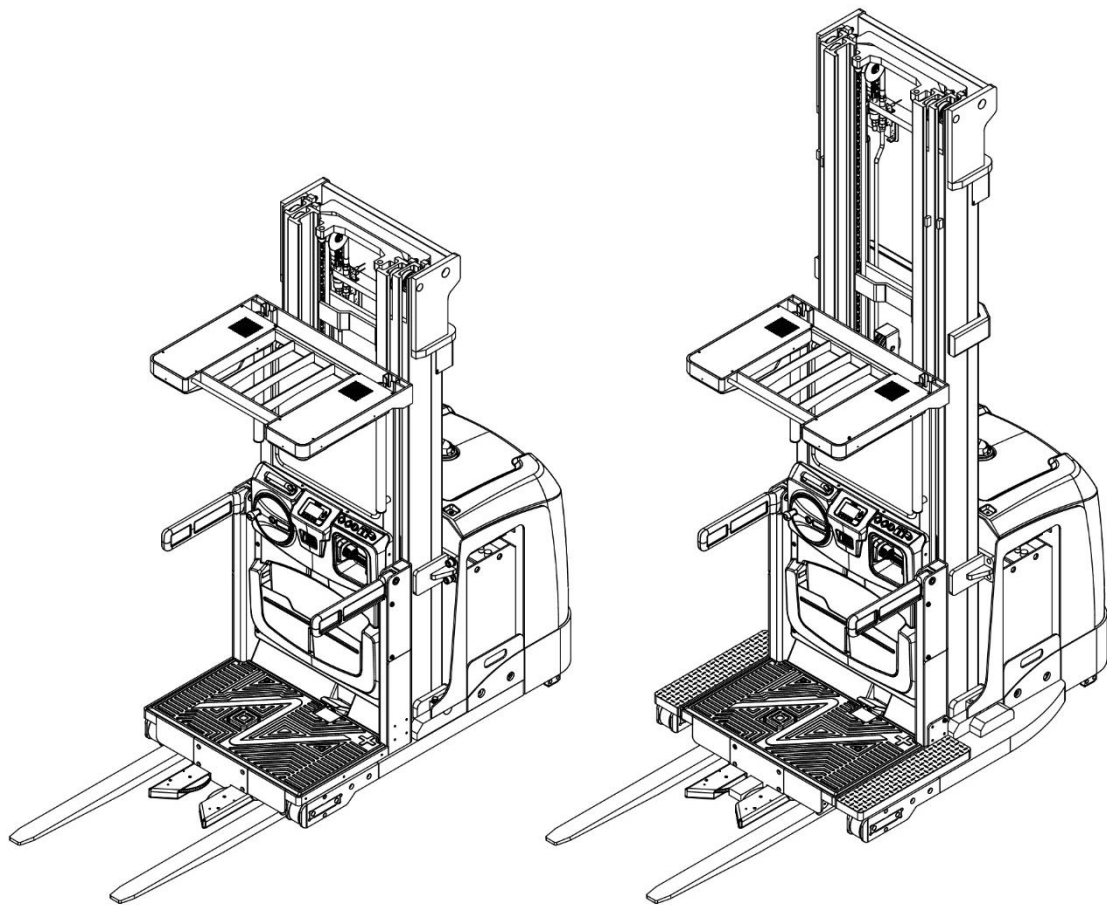


Operating Manual of High Lift-Order Picker OPH12/12K



Caution

Before using the manual, it is necessary to understand the operation instructions in this manual.



Note:

- Please check the identification of all current product types in this document and on the nameplate.
- Keep it safe for future use.

**This picker is designed
for indoor use only.**

Introduction

Before operating the picker, please read this operator's manual carefully and fully understand the use of the vehicle, improper operation may cause danger.

This manual describes the usage methods of different types of high lift-order pickers. When repairing the picker, please confirm that the picker matches your company's model.

Please keep this manual properly for future reference. Contact your local dealer for a replacement if this manual or caution/warning label is damaged or missing.

Note:

- Hazardous waste that is harmful to the environment, such as waste batteries, waste oil, and electronic products, can have negative impacts on the ecological environment or human health if not properly handled.
- Waste packaging should be placed in solid waste bins according to material classification, and collected and processed by the local specialized environmental protection bureau. To avoid pollution, littering is prohibited.
- To avoid oil leakage when using the product, users should prepare some absorbent materials (waste wood chips or dry rags) to absorb the leaked oil in a timely manner. To avoid secondary environmental pollution, absorbable materials that have been used should be handed over to specialized departments in accordance with local authority regulations.
- Please understand that our products are subject to continuous improvement, and since this manual is intended for the operation/maintenance of the picker only, it does not guarantee any special conditions that may occur in addition to those described herein.



Note: In this manual, symbols on the left represent warning and dangerous situations that may result in death or serious injury if not followed.

Contents

I.	Proper Usage and Application.....	5
1.	General rules.....	5
2.	Proper application	5
3.	Applicable conditions	5
4.	Responsibility of the piker owner.....	6
5.	Adding accessories and/or optional devices	6
II.	Vehicle Overview.....	7
1.	Vehicle application	7
2.	Main components and function description	7
2.1	Main components	7
2.2	Function description.....	8
3.	Technical parameters.....	9
4.	Identification and data nameplates.....	11
4.1	Labels and description.....	11
4.2	Nameplate.....	13
4.3	Frame number position.....	13
4.4	Load curve diagram	13
III.	Warnings, residual risks and safety instructions	14
IV.	First commissioning, lifting/transportation, storage/outage.....	15
1.	First commissioning	15
2.	Lifting/transportation	16
3.	Storage/shutdown	17
V.	Routing inspection.....	18
VI.	Operating Instructions	19
1.	Safety regulations for the operation of the picker.....	19
2.	Operation of the picker.....	20
2.1	Inspection and operation before starting daily work.....	20
2.2	Getting on and off the picker	20
2.3	Preparation	21
2.4	Inspections and operations to be carried out while the picker is running	21
2.5	Park the picker safely	21
3.	Use the picker	22
3.1	Safety regulations for picker operation.....	22
3.2	Measures taken in dangerous situations.....	23
3.3	Emergency disconnection	23
3.4	Emergency descent.....	24
3.5	Travel	24
3.6	Steering.....	25
3.7	Brake.....	25
3.8	Lifting or lowering the operating platform	25
4.	Combination lock	26

4.1 Main functions.....	26
4.2 Main Operations	26
5. Troubleshooting	29
VII. Battery - Safety regulations, charging, replacement.....	30
1. Battery type.....	30
2. Safety regulations	31
1.1 Maintenance personnel	31
1.2 Battery handling.....	31
1.3 General precautions for lead-acid batteries	32
1.4 General precautions for lithium batteries.....	33
3. Charging.....	34
4. Battery removal and installation.....	35
5. Battery replacement.....	35
VIII. Regular maintenance	36
1. Maintenance list.....	36
2. Lubricating point.....	38
3. Check and refill hydraulic oil	39
4. Check the electrical fuse.....	39
5. Schematic diagram of hydraulic system	40
6. Schematic diagram of brake system	41
7. Power display and power alarm.....	42
8. Circuit diagram.....	43
Self-diagnosis and troubleshooting.....	45

I. Proper Usage and Application

1. General rules

The use, operation, and maintenance of the picker must comply with the operating procedures specified. Any other types of operations are deemed improper use and may result in injuries to personnel and damage to other properties.

2. Proper application



Note!

The maximum load is indicated on the capacity plate, and must not be exceeded.

The following operations comply with regulations and are permitted:

- The operator carries out the operation to make the platform rise or descend.
- Carry small objects on the operating platform.
- It is possible to travel when the operating platform rises or descends.
- Operate indoors.
- Operate on flat ground.
- Goods picking
- Maintenance

The following operations are prohibited:

- Push or pull the loads
- Operate on uneven ground.
- Operate outdoors
- Wind affects the operating stability of the working platform.

The picker is only used for indoor applications. If there is wind during indoor use (for example, if the warehouse door is opened), the operation should be paused until the wind weakens.

Operating in areas open to the public



If the picker is operated in an area open to the public, it may pose a risk of harm to third parties.

- If operated in an area open to the public, the picker must be driven and operated by a trained operator or driver.
- If the situation becomes excessively chaotic, due to the presence of the public, the operator must indicate the permitted space to the public in order to avoid potential accidents. If necessary, the operator must cooperate with the dispatcher, who instructs personnel to leave the hazardous area. If there are still people inside the hazardous area, the dispatcher shall warn the operator.
- For the safety of third parties, the picker is equipped with lighting equipment. The operation button triggers a voice warning.
- If any of these safety features are not functioning, the picker will stop operating. Do not use it until the malfunction has been corrected.

3. Applicable conditions

- Application in industrial and commercial environments.
- Operate only on a paved, level ground with sufficient bearing capacity.
- Do not exceed permissible load limits of surfaces and points on the travel path.

- Only operate on the operating paths that are visible and have been approved by the operating company.
- The maximum operation tilt angle is up to 1.0°.
- When traveling on slopes, do not cross or travel at a certain angle.
- Necessary precautionary measures shall be taken when operating in areas that are partially open to the public.



Operating the picker in extreme conditions can lead to breakdowns and accidents.

- If the picker is to be used under extreme conditions, especially in dusty or corrosive environments, special equipment and authorization are required.
- It is not allowed to operate in explosive environments

The picker must only be used in industrial and commercial environments. The picker must only be parked and secured indoors.

- Allowable temperature range + 5 °C to + 25 °C.
- Safe parking is only allowed at + 5 °C to + 25 °C.
- Maximum air humidity is 95%, without condensing.
- Do not charge the battery below +5 °C.

4. Responsibility of the picker owner

For the purposes of this operating manual, "operating company" is defined as a natural person or legal person who uses the picker personally or on behalf of others. In special circumstances (such as leasing or renting), the operating company is considered as the designated entity responsible for fulfilling the specified operational duties based on the existing contractual agreement between the industrial vehicle owner and the operator.

The operating company must ensure that the picker is used only for its intended purpose and guard against risks to the health and safety of the operator and third parties. In addition, the operating company must comply with accident prevention regulations, safety regulations, and guidelines for operating, service and repair. The operating company must ensure that all operators have read and understood these operating instructions.



Failure to follow the operating instructions will result in the warranty being invalidated. The same applies if the operator or a third party performs improper operation on the picker without the permission of the manufacturer.

5. Adding accessories and/or optional devices

Prior written approval from the manufacturer is required for the installation or expansion of any additional equipment for the picker's functionality. Approval from local authority may also be required.

However, the approval of the local authority cannot replace the approval of the manufacturer.

