CBDR series

Electric Pallet Truck

● Operation Manual

● Parts Catalogue

DUROLL® **PRO**
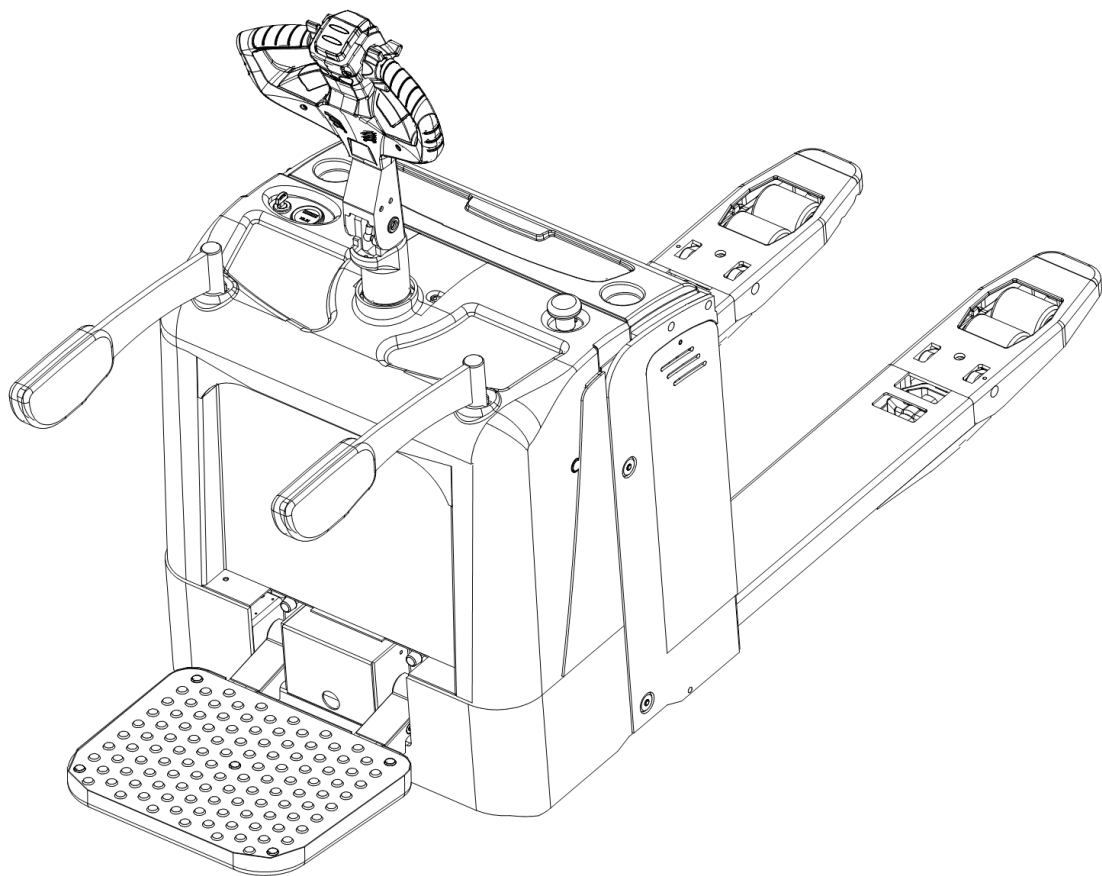
ZED6853HD

Welcome to choose CBDR series electric pallet truck!

Hope our electric trucks would bring great convenience to

your work！

- **Please read the manual carefully before operation.**
- **This manual is a universal manual. We reserve the right to modify technology of the electric pallet truck. If there is anything in the manual that is not consistent with the actual truck, the actual truck should be considered correct and the manual is only for reference.**
- **The instruction manual shall be accompanied with in case of truck leasing or transfer. Please come into contact with our sales department in case of any problem.**

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Warning

Descriptions of the labels：regulations of the following labels are of great importance to operators' safety and others as well.

⚠️	**Danger**	Indicates an impending danger. Deaths or severe injuries would be resulted without any precaution or avoidance. You must observe those requirements.
	Warning	Indicates a potential danger. Deaths or severe injuries would be resulted without any precaution or avoidance. You must observe those requirements.
	Caution	Indicates a potential danger. Moderate injuries would be resulted without any precaution or avoidance. You must observe those requirements.
☞	**Notice**	Pay attention to statements that are in direct or indirect relation with personal security and truck maintenance.

CONTENTS

I. Specified use

CBDR electric forklift is designed as a kind of ground material handling equipment to transport and lift goods.

Use, operation and maintenance must be done in strict accordance with the regulations mentioned in this operation manual. Sever injuries, damage of the truck, as well as loss of other properties might occur due to improper use of the truck. Rated capacity shown either in the nameplate or the load drawing must be born in operators' mind. Overloading or loading deflected to one side is forbidden. It's neither allowed to use the forklift in a fire and explosion hazard area, nor to use in corrode and dust area.

Obligations and responsibilities of the user: "user" refers to the natural person or legal person who use the forklift by himself or to appoint others to operate it. In cases like rent, "user" represents the contract terms between equipment owner and the user. The user must ensure that the forklift only is used to specified use, and promptly eliminate all potential dangers that is harmful to human life and health . In addition, the user must strictly abide by the accident prevention regulations, other safety technical regulations, and equipment operation, maintenance and maintenance philosophy. The use must ensure that all operations carefully read and fully understand the content of this operation manual.

If there is any violation to any of the regulations in this manual, the quality guarantee of the forklift   will automatically cease. Our factory rejects to bear any liability caused by any irregular operations.

Accessories installment：Any extra accessory installment that might has impact on the function of the truck must be done with a written permission from the supervisor. Approval of the local authority is required if needed. Review of the local authority doesn't represent our factory's opinion.

II. Electric pallet truck introduction

1. Scope of application

CBDR series electric pallet truck is powered by storage battery, and driven by a motor. It travels by gear transmission. There are electric steering and mechanical steering. The fork is lifted by the DC motor and the hydraulic actuation to push the cylinder up and down to lift the forks and the goods.

Rated load is displayed on the nameplate.

2. Allowed environment for using

a.   Altitude shall not exceed1000m;

b.   Ambient temperature is +40℃ - -25℃;

c.   When the ambient temperature reaches +40℃, the relative humidity should not exceed 50%; higher relative humidity is allowed if the temperature goes lower.

d.   Hard and flat ground;

e.   It is prohibited to use the truck in a flammable, explosive or corrosive environment with acid and alkali;

f.   Sufficient light is required over operation.

3. Technical parameters
3.1 Structure description
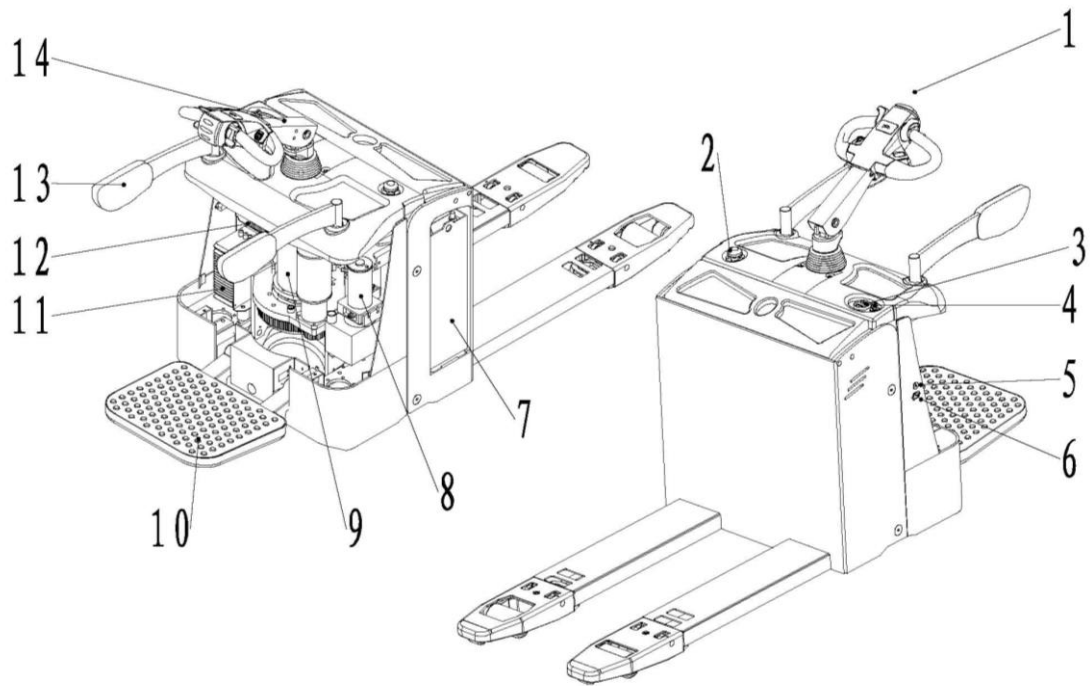
Number	CBDR	Name
1	●	Handle
2	●	Emergency stop switch
3	●	Instrument
4	●	Electric lock
5	○	Charging indicator (on-board charger)
6	○	Charging socket (on-board charger)
7	●	Battery
8	●	Hydraulic power unit
9	●	Drive unit (floating mechanisms of mechanism steering and EPS are
10	●	Standing platform
11	○	On-board charger
12	●	Electric control assembly
13	●	Guardrail
14	●	Steering mechanism(floating mechanisms of mechanism steering and EPS are different)
●=standard	○=option	

(1) instrument:

① 808 instrument

This instrument is a combination of battery capacity indicator and LCD hour meter, with the battery indicator of ten segments of colorful LED display (5 green segments, 3 yellow segments and 2 red LED).When the battery discharges by 70%, one red flicker lamp shows "energy storage" alarm. When the battery discharges by 80%, two red lamps flashes showing "energy exhaust". After the external power supply is cut off, the internal battery can generally keep storage memory of 10 years. When the life service time for monitoring of this instrument is 99999.9 hours recorded on LCD displays, the hour meter resets automatically and continues to time and display. Only if it is connected to battery, LCD hour meter will start working. This instrument possesses high reliability under extremely bad environment.
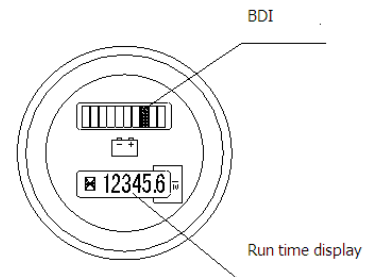
② 840 instrument

It displays sorts of systematic parameters, like, take Curtis instrument as an example, charge time, run time and motor controller under maintenance and serial communication sources. 3 LED lights: green indicates timing, amber indicates charging, red indicates failure.

③3140 instrument

It is an concise but attractive display designed to show key control parameters of the truck as well as the motor. It concludes 3 10mm figures and 6 5mm figures, which are all applied with 16 segment format to make full use of alphanumeric character set. LCD signal symbol with 16 segment allows reading with any light condition, and adoptable to all electric trucks. Percentage symbol, wrench symbol and decimal point are presented on the screen to provide more information about the truck's condition.
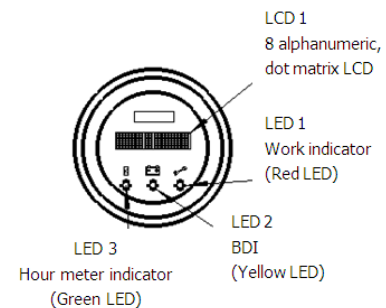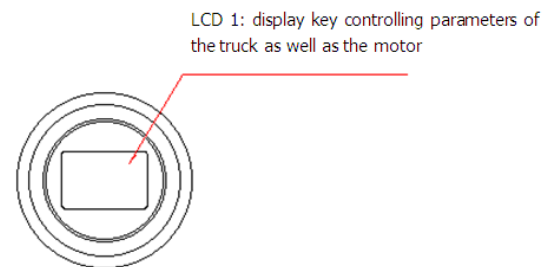
④Normally, the instrument mainly displays the travel speed,

battery quantity SOC, connection status and hour meter.

Unit for travel speed is Km/h, shown by percentage; min. resolution is 0.1Km/h,shown by battery symbol. The battery symbol is divided into 6 levels: if the battery quantity ≥ 90% shows a full battery, ≥80% shows full segments, while 60% is 3 segments, ≥40% is 2 segments, ≥20% is 1 segment and ≥0% shows an empty battery.

Unit for the hour meter is "h" with min. solution 0.1h(6mins). The symbol" h" flashes at 1Hz. When it alarms, the alarm signal "AL" will take place of the travel speed, flashing and disappearing at a frequency of 1S. If more than 1 alarms occur at the same time, alarm signal will roll on the display repeatedly with a time order. 4 alarms can be shown simultaneously.

(2) Steering system

The steering system is composed of operation handle, steering shaft, and floating support bearings. It is used to control directions of the truck.

(3) Brake

The brake of this truck is electromagnetic. When the accelerator pedal is released, the electromagnetic brake will be triggered. When the accelerator is released during traveling, the controller will carry out electric brake at first. It will regenerative braking and turn the dynamic energy to electric energy which can be recharged to battery. When the truck stops, the electromagnetic brake works. The regenerative braking not only prolongs the service time of the battery, but also reduces the wearing of the brake plate.

(4) Control buttons
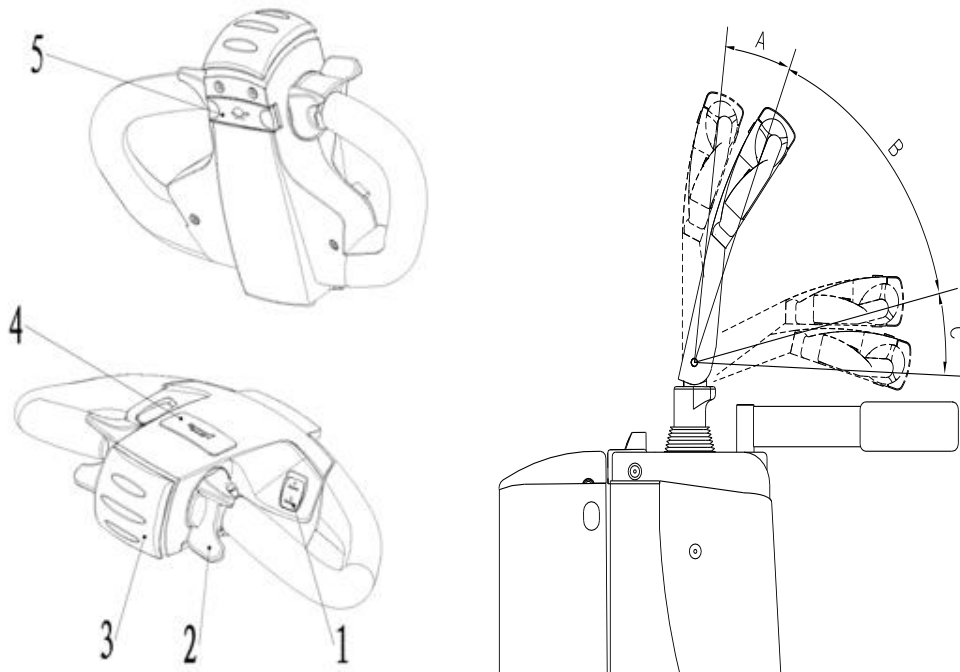
1.Lifting/ lowering button   2. Accelerator knob   3. Emergency reverse button   4. Horn
5. Turtle low speed button

①Lifting and lowering: Press the lowering button of the forks, the forks will descend. While the lifting button is pressed, the fork will rise.

②Accelerator knob: It is used to control the travel direction and speed of the electric truck. Before operation of the truck, firstly turn the operation handle to area B shown as above. When the handle is placed in area A or C, the truck will be powered-off and braked. At this time, the truck can not drive. When the operation handle is placed in area B and the acceleration knob is turned in one direction, the truck will travel in that direction. Meanwhile the truck will be accelerated with the increasing of rotation amplitude of the knob. When the accelerator knob is turned in another direction, the truck will travel in another direction. Likewise, the truck will speed up with the increasing of rotation amplitude of the knob.

③Emergency reverse button: when the operation handle is placed in area B and the emergency reverse button is pressed, the truck will travel in an opposite direction away from the operator immediately. This is a safety switch which can avoid the operator from being squeezed under unexpected condition.

④Horn button：the truck horns if this button is pressed

⑤Turtle low speed button: When this button is pressed, the truck will travel at an extremely slow speed. This button is applicable for operation on especially narrow field or on the condition that the truck needs to be accurately located.

(5) Electric lock

It is used to control switching-on and switching-off of main power supply of the truck. The key shall be kept by the truck driver or personnel who have been specially assigned. Be sure to cut off the main power supply when you leave the truck, and take the key of electric lock, for fear occurrence of accident due to operation carried out by others.

(6) Power switch ：to control the emergency power ON/OFF.

Press down the mushroom head to cut off the power, and pull up the mushroom head to connect the power. When the truck is out of control for unknown reasons, cut off the power immediately to avoid injury and accident.

(7) Charging line

It's one tool in the accessory bag. When the truck needs to charge, plug two ends of the line into the power supply and the connector at side of the truck respectively.

(8) Platform and guardrail: The driving mode of this truck is standing driving.

Normally, the standing pedal and guardrail should be open before driving the truck. During operation of the truck, the driver should stand on the pedal. When the working area is relatively narrow, the standing pedal and guardrail can be put away. Maximum traveling speed doesn't exceed 6km/h.

(9) Newest European guardrail and platform operation standards

Condition 1   Both guardrails and platform are folded, speed is≤5.0 Kmph

Condition 2.1 Both guardrails and platform unfolded, and operator is standing on the platform, speed is≤7.0 Kmph

Condition 2.2   Both guardrails and platform unfolded, but the operator is off the platform, speed is 0

Condition 3.1   Platform is unfolded, one of the guardrails is unfolded, and operator is standing on the platform, speed is 0.

Condition 3.2   Platform is unfolded, one of the guardrails is unfolded, and operator is standing on the platform, speed is 0.

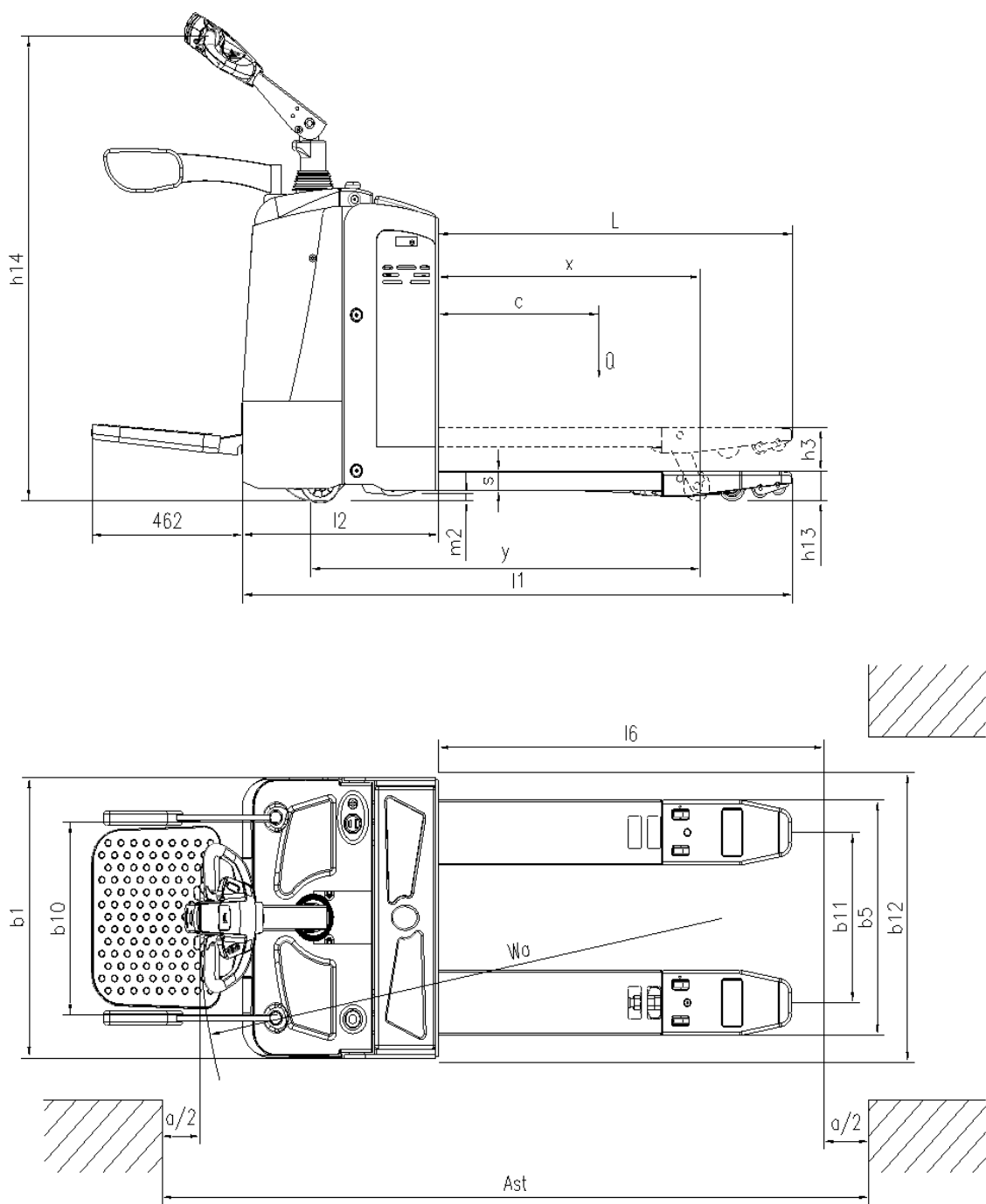Condition 4.1   Platform is unfolded, guardrails are folded, and operator is standing on the platform, Speed is ≤ 5.0 Kmph

Condition 4.2   Platform is unfolded, guardrails are folded, and operator is off the platform, speed is 0.

