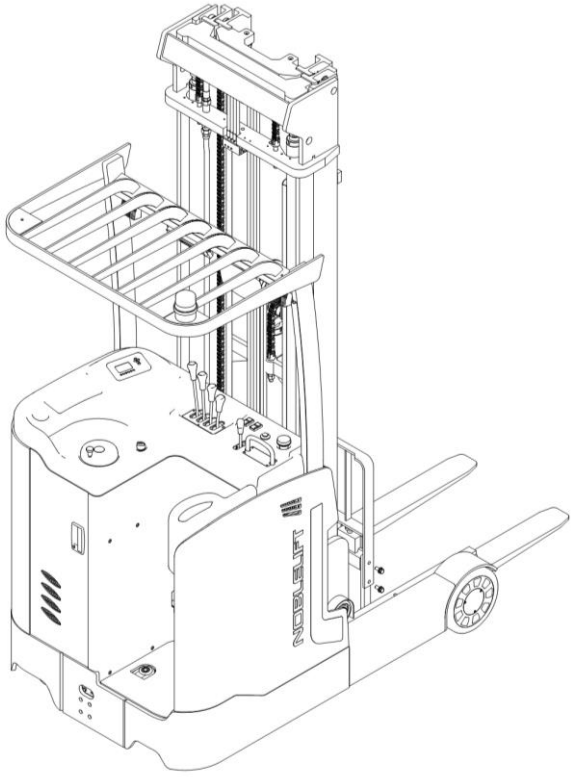
NOBLELIFT

Instruction Manual

Battery Powered Reach Truck

RT15ST2/RT20ST2/ RT25ST2



WARNING

Do not operate the reach truck before reading and understanding the instructions of this manual.

NOTE

- Please check the designation of your present type at the last page of this manual as well as on the ID-plate.
- Keep this manual for future reference.

This truck is limited to use in factories, tourist attractions and amusement places.

Version 08/2023

RTxxST2-SMS-002-EN

FOREWORD

Before operating the electric reach truck, read this ORIGINAL INSTRUCTION MANUAL carefully and understand the usage of the truck completely. Improper operation could create danger.

This manual describes the usage of different electric reach trucks. When operating and servicing the truck, make sure that it applies to your type.

Please keep this manual for future reference. If this manual or warning/caution labels are damaged or lost, please contact your local dealer for replacement.

ATTENTION:

- Environmentally hazardous waste, such as batteries, oil and electronics, will have a negative effect on the environment, or health, if handled incorrectly.
- The waste packages should be sorted and put into solid dustbins according to the materials and be collected disposal by local special environment protection bureau. To avoid pollution, it's forbidden to throw away the wastes randomly.
- To avoid leaking during the use of the products, the user should prepare some absorbable materials (scraps of wooden or dry duster cloth) to absorb the leaking oil in time. To avoid second pollution to the environment, the used absorbable materials should be handed in to special departments in terms of local authorities.
- Our products are subject to ongoing developments. Because this manual is only for the purpose of operating /servicing the truck, therefore please have understanding, that there is no guarantee out of particular features out of this manual.

NOTE: In this manual, this sign  indicates warning and hazard. Failure to comply with this instruction may result in severe injury or even death.

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1. CORRECT APPLICATION

To ensure the safety of personal and equipment, drivers shall observe the following precautions:

1. Only drivers who have been trained and hold a industrial trucks driving license can drive this truck;
2. This reach truck is suitable for hard and flat indoors floor conditions;
3. Check the control and alarm devices before driving this reach truck. If any damage or defect is found, it shall be operated after repair;
4. During handling, the load shall not exceed the specified value. Both forks should go under the goods and load should be evenly placed on the forks. Unbalanced loading is prohibited and picking up objects with single fork is not allowed;
5. Start, steer, drive, brake and stop slowly and smoothly. Slow down when steering on wet or smooth floors;
6. When driving this reach truck with goods, lower the goods as low as possible and the forks should be tilted backward;
7. Be careful when driving on the slope: move forward uphill, move backward downhill, avoid steering uphill or downhill;
8. When driving this reach truck, pay attention to pedestrians, obstacles and potholes, and pay attention to the clearance above the reach truck;
9. It is not allowed to stand on forks or truck;
10. It is not allowed to stand under or walk under the elevated part of the truck;
11. Only operate the truck from the driver's position;
12. Do not handle unsecured or loosely packed goods, and carefully handle goods in large size;
13. When driving in the racks, drive slowly, move straightly in and straightly out, when the fork is not completely removed from the racks, do not steer in case of collision.
14. For high lifted trucks, try to make the mast tilted back, and the tilting forward and backward during loading and unloading should be done within the minimum range;
15. Immediately stop using when the failure occurs, and the label shall be clearly indicated;
16. Lower the forks to the ground when leaving the truck, park the truck on level ground, turn off the power and remove the key.

It is only allowed to use this electric reach truck according to this instruction manual.

The capacity is marked on capacity sticker as well on the identification plate. The operator has to pay attention to the warnings and safety instructions.
Operating lighting must be minimum 50 Lux.

Modification

No modifications or alterations to this reach truck which may affect, for example, capacity, stability or safety requirements of the truck, shall be made without the prior written approval of the original truck manufacturer, its authorized representative, or a successor thereof. This includes changes affecting, for example braking, steering, visibility and the addition of removable attachments. When the manufacturer or its successor approve a modification or alteration, they shall also make and approve appropriate changes to capacity plate, decals, tags and operation and maintenance manual.

By not observing these instructions, the warranty becomes void.

2. TRUCK DESCRIPTION

a. Assembly Overview

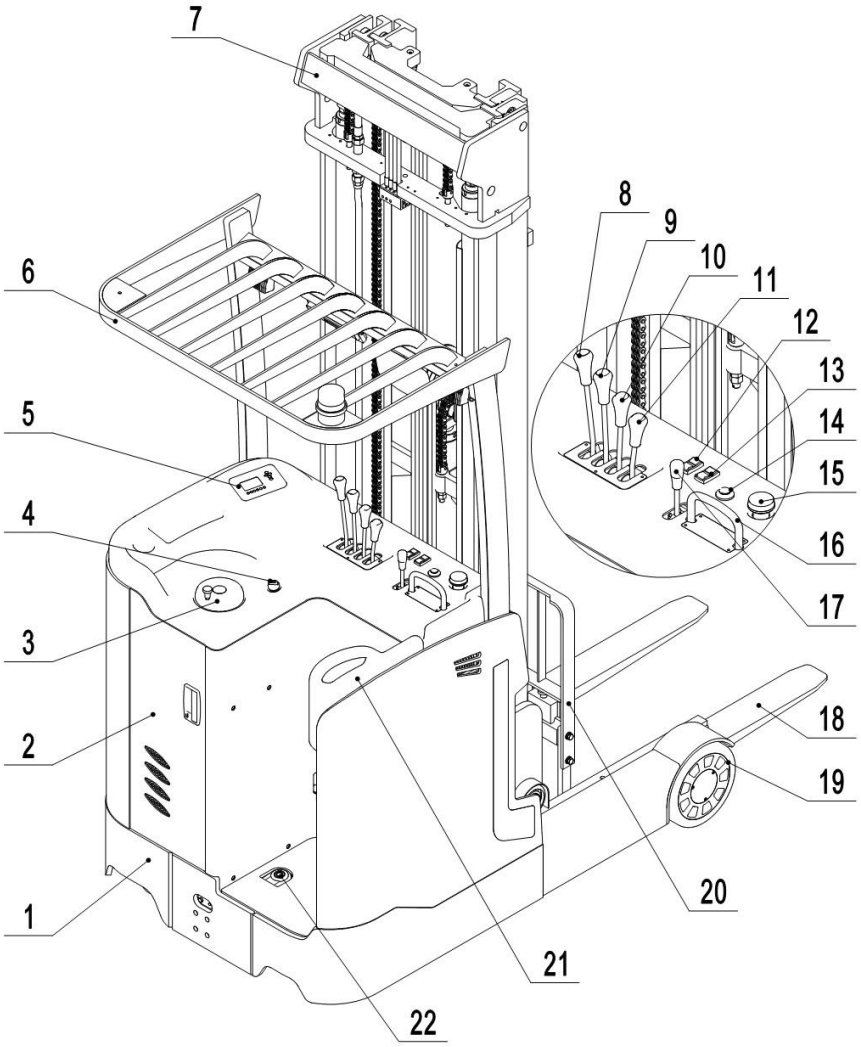


Fig. 1: Overview main components

1. Chassis
2. Motor access
3. Steering wheel
4. Key switch
5. Display
6. Overhead guard
7. Mast
8. Lift/lower control stick
9. Reach control stick
10. Tilt control stick
11. Side-shift control stick
12. Lamp switch
13. Turn signal control button
14. Horn button
15. Emergency switch
16. Handle
17. Travel FW./BW. control stick
18. Forks
19. Load wheel
20. Load backrest
21. Backrest
22. Safety pedal switch

b. Technical specifications

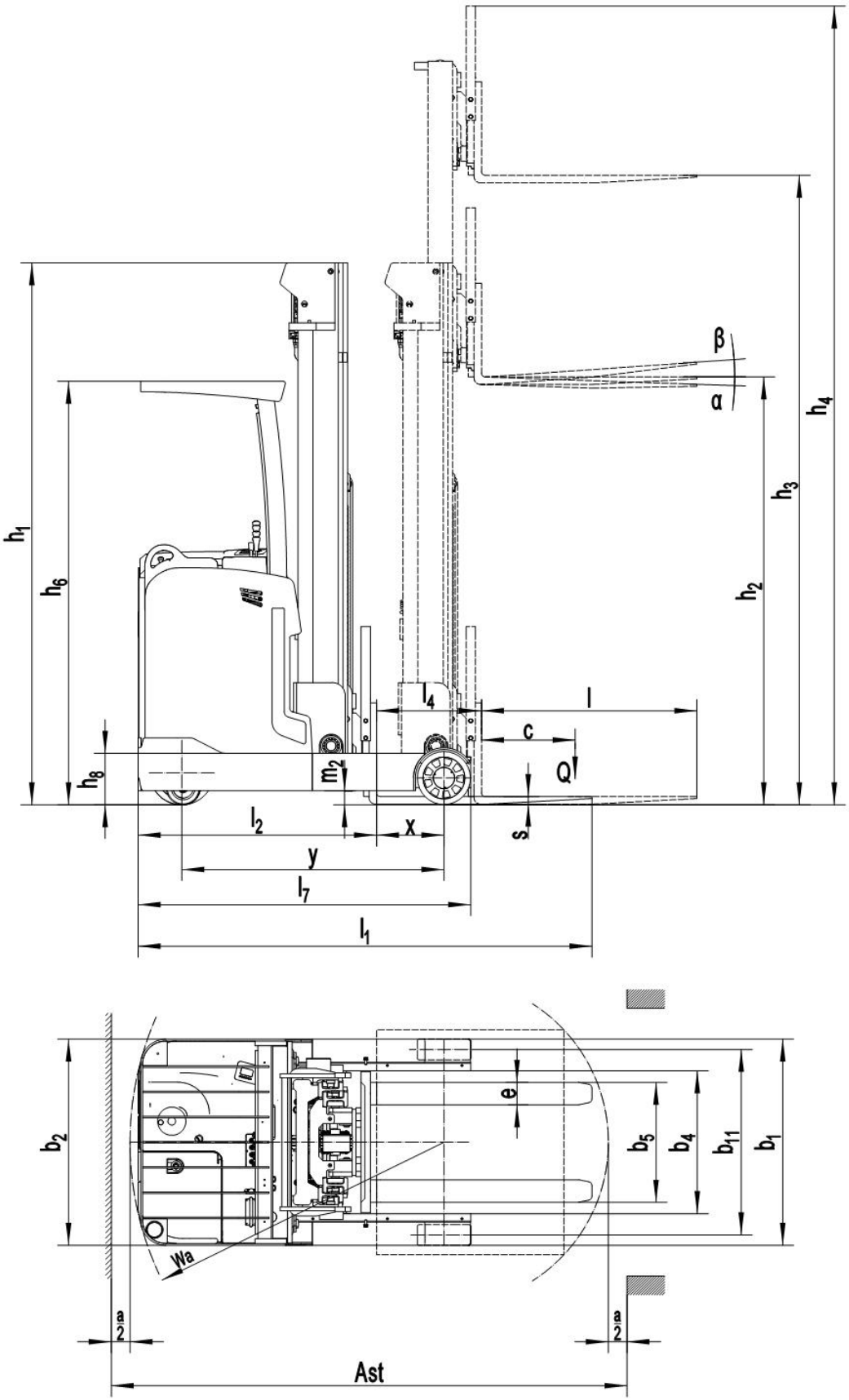


Fig. 2: Structure schematic drawing

Table1: Main technical data for standard configuration

Type sheet for industrial truck acc. to VDI 2198						
Distinguishing mark	1.2	Manufacturer's type designation		RT15ST2	RT20ST2	RT25ST2
	1.3	Drive: electric (battery type, mains, ...), diesel, petrol, fuel gas		Battery type		
	1.4	Operator type: hand, pedestrian, standing, seated, order-picker		Standing		
	1.5	Rated capacity/ rated load	Q (t)	1.5	2.0	2.5
	1.6	Load centre distance	c (mm)	500		
	1.8	Load distance, centre of drive axle to fork	x (mm)	360/300	396/336	490/430
	1.9	Wheelbase	y (mm)	1400	1500	1650
Weight	2.1	Service weight (with battery)	kg	3210	3280	3530
Tyres/ chassis	3.1	Tires		Polyurethane (PU)		
	3.2	Tire size, front	∅xW (mm)	343×140		
	3.3	Tire size, rear	∅xW (mm)	285×110	285×110	330×110
	3.5	Wheels, number front/ rear (x=driven wheels)		2/1x+2		
	3.7	Tread	b_{11} (mm)	990		
Dimensions	4.1	Tilt of fork carriage forward/backward	α / β (°)	2°/-4°		
	4.2	Height, mast lowered	h_1 (mm)	3068		
	4.3	Free lift	h_2 (mm)	2397		
	4.4	Lift	h_3 (mm)	7000		
	4.5	Height, mast extended	h_4 (mm)	7910		
	4.7	Height of overhead guard (cabin)	h_6 (mm)	2260		
	4.19	Overall length	l_1 (mm)	2340	2410	2470
	4.20	Length to face of forks	l_2 (mm)	1270	1340	1400
	4.21	Overall width	b_1 (mm)	1100		
	4.22	Fork dimensions DIN ISO 2331	s/ e/ l (mm)	35/100/1070	40/120/1070	40/120/1070
	4.25	Fork spread, min. - max. (with/without side-shift)	b_5 (mm)	220-730/660	250-730/660	250-730/660
	4.28	Reach distance, with/without side-shift	l_4(mm)	560/500	580/520	690/630
	4.31	Ground clearance, laden, below mast	m_1(mm)	75		
	4.33	Aisle width for pallets 1000×1200 crossways	Ast (mm)	2760	2830	2920
	4.34	Aisle width for pallets 800×1200 lengthways	Ast (mm)	2820	2880	2950

	4.35	Turning radius	Wa (mm)	1685	1770	1885
	4.37	Length across wheel arms	l_7 (mm)	1775	1875	2058
Performance	5.1	Travel speed, laden/ unladen	km/h	9.5/9.5		
	5.2	Lift speed, laden/ unladen	m/s	0.28/0.35	0.26/0.35	0.24/0.35
	5.3	Lowering speed, laden/ unladen	m/s	0.35/0.35		
	5.4	Reaching speed, laden/ unladen	m/s	0.1/0.1		
	5.8	Max. gradeability, laden/ unladen	%	10/15		
	5.10	Service brake		Electromagnetic Braking		
Electric-engine	6.1	Drive motor rating S2 60min	kW	3.8	5.5	5.5
	6.2	Lift motor rating at S3 15%	kW	8.2	12.5	12.5
	6.4	Battery voltage/ nominal capacity K_5	(V)/(Ah)	48/280	48/350	48/420
	6.5	Battery weight	kg	515	665	765
Addition data	8.1	Type of drive unit		Three-phase AC		
	8.2	Operating pressure	(bar)	150	180	210
	8.3	Oil volume	(l/min)	40		
	8.4	Sound pressure level at driver's seat according to EN12053	dB(A)	68		

Table of masts (RTxxST2)				
Designation	Lift h_3 mm	Free lift h_2 mm	Height, mast lowered h_1 mm	Height, mast extended h_4 mm
Three stage mast FFL (Full Free Lift)	4500	1624	2235	5410
	5000	1790	2400	5910
	5500	1956	2568	6410
	6000	2124	2735	6910
	6500	2290	2900	7410
	7000	2456	3068	7910

c. Description of the safety devices and labels (Europe and others, except USA)

Warnings and notices:

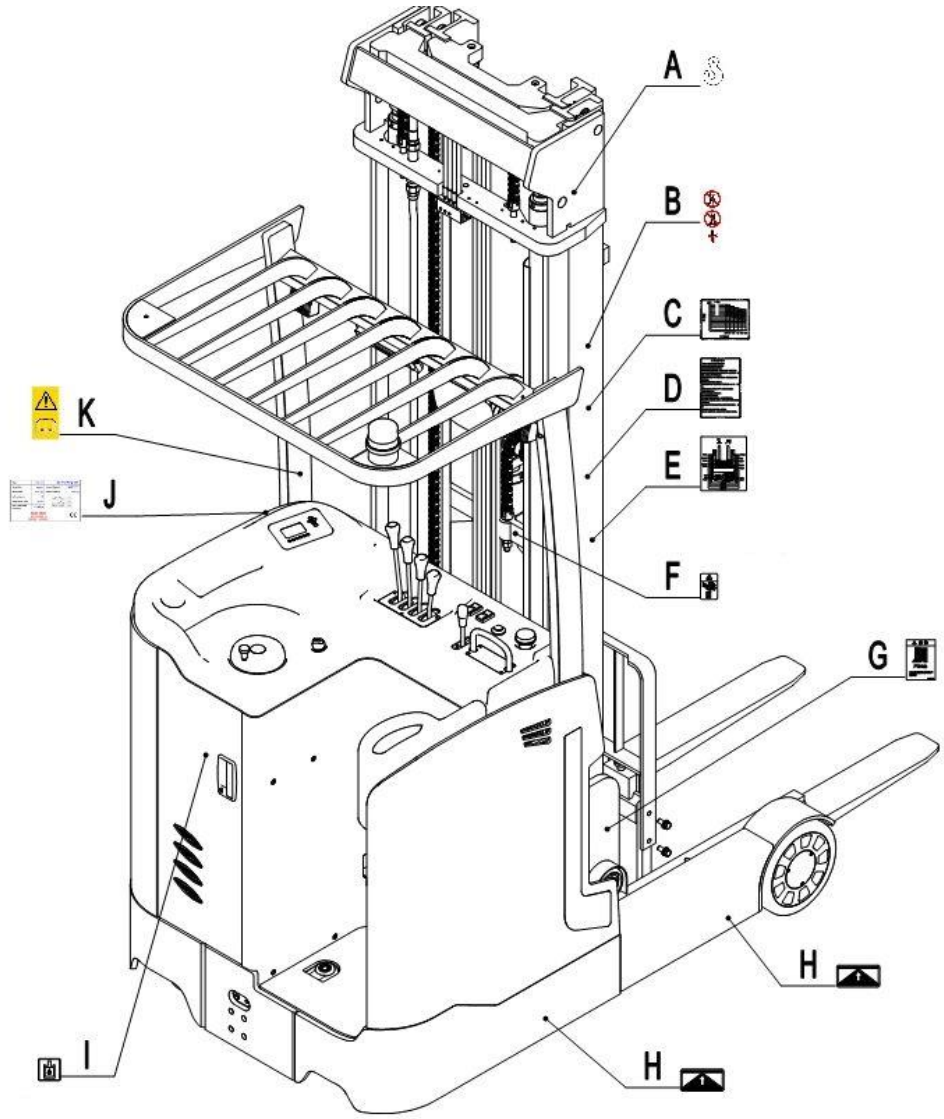


Fig 3: Labels

A. Crane hook labels: Attachment point for loading by crane.
B. Warning labels: Do not stand under or on the fork, otherwise it may cause injury.
C. Residual capacity plate
D. Instructions label
E. Lubrication label
F. Hand pinching warning: There is a risk of hand injury at this position.
G. Foot trapping warning: There is a risk of foot injury at this position.
H. Fork loading label: The fork insertion position during loading.
I. Oil filling sticker: Hydraulic oil should be filled at this position.
J. Identification plate (ID-plate): Indicate the basic information of truck, such as specification, production date, serial number, etc.
K. Warning label: Read the manual and follow the instructions.

Safety devices:

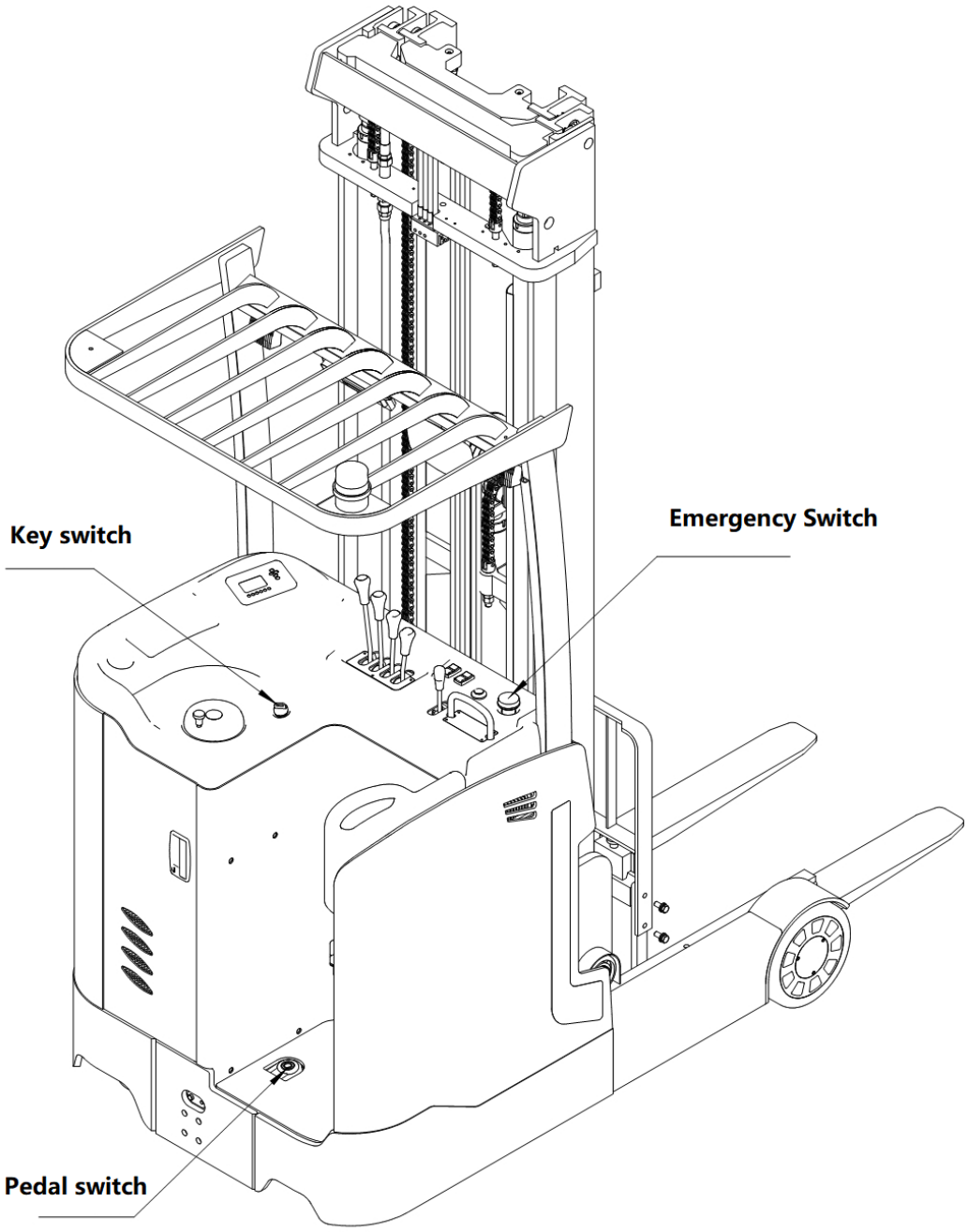


Fig 4: Safety devices

Emergency switch: Please press the button immediately to cut of the power supply when the truck is out of control, all lifting-, lowering-functions will be stopped.
Key switch: To prevent against unauthorized access, turn the key counterclockwise and remove it.
Pedal switch: Operate the truck with left foot on the foot pedal switch, otherwise it will be failed.
Attention: Emergency switch, key switch, pedal switch and hydraulic circuit explosion-proof valve are safety devices of the truck. Safety devices and labels above must be kept in good condition, please replace in time in case of damage or absence.

d. Location of truck identification number

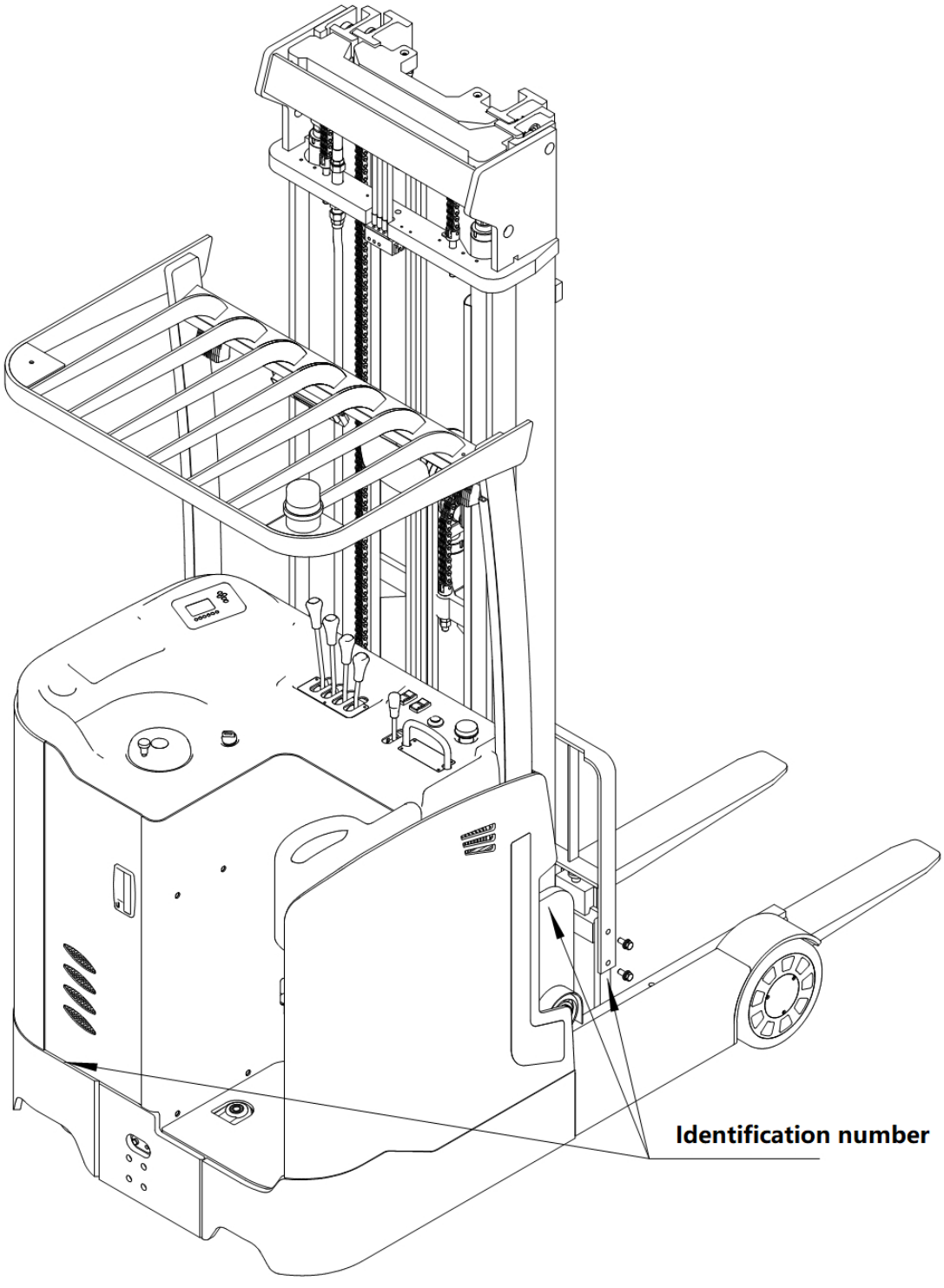


Fig.5: Location of truck identification number

The truck identification number is located on the chassis, mast and fork carriage. For truck equipped with hook-type forks, the identification number is also made on the forks.