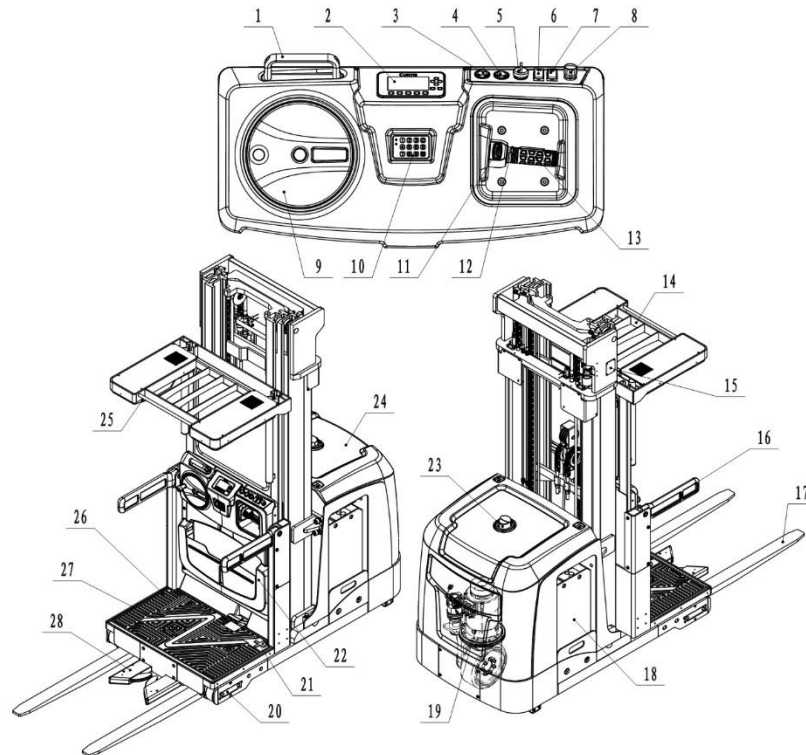
II. Vehicle Overview

1. Vehicle application

The picker is a large order picker that needs to be operated on flat ground. Small items can be placed on the pallet

The rated load is shown on the nameplate or Qmax load label.

2. Main components and function description



2.1 Main components

Serial number	Name	Serial number	Name
1	Handle	15	Height measuring device
2	LCD instrument	16	Safety arm
3	USB converter	17	Fork
4	Cigarette lighter	18	Battery
5	Key switch	19	Drive assembly
6	Fan switch	20	Load-bearing wheel
7	Headlight switch	21	Release switch (clamping)
8	Emergency stop switch	22	Instrument cover
9	Steering control	23	Warning light
10	Combination lock	24	Electrical enclosure
11	Lifting and lowering switch	25	Headlight
12	Horn	26	Operator platform
13	Handle	27	Foot pedal
14	Overhead guard	28	Clamping component

2.2 Function description

- Safety function

The operator on the picker is surrounded by elastic safety arms to protect their safety.

The safety arms must remain closed at all times while the picker is working. If the safety arms are opened, the picker cannot be used.

When the picker is working, the operator must wear a safety harness, otherwise, there will be a risk of falling when the picker is working.

Only after stepping on the foot pedal can the picker be driven.

- Emergency stop safety function



In dangerous situations, press the emergency disconnect switch to shut off all electrical functions.

- Automatic brake of the picker

If the system does not receive the required signal or detects an error, the system will urgently stop responding and brake the picker until it stops or a valid signal state is reached.

- Hydraulic System

Press the lift ascending switch (11) to start the pump set, the oil tank supplies hydraulic oil to the lift cylinder, and press the lift descending switch (11) to trigger the operating platform to descend.

The ascending/descending of the operating platform is proportional and can be controlled by the operator.

- Working platform

The picker is equipped with an operating platform. The travel function can only be enabled when the operator is standing on the operating platform, pressing down on the foot pedal, and with the safety arm closed.

- Driving system

The operator is able to activate the driving function by pressing down on the foot pedal when the safety arm is closed. They can then initiate the driving function by turning the handle (13).

The traction controller controls an AC motor to drive the mid-positioned platform located at the front of the working platform.

- Steering

Electric steering is realized through the steering wheel (9) on the left.

The picker is controlled by the steering controller, which operates the steering motor to drive the direction of the drive wheels for steering.

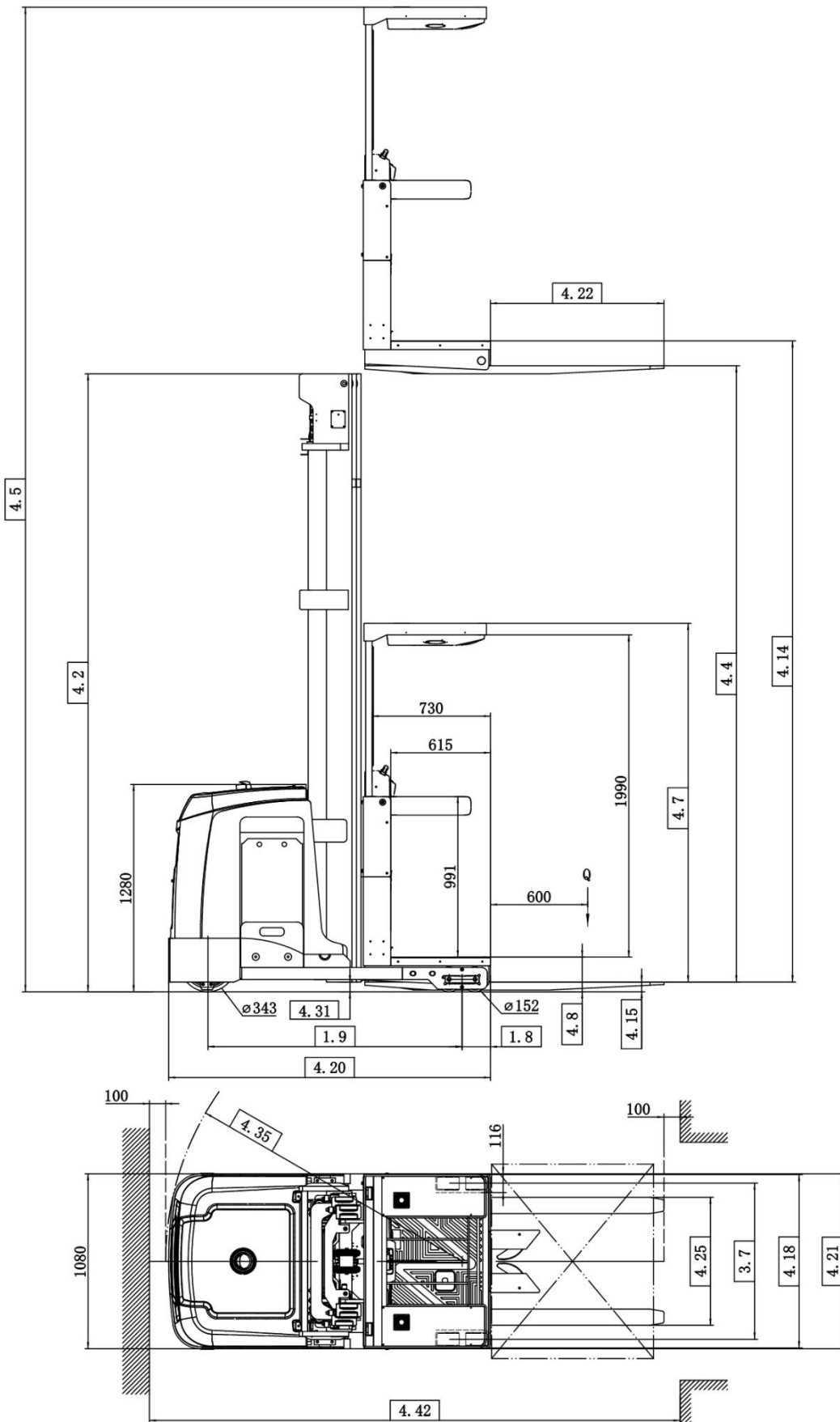
- Electric System

The picker is equipped with electronic drive and proportional lift control. The working voltage of the picker's electrical system is 24V.

- Control and display

The ergonomic control handle ensures flexible driving and ascending/descending, and the extra-large steering wheel can flexibly control the steering direction of the picker. The high-definition LCD screen displays important information for the operator, such as working hours, battery capacity, fault codes, and alarms.

3. Technical parameters



Main technical parameters

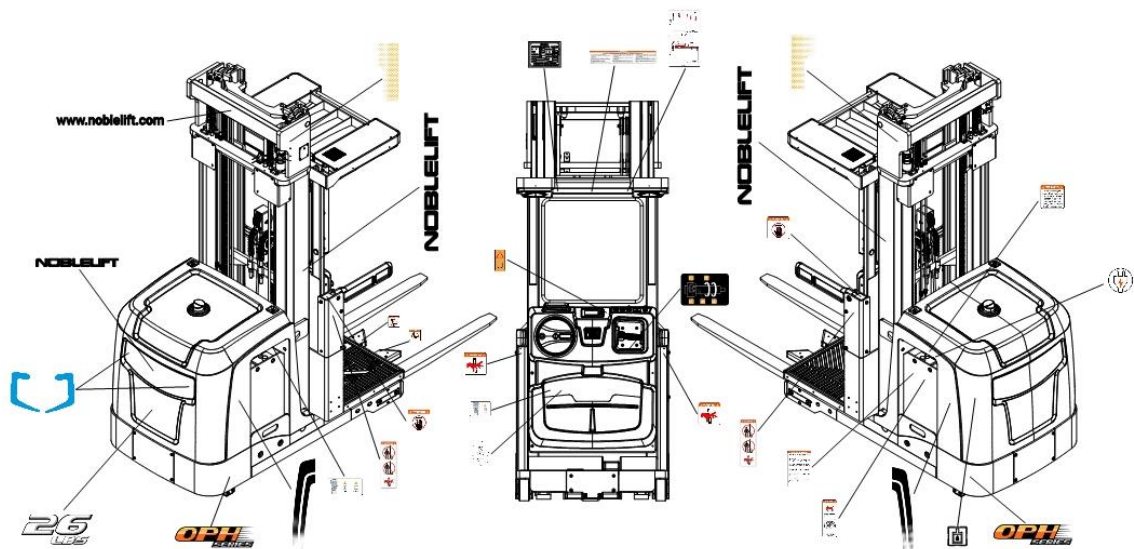
Table of industrial vehicle type

Characteristics	1.1	Manufacturer	NOBLELIFT						
	1.2	Model		OPH 12			OPH12K		
	1.3	Power supply type		Battery					
	1.4	Driving style		Picker					
	1.5	Rated load capacity	t	1.2			1.2		
	1.6	Load centre distance	c(mm)	600					
	1.8	Front overhang	x(mm)	175					
	1.9	Axle distance	y(mm)	1576					
Weight	2.1	Self-weight (including battery)	kg	3610	3640	3760	4065	4170	4275
	2.2	Load on axle (with load)	kg	1360/3450	1367/3473	1438/3522	1548/3716	1595/3775	1653/3822
	2.3	Load on axle (without load)	kg	2075/1535	2088/1552	2165/1595	2258/1822	2305/1875	2410/1870
Tire	3.1	Tire type		polvurethane					
	3.2	Tire size: front wheel (drive wheel)	mm	343x140					
	3.3	Tire size: rear wheel (support wheel)	mm	152x74					
	3.5	Number of wheels (drive wheel/support wheel)		1x/4					
	3.7	Wheelbase (load wheel side)	b10(mm)	964			1304		
Dimensions	4.2	Gantry height	h1(mm)	2315	2415	2815	3145	3481	3815
	4.3	Free lifting height	h2(mm)	40	140	540	870	1206	1540
	4.4	Lifting height	h3(mm)	4500	4800	6000	7000	8000	9000
	4.5	Maximum height after lifting	h4(mm)	6715	7015	8215	9215	10215	11215
	4.7	Overhead guard height	h6(mm)	2275					
	4.8	Leg height	h7(mm)	150					
	4.11	Additional lifting height	h9(mm)	/					
	4.14	Total width	h12(mm)	1080			1420		
	4.15	Fork height	h13	60					
	4.18	Total width (operating platform)	b9(mm)	1070			1420		
	4.20	Length to the surface of the fork	l2(mm)	1985					
	4.21	Total width	b1/b2(mm)	1080/1070			1080/1420		
	4.22	Fork size	Thxwxl(mm)	50x100x1145					
		Fork length	mm	760/915/990/1070/1220					
	4.24	Width of fork frame	b3(mm)	/					
	4.25	Fork width	b5(mm)	610-790					
	4.27	Width of guide roller	b6(mm)	/			/		
	4.31	Ground clearance	m1(mm)	60					
	4.34	Working passage width	Ast(mm)	1300			1620		
	4.34.1	Passage width (1000 x 1200, across the fork)	Ast3(mm)	1400			1620		
4.34.2	Passage width (800 x 1200, parallel to the fork)	Asts(mm)	1300			1620			
4.35	Turning radius	Wa(mm)	1830						