Condition 5   Platform is folded, one of the guardrails is unfolded or both are folded, speed is 0.

3.2 Main technical parameters (CBDR electric pallet truck)

ZED6853HD

				CBD20R-Ⅱ		CBD25R-Ⅱ	ZED6853HD
Characteristics	1.1	Manufacturer(abbreviated)					
	1.2	Model		CBD20R-Ⅱ		CBD25R-Ⅱ	**ZED6853HD**
	1.3	Driving mode		Electric		Electric	Electric
	1.4	Drive mode		Standing driving		Standing driving	Standing driving
	1.5	Rated load	Q(kg)	2000		2500	3000
	1.6	Load center distance	c(mm)	600		600	600
	1.7	Front overhang	x(mm)	914/964/1034		914/964/1034	914/964/1034
	1.8	Tread	Y(mm)	1211/1261/1331		1211/1261/1331	1286/1336/1406
Weight	2.1	Service weight(with battery)	kg	710		740	820
	2.2	Axle load, front/rear, laden	kg	1300/1410		1470/1770	1720/2100
	2.3	Axle load, front/rear, unladen	kg	600/110		620/120	660/160
Wheel chassis	3.1	Wheels		PU		PU	PU
	3.2	Wheel dimension, front		Φ250×70(80)		Φ250×70(80)	Φ250×80
	3.3	Wheel dimension, rear		Φ82×126（98）		Φ82×126（98）	Φ82×126（98）
	3.4	Additional wheel(dimension)		Φ127×57		Φ127×57	Φ127×57
	3.5	Wheel number, front/rear (x = driving wheel)		1X+2/2(4)		1X+2/2(4)	1X+2/2(4)
	3.6	Tread, front	b_{10}(mm)	537		537	537
	3.7	Tread, rear	b_{11}(mm)	340/370/470/505		340/370/470/505	340/370/470/505
Dimension	4.4	Lift height	h_3(mm)	120		120	120
	4.9	Min. /Max. height of operation handle, in driving position.	h_{14}(mm)	1050/1450		1050/1450	1050/1450
	4.15	Height, lowered	h_{13}(mm)	82		82	82
	4.19	Overall length	l_1(mm)	1710/1760/1830		1710/1760/1830	1785/1835/1905
	4.20	Length to fork face	l_2(mm)	610		610	685
	4.21	Overall width of truck body	b_1(mm)	775		775	775
	4.22	Fork dimension	S/e/l(mm)	54×180×1100 (1150/1220)		54×180×1100 (1150/1220)	54×180×1100 (1150/1220)
	4.25	Overall width of fork	b_5(mm)	520/550/650/685		520/550/650/685	520/550/650/685
	4.32	Wheelbase ground distance	m_2(mm)	28		28	28
	4.33	Aisle width, with pallet 1000x1200 crosswise	A_{st}(mm)	2360/2405/2475		2360/2405/2475	2435/2480/2550
	4.34	Aisle width, with pallet 800x1200 lengthwise	A_{st}(mm)	2245/2270/2305		2245/2270/2305	2320/2345/2380
	4.35	Turning radius	W_a(mm)	1550/1600/1670		1550/1600/1670	1625/1675/1745
Performance Data	5.1	Traveling speed, laden/unladen	Km/h	7/7		7/7	7/7
	5.2	Lifting speed, laden/unladen	mm/s	25/35	35/45	35/45	39/56
	5.3	Descending speed, laden/unladen	mm/s	35/30	60/55	60/55	64/50
	5.7	gradeability, laden/unladen	%	8/20		8/20	8/20
	5.10	Traveling brake		Electromagnetic		Electromagnetic	Electromagnetic
	6.1	Driving motor power	kW	1.2	1.5	1.5	2.2
Motor	6.2	Lifting motor power	kW	0.8	1.2	1.2	2.2
	6.4	Battery voltage/rated capacity	V/Ah	24/210		24/240	24/240
	6.5	Battery weight	Kg	195		200	200
		Battery dimension(LXWXH)	mm	750×170×534		750×170×570	650X249X500
	8.4	Noise level at operator's ear, according to DIN12053	dB(A)	70		70	70

III. Operation

1. Safety norms

![Warning triangle icon] **Warning** **Please pay attention to the following items first before operating：**

1) This electric truck is only limited to utilization indoor with a hard flat floor. Operation in inflammable, explosive environment or corrosive environment such as acid or alkaline condition shall be strictly forbidden.
2) Only drivers who have received formal training or are authorized can be allowed to drive the truck.
3) Read this instruction carefully before operation so as to master the performance of the truck; check the truck whether it is in its normal condition before each operation. It is forbidden to use faulty truck; repair by untrained persons is forbidden as well.
4) Overloading operation is forbidden.
5) As for goods carrying and operation, center of gravity of the goods must be within range of the two forks. It is forbidden to transport loose goods.
6) The truck shall travels slowly when forks pass in or out of pallet.
7) It is strictly forbidden to press the lifting or lowering button during the traveling of the truck. Meanwhile, don't switch lifting and lowering buttons rapidly or frequently, because rapid and frequent lifting or lowering will cause damage to the truck and goods
8) Don't load heavy goods on the forks rapidly.
9) Don't lay the goods on the truck for a long time.
10) It is strictly forbidden to make sharp turn on narrow aisle. When it is turning, slow down the truck so as to ensure the safety of personnel and goods.
11) Descend the forks to the lowest position when the truck is not used.
12) It is strictly forbidden to put any part of the body under heavy goods and forks！
13) This truck is suitable to be used on flat ground or flat platform. Don't put the truck on the slope for a long time.
14) Overloading operation is forbidden. Otherwise the wheel will skid, resulting in the damage of wheel and motor as well as danger of the human body and goods.
15) It is strictly to use the truck under stipulated voltage of 20.4V.
16) It is strictly forbidden to conduct charge by connecting the plug to AC power directly.

1.1 Safety operation norms

(1)Training of driver：

![Notice hand icon] **Notice**

Even though each electric pallet truck may have the same technical parameters, there may be differences on features of braking and acceleration as well. Never drive the truck until the operators get familiar with all those operations.

(2)Wear of the driver during truck driving：

![Notice hand icon] **Notice**

Put on safety shoes and protective clothes. Do not wear clothes that are too loose for sake of being caught, which would result in danger.

(3)Rules that must be observed:

☞ **Notice**

Never drive the truck when you are tired or un-concentrated, with an injection of drug, or after a liquor drinking.

(4)Safety of working place：

☞ **Notice**

This kind of electric truck is only limited to utilization indoor with a hard flat floor. Operation in inflammable, explosive environment or corrosive environment such as acid or alkaline condition shall be strictly forbidden.

A. Good roadway condition shall be kept and the traffic should be smooth.
B. Sufficient light ray shall be ensured on working place.
C. Fire extinguishing appliances shall be equipped in the places where truck and charging is operated.
D. The extinguishing appliances shall comply with the requirements of extinguishing fire of solid combustible matter and electric apparatus.
E. The value of truck noise mentioned in instruction is measured under the condition of new truck running on flat, smooth and hard ground. If the traffic surface is bad or the tyre of truck is damaged, the noise may be amplified..

(5)Integrity of the truck shall be realized

⚠ **Warning** **Do not make modifications on the truck**

A. Please observe safety rules and regulations of your working place during operation, inspection, and maintenance of the truck.
B. No modification or addition shall be made to the truck without written permission by our company. A modification of the truck may have a negative effect on its safe operation.

(6)Prepare safety operation procedure:

Safety operation procedure shall be formulated with consideration of practical situations before operation of the truck. Safety shall be taken into full consideration in preparation of the safety operation procedure..

(7)Operation of truck under unsafe condition is strictly forbidden:

A. Operation under unsafe condition is forbidden, such as under conditions with uneven floor, or impeded road. Goods lifting on slope is strictly forbidden.
B. Faulty truck is forbidden to use.
C. Make sure a daily inspection of the truck would be taken. Please immediately repair or replace in case of any abnormal conditions..

(8)Overloading is forbidden

⚠ **Warning** **Overloading would cause damage to the truck or bring harm to operators.**

(9)Use suitable pallet：

The pallet shall be of suitable dimensions, neither too wide nor too large(drivers should pay more attention for carrying extra-wide goods. Steer slowly and keep balance. Pay attention to the safety of all around meanwhile

(10)Electrical system inspection

Before checking the electrical system, turn off the key switches and the emergency isolation switches.

1.2 Safety Operation Specification

(1)Check the safety condition around the truck

A. Before starting up the truck, please ensure that there is no person around it..

B. If the driver's view is shielded by the bulky goods carried, please drive backwards or drive under the guidance of other working personnel..

C. Ensure no people around the truck when driving backwards..

D. Driving through the narrow access shall be guided by working personnel..

E. At crossroad or other places impeditive for view, the driver shall not drive until there is no person at both sides.

F. Keep concentration when operating truck.

⚠ Caution

The driving mechanism of truck is installed on the backside. Due to this difference from common trucks, the backside of truck swings comparatively fast when turning around. For this reason, to prevent collision with other objects nearby the backside of truck, do drive or turn slowly..

(2)Strictly forbid harsh driving

A. Never start up, brake or turn abruptly.(Abrupt start-up or braking may cause the falling of goods. Abrupt turning during traveling may cause the tilting of truck and result in serious accident. Do decelerate and take care to turn..

B. Observe all items of safety rules on working place. Decelerate and sound horn when travel by other truck or trucks. Avoid driving in places with bad view..

C. Ensure to provide certain clearance between truck and entrance.

(3)Never drive too close to roadside

Ensure to provide enough distance between the truck and roadside or platform edge. (When running on narrow road or platform, keep a certain safety distance with the edge against falling of the truck).

⚠ Warning **Avoid turning or loading and unloading operation on slope; otherwise the truck can go tilting.**

⚠ Warning **Once the truck is overturning, the driver should stay far away from the truck rapidly.**

⚠ Warning

a. **Forbid deflective transportation.**

b. **Passengers on truck must be forbidden.**

c. **Never push or pull the handle abruptly**

d. **Never use the truck as towing truck.**

2. Operation
2.1 Inspection before operation

For the sake of safety operation and good situation of the electric truck, it is compulsory to check the truck completely before operation. Contact the sales department of our company when founding problems.

	No.	Check point	Check content
Braking system	1	Operation handle	When the operation handle is turned, with the handle switching between area A and B, there is a noise from the brake.
	2	Brake clearance	The clearance between brakes should be kept between 0.2mm and 0.8mm.
Steering system	3	Operation tiller	Degree of tightness and rotary flexibility.
	4	Oil pipe	Leakage or not.
	5	Hydraulic oil	Appropriate oil quantity.
	6	Lifting oil cylinder	Whether there is any oil leakage.
Wheels	7	Pins, screws and all the fasteners	Check all the fasteners of the truck's wheels, i.e. pins or screws, loose or not.
	8	Wearing status	Compare the parameter list, replace the wheel when its diameter reduces by 5%.
Battery	9	Charge	Confirm the display state of the battery capacity.
	10	Electrolyte	The solution level and density of electrolyte.
	11	Connecting line	The connecting line and socket shall be firm.
Horn	12	Horn	Press down the horn button to check whether the horn sounds.
Instrument	13	Function	Turn on the switch of electric lock to check whether the instrument displays normally.
Others	14	Truck frame, etc	Damaged or not. If there is any crack.
	15	Function	Check that whether lifting, lowering, forward & backward movement and emergency reverse of the truck is normal, and if there is any abnormal noise.
Handle	16	Emer. reverse button	Turn the operating handle to the position of zone B and press the emergency reverse switch button on the top of the operating handle to see if the truck can move forward.
	17	Lifting, forward and backward button	Check whether the lifting, lowering, forward and backward driving of the truck are normal.

⚠️ **Warning** Never use any faulty truck

2.2 Driving：

(1) Start-up

Turn over the standing pedal and open the guardrail to turn the switch of electric lock to ON position. When the operation handle is turned to area B and accelerator knob is rotated slowly, the truck will start

gradually. The greater the accelerator knob is turned, the faster the truck travels.

⚠️ **Warning** **When handling goods, never rotate the accelerator knob rapidly to speed up the truck abruptly.**

(2) Slow-down

The driving motor of the car is an AC motor, and the running speed of the motor is always controlled by the speed control controller. Therefore, when the operator releases the accelerator knob slowly, the driving speed of the truck will slow down to achieve deceleration.

☞ **Notice**

When the working area is relatively narrow during operation, the standing pedal and guardrail can be put away. Then, the maximum traveling speed should not exceed 4Km/h.

(3) Turning

The driver stands on the truck pedal in the right gesture and backs to the forks. When the truck travels forward, if the operation handle is rotated clockwise, the truck will turn clockwise. If the operation handle is rotated counterclockwise, the truck will turn counterclockwise.

⚠️ **Caution**

The driving mechanism of truck is installed on the backside. Due to this difference from common trucks, the backside of the truck swings comparatively fast when turning around. For this reason, to prevent collision with other objects nearby the backside of forklift, do drive or turn slowly.

(4) Braking

Release the accelerator knob, then braking of the truck can be realized.

(5) Handling goods as the following procedures:

a   Decelerate when approaching the goods area;

Inspect safety condition around the stacking area;

b   Adjust position of the forklift, placing it in front of the goods;

c   Start the forklift slowly, and insert fork arms to the bottom of goods as deeply as possible.

d   Press the lifting button, raising forks to a position with a distance of over 40mm between bottom of the pallet and ground;

e   Start the truck and carry the goods to destination. Press lowering button and put the goods on the ground, making the forks totally out of the bottom of the pallet. Then travel backwards slowly.

☞ **Notice**

Before operating truck, do check the following items:

Make sure there is no goods falling and damaged in the loading area.

Make sure there is no goods or objects impeditive for safety.

2.3 Important notice after operation

(1) Parking: Park the truck at the appointed place. Never park the truck on slope.

Ensure the following before leaving away the truck:

a.   Lay down the fork to the lowest position naturally.

b.   Turn the steering wheel to the middle position.

c.   Turn off the key switch

(2) Clean up the truck

🖙 Notice

When cleaning up the electrical system, use compressed air but not water.

(3)Charge：

⚠ Warning

Open flame is forbidden to appear at the charge places, otherwise, explosion or fire disaster can be caused. (Make a record of charge. As for the charge method, refer to the part about storage battery operation)

(4) After operation, the smudge on truck shall be wiped out. Besides, the following check shall be carried out：

   a. Keep visibility of all graphics context marks such as warning signs, nameplate and notice board. These marks are able to instruct, caution and warn the operator to some degree.
   b. The situation about deformation, distortion, damage or breakage.
   c. Add lubricating oil and grease if necessary.
   d. Replace faulty components.

IV.Usage, maintenance and charge of the storage battery

The standard configuration for this truck is external charger and the optional is built-in charger

Charge the external charger
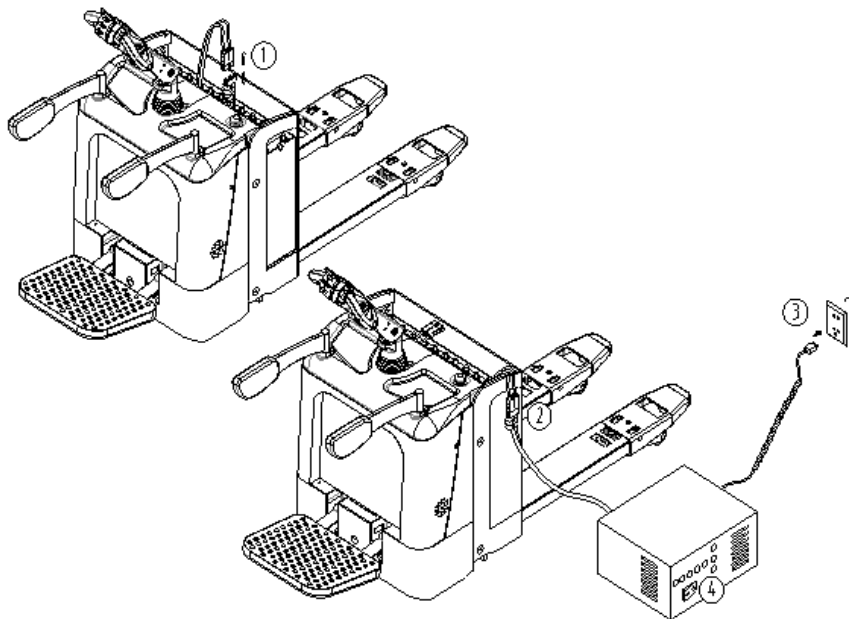
Steps to charge with an external charger

Step 1, Open the cover, pull out the charging socket from main circuit;

Step 2, Connect with charging plug of battery and charger;

Step 3, Put the battery socket into two-phase AC power supply;

Step 4, Open the power switch.
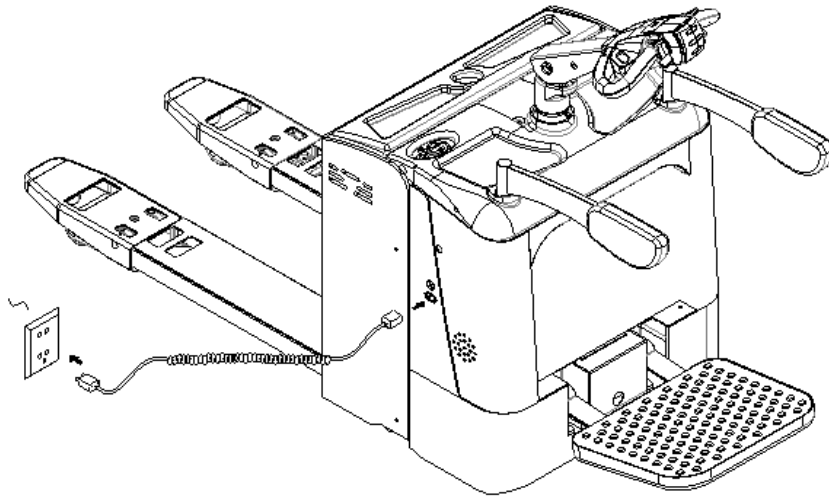
Steps to charge with an on-board charger

Step 1, Open up the over;

Step 2, Insert one end of the charging lead which comes with the truck into the socket;

Step 3, Put the other end into the two-phased AC power supply. Charge will start after several seconds.

⚠️ Warning

When charging, there is hydrogen in the battery box. The charging environment should have good ventilation conditions and no open fire. Otherwise, it will cause explosion or fire.

1. Initial charging

(1) The unused battery shall be charged for the first time before use. Before the initial charging, the battery surface shall be wiped clean to check whether there is damage and ensure reliable connection.

(2) Open the air cap.

(3) Under the condition that the charging equipment can work normally, the sulfuric acid electrolyte with the density of 1.260 ± 0.005 (25 ℃) and the temperature less than 30 ℃ is poured into the battery, and the liquid level is 15-25 (mm) higher than the protection plate. In order to reduce the temperature rise of electrolyte due to chemical reaction and let the electrolyte fully penetrate into the plate, the battery needs to stand for 3-4 hours, no more than 8 hours. The initial charging can only be carried out when the liquid temperature drops below 35 ℃. (if necessary, it can be cooled in the cold water tank) the electrolyte should be replenished when the liquid level drops after standing.

(4) Sulfuric acid electrolyte is made of battery sulfuric acid and distilled water which meet the national standard gb4554-84. Do not substitute industrial sulfuric acid and tap water. The standard temperature (25 ℃) density of electrolyte shall be converted according to the following formula.

$$D25＝Dt＋0.0007(t－25)$$

Where: D25: electrolyte density at 25 ℃.

　　　 DT: measured density of electrolyte at t ℃.

　　　 t: The temperature of the electrolyte at which the density is measured.

(5) Wipe out the electrolyte splashed on the battery surface, connect the positive and negative terminals of the battery pack with the positive and negative terminals of the DC power supply (charger) respectively, and turn on the power supply; first charge with 30A (phase I current), and then charge until the voltage reaches 28.8v (12 × 2.4V = 28.8v), then continue charging with 15A current of phase II. During the charging process, the electrolyte temperature shall not exceed 45 ℃, when it is close to 45 ℃, the

charging current shall be halved or the charging shall be suspended; the charging shall be continued after the liquid temperature drops below 35 ℃. However, the charging time shall be extended properly.

(6) The basis of sufficient power: when the battery is charged to 31.2v (12 × 2.6V = 31.2v) in the second stage, the voltage change is not more than 0.005 (V); the electrolyte density is 1.280 ± 0.005 (25 ℃), and there is no obvious change within 2 hours and there are dense bubbles, it is considered that the battery is fully charged. The charging capacity is 4-5 times of the rated capacity, and the charging time is about 70 hours.

(7) in order to accurately control the sulfuric acid content in the electrolyte, the electrolyte density of each battery should be checked at the end of charging. If there is any discrepancy, it should be adjusted with distilled water or sulfuric acid with a density of 1.40, and the electrolyte density and liquid level should be adjusted to the specified value within 2 hours of charging.

(8) After the initial charging, wipe the battery surface clean, and close the cover of the cover type liquid hole plug before putting into use

2. Use and maintenance

(1) In order to ensure the service life of the battery, the battery put into use shall be in the state of sufficient power; the battery with insufficient charge shall not be used. During use, pay close attention to the degree of discharge, and do not over discharge - i.e. when the voltage drops to 1.7v/piece (when the total voltage drops to 1.7V × 12 = 20.4v), when the electrolyte density drops to 1.17, stop discharging and charge in time; do not put it aside for a long time. This kind of supplementary electricity which needs to be carried out frequently in the use process is called ordinary charging.