e. Identification plate (ID-plate)

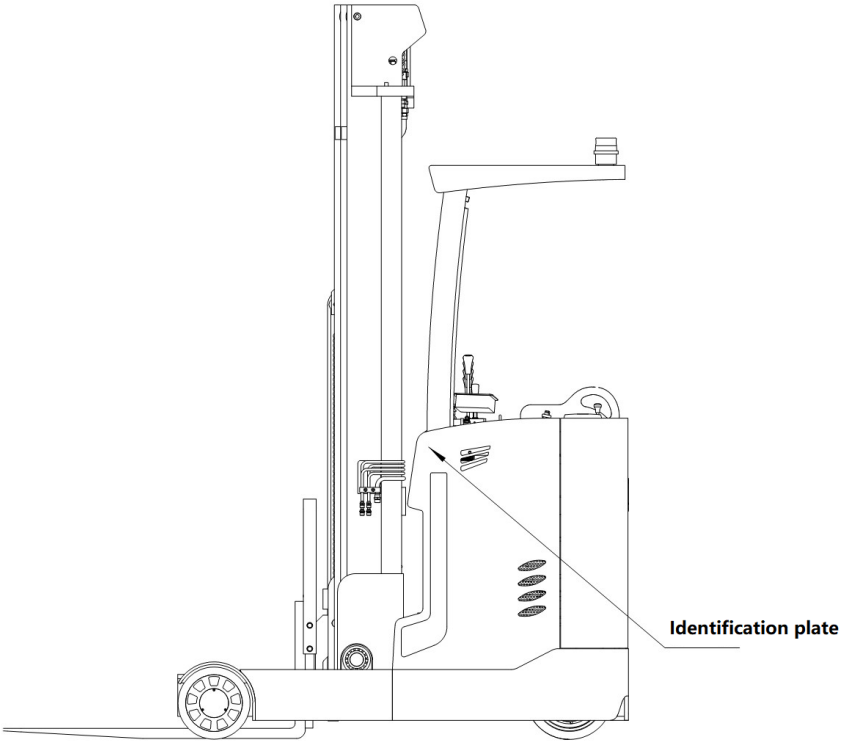


Fig. 6: Location of identification plate

1	Designation, type	6	Name and address of manufacturer)
2	Serial number	7	Battery weight minimum/ maximum
3	Rated capacity in kg	8	Nominal power in kW
4	Supply voltage in V	9	Load center distance
5	Own mass (self-weight) in kg without battery	10	Manufacturing date
		11	Option

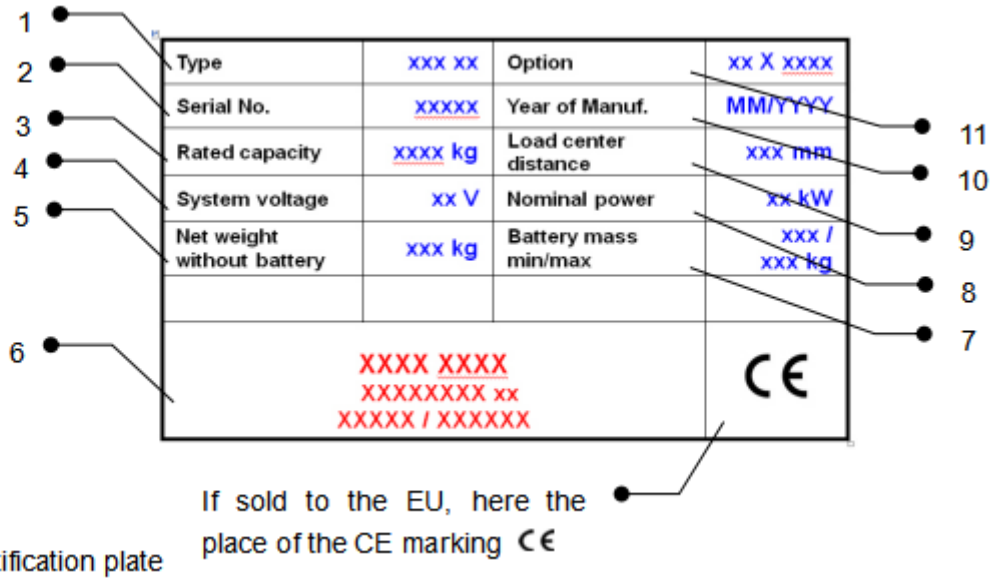


Fig. 7: Identification plate

3. WARNINGS, RESIDUAL RISK AND SAFETY INSTRUCTIONS

- Do not use truck in environments with explosive gas, explosive dust or acid and alkali corrosion;
- Do not use truck in the environment with poor outdoor or ground conditions;
- Do not put feet or hands under or inside the lifting mechanism;
- Do not stand in front or behind the truck while driving or lifting/lowering;
- Do not overload, the load weight and lifting height must meet load curve requirements;
- Do not put foot outside the truck when driving which may cause injuries;
- Do not lift people may which may cause people falling down and severe injury suffering;
- Do not push or pull goods;
- Do not drive the truck on slopes;
- Do not use truck with unstable, loose or unbalanced load, gravity center must be between two forks;
- To prevent against unauthorized access, park the truck, turn off the power and pull out the key;
- Do not make any truck modification without written consent from manufacturer;
- Do not lift the cargo in the case of wind. Lifting will be unstable under the wind influence.

Observe difference in floor levels when driving. Load could fall down or the truck could get uncontrollable.

Keep watching the condition of load. Stop operating the truck if load becomes unstable.

Brake the truck and activate the emergency button by pushing when sliding load on or off the truck. If the truck has any malfunctions, follow chapter 8.

- The truck is intended to be used on hard and flat ground indoors whose roughness should be within 1cm/m^2;
- The operator should hold driving license and have been trained;
- When operating the truck, the operator has to wear safety shoes.
- The truck is intended to be used with ambient temperatures between +5°C~+40°C;
- The operating lighting must be minimum 50 Lux.

4. COMMISSIONING, TRANSPORTING, DECOMMISSIONING

a. Commissioning

After receiving our new reach truck or for re-commissioning you have to do following before (firstly) operating the truck:

- Check if all parts are included and not damaged
- Mast installation (please follow the instructions to install the mast);
- Do the work according to the daily inspections as well as functional checks.
- Check battery installation and charge instructions (follow chapter 7).

Mast assembling:

Mast assembling required equipment:

Lifting equipment:

Driving (5 tons maximum load) or fork lifting (3 tons load capacity and 4.5 m lifting height)

Tools: crowbar.

Safety precautions:

Assembling operators must take appropriate training or be trained by professional personnel on-site to guide the assembling operation.

Operators for lifting equipment must get appropriate operating qualifications.

If the truck is directly forked on the crossbeam of the mast, the mast and the fork carriage must be tied together with the protection rope to avoid the risk of slipping.

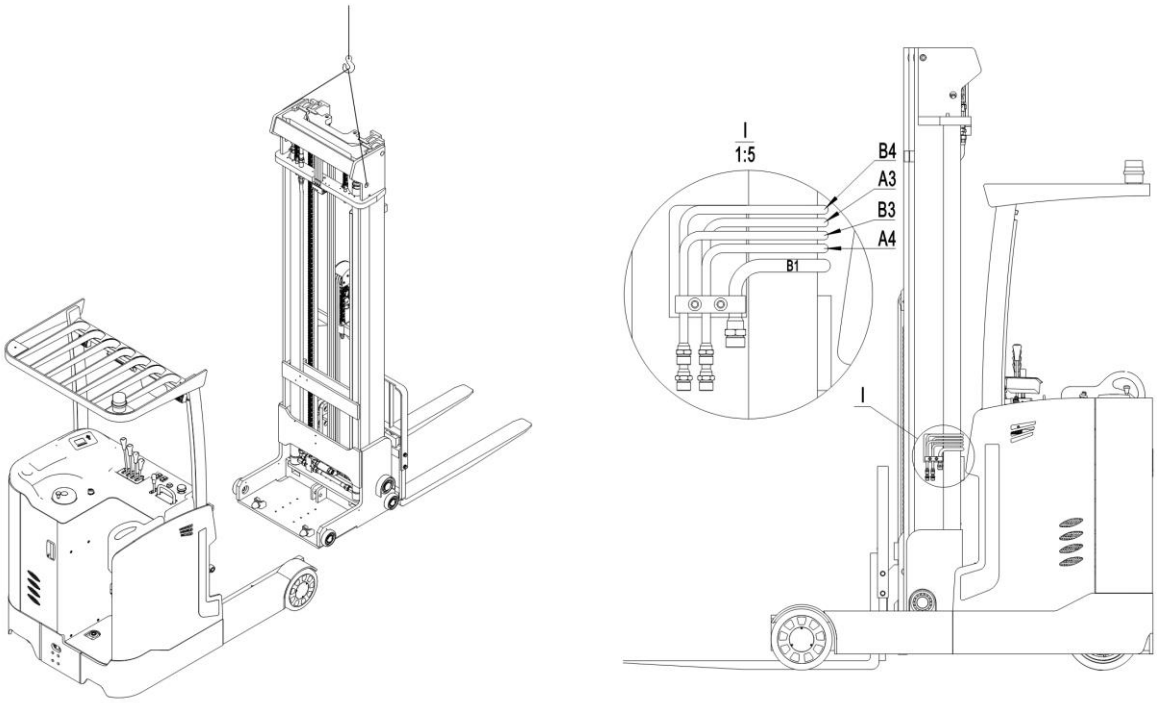


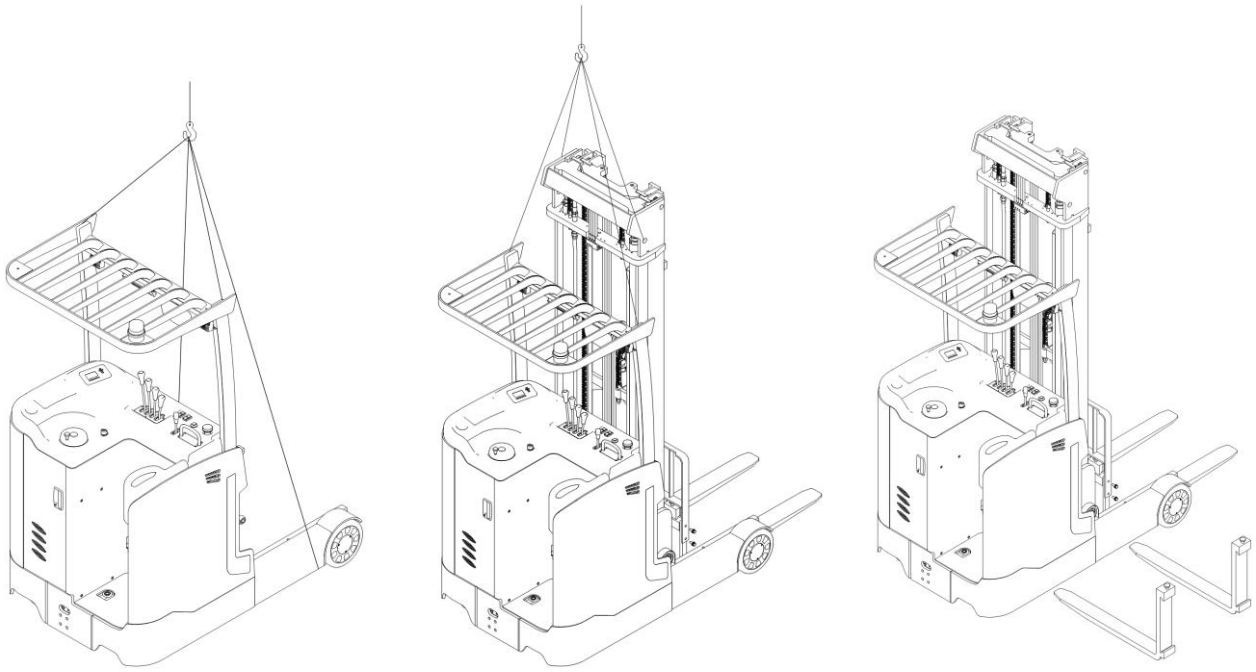
Fig 8: Mast assembling

Table 2: Weight of chassis and mast

Truck model	RT15ST2		RT20ST2		RT25ST2	
Chassis packing weight [kg]	1800		1900		2150	
Chassis packing size [mm]	1900x1200X2400		2000x1200X2400		2200x1200X2400	
Lift height H3 [mm]	4500	7000	4500	7000	4500	7000
Mast packing weight [kg]	1150	1350	1150	1350	1150	1350
Mast packing size [mm]	2300x1000 X900	3100x1000 X900	2300x1000 X900	3100x1000 X900	2300x1000 X900	3100x1000 X900

b. Loading and unloading/ transportation

When load and unload the truck, refer to the guide diagram below. The weight for chassis and mast is shown in table 2, for the whole truck weight, please check the ID plate.



Hoist the chassis | Hoist the whole truck | Fork position for loading

Fig 9: Loading and unloading

Loading and unloading

USE DEDICATED CRANE AND LIFTING EQUIPMENT.
DO NOT STAND UNDER THE SWAYING LOAD.
DO NOT WALK INTO THE HAZARDOUS AREA DURING LIFTING.
PLACE THE TRUCK ON A LEVEL GROUND.

Transportation

DURING TRANSPORTATION ON A LORRY OR TRUCK, ALWAYS FASTEN THE REACH TRUCK SECURELY.

Lower the forks and park the truck securely.
Fasten the truck according to Fig. 10, put the wood blocks under the driving cab to prevent damage to the driving wheel in transporting.

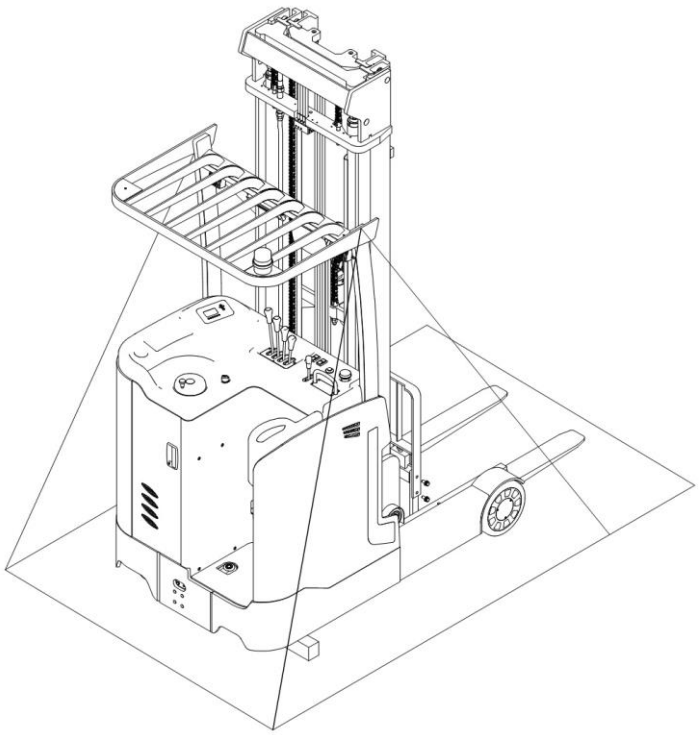


Fig 10: Fixing points

c. Storage

Lower the forks to the lowest position, as shown in Fig. 10, padded the cabin with sleepers to lift the drive wheel to prevent damage due to long-term storage.
Apply grease to all lubrication points mentioned in this manual (regular inspection) to prevent rust and dust accumulation on the truck.
Charge trucks that have been out of service for a long time once a month to prevent damage to battery.
For trucks that are eventually scrapped and out of service, please hand them to the relevant recycling company. According to regulations, oil, batteries and electronic components are recycled or treated in a harmless manner.

5. REGULAR INSPECTION

This chapter describes the pre-shift checks before operating the truck.
Regular inspection is effective to find the malfunction or fault on this truck. The following points should be checked before operation.

REMOVE THE LOAD FROM TRUCK AND LOWER THE FORKS.
DO NOT USE THE TRUCK IF ANY MALFUNCTION IS FOUND.

- Check for scratches, deformation or cracks.
- Check if there is any oil leakage from the cylinder.
- Check the function of driving in longitudinal directions
- Check the chain and rollers are without damage or corrosion.
- Check the smooth movement of the wheels.
- Check the function of the emergency brake by activating the emergency button.
- Check the functions of foot brake.
- Check the lifting and lowering functions.
- Check the seat is assembled tightly.
- Check the function of horn.
- Check if all bolts and nuts are tightened firmly.
- Check the function of key switch.
- Check the function of speed limitation.
- Visual check if there are any broken electric wires.
- If supplied with a backrest extension, check it for damages and correct assembling.

6. OPERATIONAL INSTRUCTIONS

a. Operational control devices

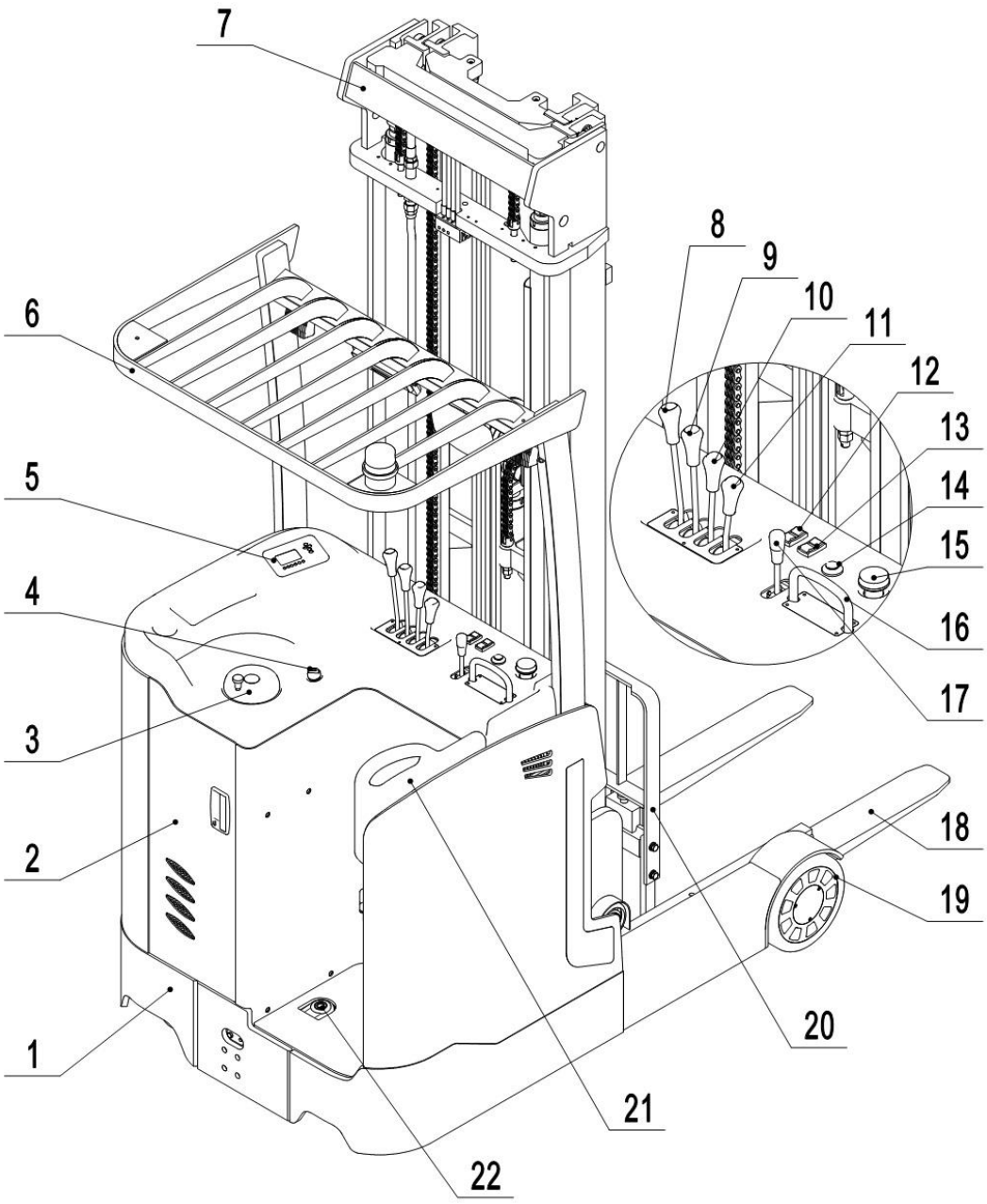


Fig. 11: Operational control devices

b. Power-on the truck

Before operating this truck, please make sure that the load or other equipment will not cause insufficient visibility, and ensure that the load is level and placed stably.

Pull the emergency button (15), insert the key switch (4), and turn it clockwise to "ON" position, then step on the safety pedal switch (22). Before start the truck, please activate the horn button (14) by pressing it to warn others if necessary. The truck is power on.

Note: please set the direction switch in the neutral position before power-on the truck, otherwise the operation sequence fault will come.

c. Travelling

After starting the truck by turning the inserted key to “ON” position, firstly step the safety pedal switch (22), then put your hand on the operating area. Move the travel FW./BW. control stick (17) forwards or backwards, and adjust the travelling speed carefully until it reaches your desired speed. The speed will be slower if you release the control stick, please adjust the speed to ensure the safety.

Carefully drive the truck to the destination. Observe the route conditions and adjust the travelling speed by operating the control stick.

This truck is equipped with adequate safety devices to avoid accidents. When the lifted forks are higher than the free lifting height, the speed of the truck will be reduced for smooth travelling and safe work. When the lowered forks are lower than the free lifting height, the lower the forks height, the truck will return to normal speed.

Please keep the lifting height of the forks below 0.5m when you need to travel over a long distance.

After using the reach truck, drive the truck to the safe storage area and lower the forks to the lowest position. Turn the key counterclockwise to "OFF" position and remove the key.

Attention: Turn on the power, the system will start self-inspection. When there is something wrong with the electrical system, such as open circuit, short circuit, or active button, if you stamp the pedal switch, then the truck cannot be operated and a fault code comes, only when the fault from electrical system is solved, the truck can be operated normally.

d. Steering

This truck is equipped with an electric steering system. Take care by operating a truck with this kind of flexible system.
Steer the truck by turning the steering wheel clockwise and counterclockwise. Turn the steering wheel to make the drive wheel move straightly forward, truck will reach full speed. Turn the steering wheel a certain angle to turn the drive wheel to achieve steering. During steering, when the turning angle is larger than ±10°, comparing with straight driving, the steering speed is different, the larger the turning angle, the slower the speed, which ensures the smooth steering and safe operation.

e. Braking

The braking performance depends on the track conditions and the load conditions of the truck.

- When driving this truck, if the control stick (for driving forward/backward) is released, the truck begins to decelerate until it stops;
- Release the safety pedal switch (22), the braking function is activated and the truck will be stopped.
- Press the emergency button (15), the braking function is activated and the truck will be stopped.

Attention: when there is load on the forks, the brake should be activated slowly. Do not use emergency braking to prevent the load from falling.

f. Residual capacity diagram

The residual capacity diagram indicates the maximum capacity Q [kg] for a given load centre c [mm] and the corresponding lift height h_3 [mm] for the truck with horizontal load.
The white mark on the mast indicates the possible lift height limits.
For instance, the truck RT15ST, with a load centre of gravity distance (c) of 500mm and a maximum lift height (h_3) of 7000mm, the maximum capacity (Q) is 1000 kg.

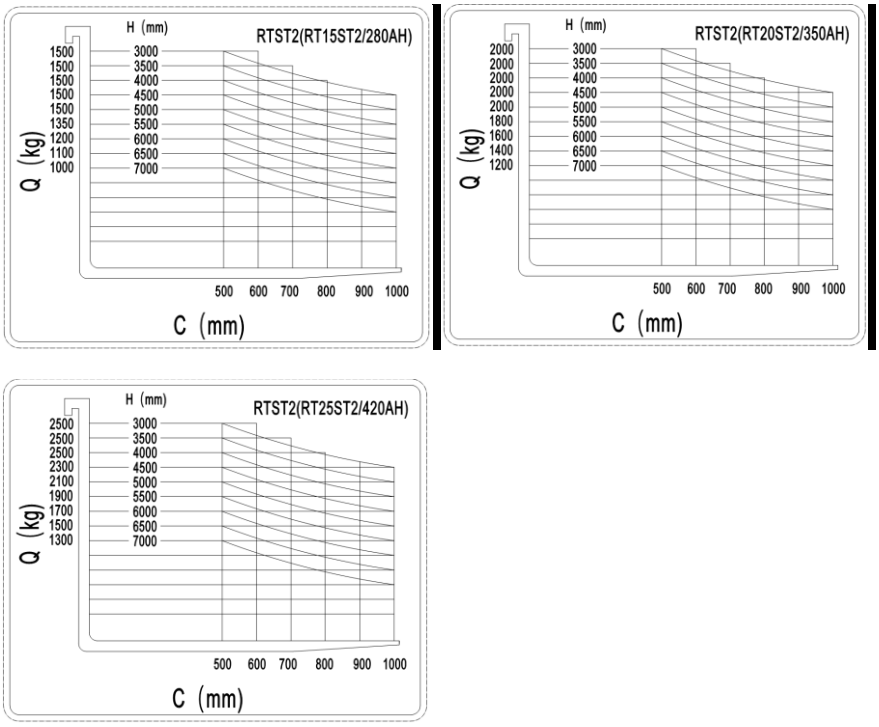


Fig. 12: Residual capacity diagram

g. Lifting

DO NOT OVERLOAD THE TRUCK! THE MAXIMUM CAPACITY IS 1500KG/2000KG/2500KG REFERRING TO THE CORRESPONDING IDENTIFICATION PLATE.
LIFT THE LOAD THAT IS INDICATED AND ALLOWED IN RESIDUAL CAPACITY DIAGRAM ONLY, OTHERWISE IT MAY DAMAGE THE TRUCK.