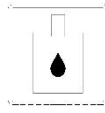



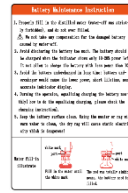

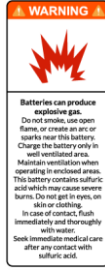

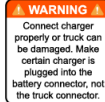

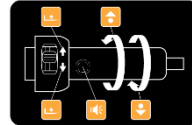



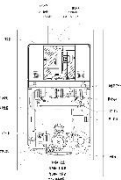
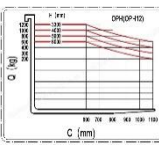
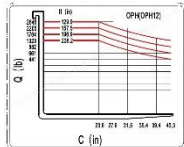
Performance	5.1	Drive speed	km/h	9
	5.2	Ascending speed, heavy load/no load	m/s	0.15/0.23
	5.3	Descending speed, heavy load/no load	m/s	0.30/0.30
	5.10	Service brake		Regenerative braking
Electric	6.1	Drive motor power	kW	3.9
	6.2	Lifting motor power	kW	24V/6.4 48V/8.2
Power	6.3	Maximum battery size	Lxwxh(mm)	374x 975x 785
	6.4	Battery voltage/capacity (discharge rate K5)	VAh	24V/1000 24V560Li 48V420 48V400Li
	6.5	Battery weight	kg	810
Other	8.1	Control method		AC control

4. Identification and data nameplates

4.1 Labels and description



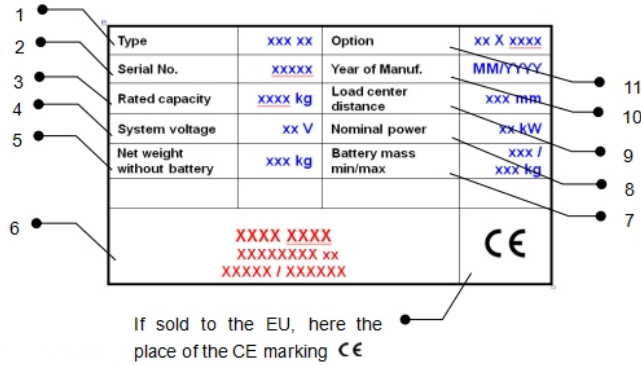
	Company website		Reflective label
	LOGO (small)		LOGO (large)
	Vehicle model label		Weight label
	Programming port		Programming port

	Reflective label		Reflective label
	Warning label		Oil filler
	Anti-pinch label		Anti-pinch label
	Anti-pinch label		Battery warning label
	Warning label		Battery explosion warning label
	Charging label		Charging warning label
	Instruction manual mark		Operation diagram
	Reflective label		Reflective label
	Nameplate		Lubrication diagram
	Load curve (Kg)		Load curve (In)

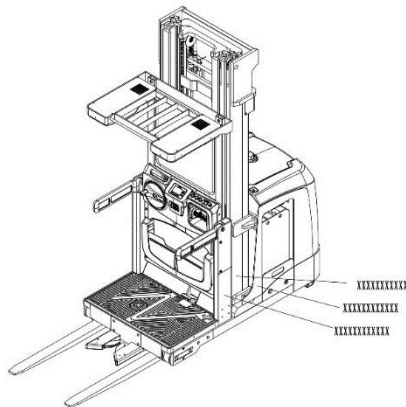
Follow the instructions on the label and replace it promptly if it is damaged or missing.

4.2 Nameplate

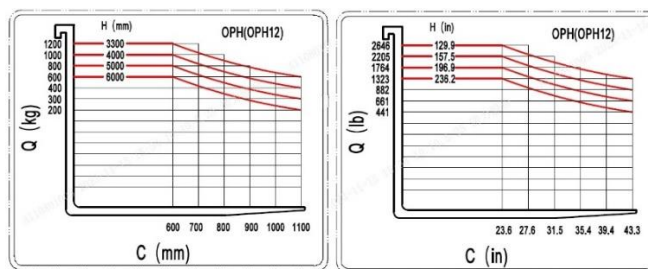
- | | | | |
|---|------------------------------------|----|-------------------------------|
| 1 | Designation, type | 7 | Battery weight Min./Max in kg |
| 2 | Serial number | 8 | Nominal power in kW |
| 3 | Rated capacity in kg | 9 | Load center distance in mm |
| 4 | Supply voltage in V | 10 | Manufacturing date (MM/YY) |
| 5 | Net weight in kg (without battery) | 11 | Option |
| 6 | Name and address of manufacturer) | | |



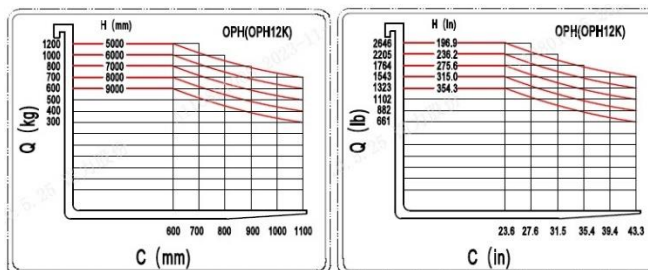
4.3 Frame number position



4.4 Load curve diagram



OPH12



OPH12K

III. Warnings, residual risks and safety instructions



- It is prohibited to use the vehicle in environments with explosive gases, explosive dust, and corrosive acid-base conditions;
- It is prohibited to use the vehicle outdoors or in the environment with poor ground conditions;
- It is prohibited to put your feet or hands under or into the lifting mechanism;
- It is prohibited for other personnel to stand in front or behind the picker while driving or lifting/lowering it;
- Overloading is prohibited, and the load weight and lifting height must meet the requirements of the load curve;
- It is strictly prohibited to place your feet on the outside of the vehicle while driving the picker, as this may result in injury;
- Lifting personnel is prohibited due to the risk of falls and serious injury;
- It is prohibited to push or pull goods;
- It is prohibited to use the picker on slopes;
- It is prohibited to load unstable, loose and unbalanced cargo, and the center of gravity of the cargo must be in the middle of the two forks;
- Turn off the power supply and unplug the key when leaving the picker to prevent other personnel from operating it by mistake;
- It is prohibited to modify the picker without the written consent of the manufacturer;
- The lifted goods will become unstable when they are affected by wind. Do not lift the goods when there is wind.

Observe different ground conditions while driving, cargo may drop or the vehicle may lose control. Check the load frequently and stop operating the vehicle immediately if the load becomes unstable. When the goods slide on or off the vehicle, immediately brake the vehicle and press the emergency power-off switch. Refer to Chapter VIII for any malfunctions of the picker.



- The picker is only allowed to be used indoors. The ground must be flat and hard, with the unevenness within 1cm/m².
- Operators of the picker must be trained and obtain the appropriate driver's license;
- When operating the picker, the operator must wear safety shoes and safety harness;
- The operating environment temperature is from +5°C to +40°C;
- The lighting conditions in the work environment must reach a minimum of 50 lux;

IV. First commissioning, lifting/transportation, storage/outage

1. First commissioning

Upon receipt of our new picker or in the event that a recommissioning is required, please perform the following steps before operating the vehicle (for the first time):

- Check all parts for damage
- Gantry installation (please refer to the gantry installation method to proceed)
- Installation and charging of batteries (refer to Chapter VII)
- Conduct daily inspections (refer to Chapter V)

Gantry installation:

Equipment required for installing the gantry:

Lifting equipment:

Overhead crane (maximum capacity: 5 tons) or forklift (capacity: 3 tons, lifting height: 4.5 m)

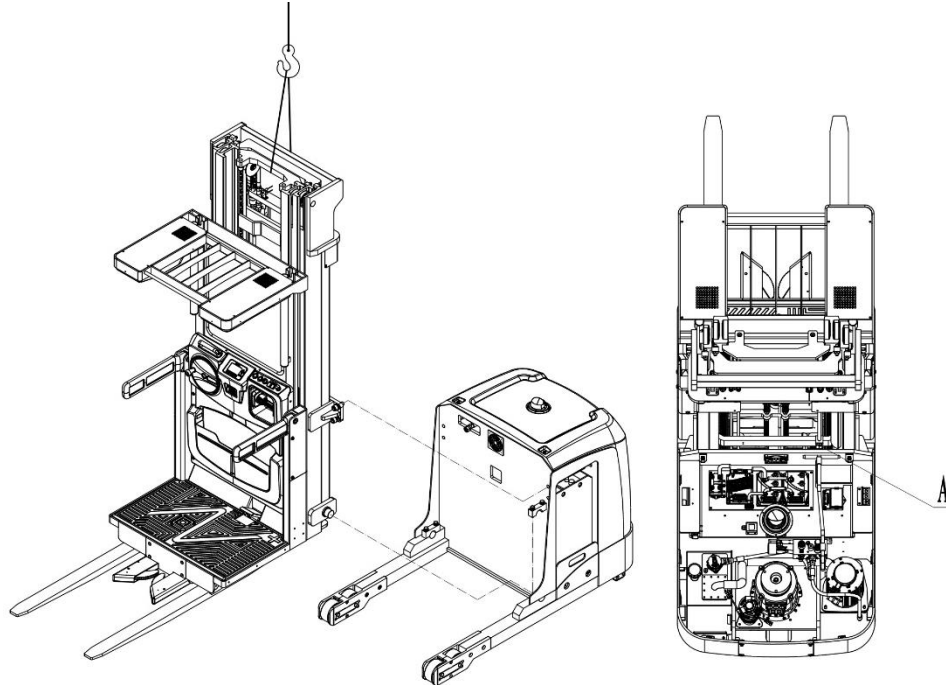
Auxiliary tools: wrench S19, S24, S32, S41, hexagon wrench, crowbar.

Safety precautions:

Installation operators must undergo relevant operation training or be guided by trained professionals on-site for installation tasks.

The operators of auxiliary lifting equipment must have corresponding job qualifications.

If a forklift is used to directly lift the gantry by putting the fork on the gantry's beam, it is necessary to use a protective rope to connect the gantry and the forklift's forks together to prevent any dangerous slipping or detachment.