(2) General charging: the general charging current is 30A in the first stage and 15A in the second stage. The charging method is the same as the initial charging. The charging power is 130-140% of the discharged power, and the charging time is about 12 hours.

(3) Overcharge shall be avoided for batteries in normal use, but the batteries under the following conditions must be overcharged appropriately, i.e. balanced charging.

    a   "Backward battery" in battery pack refers to the battery whose voltage value is lower than that of other batteries in the process of charging and discharging and the battery which has been repaired due to faults. (when equalizing charging, connect the positive and negative terminals of backward batteries with the positive and negative terminals of DC power supply separately.)

    b   The batteries in normal use shall be charged evenly every 2-3 months.

    c   Batteries that have not been used for a long time shall be charged evenly before use.

(4) Equalizing charge:

    a   Charge at 4A current.

    b   When the charging voltage reaches 31.2V (12 × 2.6V = 31.2V), the current (2A) will be reduced by half when there are bubbles in the electro hydraulic system.

    c   When charging to the state of sufficient power, stop charging for 0.5 hours and then charge for 1 hour with 1A current.

    d   After another 0.5 hours of off charge, charge for 1 hour with 1A current.

    e   Repeat d for several times until the battery bubbles occur violently as soon as the charger is closed.

3. Battery storage

The battery shall be placed in a clean, dry and ventilated warehouse with an effective storage period of two years. During the storage period, it shall be properly kept in accordance with the following requirements.

(1) It shall not be exposed to direct sunlight, and the distance from the heat source shall not be less than 2m.

(2) Avoid contact with any harmful substances, and any metal impurities shall not fall into the battery.

(3) It is not allowed to turn upside down, and it is not allowed to suffer any mechanical impact or heavy pressure.

(4) It is not allowed to store with electrolyte. If it is necessary to store with electrolyte under special circumstances, the density and liquid level of the electrolyte shall be adjusted to the specified value with sufficient batteries. After one month of storage, the power supply shall be made up once according to the normal charging method.

4. Electrolyte operation

(1) Check specific gravity

Check the specific gravity with a suction hydrometer. Do not spill the electrolyte during operation, and wear protective equipment.

(2) Operation other than inspection

Consult a professional, especially when replenishing the electrolyte (dilute sulfuric acid).

(3) Electrolyte leakage

In case of electrolyte leakage due to battery tipping and damage, emergency treatment shall be carried out immediately (refer to emergency treatment items)

5. Exhausted battery treatment

(1) Treatment on the exhausting battery

When the battery is close to the end of its life, the electrolyte in the single cell is reduced very fast. Distilled water should be added every day.

(2) Disposal of waste batteries

For the waste battery, extract the electrolyte and disassemble the battery. It can be discussed whether the battery manufacturer will recycle it. Waste electrolyte shall be disposed according to relevant local regulations.

6. Response to possible emergencies

(1) Electrolyte splashes on the skin, Flush with plenty of water

(2) Electrolyte splashes into eyes

Rinse with plenty of clear water and receive treatment from a professional doctor

(3) Electrolyte splashes on clothes

Take off the clothes immediately, wash with water and then wash with weak alkaline soap solution.

(4) Electrolyte leakage

When the electrolyte leaks, immediately neutralize it with lime, strong carbonated soda or carbonated soda, and wash it with plenty of water.

7. Charger

If the charger you are using is a fully automatic charger, your charger must meet the following two requirements:

a   charger output voltage: 24V

b   charger output current: 20-30A

If the charger you are using is semi-automatic or manually adjustable, please charge the battery pack according to the requirements in point 2 use and maintenance.

8. Battery replacement

Battery weight is 20KG, replace the battery as follow:

(1) Open and remove the battery side door;

(2) Unplug the battery connector from the truck body;

(3) Turn the location pin and lift it up;

(4) Pull out the battery from the side, and remove the battery with a special trolley or lifting method;

(5) The method of loading battery group is opposite to the above steps.

![Warning icon] **Warning**

When lifting or carrying the battery, it must be handled with care, otherwise the battery may be damaged or personal injury may be caused
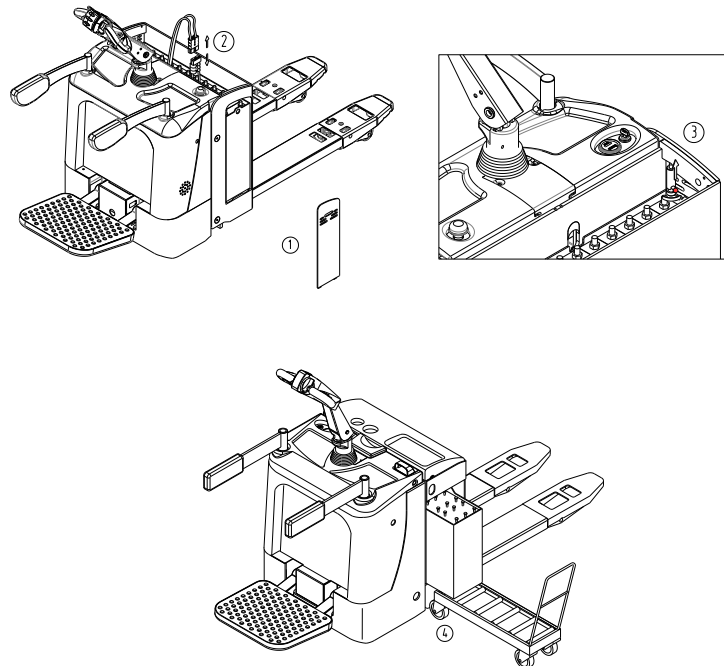
V. User Requirements for the Secondary On-board Li-ion Battery System

This URD is generally applied into the usage , maintenance and any other operations occur to the Li-ion batteries (Secondary On-board Li-ion Batteries System) on both electric storage and logistic trucks 。

1. Requirements on operators

(1) Relevant people who are able to use, maintain and take any actions to Li-ion batteries on all electric storage and logistic trucks (hereinafter referred to as operators).

(2) All operators only are allowed to operate the Li-ion batteries under the backgrounds of professional training , acquiring certain knowledge of Li-ion batteries, and obtaining certifications from relevant departments.

2. Safety Regulation

(1) These signs shown below might be found either on the Li-ion battery cases or on the trucks, which are set on the consideration of the safeties of the batteries as well as the operators. All the operations must be under the guidance of them.

High Voltage Warning：
It indicates a possible danger of lightning shock. All the electric work of the equipment must be finished only by qualified professional workers. Unauthorized disassembly is prohibited

Corrosive Risk Sign：
It indicates to pay attention to protect the products when unsafe factors exist over the production.

Waterproof & Humidity proof Sign：
It indicates to protect the products from rain, water and humidity.

No Fire Sign：
It indicates that fire is prohibited in this area when the product is on.

Do Not Step Sign：
It indicates the products must not be stepped on.

(2) The use of Li-ion battery trucks shall be in accordance with the requirements of temperature, humidity and environment specified in the truck instructions, and the maintenance and disassembly of lithium battery shall be carried out when the battery case is clear without any foreign bodies, especially metal tools, and there are no impurities or blockages in the air duct.

(3) Operators are forbidden to short-circuit connect lithium batteries, otherwise the system will be seriously damaged and people will be injured.

(4) Li-ion batteries should be kept away from heat , fire and avoid long time direct sunlight. Li-ion batteries must not be placed in liquid (such as water, solvent) or high humid environment to avoid damages caused by leakage or short circuit.

(5) Installation, commissioning and maintenance of lithium batteries in rain and snow weather should be carried out indoors to prevent short circuit caused by rainwater entering Li-ion battery system.。

(6) Because of the communication protocol between the management of lithium batteries and trucks, it is prohibited to interchange lithium batteries with the same voltage and capacity on different trucks without the permission of the host plant.

(7) It is forbidden to mix Li-ion batteries with other batteries in one truck. For the truck that is about to replace batteries, it is necessary to check up whether the new batteries   are with the same model and with the same group or not before restart it.

(8) The Li-ion battery cases shall be transported and moved strictly in accordance with the regulations without any improper operations like towing, prying and kicking, which will cause mechanical impact on the batteries, such as dropping, impacting and pressing. It's highly prohibited to overlap, upside down and side-up lithium battery cases.

(9) It is necessary to ensure the correct connection and normal operation of the lithium battery management system whether charging or discharging, and to ensure the normal communication between the lithium battery management system and the truck system.

(10) Li-ion batteries are prohibited to contact and to be placed together with objects that will possibly cause a short circuit. Sharp stuff and workers in clothes and accessories with metal are not permitted to get close to Li-ion batteries.

(11) Periodically check the lithium battery information displayed by truck meters. If there is any problem, do not open and operate the battery case by yourself. Contact relevant technical personnel immediately for further guidance.

(12) Unauthorized disassembly, damage and installation of lithium battery components are strictly prohibited. It is forbidden to dissect lithium batteries or lithium battery groups without authorization in order to avoid danger. Non-professional workers are forbidden to replace the data transmission

interface and voltage acquisition interface of lithium battery management system to prevent short-circuit damages to system components and even cause fire. Safety warning signs must be obeyed for safety 's sake.

(13) If operators find any of the following situations or have any concerns about the safety of the product, shut down the truck first, and take measures like disconnecting the power connection to ensure the safety of both the operators and the truck, then immediately contact the relevant personnel for further guidance. Solutions provided as follow:

   a   Contact relevant technicians for emergency repair when see the signs of overheating, smoking, sparking; battery pack damage (such as rupture), battery leakage; battery system case and power cord take in water.

   b   Contact relevant technicians for an overhaul when see ruptures or damages of the power cord, plug, extension cord, protective device; or when confronted with the problems that don't threat personal or truck's safety , like the truck fails to work normally.

3   Requirements on Charging the Li-ion batteries

(1) The charging temperature range is 0-50℃. Li-ion batteries are not allowed to charge in the environment below 0℃ except those with heating system. Low-temperature charging will cause lithium evolution and affect the service life of Li-ion batteries.

(2) The charging place should keep clean and well ventilated, and always keep away from inflammable and explosive articles. Fireworks are strictly prohibited in the charging area.

(3) Operators are suggested to help themselves to charge only with the certain charging equipment coming with the truck from the manufacture to maximize the safety performance of Li-ion batteries. Make sure to connect the positive and negative poles correctly and never do reverse charging.

(4) After the battery is fully charged, unplug the charging line in time to avoid other safety problems.

(5) Abnormal termination of charging may occur during the charging process of lithium batteries. For example, if the charging voltage is too high or the charging current is too large. The phenomenon is defined as "Abnormal Termination of Charging". When it occurs, it may indicate the leakage of lithium batteries or failure of some parts. It is necessary to notify relevant technicians for a complete inspection, finding out the causes and solving them before resuming the charge.

4.   Requirements on discharging the Li-ion batteries

(1) Discharge temperature range is -20-60℃.

(2) When a lithium battery fault is found in display during the start-up or operation of a truck, the cause of the fault should be inquired according to the display code and the schedule of the truck instruction, and the technical personnel should be notified to deal with it in time.

(3) It is necessary to ensure that lithium batteries are not less than 50% charged before maintenance or repair.

(4) To prevent damages of lithium batteries caused by over discharge, it is necessary to charge lithium batteries in time when the instrument displays low charge alarm.

5   Requirement on transportation and unloading

(1) Firm out packages are highly required when Li-ion batteries are about to transport.

(2) Sign of water proof, sing of humidity, sign of upward, sign of careful and light handling shall be attached to the out packages. In case of being damaged, the battery cases must be placed upward according to the sign.

(3) When the lithium batteries are dislocated or extruded during transportation, the exposed wiring harness and connectors should be checked to see if the lithium batteries are damaged or deformed. In case of smoke, sparking, stay away from the scene immediately, and professional technicians should be notified.

6. Requirements on the storage

(1) The storage of lithium batteries should be in clean and ventilated rooms with ambient temperature ranging from - 10 ~35 ℃ (recommended storage temperature ranging from 0 ~25℃). Long-term storage batteries (more than 3 months) should be placed in an environment with temperature of 25 ±3 ℃) and relative humidity of 65 (±20%).

(2) The contact between lithium battery and corrosive chemicals or gases shall be avoided, so as to prevent the corrosion of lithium battery or its connecting parts, affecting the appearance and service life of the battery.

(3) Keep Lithium batteries away from fire and heat, meanwhile, keep the batteries dry.

(4) Insulation, waterproof and dustproof are required over the storage. Make sure that the protective cover plate above the lithium battery case is fixed tightly without defects and damages. The battery case should be covered with insulation materials and sealed if there is no sealing cover plate.

(5) When lithium batteries are to be stored, the charge should be above 30%. In order to prevent over discharge during long-term storage (more than 3 months), batteries should be charged regularly, keeping the charge at 50%-80%.

(6) It is required to conduct a charge check once a month for those long-term parking trucks. After check, make sure the charge is between 50% and 80%. Charge it till the required amount if the charge is insufficient.

(7) Long-term idle lithium batteries need periodic charge-discharge activation and a standard charge-discharge cycle once a month.

VI.maintenance and repair

1. Maintenance

Comprehensive check for truck can avoid malfunction and ensure the service life. The hours listed in maintenance procedures is based on the cases that the truck works for 8 hours per day and 200 hours per month. For the sake of safety, maintenance shall be carried out according to maintenance procedure

🖝 Notice

All the repair work shall be carried out by professional personnel

Please contact the sales department of our company if you need to adjust or replace the components.

Precautions during maintenance：

🖝 Notice

The components for replacement shall be produced completely by our factory.

When replacing components of the truck, the components with the same safety requirement with the original design shall be used.

The lubricating oil and hydraulic oil in use shall be recommended by our company.

a Places for maintenance：

🖝 Notice

The place for maintenance shall be appointed and can provide other services such as hoisting and safety protection facility etc.

The place shall have level ground and good ventilation.

The place shall be equipped with fire-extinguishing devices.

b Precautions before repair and maintenance：

☞ **Notice**

No smoking.

Arrange the self-protection

Wipeout the effusive oil in time.

Before adding lubricating oil, clean up the dirty oil or dust on the joint with brush or cloth.

Except certain situation, turn off the key switch and pull off the power socket.

Lower down the fork arms to the lowest point when carrying out maintenance.

Ensure no goods on the truck when demounting the high pressure oil pipe. Besides, the fork arms shall be descended to the lowest position, by this way, the pressure of hydraulic system can be released.

For the reason that there are capacitors storing a little amount of electric energy in circuit, so before contacting the binding post of the main circuit, discharge at first.

Clean the electric section with compressed air, never flush with water.

When the truck requires high-position maintenance, the altitude safety protection must be carried out for the repairing and maintenance personnel.

2. Inspection and maintenance before the new truck put into operation

In order to follow the industry related regulations and ensure the absolute security to the truck in the transportation, for new ex-factory truck, it is possible that there is no electrolyte inside storage battery before the first use (except the inland sale).

The electrolyte of storage battery is prepared well before the truck leave the factory, and it is filled I nto the storage battery by the professional personnel before the first use. First, place the truck to the site with good ventilation, open the lid of storage battery box, and open all the top plastic lids of storage battery. The plastic pot with storage battery electrolyte inside is raised using plastic funnel, and the electrolyte is poured into the storage battery in a slow way until the liquid level can be seen. After all the storage battery is filled, conduct initial charge to the storage battery timely according to the operation requirements of initial charge 4.1.

3. Daily inspection

Inspection of hydraulic oil level: lower the fork to the lowest position, look over the oil level from the oil window. The distance between oil level and the bottom of oil tank is about 70mm, and oil charge is 1.5L. Recommendatory trademark for the hydraulic oil should be chosen.

Check the capacity of storage battery: refer to the use and maintenance of storage battery.

4. The inspection according to the need

(1) Clean the truck

(2) Inspect and screw down each fastener

(3) Inspect the damage state of wheels

5. The inspection and maintenance with different intervals

after 50 hours (Weekly)

Braking system	1	When the operation handle is turned, with the steering handle switching between area A and B, there is a noise from the brake.	
	2	The oil dirt and dust on the turning gearwheel should be cleaned.	
	3	The clearance between brakes should be kept between 0.2mm and 0.8mm	
Capability of electrolyte	4	Inspect the liquid level of electrolyte, pure water can be used for supplement if the liquid level is too low.	
density of electrolyte	5	The specific gravity should be1.28g/ml after charged.	

Clean the storage battery	6	Cover the lid, and flush with tap water.
Inspect the contactor	7	Burnish the coarse surface of contacts using sand paper.

after 200 hours(Monthly)

Besides the weekly maintenance, the following maintenance should be carried out, and when the parts must be adjusted and replaced, please contact with maintenance personnel of our company. (keep monthly maintenance record)

	No.	Check point	Check content
Whole truck	1	Whole status	Abnormal or not.
	2	Horn	Sound
Steering system, braking system, hydraulic system and lifting system	3	Operation handle	When the operation handle is turned, with the handle switching between area A and B, there is a noise from the brake.
	4	Brake clearance	The clearance between brakes should be kept between 0.2mm and 0.8mm.
	5	Operation handle	Degree of tightness and rotary flexibility.
	6	Truck frame and fastener	Function, and check cracks, lubrication and tightness of fasteners.
	7	Connecting rod and wheel carrier	Function and check the cracks, bending, deformation and lubrication condition.
	8	Oil pipe	Whether oil pipes leak or not.
	9	Hydraulic oil	Proper quantity of oil.
	10	Lifting oil cylinder	Whether there is any oil leakage or not.
Storage battery, charger and electric system	11	Battery connector	Loosen or connected
	12	Plug	Function, whether it is damaged or not
	13	Key switch	Function
	14	Contactor	Contact performance and function
	15	Inching switch	Function
	16	Controller	Function
	17	Driving motor	Wearing status of carbon brush and selenium rectifier.
	18	Lifting motor	Wearing status of carbon brush and selenium rectifier.
	19	Steering motor	Wearing status of carbon brush and selenium rectifier.
	20	Fuse	Whether it is perfect or not
	21	Wiring harness and connection terminals	Whether flexible and whether damaged or not.

1200 hours(every six months)

During the maintenance for a half year, the maintenance process for three months shall be repeated. When the parts must be adjusted and replaced, please contact with maintenance personnel of our company.

Contactor	Burnish the coarse surface of contacts using sand paper.
	Replace according to the status when the function is not well.
Motor	Wearing status of carbon brush and selenium rectifier..
Decelerate box	Replace the gear oil
Oil filter	clean
Brake	Clean the dirt and dust on friction plates of the brake, meanwhile check the wearing status of the friction plates.
Hydraulic system	Replace hydraulic oil. Check that whether there is any leakage in the lifting cylinder or not and replace the seals when necessary
Fork wheel and bearings	Check the wearing condition, and replace them if necessary

6. Recommended working medium:

(1) Hydraulic oil:

a. When it is normally loaded, we advise:

Hydraulic oil: LHPISOVG46, in accordance with standard DIN51524T.2, the average sustained temperature should between 40 °C to 60 °C.

b. When it is over loaded, we advise:

Hydraulic oil: LHPISOVG68, in accordance with standard DIN51524T.2, the average sustained temperature is above 60 °C.

c. When it is lightly loaded with low temperature, we advise:

Hydraulic oil: HLPISOVG32, in accordance with standard DIN51524T.2, the average sustained temperature is below 60 °C.

d. At the occasion with variable loading, we advise:

All the working conditions mentioned above can use the hydraulic oil LHPISOVG46 in accordance with standard DIN51524T.2 for replacement. The viscidity of this lubricant is very high (mostly used hydraulic oil).

If it is difficult to buy hydraulic oil, SAE20W/20 engine oil can be used to substitute HLP68 hydraulic oil.