Pull the lifting control stick (8) backwards until it reaches your desired lifting height.
When the lifting height of the unladen truck is more than 3m or the lifting height of the laden truck is more than 1m, please reduce the speed of the truck. Be careful of operation during steering, it is forbidden to take sharp start, stop or steering.
Be cautious when lifting in racks, pay attention to the gap between load and rack.

h. Lowering

If forks are on the rack, first carefully remove the truck along with the pallet or separately from the rack.

Push the lifting control stick (8) forwards for lowering.
Lower the load until the forks are clear of the pallet, then carefully drive the truck away from the load.

i. Mast movements (extended/ retracted)

Push the reach control stick (9) forwards, the mast reaches forwards (extended).
Pull the reach control stick (9) backwards, the mast reaches backwards (retracted).

j. Fork side-shifts (left/ right)

Push the side-shift control stick (11) forwards, the forks shifts to the left.
Pull the side-shift control stick (11) backwards, the forks shifts to the right.

k. Fork tilts (up/ down)

Push the tilt control stick (10) forwards, the forks tilt downward.
Pull the tilt control stick (10) backwards, the forks tilt upward.

l. Malfunctions

If there are any malfunctions or the truck is inoperative, please stop using the truck and activate the emergency button (15) by pressing it. If possible, park the truck in a safe area, turn the key switch (4) counterclockwise and remove the key. Immediately inform the supervisor or call the service. If necessary, remove the truck out of the operating area by using dedicated towing/ lifting equipment.

When the truck breaks down, stop using it immediately and put a label for indication;

When the truck breaks down, the wrench indicator at the bottom of the display will be on. The cause of the fault can be checked through the fault code.

m. Emergency

In case of emergency or when there is a risk of the truck tipping, please keep a safe distance. If possible, press the emergency switch (15) and all electrical functions are about to stop.

7. BATTERY CHANGE AND REPLACEMENT

- Only qualified personnel are allowed to service or charge the battery, be sure to follow this manual and the battery manufacturer's instructions.
- Lead-acid batteries and lithium batteries are allowed.
- Battery recycling is subject to national regulations. Please follow these rules.
- When handling the battery, open flame is not allowed, which may cause a gas explosion.
- It is forbidden to burn materials or burning liquids in the battery charging area, smoking is strictly prohibited, and good ventilation must be ensured in the area.
- Park the truck securely before starting charging or installing/replacing batteries.
- Before completing the maintenance, make sure that all cables are connected correctly and that there is no interference with other parts of the truck.
- During charging or operation, due to water evaporation, lead-acid battery must be regularly replenished with distilled water, it is best to check the electrolyte weekly, the liquid level must be maintained between MAX. and MIN. liquid level, and then add distilled water after charging.

Distilled water supplement and filling quantity are indicated as below:

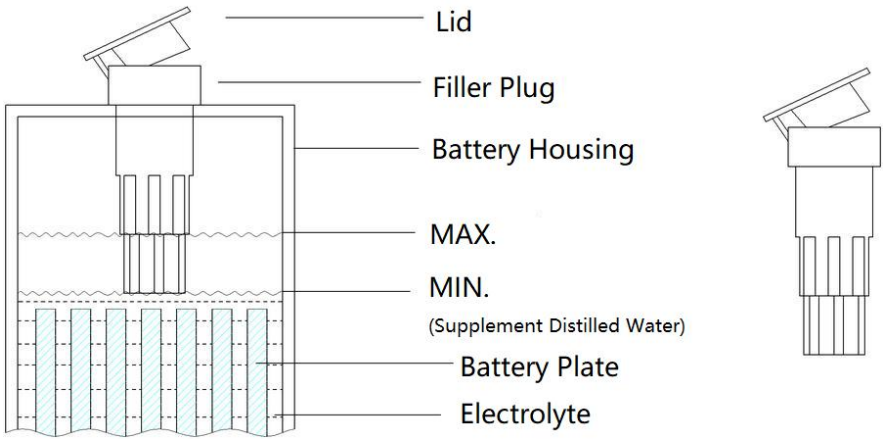


Fig. 13: Electrolyte level diagram

Note: When the electrolyte level is found insufficient, do not blindly supplement acid (test the specific gravity after fully charged). The battery supplement solution must be distilled water!
After charging, the standard specific gravity of the electrolyte is 1.28g/ml.

For standard batteries, the following battery specifications are available for this truck:

RT15ST2:

1pc, 48V 4VBS 280Ah (standard) [972x328x590mm (LxWxH)]

1pc, 48V 300Ah 1HR [972x328x590mm (LxWxH)]

RT20ST2:

1pc, 48V 5VBS 350Ah (standard) [972x392x590mm (LxWxH)]

1pc, 48V 300Ah 1HR [972x392x590mm (LxWxH)]

RT25ST2:

1pc, 48V 6VBS 420Ah (standard) [972x456x590mm (LxWxH)]

1pc, 48V 300Ah 1HR [972x456x590mm (LxWxH)]

THE WEIGHT OF BATTERIES HAS AN INFLUENCE TO THE TRUCK'S OPERATION BEHAVIOR. PLEASE CONSIDER THE MAXIMUM OPERATING TEMPERATURE OF THE BATTERIES.

a. Replacement

Park the truck securely, release the battery hook and move the mast and battery assembly forward to the appropriate position, turn off the key switch (4) and press the emergency button (15), unplug the battery connector and remove the battery.

Note that if the equipment is unsafe, the battery may tip over.

Installation is in the reverse order of removal.

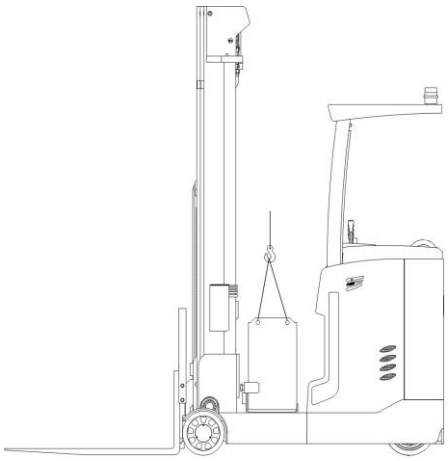


Fig. 14: Battery replacement

b. Charging

- Before charging ensure that an appropriate charger is used for charging the installed battery!
- Please fully understand the instructions of the charger manual before using the charger.
- Please follow these instructions.
- The room for charging must be ventilated.

Park the truck at a specific secured area with a dedicated power supply. Lower forks and remove load.
Turn the truck off and connect the battery and the charger.
Then the charger starts charging the battery.
Disconnect the battery and the charger when charging is completed.
Connect the battery plug with the truck.

c. Description of the lithium-ion battery

The lithium-ion battery is a battery with rechargeable cells, the battery is designed for industrial trucks and can withstand related vibrations during operation. The battery is equipped with special connections for charging and discharging operations. Do not try to install or connect improper connectors to the battery.

The battery is equipped with BMS – battery management system, which performs the control of battery condition and implements related safety protocols to protect the battery and cells from damages caused by operation or environmental conditions. The BMS controls the following safety functions and conditions: voltage, temperature, undervoltage, overvoltage, overtemperature, overcurrent, short circuit, etc. The internal resistance of lithium battery is generally low, which minimizes heat generation and maximizes the available power of the truck.

Temperature range for using the battery is from +5°C to +40°C. Low temperatures reduce the effective battery capacity, high temperatures reduce the battery's life time. The temperature difference between the two sides of the battery shall not exceed 5°C.

Only approved battery chargers must be used to charge the lithium battery.

d. Lithium Battery Decals

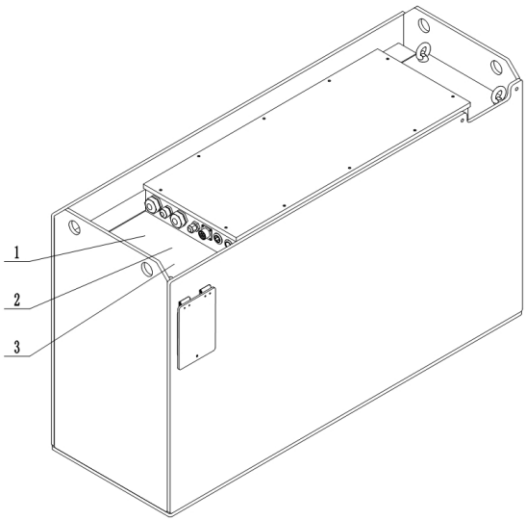


Fig.15: Lithium Battery Decals

Table 3: Lithium Battery Decals

Item	Description
1	Safety information
2	Identification plate
3	Serial number

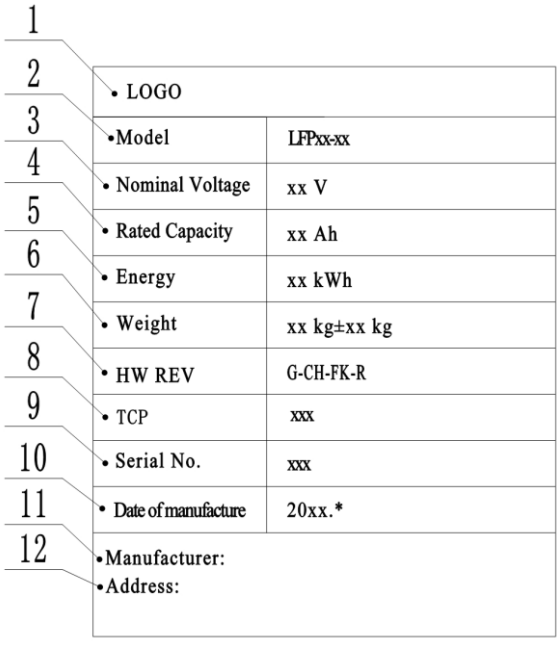


Fig.16: Lithium Battery identification plate

Table 4: Lithium Battery data plate

Item	Description	Item	Description
1	Manufacturer logo	7	Configuration of battery
2	Battery model	8	Protocol version of battery
3	Nominal voltage of battery	9	Production serial No.
4	Rated capacity of battery	10	Production date
5	Battery energy of battery	11	Name of manufacturer
6	Weight of battery	12	Manufacturer's address

e. Safety Instructions, Warning Indications and other Notes

Safety regulations for handling lithium-ion batteries

Do not try to make any repairs or servicing of lithium batteries. Replacement of parts is not assumed.

Risk of electric shock and burning

The battery's charging and discharging connectors have open terminals, avoid any body contacts, contamination or direct contacts with objects which can cause short circuit connection of terminals. Use necessary pre-cautions and protective caps to secure the open terminals. The connectors should be maintained in clean and dry conditions.

Use only batteries designed and approved by the manufacturer for the truck.
Do not try to modify or alter the battery.

Any damage or defects to the charger can result in accidents. Use only charger approved by the manufacturer of the truck, which is suitable for used battery.

In case charger has any damages or defects, exclude the charger from operation and contact your service provider. Do not modify or try to repair the charger.

Improper use of charger or use of wrong charger can cause damages to a battery or charger. Follow the required charger specifications; If the operation voltage of the charger is out of the applicable voltage range, the charger or battery may be damaged causing serious safety risks. The charger in use must be approved by the battery (truck) manufacturer.

Reversed connection of charging plug is prohibited. Follow the instruction for correct connection. For disconnection of charging plug use dedicated grip and never pull out the plug by means of cable.

Stop charging immediately if any abnormalities are detected, e.g. severe temperature increase, deformation of battery case, smoke, noise etc.

Intermediate charging

Lithium batteries support so called opportunity charging. The lithium battery, which is not fully discharged can be charged in any time. However, frequent opportunity charging not to the full charging state and stop of charging process before the appearance of corresponding indication of charger may result in dis-balance voltage of cells which increases the battery BMS calculation error. In order to effectively deal with this phenomenon, charge the battery in full allowing the automotive balancing process to be completed at least once a week.

Do not charge a fully charged battery

Note that in order to prevent the battery from continuing restart of charging under fully charged condition causing reduction of battery lifetime, the BMS has a protection function that prohibits recharging of fully charged battery. The charger will not work while battery is fully charged.

Potential hazards

If equipment is used according to its design purpose, following the correct operations procedures, there are no hazards anticipated.

The following hazards can arise in the event of improper use:

- Physical damage to the battery in case a battery falls or is deformed through impacts. Mechanical damages can cause leakages of harmful materials, fire or battery explosion.
- Short circuits may be caused by short connection of battery terminals, for instance, by water or other intentional/unintentional short connections.
- Temperature damages caused by placing of batteries in overheated environment conditions or being exposed to impact of fire, open sunlight etc. can cause leakages of harmful materials, fire or battery explosion. ·

In order to avoid fire, explosion and/or leakage of harmful materials, a safe place for storing non-functional or damaged batteries until the service arrives on site must satisfy the following criteria:

- Do not store in places where personnel is located.
- Do not store in places with valuable objects and close to valuable objects.
- A Class D fire extinguisher must be available on demand.
- There should not be any fire or smoke detectors in the storage area in order to ensure that an automatic fire detection system is only activated in the event of actual danger (e.g. flames).
- No ventilation intake pipes should be in the facility to exclude spreading of discharged content within a building. ·

Examples of where to store a non-functional battery:

- Roofed outdoor position.
- Ventilated container.
- Covered fire resistant box with pressure and smoke discharge option.

Symbols - Safety and Warnings

Table 5: Symbols - Safety and Warnings

	Used lithium-ion batteries must be treated as hazardous waste. Lithium-ion batteries marked with the recycling symbol and the sign showing a crossed-out waste bin must not be disposed of with ordinary household waste.
	Avoid fire and short circuits causing overheating. Do not ignite or locate batteries close to open flame, heat sources or sparks. Keep lithium-ion batteries away from heat sources.
	Caution! Battery short-circuit is prohibited.
	Protect the lithium-ion battery from solar radiation or other forms of heat radiation. Do not expose the lithium-ion battery to heat sources.

Explosion and fire hazard

Physical damage, thermal impacts or incorrect storage in the event of a defect can result in explosions or fire. The battery materials can be flammable.

Particular hazard from combustion products

The lithium batteries may be damaged by a fire. When extinguishing a lithium battery fire, the following information must be taken into consideration.

Contact with combustion products can be hazardous

Fire produces combustion products, which can occur in the form of smoke, through leaking fluids, escaping gases, debris as well decomposition products of certain chemicals. These combustion products are substances that enter the body through the respiratory tract and/or the skin, can produce and adverse effects such as choking.

Avoid contact with combustion products.
Use protective equipment.

Special firefighting protective equipment

Use self-contained breathing apparatus.
Wear protective equipment.

Additional firefighting instructions

To prevent secondary fires, the lithium-ion battery must be cooled from the outside.

Suitable extinguishing agents

- Carbon dioxide extinguisher (CO2)
- Water (not on mechanically opened or damaged batteries) ·

Unsuitable extinguishing agents

- Foam
- Grease fire extinguishing agents
- Powder extinguishers
- Metal fire extinguishers (PM 12i extinguishers)
- Metal fire powder PL-9/78 (DIN EN 3SP-44/95)
- Dry sand

Instructions for cooling an overheated, non-physically damaged battery

This type of damage may be caused by a short circuit inside the battery, which may result in leakage of harmful materials, fire or battery explosion.

Material discharge

Battery electrolyte fluid can be hazardous

Electrolyte fluid can be discharged if the battery is physically damaged. Avoid its contact with skin or eyes. If the contact happened:

- Rinse the affected parts with big amount of water and request for medical assistance immediately.
- In case of skin irritation or if any substances are breathed in request the medical assistance immediately.

Precautionary measures for personnel

- Keep personnel away, avoid any contact with smoke or discharged materials.
- Block off the affected area and ensure its reasonable ventilation.
- Wear personal protective equipment. If vapors, dust or aerosols are presented use self-contained breathing apparatus.

Precautionary measures for the environment

Do not allow spilled fluids to enter the water system, drainage system or the underground water.

Cleaning measures

The leaked fluid must be removed professionally following the related protocols.

Battery lifetime, maintenance and storage

The lithium-ion batteries are maintenance-free.

Deep discharge can damage the battery

Self-discharge without periodical recharge can lead the battery to fully discharged state. Full discharge shortens the service life of the battery and can cause deep discharge and activation of related safety protocols when battery will not be able to be charged anymore.

Before a long period of inactivity, the battery must be charged to 40%~60%.
Control the level of battery charge at least every 12 weeks and re-charge if necessary.
The temperature range for storing of the battery should be within the range of 0°C to 30°C.

If the battery is deeply discharged or if the battery temperature is below the permissible level, the battery cannot be charged. Deeply discharged batteries can never be charged. Due to the risk of condensate formation, batteries that have been stored at 0°C or below must only be charged after natural warming up to at least +5°C, forced heating is forbidden.

Instructions for safe handling of batteries

- Do not modify the battery.
- Do not open, damage, drop, penetrate or deform the battery.
- Do not throw the battery into a fire.
- Protect the battery from overheating.
- Protect the battery from direct sun light.
- Follow storage and charging procedures
- Protect the battery from water damages and other impacts

Failure to comply with these safety instructions can result in fire and explosion or the leakage of harmful materials.

Pre-shift checks before the system is put into operation

Check that the battery is in its normal condition, has no evidence of damages, leakages, abnormal findings, e.g. high temperature, smell, smoke etc. The surface of the battery should be clean and dry, without evidence of water damages, marks of rust on terminals and housing (if applicable). Connecting cables and plugs are in good condition.

Faults

If any damage is found to the battery or battery charger contact the service provider immediately.

Do not open the battery or attempt to repair it.

Disposal and transport of a lithium-ion battery

Instructions for disposal

Lithium-ion batteries must be disposed in accordance with the relevant national environmental protection regulations. Batteries must be treated as hazardous waste. Batteries must not be disposed with ordinary waste.

Shipping information

The lithium-ion battery is a hazardous material. The applicable regulations must be fulfilled during transportation.

Shipping functional batteries

Functioning batteries can be shipped in accordance with the related regulations

Shipping faulty batteries

To transport faulty lithium-ion batteries, contact the service provider. Faulty lithium batteries require following of special transporting procedures.

8. REGULAR MAINTENANCE

- Only qualified and trained personnel are allowed to maintain this truck.
- Remove the load from the forks and lower the forks to the lowest position before maintenance.
- To lift the truck, follow chapter 4 by using designated lashing equipment or crane. Before working, put safety devices (for instance designated lift jacks, wedges or wooden blocks) under the truck to protect against accidental lowering, movement or slipping.
- If you need to remove the high-pressure oil hose, lower the forks and turn off the truck. After 10 minutes, release the pressure in each hydraulic hose and remove the hoses.
- Use approved and from your dealer released original spare parts.
- Please consider that oil leakage of hydraulic fluid can cause failures and accidents.
- It is allowed to adjust the pressure valve only from trained service technicians.

If you need to replace the wheels, please follow the instructions above. The casters must be round and free of abnormal wear.
Check the key items on the maintenance list.

a. Maintenance checklist

Table 6: Maintenance checklist table

		Interval (Month)			
		1	3	6	12
	Hydraulic				
1	Check the hydraulic cylinder(s), piston for damage noise and leakage		•		
2	Check the hydraulic joints for damage and leakage		•		
3	Inspect the hydraulic oil level, refill if necessary		•		
4	Refill the hydraulic oil (12 month or 1500 working hours)				•
	Mechanical system				
5	Inspect the forks for deformation and cracks		•		
6	Check the chassis for deformation and cracks		•		
7	Check if all screws are fixed		•		
8	Check mast and chain for deformation and damages, replace if necessary	•			
9	Check the gearbox for abnormal sound, noise and leakage		•		
10	Check the wheels for deformation and damages, replace if necessary		•		
11	Check and lubricate the mast and chain	•			
12	Check and fill the brake fluid if necessary	•			
13	Lubricate the grease nipples		•		
14	Check the function of brake	•			
	Electrical system				
15	Inspect the electric wiring for damage		•		
16	Check the electric connections and terminals		•		
17	Test the Emergency switch function		•		
18	Check the electric drive motor for noise and damages		•		
19	Test the display		•		
20	Check, if correct fuses are used		•		
21	Test the warning signal		•		
22	Check the contactor (s)		•		
23	Check the frame fault (insulation test)		•		
24	Check function and mechanical wear of the accelerator		•		
25	Check the electrical system of the drive motor		•		
	Braking system				
26	Check brake performance		•		
	Battery				
27	Check the battery electrolytic liquid proportion		•		
28	Clean and grease the terminals and check for corrosion and damage		•		
29	Check the battery housing for damages		•		
	Charger				

30	Check the main power cable for damages			•	
31	Check the fail-safe protection during charging			•	
	Function				
32	Check the horn function	•			
33	Check the air gap of the electromagnetic brake	•			
34	Test the emergency braking	•			
35	Test the reverse and regenerative braking	•			
36	Check the steering function	•			
37	Check the lifting and lowering function	•			
38	Check the tiller arm switch function	•			
39	Check the key switch for damage or normal work	•			
40	Check the speed limitation switch function	•			
	General				
41	Check if all decals are legible and complete	•			
42	Check if the protective screen and or guarding is not damaged	•			
43	Inspect the castors, adjust the height or replace these if worn out.		•		
44	Carry out a test run	•			

b. Lubricating points

Lubricate the marked points according to the maintenance checklist. The required grease specification is: DIN 51825, standard grease.

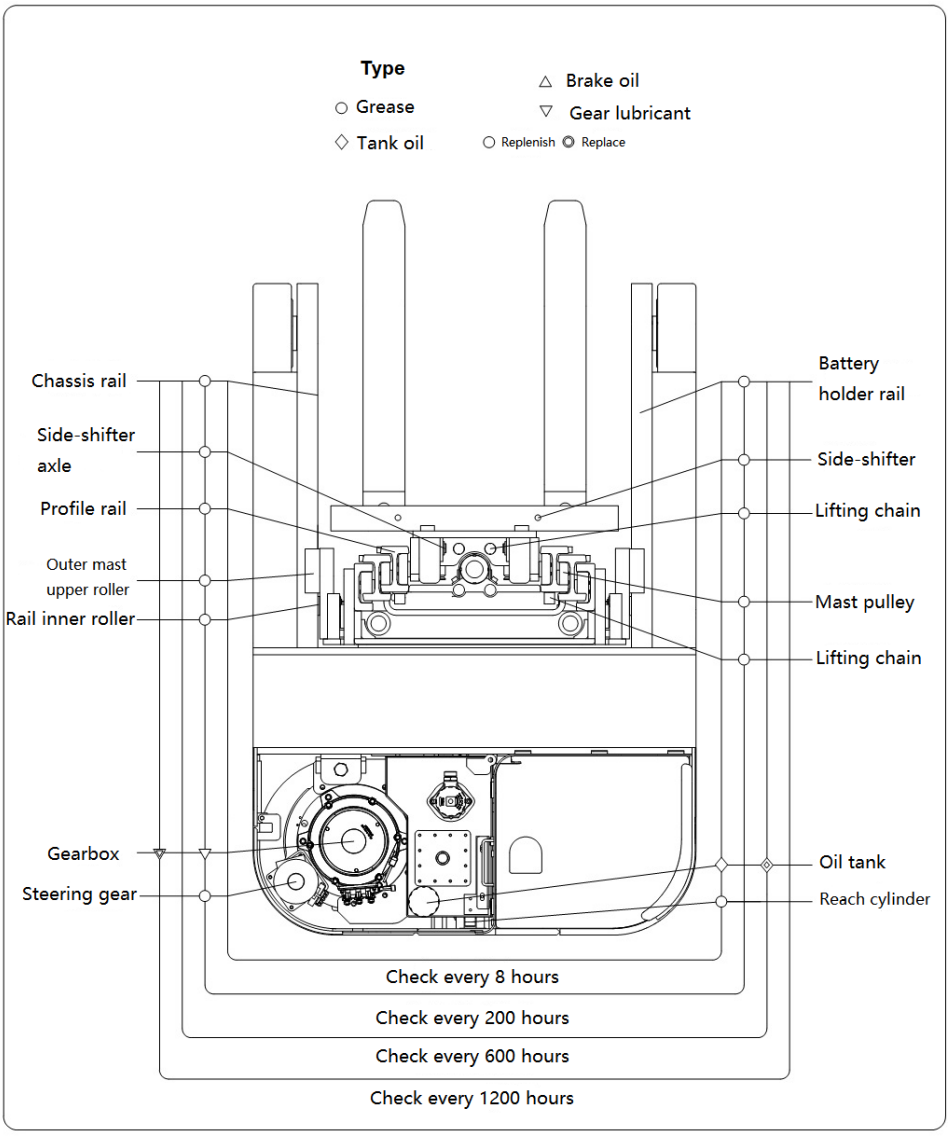


Fig. 17: Lubricating points

c. Check and refill hydraulic oil

It is recommended to use the hydraulic oil:

- Type: H-LP 32, DIN 51524
- Viscosity: 41.4 – 47

Waste material like oil, used batteries or others must be probably disposed and recycled according to the national regulations and if necessary brought to a recycling company.
The oil level in the oil tank should not be lower than the minimum mark when lifting the load.
If necessary, add oil to the refueling level.

d. Checking electrical fuses

Remove the plastic housing, the location of fuses is shown in Fig. 18 below. Check Table 7 for specifications of the fuses.