Chassis and gantry weights

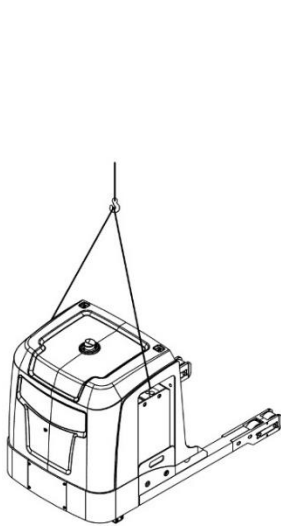
Vehicle Model	OPH12		
Packing weight of chassis [kg]	1920		
Packing size of chassis [mm]	2000x1300X1500		
Lifting height H3 [mm]	4500	4800	6000

Gantry packing weight [kg]	1490	1520	1685
Gantry packing size [mm]	2300x1200X1200	2400x1200X1200	2800x1200X1200

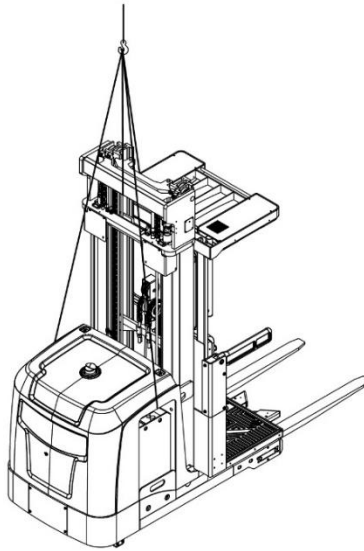
Vehicle Model	OPH12K					
Packing weight of chassis [kg]	2010					
Packing size of chassis [mm]	2000x1600X1500					
Lifting height H3 [mm]	4500	4800	6000	7000	8000	9000
Gantry packing weight [kg]	1490	1520	1685	1815	1925	2040
Gantry packing size [mm]	2300x1200 X1200	2400x1200 X1200	2800x1200 X1200	3150x1200 X1200	3460x1200 X1200	3800x1200 X1200

2. Lifting/transportation

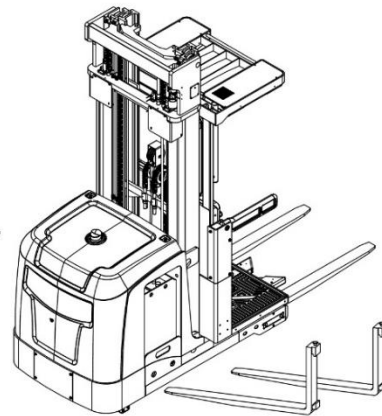
During loading and unloading, please lift or forklift the equipment as shown in the diagram below. The weight of the chassis and gantry should be as shown in the table above, and the overall weight should refer to the nameplate.



Chassis lifting diagram



Picker lifting diagram




Picker forklifting diagram

Lift



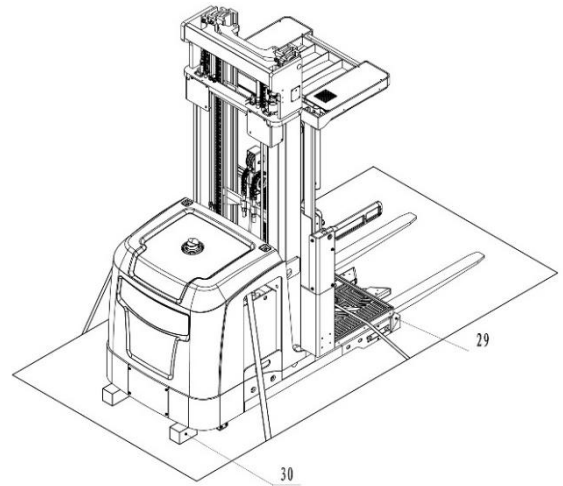
- Using professional cranes and lifting equipment.
- Do not stand under wobble goods.
- Do not enter hazardous areas during lifting.
- Place the picker on a level ground.

Transportation

 During transportation, the picker needs to be securely fixed to the truck.

Lower the operating platform and park the vehicle safely.

Secure the picker with specialized lifting straps, as shown in the figure, and use wedges (29) on the other side to secure wheels, preventing any slippage.



Transportation bundling diagram

3.Storage/shutdown

Lower the fork to the lowest position as shown in figure above. Cushion the drive wheel end with sleepers (30) to suspend the drive wheel and prevent damage to the drive wheel during long-term storage.

Apply grease to all lubrication points mentioned in this manual (regular inspection) to prevent rusting and dust accumulation on the vehicle.

Charge vehicles that have been out of service for a long time once a month to prevent battery damage.

For vehicles that are eventually scrapped, please give them to the relevant recycling company. According to regulations, oil, batteries and electronic components should be recycled or treated harmlessly.

V. Routing inspection

This chapter explains the pre-work inspection required before operating the vehicle.

The vehicle should undergo daily inspections to effectively detect faults or malfunctions. Before operation, the following key points of the vehicle need to be checked.

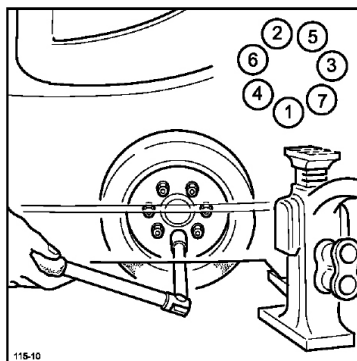
Remove the goods from the vehicle and lower the forks.

If any malfunctions are found, please stop using this vehicle.

- ⚠ ● Check for scratches, deformations, or cracks.
- Check the oil cylinder for oil leakage.
- Check the longitudinal driving condition of the vehicle.
- Check the chain and roller for damage or corrosion.
- Check whether the wheels can move smoothly.
- Press the emergency stop button to check the emergency stop function.
- Check the logic function of the foot pedal.
- Operate the integrated handle to check the lifting and lowering functions.
- Check if the safety arms are firmly installed
- Check the horn.
- Check that all bolts and nuts are securely tightened
- Check the function of the key switch.
- Check the speed limit switch.
- Visually inspect for any damaged tubing or electrical wiring.
- Check the condition of the anti-fall limiter and safety harness for any damage or missing function
- If the vehicle is equipped with attachments, Check if they are damaged and installed correctly

Special Note:

For new vehicles put into use or forklifts with changed wheels, the operator must check the tightness of the tire nuts before starting work every day within the initial 50 hours of operation. If any nuts are found to be loose, they must be tightened to a torque of 140Nm. After working for 50 hours, it is necessary to conduct another inspection, and then repeat the inspection every 50 hours until there is no looseness after multiple consecutive checks (maintain the correct torque).



VI. Operating Instructions

1. Safety regulations for the operation of the picker

Driver authorization

The picker shall only be used by the properly trained personnel with necessary driving skills and cargo handling ability, and have explicit authorization. National regulations must be adhered to, where applicable. A driving license may not be required.

Wind will affect the operational stability of the picker.

The picker is only suitable for indoor applications. If wind occurs during indoor applications (e.g. if warehouse doors are open), operation shall be suspended until the wind abates.

Operator's rights, obligations and responsibilities

The operator must be informed of their duties and responsibilities, and guided in picker operation. The operator must be familiar with the content of the operating instructions.

Unauthorized use

The operator is responsible for the picker in use. Operators must prevent unauthorized personnel from driving or operating the picker. No person should be lifted or carried on the picker (except for the operator).

Damage and malfunction

If there is any damage or malfunction of the picker, the operator must immediately notify the supervisor. Do not operate the picker in unsafe conditions (such as worn wheel or brake failure) until they are properly repaired.

Maintenance

Operators are strictly prohibited from performing any repairs or modifications on the picker without proper authorization and necessary training. Operators are not allowed to disable or adjust safety mechanisms or switches.

Danger zone



There is a risk of accidents or injuries in the dangerous zones around the picker

Dangerous areas are areas where the picker may endanger personnel during traveling or lifting, including the area where the load falls or operating equipment descends or falls.

- Instruct unauthorized persons to leave dangerous areas.
- When a third-party danger occurs, send a warning signal promptly.
- If unauthorized personnel are still in the dangerous area despite being asked to leave, please stop the picker immediately.

Instructions of safety devices, warning signs and warnings

The instructions of safety devices, warning signs (see pages 11-13) and warnings must be strictly observed.




Removing or disabling safety devices may lead to accidents

Removing or disabling safety devices such as emergency disconnect switches, key switches, buttons, horns, blue lights, sensors, panels, etc., may result in accidents and injuries.

- Report any defects to your supervisor immediately.
- Identify faulty pickers and stop using them.
- Do not resume using the picker until the fault has been identified and rectified.

2. Operation of the picker

2.1 Inspection and operation before starting daily work

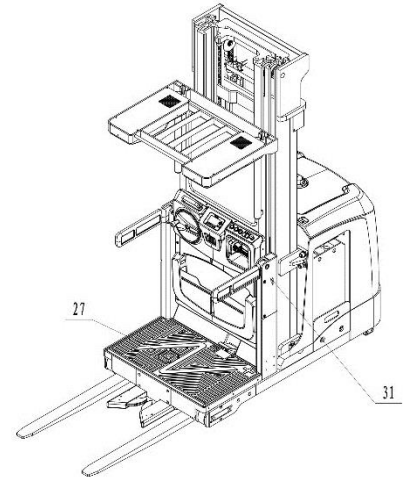
 Damage or other defects of the picker may lead to accidents.

If any damage or defects of the picker is found during the following inspection process, the picker must be immediately taken out of use until it is properly repaired.

- Report any defects to your supervisor immediately.
- Identify faulty pickers and stop using them.
- The picker can be put back into operation only after the failure has been identified and repaired.

Inspection before daily operation

- Inspect the entire picker for damage and leaks.
- Check whether the drive wheel and the load bearing wheel are damaged.
- Check marks and labels for completeness and legibility, see Chapter II.
- Make sure the panels are firm and check whether they are damaged.
- Check the functionality of the foot pedal (27) to ensure it is working properly.
- Check the safety functions, such as the safety arm switch (31), to ensure they are working properly.



2.2 Getting on and off the picker

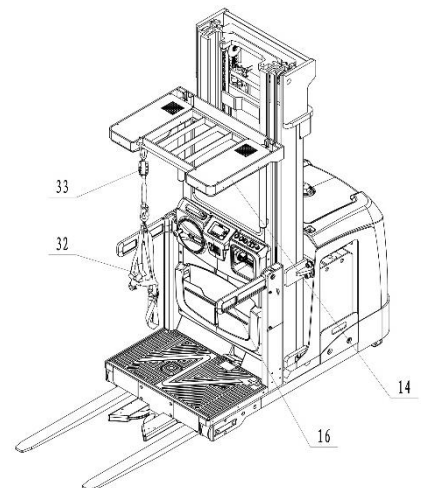
The operator must completely lower the platform before getting on or off the picker.

Make sure the picker is already parked and completely stationary before getting on and off.

Getting on and off the picker

- Open the safety arm upward (16).
- Grab the safety arm frame when getting on and off the picker
- Close the safety arm (16).

In addition, users can purchase their own safety harness (32) and anti-fall limiter (33), and hang them on the protective roof (14).



 Caution!

- There is a risk of being pinched when opening and closing the safety arm (16).
- After the operating platform is raised, do not open the safety arm (16) to prevent the driver from falling.
- It is not allowed to operate the picker in the operating platform by multiple persons.
- To operate the open-type picker, it is mandatory to fasten the safety harness (32) beforehand. Failure to do so will result in the prohibition of operating the picker and raising the gantry.

- Do not unfasten the safety harness until the gantry reaches the lowest end (32).

2.3 Preparation

Do not place your hands on the control handle when starting the picker.

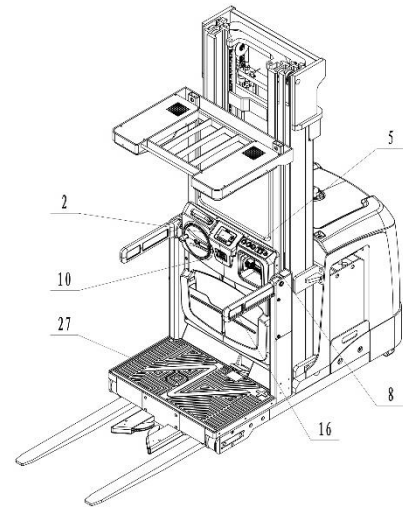
The control handle can only be used after the picker has been completely started and the self-diagnostic program has run.

Start the picker

Perform inspections and operations before starting daily work.

- Pull out the emergency stop switch (8).
- Turn the key switch (5) or enter the code to open the combination lock (10).
- Check that the safety arm (16) is in place.
- Step on the foot pedal (27), then release the foot pedal.