(2) Gear oil：

Hyperbola gear oil 85W-90(GL-5)

(3) Lubricating grease:

Lithium grease of #3

All kinds of depleted hydraulic oil, gear oil and grease will pollute the environment. For this reason, recycle the replaced working medium or treat according to local pertinent regulations

7. Structure of lifting cylinder and wearing parts：
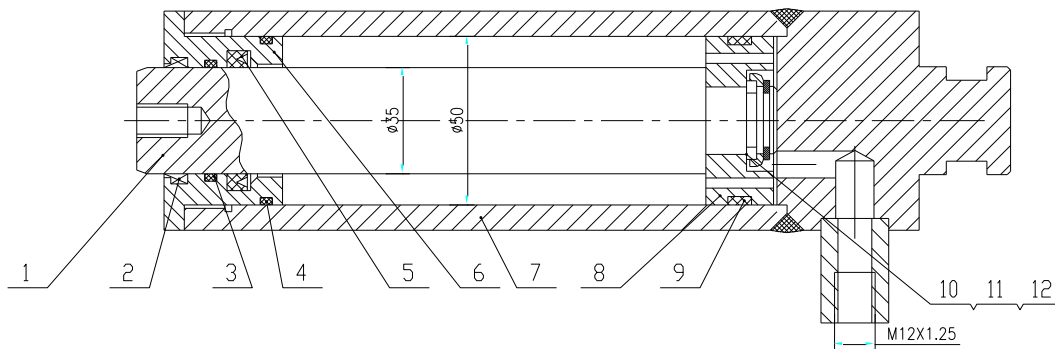
1. Plunger   2. Dust ring DH35   3. O-rings 35.5X2.65   4. O-rings 42X2.65   5.Seal ring UHS35
6. Guide sleeve   7. Hydro-cylinder   8.Piston   9. Rider ring   10. Semi-ring
11.Pad   12. Circlip for shaft 20

8. Maintenance period of consumables and partial parts:

Items	Maintenance content	Maintenance period	Remarks
Bearings of fork wheel	Replacement	1200 hours	
Fork wheel	Replacement	1200 hours	
Seals	Replacement	1200 hours	Replace when found damaged
Gear box	Replacing lubricant grease	1000 hours	
Hydraulic oil	Replacement	1000 hours	
High pressure oil pipe	Replacement	2000 hours	Replace when found damaged
Strainer of hydraulic reservoir	Cleaning	1000 hours	
Driving motor	Check for carbon brushes and bearings	1000 hours	
Steering motor	Check for carbon brushes and bearings	1000 hours	
Oil pump motor	Check for carbon brushes and bearings	1000 hours	

9. Common faults and trouble shooting:

9.1Mechanical failure

Faults	Possible cause	Trouble shooting
Abnormal noise during lifting	The oil-absorptive filter is blocked	Clean or replace the oil-absorptive filter
	The oil-absorptive tube leaks and the oil are foaming.	Fasten the tie-in, check the oil level, or add some oil.
	Hydraulic pump or motor is damaged.	Contact maintenance personnel of our company
	Seal malfunction, and make the air enter oil pump.	Contact maintenance personnel of our company
	The viscidity of oil is not correct, oil level is too low.	Replace the oil or add some oil
Weak hydraulic system or its	Malfunction in pump oil-absorptive, and noise exists.	Replace the oil or add some oil

pressure is low	Oil pump is damaged	Contact maintenance personnel of our company
	There is malfunction in valve block.	Contact maintenance personnel of our company
	The pipeline is broken or leaking.	Replace the pipeline or screw down the tie-in.
	The viscidity of oil is not suitable; the leakage loss is too great.	Change the oil.
The oil pressure is not stable	The cause is the same as that of abnormal noise.	Refer to the treatment methods for abnormal noise.
	The lifting cylinder or seal ring is worn.	Replace the cylinder sleeve or seal ring
	The quantity of oil is not enough	Add oil
The truck cannot start	Storage battery is used up.	Inspect, charge, or replace the storage battery
	The wire terminal is loosened.	Screw down the terminal screw
	he fuse is burn out.	Replace the fuse
	The accelerator is damaged.	Replace accelerator
The direction is ineffective and heavy.	The steering device is blocked by the abnormal matter.	Clean up the foreign matter.
	The bearings of steering device are worn.	Replace the bearings
Brake failure	The friction plates of the electromagnetic brake are damaged	Replace
Brake doesn't release	The electromagnetic brake is out of electricity.	Check the circuit.
	The clearance of the electromagnetic brake is too large.	Adjust the brake clearance to 0.2mm.

Adjustment methods of safety valve pressure

The pressure of safety valves has already been adjusted when the truck is ex-factory. Users shall not adjust the pressure at will. Otherwise it will bring danger to the truck's hydraulic system and safety. If the oil pressure is not in accordance with specified value, please ask the professional personnel to adjust according to the test methods stipulated in the JB/T3300 standards as well as the following methods:

a Screw out high pressure oil tube and install pressure meter with capacity over 20Mpa at the high pressure oil outlet.

b Press lifting operation button to measure the system pressure. The stipulated system pressure is 11.5Mpa for truck with rated load of 2000KG and 13.5 Mpa for truck with rated load of 2500KG.

c If oil pressure is not in accordance with the specified value, please loosen locknuts of the overflow valves. Turn pressure screw left and right until the pressure reaches the specified value. When the screw is turned

Locknut

Pressure adjusting screw
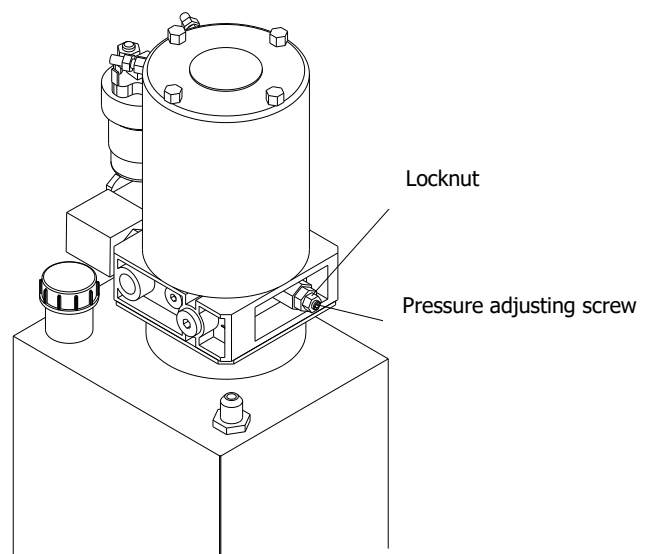
clockwise, the system pressure increases. While the screw is turned counter-clockwise, the system pressure decreases.

d   After the adjustment, please screw down the locknuts.

Hydraulic principle diagram

Lifting cylinder

Small cylinder of the floating mechanism (Mechanism steering only)

Solenoid valve

One-way valve

Relief valve

Motor

Speed limit valve

Oil pump

Oil filter

Oil tank
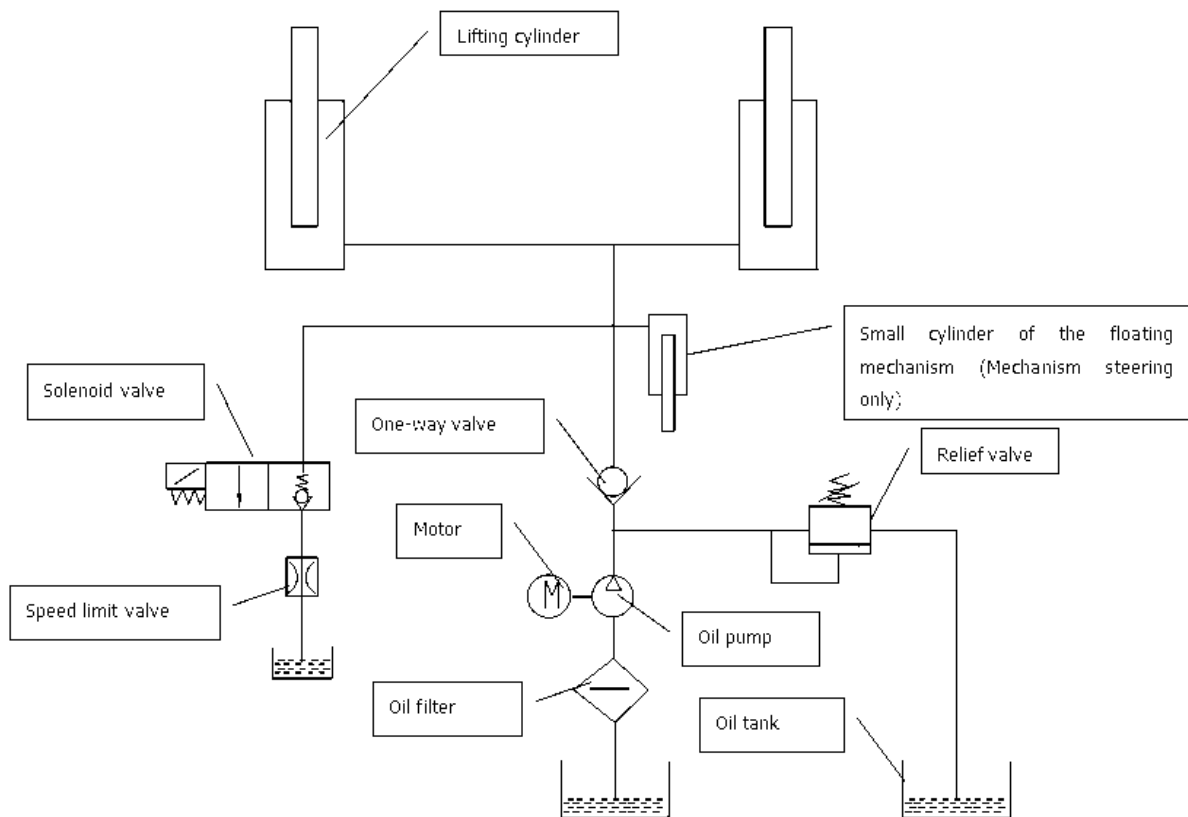
9.2 Controller error code

a. 1230 controller
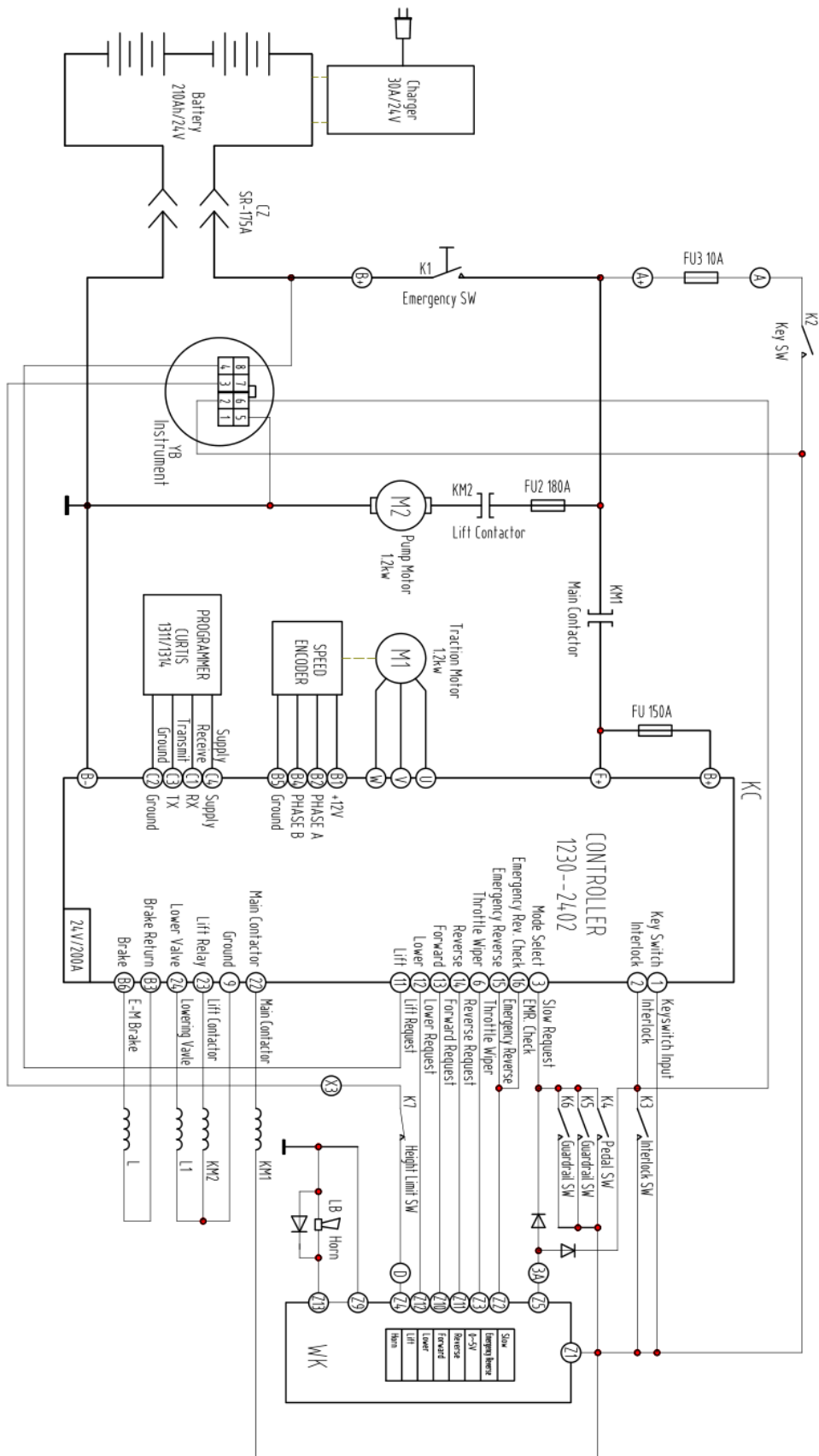
LED CODE	1311 Display	Description	Possible causes
1,2	motor speed encoder	The speed sensor signal can't be detected.	1 Incorrect or ineffective speed sensor wiring.
			2 Controller defective.
	Motor Failsafe	The motor speed is not in the normal scope.	1 Speed sensor malfunction.
			2 The electromagnetic brake of motor is not loosened completely.
			3 Insufficient braking torque.
			4 P,I setting improper
			5 Failsafe delay too short
1,3	Motor Overcurrent	Motor overcurrent	1 Incorrect motor wiring
			2 Controller defective.
	Motor Output Fault	Controller output abnormal	1 Incorrect motor wiring
			2 Controller defective.
1, 4	Static Return To Off	SRO sequencing error	1 Improper sequence of KSI,INTERLOCK,F/R
			2 Wrong SRO type selected.
			3 Direction switch malfunction.
			4 Sequencing delay too short.
2, 1	Throttle Wiper High	Accelerator voltage is too high.	1 Accelerator is damaged.
			2 Wrong accelerator type selected.
2, 2	EMR Wiring Open	EMR wiring fault	1 EMR wire or check wire broken.
2, 3	High Pedal Disable	HPD	1 Incorrect sequence of accelerator and KSI,INTERLOCK.
			2 Wrong HPD type selected.
			3 Accelerator malfunction
			4 Key switch and INTERLOCK power-off.
			5 Sequencing delay too short.
			6 Wrong accelerator type selected.
2, 4	Throttle Wiper Low	Accelerator voltage is too low.	1 Accelerator is damaged.
			2 Wrong accelerator type selected.
3, 1	Multiplexer Fault	Multiplexer malfunction	Multiplexer malfunction
3, 2	Main Contactor	Misssing or welded main contactor.	1 Main contactor coil open.
			2 Main contactor stuck closed
			3 Welded main contactor
			4 Main contactor driver shorted.
	Precharge	Precharge fault	1 Controller defective.
			2 Low battery voltage.
3, 3	Brake Fault	Electromagnetic brake fault.	1 Brake coil shorted or open.
			2 Brake driver fault.
4, 1	Service Total Disable	Total KSI timer has expired.	Expired total KSI timer.
	Service Driver Disable	Total driving timer has expired.	Total driving timer has expired.
	Service Total Expired	Setted (KSI) service timer has expired.	Setted (KSI) service timer has expired.
	Service Driver Expired	Setted (driver) service timer	Setted (driver) service timer has expired.

			has expired.	
4, 2	Battery Over voltage	Battery voltage is too high.	Battery voltage is too high.	
	Battery Under voltage	Battery voltage is too low.	1 Battery voltage is too low.	
			2 Corroded battery terminal.	
			3 Storage battery is damaged.	
4, 3	Temperature Cutback	Controller heatsink is too hot or too cold.	1 The power of controller is small.	
			2 Excessive load on truck fo a long time.	
			3 Abstraction of heat is bad.	
4, 4	Anti Tiedown	Mode switch is closed at startup.	1 Mode switch is adhesive.	
			2 Switch is in M2 position.	
5, 1	Hardware Failure	Hardware failure	Controller defective.	
5, 2	Software Failure	Software failure	Controller defective.	
5, 3	Parameters Corrupt	Parameters corrupt.	Controller defective.	

LED display code examples, (2,4)：✪✪ ✪✪✪✪ LED flashes 2 times continuously and flashes 4times again after several seconds

- 1230 controller equipped with motor encoder
- Specified steps to inspect:

  Do system measurement and troubleshooting with encoder ligature and voltage. Voltage between positive pole and negative pole is 12 v in normal circumstances.

  The voltage of A (J2-2) to the negative electrode (j2-5) is 0V or 10V,

  The voltage of B (j2-4) to negative (j2-5) is 0V or 10V.

- Alternating transformation are 0V and 10V of rotary motor encoder A,B negative pole (J2-5). Speed cases will keep 5 v unchanged under the condition of fast speed