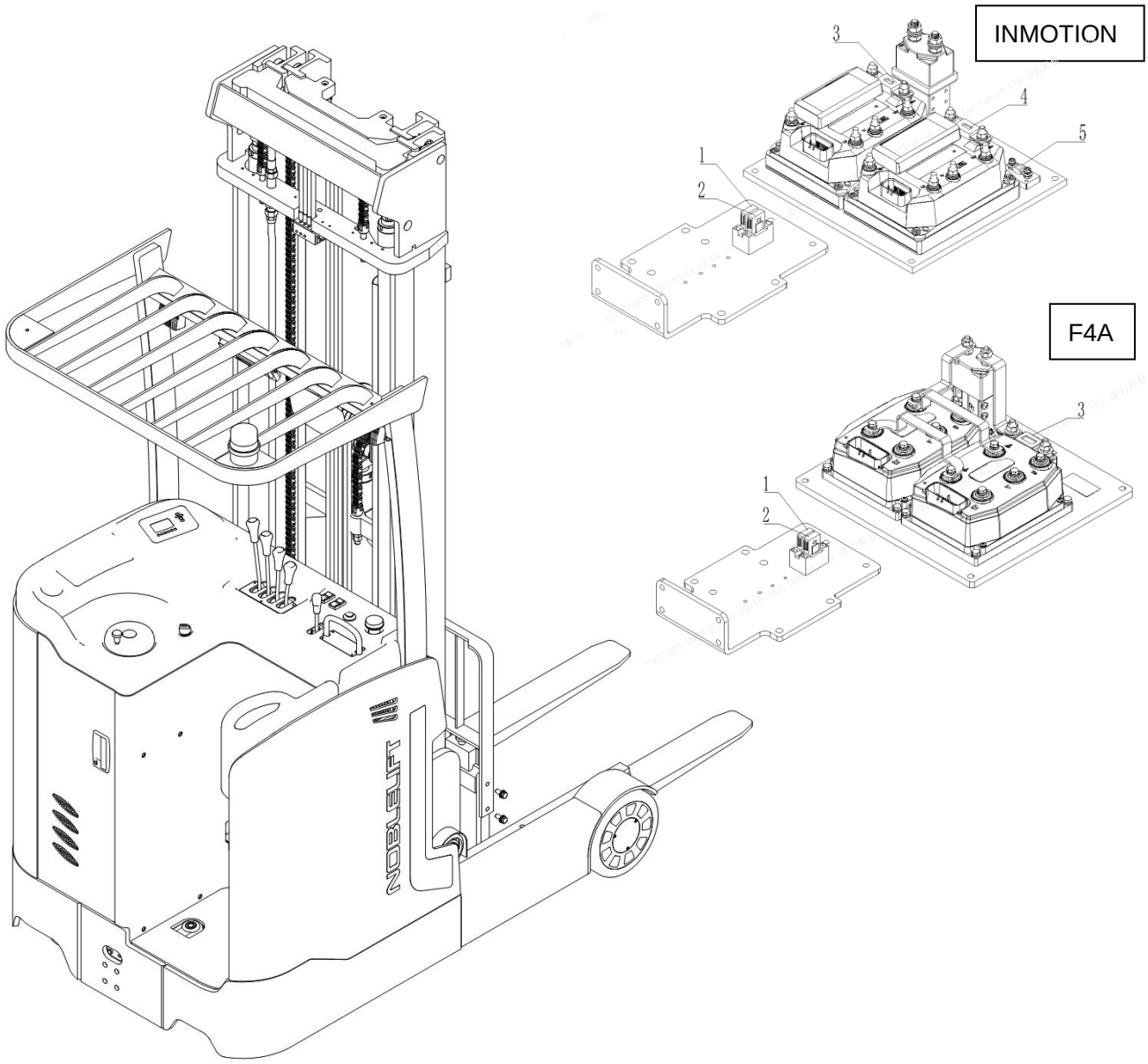


Fig 18: Location of fuses

Table 7: Specification of the fuses

Truck (F4A controller)	Fuse Specification
FU 1	10A
FU 2	10A
FU 3	500A

Truck (Inmotion controller)	Fuse Specification
FU 1	10A
FU 2	10A
FU 3	300A
FU 4	300A
FU 5	30A

9. TROUBLE SHOOTING

- If the truck still malfunctions, follow the instructions in Chapter 6 of the manual.

Table 8: Trouble shooting

TROUBLE	CAUSE	MAINTENANCE
Failed in lifting the load	Load is too heavy.	Only lift the maximum load indicated on the identification plate.
	Battery is discharged.	Charging the battery.
	Defective lift fuse.	Check and finally replace the lift fuse.
	Hydraulic oil level is too low.	Check and finally refill hydraulic oil.
	Oil leakage.	Check the sealing of oil hoses and/or cylinders.
Oil leakage from air suction	Excessive quantity of oil.	Reduce oil quality
Truck operating failure	Battery is charging.	Fully charge the battery, then unplug the main power plug from the power socket.
	Battery is disconnected.	Connect the battery correctly.
	Defective fuse.	Check and finally replace the fuse.
	Battery is discharged.	Charging the battery.
	Emergency switch is activated.	Insert and pull the knob to deactivate the emergency switch.
Only travelling in one direction	Defective accelerator and connectors are damaged.	Check the accelerator and the connector.
The truck travels very slowly	Battery is disconnected.	Check the battery condition on the battery indicator display.
	Electromagnetic brake is activated.	Check the electromagnetic brake.
	The relevant handle wire harness is disconnected or damaged.	Check the handle wire harness and the connector.
	Electrical system is overheated.	Stop using, cool down the truck.
	Defective thermal sensor.	Check and replace the thermal sensor if necessary.
The truck starts up suddenly	Defective controller.	Replace the controller.
	Accelerator is not in neutral position.	Repair or replace the accelerator.

If the truck malfunctions and cannot be operated out of the working area, jack up the truck, place a load handling device under the truck and secure the truck, then move the truck out of the aisle.

10. Hydraulic circuit diagram

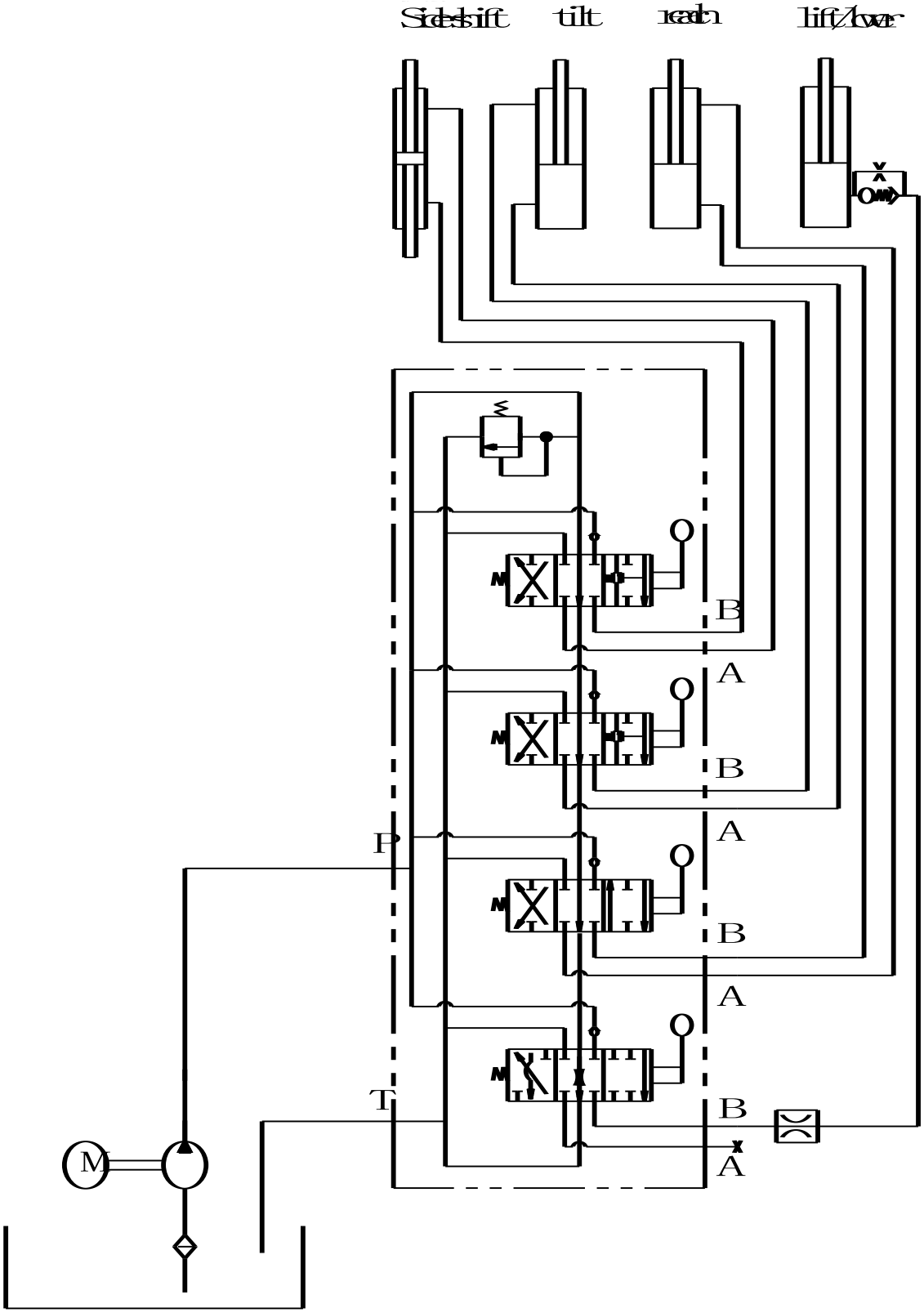


Fig. 19: Hydraulic circuit diagram

11. Braking system diagram

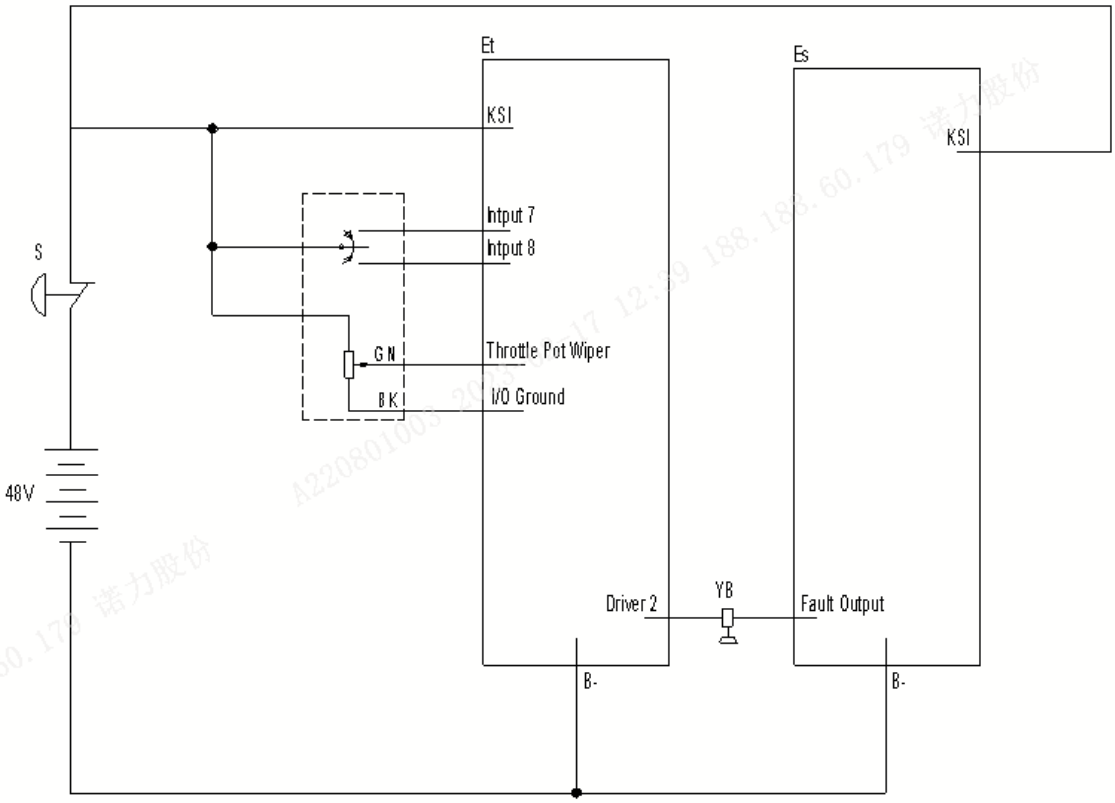


Fig. 20: Braking system diagram - CURTIS (parking brake)

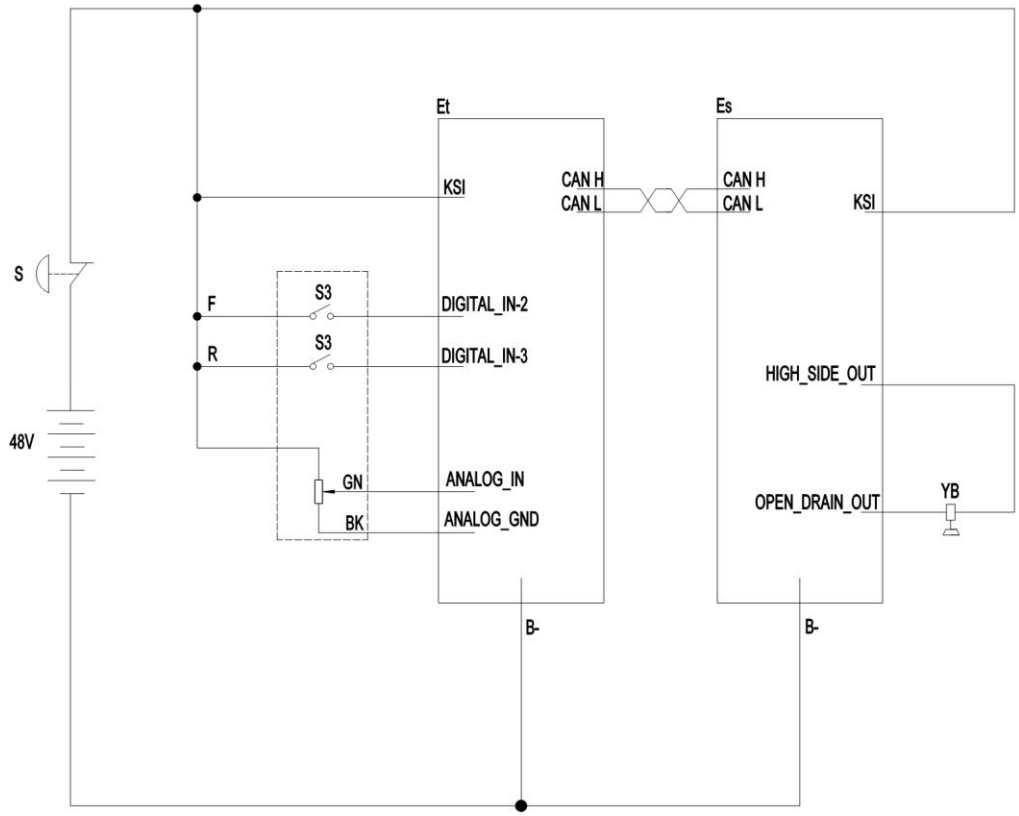


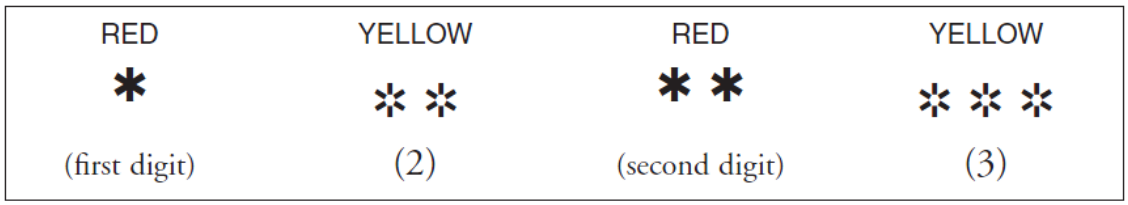
Fig. 21: Braking system diagram - INMOTION (parking brake)

12. DIAGNOSTICS AND TROUBLESHOOTING, DISPLAY, AND WIRING DIAGRAM

These controllers detect a wide variety of faults or error conditions. Faults can be detected by the operating system or by the VCL code. This section describes the faults detected by the operating system. Diagnostics information can be obtained in either of two ways:
(1) by reading the display on a hand-held or PC programmer or
(2) by observing the fault codes issued by the Status LEDs. See Table for a summary of LED display formats.

The pair of LEDs built into the controller (one red, one yellow) produce flash codes displaying all the currently set faults in a repeating cycle. Each code consists of two digits. The red light flashes once, indicating that the number of times the yellow light flashes below is the first digit of the fault code, and the red light flashes twice, indicating that the number of times the yellow light flashes below is the second digit of the fault code.
Example: red light flashes once, followed by yellow light flashes four times.Then the red light blinks twice, then the yellow light blinks twice, so the fault code is 42. Please refer to the list of fault information in this manual for relevant fault codes and causes.
In the fault menu of the programmer, the words **Throttle Wiper Low** will be displayed if the accelerator output is low.

The controller's two LEDs will display this repeating pattern:



The numerical codes used by the yellow LED are listed in the troubleshooting table, which also lists possible fault causes and describes the conditions that set and clear each fault.

Summary of LED display formats

The two LEDs have four different display modes, indicating the type of information they are providing:

DISPLAY	STATUS
Neither LED illuminated	Controller is not powered on/ vehicle has dead battery/ or severe damage.
Yellow LED flashing	Controller is operating normally.
Yellow and red LEDs both on solid	Controller is in Flash program mode.
Red LED light on solid	No software loaded, or an internal hardware fault detected by the Supervisor or Primary microprocessor. Cycle KSI to clear. Reload software or replace controller if necessary.
Red LED and yellow LED flash alternately	Controller has detected a fault. 2-digit code flashed by yellow LED identifies the specific fault; one or two flashes by red LED indicate whether first or second code digit will follow.

Troubleshooting

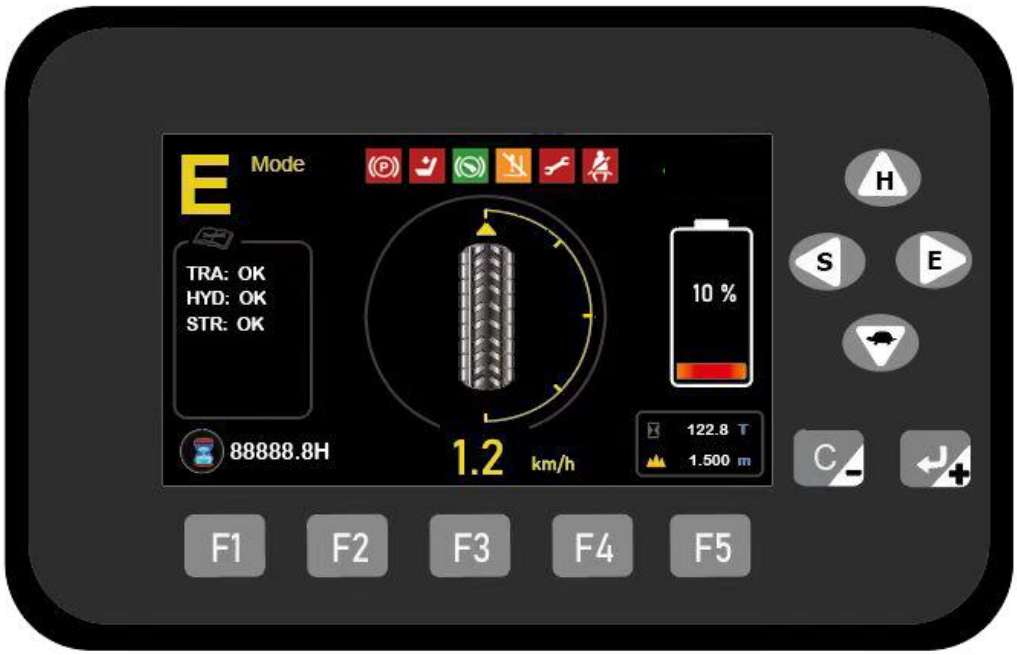
The troubleshooting chart provides the following information on all the controller faults:

- fault code
- fault name as displayed on the programmer's LCD
- the effect of the fault
- possible causes of the fault
- fault set conditions
- fault clear conditions.

Whenever a fault is encountered and no wiring or vehicle fault can be found,shut off KSI and turn it back on to see if the fault clears. If it does not, shutoff KSI and remove the 35-pin connector. Check the connector for corrosion or damage, clean it if necessary, and re-insert it.

a. Display (F4A controller)

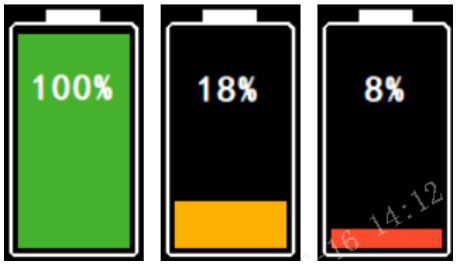
CURTIS-3401 display (F4A):



The indications of the icons below:

	Parking brake		Safety pedal		Seat
	Seat belt		Fault		Turtle speed mode
	Battery charge is below 10% battery, lift lockout is activated.				

BDI (battery discharge indicator)



The BDI icon of the main interface of 3401T-5002 display will show different colors according to the battery level (0~100%). BDI icon in different colors indicates different states of the battery:
Green BDI icon: state of charge of battery is 20%~100%
Yellow BDI icon: state of charge of battery is 10%~19%, BDI icon flashes

Red BDI icon: state of charge of battery is 0%~9%, BDI icon flashes and  icon is displayed on the main interface

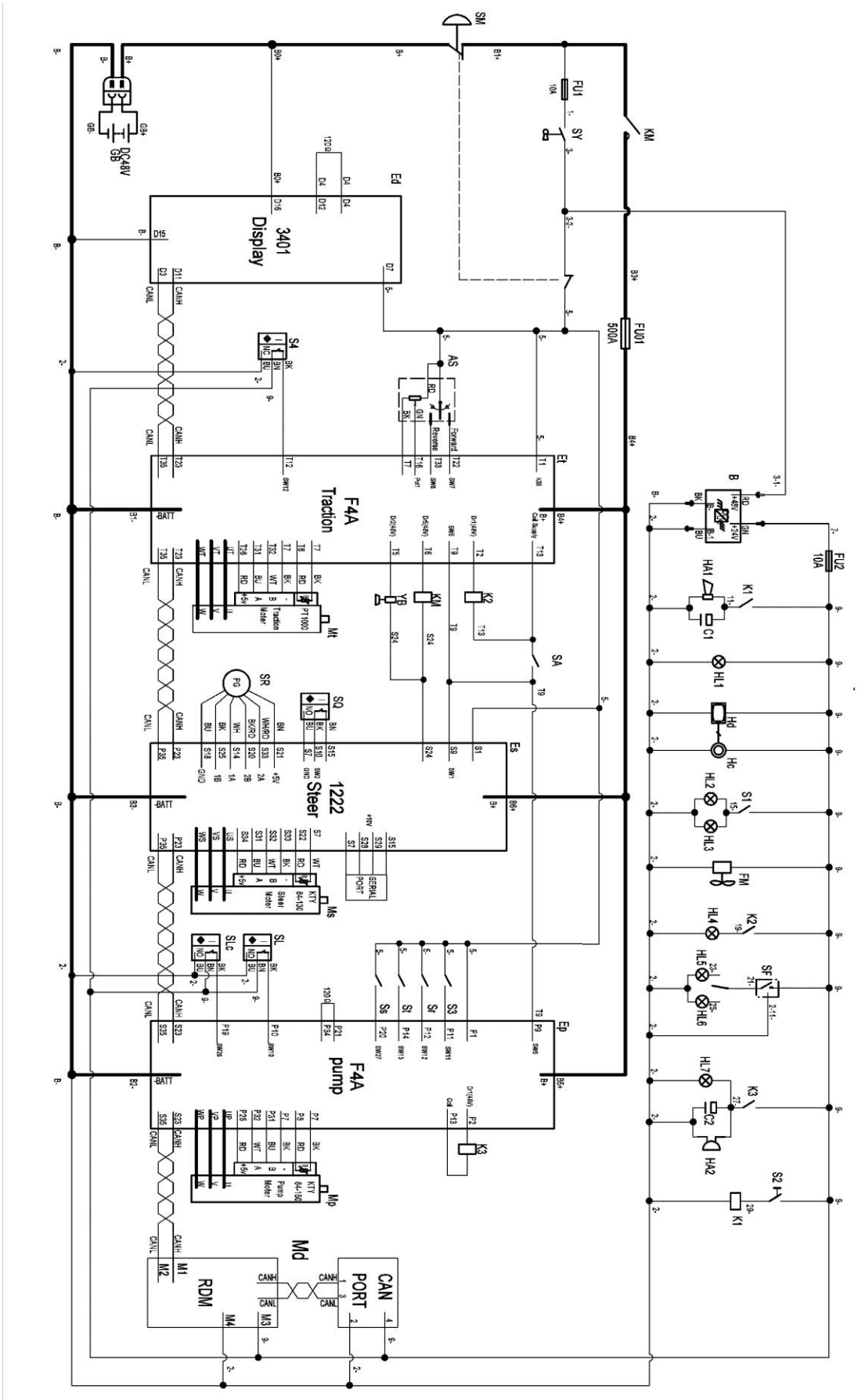


Fig. 22: Electrical diagram (truck with F4A controller, lead-acid battery)

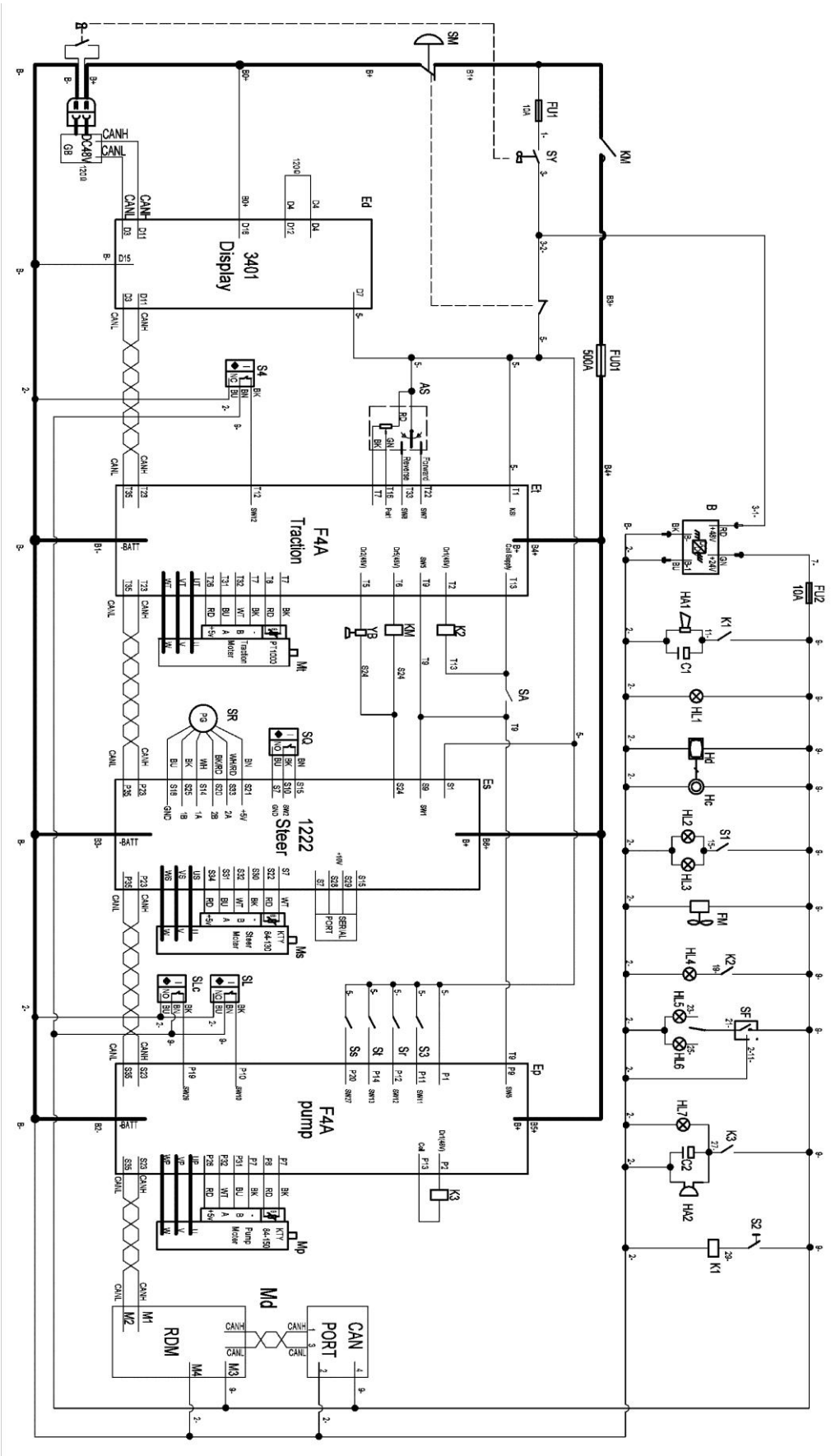


Fig. 23: Electrical diagram (truck with F4A controller, lithium battery)

