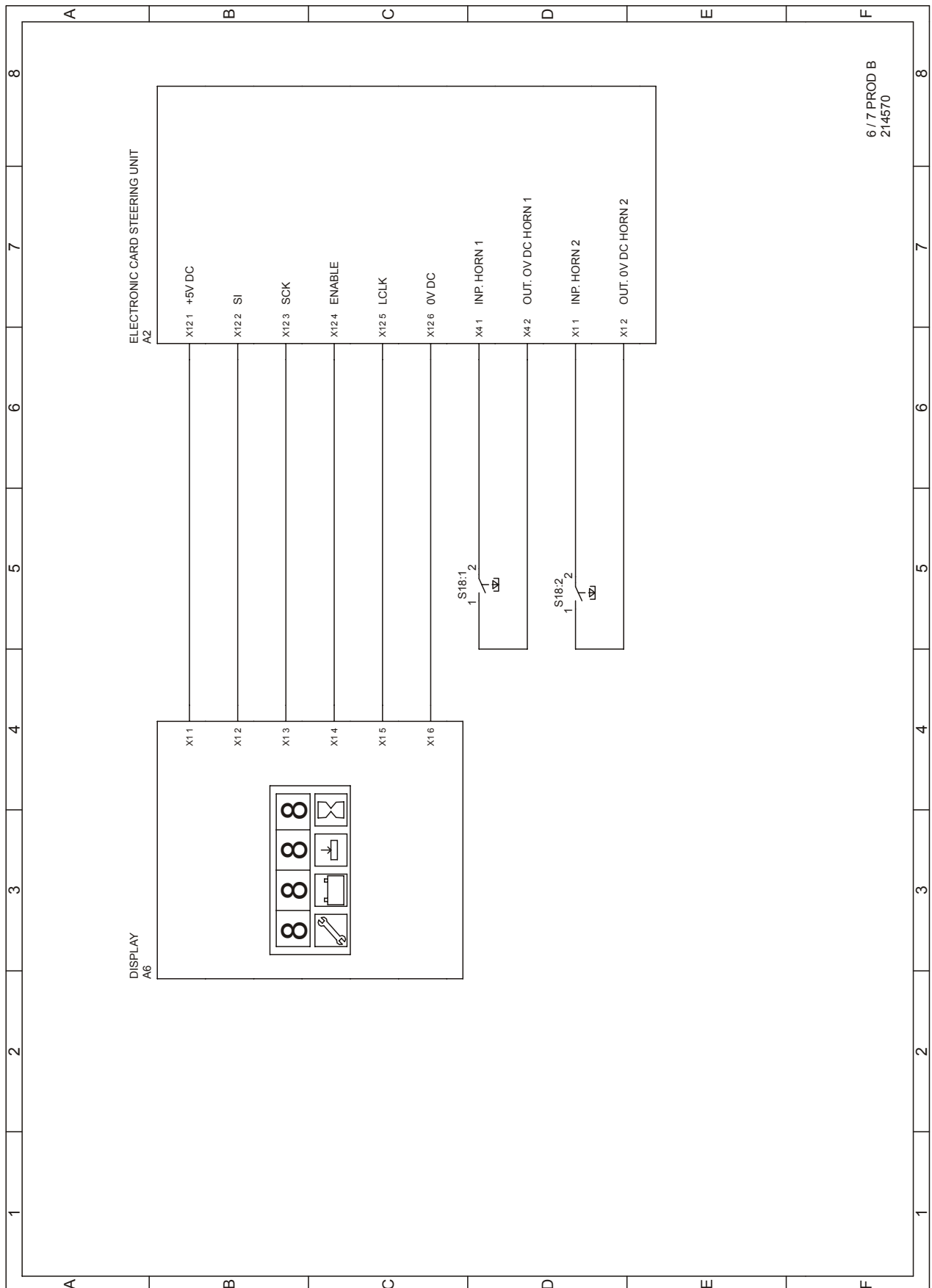
Electrical wiring diagram

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Table 9: Functional description