b. 1232 controller

Mechanical steering + lead acid battery

Mechanical steering + lithium battery

EPS+Lead acid battery

EPS+ Lithium battery
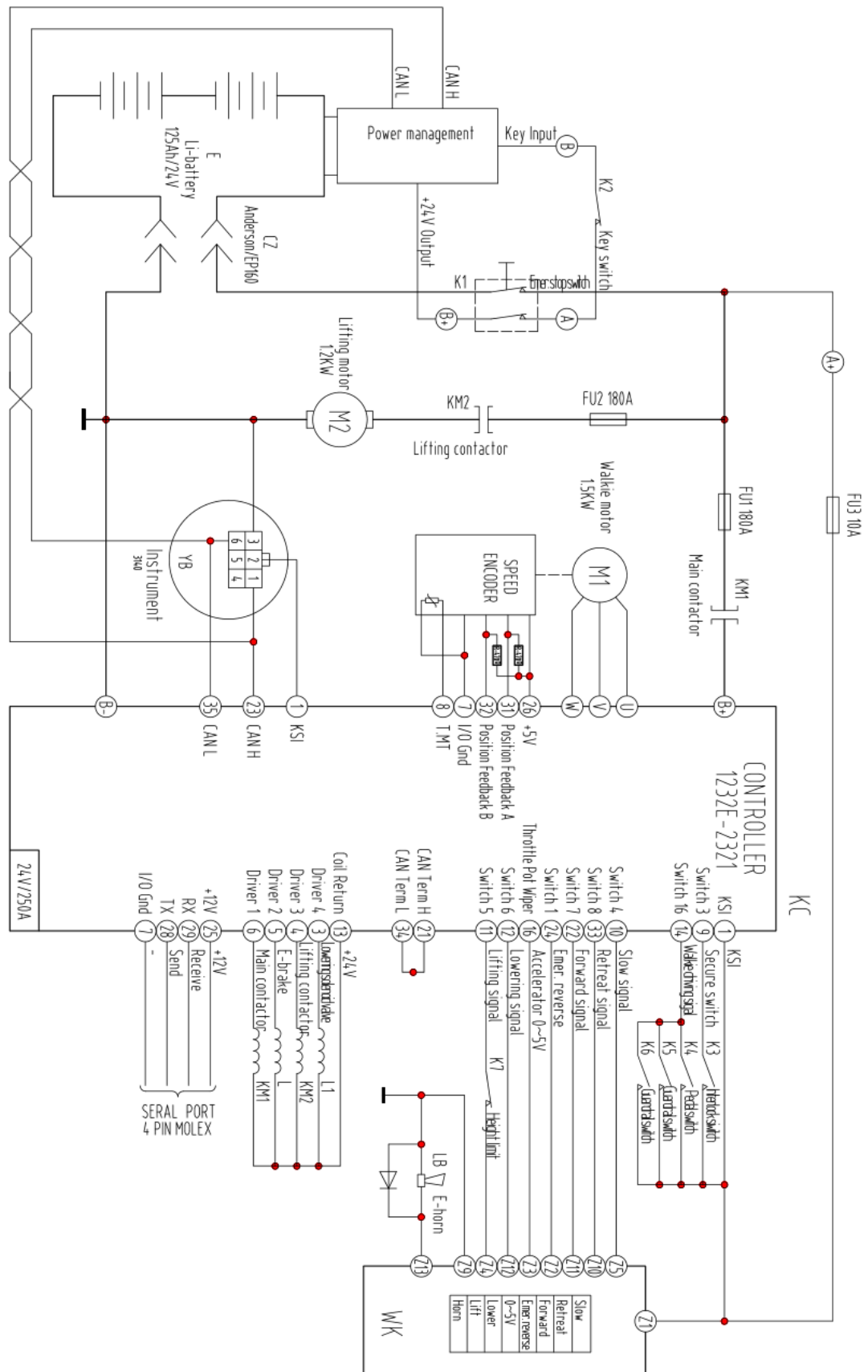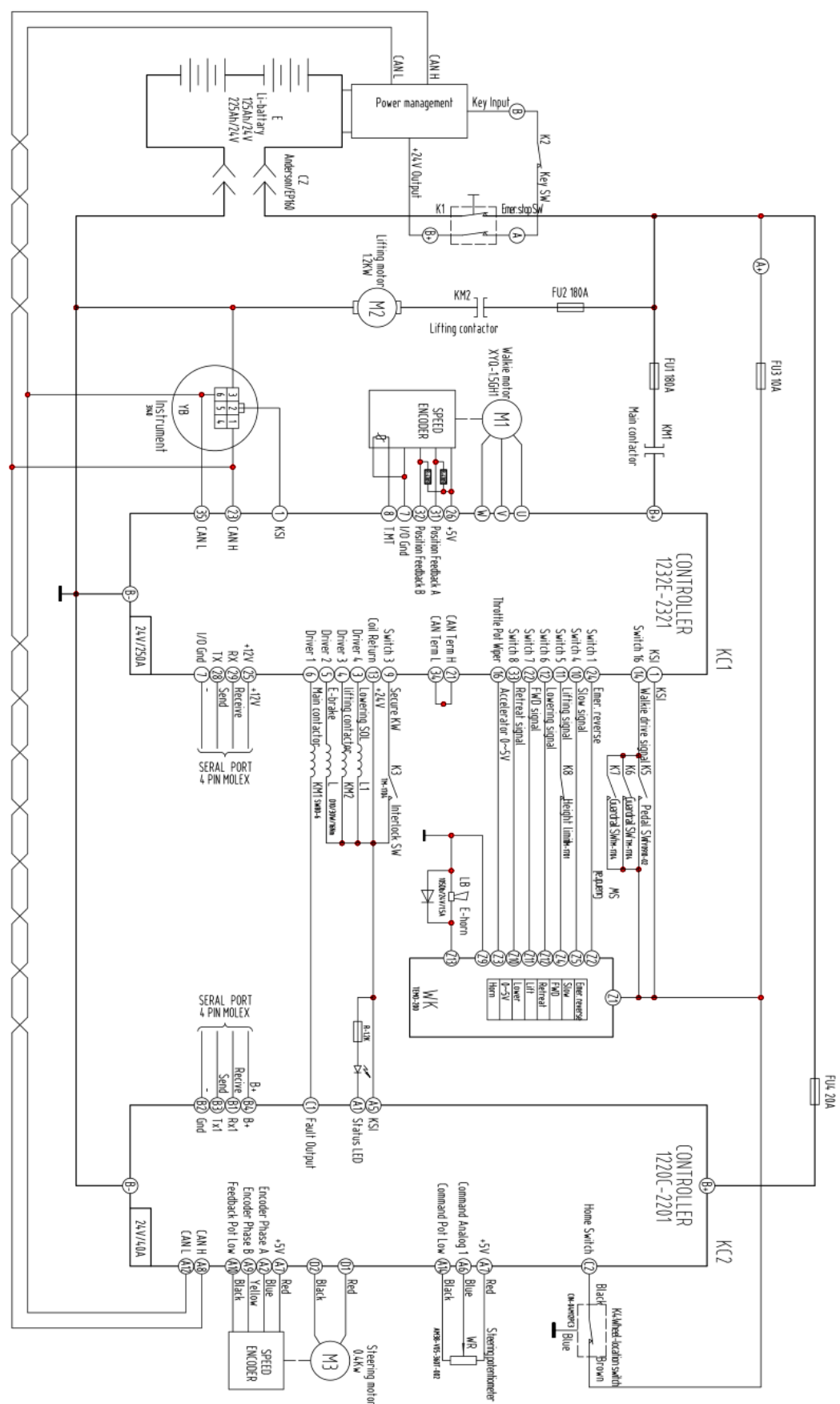
EPS+ Lead acid battery (New EU standard)
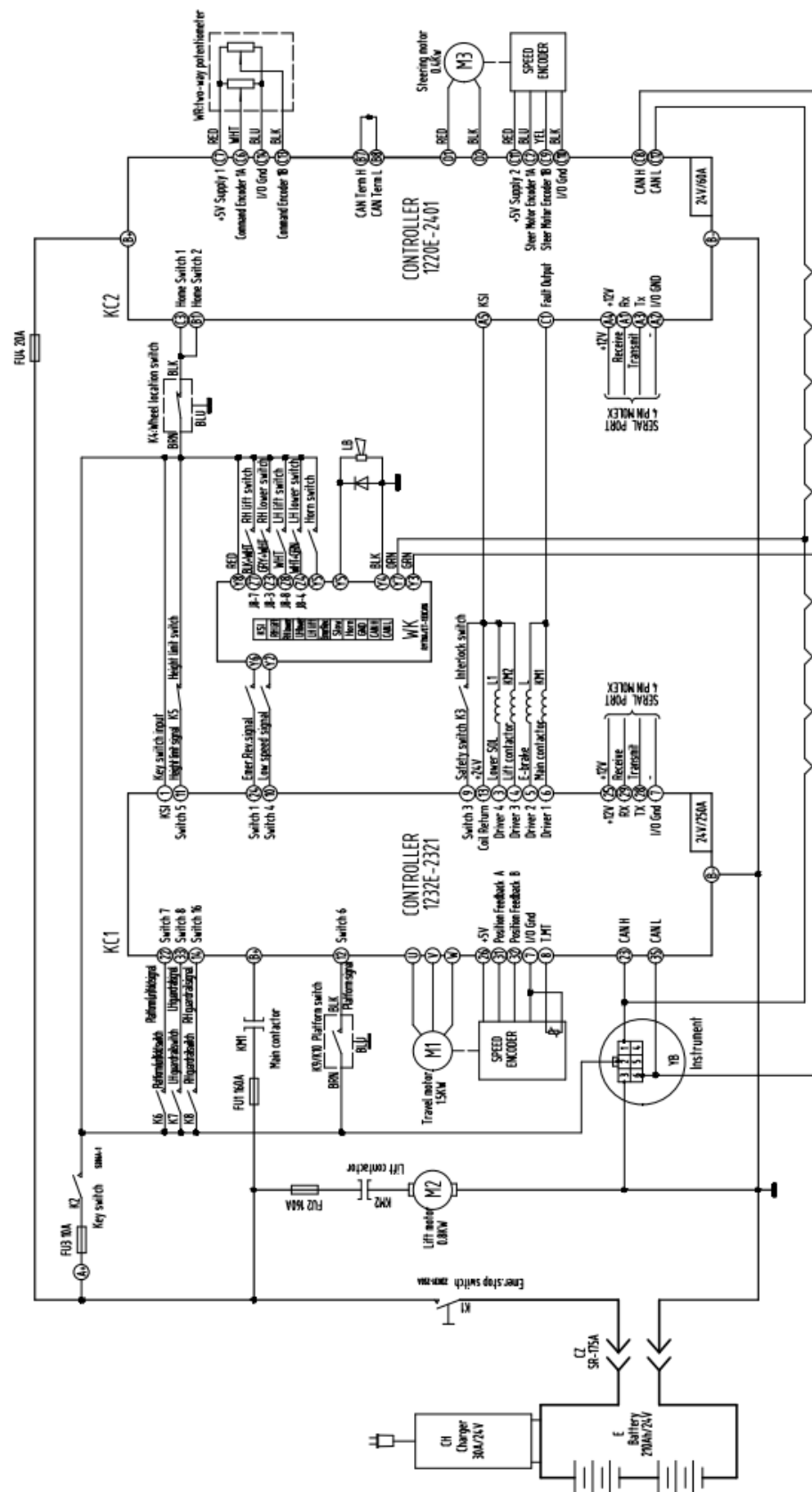
EPS+ Li-ion battery (New EU standard)
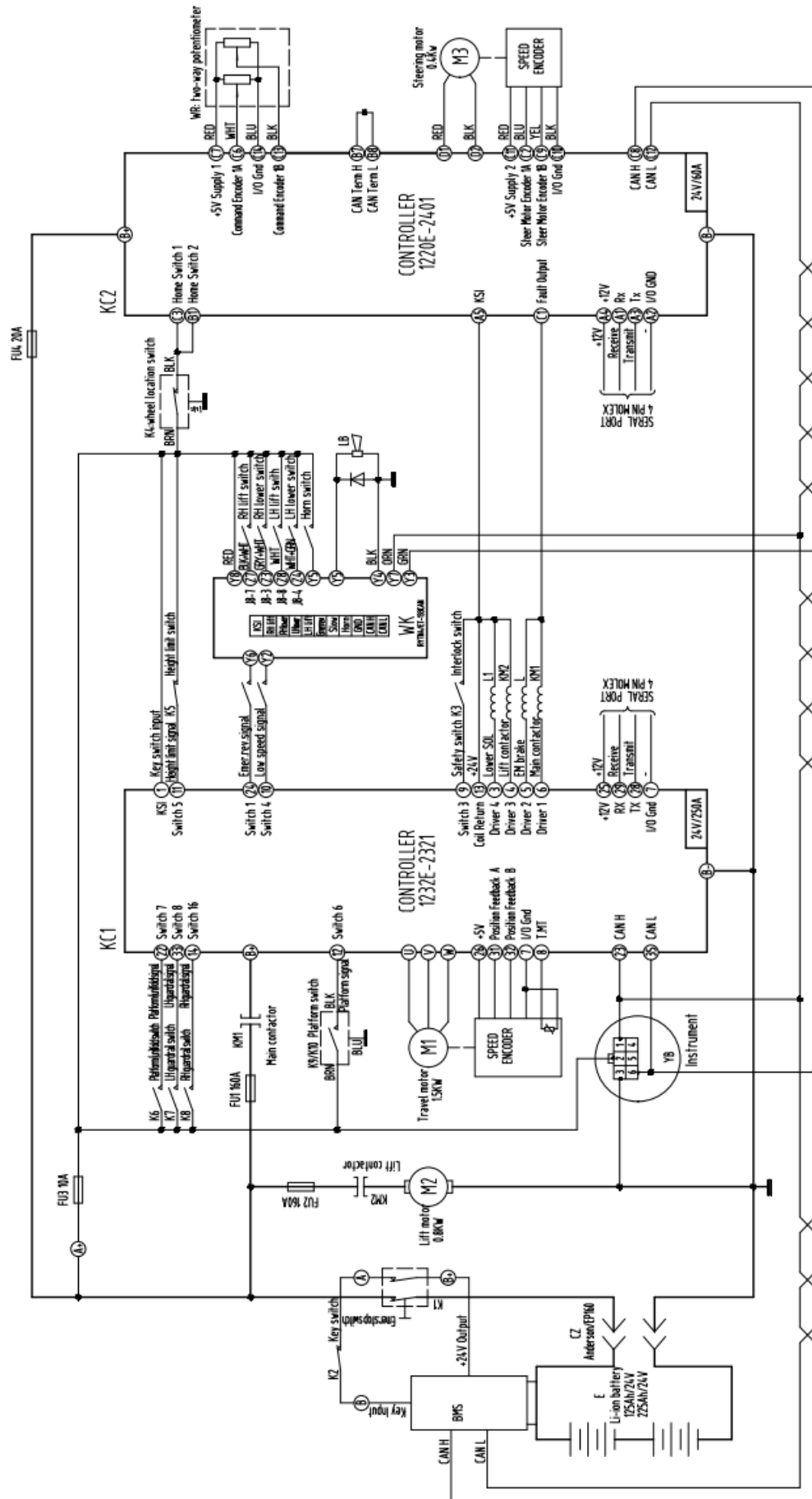
1232/1234/1236/1238 Programmer Fault Diagnosis Menu and Status Display LED Fault Diagnosis Table

There are red and yellow LED lights on the controller housing. Different flashing situations represent different failure situations. Seeing below：

Lights Flashing	Indication
Both off	Controller is dead, for battery is out of power or a cable fault occurs
Yellow light flashes	Controller works fine
Both on	Controller is updating
Both flash	Controller fault

| Code	Fault	Possible Causes
1,2	Controller Over current : main contactor, electromagnetic brake, motor quit	1. Short circuit among motor connection U, V or W phase 2. Error in setting motor parameters 3. Controller failure
1,3	Current Sensor Fault: main contactor, electromagnetic brake, motor quit	1. U, V, W Short Circuit in the car Body (Motor Stator Short Circuit) 2. Controller failure
1,4	Precharge Failed: main contactor, electromagnetic brake, motor quit	1. The external load connected to the capacitor bank (B + terminal) prevents the capacitor from charging. 2. Check up the capacitance voltage under the Monitor Menu
1,5	Controller Severe Undertemp: main contactor, electromagnetic brake, motor and speed governor quit；Full Brake Input	1. The controller works at a extreme low temperature (below - 40 C). 2. Check the controller temperature under the monitor menu.
1,6	Controller Severe Overtemp main contactor, electromagnetic brake, motor and speed governor quit；Full Brake Input	1. The controller works at a extreme high temperature (higher than 95 C). 2. Overloaded 3. Improper installment of the monitor 4. Check the controller temperature under the monitor menu.
1,7	Severe Undervoltage: Driving torque descending	1. Error on battery voltage parameter setting 2. Out of battery 3. Excessive internal resistance in the battery 4. Battery is not connected when driving. 5. Check Capacitance Voltage under the Monitor Menu. 6. B + fuse melts or main contactor not closed.
1,8	Severe Overvoltage: main contactor, electromagnetic brake, motor and speed governor quit；full brake input	1. Error on battery voltage parameter setting 2. Battery resistance is too high when regenerative braking current is generated. 3. Batteries are not connected during regenerative braking. 4. Check capacitance voltage under the Monitor Menu
2,1	Controller Undertemp Cutback: reduction of driving and braking torque, controller does not start when	1. The function of cutback under low temp. takes effect 2. The controller works in a extreme temp. 3. Check the controller temperature under the monitor menu.

	VCL language fails to execute	
2,2	Controller Overtemp Cutback: reduction of driving and braking torque,	1. The function of cutback under high temp. takes effect 2. The controller works in a extreme temp. 3. overloaded 4. Improper installment of the monitor 5. Check the controller temperature under the monitor menu
2,3	Undervoltage Cutback: low Voltage Reduction (Reduced Driving Torque)	1. Under normal operation, the battery needs to be charged, and the low-voltage limit function of the controller takes effect. 2. Error on battery voltage parameter setting 3. Run out of battery 4. The internal resistance of the battery is too high 5. Battery is not connected when driving. 6. Check capacitance voltage under the Monitor Menu 7. B + fuse melts or main contactor not closed.
2,4	Overvoltage Cutback over Voltage Reduction (Reduced Driving Torque)	1. During regenerative braking, the regenerative braking current causes the battery voltage to be too high and shows the fault. The overvoltage limit parameter of the controller takes effect under normal operation 2. Error on battery voltage parameter setting 3. The battery resistance is too high when regenerative braking current is generated. 4. The battery connection is open When regenerative braking 5. Check capacitance voltage under the Monitor Menu
2,5	+5V Supply Failure: controller does not start when VCL language fails to execute	1. The external load resistance connected to the + 5V supply terminal (pin26) is too low. 2. Check the current supplied by 5V and Ext under the Programmer Monitor menu.
2,6	Digital out 6 over current: digital output driver 6 does not run	The external load resistance connected to the digital output driver 6 (pin19) is too low.
2,7	Digital Out 7 over current: digital output driver 6 does not run	The external load resistance connected to the digital output driver 7 (pin19) is too low.
2,8	Motor Temp Hot Cutback: reduction of driving torque	1. The temperature of the motor exceeds the parameter setting, so the requested current is reduced. 2. The motor temperature control parameters are not correctly adjusted. 3. Check the motor temperature and Analog 2 input under the programmer monitor menu. 4. Temperature compensation and temperature cut-off should be set to OFF without an electrically heated regulator.
2,9	Motor Temp Sensor Fault: limited operation (maximum speed reduction) and motor overheat reduction function failure	1. Improper connection of motor temperature sensor. 2. Temperature compensation and temperature cut-off should be set to OFF without an electrically heated regulator. 3. The temperature of the motor exceeds the set maximum temperature.

3,1	Coil1 Driver Open/Short: No output from Coil1 Driver	1. Connected load open or short circuit 2. Contaminated connection terminals. 1. Wire harness damage or wiring error
	Main connector Open/Short: coil1 driver, electromagnetic brake quit	1. Main connector open or short circuit 2. Contaminated connection terminals. 3. Wire harness damage or wiring error
3,2	Coil2 Driver Open/Short: No output from Coil2 Driver	1. Connected load open or short circuit 2. Contaminated connection terminals. 3. Wire harness damage or wiring error
	EM Brake Open/Short: electromagnetic brake coil open/short circuit (drive 2 and speed governor quit, full brake)	3. Connected load open or short circuit 4. Contaminated connection terminals. 5. Wire harness damage or wiring error
3,3	Coil 3 Driver Open/Short: No output from Coil3 Driver	1. Connected load open or short circuit 2. Contaminated connection terminals. 3. Wire harness damage or wiring error
3,4	Coil 4 Driver Open/Short: No output from Coil4 Driver	1. Connected load open or short circuit 2. Contaminated connection terminals. 3. Wire harness damage or wiring error
3,5	PD Open/Short: PD quit	1. Connected load open or short circuit 2. Contaminated connection terminals. 3. Wire harness damage or wiring error
3,6	Encoder Fault: the function of restricting the operation takes effect	1. Encoder Fault 2. Wire harness damage or misconnection 3. Check motor monitoring menu: Motor RPM
3.7	Motor Open: main contactor, motor and electromagnetic brake quit)	1. Motor U, V, W line open circuit. 2. Wire harness damage or misconnection
3,8	Main Contactor Welded: main contactor, motor and electromagnetic brake quit	1. Contact cohesion of the main contactor. 2. U phase of the motor has a poor connection or an open circuit 3. An alternating voltage path (such as an external pre-charged resistor) provides a current for the capacitor bank (B+terminal).
3,9	Main Contactor Did Not Close: main contactor, motor and electromagnetic brake quit	1. Main contact is open 2. Contact of the main contactor is burnt or has a poor connection 3. The external load of the capacitor bank (B + terminal) prevents the capacitor bank from charging. 4. B+ fuse blows out
4,1	Throttle Wiper High: Speed governor quit	1. Voltage of the throttle wiper is too high. 2. Check input of the throttle wiper under the monitor menu.
4,2	Throttle Wiper Low: Speed governor quit	1. Voltage of the throttle wiper is too low. 2. Check input of the throttle wiper under the monitor menu.
4,3	Brake Wiper High: full braking input	1. Voltage of the brake wiper is too high. 2. Check input of the throttle wiper under the monitor menu.
4,4	Brake Wiper Low: full braking input	1. Voltage of the brake wiper is too low. 2. Check input of the throttle wiper under the monitor menu.

4,5	Pot Low Over current Speed governor quit, full braking input	1. The combination of potentiometers connected to the low end of potentiometers is too low 2. Check the pot low under the monitor menu
4,6	EEPROM Failure main contactor, motor and electromagnetic brake, speed governor ,interlock,1-4of the driver and proportional valve all quit ,full braking input)	Fail to write into EEPROM memory EEPROM memory is written through VCL, CAN bus, by adjusting 1311 parameters or loading new software to the controller. These may be the causes of the failure.
4,7	HPD/Sequencing Fault: speed governor quit	1. Error on the disordered input of key switch, interlock, direction and accelerator 2. Check monitor menu entry of the programmer
	Emer Rev HPD: Speed governor and electromagnetic brake quit	Emergency reverse operation terminated, but accelerator, forward and backward input, interlock switch did not return to neutral.
4,9	Parameter Change Fault: main contactor, motor and electromagnetic brake quit	This is a safety failure caused by a change in the setting of a parameter 1311, which can be eliminated by opening a new switch. It error will occur if the user changes the type of accelerator, and the truck can be operated only after the switch is reopened.
5,1-6,7	OEM Faults	require higher level programmers to solve
6,8	VCL Runtime Error main contactor, motor and electromagnetic brake, speed governor ,interlock,1-4of the driver and proportional valve all quit ,full braking input	1. Error on run time of VCL code 2. Refer to 1311 controller monitoring menu: VCL Failure Mould and VCL Failure. This failure can be likened to an ID of the run-time VCL module and the specified error code in the OS system information file .
6,9	External Supply Out of Range	1. The input current generated by any external load connected to 5V and 12V is too large or too small. 2. The external maximum and minimum input of the fault check menu parameters are not adjusted correctly. 3. Refer to 1311 input inspection menu: External Input Current
7,1	OS General main contactor, motor and electromagnetic brake, speed governor ,interlock,1-4of the driver and proportional valve all quit ,full braking input	1. Failure of internal controller.
7,2	PDO Timeout CAN PDO accepts a timeout.	1. The communication reception time of CAN PDO exceeds the PDO timeout period.
7,3	Stall Detect Control Running in Restricted Operating Mode	1. the motor stops working 2. encoder of the motor meets a failure 3. Wire harness damage or wiring misconnection. 4. A problem occurs on the encoder power supply 5. Refer to 1311 motor monitor menu: Motor RPM
8,7	Motor Characterization Fault:	Misdescription of motor characteristics in motor description step.

	main contactor, motor and electromagnetic brake, speed governor quit	
8,8	Encoder Characterization Fault: main contactor, motor and electromagnetic brake, speed governor quit	1. The description of encoder characteristics is wrong in the encoder description step. 2. Pulse frequency of motor encoder is not a standard value(32,48,64,80ppr)
8,9	Motor Type Fault: main contactor, motor and electromagnetic brake, speed governor quit	The parameters of motor type is out of range.
9,2	EM Brake Failed to Set Electromagnetic brake failure	1. The truck still travels after getting the brake signal. 2. Electromagnetic brake cant embrace the motor in rotation.
9,3	Limited Operating Strategy(LOS): star restricted operation mode	1. Both the encoder fault (code 36) and the stop detection fault (code 73) lead to the motivation of restricted operation mode 2. Motor encoder failure 3. Wire harness damage or wiring misconnection 4. Truck stalls
9,4	Emer Rev Timeout: motor and electromagnetic brake quit	1. Emergency reverse order is activated, but it has stopped working because the emergency reverse order is out of time. 2. Emergency reverse signal adhesion
9,8	Illegal Model Number	1.Moder_Number variable contains illegal valur 2.Software and hardware do not match 3.Controller defective
9,9	Parameter Mismatch	Dual Motor Enable parameter is set On and Control Mode Select parameter not set to 1(Speed Mode Express)or 2(Speed Mode) Motor Technology and Feedback Type parameters do not match

1220-2201 Programmer Fault Diagnosis Menu and Status Display LED Fault Diagnosis Table

The fault information can be displayed through the hand-held programmer. If there is an external LED (j1-1), the LED will flash according to the fault information, corresponding to the fault code in the fault list.