LCD instrument (2) indicates that the function is normal, and the picker is ready to run.



2.4 Inspections and operations to be carried out while the picker is running



Caution!

Damage or other defects of the picker may lead to accidents.

If any damage or defects of the picker is found during the following inspection process, the picker must be immediately taken out of use until it is properly repaired.

- Report any defects to your supervisor immediately.
- Identify faulty pickers and stop using them.
- The picker can be put back into operation only after the failure has been identified and repaired.

Test warning indicators and safety devices:

- Test the emergency disconnect function by pressing the emergency disconnect switch. When the main loop is disconnected, the picker cannot move.
- Press the "Horn" button to test the horn.
- Check braking efficiency.
- Test travel and steering functions.
- Perform functional testing on the hydraulic system.
- Check if the clamping device is functioning properly.
- Test control elements and displays and check for damage.

2.5 Park the picker safely



Caution!

Unsafe parking of the picker can lead to the risk of accidents

It is forbidden to leave the picker without safety protection.

- When the operator leaves, please park the picker safely.
- It is enough to simply press the emergency stop switch if the operator is only away from the picker for a short period of time.

⚠ Caution!

Unsafe parking of the picker can lead to the risk of accidents

It is prohibited to park the picker on slopes.

- Place the picker on a level ground. In special cases, the picker may need to be secured with wedges.
- If the brake is not working, place wedges under the wheels of the picker to prevent it from moving.

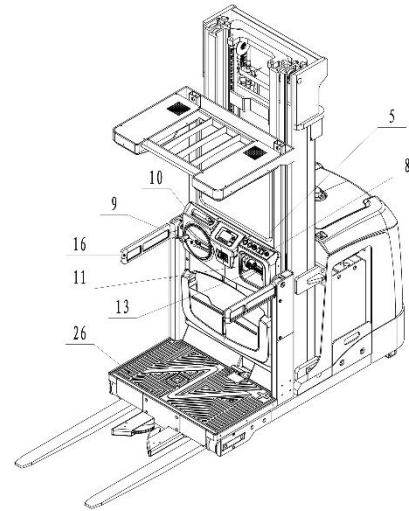
Steps

- Park the picker on a level ground.
- Completely lower the operating platform:
- Turn the "Lifting and lowering switch" (11) knob. Lower operator platform (26)
- Turn the travel handle (13) and steering wheel (9) to turn the vehicle into "straight driving."

Shut down the picker:

- Turn off the key switch (5) or the combination lock (10).
- Press the emergency disconnect switch (8).
- Open the safety arm (16).
- Leave the operator platform (26).
- Close the safety arm (16).

Parking of the picker is completed.



3. Use the picker

3.1 Safety regulations for picker operation

Travel routes and working areas

Use only lanes and routes specified for the picker. Unauthorized third parties must stay away from the working area. The load can only be stored in a specially designated place.

The picker must only operate in well-lit working areas to avoid hazards to personnel and materials. If the picker operates in an area with insufficient lighting, additional optional devices are required.

Operating is only allowed within the enclosed area.

⚠ Danger!

Do not exceed the permissible surface loads and point loads on the driving lane.

In the blind spot, please have another person assist.

The operator must ensure that the loading platform is not removed or loosened during loading and unloading.

Travel process

The operator must adjust the travel speed according to site conditions. When passing through bends or narrow passages, revolving doors, and blind spots, operators must drive slowly. The operator must always maintain a safe braking distance from any vehicle in front and must always control the operator platform. Sudden stops (except in emergency situations), sharp turns and overtaking in dangerous or blind areas are not permitted. When leaving the work and operation area, it is prohibited to lean you body or reach your hands out.

Tilt sensor

The tilt sensor is switched on at a lifting height of 500mm at the platform height. It can prevent the picker from tipping over when driving on inclined surfaces. When the inclination angle exceeds 1.0°, driving and lifting will be turned off. The operator platform must be lowered to continue operating the picker, and then the picker can be driven out of the hazardous area.

Operating field of view

The operator must always face the travel direction of the picker and maintain clear visibility of the path ahead. If the load affects visibility, the picker must travel in the opposite direction of the load. If this is impossible, another person must walk next to the picker to assist in observing the path of travel while maintaining communication with the operator. Drive at crawling speed only, and pay attention to safety. If personnel assistance is lost, please stop the picker immediately.

Load type

The load must always be safely and carefully placed. Take appropriate precautions to prevent part of the load from tipping over or dropping. Prevents liquid loads from sloshing.

Electromagnetic effects may cause accidents

Strong magnets can cause damage to electronic components such as Hall sensors, resulting in accidents.



- Do not use magnets in the operating area of the picker.

Dropped parts pose a risk of injury.

If placed on a fork, objects may fall off.



- Use containers or fixing devices to prevent objects from falling off the fork.
- Do not exceed the allowable load of the fork.
- No loose objects shall be placed on the fork.

3.2 Measures taken in dangerous situations

If the picker is in danger of tipping over or falling off the loading ramp, follow these steps:



- Abandon the picker.

Avoid turning when driving on loading ramps.

3.3 Emergency disconnection

Maximum braking may cause accidents

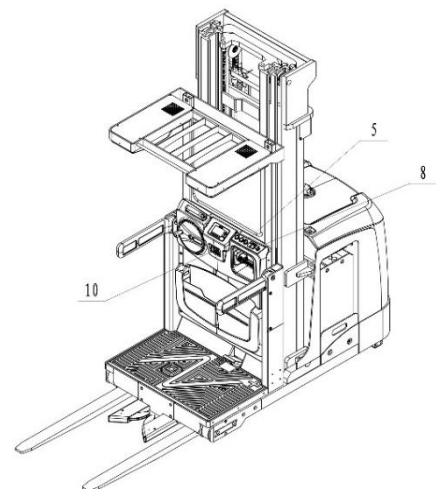
Operating the emergency stop switch during driving will cause the picker to stop with maximum braking force, which will cause the load to slide. This increases the risk of accidents and injuries.



- Do not use the emergency stop switch as a service brake.
- When traveling, only use the emergency stop switch in case of danger.

Failure or unable to access to the emergency stop switch can lead to accidents.

In dangerous situations, the operator cannot stop the picker in a timely manner by applying the emergency stop switch.



- The operation of the emergency stop switch shall not be obstructed by objects placed on it.
- Immediately report any defect in the emergency stop switch to your supervisor.
- Identify faulty pickers and stop using them.
- It can only be put into use after the fault is repaired.

Disconnection

Press the emergency disconnect switch (8).
 All major electrical functions are deactivated.
 The picker brakes and stops.

Start

Turn the emergency disconnect switch (8) to unlock the picker.
 Then turn the key switch (5) or enter the password on the combination lock (10).

All electrical functions have been turned on and the picker is running again (provided that the picker can run before pressing the emergency disconnect switch).

3.4 Emergency descent

Emergency descent can only be carried out by trained personnel.

- During the operation, the operator must pay attention to the surroundings of the picker.
- Pay attention to the cut and break points below the operating platform before lowering the operating platform.

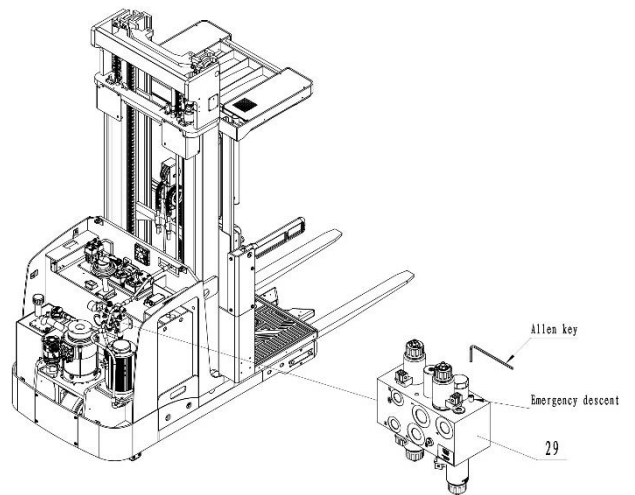
Even in the event of electronic equipment failure, the emergency descent function can be utilized to lower the operating platform.

Requirements

- In case of emergencies.
- Safe parking of picker, refer to page 20.
- The platform cannot be lowered through emergency control.

Steps

Remove electrical cover (24).
 Use an Allen key to loosen the screws on the valve set (29) shown in the figure (emergency descent).
 Slowly lower the operator platform.



3.5 Travel

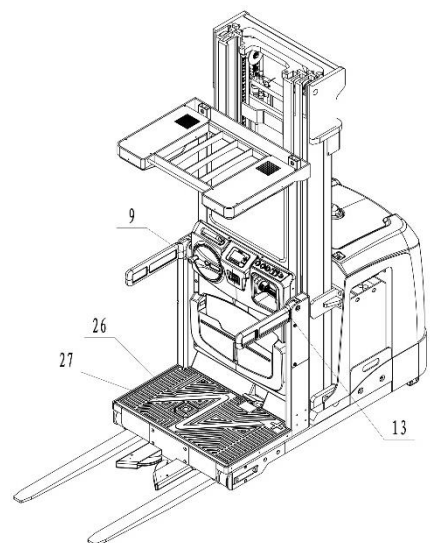
Drive only on roads with clear visibility.
 Do not drive on the road where the specified technical parameters are exceeded.

Steps

Step onto the operating platform (26).
 Step on the pedal (27) with your left foot. This is a necessary requirement for forward and backward movement.
 Grab the handle (13).

Rotate the handlebar of the handle (13) to move the vehicle forward and backward. When the handlebar is released, it automatically returns to the neutral position.


Rotate the handlebar of the handle (13) to control the travel speed.



Change direction

Changing direction while driving can be dangerous.

Changing direction while in motion can lead to a significant decrease in the forklift's speed. When the vehicle changes direction, unless the handlebar of the handle (13) is released in time, it can travel at high speed in the opposite direction.

-  ● After starting traveling in the opposite direction, gently or not at all use the travel switch.
- Do not perform any sudden turning operations.
- Always face the direction of travel.
- Be fully aware of the route you are driving.

Steps

Gently rotate the handlebar of the handle (13) in the opposite direction while driving.

The picker starts slowing down until it starts traveling in the opposite direction.

3.6 Steering

Turn the steering wheel (9) to the left or right.

The working platform will turn in the desired direction.

After the steering switch reaches its maximum stroke, the working platform will rotate around itself.

Note

Steering action needs to be used in conjunction with vehicle travel functions

3.7 Brake

Accident risk

The braking mode of the picker largely depends on the conditions of the driving lane.

- The operator must consider the condition of the driving lane when braking.
 - Brake the picker carefully to prevent load from slipping.
 - In normal operation, only the service brake can be used to brake the picker.
- Only in case of emergency, can the emergency disconnect switch be pressed to brake.

Braking with the coasting brake

When the handlebar of the handle (13) is set to zero (0) position, the working platform performs regenerative braking.

Regenerative braking of the picker is performed via the coasting brake and the picker stops.

Reverse braking

When driving, set the handlebar of the handle (13) in the opposite direction of travel, refer to page 23.

The picker is reverse-braked until it begins to move in the opposite direction.


Parking brake

When the picker stops, the mechanical brake is automatically activated.

3.8 Lifting or lowering the operating platform

Dropped parts pose a risk of injury.

If an object is placed on the fork of the operating platform, there is a chance that it may fall off.

-  ● Use containers or fixing devices to prevent objects from falling off the operator's platform.
- Do not exceed the allowable load of the operating platform.