Event:	10. Fork lifting
Preceding event	2
Action(s)	Depress the fork lift button [A2:S19]
Influencing elements	Forks lift button [A2:S19] Battery status ok (>20% charge left) Lift height limit S31 [A1:INP.LIFT LIMIT] not activated
Resulting conditions	[A1: OUT. FORKS LIFT/LOWER VALVE] goes {low} Valve coil [Y45] activated, the valve opens [A1:OUT.PUMP CONTACTOR] goes {low} Pump contactor [K30] activates Pump motor [M3] starts
Logic	<p>The logic diagram illustrates the control sequence for fork lifting. It features a central logic block with three inputs: a Hall sensor (A2:S19), a lift height limit switch (S31), and a battery status sensor (batt.>20% =0). The logic block contains an AND gate (&) that combines the Hall sensor and battery status inputs, and an OR gate (>1) that combines the lift height limit switch and battery status inputs. The output of the logic block is labeled A1, which is connected to a contactor (K30) and a valve coil (Y45).</p>

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Collision sensor

If there is a collision sensor installed on the CAN bus, it registers when the truck bumps into something. If the impact exceeds a certain level, it is classified as a collision and the truck comes to a halt. It can be reset by entering the PIN code for “resetting the collision sensor” (see table below).

Settings

Additional equipment (software and wiring) from Davis Derby is required to change the TLS settings.

Table 12: Settings TLS

Function	Description	Default setting
PIN code	PIN code for different driver profiles.	00001 (profile 1) 00002 (profile 2) 00003 (profile 3) 11111 (resetting the collision sensor)
Logoff time	Time in minutes (1-254) that the truck is inactive before it is switched off.	255 (not switched off)
Impact level	Determines how sensitive the truck is to an impact.	5 % (sideways) 5 % (forwards/backwards)
Department	Only applies when ID unit is installed.	14
Type of truck	Only applies when ID unit is installed.	16

11.4.6 ID unit (optional)

See the separate manual that is included with the software.

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11 - Reverse braking force

Determines the amount of motor braking when the speed control [L1] is operated opposite the travel direction. The lower the parameter value, the longer time it will take to slow down for a given degree of actuation of [L1].

14 - Creep speed

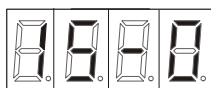
This parameter allows adjustment of the initial speed when the first Hall sensor is activated in the speed control [L1].

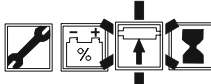
15 - Non-configurable options

Up to 16 so called sub-parameters are stored and accessed via parameter #15. These options are either switched ON or switched OFF and require no other adjustments. They are therefore called non-configurable options. The number of available options is dependant on the truck type. Consult table Parameter #15 Non-configurable options on page 68 for available options.

Setting Non-configurable options

- Ensure the truck is in the parameter mode.

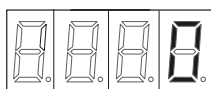


The parameters symbol lights. 

- Select parameter #15 using [L1].

The first sub-parameter will be displayed

Continued operation of the speed control [L1] will display the next sub-parameter. Note also that only relevant sub-parameters will be displayed.

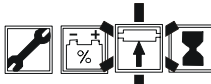



After 1 second the value of the sub-parameter will be displayed.

- Press horn button [S18].

Parameter symbol flashes. 

- Set the sub-parameter value by repeatedly operating speed control [L1] up or down. See Table 19: for details.
- Press horn button [S18] once to confirm the new setting.

The parameters symbol lights. (stops flashing). 

- Switch off the truck by pressing  on the keypad.

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11.5.9 Configurable “Option” Parameters

WARNING!

The information in this section is not intended as a programming reference and is included solely to allow the reader to gain a thorough understanding of parameter setting / checking.

Do not attempt to make any adjustments to these parameters unless you have sufficient knowledge of the truck’s options/ modified functions. This manual only covers the truck’s standard equipment. Specially modified trucks may require that you have access to special service information. Improper adjustment of the option service parameters may compromise safe operation and / or result in a malfunction.

General

Parameters #16 to #19 are reserved in the truck’s control system for extra truck options and/or special product modifications. The parameters configure and control the behavior of the Spider expansion unit (SEU) which must be fitted in the truck. See “11.4.2 Spider expansion unit (SEU)” on page 51. This method of implementation allows the standard software program to be used without the need for a specialised software. Normally, these parameters are configured by the manufacturer when the truck is modified or customized. It is advisable to upload the parameter settings from trucks which are modified. In the event the main control card [A2] is changed, the original parameter settings can then be transferred to the new card thus ensuring the special option functions correctly.

Parameter Nos. #16, #17, #18 & #19 can be adjusted to allow up to a maximum of 4 preprogrammed “base options” to be activated and configured to suit a specific special option or customisation. See table below.