Fault table					
Code	Fault	Possible cause	Trouble shooting	Steering	Travel
12	Controller Overcurrent	1. Steering motor wiring short circuit 2.Controller failure	Restart KSI	Shut	Stop
13	Current Sense Fault	1.Controller failure	Restart KSI	Shut	Stop
14	Precharge Fault	1.Controller failure	Restart KSI	Shut	Stop
15	Controller Severe Undertemp	1.Controller runs at a sever undertemp. 2.Temp.sensor damaged	Wait until the temp. goes back over -35℃	Alarm	Null
16	Controller Severe Overtemp	1.Overloading 2.Controller runs at a sever overtemp. 3.Improper controller position	Restart KSI	Alarm then Shut	Stop

17	Severe Undervoltage	1.Connecting failure of the battery or the battery wiring 2. There are other large loads connected to the battery 3. The battery is dead or the model is inconsistent	Restart KSI	Shut	Stop
18	Severe Overvoltage	1. In regen, the resistance of battery or battery cable is too high 2. Battery cable disconnected during regen	Restart KSI	Shut	Stop
21	Motor Temp Hot Cutback	1.Overloading 2.Controller runs at a sever overtemp.	Wait under the motor temp. goes back to normal	Alarm and restrict the currency	Null
22	Controller Overtemp	1.Overloading 2.Controller runs at a sever overtemp. 3.Improper controller position	Wait under the motor temp. goes back less then 85℃	Alarm	Slow down
23	Motor Polarity Fault	1. The polarity of the motor is reversed 2. The polarity of the position feedback device is reversed	Restart KSI	Shut	Stop
24	5V Output Failure	1.5V output overload2.Controller failure	Restart KSI	Remain then shut	Stop
31	Main Driver Fault	1. Internal relay coil damaged 2. Internal relay drive open or short	Restart KSI	Alarm then Shut	Stop
32	Relay Welded	1. Internal relay stuck 2.Controller failure	Restart KSI	Shut	Stop
33	Relay Did Not Close	1. Internal relay receives pull in command but does not pull in 2. Internal relay chip oxidation	Restart KSI	Shut	Stop
34	Hardware Fault	1. Hardware failure detected 2. Motor voltage out of range 3. IIC communication lost 4. Power tube short circuit	Restart KSI	Shut	Stop
35	Fault Output Failed	1. Faulty output wiring incorrect 2.Controller failure	Restart KSI	Alarm then Shut	Stop
36	Motor Stalled	1. Motor stalling 2. The encoder of steering motor fails or the wiring is disconnected 3. The steering motor wiring is disconnected 4. Parameter does not match motor	Restart KSI	Shut	Stop
37	Motor Open	1. Steering motor wiring open circuit 2. Motor wiring error3.Controller failure	Restart KSI	Alarm then Shut	Stop
38	Motor Short	1. Steering motor wiring short circuit	Restart KSI	Shut	Stop

41	Command Analog 1 Out Of Range	1. Analog command input 1 (J1-6) out of range 2. Command low side (j1-14) out of range (for resistance type) 3. Incorrect parameter setting	Restart KSI	Remain then Shut	Stop
42	Command Analog 2 Out Of Range	1. Analog command input 2 (j1-13) out of range 2. The cross check of analog quantity of j16 and j113 failed 3. Incorrect parameter setting	Restart KSI	Remain then Shut	Stop
43	Feedback Analog 1 Out Of Range	1. Analog feedback input 1 (j1-11) out of range 2. Incorrect parameter setting	Restart KSI	Remain then Shut	Stop
44	Feedback Analog 2 Out Of Range	1. Analog feedback input 2 (j1-3) out of range 2. J-11 and j13 analog quantity cross check failed 3. Incorrect parameter setting	Restart KSI	Remain then Shut	Stop
45	Parameter Change Fault	1. Parameter value changes, need to restart 2. Restore the parameter to the default value	Restart KSI	Shut	Stop
46	EEPROM Failure	Memory parameter verification calculation error 2.Controller failure	Restart KSI	Remain then Shut	Stop
47	Encoder Fault	1. Encoder data out of allowable range 2. Open circuit of phase a or phase B of orthogonal encoder 3. Phase B of polarity encoder is open	Restart KSI	Remain then Shut	Stop
53	Home Position Not Found	1. Home switch failure 2. Wrong installation or wiring	Restart KSI	Shut	Stop
62	Communication Fault	1. Lost communication with walking	Restart KSI	Shut	Stop
63	Communication Lost	1. RX (j1-8) wiring failure 2. A hand-held programmer is in use on the walking controller	Restart KSI	Alarm and output the maximum angle signal	减速
71	Software Fault	1. Software failure 2.Controller failure	Restart KSI	Shut	Stop
73	Following Error	1. Wrong parameter setting 2. Failure of position feedback equipment 3. Steering motor failure	Restart KSI	Alarm then Shut	Stop
75	Parameter Conflict	1. Parameter setting conflicts with other parameters	Restart KSI	Shut	Stop

1220E-2401

FLASH CODE	NAME	POSSIBLE CAUSE	CLEAR CONDITION	STEER FAULT ACTION	TRACTION FAULT ACTION
12	Controller Overcurrent	1. The steer motor wires shorted. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop
13	Current Sense Fault	1. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop
14	Precharge Fault	1. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop
15	Controller Severe Undertemp	1. Controller is operating in extreme low temperature environment. 2. The temperature sensor is broken.	Heatsink temperature above–35°C.	Warning Only.	3 = No Action
16	Controller Severe Overtemp	1.Excessive load on vehicle. 2.Controller is operating in an extreme high temperature environment. 3. Improper mounting of controller..	Cycle KSI.	Warning then Shutdown.	1 = Stop
17	Severe Undervoltage	1. Battery or battery cables or battery connections defective. 2. Excessive non-controller hydraulic system drain on battery. 3. Battery discharged or improper battery.	Cycle KSI.	Shutdown.	1 = Stop
18	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
23	Motor Polarity Fault	1. The motor polarity is reversed. 2. The position feedback device polarity is reversed.	Cycle KSI.	Shutdown.	1 = Stop
24	5V Supply Failure	1. Overload for the 5V supply 2. Controller defective 3. Load wiring open for the 5V supply	Cycle KSI.	Hold then Shutdown	1= Stop
25	12V Supply Failure	1. Overload for the 12V supply 2. Controller defective	Cycle KSI	Warning then	1= Stop

				Shutdown	
26	Motor Temp Hot Cutback	1. Excessive load on vehicle. 2. Controller is operating in extreme high temperature.	Bring Steering Motor temperature backs to range.	Warning and Reduce Current Limit	2 = Reduce Speed
31	Main Driver Fault	1. Internal relay coil is broken. 2. Internal relay driver is open or shorted.	Cycle KSI.	Warning then Shutdown.	1 = Stop
33	Motor Short	1. The steer motor wires shorted.	Cycle KSI.	Shutdown.	1 = Stop
34	Encoder Fault	1. Encoder is broken. 2. Encoder wiring is open. 3. Controller defective.	Cycle KSI.	Hold then Shutdown	1 = Stop
35	Fault Output Failure	1. Incorrect Fault Output wiring. 2. Controller defective.	Cycle KSI.	Shutdown	1 = Stop
36	Motor Stalled	1. Stalled steer motor. 2. Steer motor encoder failure or wires open. 3. Steer motor wires open. 4. Related parameters do not match with steer motor.	Cycle KSI.	Shutdown.	1 = Stop
37	Motor Open	1. Steer motor wires open. 2. Faulty motor cable wiring. 3. Controller defective.	Cycle KSI.	Warning then Shutdown.	1 = Stop
38	Relay Welded	1. Internal relay welded. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop
39	Relay Did Not Close	1. Internal relay was commanded to be close but it did not. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop
41	Command Analog1 Out of Range	1. Command Analog Input 1 (J3-6) is out of range. 2. Incorrect parameter settings.	Cycle KSI.	Hold then Shutdown.	1 = Stop
42	Command Analog2 Out of Range	1. Command Analog Input 2 (J3-13) is out of range. 2. The crosscheck on Command Analog Input 1 (J3-6) and Command Analog Input 2 (J3-13) failed. 3. Incorrect parameter settings.	Cycle KSI.	Hold then Shutdown.	1 = Stop
43	Feedback	1. Analog Input (J3-2) is out of	Cycle KSI.	Hold then	1 = Stop

		range.		Shutdown.	
	Analog1 Out of Range	2. Incorrect parameter settings.			
44	Feedback Analog2 Out of Range	1. Position Analog Input 2 (J3-9) is out 　of range. 2. The crosscheck on Position Analog 　Input 1 (J3-2) and Position Analog 　Input 2 (J3-9) failed. 3. Incorrect parameter settings.	Cycle KSI.	Hold then Shutdown.	1 = Stop
45	CAN Not Operational	1. 1220E CAN NMT State did not go 　operational within 80 ms of interlock 　being applied.	Cycle KSI.	Warning then Shutdown	1 = Stop
46	NV Failure	1. Internal Non-Volatile Memory 　defective.	Cycle KSI.	Shutdown	1 = Stop
47	Parameter Change	1. A parameter value was changed that 　requires a power cycle. 2. Parameters are restored to the default 　settings.	Cycle KSI.	Shutdown	1 = Stop
51	Interlock Switch Supervision	1. A fault is set if the 2 switch inputs are 　not matched. 2. Interlock switch defective.	Cycle KSI	Interlock = OFF	1 = Stop
52	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.	Cycle KSI	Warning then Shutdowm	1 = Stop
53	Home Position Not Found	1. Home switch defective. 2. Mounting or wiring defective.	Cycle KSI.	Shutdown.	1 = Stop
54	Home Reference Tolerance Fault	1. Home switch defective.	Cycle KSI.	Shutdown.	1 = Stop
55	Steer Command Supervision	1. Command input device defective.	Cycle KSI.	Hold then Shutdown	1 = Stop
56	Wheel Position Supervision	1. Position feedback device defective.	Cycle KSI.	Hold then Shutdown	Speed reduced.

71	Software Fault	1. Software defective. 2. Controller defective.	Cycle KSI.	Shutdown.	1 = Stop
72	PDO1 Timeout	1. Communication between the traction controller and the 1220E has halted.	Cycle KSI.	Warning then Shutdown.	1 = Stop
73	Following Error	1. Incorrect parameter settings. 2. Position feedback device defective. 3. Steer motor defective.	Cycle KSI.	Shutdown.	1 = Stop
74	Hardware Fault	A hardware error has been detected. 1. Power MOSFETs shorted. 2. MODFETs driver defective. 3. Watchdog cross checking defective. 4. Internal +15V defective. 5. Poor connection to battery terminals	Cycle KSI.	Shutdown.	1 = Stop
75	Parameter Conflict	1. Parameter settings are selected that are in conflict with each other. 2. Parameter setting out of range.	Cycle KSI.	Shutdown.	1 = Stop
78	CAN Bus Loading	1. CAN bus defective. 2. The message sending is too fast.	Cycle KSI.	Warning then Shutdown	1 = Stop
79	PDO Mapping Error	1. Incorrect CAN mapping data.	Cycle KSI.	Shutdown.	1 = Stop
81	Bad Calibrations	1. Calibration data is out of range	Cycle KSI.	Shutdown.	1 = Stop
82	Parameter Out of Range	1. Parameter data out of range	Cycle KSI.	Shutdown.	1 = Stop
84	Supervision	1. Supervisor defective	Cycle KSI.	Shutdown.	1 = Stop

c. AC0 controller

Mechanical steering + lead acid battery
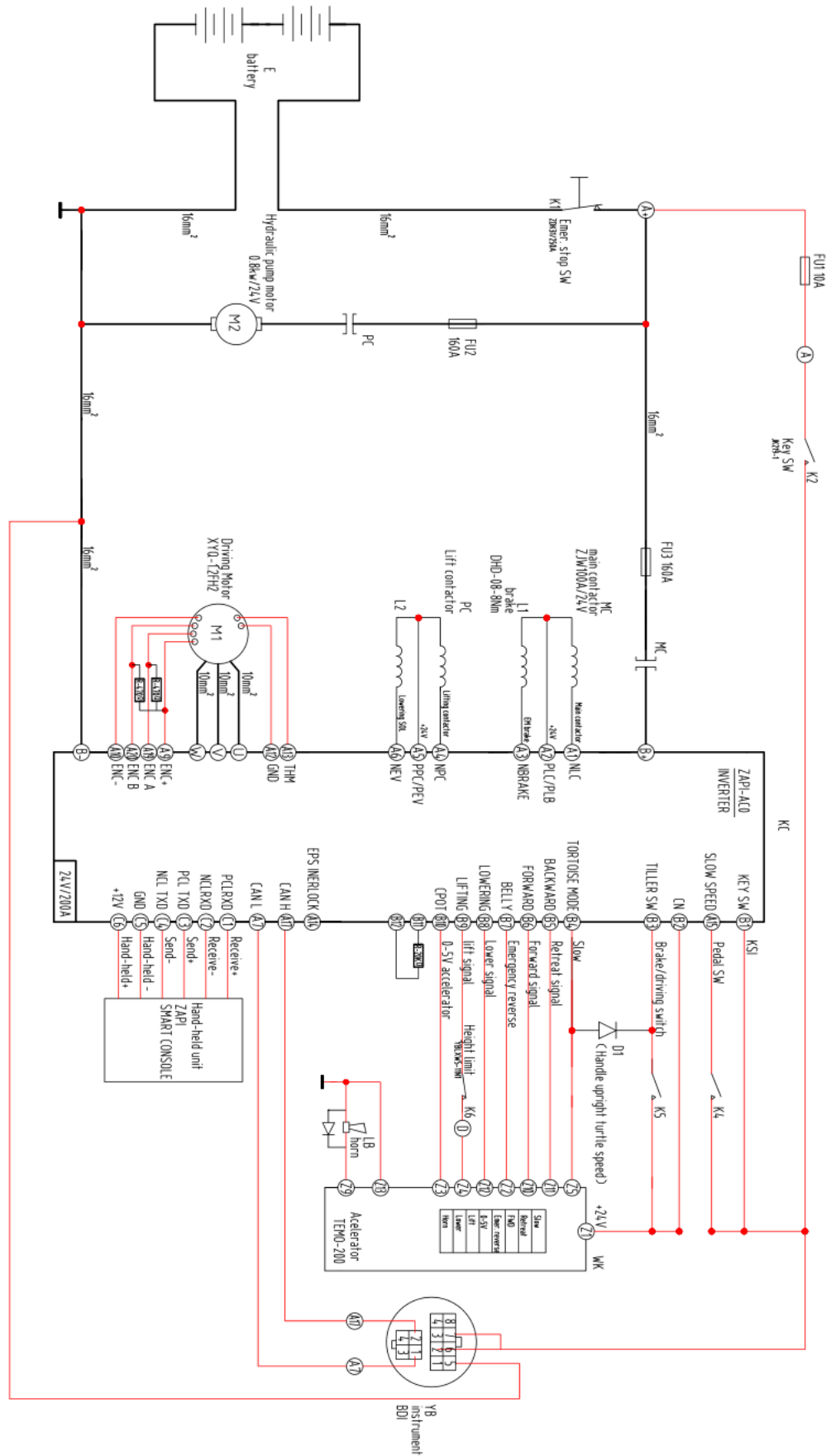
EPS + lead acid battery
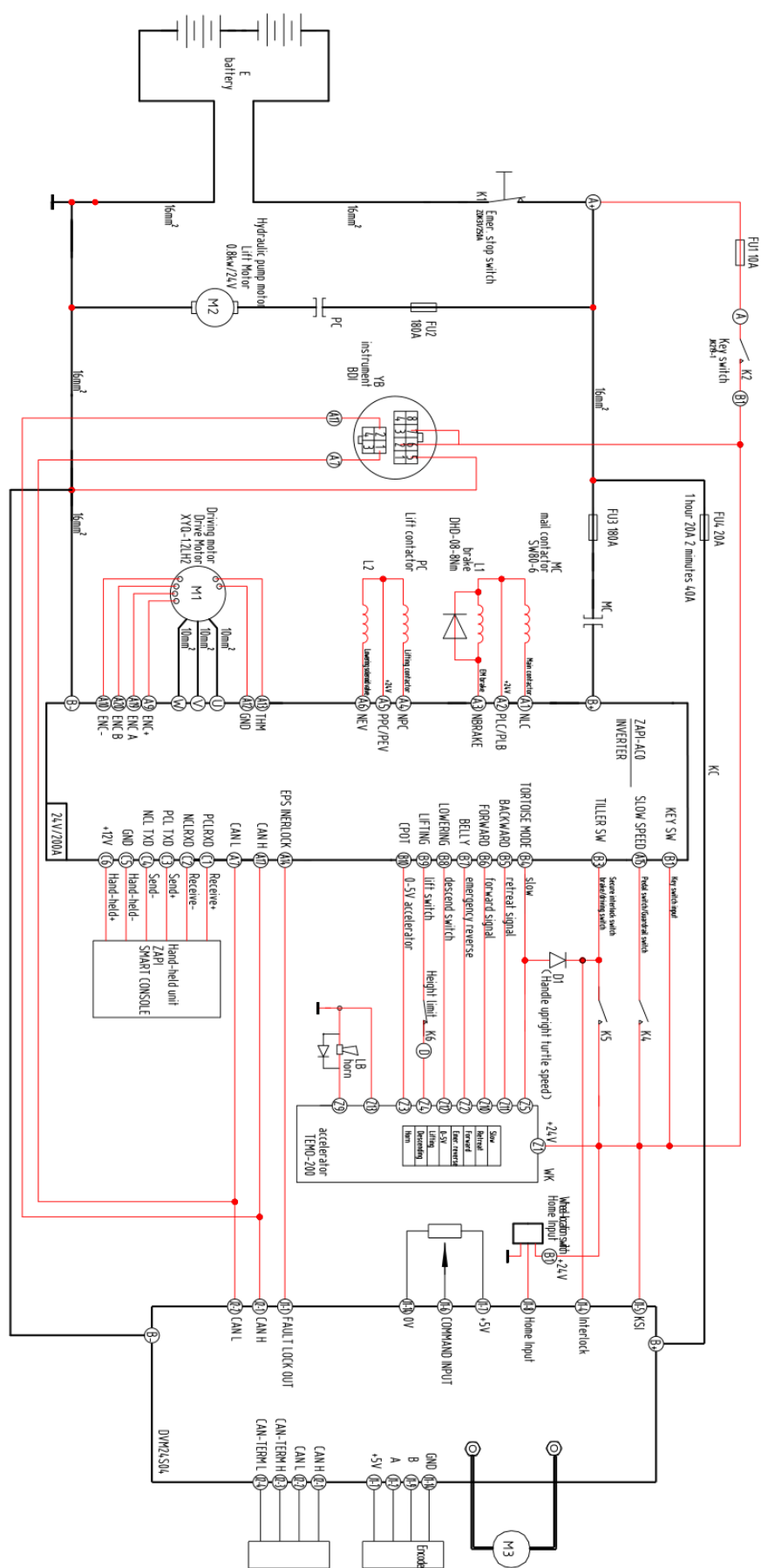
Mechanical steering + lithium battery

EPS+Lithum battery
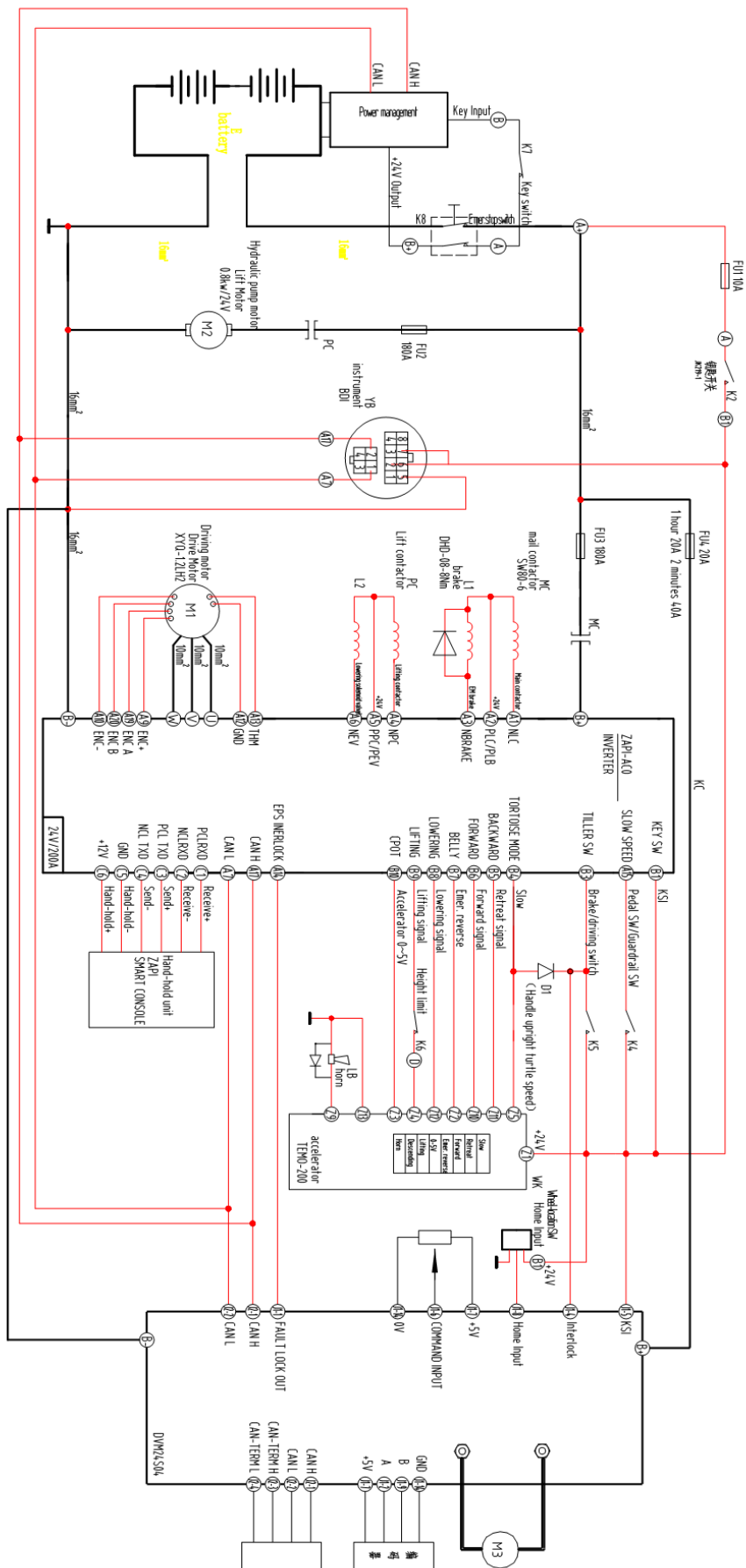
AC0 failure and trouble shooting