Description of electrical components (truck with F4A controller)			
Code	Item	Code	Item
GB	Battery 48V	St	Tilting switch
SM	Emergency switch	Ss	Side-shift switch
Mt	Traction motor	SL	Mast limit switch
Mp	Pump motor	SLC	Mast speed limit switch
Ms	Steering motor	C1-C2	Capacitor
Es	Steering controller	HA1	Horn
Et	Traction controller	HL1	Warning signal light
Ed	Display	HL2/HL3	Front lamp
SQ	0° proximity switch	HL4	Brake signal light
SR	Steering wheel	SF	Flasher
FU01	Fuse 500A	HL5	Left signal light
Ep	Pump controller	HL6	Right signal light
AS	Accelerator	HL7	Reversing light
SY	Key switch	HA2	Buzzer
KM	Contactor	K1-K3	Relay
YB	Electromagnetic brake	MD	Remote module
B	DC converter		
SA	Pedal switch		
FU1~FU2	Fuse 10A		
S1	Lamp button		
S2	Horn button		
S4	Travel speed limit switch		
HD	Display		
HC	Camera		
S3	Lifting switch		
Sr	Forward and backward switch		

Table of F4A controller (pump motor) troubleshooting

NO.	FLASH CODE	FAULT NAME	FAULT ACTIONS	POSSIBLE CAUSES SET/CLEAR CONDITIONS	FAILT CAUSE
1	1-2	**Controller Overcurrent** Fault Type(s): 1 = Controller OverCurrent Phase U 2 = Controller OverCurrent Phase W 3 = Controller OverCurrent Phase V 4 = Irms > 120 % Current Limit	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. External short of phase U, V, or W motor connections. 2. Speed encoder noise problems. 3. Motor parameters are mistuned. 4. Controller defective.	1
2	1-3	**Current Sensor** Fault Type(s): 1	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective. Clear: Reset Controller.	2
3	1-4	**Precharge Failed** Fault Type(s): 1 = Abort. 2 = Energy Limit Exceeded 3 = Time Limit Exceeded	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. An external load on the capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 2. See Programmer » System Monitor menu » Controller » Capacitor Voltage. Clear: Reset Controller.	3
4	1-5	**Controller Severe Undertemp** Fault Type(s): 1	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Controller is operating in an extreme environment. 2. See Programmer » System Monitor menu » Controller » Controller Temperature. Clear: Bring the heatsink temperature above –40°C and then Cycle KSI or Interlock, if fault is still there, Reset Controller.	4

5	1-6	**Controller Severe Overtemp** Fault Type(s): 1	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. See Programmer » System Monitor menu » Controller » Controller Temperature. Clear: Bring heatsink temperature below +95°C and then Cycle KSI or Interlock, if fault is still there, Reset Controller.	5
6	1-7	**Severe B+ Undervoltage**	No drive torque.	1. Non-controller system drain on battery. 2. Battery resistance too high. 3. Battery disconnected while driving. 4. Blown B+ fuse or main contactor did not close. 5. Battery parameters are misadjusted. 6. See Programmer » Monitor menu » Controller » Capacitor Voltage.	Controller
7		**Severe KSI Undervoltage**	<u>Fault Action:</u> None, unless a fault action is programmed in VCL.	1. Non-controller system drain on battery/keyswitch circuit wiring. 2. Resistance in low power (KSI) circuit is too high. 3. KSI disconnected while driving. 4. Blown fuse. 5. See Programmer»System Monitor menu» Battery» Keyswitch Voltage.	Controller
8	1-8	**Severe B+ Overvoltage**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Battery parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. See Programmer» System Monitor menu » Controller » Capacitor Voltage.	Controller

9		**Severe KSI Overvoltage**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Battery-voltage applied to KSI (pin 1) exceeds the Severe Overvoltage limit. 2. See Programmer » Monitor menu » Battery » Keyswitch Voltage.	Controller
10	1-9	**Speed Limit Supervision**	ShutdownInterlock ShutdownEMBrake	1. Motor speed detected that exceeds the limit set by the Max Speed. Supervision parameter. 2. Misadjusted Max Speed Supervision parameters. 3. See: Programmer » Application Setup » Max Speed Supervision menu.	Controller
11	1-A	**Motor Not Stopped** Fault Type(s): 1 = The motor moved more revolutions than the parameter, Motor_ Not_Stopped_Position_Error setting. 2 = The motor moved faster than the parameter, Motor_ Not_Stopped_Speed_Error (RPM) for 160ms. 3 = The three-phase drive has applied an electrical frequency greater than the Motor _Not_Stopped_Max_ Frequency parameter, and applied an RMS current greater than the Motor _Not_ Stopped_Max_Current parameter for 64 ms.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Misadjusted Motor Not Stopped parameters. 2. See: Programmer » Application Setup » Motor Not Stopped menu. 3. Internal Controller fault or conflict allowing the motor to rotate when in the stopped state.	Controller

12	1-B	**Critical OS General** Fault Type(s): (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-7 ShutdownPDFullBrake ShutdownPump ShutdownCoilSupply	1. (<100) Internal Fault. 2. (>100) CIT version is too old to fully support the FOS version.	Controller
13	1-C	**OS General 2** Fault Type(s): (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	NO ACTION (controller is not operable)	1. (<100) Internal Fault. 2. (>100) CIT version is too old to fully support the FOS version.	Controller
14	1-D	**Reset Rejected** Fault Type(s): 1	ShutdownInterlock ShutdownThrottle	Clear: Cycle KSI.	Controller
15	1-E	**Motor Short** Fault Type(s): 1	NO ACTION (controller is not operable)	Clear: Reset controller.	Controller
16	2-2	**Controller Overtemp Cutback**	Reduced drive torque. Reduced regen-braking torque.	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller which is preventing controller cooling. 4. Controller is performance-limited at this temperature. 5. See Programmer » System Monitor menu » Controller » Temperature. Clear: Bring heatsink temperature below 85°C and then Cycle KSI or Interlock, if fault is still there, Reset Controller.	Controller

17	2-3	**Undervoltage Cutback** Fault Type(s): 1	Reduced drive torque.	1. Batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system- drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. Blown B+ fuse or main contactor did not close. 7. See Programmer » System Monitor menu » Controller » Cutbacks» Undervoltage Cutback. 8. See Programmer» System Monitor menu » Controller » Capacitor Voltage.	Controller
18	2-4	**Overvoltage Cutback** Fault Type(s): 1	Reduced brake torque. Note: This fault is declared only when the controller is running in regen.	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Programmer » System Monitor menu » Controller » Cutbacks » Overvoltage Cutback. 6. See Programmer» System Monitor menu » Controller » Capacitor Voltage.	Controller
19	2-5	**Ext 5V Supply Failure** Fault Type(s): 1 = 5V Supply's voltage is out- of-range 2 = 5V Supply's current is out- of-range	Disables the 5V Supply.	1. External load impedance on the +5V supply (pin 16) is too low. 2. See the System Monitor » Outputs menu: External_5V_ Supply, Ext_5V_Current.	Controller
20	2-6	**Ext 12V Supply Failure** Fault Type(s): 1 = 12V Supply's voltage is out-of-range 2 = 12V Supply's current is out-of-range	Disables the 12V Supply.	1. External load impedance on the +12V supply (pin 23) is too low. 2. See Programmer» System Monitor menu » Outputs: External_ 12V_Supply, Ext_ 12V_Current.	Controller

21	2-8	**Motor Temp Hot Cutback**	1. Torque is reduced. 2. If MotorBraking Thermal CutBack_ Enable = On, then Regen Braking.	1. Motor temperature is at or above the programmed Temperature Hot setting—resulting in a reduction of controller drive current. 2. The motor temperature and sensor control parameters are misadjusted. 3. See Programmer » AC Motor Setup » Temperature Sensor.	Controller
22	2-9	**Motor Temp Sensor**	Enter LOS mode. Motor speed is reduced. Motor temperature cutback disabled.	1. Motor thermistor is not connected properly. 2. Sensor polarity (between pin 9 and pin 12) is incorrect. 3. The motor temperature and sensor parameters are misadjusted. 4. See Programmer» System Monitor menu » AC Motor » Temperature.	Controller
23	3-1	**Main Driver** Fault Type(s): 1 = Drive short. 2 = Drive Overcurrent. 3 = Driver open/ short (Voltage measured high, should be low.) 4 = Drive open/ short (Voltage measured low, should be high.) 5 = Wiring disabled.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.	Controller
24	3-2	**EM Brake Driver Fault** Fault Type(s): 1 = Drive short. 2 = Drive Overcurrent. 3 = Driver open/ short (Voltage measured high, should be low.) 4 = Drive open/ short (Voltage measured low, should be high.) 5 = Wiring disabled.	ShutdownEMBrake ShutdownThrottle FullBrake	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.	Controller
25	3-4	**Load Hold Diver Fault**	The assigned driver is open.	Same as Driver 1 Fault	Controller
26	3-5	**Lower Driver Fault**	Shutdown the assigned driver.	Same as Driver 1 Fault	Controller

27	3-6	**Encoder Fault** Fault Type(s): 1. Checksum loss. 2. Pulse loss due to Over-current. 3. Speed pulse signal loss. 4. Motor matching. 5. Encoder supply failed.	ShutdownEMBrake ShutdownThrottle FullBrake	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Programmer» System Monitor Menu » AC Motor » Motor RPM. 4. See Programmer» System Monitor menu » Hardware Inputs: Analog 3 and 4.	Controller
28	3-7	**Motor Open**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Motor phase is open. 2. Bad crimps or faulty wiring.	Controller
29	3-8	**Main Contactor Welded**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external circuit to B+) is providing a current to the capacitor bank (B+ connection terminal).	Controller
30	3-9	**Main Contactor Did Not Close** Fault Type(s): 1 = Main did not close when commanded. 2 = Main disconnected during operation.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Type 1: 1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. An external load on the capacitor bank (B+ connection terminal) is preventing the capacitor bank from charging. 4. Blown B+ fuse. 5. Main Contactor parameters mistuned; Type 2: 1. Main contactor opened during operation (while commanded closed). 2. Driver wiring to contactor's coil (e.g., pin wiring) removed during operation. 3. Contactor/coil defective.	Controller

31	4-2	**Throttle Input** Fault Type(s): * 1 = Outside the Low or High parameter.	ShutdownThrottle	1. Throttle voltage exceeded the Analog Low or Analog High parameters for the analog input defined for the throttle input. 2. See Programmer » Controller Setup » Inputs » Analog 1 Type. 3. See Programmer » Controller Setup » Inputs » Configure.	Controller
32	4-4	**Brake Input**	FullBrake	Triggered by the respective fault diagnostic associated with the brake input source (assigned analogX input). Note: An Input fault diagnostics may be out of range if it is configured as a voltage input.	Controller
33	4-6	**NV Memory Failure** Fault Type(s): 1 = Invalid checksum. 2 = NV write failed. 3 = NV read failed. 4 = NV write did not complete during power down.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-5 ShutdownPD FullBrake	1. Failure to read or write to nonvolatile (NV) memory. 2. Internal controller fault.	Controller
34	4-7	**HPD Sequencing**	ShutdownThrottle	1. Incorrect sequence in application of KSI, Interlock, Direction, or Throttle. 2. Faulty wiring, crimps, or switches at KSI, Interlock, Direction, or Throttle. 3. Moisture in above-noted digital input switches causing invalid (real) On/Off state. 4. Verify input switch status. See Programmer » System Monitor menu » Hardware Inputs » Switch Status. 5. Verify Throttle. See Programmer » System Monitor menu » Hardware Inputs » Throttle Command.	Controller

35		**EMR Rev HPD**	ShutdownThrottle ShutdownEMBrake	Emergency Reverse operation has concluded, but the throttle, forward and reverse, and interlock inputs have not been returned to neutral.	Controller
36		**Pump HPD** Fault Type(s): 1. Only lifting 2. Only lowering 3. Lifting and lowering	ShutdownPump	Incorrect lifting/lowering throttle input condition (>25%) Parameters setting errors: 1. Hydraulic suppression type 2. HPD/SRO judgment time Pump throttle hardware fault	Controller
37	4-9	**Parameter Change** Fault Type(s): Reports the CAN Object ID of parameter.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	While the Interlock was On, a safety- based parameter was changed. Parameters with this property are marked with a [PCF] (Parameter Change Fault) in the Parameter listings.	Controller
38	4-A	**EMR Switch Redundancy**	ShutdownInterlock ShutdownEMBrake	1. Either or both Emergency Reverse input switches are inoperative, resulting in an invalid state. 2. Ingress of dirt or moisture in switch(es).	Controller
39	5-1	**Pump_SRO_Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Follow the correct sequence of operations.	Controller
40	5-2	**Lift_Pot_Open_Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Check lifting sensor.	Controller

41	5-3	**Arm_PDO_Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Clear communication issues with the controller (matching, protocols, wiring, etc.)	Controller
42	6-8	**VCL Run Time Error**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-5 ShutdownPDFullBrake	1. Runtime errors are defined using the VCL Error Module and VCL Error. 2. Using driver control commands in VCL can lead to VCL runtime errors if the VCL command and the driver assignment do not match.	Controller
43	7-1	**OS General**	ShutdownAll	Clear: Reset Controller.	Controller
44	7-2	**PDO Timeout**	Set: Time between CAN PDO messages received exceeded the PDO Timeout Period. Clear: Receive CAN NMT message, or Reset Controller.	1. The time between CAN PDO messages received exceeded the PDO Timeout Period as defined by the Event Timer parameter. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.	Controller
45	7-3	**Stall Detected**	ShutdownMotor ShutdownEMBrake ShutdownThrottle Control Mode	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Programmer »System Monitor menu » AC Motor »	Controller

			changed to LOS (Limited Operating Strategy)	Motor RPM.	
46	7-7	**Supervision** Fault Type(s): Curtis supervision code.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-5 ShutdownPDFullBrake	Set: Internal controller failure.	Controller
47	7-9	Supervision Input Check	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-5 ShutdownPDFullBrake	Set: Internal controller failure.	Controller
48	8-2	PDO Mapping Error	PDO message disabled.	1. The PDO Map has too many data bytes assigned or has objects mapped that are not compatible. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.	Controller
49	8-3	**Internal Hardware** Fault Type(s): Curtis hardware code.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Set: Internal controller fault detected.	Controller

50	8-4	**Motor Braking Impaired**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Battery overcharged, excessive motor or controller heating, or misadjusted parameters. Clear: Reset interlock.	Controller
51	8-7	**Motor Characterization Error** Fault Type(s): 1 Write to memory RAM failure 72 Temp sensor fault 73 Motor hot 74 Controller temperature cutback 76 Undervoltage cutback 77 Overvoltage cutback 78 Encoder not reading properly 79 Current Regulator Tuning out of range 80 Current Regulator Tuning out of range 81 Encoder signal seen but step size not auto-detected, it must be set manually. 82 Aborted auto-commissioning 90/98 PMAC Motor feedback sine/cosine signal not detected 91 PMAC motor not rotating or motor type incorrect 92 PMAC Motor not accelerating. Or low acceleration 94-97 PMAC lag compensation out of range 99 PMAC Motor rotating when starts characterization 102 PMAC motor temp sensor fault 103 PMAC motor temp hot cutback 104 PMAC motor controller temp cutback 106 PMAC motor controller Undervoltage cutback 107 PMAC motor controller overvoltage cutback	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Motor characterization failed during characterization process.	Controller

52	8-8	**Encoder Pulse Error**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Encoder Steps parameter does not match the actual motor encoder. 2. Verify parameter settings: AC Motor Setup » Quadrature Encoder » Encoder Steps. 3. Motor loses IFO control, and motor increase rotation without throttle signal input.	Controller
53	8-9	**Parameter Out of Range** Fault Type(s): Reports the CAN Object ID	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Parameter value detected outside of the limits. 2. Use CIT to view the parameter's range and adjust the parameter’s value.	Controller
54	9-1	**Bad Firmware** Bad_Firmware	The controller does not start completely	The firmware in the controller is incorrect. 1. The CRC of the application or OS does not match. 2. The application was built with an incompatible OS version.	Controller
55	9-2	**EM Brake Failed To Set** EM_Brake_Failed_to_Set	ShutdownEMBrake ShutdownThrottle Activate the Interlock (EM Brake type 1).	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	Controller
56	9-3	**Encoder LOS** Encoder_LOS	LOS Mode	1. Limited Operating Strategy (LOS) control mode has been activated as a result of either an Encoder Fault (flash code 3-6) or a Stall Detected fault (flash code 7-3). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle has stalled.	Controller

57	9-4	**Emer Rev Timeout** Emer_Rev_ Timeout	ShutdownThrottle ShutdownEMBrake	1. Emergency Reverse was activated and concluded because the EMR Timeout timer had expired. 2. The emergency reverse input is stuck On.	Controller
58	9-6	**Pump BDI** Pump_BDI	The pump is deactivated.	1. The BDI is below the Lift_BDI_ Lockout setting. 2. BDI parameters are mistuned.	Controller
59	9-9	**Parameter Mismatch** Fault Type(s): 1. Dual Drive is enabled in torque mode. 2. SPMSM motor feedback selected the encoder. 3. AC motor selected sine-cosine.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Incorrect position feedback type chosen for motor technology in use. 2. Dual drive is enabled in torque mode. 3. Dual drive enabled on only one controller.	Controller
60	9-A	**Interlock Braking Supervision** Fault Type(s): 1. MotorSpeed did not ramp down fast enough to meet configuration 2. Vehicle brought to stop, but then EM brake (if configured) failed to set. 3. Vehicle brought to stop, but then traversed a distance beyond that set by Interlock_ Brake_ Supervision_ Position_ Settling_Limit.	ShutdownMotor ShutdownEMBrake ShutdownMainContactor	1. During interlock braking, motor speed exceeds the parameters set under Interlock Braking Supervision 2. See Programmer / Application Setup / Interlock Braking / Supervision Enable. 3. See Programmer / Application Setup / Interlock Braking / Interlock Braking Supervision	Controller
61	9-B	**EMR Supervision** Emr_Supervision	ShutdownMotor ShutdownEMBrake ShutdownMainContactor	1. During interlock braking, motor speed exceeds the parameters set under Interlock Braking Supervision 2. See Programmer / Application Setup / Emergency Reverse / Emergency Reverse Supervision.	Controller

62	A-1	**Driver 1 Fault** Fault Type(s): 1. Driver short circuit 2. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver1	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 1 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 1 » Driver 1 Overcurrent.	Controller
63	A-2	**Driver 2 Fault** Fault Type(s): 1. Driver short circuit 3. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver2	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 2 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 2 » Driver 2 Overcurrent.	Controller
64	A-3	**Driver 3 Fault** Fault Type(s): 1. Driver short circuit 4. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver3	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 3 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 3 » Driver 3 Overcurrent.	Controller

65	A-4	**Driver 4 Fault** Fault Type(s): 1. Driver short circuit 5. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver4	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 4 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 4 » Driver 4 Overcurrent.	Controller
66	A-5	**Driver 5 Fault** Fault Type(s): 1. Driver short circuit 6. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver5	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 5 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 5 » Driver 5 Overcurrent.	Controller
67	A-6	**Driver 6 Fault** Fault Type(s): 1. Driver short circuit 7. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver6	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 6 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 6 » Driver 6 Overcurrent.	Controller

68	A-7	**Driver 7 Fault** Fault Type(s): 1. Driver short circuit 8. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver7	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 7 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 7 » Driver 7 Overcurrent.	Controller
69	A-8	**Driver Assignment** Fault Type(s): 5 Driver number that caused the fault.	ShutdownDriver	1. A Driver Output is used for two or more functions. 2. See Programmer » Controller Setup » IO Assignments » Coil Drivers: Main Contactor Driver EM Brake Driver Hydraulic Contactor Driver	Controller
70	A-9	**Coil Supply** Coil_Supply_Fault Fault Type(s): 1. Short to B- or hardware fault. 2. Driver short-circuit causes coil open circuit. 3. Coil Supply startup enable check failed. 4. Coil Supply startup disable check failed.	ShutdownAll:	1. Short on driver loads. 2. Dirty connector pins at controller or device. 3. Bad connector crimps or faulty wiring. 4. Controller is defective.	Controller
71	B-1	**ANALOG 1 OUT OF RANGE** Analog_ 1_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	Fault Action: None, unless a fault action is programmed in VCL.	1. Analog 1 input voltage is above the parameter setting of Analog 1 High. 2. Analog 1 input voltage is below the parameter setting of Analog 1 Low. 3. See Programmer » Controller Setup » Inputs » Analog 1. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 1 Low / Analog 1 High.	Controller

72	B-2	**ANALOG 2 OUT OF RANGE** Analog_ 2_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
73	B-3	**ANALOG 3 OUT OF RANGE** Analog_ 3_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
74	B-4	**ANALOG 4 OUT OF RANGE** Analog_ 4_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
75	B-5	**ANALOG 5 OUT OF RANGE** Analog_ 5_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
76	B-6	**ANALOG 6 OUT OF RANGE** Analog_ 6_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
77	B-7	**ANALOG 7 OUT OF RANGE** Analog_ 7_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
78	B-8	**ANALOG 8 OUT OF RANGE** Analog_ 8_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
79	B-9	**ANALOG 9 OUT OF RANGE** Analog_ 9_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller

80	B-B	**ANALOG 14 OUT OF RANGE** Analog_ 14_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
81	B-C	**Analog Assignment** Analog_Assignment Fault Type(s): 9 Analog Input number that caused the fault.	Fault Action: None, unless a fault action is programmed in VCL.	1. An Analog input is used for two or more functions. 2. An Analog input is outside the range of analog inputs. 3. See Programmer » Controller Setup » IO Assignments » Controls	Controller
82	B-D	**ANALOG 18 OUT OF RANGE** Analog_ 18_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
83	B-E	**ANALOG 19 OUT OF RANGE** Analog_ 19_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
84	C-1	**Branding Error** Branding_Error	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Software and hardware branding mismatch. 2. For technical support on this fault, contact the Curtis distributor where you obtained your controller or the Curtis sales-support office in your region.	Controller
85	C-2	**BMS Cutback** BMS_Cutback Fault Type(s): 1. Battery Current Cutback. 2. Low Cell Cutback. 3. High Cell Cutback.	Set: See Fault Type Clear: Resolve battery or battery cell issue.	A cutback based on cell loading has occurred.	Battery
86	C-5	**PWM Input 10 Out of Range** PWM_Input_ 10_Out_Of_Range	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller

87	C-7	**ANALOG 31 OUT OF RANGE** Analog_ 31_Out_Of_Range Fault Type(s): 1. Above High limit. 2. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
88	C-8	**Invalid_CAN_Port**	NO ACTION	1. Mistuned Dual Drive CAN parameters. 2. Conflicting CAN Node IDs for Dual Drive.	Controller
89	C-9	**VCL Watchdog**	NO ACTION	See the associated VCL Functions, • Set_ Watchdog_ Timeout(). • Set_ Watchdog_Fault_Action(). • Kick_ Watchdog().	Controller
90	C-B	**PWM Input 28 Out of Range** PWM_Input_28_Out_of_Range Fault Type(s): 1. The input is disconnected. 2. The measured input frequency is below the (PWM_Input_28_Low_ Frequency) – (PWM_Input_28_Frequency_ Fault_ Tolerance). 3. The measured input frequency is above the (PWM_ Input_28_High_Frequency) + (PWM_Input_28_Frequency_ Fault_ Tolerance). 4. The measured duty cycle is below set limits, (PWM_ Input_28_Low_Duty_Cycle) – (PWM_Input_28_Duty_ Cycle_ Fault_ Tolerance). 5. The measured duty cycle is above set limits, (PWM_ Input_28_High_Duty_Cycle) + (PWM_Input_28_Duty_ Cycle_Fault_ Tolerance).	<u>Fault Action:</u> None, unless a fault action is programmed in VCL.	1. This fault diagnostic execution cycles every 4msec. The input is considered disconnected if no PWM signal occurs for 16msec or the measurements are not updated every 16msec. 2. Mistuned parameters. 3. Faulty wiring.	Controller

91	C-C	**PWM Input 29 Out of Range** PWM_Input_29_Out_of_Range Fault Type(s): 1. The input is disconnected. 2. The measured input frequency is below the (PWM_Input_29_Low_ Frequency) – (PWM_ Input_29_Frequency_ Fault_ Tolerance). 3. The measured input frequency is above the (PWM_Input_29_High_ Frequency) + (PWM_ Input_29_Frequency_Fault_ Tolerance). 4 = The measured duty cycle is below set limits, (PWM_Input_29_Low_Duty_ Cycle) – (PWM_Input_29_Duty_Cycle_Fault_ Tolerance). 5 = The measured duty cycle is above set limits, (PWM_ Input_29_High_Duty_Cycle) + (PWM_Input_29_Duty_ Cycle_Fault_ Tolerance).	<u>Fault Action:</u> None, unless a fault action is programmed in VCL.	1. This fault diagnostic execution cycles every 4msec. The input is considered disconnected if no PWM signal occurs for 16msec or the measurements are not updated every 16msec. 2. Mistuned parameters. 3. Faulty wiring.	Controller