Table 20: Summary of base options

Base option no.	Function	Refer to..
1	Pressing an option button controls a digital o/p	table 21 on page 80
2	Activating a digital input will reduce maximum drive speed	table 22 on page 81
3	Specific truck movement(s) activates a digital o/p	table 23 on page 82
4	Activating a digital input causes main contactor to close	table 24 on page 84
5	Activating digital inputs will operate lift /lower	table 25 on page 85
6	Lift height can be restricted by activating a digital input + ability to override by pressing an option button	table 26 on page 87

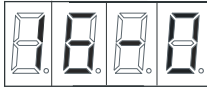
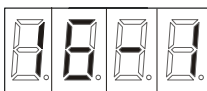
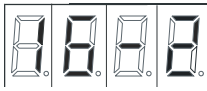
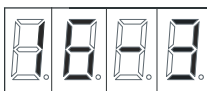
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Table 26: Base option 6 - Lift height restriction by SEU i/p & override

Argument #0	Option designator		
Initial display  (value shown after 2s delay)	Values	Meaning	
	6	Sets relevant option parameter to handle base option 6	
Argument #1	Selection of SEU unit 1 or 2		
Initial display  (value shown after 2s delay)	Values	Meaning	
	0	option is handled by SEU unit 1(A36)	
	1	option is handled by SEU unit 2 (second SEU unit)	
Argument #2	Selection of SEU digital input for restriction switch		
Initial display  (value shown after 2s delay)	Values	Meaning	Pin no.
	0	activate SEU digital i/p 1 (1mA)	5
	1	activate SEU digital i/p 2 (1mA)	19
	2	activate SEU digital i/p 3 (1mA)	33
	3	activate SEU digital i/p 4 (1mA)	6
	4	activate SEU digital i/p 5 (7mA)	20
	5	activate SEU digital i/p 6 (7mA)	34
	6	activate SEU digital i/p 7 (7mA)	7
	7	activate SEU digital i/p 8 (7mA)	21
Argument #3	Selection of option button to override		
Initial display  (value shown after 2s delay)	Values	Meaning	
	1	activated by option button 1	
	2	activated by option button 2	
	3	activated by option button 3	
	4	activated by option button 4	
	5	activated by option button 5	
	6	activated by option button 6	
Argument #4	Not used		

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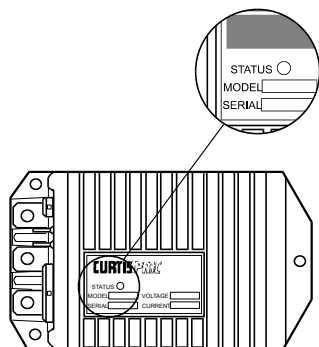
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Transistor regulator errors

The table below depicts the error codes that may be shown by the status LED or read using the hand-held terminal.