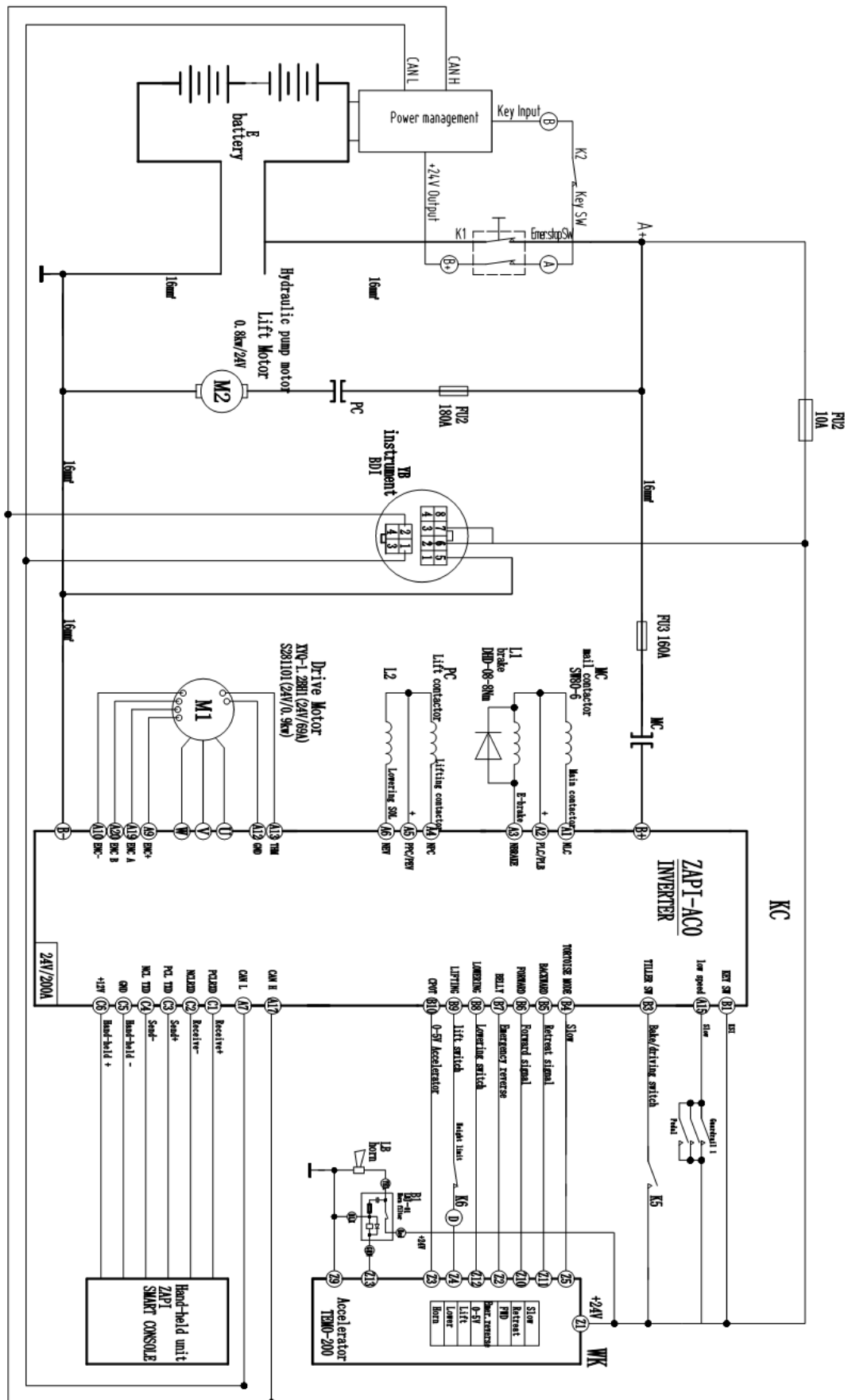| Display code	Description	Failure	Inspection method
240	wrong config	Config failure	Clean up EEPROM
8	watchdog	Watchdog failure	1. Check whether the controller plug-in is plugged in properly. 2. If the plug-in contacts well, please replace the control and check whether the fault is eliminated.
76	coil shorted	Coil short circuit	Check the wires of main contactor and oil pump contactor Circle for short circuit.
17	logic failure #3	Logic fault 3	The coil output circuit is suddenly disconnected during operation.
60	capacitor charge	Precharge failure	Check the power circuit for problems.
30	vmn low	Vmn failure	Check vmn
253	encoder error	Encoder failure	Check the encoder
75	contactor driver	Main contactor short circuit	Check whether there is short circuit between controllers A1 and A2,if not, replace the controller.
31	vmn high	Vmn failure	Check vmn
49	i=0 ever	Drive current does not stop	If the three-phase connection of the motor is not asked Please replace the controller.
53	stby i high		1. Check whether the controller plug-in is plugged in properly. 2. If the plug-in contacts well, please replace the control. Check whether the fault is eliminated.
38	contactor open	Main contactor open	1. The circuit of main contactor coil is disconnected. 2. The main contactor is damaged.
74	driver shorted	Contactor short circuit	Check whether the coil output by the controller is short; If not, replace the controller.
254	auxoutput ko	Solenoid brake coil fault	Check whether the solenoid brake coil is different; If not, replace the controller.
19	logic failure #1	Logic fault 1	1. Detect the battery voltage; 2. View adjust in the controller Whether battery is consistent with the actual battery voltage.
18	logic failure#2	Logic fault 2	1. Check whether there is any problem in the power line circuit of the motor, including the fuse of the controller; 2. Check the parameter list; 3. If there is no problem in the above two items, the controller shall be replaced.
248	canbus ko	CAN BUS failure	Check can line for abnormality
80	fwd+back	Forward and backward closed at the same time	Check the forward and reverse switch harness.
79	incorrect start	Start sequence	Ensure that the handle is started in the vertical position

			error
78	vacc not ok	Accelerator failure	1. Reset the accelerator; 2. The accelerator is damaged.
86	Pedal wire ko	Accelerator failure	Check whether the power supply and ground of the accelerator are connected correctly. If they are connected correctly, please change Change the controller.
61	High temperature	Controller over temperature	Measure the temperature of controller base plate.
13	Eeprom ko	Memory error	1. Restart the electric lock, if the fault still exists, please replace the controller; 2. Restart the electric lock. If the fault disappears, please reset the parameters.
65	Motor temperature	Motor overtemp.	Motor overtemp.
251	Handbrake		
250	sens. Motor temp. ko	Motor temperature sensor error	Check the harness of motor temperature sensor.
0	reload hm from mdi		
249	checkup needed	Inspection need	Inspection needed, contact the maintenance personnel.
69	data acquistion	Data update error	cannot change the controller parameter settings while the controller is working.
247	pev not ok		
99	input error#1	Check whether A13 input is normal	
37	contactor closed	Main contactor adhesion	Please check whether the main contactor is adhered
236	wrong battery	Voltage level setting error	Check whether the battery voltage is normal.
235	can bus ko eps		
234	eps rele open		
237	slip profile		
238	lift low active	Lowering switch triggered	The lowering switch is triggered when starting up. Please check the lowering switch
239	lift+lower	Raise and lower trigger at the same time	Check whether the handle switch signal is normal
232	end teach ko		
228	card tiller		
227	canbus ko tiller	Handle communication failure	Check can communication line

98	input error#2		Check whether A14 input is normal
230	reset cutback 1		
233	canbus ko bms	Power manager communication failure	Check can communication line

BMS failure description

Display	Description	Failure	Check method
B01	battery high temp. warning	Battery high temperature warning	
B02	battery high temp. alarm	Battery high temperature warning	
B03	battery leakage warning	Battery leakage warning	
B04	battery leakage serious	Battery leakage warning	
B05	battery Status Alarm	Battery status alarm	
B06	BDI low	Low battery	

EPS failure and trouble shooting

Code	Description	Trouble shooting
C1	Feedback overspeed	Check whether the encoder connection is normal.
C2	Kernel running error	Controller fails, contact the manufacturer.
C3	Long time overload of controller and motor	Check whether the controller is matched with the motor and whether the controller selection is too small.
C4		
C5	Position command change after electronic gear ratio exceeds maximum motor speed	Controller fails, contact the manufacturer.
C6	In speed mode, the speed command exceeds the maximum motor speed	Controller fails, contact the manufacturer.
C7	In torque mode, the torque command exceeds the maximum motor torque	Controller fails, contact the manufacturer.
C8	Position command error	Check whether the position command voltage configuration parameter is appropriate.
C9	The direction of speed sensor is wrong.	The direction of phase ab of speed sensor is inconsistent with that of motor M1 and M2. Solution (choose one of the following three methods): 1 change parameter P3.0 encoder reversing; 2 or M1 and M2 two-phase exchange positions of the controller; 3 or speed sensor AB phase connection exchange position.
C10	Steering wheel encoder error	When the steering wheel double encoder input is enabled, the two encoders are not synchronized.
C11	2 minute maximum current protection of motor	The motor current lasts for more than 2 minutes and the maximum current lasts for more than 2 minutes.

		1. The motor is locked; check whether the brake is open and whether there is any foreign matter stuck in the driving mechanism. 2. The controller parameters are not set properly. See motor parameter adjustment for details.
C12	Over current of controller	Wrong controller selection; or controller failure, contact the manufacturer.
C13	Bus capacitance charging fault	Controller fails, contact the manufacturer.
C14	Main contactor connection failure	Check whether the main contactor is connected normally.
C15	Electromagnetic brake connection failure	Check whether the electromagnetic brake is connected normally.
C16	Battery voltage is too low	Check the battery level; or the controller battery voltage level is set incorrectly.
C17	Battery voltage too high	Check the battery voltage; or the controller battery voltage level is set incorrectly.
C18	Severe over temperature of power board	Controller protection, out of service.
C19	Serious over temperature of motor	Controller protection, out of service.
C21	main contactor contact fusion	Check whether the main contactor is damaged and replace it.
C22	5Voutput failure	The motor encoder is short circuited; or other 5V external equipment is short circuited; or the controller is faulty, contact the manufacturer.
C23	MACID test failed	The controller can network ID number is set repeatedly and reset.
C24	Main contactor drive failure	Check whether the main contactor is damaged and replace it.
C25	Power module failure	If the controller fails, contact the manufacturer.
C26	Motor short circuit	Check the winding between M1 and M2 for short circuit.
C27	Error in return	Check whether the middle return switch is installed normally.
C28	Position command sensor error	Check whether the connection of analog input 1 is normal (if the voltage of analog input 1 is less than 0.3V or greater than 4.8V, an error will be reported).
C29	Heartbeat error (AGV mode only)	Check whether can bus is connected normally.
C31	Battery voltage is slightly too low	The battery is low. Charge it as soon as possible.
C32	Power board slightly over temperature	Reduce the load.
C33	Power board low temperature	The ambient temperature is too low.
C34	Slight over temperature of the motor	Reduce the load.
C35	12V output failure	If the power supply of the handheld terminal is short circuited, or if the controller fails, contact the manufacturer.
C36	Drive3 connection failure	Check Drive3 connection.
C37	Drive4 connection failure	Check Drive4 connection.

C38	EEPROM reading and writing parameter error	Controller fails, contact the manufacturer.
C39	Parameter overrun error	If the parameter setting fails, contact the manufacturer.
C40	Operation timing error	After reset, the key signal is not in the original position (throttle switch, direction switch, lifting / lowering, safety switch). The signal returns to its original position and the alarm is automatically eliminated.
C41	Power board slightly over temperature	Reduce the load.
C42	Low temperature of power board	The working environment temperature is too low.

（4）**F2-A controller**

EPS+ Lead acid battery (New EU standard)

EPS +Lithium battery (New EU standard)

Table 17 AC F2-A Controller Troubleshooting Chart

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
1-2 0x12	**Controller Overcurrent** *Controller_Overcurrent_Active* 0x2510 Fault Type(s): 1 = Controller Over Current Phase U 2 = Controller Over Current Phase W 3 = Controller Over Current Phase V 4 = Irms > 135 % Current Limit	1. External short of phase U, V, or W motor connections. 2. Speed encoder noise problems. 3. Motor parameters are mistuned. 4. Controller defective.	*Set:* Phase current exceeded the current measurement limit. *Clear: Reset Controller*	*ShutdownMotor ShutdownMainContact or ShutdownEMBrake ShutdownThrottle FullBrake*
1-3 0x13	**Current Sensor** *Current_Sensor_Active* 0x2832 Fault Type(s): 1	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective.	*Set:* Controller current sensors have invalid offset reading. *Clear: Reset Controller*	*ShutdownMotor ShutdownMainContact or ShutdownEMBrake ShutdownThrottle FullBrake*
1-4 0x14	**Precharge Failed** *Precharge_Failed_Active* 0x2223 Fault Type(s): 1 Abort 2 Energy Limit Exceeded 3 Time Limit Exceeded	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.	*Set:* The precharge failed to charge the capacitor bank. *Clear:* Cycle Interlock or *Reset Controller*	*ShutdownMotor ShutdownMainContact or ShutdownEMBrake ShutdownThrottle FullBrake*
1-5 0x15	**Controller Severe Undertemp** *Controller_Severe_Undertemp_ Active* 0x2141 Fault Type(s): 1	1. Controller is operating in an extreme environment. 2. See Programmer » System Monitor menu » Controller » Controller Temperature.	*Set:* Heatsink temperature below –40 C. *Clear:* Bring heatsink temperature above –40 C. and then *Reset Controller*	*ShutdownMotor ShutdownMainContact or ShutdownEMBrake ShutdownThrottle FullBrake*

1-6 0x16	**Controller Severe Overtemp** *Controller_Severe_Overtemp_* *Active* 0x2142 Fault Type(s): 1	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.	*Set:* Heatsink temperature above +95　C. *Clear:* Bring heatsink temperature below +95　C, and then *Reset Controller*.	*ShutdownMotor ShutdownMainContact or ShutdownEMBrake ShutdownThrottle FullBrake*
1-7 0x17	**Severe B+ Undervoltage** *Severe_B_Plus_Undervoltage_* *Active* 0x2120 Fault Type(s): 1	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.	*Set:* When Main is closed and FET Bridge enabled: Either the undervoltage drive current cut back = 0 % for 64 ms or the Brownout Voltage is reached. *Clear:* Undervoltage drive current cut back > 0 % for 100 ms and capacitor voltage > brownout voltage.	No drive torque
1-7 0x17	**Severe KSI Undervoltage** *Severe_KSI_Undervoltage_* *Active* 0x2122 Fault Type(s): 1	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	*Set:* When below Brownout Voltage for 2 seconds. *Clear:* Bring KSI voltage above Brownout Voltage.	None, unless a fault action is programmed in VCL.

		menu » Battery » Keyswitch Voltage.		
1-8 0x18	**Severe B+ Overvoltage** *Severe_B_Plus_Overvoltage_ Active* 0x2130 Fault Type(s): 1	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.	*Set:* Capacitor bank voltage exceeded the Severe Overvoltage limit with FET bridge enabled. *Clear:* Bring capacitor voltage below Severe Overvoltage limit, and then *Reset Controller*.	*ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake*
1-8 0x18	**Severe KSI Overvoltage** *Severe_KSI_Overvoltage_Active* 0x2132 Fault Type(s): 1	1. Battery-voltage applied to KSI (pin 1) exceeds the Severe Overvoltage limit. 2. See Programmer » Monitor menu » Battery » Keyswitch Voltage.	*Set:* KSI voltage exceeded the Severe Overvoltage limit. *Clear:* Bring KSI voltage below the Severe Overvoltage limit, and then *Reset Controller.*	*ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake*
1-9 0x19	**Speed Limit Supervision** *Speed_Limit_Supervision_ Active* 0x2133 Fault Type(s): 1	1. Motor speed detected exceeding the limit set by the Max Speed Supervision parameter. 2. Misadjusted Max Speed Supervision parameters. 3. See: Programmer » Application Setup » Max Speed Supervision menu.	*Set:* Motor rpm has exceeded the Max Speed Limit setting for the Max Speed Time Limit setting's duration. *Clear: Reset Controller.*	ShutdownInterlock ShutdownEMBrake
1-10 0x1A	**Travel Control Supervision** *Travel_Control_Supervision_ Active*	1. With the vehicle in the stopped state, the motor	*Set:* The motor frequency and/ or and phase-current	*ShutdownMotor ShutdownMainContactor ShutdownEMBrake*

	0x2134 Fault Type(s): 1	frequency and/or phase current detected exceeding the limit set by the Travel Control Supervision parameter. 2. Misadjusted Travel Control Supervision parameters. 3. See: Programmer » Application Setup » Travel Control Supervision menu.	are above their Travel Control Supervision settings when in the stopped state. *Clear: Reset Controller.*	*ShutdownThrottle* *FullBrake*
2-2 0x22	**Controller Overtemp Cutback** *Controler_Overtemp_Cutback_Active* 0x2140 Fault Type(s):1	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.	*Set:* Controller's Heatsink temperature exceeded 85 C. *Clear:* Bring heatsink temperature below 85 C.	Reduced drive torque. Reduced regen braking torque.
2-3 0x23	**Undervoltage Cutback** *Undervoltage_Cutback_Active* 0x2121 Fault Type(s): 1	1. Batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system-drain on battery.	*Set:* Capacitor bank voltage dropped below the UnderVoltageCutback limit with the FET bridge enabled. *Clear:* Bring the capacitor voltage above the controller's	Reduced drive torque.

		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 » Currents » UnderVoltageCutback. 8. See Programmer » System Monitor menu » Controller » Capacitor Voltage.	UnderVoltageCutback limit.	
2-4 0x24	**Overvoltage Cutback** *Overvoltage_Cutback_Active* 0x2131 Fault Type(s): 1	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 » Currents » OverVoltageCutback. 6. See Programmer » System Monitor	*Set:* The controller's capacitor bank voltage exceeded the OverVoltageCutback limit with the FET bridge enabled. *Clear:* Bring controller's capacitor voltage below the OverVoltageCutback limit.	Reduced brake torque. Note: This fault is declared only when the controller is running in regen.

		menu » Controller » Capacitor Voltage.		
2-5 0x25	**Ext 5V Supply Failure** *Ext_5V_Supply_Failure_Active* 0x2531 Fault Type(s): 1 = 5 V Supply's voltage is out of-range 2 = 5 V Supply's current is out of-range	1. External load impedance on the +5 V supply (pin 16) is too low. 2. See Programmer » System Monitor menu » Outputs: External_5V_Supply, Ext_5V_Current.	*Set:* (1) The 5 V Supply (pin 16) is outside 5 V±10 % (2) The current is outside limits defined by: *Ext_5V_Supply_Min* *Ext_5V_Supply_Max* *Clear: Reset Controller,* or Re-set using VCL variable Ext_5V_Output_Enable	Disables the 5 V Supply
2-6 0x26	**Ext 12V Supply Failure** *Ext_12V_Supply_Failure_Active* 0x2532 Fault Type(s): 1 = 12 V Supply's voltage is out-of-range 2 = 12 V Supply's current is out-of-range	1. External load impedance on the +12 V supply (pin 23) is too low. 2. See Programmer » System Monitor menu » Outputs: External_12V_Supply, Ext_12V_Current.	*Set:* (1) The 12 V supply (pin 23) is outside 12 V ± 15 % (2) The current is outside the limits defined by: *Ext_12V_Supply_Min* *Ext_12V_Supply_Max* *Clear: Reset Controller.* Or Re-set using VCL variable Ext_12V_Output_Enable.	Disables the 12 V Supply None, unless a fault action is programmed in VCL.
2-8 0x28	**Motor Temp Hot Cutback** *Motor_Temp_Hot_Cutback_Active* 0x2151 Fault Type(s): 1	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 »	*Set:* Motor temperature is at or above the Temperature Hot parameter setting. *Clear:* Bring the motor temperature within range.	Reduced Drive Torque If MotorBrakingThermal CutBack_Enable = On, then Regen Braking Torque is reduced.