92	C-D	**Primary State Error** Primary_State_Error Fault Type(s): These are internal issues either occurring during startup, parameter initialization, secondary micro update or other runtime issues. 1. PRIMARY_DEVICE_ STARTUP = 0, 2 = PRIMARY_WAIT_KSI_ STABLE, 3 = PRIMARY_DEVICE_ STARTUP_ VALID, 4 = PRIMARY_INITIALIZE_ PARAMETERS, 5 = PRIMARY_WAIT_FOR_ FIRST_SIGNALS, 6 = PRIMARY_WAIT_FOR_ SUPERVISOR, 7 = PRIMARY_RESTORE_ PARAMETER_FAIL, 8 = PRIMARY_SUPERVISOR_ FIRST_ SIGNALS_ERROR, 9 = PRIMARY_SUPERVISOR_ STARTUP_ERROR, 10 = PRIMARY_STARTUP_ TIMER_ FAILURE, 11 = PRIMARY_WAIT_CAN_ HANDSHAKING_DONE, 12 = PRIMARY_RUNNING	NO_ACTION (controller is not operable)	Set: Internal error with the controller. Kindly reset controller. Clear: Reset controller	Controller
93	D-1	**Lift Input Fault** Lift_Input	ShutdownLift	The associated fault diagnostic with the assigned lift-input source triggers this fault. For example: If the Lift_Input_Source is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code. Set: Faults from the respective/ assigned “Lift_Input_Source” are cascaded and reported. Clear: Resolve any input assignment conflict, or out of range faults, then Reset Controller.	Controller

94	D-2	**Phase PWM Mismatch** Phase_PWM_Mismatch Fault Type(s): 0 = U phase. 1 = V phase. 2 = W phase.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: The difference between the commanded phase PWM duty cycle and the measured is greater than allowed. Clear: Reset Controller.	Controller
95	D-3	**Hardware Compatibility** Hardware_Compatibility	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	The OS (device profile, .cdev file) is incompatible with the controller. The loaded software (.cdev) is not compatible with the controller hardware.	Controller
96	D-4	**Lower Input Fault** Lower_Input	ShutdownLower	The associated fault diagnostic with the assigned lift-input source triggers this fault. For example: If the Lift_Input_Source is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code. Set: Faults from the respective/ assigned “Lift_Input_Source” are cascaded and reported. Clear: Resolve any input assignment conflict, or out of range faults, then Reset Controller.	Controller

97	D-6	**Hazardous Movement** Hazardous_Movement Fault Type(s): 1 = The motor speed is in the opposite direction of the speed request and the motor fails to accelerate in the correct direction for a programmed time. In the event of a change to neutral, this hazard will be detected if the motor fails to accelerate toward zero speed for a programmed time. 2 = The acceleration is in the opposite direction of the difference between the operator speed request and the motor speed. The speed in the commanded direction is greater than the commanded speed by more than a parameter (Hazardous_Speed) for a programmed time (Hazardous_ Throttle_ Response_ Time).	ShutdownInterlock	Set: This fault detects hazardous movement when the motor is requested to be moving. The first hazard is a motor that is not able to slow down if the throttle goes to zero or the direction switch is not in the direction of travel. The second hazard is a motor that accelerates the wrong way or goes too fast. Note: This fault only occurs when the Control Mode Select is in Speed_Mode, Speed_Mode_ Express, or Servo_Mode. Clear: Reset Controller. Setting Hazardous_Direction_ Response_ Time = 0 will disable these checks	Controller
98	D-D	**IMU Failure** IMU_Failure Fault Type(s): 1. SPI Communication Failure 2. Curtis Factory Self Test Failure 3. Run Time Check Failure, bad data received from the IMU 4. Gyro Cal out of range, maximum calibration offset exceeded.	NO_ACTION	Check if configured correctly or the vehicle is moving when calibrating. Set: Internally set as per fault type. Clear: Cycle KSI	Controller

Table of F4A traction controller troubleshooting

NO.	FLASH CODE	FAULT NAME	FAULT ACTIONS	POSSIBLE CAUSES SET/CLEAR CONDITIONS	FAILT CAUSE
1	1-2	**Controller Overcurrent** Fault Type(s): 1 = Controller OverCurrent Phase U 2 = Controller OverCurrent Phase W 3 = Controller OverCurrent Phase V 4 = Irms > 135 % Current Limit	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. External short of phase U, V, or W motor connections. 2. Speed encoder noise problems. 3. Motor parameters are mistuned. 4. Controller defective.	Controller

2	1-3	**Current Sensor** Fault Type(s): 1	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective. Clear: Reset Controller.	Controller
3	1-4	**Precharge Failed** Fault Type(s): 1 = Abort. 2 = Energy Limit Exceeded 3 = Time Limit Exceeded	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. An external load on the capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 2. See Programmer » System Monitor menu » Controller » Capacitor Voltage. Clear: Reset Controller.	Controller
4	1-5	**Controller Severe Undertemp** Fault Type(s): 1	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Controller is operating in an extreme environment. 2. See Programmer » System Monitor menu » Controller » Controller Temperature. Clear: Bring the heatsink temperature above –40°C and then Cycle KSI or Interlock, if fault is still there, Reset Controller.	Controller
5	1-6	**Controller Severe Overtemp** Fault Type(s): 1	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. See Programmer » System Monitor menu » Controller » Controller Temperature. Clear: Bring heatsink temperature below +95°C and then Cycle KSI or Interlock, if fault is still there, Reset Controller.	Controller
6	1-7	**Severe B+ Undervoltage**	No drive torque.	1. Non-controller system drain on battery. 2. Battery resistance too high. 3. Battery disconnected while driving. 4. Blown B+ fuse or main contactor did not close. 5. Battery parameters are misadjusted.	Controller

				6. See Programmer » Monitor menu » Controller » Capacitor Voltage.	
7		**Severe KSI Undervoltage**	Fault Action: None, unless a fault action is programmed in VCL.	1. Non-controller system drain on battery/keyswitch circuit wiring. 2. Resistance in low power (KSI) circuit is too high. 3. KSI disconnected while driving. 4. Blown fuse. 5. See Programmer»System Monitor menu» Battery» Keyswitch Voltage.	Controller
8	1-8	**Severe B+ Overvoltage**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Battery parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. See Programmer» System Monitor menu » Controller » Capacitor Voltage.	Controller
9		**Severe KSI Overvoltage**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Battery-voltage applied to KSI (pin 1) exceeds the Severe Overvoltage limit. 2. See Programmer » Monitor menu » Battery » Keyswitch Voltage.	Controller
10	1-9	**Speed Limit Supervision**	ShutdownInterlock ShutdownEMBrake	1. Motor speed detected that exceeds the limit set by the Max Speed. Supervision parameter. 2. Misadjusted Max Speed Supervision parameters. 3. See: Programmer » Application Setup » Max Speed Supervision menu.	Controller

11	1-A	**Motor Not Stopped** Fault Type(s): 1 = The motor moved more revolutions than the parameter, Motor_ Not_Stopped_Position_Error setting. 2 = The motor moved faster than the parameter, Motor_ Not_Stopped_Speed_Error (RPM) for 160ms. 3 = The three-phase drive has applied an electrical frequency greater than the Motor _Not_Stopped_Max_ Frequency parameter, and applied an RMS current greater than the Motor _Not_ Stopped_Max_Current parameter for 64 ms.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Misadjusted Motor Not Stopped parameters. 2. See: Programmer » Application Setup » Motor Not Stopped menu. 3. Internal Controller fault or conflict allowing the motor to rotate when in the stopped state.	Controller
12	1-B	**Critical OS General** Fault Type(s): (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-7 ShutdownPDFullBrake ShutdownPump ShutdownCoilSupply	1. (<100) Internal Fault. 2. (>100) CIT version is too old to fully support the FOS version.	Controller
13	1-C	**OS General 2** Fault Type(s): (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	NO ACTION (controller is not operable)	1. (<100) Internal Fault. 2. (>100) CIT version is too old to fully support the FOS version.	Controller
14	1-D	**Reset Rejected** Fault Type(s): 1	ShutdownInterlock ShutdownThrottle	Clear: Cycle KSI.	Controller
15	1-E	**Motor Short** Fault Type(s): 1	NO ACTION (controller is not operable)	Clear: Reset controller.	Controller

16	2-2	**Controller Overtemp Cutback**	Reduced drive torque. Reduced regen-braking torque.	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller which is preventing controller cooling. 4. Controller is performance-limited at this temperature. 5. See Programmer » System Monitor menu » Controller » Temperature. Clear: Bring heatsink temperature below 85°C and then Cycle KSI or Interlock, if fault is still there, Reset Controller.	Controller
17	2-3	**Undervoltage Cutback** Fault Type(s): 1	Reduced drive torque.	1. Batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system- drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. Blown B+ fuse or main contactor did not close. 7. See Programmer » System Monitor menu » Controller » Cutbacks» Undervoltage Cutback. 8. See Programmer» System Monitor menu » Controller » Capacitor Voltage.	Controller
18	2-4	**Overvoltage Cutback** Fault Type(s): 1	Reduced brake torque. Note: This fault is declared only when the controller is running in regen.	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Programmer » System Monitor menu » Controller » Cutbacks » Overvoltage Cutback.	Controller

				6. See Programmer» System Monitor menu » Controller » Capacitor Voltage.	
19	2-5	**Ext 5V Supply Failure** Fault Type(s): 1 = 5V Supply's voltage is out- of-range 2 = 5V Supply's current is out- of-range	Disables the 5V Supply.	1. External load impedance on the +5V supply (pin 16) is too low. 2. See the System Monitor » Outputs menu: External_5V_ Supply, Ext_5V_Current.	Controller
20	2-6	**Ext 12V Supply Failure** Fault Type(s): 1 = 12V Supply's voltage is out-of-range 2 = 12V Supply's current is out-of-range	Disables the 12V Supply.	1. External load impedance on the +12V supply (pin 23) is too low. 2. See Programmer» System Monitor menu » Outputs: External_ 12V_Supply, Ext_ 12V_Current.	Controller
21	2-8	**Motor Temp Hot Cutback**	3. Torque is reduced. 4. If MotorBraking Thermal CutBack_ Enable = On, then Regen Braking.	1. Motor temperature is at or above the programmed Temperature Hot setting— resulting in a reduction of controller drive current. 2. The motor temperature and sensor control parameters are misadjusted. 3. See Programmer » AC Motor Setup » Temperature Sensor.	Controller
22	2-9	**Motor Temp Sensor**	Enter LOS mode. Motor speed is reduced. Motor temperature cutback disabled.	1. Motor thermistor is not connected properly. 2. Sensor polarity (between pin 9 and pin 12) is incorrect. 3. The motor temperature and sensor parameters are misadjusted. 4. See Programmer» System Monitor menu » AC Motor » Temperature.	Controller
23	3-1	**Main Driver** Fault Type(s): 1 = Drive short. 2 = Drive Overcurrent. 3 = Driver open/ short (Voltage measured high, should be low.) 4 = Drive open/ short (Voltage measured low, should be high.) 5 = Wiring disabled.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.	Controller

24	3-2	**EM Brake Driver Fault** Fault Type(s): 1 = Drive short. 2 = Drive Overcurrent. 3 = Driver open/ short (Voltage measured high, should be low.) 4 = Drive open/ short (Voltage measured low, should be high.) 5 = Wiring disabled.	ShutdownEMBrake ShutdownThrottle FullBrake	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.	Controller
25	3-4	**Load Hold Diver Fault**	The assigned driver is open.	Same as Driver 1 Fault	Controller
26	3-5	**Lower Driver Fault**	Shutdown the assigned driver.	Same as Driver 1 Fault	Controller
27	3-6	**Encoder Fault** Fault Type(s): 1. Checksum loss. 2. Pulse loss due to Over-current. 3. Speed pulse signal loss. 4. Motor matching. 5. Encoder supply failed.	ShutdownEMBrake ShutdownThrottle FullBrake	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Programmer» System Monitor Menu » AC Motor » Motor RPM. 4. See Programmer» System Monitor menu » Hardware Inputs: Analog 3 and 4.	Controller
28	3-7	**Motor Open**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Motor phase is open. 2. Bad crimps or faulty wiring.	Controller
29	3-8	**Main Contactor Welded**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external circuit to B+) is providing a current to the capacitor bank (B+ connection terminal).	Controller

30	3-9	**Main Contactor Did Not Close** Fault Type(s): 1 = Main did not close when commanded. 2 = Main disconnected during operation.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Type 1: 1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. An external load on the capacitor bank (B+ connection terminal) is preventing the capacitor bank from charging. 4. Blown B+ fuse. 5. Main Contactor parameters mistuned; Type 2: 1. Main contactor opened during operation (while commanded closed). 2. Driver wiring to contactor's coil (e.g., pin wiring) removed during operation. 3. Contactor/coil defective.	Controller
31	4-2	**Throttle Input** Fault Type(s): * 1 = Outside the Low or High parameter.	ShutdownThrottle	1. Throttle voltage exceeded the Analog Low or Analog High parameters for the analog input defined for the throttle input. 2. See Programmer » Controller Setup » Inputs » Analog 1 Type. 3. See Programmer » Controller Setup » Inputs » Configure.	Controller
32	4-4	**Brake Input**	FullBrake	Triggered by the respective fault diagnostic associated with the brake input source (assigned analogX input). Note: An Input fault diagnostics may be out of range if it is configured as a voltage input.	Controller
33	4-6	**NV Memory Failure** Fault Type(s): 1 = Invalid checksum. 2 = NV write failed. 3 = NV read failed. 4 = NV write did not complete during power down.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-5 ShutdownPD FullBrake	1. Failure to read or write to nonvolatile (NV) memory. 2. Internal controller fault.	Controller

34	4-7	**HPD Sequencing**	ShutdownThrottle	1. Incorrect sequence in application of KSI, Interlock, Direction, or Throttle. 2. Faulty wiring, crimps, or switches at KSI, Interlock, Direction, or Throttle. 3. Moisture in above-noted digital input switches causing invalid (real) On/Off state. 4. Verify input switch status. See Programmer » System Monitor menu » Hardware Inputs » Switch Status. 5. Verify Throttle. See Programmer » System Monitor menu » Hardware Inputs » Throttle Command.	Controller
35		**EMR Rev HPD**	ShutdownThrottle ShutdownEMBrake	Emergency Reverse operation has concluded, but the throttle, forward and reverse, and interlock inputs have not been returned to neutral.	Controller
36		**Pump HPD** Fault Type(s): 1. Only lifting 2. Only lowering 3. Lifting and lowering	ShutdownPump	Incorrect lifting/lowering throttle input condition (>25%) Parameters setting errors: 1. Hydraulic suppression type 2. HPD/SRO judgment time Pump throttle hardware fault	Controller
37	4-9	**Parameter Change** Fault Type(s): Reports the CAN Object ID of parameter.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	While the Interlock was On, a safety- based parameter was changed. Parameters with this property are marked with a [PCF] (Parameter Change Fault) in the Parameter listings.	Controller
38	4-A	**EMR Switch Redundancy**	ShutdownInterlock ShutdownEMBrake	1. Either or both Emergency Reverse input switches are inoperative, resulting in an invalid state. 2. Ingress of dirt or moisture in switch(es).	Controller
39	5-1	**Pump_SRO_Fault**	ShutdownMotor ShutdownMainContactor ShutdownEM	Follow the correct sequence of operations.	Controller

			Brake ShutdownThrottle FullBrake ShutdownPump		
40	5-2	**Lift_Pot_Open_Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Check lifting sensor.	Controller
41	5-3	**Arm_PDO_Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Clear communication issues with the controller (matching, protocols, wiring, etc.)	Controller
42	5-4	**VCL HPD Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Throttle signal comes first, operate in the correct order	Controller
43	5-5	**VCL SRO Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Switch signal comes first, operate in the correct order	Controller

44	5-6	**Display Config Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the display configuration	Controller
45	5-7	**BMS Fault Grade NonZero**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the battery	Battery
46	5-8	**Remote pdo timeout**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Clear communication problems with the controller (matching, protocol, line, etc.)	Controller
47	5-9	**Steer angle changed**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Switch the 180/360 angle mode, restart the key switch after the fault is eliminated and switch to the corresponding angle mode	Controller
48	5-A	**BMS Temp LOW fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the battery	Battery

49	5-B	**Redundancy Check Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake		Controller
50	5-C	**Battery type mismatch**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Select the correct battery type	Battery
51	5-D	**Wrong 3401 Model**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Select the correct display	Display
52	5-E	**Not Curtis Display**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the display	Controller
53	5-F	**Pump Handshake Fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Clear communication problems with the controller (matching, protocol, line, etc.)	Controller

54	6-2	**PDO Timeout BMS**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the battery and communication	Battery
55	6-3	**BMS Temp High fault**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the battery	Battery
56	6-4	**BMS low AH**	No action	Charges required	Battery
57	6-5	**BMS voltage difference**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the battery	Battery
58	6-6	**BMS Severe Overvoltage**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Check the battery	Battery
59	6-7	**BMS Undervoltage**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake	Check the battery	Battery

			ShutdownThrottle FullBrake		
60	6-8	**VCL Run Time Error**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownDriver1-5 ShutdownPD FullBrake	1. Runtime errors are defined using the VCL Error Module and VCL Error. See the System Information file: • Curtis Integrated Toolkit™ » VCL Studio » Help » System Information. 2. Using driver control commands in VCL can lead to VCL runtime errors if the VCL command and the driver assignment do not match.	Controller
61	6-A	**Battery Unlock**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	Push battery back into place and lock it	Controller
62	7-1	**OS General**	ShutdownAll	Reset controller	Controller
63	7-2	**PDO Timeout**	Set: Time between CAN PDO messages received exceeded the PDO Timeout Period. Clear: Receive CAN NMT message, or Reset Controller.	1. The time between CAN PDO messages received exceeded the PDO Timeout Period as defined by the Event Timer parameter. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.	Controller

64	7-3	**Stall Detected**	ShutdownMotor ShutdownEMBrake ShutdownThrottle Control Mode changed to LOS (Limited Operating Strategy)	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Programmer »System Monitor menu » AC Motor » Motor RPM.	Controller
65	7-7	**Supervision** Fault Type(s): Curtis supervision code.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-5 ShutdownPDFullBrake	Set: Internal controller failure.	Controller
66	7-9	Supervision Input Check	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1-5 ShutdownPDFullBrake	Set: Internal controller failure.	Controller
67	8-2	PDO Mapping Error	PDO message disabled.	1. The PDO Map has too many data bytes assigned or has objects mapped that are not compatible. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.	Controller
68	8-3	**Internal Hardware** Fault Type(s): Curtis hardware code.	ShutdownMotor ShutdownMai	Set: Internal controller fault detected.	Controller

			nContactor ShutdownEM Brake ShutdownThr ottle FullBrake		
69	8-4	**Motor Braking Impaired**	ShutdownMo tor ShutdownMai nContactor ShutdownEM Brake ShutdownThr ottle FullBrake	Battery overcharged, excessive motor or controller heating, or misadjusted parameters. Clear: Reset interlock.	Controll er
70	8-7	**Motor Characterization Error** Fault Type(s): 1 Write to memory RAM failure 72 Temp sensor fault 73 Motor hot 74 Controller temperature cutback 76 Undervoltage cutback 77 Overvoltage cutback 78 Encoder not reading properly 79 Current Regulator Tuning out of range 80 Current Regulator Tuning out of range 81 Encoder signal seen but step size not auto-detected, it must be set manually. 82 Aborted auto-commissioning 90/98 PMAC Motor feedback sine/cosine signal not detected 91 PMAC motor not rotating or motor type incorrect 92 PMAC Motor not accelerating. Or low acceleration 94-97 PMAC lag compensation out of range 99 PMAC Motor rotating when starts characterization 102 PMAC motor temp sensor fault 103 PMAC motor temp hot cutback 104 PMAC motor controller temp cutback 106 PMAC motor controller Undervoltage cutback 107 PMAC motor controller overvoltage cutback	ShutdownMo tor ShutdownMai nContactor ShutdownEM Brake ShutdownThr ottle FullBrake	Motor characterization failed during characterization process.	Controll er

71	8-8	**Encoder Pulse Error**	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Encoder Steps parameter does not match the actual motor encoder. 2. Verify parameter settings: AC Motor Setup » Quadrature Encoder » Encoder Steps. 3. Motor loses IFO control, and motor increase rotation without throttle signal input.	Controller
72	8-9	**Parameter Out of Range** Fault Type(s): Reports the CAN Object ID	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Parameter value detected outside of the limits. 2. Use CIT to view the parameter's range and adjust the parameter's value.	Controller
73	9-1	**Bad Firmware** Bad_Firmware	The controller does not start completely	The firmware in the controller is incorrect. 1. The CRC of the application or OS does not match. 2. The application was built with an incompatible OS version.	Controller
74	9-2	**EM Brake Failed To Set** EM_Brake_Failed_to_Set	ShutdownEMBrake ShutdownThrottle Activate the Interlock (EM Brake type 1).	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	Controller
75	9-3	**Encoder LOS** Encoder_LOS	LOS Mode	1. Limited Operating Strategy (LOS) control mode has been activated as a result of either an Encoder Fault (flash code 3-6) or a Stall Detected fault (flash code 7-3). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle has stalled.	Controller
76	9-4	**Emer Rev Timeout** Emer_Rev_ Timeout	ShutdownThrottle ShutdownEMBrake	1. Emergency Reverse was activated and concluded because the EMR Timeout timer had expired. 2. The emergency reverse input is stuck On.	Controller

77	9-6	**Pump BDI** Pump_BDI	The pump is deactivated.	1. The BDI is below the Lift_BDI_ Lockout setting. 2. BDI parameters are mistuned.	Controller
78	9-9	**Parameter Mismatch** Fault Type(s): 1. Dual Drive is enabled in torque mode. 2. SPMSM motor feedback selected the encoder. 3. AC motor selected sine-cosine.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	1. Incorrect position feedback type chosen for motor technology in use. 2. Dual drive is enabled in torque mode. 3. Dual drive enabled on only one controller.	Controller
79	9-A	**Interlock Braking Supervision** Fault Type(s): 4. MotorSpeed did not ramp down fast enough to meet configuration 5. Vehicle brought to stop, but then EM brake (if configured) failed to set. 6. Vehicle brought to stop, but then traversed a distance beyond that set by Interlock_ Brake_ Supervision_ Position_ Settling_Limit.	ShutdownMotor ShutdownEMBrake ShutdownMainContactor	2. During interlock braking, motor speed exceeds the parameters set under Interlock Braking Supervision 2. See Programmer / Application Setup / Interlock Braking / Supervision Enable. 3. See Programmer / Application Setup / Interlock Braking / Interlock Braking Supervision	Controller
80	9-B	**EMR Supervision** Emr_Supervision	ShutdownMotor ShutdownEMBrake ShutdownMainContactor	9. During interlock braking, motor speed exceeds the parameters set under Interlock Braking Supervision 2. See Programmer / Application Setup / Emergency Reverse / Emergency Reverse Supervision.	Controller
81	A-1	**Driver 1 Fault** Fault Type(s): 1. Driver short circuit 10. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver1	5. Open or short on driver load. 6. Dirty connector pins at controller or contactor coil. 7. Bad connector crimps or faulty wiring. 8. Driver overcurrent, as set by the Driver 1 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 1 » Driver 1 Overcurrent.	Controller

82	A-2	**Driver 2 Fault** Fault Type(s): 1. Driver short circuit 11. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver2	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 2 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 2 » Driver 2 Overcurrent.	Controller
83	A-3	**Driver 3 Fault** Fault Type(s): 1. Driver short circuit 12. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver3	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 3 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 3 » Driver 3 Overcurrent.	Controller
84	A-4	**Driver 4 Fault** Fault Type(s): 1. Driver short circuit 13. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver4	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 4 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 4 » Driver 4 Overcurrent.	Controller

85	A-5	**Driver 5 Fault** Fault Type(s): 1. Driver short circuit 14. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver5	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 5 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 5 » Driver 5 Overcurrent.	Controller
86	A-6	**Driver 6 Fault** Fault Type(s): 1. Driver short circuit 15. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver6	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 6 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 6 » Driver 6 Overcurrent.	Controller
87	A-7	**Driver 7 Fault** Fault Type(s): 1. Driver short circuit 16. Driver current exceeded configured over-current limits 3. Open/short circuit (Voltage measured high, should be low) 4. Open/short circuit (Voltage measured low, should be high) 5. Broken wire 6. No current of the output limit Fault types 3-5 are only checked if driver checks are enabled	ShutdownDriver7	1.Open or short on driver load. 2.Dirty connector pins at controller or contactor coil. 3.Bad connector crimps or faulty wiring. 4.Driver overcurrent, as set by the Driver 7 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 7 » Driver 7 Overcurrent.	Controller
88	A-8	**Driver Assignment** Fault Type(s): 5 Driver number that caused the fault.	ShutdownDriver	1. A Driver Output is used for two or more functions. 2. See Programmer » Controller Setup » IO Assignments » Coil Drivers: Main Contactor Driver	Controller

				EM Brake Driver Hydraulic Contactor Driver	
89	A-9	**Coil Supply** Coil_Supply_Fault Fault Type(s): 5. Short to B- or hardware fault. 6. Driver short-circuit causes coil open circuit. 7. Coil Supply startup enable check failed. 8. Coil Supply startup disable check failed.	ShutdownAll:	1. Short on driver loads. 2. Dirty connector pins at controller or device. 3. Bad connector crimps or faulty wiring. 4. Controller is defective.	Controller
90	B-1	**ANALOG 1 OUT OF RANGE** Analog_ 1_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	Fault Action: None, unless a fault action is programmed in VCL.	1. Analog 1 input voltage is above the parameter setting of Analog 1 High. 2. Analog 1 input voltage is below the parameter setting of Analog 1 Low. 3. See Programmer » Controller Setup » Inputs » Analog 1. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 1 Low / Analog 1 High.	Controller
91	B-2	**ANALOG 2 OUT OF RANGE** Analog_ 2_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
92	B-3	**ANALOG 3 OUT OF RANGE** Analog_ 3_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
93	B-4	**ANALOG 4 OUT OF RANGE** Analog_ 4_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
94	B-5	**ANALOG 5 OUT OF RANGE** Analog_ 5_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller

95	B-6	**ANALOG 6 OUT OF RANGE** Analog_ 6_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
96	B-7	**ANALOG 7 OUT OF RANGE** Analog_ 7_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
97	B-8	**ANALOG 8 OUT OF RANGE** Analog_ 8_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
98	B-9	**ANALOG 9 OUT OF RANGE** Analog_ 9_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
99	B-B	**ANALOG 14 OUT OF RANGE** Analog_ 14_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
100	B-C	**Analog Assignment** Analog_Assignment Fault Type(s): 9 Analog Input number that caused the fault.	Fault Action: None, unless a fault action is programmed in VCL.	1. An Analog input is used for two or more functions. 2. An Analog input is outside the range of analog inputs. 3. See Programmer » Controller Setup » IO Assignments » Controls	Controller
101	B-D	**ANALOG 18 OUT OF RANGE** Analog_ 18_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller