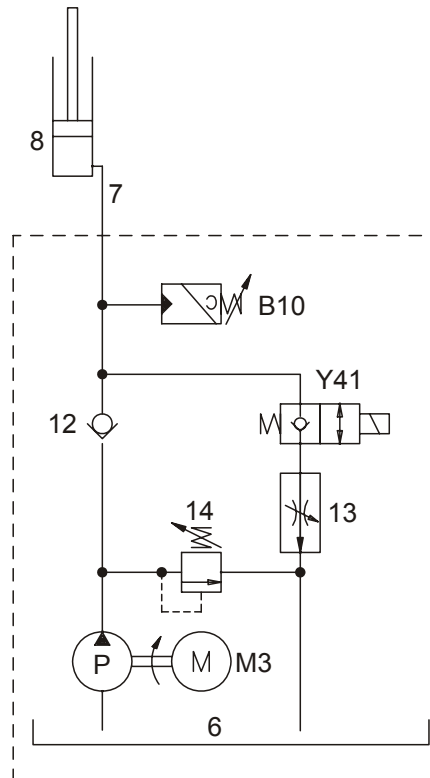


STATUS LED		Hand-held terminal display	Explanation	Possible cause
Status lamp off		-	No voltage or defective regulator	Burnt fuse, bad contact, not connected, defective regulator
LED on		-	Defective regulator	Defective regulator
1,1	α α	CURRENT SHUNT FAULT	Built-in current shunt defective	Armature current sensor fault in motor controller.
1,2	α αα	HW FAILSAFE	Power amplifier CAN timeout	Motor controller reports unexpected loss of data flow from tiller head
1,3	α ααα	M- SHORTED	Internal M- short to B-	Problem with switch transistor in armature circuit inside motor controller
3,1	αααα α	CONT COIL/FLD SHORT	Too high current for contactor feeding or shorted field winding	Attempt to drive more current than specified from outputs. Problem to regulate field current. Internal controller fault.
3,3	αααα αααα	FIELD OPEN	Open field winding	Shunt field open, harness broken, motor controller defect.
4,1	ααααα α	LOW BATTERY VOLTAGE	Low battery voltage	1. Battery voltage < 17 volts. 2. Corroded battery terminals 3. Loose battery or regulator connections
4,2	ααααα αα	OVERVOLTAGE	Overvoltage	1. Battery voltage > 33 volts
4,3	ααααα αααα	THERMAL CUTBACK	Over-/under-temperature reduction	1. Temp. > 85°C or < -25°C. 2. Truck overloaded. 3. Wrong installation of transistor regulator 4. Operation under extreme conditions

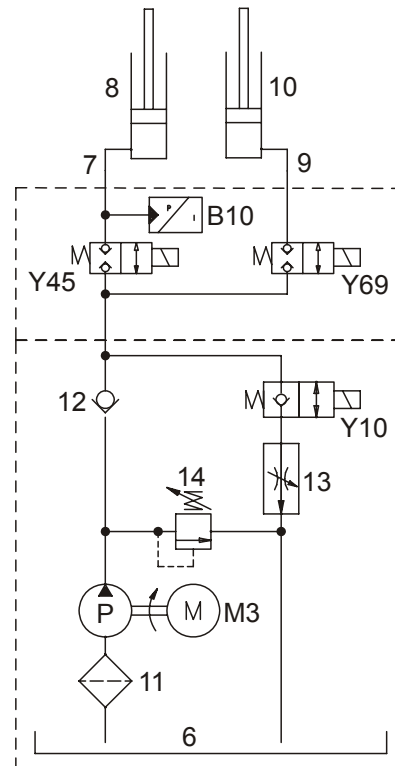
Hydraulic system – 6000

Hydraulic diagrams

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TRUCK WITHOUT MAST AND WITHOUT PLATFORM



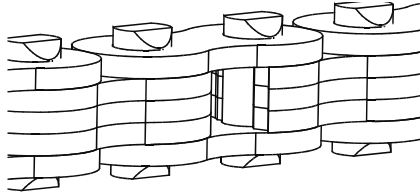
TRUCK WITHOUT MAST WITH PLATFORM

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13.3.10 Damaged discs

If a disc has broken on the chain, this can be due to overloading or corrosion.

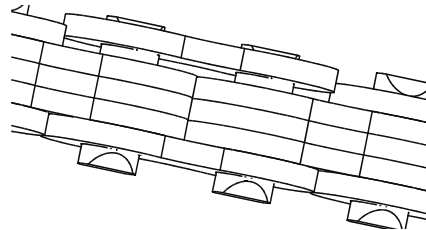
The chain should be replaced.



13.3.11 Damaged bolts

It can be difficult to discover whether a bolt has broken. It can appear as bolt rotation and/or that the outer disc is loose.

The chain should be replaced.



13.3.12 Dirty chain

If a chain is very dirty it is first and foremost recommended that it is replaced. It can also be dismantled and cleaned as set out in the chapter "Cleaning".

13.4 Cleaning

If a chain is very dirty it is recommended that it is replaced.

Dirty chains should be cleaned before they are lubricated, e.g. by washing with solvent such as diesel or petrol.

The chain should be blown dry using compressed air and lubricated directly after cleaning

NOTE!

Exercise care with degreasing agent as these can contain abrasives.