		AC Motor Setup » Temperature Sensor.		
2-9 0x29	**Motor Temp Sensor** *Motor_Temp_Sensor_Active* 0x2150 Fault Type(s): 1	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.	*Set:* Motor thermistor input (pin 9) is at the voltage rail. *Clear:* Bring the motor thermistor input voltage within range.	MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled.
3-1 0x31	**MAIN DRIVER** *Main_Driver_Fault_Active* 0x2222 Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Open Wire (at pin)	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.	*Set:* Main Contactor driver is either open or shorted. This fault can be set only when Main Enable = On. *Clear:* Restore/repair any external wiring or device-coil to their correct state, then *Reset Controller*.	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *FullBrake*
3-2 0x32	**EM Brake Driver** *EM_Brake_Driver_fault_Active* 0x2320 Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Open Wire (at pin)	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.	*Set:* Electromagnetic brake driver (pin 4) is either open or shorted. This fault can be set only when EM Brake Type >0. *Clear:* Restore/repair any external wiring or device-coil to their correct state, then *Reset*	ShutdownEMBrake ShutdownThrottle FullBrake

			Controller.	
3-5 0x35	**Lower Driver** *Lower_Driver_Fault_Active* 0x2440	See Driver 1 Fault (page 145)		
3-6 0x36	**Encoder Fault** *Encoder_Fault_Active* 0x2230 Fault Type(s): 1 = Loss of regulation 2 = Over Current trips Loss of pulses 3 = Loss of speed signal pulses 4 = Autocharacterization 5 = Encoder supply (voltage) fault	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Programmer » System Monitor menu » AC Motor: Motor RPM. 4. See Programmer » AC Motor Setup » Quadrature Encoder » Encoder fault Setup.	*Set:* Motor encoder phase failure detected. *Clear:* Either *Reset Controller*, or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Encoder Fault is cleared and Encoder LOS fault (flash code 9-3) is set, allowing limited motor control.	ShutdownEMBrake ShutdownThrottle ShutdownMotor
3-7 0x37	**Motor Open** *Motor_Open_Active* 0x2240 Fault Type(s): 1	1. Motor phase is open. 2. Bad crimps or faulty wiring.	*Set:* Motor phase U, V, or W detected open. *Clear:* Cycle KSI.	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *FullBrake*
3-8 0x38	**Main Contactor Welded** *Main_Contactor_Welded_Active* 0x2220 Fault Type(s): 1	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).	*Set:* Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded (via the motor) for a short time and the voltage did not discharge indicating a direct-contact to the battery (i.e., Main tips are welded closed). *Clear:* Reset Controller	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *FullBrake*
3-9	**Main Contactor Did Not**	Type1:	*Set:* With the main	*ShutdownMotor*

0x39	**Close** Main_Contactor_Did_Not_ Close_Active 0x2221 Fault Type(s): 1 = Main did not close when commanded 2 = Main disconnected during operation	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 Main Pull In Voltage, Main Holding Voltage. Type2: 1. Main opened during operation (while commanded closed). 2. Driver wiring to contactor's coil (e.g., pin 3 wiring) removed during operation. 3. Contactor/coil defective.	contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+. *Clear: Reset Controller.*	*ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *FullBrake*
4-2 0x42	**Throttle Input** Throttle_Input_Active 0x2210 Fault Type(s): 4 1 = Outside the Low or High parameter.	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 » Analog Inputs » Analog 1 Type.	*Set:* Throttle voltage exceeded the *Analog Low* or *Analog High* parameters for the analog input defined for the throttle input. *Clear:* Bring throttle input voltage within the Min and max thresholds. *Reset*	ShutdownThrottle

		3. See Programmer » Controller Setup » Analog Inputs » Configure.	*Controller*.	
4-6 0x46	**NV Memory Failure** *NV_Memory_Failure_Active* 0x2830 Fault Type(s): 1 = Invalid checksum. 2 = NV write failed. 3 = NV read failed. 4 = NV write did not complete during power down.	1. Failure to read or write to nonvolatile (NV) memory. 2. Internal controller fault.	*Set:* Controller operating system tried to read or write to EEPROM memory and failed. *Clear:* Download the correct software and matching parameter default settings into the controller and *Reset Controller.*	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *ShutdownInterlock* *ShutdownDriver1* *ShutdownDriver2* *ShutdownDriver3* *ShutdownDriver4* *ShutdownDriver5* *ShutdownPD* *FullBrake*
4-7 0x47	**HPD Sequencing** *Hpd_Sequencing_Active* 0x2211 Fault Type(s): 1	1. Incorrect sequence in application of Keyswitch, 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 » Inputs » Switch Status. 5. Verify Throttle. See Programmer » System Monitor menu » Inputs » Throttle Command.	*Set:* HPD (High Pedal Disable) or SRO (Static Return to Off) sequencing fault caused by incorrect sequence of KSI, interlock, direction, and throttle inputs. *Clear:* Reapply inputs in correct sequence.	ShutdownThrottle
4-7	**EMER Rev HPD**	1. Emergency	*Set:* At the conclusion	ShutdownThrottle

0x47	Emer_Rev_Hpd_Active 0x2331 Fault Type(s): 1	Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral.	of Emergency Reverse, the fault was set because various inputs were not returned to neutral. *Clear:* If EMR_Interlock = On, clear the interlock, throttle, and direction inputs. If EMR_Interlock = Off, clear the throttle and direction inputs.	ShutdownEMBrake
4-9 0x49	**Parameter Change** *Parameter_Change_Active* 0x2813 Fault Type(s): Reports the CAN Object ID of parameter.	1. When Interlock is On, changing a safety-based parameter. Parameters with this property are marked with a [PCF] (Parameter Change fault) in the Parameter menu listings.	*Set:* Adjustment of a parameter setting that requires cycling of KSI. *Clear: Reset Controller.*	*ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake*
4-10 0x4A	**EMR Switch Redundancy** *Emr_Switch_Redundancy_ Active* 0x2817 Fault Type(s): 1	1. Either or both Emergency Reverse input switches are inoperative, resulting in an invalid state. <table><tr><td>NO</td><td>NC</td><td>State</td></tr><tr><td>On</td><td>Off</td><td>valid</td></tr><tr><td>Off</td><td>On</td><td>valid</td></tr><tr><td>On</td><td>On</td><td>invalid</td></tr><tr><td>Off</td><td>Off</td><td>invalid</td></tr></table> 2. Ingress of dirt or moisture in switch(s).	*Set:* Emer Rev Switch NO input does not agree with the Emer Rev Switch NC input. *Clear:* Correct switch states. *Reset Controller.*	ShutdownInterlock ShutdownEMBrake
5-1 ~ 7-13	**User 1 Fault** *User_{1, 2 … 32}_Fault_Active* 0x2710 Fault Type(s): OEM Definable	1. These faults (and fault actions) can be defined by the User/ OEM and are	*Set:* See User/OEM documentation *Clear:* See User/OEM Documentation	See User/OEM Documentation

		implemented in the application-specific VCL software. 2. See User/OEM documentation.		
6-8 0x68	**VCL Run Time Error** *VCL_Run_Time_Error_Active* 0x2820 Fault Type(s): 1	1. Runtime errors are defined using the VCL Error Module and VCL Error. See the System Information file: • Curtis Integrated Toolkit™ » VCL Studio » Help 2. Using driver control commands in VCL can lead to VCL runtime errors if the VCL command and the driver assignment do not match.	*Set:* VCL Run Time Error detected *Clear:* Edit VCL application software to fix this error condition; flash the new compiled software and matching parameter settings; *Reset Controller.*	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *ShutdownInterlock* *ShutdownDriver1* *ShutdownDriver2* *ShutdownDriver3* *ShutdownDriver4* *ShutdownDriver5* *ShutdownPD* *FullBrake*
7-2 0x72	**PDO Timeout** *PDO_Timeout_Active* 0x2541 Fault Type(s): 1	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.	*Set:* Time between CAN PDO messages received exceeded the PDO Timeout Period. *Clear:* Receive CAN NMT message, or *Reset Controller.*	ShutdownThrottle
7-3 0x73	**Stall Detected** *Stall_Detected_Active* 0x2231 Fault Type(s): 1	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	*Set:* No motor encoder movement detected. *Clear:* Either *Reset Controller,* or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the	ShutdownEMBrake ShutdownThrottle ShutdownMotor Control Mode changed to LOS (Limited Operating Strategy).

		»System Monitor menu » AC Motor » Motor RPM.	Stall Detected fault is cleared and the Encoder LOS fault (flash code 9-3) is set, allowing limited motor control.	
7-7 0x77	**Supervision** *Supervision_Active* 0x2840 Fault Type(s): Curtis Supervision Code	1. Internal controller fault.	*Set:* Internal controller failure *Clear: Reset Controller.*	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *ShutdownInterlock* *ShutdownDriver1* *ShutdownDriver2* *ShutdownDriver3* *ShutdownDriver4* *ShutdownDriver5* *ShutdownPD* *FullBrake*
7-9 0x79	**Supervision Input Check** *Supervision_Input_Check Active* 0x2841 Fault Type(s): 1	1. Internal controller fault.	*Set:* Damaged Controller. *Clear: Reset Controller.*	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *ShutdownInterlock* *ShutdownDriver1* *ShutdownDriver2* *ShutdownDriver3* *ShutdownDriver4* *ShutdownDriver5* *ShutdownPD* *FullBrake*
8-2 0x82	**PDO Mapping Error** *PDO_Mapping_Error_Active* 0x2542 Fault Type(s): 1	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.	*Set:* Incorrect PDO map detected. *Clear: Reset Controller.*	PDO message disabled
8-3 0x83	**Internal Hardware** *Internal_Hardware_Active*	1. Internal controller fault detected.	*Set:* Internal controller fault	*ShutdownMotor* *ShutdownMainContactor*

	0x2835 Fault Type(s): Curtis hardware code		detected. *Clear: Reset Controller.*	*ShutdownEMBrake* *ShutdownThrottle* *FullBrake*
8-7 0x87	**Motor Characterization Error** *Motor_Characterization_Active* 0x2850 Fault Type(s): 71 Failure to write NV ram 72 Temp sensor fault 73 Motor hot 74 Controller temperature cutback 76 Undervoltage cutback 77 Overvoltage cutback 78 No encoder information 79 Current Regulator Tuning out of range 80 Current Regulator Tuning out of range 81 Encoder signal seen but step size not auto-detected 82 Aborted autocharacterization — 90/98 PMAC Sin/Cos no rotation detected 91 PMAC motor not rotating 92 PMAC Motor not accelerating. Low acceleration 94–97 PMAC lag compensation out of range 99 PMAC Motor rotating at start of characterization 102 PMAC motor temp sensor 103 PMAC motor temp hot cutback 104 PMAC controller temp cutback 106 PMAC Undervoltage cutback 107 PMAC overvoltage cutback	1. Motor characterization failed during characterization process. See fault type for cause.	*Set:* Motor characterization failed during the motor characterization process. *Clear: Reset Controller.*	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *FullBrake*
8-8 0x88	**Encoder Pulse Error** *Encoder_Pulse_Error_Active* 0x2234 Fault Type(s): 1	1. Encoder Steps parameter does not match the actual motor encoder. 2. Verify parameter	*Set:* Detected wrong setting of the Encoder Steps parameter. *Clear:* Ensure the	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *FullBrake*

		settings: AC Motor Setup » Quadrature Encoder » Encoder Steps. 3. Motor lost IFO control and accelerated without throttle command.	Encoder Steps parameter matches the actual encoder; *Reset Controller.*		
8-9 0x89	**Parameter Out of Range** *Parameter_Out_Of_Range_ Active* 0x2811 Fault Type(s): Reports the CAN Object ID of parameter.	1. Parameter value detected outside of the limits. 2. Use CIT to view and write parameter value and range.	*Set:* Parameter detected outside of limits *Clear:* Bring parameter within its limits.		*ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake*
9-1 0x91	**Bad Firmware** *Bad_Firmware_Active* 0x2815 Fault Type(s): 1	The firmware in the controller is incorrect. 1. The CRC of the application or OS do not match. 2. The application was built with an incompatible OS version.	*Set:* The Loaded software is not compatible with the controller hardware *Clear:* Load the matching software. Verify that the controller model matches the cdev file for the project and the VCL Studio application.		*Controller does not fully startup (without error).*
9-2 0x92	**EM Brake Failed To Set** *EM_Brake_Failed_to_Set_ Active* 0x2321 Fault Type(s): 1	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	*Set:* After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed. *Clear:* 1. Activate the Throttle (EM Brake type 2). 2. Activate the Interlock (EM Brake		ShutdownEMBrake ShutdownThrottle Position Hold is engaged when Interlock = On.

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			type 1).	
9-3 0x93	**Encoder LOS** *Encoder_LOS_Active* 0x2233 Fault Type(s): 1	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 is stalled.	*Set:* Encoder Fault (flash code 3-6) or Stall Detected (flash code 7-3) was activated, if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Encoder LOS (flash code 9-3) control mode is activated, allowing limited motor control. *Clear:* Cycle KSI or, if LOS Mode was activated by the Stall Detected fault, clear by ensuring encoder senses proper operation, Motor RPM = 0, and Throttle Command = 0.	LOS Mode
9-4 0x94	**Emer Rev Timeout** *Emer_Rev_Timeout_Active* 0x2330 Fault Type(s): 1	1. Emergency Reverse was activated and concluded because the EMR Timeout timer has expired. 2. The emergency reverse input is stuck On.	*Set:* Emergency Reverse was activated and ran until the EMR Timeout timer expired. *Clear:* Turn the emergency reverse input (switch) to Off.	ShutdownThrottle ShutdownEMBrake
9-9 0x99	**Parameter Mismatch** *Parameter_Mismatch_Active* 0x2812 Fault Type(s): 1 = Dual Drive is enabled in Torque Mode.	1. Incorrect position feedback type chosen for motor technology in use. 2. Dual drive is	*Set:* 1. When the Dual Drive software is enabled, the controller must be set to either	*ShutdownMotor* *ShutdownMainContactor* *ShutdownEMBrake* *ShutdownThrottle* *FullBrake*

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	2 = Motor Tech = SPMSM, Feedback = Encoder 3 = Motor Tech = ACIM, Feedback = Sin/Cos	enabled in torque mode. 3. Dual drive enabled on only one controller.	Speed Mode Express or Speed Mode; otherwise this fault is set. 2. Motor Technology = 1 must be paired with Feedback Type = 2; otherwise this fault is set. 3. Motor Technology = 0 must be paired with Feedback Type = 1; otherwise this fault is set. *Clear:* Adjust parameters to appropriate values and then Reset Controller.	
9-10 0x9A	**Interlock Braking Supervision** *Interlock_Braking_Supervision_Active* 0x2332 Fault Type(s): 1 Motor speed is outside the Interlock Brake Supervision Speed Limit. 2 Interlock is Off and EM Brake not applied within time limit. 3 Interlock is Off and EM Brake not applied, and the rotor position is outside the RPM position limit.	1. During an interlock braking event, the motor speed exceeded the limit set by the Interlock Braking Supervision parameters. 2. See Programmer » Application Setup » Interlock Braking » Supervision Enable. 3. See Programmer » Application Setup » Interlock Braking » Interlock Braking Supervision.	*Set:* During an interlock braking event, the motor speed exceeded the limit set by the Interlock Braking Supervision parameters. *Clear: Reset Controller.*	ShutdownMotor ShutdownEMBrake ShutdownMainContactor
9-11 0x9B	**EMR Supervision** *Emr_Supervision_Active* 0x2333 Fault Type(s): 1	1. During an EMR event, the motor speed exceeded the limit set by the Emergency	*Set:* During an interlock braking event, the motor speed exceeded the limit set	ShutdownMotor ShutdownEMBrake ShutdownMainContactor

		Reverse Supervision parameters. 2. See Programmer » Application Setup » Emergency Reverse » Emergency Reverse Supervision.	by the Emergency Reverse Supervision parameters. *Clear: Reset Controller.*	
10-1 0xA1	**Driver 1 Fault** *Driver_1_Fault_Active* 0x2160 Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Driver Open	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.	*Set:* Driver 1 is either open or shorted. Or Driver 1 exceeded its overcurrent setting. *Clear:* Correct open or short, and then *Reset Controller.*	ShutdownDriver1
10-2 0xA2	**Driver 2 Fault** *Driver_2_Fault_Active* 0x2161 Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Driver Open	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.	*Set:* Driver 2 is either open or shorted. Or Driver 2 exceeded its overcurrent setting. *Clear:* Correct open or short, and then *Reset Controller.*	ShutdownDriver2
10-3 0xA3	**Driver 3 Fault** *Driver_3_Fault_Active* 0x2162	1. Open or short on driver load. 2. Dirty connector	*Set:* Driver 3 is either open or shorted. Or Driver 3	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.	exceeded its overcurrent setting. *Clear:* Correct open or short, and then *Reset Controller.*	
Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Driver Open				
10-4 0xA4	**Driver 4 Fault** *Driver_4_Fault_Active* 0x2163 Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Driver Open	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.	*Set:* Driver 4 is either open or shorted. Or Driver 4 exceeded its overcurrent setting. *Clear:* Correct open or short, and then *Reset Controller.*	ShutdownDriver4
10-5 0xA5	**Driver 5 Fault** *Driver_5_Fault_Active* 0x2164 Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Driver Open	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 »	*Set:* Driver 5 is either open or shorted. Or Driver 5 exceeded its overcurrent setting. *Clear:* Correct open or short, and then *Reset Controller.*	ShutdownDriver5

		Driver 5 » Driver 5 Overcurrent.		
10-8 0xA8	**Driver Assignment** *Driver_Assignment_Active* 0x2632 Fault Type(s): 5 {X} = Driver number that cause the fault	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.	*Set:* Driver assignment conflict *Clear:* Resolve the conflicted driver assignment, then *Reset Controller.*	ShutdownDriver{X} (Driver in non-operational)
11-1 0xB1	**ANALOG 1 OUT OF RANGE** *Analog_1_Out_Of_Range* 0x2620 Analog_X_Out_of_Range Fault Type(s): 1 = above High limit 2 = below Low limit	1. Analog 1 input voltage 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 » Analog Inputs » Analog 1. 4. See Programmer » Controller Setup » Analog Inputs » Configure » Analog 1 Low/Analog 1 High.	*Set:* (1) Input voltage (on pin) is above the parameter's set-point threshold. (2) Input voltage (on pin) is below the parameter's set-point threshold. *Clear:* Return the voltage to within the allowed range, then *Reset Controller.*	None, unless a fault action is programmed in VCL.
11-2 0xB2	**ANALOG 2 OUT OF RANGE** *Analog_2_Out_Of_Range* 0x2621	See Analog 1 Out of Range.	See Analog 1 Out of Range	None, unless a fault action is programmed in VCL.
11-3 0xB3	**ANALOG 3 OUT OF RANGE** *Analog_3_Out_Of_Range* 0x2622	See Analog 1 Out of Range.	See Analog 1 Out of Range.	None, unless a fault action is programmed in VCL.
11-4 0xB4	**ANALOG 4 OUT OF RANGE** *Analog_4_Out_Of_Range* 0x2623	See Analog 1 Out of Range.	See Analog 1 Out of Range.	None, unless a fault action is programmed in VCL.
B-5 0xB5	**ANALOG 5 OUT OF RANGE** *Analog_5_Out_Of_Range* 0x2624	See Analog 1 Out of Range.	See Analog 1 Out of Range.	None, unless a fault action is programmed in VCL.

11-6 0xB6	**ANALOG 6 OUT OF RANGE** *Analog_6_Out_Of_Range* 0x2625	See Analog 1 Out of Range.	See Analog 1 Out of Range	None, unless a fault action is programmed in VCL.

VII. Storage, transportation and loading of the truck

1. Loading and unloading of the truck:

Before loading the truck, check out the nameplate for the total weight of truck to choose appropriate hoisting handling equipment. The hoisting of truck shall be kept level, and landing shall be kept slow and stable. The personnel around shall watch for safety. One of the personnel is responsible for conducting. If the other truck is used for loading and unloading, please watch the bottom situation of the truck. Take care to insert the fork arms to the bottom, in avoidance of damaging the driving wheel, balance wheel and forward wheel.

2. Transportation of the truck:

If the truck needs to be transported for a long distance, support the side near to driver of truck with square timber to lift the driving wheels of truck from the ground. The two front wheels of truck shall be fixed stably by sphenoid wood block. Fasten the truck to transport truck with ropes.

Movement of the damaged truck

Towing of the truck is not allowed. As for the movement of damaged trucks, please refer to the operation methods of loading &unloading and transportation mentioned above.

3. The store of truck:

If the electric pallet truck is not used for over two months, it should be placed in the room which is in good ventilation, no frost, clean and dry; also the following measures should be taken:

Clean the truck thoroughly.

Lift the forks completely for several times, check it is normal or not.

Lower the forks to the lowest position.

Support the side near to driver of truck with square timber to lift the driving wheels of truck from the ground.

Apply a layer of flimsy oil or grease on all the bared surface of mechanical parts.

Lubricate the truck.

Check the status of storage battery and electrolyte, and imbrue the non-acid lubricating grease to the binding post of storage battery.

All the electrical contacts should be sprayed using appropriate contacts spray

Appendix I

CBDR Electric Pallet Truck packing list

Consignee：   manufacturing number：

contract number：   date of production：

Serial number	Cargo name	Number of units	Net (kg)	contour dimension(L×W×H)	Remark
1	Electric Pallet Truck	1			Complete machine
2	Accessory bag	1			Technical documents, accessories and spare parts

Note：1. The following documents are in the file bag

      ① CBDR Electric Pallet Truck operating instruction   1 volume

      ② Packing list   1 copy

      ③ certificate of quality   1 copy

    2.Accessory and spare parts

1230 controller

No.	Use part	Specification	Quantity	Remark	Designation
1	Electric lock key	Open the electric lock		2	
2	Charging plug, socket	Matched with charger		1set	For external
3	Fuse	Electrical equipment	10A	1	
4	Fuse	Electrical equipment	150A	1	
5	Fuse	Electrical equipment	180A	1	
6	seal ring UHS35	Hydro-cylinder	35X45X6	2	
7	O-seal ring	Hydro-cylinder	35.5×2.65	2	
8	O-seal ring	Hydro-cylinder	45×2.65	2	
9	Dust ring DH35	Hydro-cylinder	DH35	2	
10	Charging cable	Charger		1	For built in

1232 controller

No.	Use part	Specification	Quantity	Remark	Designation
1	Electric lock key	Open the electric lock		2	
2	Charging plug, socket	Matched with charger		1set	For external charger
3	Fuse	Electrical equipment	10A	1	

4	Fuse	Electrical equipment	20A	1	
5	Fuse	Electrical equipment	180A	2	
6	seal ring UHS35	Hydro-cylinder	35X45X6	2	
7	O-seal ring	Hydro-cylinder	35.5×2.65	2	
8	O-seal ring	Hydro-cylinder	45×2.65	2	
9	Dust ring DH35	Hydro-cylinder	DH35	2	
10	Charging cable	Charger		1	For on-board charger

AC0 controller

No.	Use part	Specification	Quantity	Remark	Designation
1	Electric lock key	Open the electric lock		2	
2	Charging plug, socket	Matched with charger		1set	For external charger
3	Fuse	Electric parts	10A	1	
4	Fuse	Electric parts	20A	1	
5	Fuse	Electric parts	160A	2	
6	Seal ring UHS35	Cylinder	35X45X6	2	
7	O-seal ring	Cylinder	35.5×2.65	2	
8	O-seal ring	Cylinder	45×2.65	2	
9	Dust ring DH35	Cylinder	DH35	2	