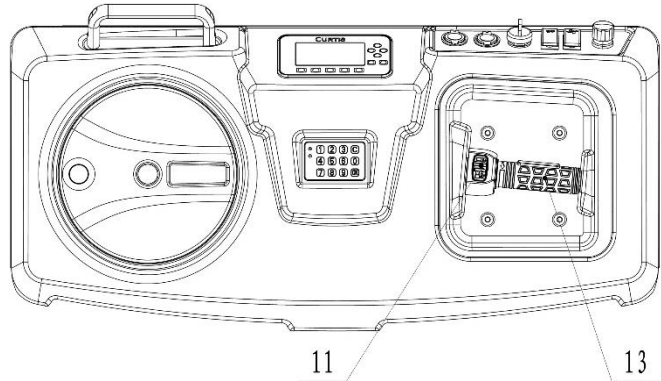
- Loose objects shall not be placed on the operating platform.

Lifting the operating platform

Requirements

- The picker is ready, see page 19.
- Place your right hand on the handle (13).
- Ensure that there is sufficient overhead space.

Rotate the "raise operating platform" knob (11).
The operating platform of the picker is raised.



Lower the operator platform

Requirements

- The picker is ready, see page 19.
- Put your right hand on the handle.
- Continuously check to ensure that there is no one below the operating platform.

Press the "lower operating platform" button (11).
The operating platform of the picker is lowered.

4. Combination lock

The picker shall only be operated by specially trained personnel, and the warnings and safety instructions (see page 14) shall be observed.



Personnel who have not been trained are not allowed to operate this vehicle.

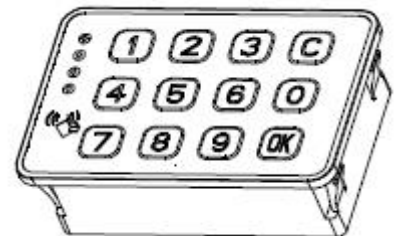
This vehicle is prohibited from carrying passengers.

If any damages or other defects are found in this vehicle, it must be immediately taken out of service and the higher authorities shall be informed.

Untrained or unauthorized personnel are not allowed to repair or alter the working platform.

4.1 Main functions

Before using a new ID card, you must enter the correct administrator password to add the card number, otherwise you cannot add the card number. You can add up to 24 card numbers and also remove any unused card numbers. After the card reader is powered on and if there is no correct card recognition operation, the card reader switch will not close. The CAN bus will send the card swipe status and fault signals, and the picker cannot be started. Only when the card is correctly swiped and recognized as valid, the card reader can output the switch signal, and the CAN bus will send the card swipe status and card number, allowing the forklift to be operated. The card reader currently supports up to 24 ID cards. The default administrator password of this product when it is shipped from the factory is "5118".

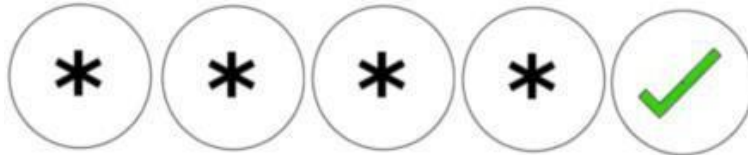


4.2 Main Operations

ID card operation

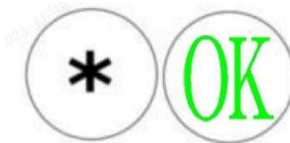
When the ID card is placed close to the card reader panel, if the ID card is valid and has been registered, the card reader will emit a brief beep sound and the blue indicator light will stay on, indicating that the card reader is functioning properly. This means that the switch signal of electric lock is being outputted correctly and the card reader is sending the card status and card number information via the CAN bus. (*When there is a card reading error, the red indicator will flash at a frequency of 2Hz, and the CAN bus will send a fault code command.)

Operation of adding card command



Before using the adding card command, enter the administrator password first. Then press the "OK" button and release it. If the administrator password is correct, the yellow indicator will flash (frequency: 1Hz), indicating that it is ready to input the control code. If wrong password is entered, the red indicator will stay on continuously, indicating that the operation is invalid.

After the administrator password is entered correctly, enter the control code "0", then press the "OK" key and release it to enter the card adding mode, and then the yellow indicator stays on, indicating it is ready to register the ID card.



To register your ID card, simply bring it close to the card reader, You will hear a single beep sound from the buzzer, indicating that the registration process has been successfully completed. If you need to exit the card adding mode, press the "C" button on the panel and release it to exit the card adding mode, and then the yellow indicator is off. (Adding card operation is limited to 5 seconds. If it exceeds 5 seconds, the buzzer will sound once, indicating the end of card addition.

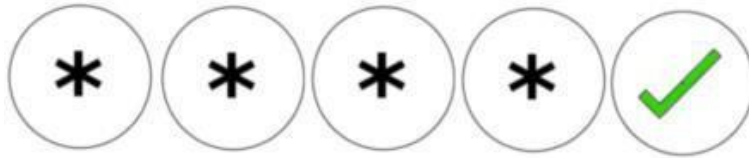
If you need to continue adding cards, you will need to reauthorize by referring to the "1.2 Operation of adding card command" section.)



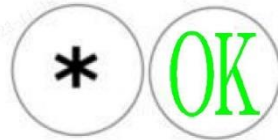
Warning: During the process of adding cards by the administrator, it is important to keep the power supply stable and uninterrupted. Switching off the power supply is strictly prohibited to avoid causing irreversible errors in the ID card data.

Operation of deleting card command

Before using the deleting card command, please input the administrator password "5118". Then, press "OK" button and release it. If the administrator password is entered correctly, the yellow indicator will flash (frequency: 2Hz), indicating that you can proceed to input the control code. If the password is entered incorrectly, the red indicator will stay on, indicating that the operation is invalid.



After correctly inputting the administrator password, input the control code "1", then press the "OK" button and release it. This will enter the card deletion mode. Afterwards, the yellow indicator will remain on, and the buzzer will continuously sound (at a frequency of 0.5Hz).



To delete the ID card, simply bring it close to the card reader, the buzzer stops beeping, indicating that the card deletion process has been successfully completed. If you need to exit the card deleting mode, press the "C" button on the panel and release it to exit the card deleting mode, and then the yellow indicator is off. (*Card deletion is limited to 5 seconds. If it exceeds 5 seconds, the card deletion process will end. If you still need to delete cards, you will need to reauthorize by referring to the "1.3 Operation of deleting card command").



Warning: During the process of deleting cards by the administrator, it is important to keep the power supply stable and uninterrupted. Switching off the power supply is strictly prohibited to avoid causing irreversible errors in the ID card data.

Definition of card reader indicators

Red-----error; Yellow-----card addition and deletion status indication

Blue----status indication; Green----Power indication (when the combination lock is powered on, the green indicator stays on)

5. Troubleshooting

If the vehicle still fails, follow the instructions in Chapter VI of the instruction manual.

Fault Analysis

Faulty	Cause	Maintenance
Goods cannot be lifted	Overweight goods	Lift only the maximum load shown on the nameplate.
	Battery discharging	Battery charge
	The lifting fuse is faulty.	Check and eventually replace the lifting fuse.
	Hydraulic oil level is too low.	Check and fill the hydraulic oil.
Oil leak	Check the sealing of hydraulic hoses and/or cylinders.	
Oil leakage due to inhalation.	Excessive oil temperature	Reduce oil temperature
The picker is inoperable.	The battery is charging.	Fully charge the battery, and then pull the main power plug out of the power socket.
	Battery not connected.	Connect the battery properly.
	The fuse is faulty.	Check and eventually replace the fuse.
	Battery power shortage	Battery charge
	The emergency stop switch is activated.	Insert and pull the knob to eliminate the emergency stop switch function.
The vehicle is only traveling in one direction.	The forward and backward switch and connector are damaged.	Check the throttle and connector.
The picker travels at a very slow speed.	Battery power shortage	Check the battery condition on the discharge display.
	The electromagnetic brake has been activated.	Check the electromagnetic brake.
	Corresponding handle harnesses are not connected or damaged.	Check the handle harnesses and connectors
	Electric system overheating	Stop using and cool down the vehicle.
	Heat sensor error	Check and replace the thermal sensor if necessary.
The picker suddenly starts	Controller damaged.	Replace the controller.
	The throttle did not move back to the center position.....	Repair or replace the throttle.

If all the steps listed in the above "solutions" are followed and the fault of the picker cannot be resolved, please contact the local dealer or our after-sales service department. They are responsible for further investigating the cause of the vehicle malfunction.

In order to find out the cause of the failure more accurately and quickly, please provide the following important information when contacting the local dealer or our after-sales service department:

- Production serial number of the picker (nameplate contains this information);
- The fault code displayed by the instrument;
- Fault description;
- The position of the faulty component of the picker
- Your valid contact information;

VII. Battery - Safety regulations, charging, replacement


1. Battery type

For standard batteries, this picker is equipped with the following battery models:

OPH12/12K:

1 x 24V/1000Ah lead-acid battery [975x374x785 mm (LxWxH)]

1 x 24V/560Ah lithium battery [975x374x785 mm (LxWxH)]

 The weight of the battery has a certain impact on vehicle operation behavior.
Consider the maximum operating temperature of the battery.

Lithium battery

- Lithium-ion battery is a kind of battery with rechargeable high-performance energy cells.
- The battery is specially designed for industrial vehicles and can withstand severe vibration and knocking.
- The battery has special interfaces for charging and discharging. Do not use incorrect batteries and chargers.
- The battery has intelligent battery management system, including voltage, temperature and current detection, under-voltage, over-voltage, low temperature, over-temperature, over-current, short circuit, communication and other protective safety functions.
- The internal resistance of the battery is very low, which can minimize heat generation and maximize the available power of the vehicle.

Battery operating temperature range

- The best battery life is achieved when the battery is operated at + 5°C to + 40°C.
- Low temperatures will reduce the available capacity of the battery, and high temperatures will reduce the service life of the battery.
- The temperature difference between the two ends of the battery must not exceed 5 °C.

Battery charger

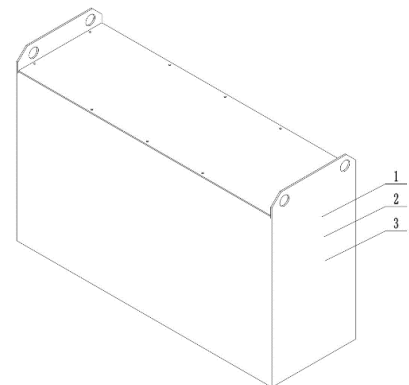
- Use only approved battery chargers to charge lithium-ion batteries.

Lithium battery label

Serial	Name
1	Warning label
2	Nameplate
3	Serial number

Lithium battery nameplate

Serial number	Name	Serial	Name
1	Manufacturer's	7	Configuration
2	Product Model	8	Protocol Version
3	Rated voltage	9	Serial number
4	Rated	10	Date of
5	Energy	11	Battery
6	Weight	12	Manufacturer's



1	
2	• LOGO
3	• Model LFPxx-xx
4	• Nominal Voltage xx V
5	• Rated Capacity xx Ah
6	• Energy xx kWh
7	• Weight xx kg±xxx kg
8	• HW REV G-CH-FK-R
9	• TCP xxx
10	• Serial No. xxx
11	• Date of manufacture 20xx.*
12	• Manufacturer: • Address:

2. Safety regulations

1.1 Maintenance personnel

Batteries should only be charged, repaired or replaced by trained personnel. These operating instructions and the manufacturer's instructions for batteries and charging stations must be observed when performing the work.

Operation, installation and disassembly of the battery can only be performed by service personnel.