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15.3 Layout

15.3.1 Main program screen

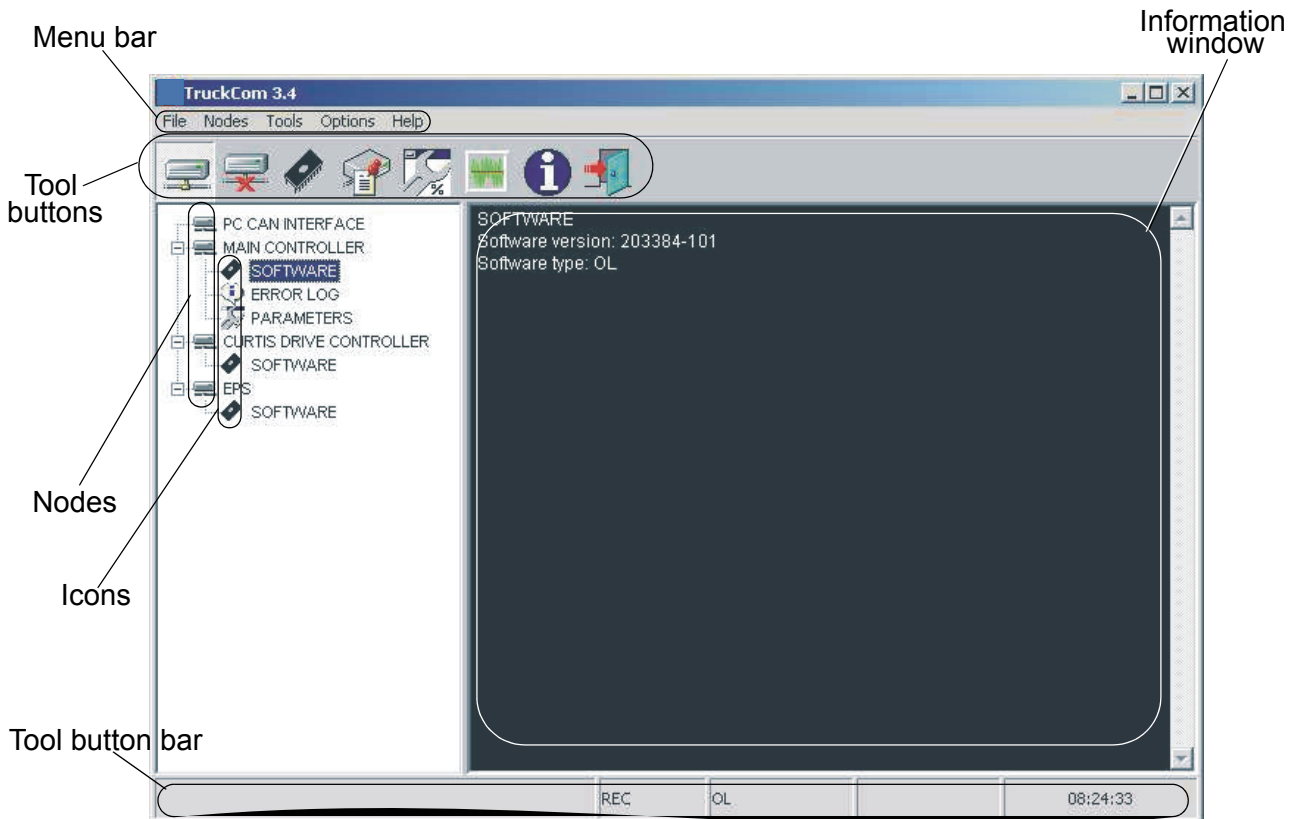


Fig. 21 Main TruckCom program screen

The Main window opens when the program is started. This shows the menu bar, tool buttons, workspace, log window and status window.

15.3.2 Nodes

Devices which are connected to and communicate via the CAN interface are called *nodes*. The nodes detected on the bus are shown in the node window. The current node status and input component/information is shown with different icons.