102	B-E	**ANALOG 19 OUT OF RANGE** Analog_ 19_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
103	C-1	**Branding Error** Branding_Error	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake	2. Software and hardware branding mismatch. 2. For technical support on this fault, contact the Curtis distributor where you obtained your controller or the Curtis sales-support office in your region.	Controller
104	C-2	**BMS Cutback** BMS_Cutback Fault Type(s): 4. Battery Current Cutback. 5. Low Cell Cutback. 6. High Cell Cutback.	Set: See Fault Type Clear: Resolve battery or battery cell issue.	A cutback based on cell loading has occurred.	Battery
105	C-5	**PWM Input 10 Out of Range** PWM_Input_ 10_Out_Of_Range	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
106	C-7	**ANALOG 31 OUT OF RANGE** Analog_ 31_Out_Of_Range Fault Type(s): 3. Above High limit. 4. Below Low limit.	See Analog 1 Out of Range.	See Analog 1 Out of Range.	Controller
107	C-8	**Invalid_CAN_Port**	NO ACTION	1. Mistuned Dual Drive CAN parameters. 2. Conflicting CAN Node IDs for Dual Drive.	Controller
108	C-9	**VCL Watchdog**	NO ACTION	See the associated VCL Functions, • Set_ Watchdog_ Timeout(). • Set_ Watchdog_Fault_Action(). • Kick_ Watchdog().	Controller

109	C-B	**PWM Input 28 Out of Range** PWM_Input_28_Out_of_Range Fault Type(s): 6. The input is disconnected. 7. The measured input frequency is below the (PWM_Input_28_Low_ Frequency) – (PWM_Input_28_Frequency_ Fault_ Tolerance). 8. The measured input frequency is above the (PWM_ Input_28_High_Frequency) + (PWM_Input_28_Frequency_ Fault_ Tolerance). 9. The measured duty cycle is below set limits, (PWM_ Input_28_Low_Duty_Cycle) – (PWM_Input_28_Duty_ Cycle_ Fault_ Tolerance). 10. The measured duty cycle is above set limits, (PWM_ Input_28_High_Duty_Cycle) + (PWM_Input_28_Duty_ Cycle_Fault_ Tolerance).	Fault Action: None, unless a fault action is programmed in VCL.	1. This fault diagnostic execution cycles every 4msec. The input is considered disconnected if no PWM signal occurs for 16msec or the measurements are not updated every 16msec. 2. Mistuned parameters. 3. Faulty wiring.	Controller
110	C-C	**PWM Input 29 Out of Range** PWM_Input_29_Out_of_Range Fault Type(s): 4. The input is disconnected. 5. The measured input frequency is below the (PWM_Input_29_Low_ Frequency) – (PWM_ Input_29_Frequency_ Fault_ Tolerance). 6. The measured input frequency is above the (PWM_Input_29_High_ Frequency) + (PWM_ Input_29_Frequency_Fault_ Tolerance). 4 = The measured duty cycle is below set limits, (PWM_Input_29_Low_Duty_ Cycle) – (PWM_Input_29_Duty_Cycle_Fault_ Tolerance). 5 = The measured duty cycle is above set limits, (PWM_ Input_29_High_Duty_Cycle) + (PWM_Input_29_Duty_ Cycle_Fault_ Tolerance).	Fault Action: None, unless a fault action is programmed in VCL.	1. This fault diagnostic execution cycles every 4msec. The input is considered disconnected if no PWM signal occurs for 16msec or the measurements are not updated every 16msec. 2. Mistuned parameters. 3. Faulty wiring.	Controller

111	C-D	**Primary State Error** Primary_State_Error Fault Type(s): These are internal issues either occurring during startup, parameter initialization, secondary micro update or other runtime issues. 1. PRIMARY_DEVICE_ STARTUP = 0, 2 = PRIMARY_WAIT_KSI_ STABLE, 3 = PRIMARY_DEVICE_ STARTUP_ VALID, 4 = PRIMARY_INITIALIZE_ PARAMETERS, 5 = PRIMARY_WAIT_FOR_ FIRST_SIGNALS, 6 = PRIMARY_WAIT_FOR_ SUPERVISOR, 7 = PRIMARY_RESTORE_ PARAMETER_FAIL, 8 = PRIMARY_SUPERVISOR_ FIRST_ SIGNALS_ERROR, 9 = PRIMARY_SUPERVISOR_ STARTUP_ERROR, 10 = PRIMARY_STARTUP_ TIMER_ FAILURE, 11 = PRIMARY_WAIT_CAN_ HANDSHAKING_DONE, 12 = PRIMARY_RUNNING	NO_ACTION (controller is not operable)	Set: Internal error with the controller. Kindly reset controller. Clear: Reset controller	Controller
112	D-1	**Lift Input Fault** Lift_Input	ShutdownLift	The associated fault diagnostic with the assigned lift-input source triggers this fault. For example: If the Lift_Input_Source is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code. Set: Faults from the respective/ assigned “Lift_Input_Source” are cascaded and reported. Clear: Resolve any input assignment conflict, or out of range faults, then Reset Controller.	Controller

113	D-2	**Phase PWM Mismatch** Phase_PWM_Mismatch Fault Type(s): 0 = U phase. 1 = V phase. 2 = W phase.	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: The difference between the commanded phase PWM duty cycle and the measured is greater than allowed. Clear: Reset Controller.	Controller
114	D-3	**Hardware Compatibility** Hardware_Compatibility	ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	The OS (device profile, .cdev file) is incompatible with the controller. The loaded software (.cdev) is not compatible with the controller hardware.	Controller
115	D-4	**Lower Input Fault** Lower_Input	ShutdownLower	The associated fault diagnostic with the assigned lift-input source triggers this fault. For example: If the Lift_Input_Source is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code. Set: Faults from the respective/ assigned “Lift_Input_Source” are cascaded and reported. Clear: Resolve any input assignment conflict, or out of range faults, then Reset Controller.	Controller

116	D-6	**Hazardous Movement** Hazardous_Movement Fault Type(s): 1 = The motor speed is in the opposite direction of the speed request and the motor fails to accelerate in the correct direction for a programmed time. In the event of a change to neutral, this hazard will be detected if the motor fails to accelerate toward zero speed for a programmed time. 2 = The acceleration is in the opposite direction of the difference between the operator speed request and the motor speed. The speed in the commanded direction is greater than the commanded speed by more than a parameter (Hazardous_Speed) for a programmed time (Hazardous_ Throttle_ Response_ Time).	ShutdownInterlock	Set: This fault detects hazardous movement when the motor is requested to be moving. The first hazard is a motor that is not able to slow down if the throttle goes to zero or the direction switch is not in the direction of travel. The second hazard is a motor that accelerates the wrong way or goes too fast. Note: This fault only occurs when the Control Mode Select is in Speed_Mode, Speed_Mode_ Express, or Servo_Mode. Clear: Reset Controller. Setting Hazardous_Direction_ Response_ Time = 0 will disable these checks	Controller
117	D-D	**IMU Failure** IMU_Failure Fault Type(s): 5. SPI Communication Failure 6. Curtis Factory Self Test Failure 7. Run Time Check Failure, bad data received from the IMU 8. Gyro Cal out of range, maximum calibration offset exceeded.	NO_ACTION	Check if configured correctly or the vehicle is moving when calibrating. Set: Internally set as per fault type. Clear: Cycle KSI	Controller

1232SE steering controller troubleshooting table

FLASH CODE	SUB CODE	FAULT NAME	POSSIBLE CAUSE	CLEAR CONDITION	STEER FAULT ACTION	TRACTION FAULT ACTION
11	1	Hardware Fault	An internal hardware error has been detected; controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
12	1	Controller Overcurrent 1	1. External short of phase U, V, or W motor connection. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
12	2	Controller Overcurrent 2	1. External short of phase U, V, or W motor connection. 2. Motor parameters are mis-tuned.	Cycle KSI.	Shutdown.	1 = Stop.

			3. Controller defective.			
13	1	Current Sensor Fault	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
14	1	Precharge	1. External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
15	1	Controller Severe Undertemp	Controller is operating in an extreme environment.	Bring heatsinktemp above -35°C.	Warning Only.	3 = No action.
16	1	Controller Severe Overtemp	1. Improper mounting of controller. 2. Excessive load on vehicle. 3. Controller is operating in an extreme environment.	Cycle KSI.	Shutdown.	1 = Stop.
17	1	Severe Undervoltage	1. Battery or battery cables or battery connections defective. 2. Excessive non-controller system drain on battery. 3. Battery disconnected while driving. 4. Blown B+ fuse or steer contactor did not close.	Cycle KSI.	Shutdown.	1 = Stop.
18	1	Severe Overvoltage	1. Battery or battery cable resistance too high for a given regen current. 2. Battery disconnected while regen braking.	Cycle KSI.	Shutdown.	1 = Stop.
22	1	Controller Overtemp	1. Improper mounting or cooling of controller. 2. Excessive load on vehicle. 3. Controller is operating in an extreme environment.	Heatsink temp < 85°C.	Warning Only.	2 = Reduce speed. (Max speed reduced linearly from 100% at 85°C to 0% at 95°C.)
25	1	5V Supply Failure	External load impedance on the +5V supply is too low.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
26	1	10V Supply Failure	External load impedance on the +10V supply is too low.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
27	1	Severe Motor Over Temp	1. Motor is operating in an extreme environment.	Cycle KSI.	Warning then	1 = Stop.

			2. Motor Temperature Control parameters are mis-tuned.		Shutdown.	
28	1	Motor Temp Hot Cutback	1. Motor is operating in an extreme environment. 2. Motor Temperature Control parameters are mis-tuned.	Steer motor temperature < programmed Temperature Hot.	Warning Only.	2 = Reduce speed.
29	1	Motor Temp Sensor Fault	1. Motor thermistor is not connected properly. 2. If the application does not use a motor thermistor, the Motor Temperature Sensor Enable parameter should be programmed Off.	Motor temp input within the normal operating range.	Warning Only.	2 = Reduce speed. (Max speed reduced to Sensor Fault Traction Cutback.)
31	1	Contactor Open/Short	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
35	1	Fault Output Open/Short	1. External load impedance on the fault output is too low. 2. Controller defective.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
36	1	Motor Stalled	1. Stalled steer motor. 2. Steer motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply of the steer motor encoder.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
37	1	Motor Open	1. Motor phase is open. 2. Bad crimps or faulty motor cable wiring. 3. Controller defective.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
38	1	Contactor Welded	1. Steer contactor tips are welded closed. 2. An alternative voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ terminal).	Cycle KSI.	Shutdown.	1 = Stop.
39	1	Contactor Opened	1. Steer contactor was closed temporarily, but then opened. 2. Steer contactor tips are oxidized. 3. An external load on the capacitor bank (B+ terminal) that prevents the bank from charging.		Warning then Shutdown.	
39	2	Contactor Did	1. Steer contactor did not close.	Cycle KSI.	Shutdown.	1 = Stop.

		Not Close	2. Steer contactor tips are oxidized. 3. An external load on the capacitor bank (B+ terminal) that prevents the bank from charging.			
41	1	Command Analog1 Out of Range	Command input device's Analog 1 input (pin 8) is out of range.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
42	1	Command Analog3 Out of Range	Command input device's Analog 3 input (pin 19) is out of range.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
43	1	Feedback Analog5 Out of Range	Command input device's Analog 5 input (pin 16) is out of range.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
44	1	Feedback Analog6 Out of Range	Command input device's Analog 6 input (pin 17) is out of range.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
45	1	CANNot Operational	1222 CAN NMT State did not go operational within 80 ms of interlock being applied.	Cycle KSI.	Warning and drop fault output.	1 = Stop.
46	1	EEPROM CRC Fault	1. New software loaded into EEPROM memory. 2. Try using function "Restore to Factory Defaults" to clear fault. 3. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
47	1	Sin/Cos command sensor	1. Sin/Cos Sensor defective. 2. Sin/Cos Sensor parameters are mis-tuned.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
47	2	Sawtooth Command Sensor	1. Sawtooth Sensor defective. 2. Sawtooth Sensor parameters are mis-tuned.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
48	1	Sin/Cos Feedback sensor	1. Sin/Cos Sensor defective. 2. Sin/Cos Sensor parameters are mis-tuned.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
48	2	Sawtooth Feedback Sensor	1. Sawtooth Sensor defective. 2. Sawtooth Sensor parameters are mis-tuned.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
49	1	Parameter Change Fault	A parameter value or the software was changed that required a power cycle. This fault is set automatically to force the vehicle operator to cycle power, for safety purposes.	Cycle KSI.	Shutdown.	1 = Stop.
51	1	Interlock Switch Supervision	1. When the interlock switch inputs are a crossed configuration (N.O.	Interlock Input 1 <>	Interlock = Off.	1 = Stop.

			and N.C.), the two inputs are checked. A fault is set if Switch 1 (pin 9) =Switch 3 (pin 11). 2. Interlock switch defective.	Interlock Input 3.		
52	1	Home Switch Supervision	1. When the wheel position is not close to home, the redundant home switch inputs are checked and a fault is set if they disagree. 2. Home switch defective. 3. For 360° steering, parameter Homing Cam Angle (deg) not set correctly.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
53	1	Home Position Not Found	Home switch defective.	Cycle KSI.	Shutdown.	1 = Stop.
54	1	Home reference Tolerance Fault	1. Home switch defective. 2. For 360° steering, parameter Homing Cam Angle (deg) not set correctly.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
55	1	Steer Command Supervision	Command input device defective.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
56	1	Wheel Position Supervision	Position feedback device defective.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
69	1	5V Current Out of Range	The external load on the 5V supply is drawing either too much or too little current.	Cycle KSI.	Hold then Shutdown.	1 = Stop.
71	1	Software Fault 1	Reserved for future use.			
71	2	Software Fault 2	1. Software defective. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
71	3	Software Fault 3	Reserved for future use.			
71	4	Software Fault 4	1. Software defective. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
71	5	Software Fault 5	1. Software defective. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop.
72	1	PDO1 Timeout	Communication between the traction controller and the 1222 has halted.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
72	2	PDO2 Timeout	Communication from the CAN device sending the PDO2 message to the 1222 has halted.	Cycle KSI.	Warning then Shutdown.	1 = Stop.

72	3	PDO3 Timeout	Communication from the CAN device sending the PDO3 message to the 1222 has halted.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
72	4	PDO4 Timeout	Communication from the CAN device sending the PDO4 message to the 1222 has halted.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
73	1	Following Error	1. Position feedback device defective. 2. Steer motor stalled. 3. Steer motor encoder failed.	Cycle KSI.	Warning then Shutdown.	1 = Stop.
74	1	Hardware Software Mismatch	1. New software loaded. 2. Controller hardware cannot use the loaded software.	Cycle KSI.	Shutdown.	1 = Stop.
75	1	Parameter Conflict	1. Parameter settings are in conflict with each other. 2. Parameter setting out of range.	Cycle KSI.	Shutdown.	1 = Stop.

b. Display (Inmotion controller)

Inmotion display:

State of charge (SOC) of the battery is displayed on the right side of the indicator, if the battery is fully charged, the indicator displays 100% (10 segments), when SOC of battery is 20%, the battery symbol will light on (the sixth one from left in Fig .19), indicating the battery needs charging. When SOC of the battery is 10%, the prohibition symbol will light on (the fourth one from left in Fig .19), the lifting function is not available but slow travelling is available.

When the battery is removed, the indicator will display code 133, the travelling is not available but mast movement (reach forward/ backward) is available.

There are keys on the right of the display for different “modes”, you can switch the mode by operating different “mode” keys, as shown in Fig .12:

Fig. 24: Inmotion display

P Mode	High speed mode	Full speed drive 9.5 Km/h
E Mode	Normal mode	Full speed drive 7.6 Km/h
S Mode	Economic mode	Full speed drive 5.7 Km/h

When switch to economic mode, slow speed (turtle) symbol is on (the first one from left in Fig .22).
Turtle Speed Symbol: Lights up when the truck is running in Slow (Turtle) Speed Mode.
Wrench Symbol: Lights up when the truck is in neutral.
Battery Symbol: Lights up when the battery charge is lower than or equal to 20%.
Lift Lock Symbol: Lights up when the battery charge is lower than or equal to 10%.
Seat Symbol: Lights up when the driver leaves the seat.
Handbrake Symbol: Lights up when the driver operates the handbrake.

Key	Key Name	Key functions
	UP	Press the key to scroll the cursor up on the screen or increase the selected writable parameter value; It specifies “S Mode” (economic mode) when the display is in the Menu Screen.
	LEFT	Press the key to move the cursor to the left on the screen; It specifies “P Mode” (high speed mode) when the display is in the Menu Screen.
	RIGHT	Press the key to move the cursor to the right on the screen; It specifies “E Mode” (normal mode) when the display is in the Menu Screen.
	DOWN	Press the key to move the cursor down on the screen or decrease the selected writable parameter value; It specifies “Turtle Mode” when the display is in the Menu Screen.
	CANCEL	Press the key to cancel the entered content; when a menu is selected, it navigates to the the previous menu.
	CONFIRM	Press the key to confirm the entered content; when a menu is selected, it enters the menu.

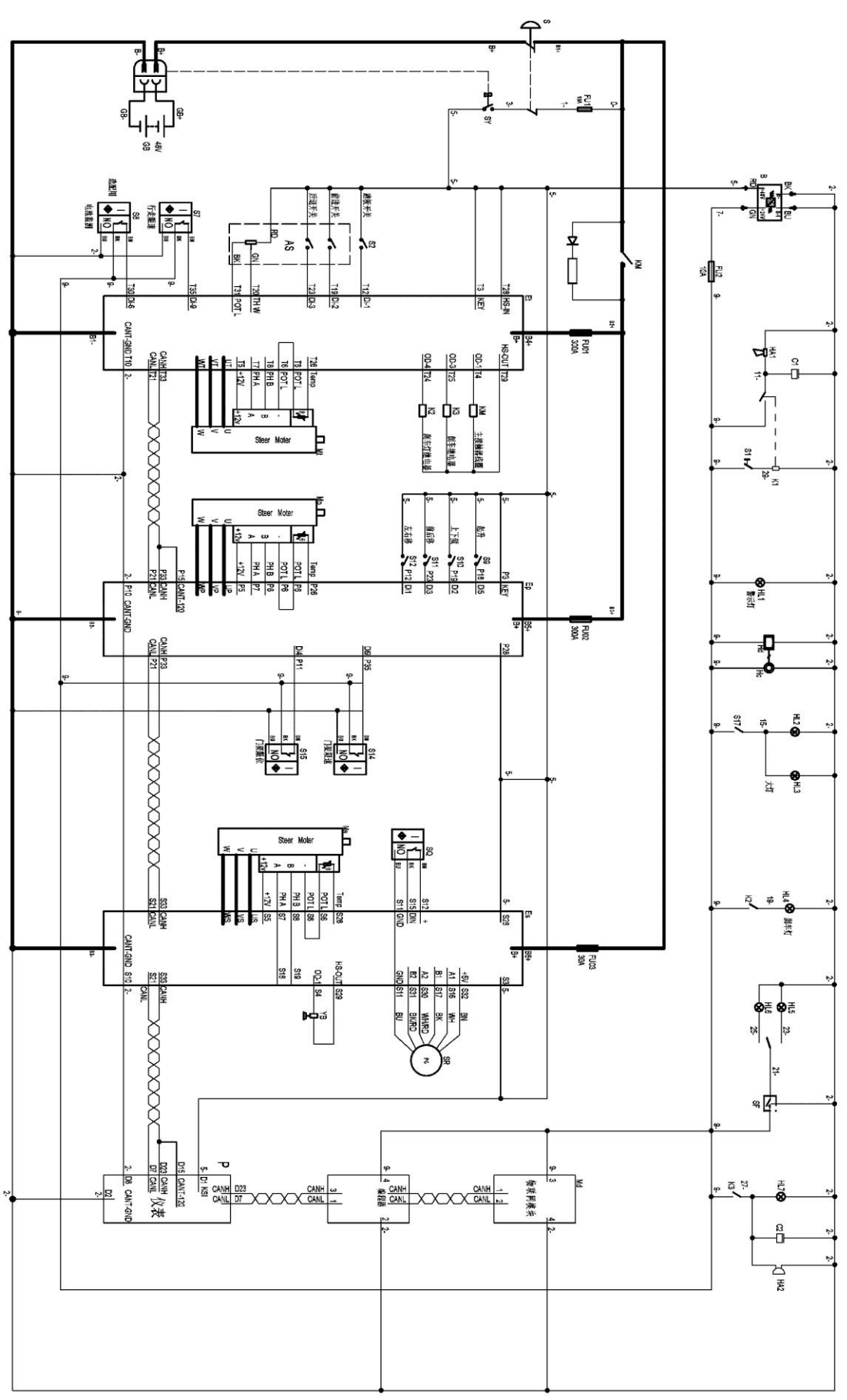


Fig. 25: Electrical diagram (truck with Inmotion controller)

Description of electrical components (truck with Inmotion controller)			
Code	Item	Code	Item
GB	Battery 48V/480AH	S15	Mast limit switch
S	Emergency button	C1	Capacitor
Mt	Traction motor	C2	Capacitor
Mp	Pump motor	HA1	Horn
Ms	Steering motor	HL1	Warning signal light
Es	Steering controller	HL2/HL3	Front lamp
Et	Traction controller	HL4	Brake signal light
P	Display	HC	Camera
SQ	0° proximity switch	SF	Flasher
SR	Steering wheel	HD	Display
S1	Horn switch	HL5	Left signal light
FU01	Fuse 300A	HL6	Right signal light
FU02	Fuse 300A	HL7	Reversing light
Ep	Pump controller	HA2	Buzzer
AS	Accelerator	K1	Horn relay
SY	Key switch	K2	Brake relay
FU2	Fuse 10A	K3	Astern relay
YB	Electromagnetic brake	KM	Main contactor
B	DC converter	FU03	Fuse 30A
S2	Pedal switch	Md	Remote module
FU1	Fuse 10A		
S17	Lamp switch		
S7	Travel speed limit switch		
S8	Battery monitor switch		
S9	Lift switch		
S10	Tilt switch		
S11	Travel FW./BW. switch		
S12	Left/right switch		
S14	Mast speed limit switch		

Inmotion controller troubleshooting table

FAULT CODE (0-255)	FAULT DISPLAYED ON SCREEN	CLEAR CONDITIONS
20	ERROR Incorrect start Accelerator pedal switch active before key on	Release pedal switch
21	ERROR Incorrect start Accelerator pedal switch active before key on	Turn off the direction switch
22	ERROR Forward switch and reverse switch active at the same time	Direction switch fault
23	ERROR Throttle analog value out of range	Throttle fault or analog need to be calibrated
24	ERROR Throttle analog fault	Throttle fault or analog need to be calibrated
31	ERROR Traction controller CAN communication fault	1. Check whether the insulation of CAN communication line 33/ 21 is good and whether the resistance between line 33 and 21 is 60Ω; 2. If there is a remote module, remove it first and then test it; 3. Check whether each controller does not work (for example, check whether the controller fault indicator is on); 4. Monitor whether there are error frames in the can system. If so, eliminate the error frames (such as lithium battery can interference). If there is interference in DC pump control, shield the communication fault; [other communication problems can also be detected by this method, such as the vehicle is in normal use but the instrument direction display is stuck, or there is no lifting tilt but the walking is normal and the instrument has no fault code]
32	ERROR Battery voltage low	Charge the battery.
34	ERROR CPU fault	Abnormal 12V/ 5V power supply line of controller.

35	ERROR Multiple pump action switches are activated at the same time	Reset the pump control switch
36	ERROR Incorrect start Tilt switch active before key on	Reset tilt switch
37	ERROR Incorrect start Side switch active before key on	Reset side switch
38	ERROR Incorrect start Attachment switch active before key on	Reset attachment switch
39	ERROR Incorrect start Lift switch active before key on	Reset lift switch
40	ERROR Incorrect start Reach In/Out switch active before key on	Reset Reach In/Out switch
41	ERROR Lift analog value out of range	Lift analog fault or need to be calibrated
42	ERROR Reach pot analog value out of range	Reach pot analog fault or need to be calibrated
43	ERROR Tilt pot analog value out of range	Tilt pot analog fault or need to be calibrated
44	ERROR Side Pot analog value out of range	Side Pot analog fault or need to be calibrated
81	WARNING Traction controller temperature is low	1. Compare whether the monitored temperature of the controller is significantly different from the actual temperature; 2. The controller is defective.
82	WARNING Traction controller temperature is high	1. Compare whether the monitored temperature of the controller is significantly different from the actual temperature; 2. Check whether sufficient silicone grease is applied between the controller and the electric control aluminum plate and between the electric control aluminum plate and the truck; 3. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 4. The controller is defective.

83	ERROR Traction controller temperature sensor fault	Traction controller temperature sensor fault
84	WARNING Traction motor temperature is low	[refer to the inspection method when ACS controller reports 86 fault]
85	WARNING Traction motor temperature is high	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 5. The controller is defective.
86	ERROR Traction motor tenperature sensor fault	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. The controller is defective.
87	ERROR Traction motor encoder fault	1. Check the wiring from motor encoder to controller for open circuit or poor insulation; 2. Check whether the encoder is installed in place or installed in the opposite direction; 3. Replace the encoder (for the newly replaced encoder, confirm whether the wiring definition is consistent with the original encoder); 4. The controller is defective.

88	WARNING DC bus voltage of traction controller is high	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
89	WARNING DC bus voltage of traction controller is low	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
90	WARNING The default value of the traction controller is updated	For protection after refreshing the program, restart the key.
91	WARNING Traction drive limit	Low battery power, low voltage, motor over temperature or controller over temperature, and the vehicle limits the output. Find out the cause according to other fault codes reported at the same time.
97	ERROR Open drain of traction output open or short	1. Measure whether there is battery voltage on the 28 pin line of the controller (it is necessary to turn on the key switch for measurement); 2. Measure whether the insulation of line 29 / 4 / 16 / 24 / 25 is good; 3. Measure the resistance between pin 29 and line 4/ 16/ 24/ 25 respectively (the normal resistance value is determined according to the specific wiring); 4. The controller is defective.
98	WARNING Traction controller over current or short	[refer to the inspection method when ACS controller reports 101 fault]
101	ERROR Traction controller short	1. Check whether the motor line has open circuit or poor insulation; 2. Controller failure.
102	ERROR Traction controller temperature is high cutback	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check whether sufficient silicone grease is applied between the controller and the electric control aluminum plate and between the electric control aluminum plate and the truck; 3. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 4. The controller is defective.