Fire prevention

Do not smoke and avoid open flames when handling batteries. When parking the picker for charging, ensure that there are no flammable materials or operating equipment that could potentially cause sparks within a radius of at least 2 m. The room must be ventilated. Fireproof equipment must be equipped.

Using inappropriate fire protection equipment can cause burns

When a fire occurs, using water to put it out may cause a reaction with the battery fluid. This can cause burns.



- Use a dry powder fire extinguisher.
- Never extinguish a burning battery with water.

A short circuit can cause a fire

A damaged battery connection can cause a short circuit, which in turn can cause the picker and battery to catch fire.



- Before closing the battery cover, make sure the battery connection is not damaged.
- Report any defects to your supervisor immediately.
- Identify faulty pickers and stop using them.
- The picker should only be put back into service after the fault has been identified and rectified.

Storage

To avoid fire, explosion, and/or leakage of harmful substances, a safe place for storing batteries must meet the following conditions before service personnel arrive at the site:

- Do not store in an occupied place.
- Do not store in places with or near valuable items.
- Class D fire extinguishers must be available as required.
- There should be no fire or smoke detectors in the storage area to ensure that the automatic fire detection system is only activated in the event of actual danger (such as open flames).
- There should be no ventilation intake pipe nearby to prevent the emission from spreading in the building.

Examples of places where non-functional batteries are stored:

- Outdoor sites with roofs.
- Ventilation container.
- Covered fireproof box with pressure and smoke vent.

1.2 Battery handling

Batteries shall be disposed of in accordance with national laws and regulations. The manufacturer's disposal instructions must be followed.

1.3 General precautions for lead-acid batteries

Risk of accidents and injuries when handling batteries

The battery contains dissolved acid, which is toxic and corrosive. Avoid physical contact with battery acid.

- The used battery acid shall be disposed of according to regulations.
- Always wear protective clothing and goggles when handling batteries.
- Do not allow battery acid to come into contact with skin, clothing, or eyes. If necessary, rinse with plenty of water.
- If physical injury occurs (e.g. skin or eye contact with battery acid), seek medical attention immediately.
- The spilled battery acid fluid shall be immediately neutralized with a large amount of water.
- National guidelines and laws shall be observed.

Using batteries that are not approved by the manufacturer and are not suitable for the picker may pose a danger

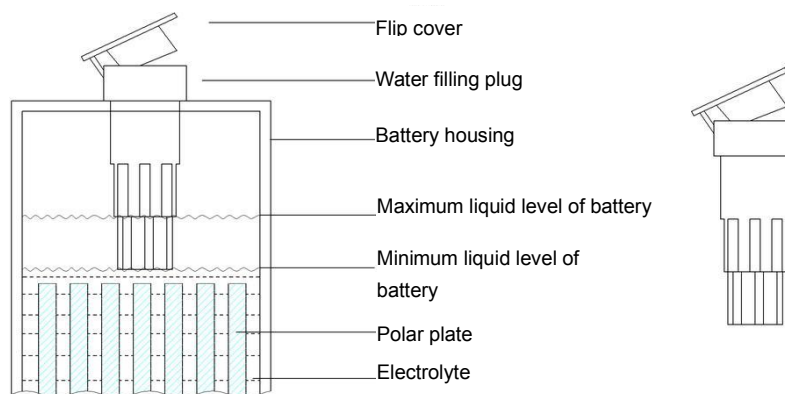
The design, weight and size of the battery have a considerable influence on the operational safety of the picker, especially its operational stability and capacity. Using batteries not approved by the manufacturer and unsuitable for the picker can result in deteriorated braking characteristics during energy recovery, cause significant damage to the electrical controller, and pose serious risks to personal health and safety.

- Please only use batteries approved by the manufacturer and suitable for the picker.
- Battery can only be replaced with the manufacturer's consent.
- When replacing/installing the battery, ensure that the battery is securely placed in the battery compartment of the picker.
- Do not use batteries that are not approved by the manufacturer.

Please park the picker safely before performing any work on the battery.

In the process of charging or using, the battery must be replenished with distilled water regularly due to evaporation of water. It is best to check the electrolyte every week, and the liquid level must be maintained between the highest liquid level and the lowest liquid level of the battery. Add distilled water after charging.

The replenishment of distilled water and dosage are shown in the following figure:



Electrolyte level diagram

1.4 General precautions for lithium batteries

Risk of accidents and injuries when handling batteries

Do not perform any repair or maintenance on the lithium-ion battery. Replacing battery components is not allowed.



- Lithium-ion batteries must be disposed of in accordance with relevant national environmental regulations. Batteries must be disposed of as hazardous waste. Batteries must not be disposed of together with ordinary waste.
- Lithium-ion battery is a dangerous material. Applicable regulations must be followed during transportation.
- Normal batteries can be transported according to relevant regulations.
- If you need to transport a faulty lithium-ion battery, please contact the service provider. Special transportation procedures must be followed for transporting defective lithium batteries.





Using batteries that are not approved by the manufacturer and are not suitable for the picker may pose a danger

The design, weight and size of the battery have a considerable influence on the operational safety of the picker, especially its operational stability and capacity. Using batteries not approved by the manufacturer and unsuitable for the picker can result in deteriorated braking characteristics during energy recovery, cause significant damage to the electrical controller, and pose serious risks to personal health and safety.



- Please only use batteries approved by the manufacturer and suitable for the picker.
- Battery can only be replaced with the manufacturer's consent.
- When replacing/installing the battery, ensure that the battery is securely placed in the battery compartment of the picker.
- Do not use batteries that are not approved by the manufacturer.

Safety and warning sign

	Used lithium-ion batteries must be disposed of as hazardous waste. Lithium-ion batteries marked with recycling signs and crossed trash can signs shall not be disposed of together with ordinary household garbage.
	Avoid fire and short circuit caused by overheating. Do not ignite or place open flames, hot ashes, or sparks near lithium-ion batteries. Keep lithium-ion batteries away from strong heat sources.
	Watch out for the battery! Do not short-circuit the battery.
	Prevent lithium-ion batteries from being exposed to solar radiation or other forms of thermal radiation. Do not expose lithium-ion batteries to heat sources.

3.Charging

- It can only be charged with the included charger.
- Before using the charger, please fully understand the contents of the charger manual.
- Please follow these rules.
- The charging room must be well ventilated.
- The condition of a full charge can only be determined by referring to the discharge display. To control this situation, interrupt the charging process and start the vehicle

Park the vehicle in a dedicated safe area with dedicated power supply.

Lower the operator platform and remove cargo.

Turn off the vehicle's power supply. Connect the charger plug and power outlet.

The charger starts charging.


When charging is complete, disconnect the connector from the socket and place it in the specified position.

Electric shock and burning hazard

The charge and discharge connector terminals of the battery are open. Avoid physical contact, contamination, or direct contact with objects that may short-circuit the terminals. Use necessary preventive measures and protective sleeves to secure open terminals. The connector must be dry and clean when used.

Any damage and other defects of the charger may lead to accidents. Only use the charger approved by the manufacturer and suitable for the battery used.

If the charger is damaged or defective, you must stop using the charger and contact the service provider. Do not modify or attempt to repair the charger.

 Improper use of the charger or the wrong charger may damage the battery or charger. The input working voltage range and output voltage of the charger are subject to the charger specifications, and the charger can only be used for batteries provided by the manufacturer.

Reversing the charging plug is prohibited. Please follow the instructions to connect correctly. Use a dedicated handle to disconnect the charging plug. Do not pull the cable to remove the plug.

If any abnormality is detected, stop charging immediately, such as serious temperature rise, battery shell deformation, smoke, abnormal noise, etc.

Intermediate charge

Lithium battery support, the so-called opportunity charging. Lithium-ion batteries that are not fully discharged can be charged at any time, whether they are fully charged or not. However, frequent opportunity charging of the battery without being fully charged, and stopping the charging process before the corresponding indication from the charger appears, may lead to voltage imbalance in the battery cells,

resulting in an increase in battery BMS calculation error. To effectively address this phenomenon, please fully charge the battery and complete the "automatic balancing" process at least once a week.

⚠ It is prohibited to recharge when fully charged.

Note that in order to prevent the battery from being recharged in the full charge state, which will deplete the service life of the battery, the BMS is set with the protection function of prohibiting recharging in the full charge state, and the charger will not work in the full charge state.

⚠ Deep discharge can damage the battery.

Long term self discharge without regular replenishment can lead to complete discharge of the battery. Complete discharge will shorten the service life of the battery. When the battery cannot be recharged, it may cause deep discharge and trigger relevant safety protection functions.

The battery must be charged to 40%~60% before it is not used for a long time.

Charge the battery at least once every 12 weeks.

The storage temperature range of the battery is 0°C~ 30°C.

If the battery is deeply discharged or the battery temperature is lower than the allowable level, the battery is not rechargeable. A deeply discharged battery cannot be recharged permanently. Because of the risk of condensed water, batteries stored at 0°C or below zero must be naturally heated to at least +5°C before charging, and forced heating is prohibited.

4. Battery removal and installation

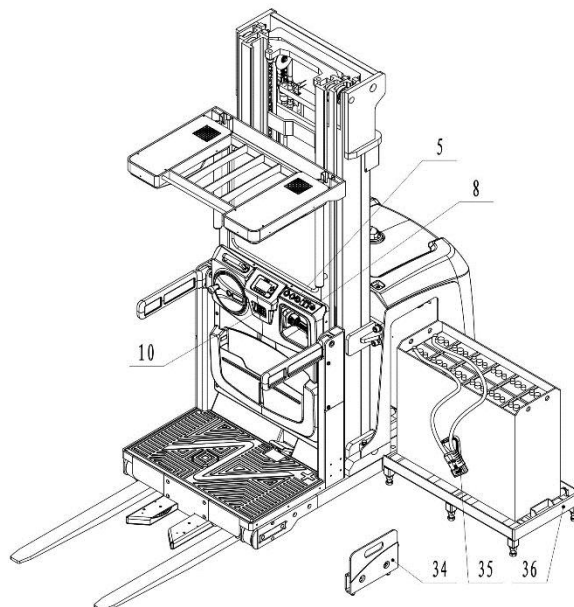
Operation, installation and disassembly of the battery can only be performed by service personnel.

5. Battery replacement

Safely park the vehicle, turn off the key switch (5) or lock the combination lock (10), press the emergency stop switch (8), pull out the battery connector (35), pull out the battery baffle (34), completely pull out the battery, and firmly fix the battery on the battery carrier (36).

Note that if the device is not safe, the battery may tip over.

Please follow the reverse procedure when installing the battery.



VIII. Regular maintenance



- Only qualified and trained personnel are allowed to carry out maintenance work on this vehicle.
- Remove cargo from operator platform and lower operator platform to the lowest position before maintenance
- To lift the vehicle, please use the designated strapping or lifting equipment as specified in Chapter III. Before operation, place safety devices (such as designated lifting jacks, wedges or blocks) under the vehicle to prevent it from accidentally falling, moving or sliding.
- Please use the original spare parts approved and issued by the distributor.
- Please consider that the leakage of hydraulic oil that may lead to machine failures and accidents.
- Only trained service technicians are allowed to adjust the pressure valve.

If you need to replace the wheel, please follow the instructions above. Casters must be round and free of abnormal wear.

Check the key items on the maintenance list.