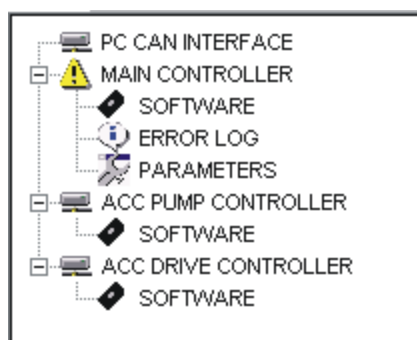


Fig. 22 A typical node window display

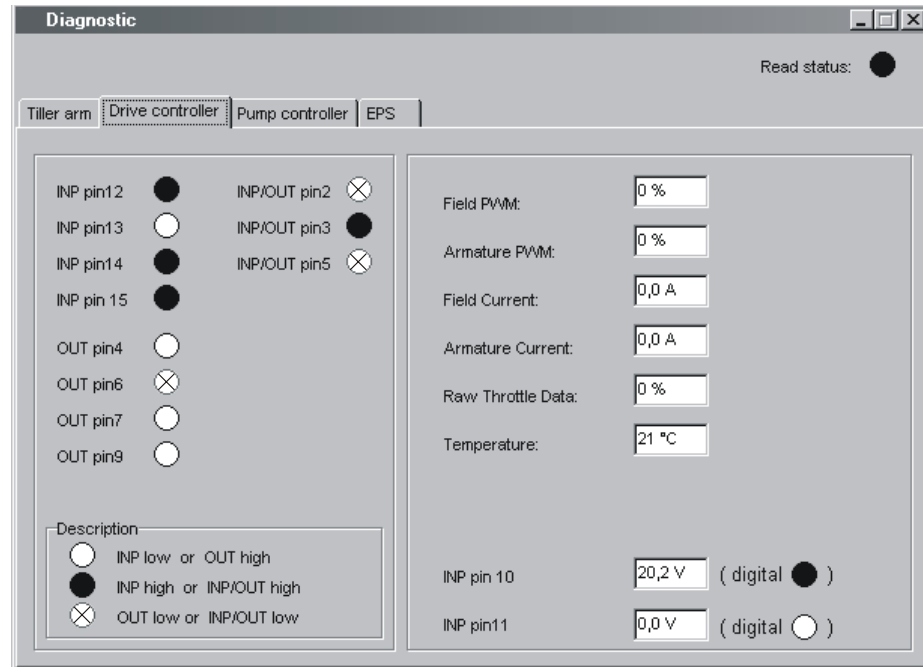
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15.9.3 “Drive Controller” tab (transistor regulator driving)

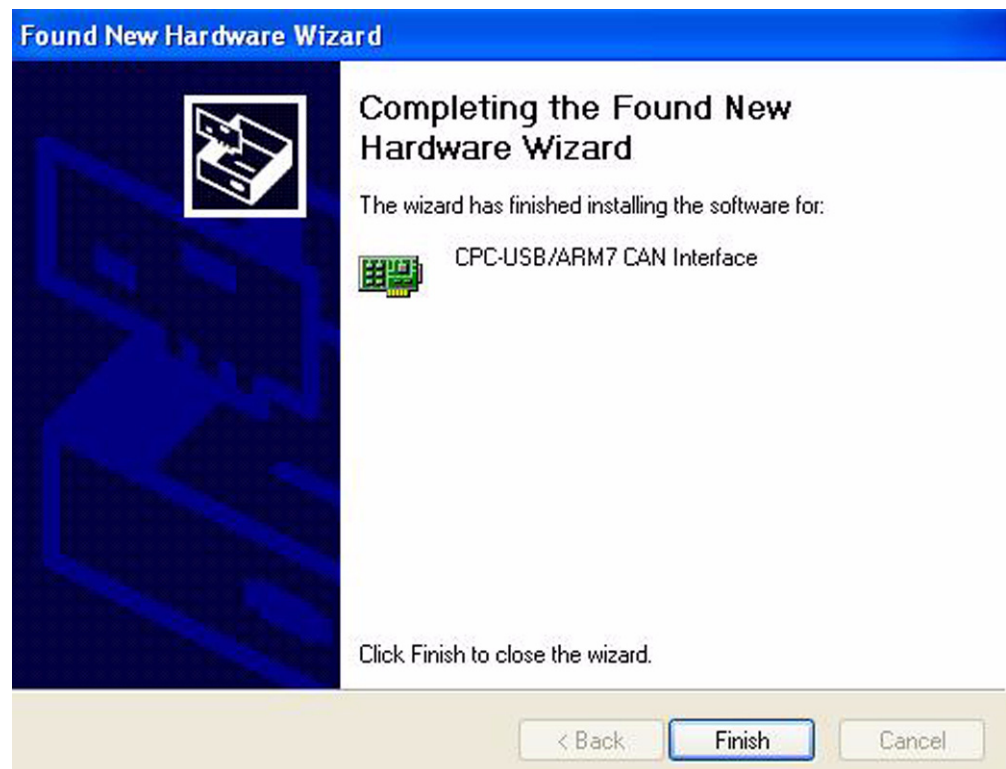


Clicking on the *Drive Controller* tab will display a dialogue showing the following:

- Status of digital inputs and outputs of the transistor regulator. *pin* refers to the motor controller pin designations as given in the circuit diagram.
- *Field PWM* - The effective power output supplied to the field circuit as a percentage.
- *Armature PWM* - The effective power output supplied to the armature circuit as a percentage
- *Field current* - The current flowing in the field circuit in Amperes.
- *Armature current* - The current flowing in the Armature circuit in Amperes
- *Raw throttle data* - The received speed control signal as a percentage.
- *Temperature* - The temperature of the output stage of the transistor controller in degrees Celsius
- *Inp pin 10* - The input voltage from the mode/pressure sensor. “digital O” indicates the digital status of the input.
- *Inp pin 11* -The input voltage from the man-on platform sensor. “digital O” indicates the digital status of the input.