103	ERROR Traction motor temperature is high cutback	1. Compare whether the monitored temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 5. The controller is defective.
104	ERROR Traction controller over current	[refer to the inspection method when ACS controller reports 101 fault]
105	ERROR Traction controller precharge failed	1. Check whether the battery voltage is too low; 2. Check whether the precharge resistance is normal; 3. Measure whether the insulation between the motor line and the truck is normal; 4. Check whether there are other wiring (including the power line connected to the pump control) on the controller B+ terminal except the normal contactor copper bar. If so, remove it first and then test; 5. The controller is defective.
110	ERROR DC bus voltage of traction controller is low cutback	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
111	ERROR DC bus voltage of traction controller is high cutback	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
113	ERROR The safety pedal switch is activated at start-up	Reset the safety pedal switch.

114	ERROR Internal power supply error	1. Check whether the wiring from the accelerator to the controller has poor insulation, unplug the accelerator plug-in, and test whether there is still code 114 (if yes, go to the next step, if not, it is accelerator fault); 2. Check whether the wiring from the motor encoder to the controller has poor insulation, unplug the motor encoder plug-in, and test whether there is 114 code (if yes, proceed to the next step; if not, it is the motor encoder fault); 3. Check whether the wiring from the lifting speed regulation sensor to the controller has poor insulation, unplug the lifting speed regulation sensor plug-in, and test whether there is still code 114 (if there is, proceed to the next step, if there is no, it is accelerator fault) [it is not necessary to check if there is no lifting speed regulation function or semi AC vehicle]; 4. Controller failure.
121	WARNING Pump controller temperature is low	1. Compare whether the monitored temperature of the controller is significantly different from the actual temperature; 2. The controller is defective
122	WARNING Pump controller temperature is high	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check whether sufficient silicone grease is applied between the controller and the electric control aluminum plate and between the electric control aluminum plate and the truck ; 3. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 4. The controller is defective.
123	ERROR Pump controller temperature sensor fault	Pump controller temperature sensor fault

124	WARNING Pump motor temperature is low	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. The controller is defective.
125	WARNING Pump motor temperature is high	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 5. The controller is defective.
126	ERROR Pump motor temperature sensor fault	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. The controller is defective.

127	ERROR Pump controller encoder fault	1. Check the wiring from motor encoder to controller for open circuit or poor insulation; 2. Check whether the encoder is installed in place or installed in the opposite direction; 3. Replace the encoder (for the newly replaced encoder, confirm whether the wiring definition is consistent with the original encoder); 4. The controller is defective.
128	WARNING DC bus voltage of pump controller is high	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
129	WARNING DC bus voltage of pump controller is low	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
130	WARNING The default value of the pump controller is updated	For protection after refreshing the program, restart the key.
133	Battery safety switch failure	Check whether the battery safety switch is damaged or improperly installed.
134	ERROR CPU fault	1. Check whether the wiring from the accelerator to the controller has poor insulation, unplug the accelerator plug-in, and test whether there is still code 114 (if yes, go to the next step, if not, it is accelerator fault); 2. Check whether the wiring from the motor encoder to the controller has poor insulation, unplug the motor encoder plug-in, and test whether there is 114 code (if yes, proceed to the next step; if not, it is the motor encoder fault); 3. Check whether the wiring from the lifting speed regulation sensor to the controller has poor insulation, unplug the lifting speed regulation sensor plug-in, and test whether there is still code 114 (if there is, proceed to the next step, if there is no, it is accelerator fault) [it is not necessary to check if there is no lifting speed regulation function or semi AC vehicle]; 4. Controller failure

137	ERROR Open drain of pump output open or short	1. Measure whether there is battery voltage on the 28 pin line of the controller (it is necessary to turn on the key switch for measurement); 2. Measure whether the insulation of line 29/ 4/ 16/ 24/ 25 is good; 3. Measure the resistance between pin 29 and line 4/ 16/ 24/ 25 respectively (the normal resistance value is determined according to the specific wiring); 4. The controller is defective.
138	WARNING Pump controller over current or short	1. Check whether the motor line has open circuit or poor insulation; 2. Controller failure
141	ERROR Pump controller short	1. Check whether the motor line has open circuit or poor insulation; 2. Controller failure
142	ERROR Pump controller temperature is high cutback	1. Compare whether the monitored temperature of the controller is significantly different from the actual temperature; 2. Check whether sufficient silicone grease is applied between the controller and the electric control aluminum plate and between the electric control aluminum plate and the truck; 3. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 4. The controller is defective.
143	ERROR Pump motor temperature is high cutback	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 5. The controller is defective.

144	ERROR Pump driver internal power failure	1. Check whether the wiring from the accelerator to the controller has poor insulation, unplug the accelerator plug-in, and test whether there is still code 114 (if yes, go to the next step, if not, it is accelerator fault); 2. Check whether the wiring from the motor encoder to the controller has poor insulation, unplug the motor encoder plug-in, and test whether there is 114 code (if yes, proceed to the next step; if not, it is the motor encoder fault); 3. Check whether the wiring from the lifting speed regulation sensor to the controller has poor insulation, unplug the lifting speed regulation sensor plug-in, and test whether there is still code 144 (if there is, proceed to the next step, if there is no, it is accelerator fault) [it is ot necessary to check if there is no lifting speed regulation function or semi AC vehicle]; 4. Controller failure.
145	ERROR Pump controller pre-charge failed	1. Check whether the battery voltage is too low; 2. Check whether the precharge resistance is normal; 3. Measure whether the insulation between the motor line and the truck is normal; 4. Check whether there are other wiring (including the power line connected to the pump control) on the controller B+ terminal except the normal contactor copper bar. If so, remove it first and then test; 5. The controller is defective.
150	ERROR DC bus voltage of pump controller is low cutback	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
151	ERROR DC bus voltage of pump controller is high cutback	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
152	WARNING Enter energy limiting mode	Both the travel and pump enter the energy limiting mode.
201	ERROR Steer controller short	1. Check whether the motor line has open circuit or poor insulation; 2. Controller failure.

202	ERROR Steer controller temperature is high cutback	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check whether sufficient silicone grease is applied between the controller and the electric control aluminum plate and between the electric control aluminum plate and the truck; 3. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 4. The controller is defective.
203	ERROR Steer motor temperature is high cutback	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 5. The controller is defective.
204	ERROR Internal power supply error	[refer to the inspection method when ACS controller reports 114 fault]
205	ERROR Steer controller precharge failed	1. Check whether the battery voltage is too low; 2. Check whether the precharge resistance is normal; 3. Measure whether the insulation between the motor line and the truck is normal; 4. Check whether there are other wiring (including the power line connected to the pump control) on the controller B+ terminal except the normal contactor copper bar. If so, remove it first and then test; 5. The controller is defective.
206	ERROR DC bus voltage of Steer controller is low cutback	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.

207	ERROR DC bus voltage of steer controller is high cutback	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
208	ERROR VehicleSpeed counter Error	There is a large difference between the output of the steering wheel sensor and the output pulse number of the steering motor. It is necessary to check the encoder of the steering motor and the steering wheel sensor.
209	ERROR Wheel steering encoder error	Steering wheel sensor error.
210	ERROR Steer controller encoder fault	1. Check the wiring from motor encoder to controller for open circuit or poor insulation; 2. Check whether the encoder is installed in place or installed in the opposite direction; 3. Replace the encoder (for the newly replaced encoder, confirm whether the wiring definition is consistent with the original encoder); 4. The controller is defective.
211	ERROR Steer motor temperature sensor fault	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. The controller is defective.
212	ERROR Steer controller temperature sensor fault	Steer controller temperature sensor fault.
213	ERROR	The steering contactor cannot be closed or the line from the drive line of the steering contactor to the controller is damaged. It is necessary to check the line.
214	ERROR	
215	ERROR Startup calibration of position has timedout.	After startup, the steering controller cannot find the zero position, and it needs to check the proximity switch.
217	ERROR Open drain of steer output open or short	[refer to the inspection method when ACS controller reports 97 fault]

218	WARNING Steer motor temperature is low	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. The controller is defective.
219	WARNING Steer motor temperature is high	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check the wiring from the controller to the motor temperature sensor for open circuit or poor insulation; 3. Measure whether the resistance value of the motor temperature sensor is normal (the resistance value is about 600Ω at room temperature), and whether the insulation with the motor line and truck is normal; 4. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 5. The controller is defective.
220	WARNING Steer controller temperature is low	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. The controller is defective.
221	WARNING Steer controller temperature is high	1. Compare whether the monitoring temperature of the controller is significantly different from the actual temperature; 2. Check whether sufficient silicone grease is applied between the controller and the electric control aluminum plate and between the electric control aluminum plate and the truck; 3. Check whether the operating current of the controller is significantly higher than the commissioning current (it can be asked from relevant technical personnel); 4. The controller is defective.

222	WARNING DC bus voltage of steer controller is high	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
223	WARNING DC bus voltage of steer controller is low	1. Measure the battery voltage; 2. Check the cable for looseness or poor insulation.
231	ERROR CAN traction controller CAN communication fault	[refer to the inspection method when ACS controller reports 31 fault]
232	ERROR CAN Pump controller CAN communication fault	[refer to the inspection method when ACS controller reports 31 fault]
233	ERROR CAN Steer controller CAN communication fault	[refer to the inspection method when ACS controller reports 31 fault]
234	ERROR CPU fault	1. Check whether the wiring from the accelerator to the controller has poor insulation, unplug the accelerator plug-in, and test whether there is still code 114 (if yes, go to the next step, if not, it is accelerator fault); 2. Check whether the wiring from the motor encoder to the controller has poor insulation, unplug the motor encoder plug-in, and test whether there is 114 code (if yes, proceed to the next step; if not, it is the motor encoder fault); 3. Check whether the wiring from the lifting speed regulation sensor to the controller has poor insulation, unplug the lifting speed regulation sensor plug-in, and test whether there is still code 234 (if there is, proceed to the next step, if there is no, it is accelerator fault) [it is not necessary to check if there is no lifting speed regulation function or semi AC vehicle]; 4. Controller failure
235	WARNING The default value of the steer controller is updated	For protection after refreshing the program, restart the key

13. DECLARATION OF CONFORMITY

[GB] Original CE Declaration of conformity
The signatory hereby declares that the specified machine conforms to the EC Directive 2006/42/EC (Machine Directive), and 2014/30/EU (Electro-Magnetic Compatibility, EMC) including their amendments as translated into national legislation of the member countries. The signatory is individually authorized to compile the technical documents and declares that the following standards, including the normative procedures contained therein, have been applied:

[D] Original EG- Konformitätserklärung
Der Unterzeichner erklärt hiermit, dass die angegebene Maschine den EG-Richtlinien 2006/42/EG (Maschinenrichtlinie) und 2014/30/EU (Elektromagnetische Verträglichkeit, EMV) einschließlich ihrer Änderungen in der Umsetzung in die nationale Gesetzgebung der Mitgliedsländer entspricht. Der Unterzeichner ist zur Zusammenstellung der technischen Unterlagen einzeln befugt und erklärt, dass folgende Normen, einschließlich der darin enthaltenen normativen Verfahren, angewendet wurden:

[E] Original DECLARACIóN DE CONFORMIDAD CE
El signatario declara por la presente que la máquina especificada cumple con la Directiva CE 2006/42/EC (Directiva de Máquinas) y 2014/30/EU (Compatibilidad Electromagnética, EMC) incluidas sus enmiendas traducidas a la legislación nacional de los países miembros. El firmante está autorizado individualmente para compilar los documentos técnicos y declara que se han aplicado los siguientes estándares, incluidos los procedimientos normativos contenidos en ellos:

[F] Originale DECLARATION DE CONFORMITE CE
Le signataire déclare par la présente que la machine spécifiée est conforme à la directive CE 2006/42/CE (directive machine) et 2014/30/UE (compatibilité électromagnétique, CEM), y compris leurs modifications telles que traduites dans la législation nationale des pays membres. Le signataire est individuellement autorisé à compiler les documents techniques et déclare que les normes suivantes, y compris les procédures normatives qu'elles contiennent, ont été appliquées:

[NL] Origineel EG-CONFORMITEITSVERKLARING
De ondertekenaar verklaart hierbij dat de gespecificeerde machine voldoet aan de EG-richtlijnen 2006/42/EG (machinerichtlijn) en 2014/30/EU (elektromagnetische compatibiliteit, EMC) inclusief hun amendementen zoals vertaald in de nationale wetgeving van de aangesloten landen. De ondertekenaar is individueel gemachtigd om de technische documenten samen te stellen en verklaart dat de volgende normen, inclusief de normatieve procedures die daarin zijn opgenomen, zijn toegepast:

[P] Original DECLARAÇÃO DE CONFORMIDADE CE
O signatário declara que a máquina especificada está em conformidade com a Diretiva EC 2006/42/EC (Diretiva de Máquinas) e 2014/30/EU (Compatibilidade Eletromagnética, EMC), incluindo suas emendas traduzidas para a legislação nacional dos países membros. O signatário está individualmente autorizado a compilar os documentos técnicos e declara que as seguintes normas, incluindo os procedimentos normativos neles contidos, foram aplicadas:

[I] Originale DICHIARAZIONE DI CONFORMITÀ CE
Il firmatario dichiara che la macchina specificata è conforme alla Direttiva CE 2006/42/CE (Direttiva macchine) e 2014/30/UE (Compatibilità elettromagnetica, EMC) compresi i relativi emendamenti tradotti nella legislazione nazionale dei paesi membri. Il firmatario è autorizzato individualmente alla compilazione dei documenti tecnici e dichiara che sono state applicate le seguenti norme, comprese le procedure normative ivi contenute:

[BG] Оригинален ЕВРОПЕЙСКА ОБЩНОСТ - ДЕКЛАРАЦИЯ ЗА СЪОТВЕТСТВИЕ
С настоящото подписалото лице декларира, че посочената машина отговаря на Директива на ЕО 2006/42/ЕС (Директива за машини) и 2014/30/EU (Електромагнитна съвместимост, ЕМС), включително техните изменения, преведени в националното законодателство на страните-членки. Подписалото лице е лично упълномощено да съставя техническите документи и декларира, че са приложени следните стандарти, включително съдържащите се в тях нормативни процедури:

[CZ] Originál EG - PROHLÁŠENÍ OSHODĚ
Signatář tímto prohlašuje, že uvedený stroj je ve shodě se směrnicí ES 2006/42/ES (Směrnice o strojích) a 2014/30/EU (Elektromagnetická kompatibilita, EMC) včetně jejich změn ve znění přeložené do národní legislativy členských zemí. Podepisující osoba je samostatně oprávněna sestavit technické dokumenty a prohlašuje, že byly použity následující normy, včetně normativních postupů v nich obsažených:

[DK] Original EF-OVERENSSTEMMELSESERKLÆRING
Underskriveren erklærer hermed, at den specificerede maskine er i overensstemmelse med EF-direktivet 2006/42/EC (maskindirektivet) og 2014/30/EU (elektro-magnetisk kompatibilitet, EMC) inklusive deres ændringer som oversat til national lovgivning i medlemslandene. Underskriveren er individuelt bemyndiget til at udarbejde de tekniske dokumenter og erklærer, at følgende standarder, inklusive de normative procedurer indeholdt deri, er blevet anvendt:

[EST] Originaal EL vastavusavaldus
Allakirjutanu kinnitab käesolevaga, et nimetatud masin vastab EÜ direktiivile 2006/42/EÜ (masinadirektiiv) ja 2014/30/EL (elektromagnetiline ühilduvus, EMC), sealhulgas nende muudatustele, nagu on tõlgitud liikmesriikide siseriiklikesse õigusaktidesse. Allakirjutanul on individuaalselt õigus koostada tehnilisi dokumente ja ta kinnitab, et on kohaldatud järgmisi standardeid, sealhulgas neis sisalduvaid normatiivprotseduure:

[FIN] Alkuperäinen EU-YHDENMUKAISUUSSELOSTUS
Allekirjoittaja vakuuttaa täten, että määritetty kone on EY-direktiivin 2006/42/EY (konedirektiivi) ja 2014/30/EU (sähkömagneettinen yhteensopivuus, EMC) mukainen, mukaan lukien niiden muutokset, sellaisina kuin ne on käännetty jäsenmaiden kansalliseen lainsäädäntöön. Allekirjoittaja on henkilökohtaisesti valtuutettu kokoamaan tekniset asiakirjat ja vakuuttaa, että seuraavia standardeja, mukaan lukien niihin sisältyvät normatiiviset menettelyt, on sovellettu:

[GR] Πρωτότυπο ΔΗΛΩΣΗΣΥΜΜΟΡΦΩΣΗΣΕΟΚ
Ο υπογράφοντος δηλώνει με το παρόν ότι το συγκεκριμένο μηχάνημα συμμορφώνεται με την Οδηγία 2006/42/ΕΚ (Οδηγία Μηχανών) και 2014/30/ΕΕ (Ηλεκτρομαγνητική Συμβατότητα, ΕΜC) συμπεριλαμβανομένων των τροποποιήσεών τους όπως έχουν μεταφραστεί στην εθνική νομοθεσία των χωρών μελών. Ο υπογράφοντος είναι ατομικά εξουσιοδοτημένος να συντάξει τα τεχνικά έγγραφα και δηλώνει ότι έχουν εφαρμοστεί τα ακόλουθα πρότυπα, συμπεριλαμβανομένων των κανονιστικών διαδικασιών που περιέχονται σε αυτά:

[H] Eredeti EU KONFORMITÁSI NYILATKOZAT
Az aláíró ezennel kijelenti, hogy a megadott gép megfelel a 2006/42/EC (gépirányelv) és a 2014/30/EU (elektromágneses összeférhetőség, EMC) irányelveknek, beleértve azok módosításait a tagországok nemzeti jogszabályaiba lefordítva. Az aláíró egyénileg jogosult a műszaki dokumentumok összeállítására, és kijelenti, hogy a következő szabványokat, beleértve az abban foglalt normatív eljárásokat, alkalmazták:

[LT] Originalus ES atitikimo deklaracija
Pasirašęs asmuo pareiškia, kad nurodyta mašina atitinka EB direktyvą 2006/42/EB (mašinų direktyvą) ir 2014/30/ES (elektromagnetinį suderinamumą, EMC), įskaitant jų pakeitimus, išverstus į šalių narių nacionalinius teisės aktus. Pasirašęs asmuo yra individualiai įgaliotas rengti techninius dokumentus ir pareiškia, kad buvo taikomi šie standartai, įskaitant juose nurodytas normines procedūras:

[LV] Oriģināls ES atbilstības deklarācija
Parakstītājs ar šo apliecina, ka norādītā iekārta atbilst EK Direktīvai 2006/42/EK (Mašīnu direktīva) un 2014/30/ES (Elektromagnētiskā saderība, EMC), ieskaitot to grozījumus, kas ir tulkoti dalībvalstu nacionālajos tiesību aktos. Parakstītājs ir individuāli pilnvarots sastādīt tehniskos dokumentus un apliecina, ka ir piemēroti šādi standarti, tostarp tajos ietvertās normatīvās procedūras:

[N] Opprinnelig EU-KONFORMITETSERKLÆRING
Underskriveren erklærer herved at den spesifiserte maskinen er i samsvar med EC-direktivet 2006/42/EC (maskindirektivet), og 2014/30/EU (elektromagnetisk kompatibilitet, EMC) inkludert deres endringer som oversatt til nasjonal lovgivning i medlemslandene. Underskriveren er individuelt autorisert til å sammenstille de tekniske dokumentene og erklærer at følgende standarder, inkludert de normative prosedyrene som finnes deri, er brukt:

[PL] Oryginalny DEKLARACJA ZGODNOŚCI WE
Sygnatariusz niniejszym oświadcza, że określona maszyna jest zgodna z dyrektywą WE 2006/42/WE (dyrektywa maszynowa) i 2014/30/UE (kompatybilność elektromagnetyczna, EMC) wraz z ich poprawkami w tłumaczeniu na ustawodawstwo krajowe krajów członkowskich. Sygnatariusz jest indywidualnie

upoważniony do sporządzania dokumentacji technicznej i oświadcza, że zastosowano następujące normy, w tym zawarte w nich procedury normatywne:

[RO] Original DECLARAŢIE DE CONFORMITATE CE

Semnatarul declară prin prezenta că maşina specificată este conformă cu Directiva CE 2006/42/CE (Directiva Maşini) şi 2014/30/UE (Compatibilitate electro-magnetică, EMC), inclusiv amendamentele acestora, astfel cum au fost traduse în legislaţia naţională a ţărilor membre. Semnatarul este autorizat individual să întocmească documentele tehnice şi declară că au fost aplicate următoarele standarde, inclusiv procedurile normative cuprinse în acestea:

[RUS] Оригинал Декларация соответствия стандартам ЕС

Настоящим подписывающая сторона заявляет, что указанная машина соответствует Директиве ЕС 2006/42/ЕС (Директива по машинам) и 2014/30/ЕС (Электромагнитная совместимость, ЭМС), включая их поправки, переведенные в национальное законодательство стран-членов. Подписавшаяся сторона имеет индивидуальное право на составление технических документов и заявляет, что были применены следующие стандарты, включая содержащиеся в них нормативные процедуры:

[S] Original EG-KONFORMITETSFÖRKLARING

Undertecknaren intygar härmed att den specificerade maskinen överensstämmer med EG-direktivet 2006/42/EC (maskindirektivet) och 2014/30/EU (elektromagnetisk kompatibilitet, EMC) inklusive deras tillägg som översatts till nationell lagstiftning i medlemsländerna. Undertecknaren är individuellt behörig att sammanställa de tekniska dokumenten och förklarar att följande standarder, inklusive de normativa procedurerna som finns däri, har tillämpats:

[SK] Originál vyhlásenie o zhode

Signatár týmto vyhlasuje, že špecifikovaný stroj je v súlade so Smernicou ES 2006/42/EC (Smernica o strojoch) a 2014/30/EU (Elektromagnetická kompatibilita, EMC) vrátane ich dodatkov preložených do národnej legislatívy členských krajín. Signatár je individuálne oprávnený zostavovať technické dokumenty a vyhlasuje, že boli aplikované nasledujúce normy vrátane normatívnych postupov v nich obsiahnutých:

[SLO] Original EU IZJAVA O SKLADNOSTI

Podpisnik s tem izjavlja, da je navedeni stroj v skladu z Direktivo ES 2006/42/ES (Direktiva o strojih) in 2014/30/EU (Electro-Magnetic Compatibility, EMC), vključno z njunimi spremembami, kot so prevedene v nacionalno zakonodajo držav članic. Podpisnik je posamično pooblaščen za sestavo tehnične dokumentacije in izjavlja, da so bili uporabljeni naslednji standardi, vključno z normativnimi postopki, ki jih vsebuje:

[TR] Orijinal AB Uygunluk Açıklaması

İmza sahibi, belirtilen makinenin AB Direktifi 2006/42/EC (Makine Direktifi) ve 2014/30/EU (Elektro-Manyetik Uyumluluk, EMC) ve bunların üye ülkelerin ulusal mevzuatına tercüme edilen değişiklikleri ile uyumlu olduğunu beyan eder. İmza sahibi, teknik belgeleri derlemeye bireysel olarak yetkilidir ve burada yer alan normatif prosedürler dahil olmak üzere aşağıdaki standartların uygulandığını beyan eder:

<the applied standards have to be shown here>

(1) Type: **XX XX– Self-propelled industrial truck**

(2) Serial No: **XXXXXXXX**

(3) Year of constr.: **YYYY**

(4) Manufacturer: Noblelift Intelligent Equipment Co., Ltd.
528 Changzhou Road, Taihu Sub-district, Changxing, 313100, PR China

(5) Responsible for compiling the technical documentation: <Company name>,
<Company Address>

(6) Date: <Place>, **YYYY.MM.DD**

(7) Authorized signatory: <Position> **Mr. Sample**

(1) Type/ Typ/ Tipo/ Modello/ Tyyppi/ Tipo / ΤΥΠΟΣ/ Típus/ Tip/ Тип/ Tips/ Tipas/ Tüüp:
(2) Serial No./ Serien-Nr./ N°. de série/ Serienummer/ Nº de serie/ Numero di serie/ Serienr./ Sarjanro/ αυξάνωναριθμός/ Seriové číslo/ Szériaszám/ Nr.Seryjny/ Serijska številka/ Výrobné číslo/ Серийныйномер/ Seri No./ Seerianr./ Sērijas Nr./ Serijos numeris:
(3) Year of constr./ Baujahr/ Année de constr./ Bouwjaar/ Año de constr./ Anno di costruzione/ Produktionsår/ Byggeår/ Tillverkningsår/ Valmistusvuosi / Ano de fabrico / έτοςκατασκευής/ Rokvýroby/ Gyártásiév/ Rokprodukcji / Letnik / Годизготовления / Üretimyılı / Väljalaskeaasta / Izgatavošanas gads / Gamybosmetai
(4) Manufacturer/ Hersteller/ Fabricante/ Fabricant/ Fabrikant/ Fabricante/ Produttore/ производител/ Výrobce/ Fabrikant/ Tootja/ Valmistaja/ Κατασκευαστής/ Gyártó/ Gamintojas/ Ražotājs/ Produsent/ Producent/ Producător/ Производитель/ Tillverkare/ Výrobca/ Proizvajalec/ Üretici firma
(5) Responsible for compiling the technical documentiton/ Verantwortlich für die Zusammenstellung der technischen Dokumentation/ Responsable de compilar la documentación técnica/ Responsable de la compilation de la documentation technique/ Verantwoordelijk voor het samenstellen van de technische documentatie/ Responsável pela compilação da documentação técnica/ Responsabile della compilazione della documentazione tecnica/ Отговаря за съставянето на техническата документация/ Zodpovídá za sestavení technické dokumentace/ Ansvarlig for udarbejdelse af den tekniske documentation/ Vastutab tehnilise dokumentatsiooni koostamise eest/ Vastaa teknisen dokumentaation laatimisesta/ Υπεύθυνος για τη σύνταξη της τεχνικής τεκμηρίωσης/ Felelős a műszaki dokumentáció összeállításáért/ Atsakingas už techninės dokumentacijos sudarymą/ Atbildīgs par tehniskās dokumentācijas sastādīšanu/ Ansvarlig for sammenstilling av teknisk dokumentasjon/ Odpowiedzialny za kompletowanie dokumentacji technicznej/ Responsabil cu intocmirea documentatiei tehnice/ Ответственный за составление технической документации/ Ansvarig för att sammanställa den tekniska dokumentationen/ Zodpovedá za zostavenie technickej dokumentácie/ Odgovoren za pripravo tehnične dokumentacije/ Teknik dokümantasyonun derlenmesinden sorumlu
(6) Date/ Datum/ Data/ Fecha/ datum/ Dato/ päiväys/ Kuupäev/ Datums/дата/ Dátum/ dátum/ tarih/ ημερομηνία
(7) Authorised signatory/ ImAuftrag/ pour ordre/ Incaricato/ Por orden de/ por procuração/ op last van/ påvegneaf/ påuppdrag/ Etteroppdrag/ psta./ Ülesandel / pavedus / v.i. / Попоручению / megbízásából /длъжностнолице / z pověření / z poverenia / po nalogu / napolecenie / din sarcina / adına / θαη' ελληνή