Order number	Date	Valid from serial number	T-code
232371-040	2007-03-30	932596-	649, 783

5. Installation of the drivers is complete.



15.14 To uninstall

To uninstall TruckCom under Windows®:

- Click on the Start button, select Settings, Control Panel, Add/Remove Programs.
- To uninstall the application, select the TruckCom application and click on Change/Remove.

Order number	Date	Valid from serial number	T-code
232371-040	2007-03-30	932596-	649, 783

16.11 Operator protection (0840)

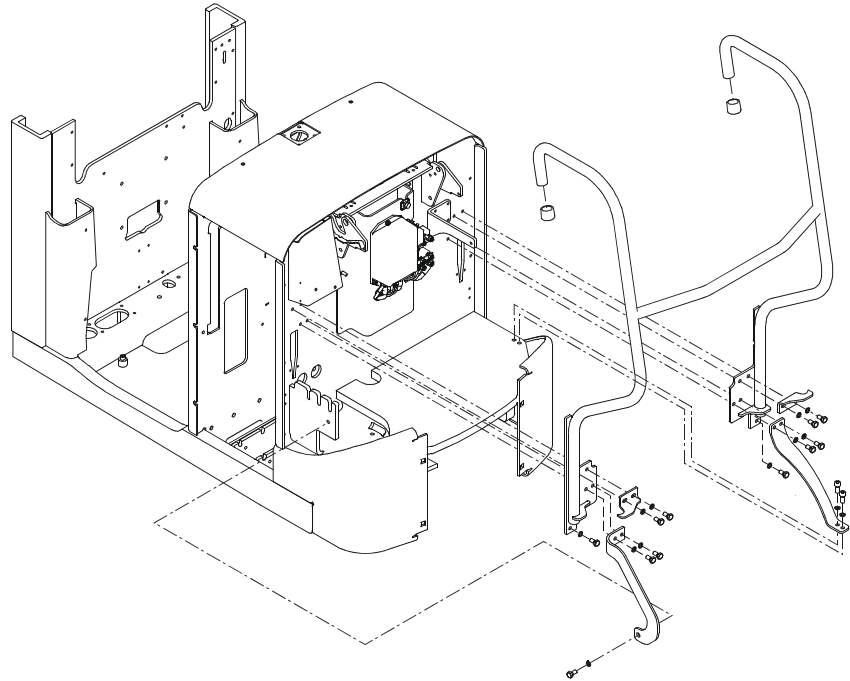


Fig. 30 Operator protection device

16.11.1 Disassembly

- Remove the operator protection device.

16.11.2 Material handling

The operator protection device should be placed in a container intended for iron and steel scrap.

Order number	Date	Valid from serial number	T-code
232371-040	2007-03-30	932596-	649, 783

16.21 Charger adaptor (9380)

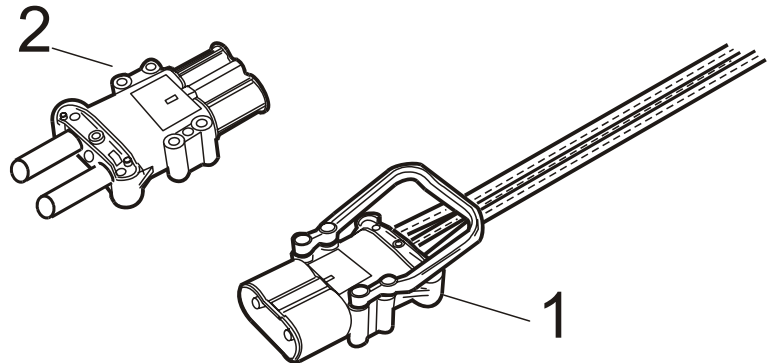


Fig. 40 Charger adapter

16.21.1 Disassembly

- Charger adaptor Fig. 40 (1) comes with the battery.
- Remove the charger adaptor Fig. 40 (2).

16.21.2 Material handling

The charger adaptor (2) should be placed in a container for electronic scrap.

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