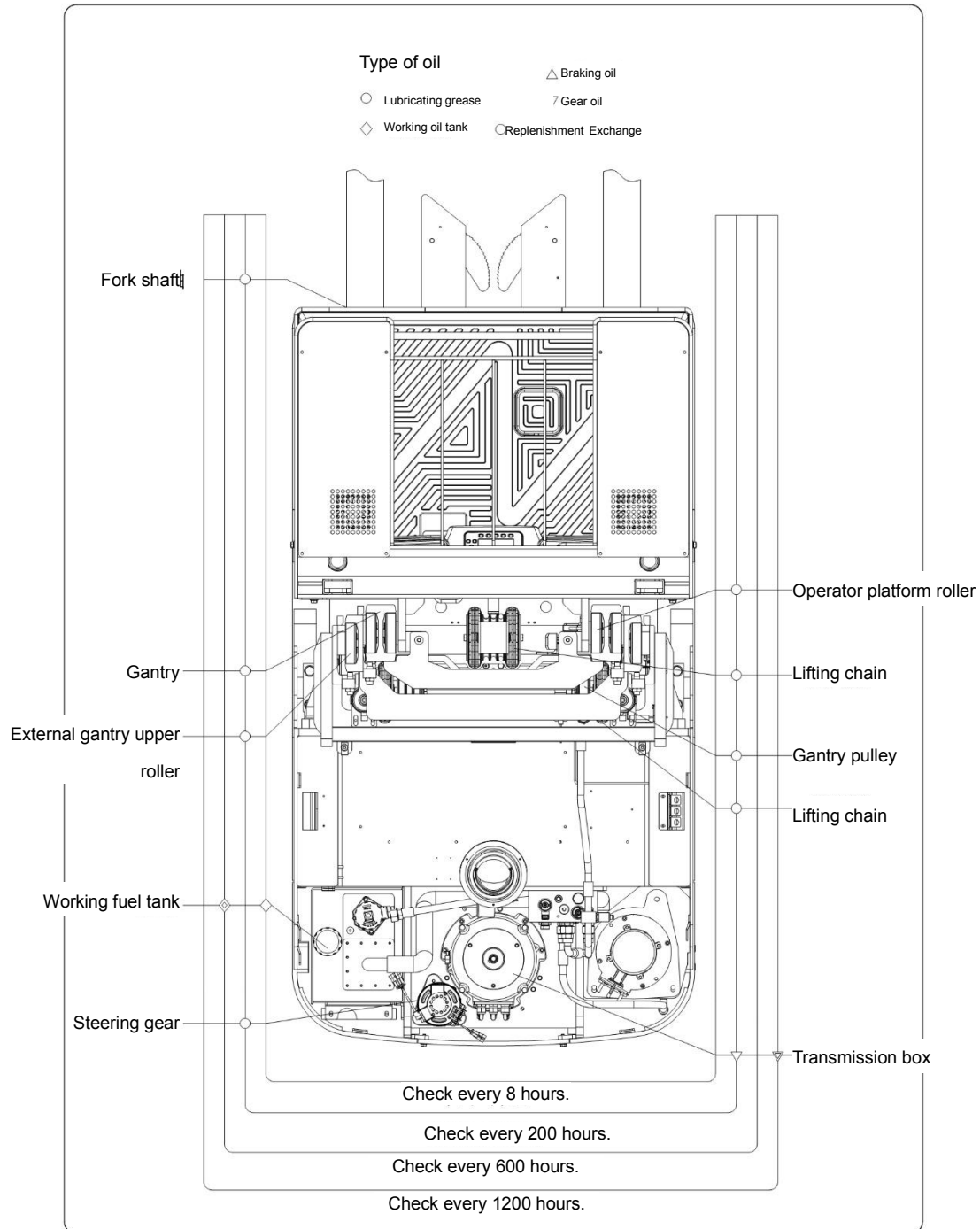
1. Maintenance list

		Time interval (month)			
		1	3	6	12
Hydraulic System					
1	Check hydraulic cylinder and piston for damage noise and leakage.		•		
2	Check hydraulic connectors and pipes for damage and leakage.		•		
3	Check the hydraulic oil level and replenish it if necessary.		•		
4	Hydraulic oil change (12 months or 1500 working hours)				•
Mechanical System					
5	Check the fork for distortion and cracks.		•		
6	Check the chassis for deformation and cracks.		•		
7	Check that all screws are tight.		•		
8	Check whether the gantry and chain are corroded, deformed or damaged, and replace them if necessary.	•			
9	Check gear box for noise and leakage.		•		
10	Check the wheel for deformation and damage, and replace it if necessary.		•		
11	Lubricate gantry roller and gantry chain.	•			
12	Check the brake fluid and replenish it if necessary	•			
13	Lubricating grease nozzle.		•		
14	Check whether the braking function is normal.	•			
Electric System					
15	Check the wire for damage.		•		
16	Check whether the electrical connection ends are securely fastened.		•		
17	Check the function of the emergency stop switch.		•		

18	Check the electric drive motor for noise and damage.		•		
19	Check the display		•		
20	Check that the correct fuse is used and replace it if necessary.		•		
21	Check the buzzer.		•		
22	Check the current contactor.		•		
23	Check frame for leakage (insulation test).		•		
24	Check the function and wear of the throttle.		•		
25	Check the electrical system of the drive motor.		•		
Braking System					
26	Check braking performance.		•		
Battery					
27	Check the specific gravity of battery electrolyte.		•		
28	Clean and grease the terminal and check for corrosion and damage.		•		
29	Check whether the battery case is damaged.		•		
Charger					
30	Check whether the main power cable is damaged.			•	
31	Check the startup protection procedure during charging.			•	
Function					
32	Check the buzzer.	•			
33	Check the clearance of the electromagnetic brake.	•			
34	Detect the emergency braking function.	•			
35	Detect the reverse braking and regenerative braking functions.	•			
36	Check steering function.	•			
37	Check the lifting and lowering functions.	•			
38	Check the function of the handlebar switch.	•			
39	Check for damage and functional condition of the key switch.	•			
40	Detect speed limit switch.	•			
Comprehensive					
41	Check that all labels are clear and complete.	•			
42	Check the protective panels and/or protective covers for any damages or defects.	•			
43	Check the wheels and adjust or replace them if they are worn.		•		
44	Conduct a trial run.	•			

2. Lubricating point

Lubricate marked points according to maintenance list. Required grease specification: DIN 51825 standard grease.



Lubrication diagram of the vehicle

3. Check and refill hydraulic oil

Based on temperature, the recommended hydraulic oil model is:

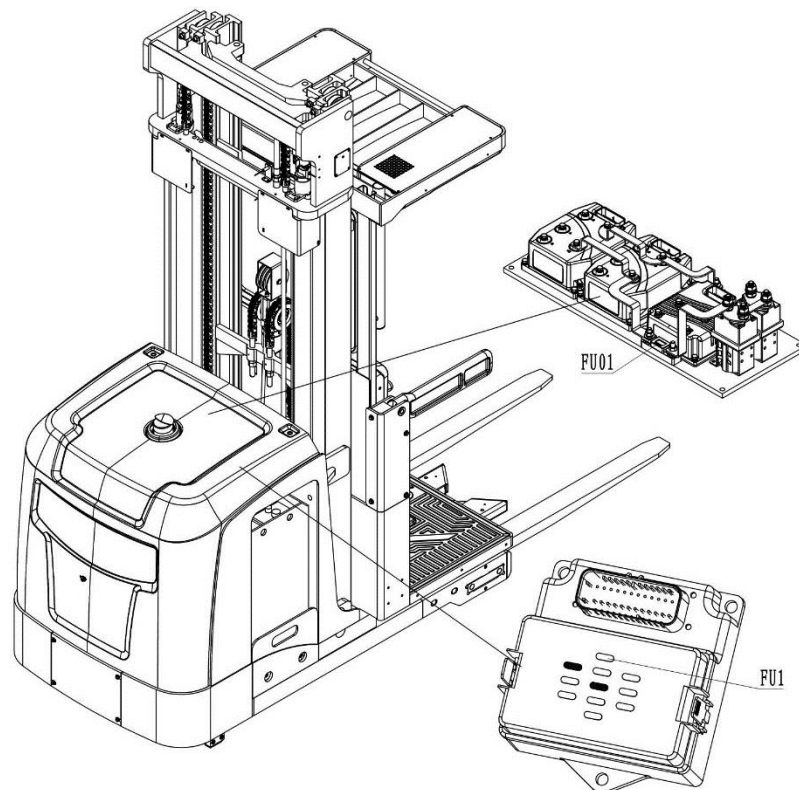
Ambient temperature	-5°C~25°C	>25°C
Model	HVLP 32, DIN 51524	HLP 46, DIN 51524
Viscosity	28.8-35.2	41.4 - 47
Oil quantity	35L	

Waste materials such as waste oil, batteries, or other materials must be processed and recycled in accordance with national regulations, and if necessary, they must be handed over to recycling companies for recycling.

The oil level should not be lower than the minimum amount of oil required to start the vehicle. Add oil to the filling point if necessary.

4. Check the electrical fuse

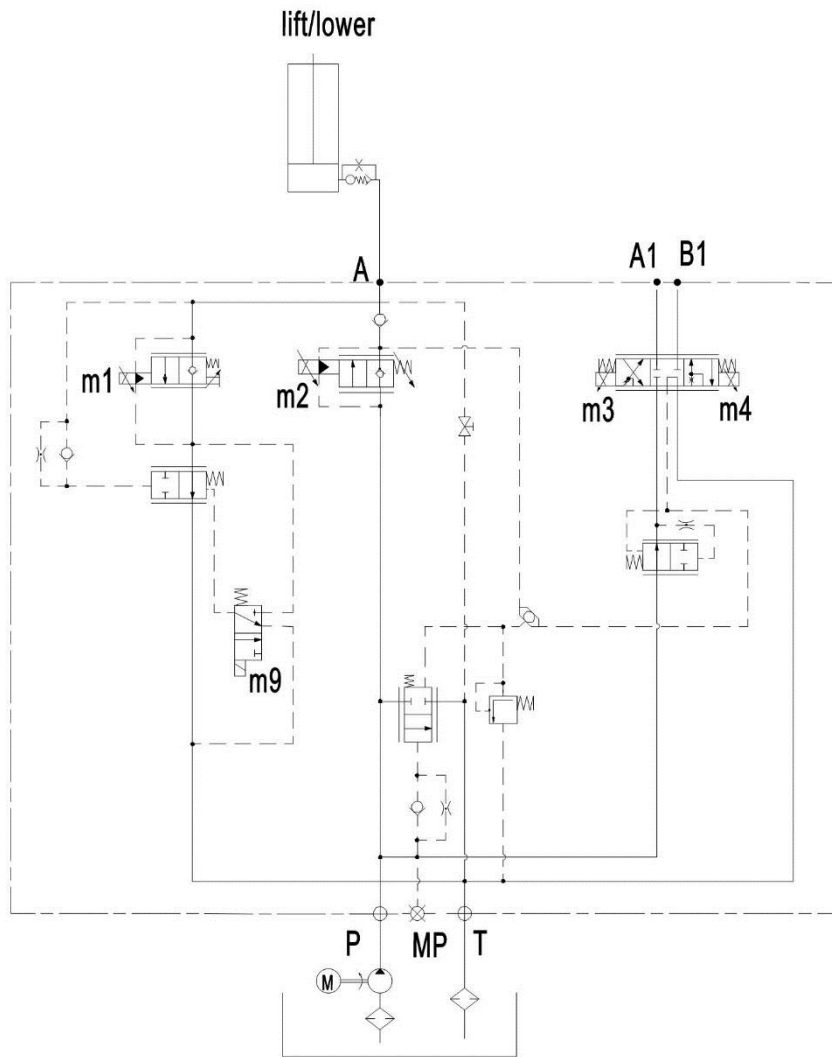
Remove the electrical cover (24) and the fuse is located in the indicated position.



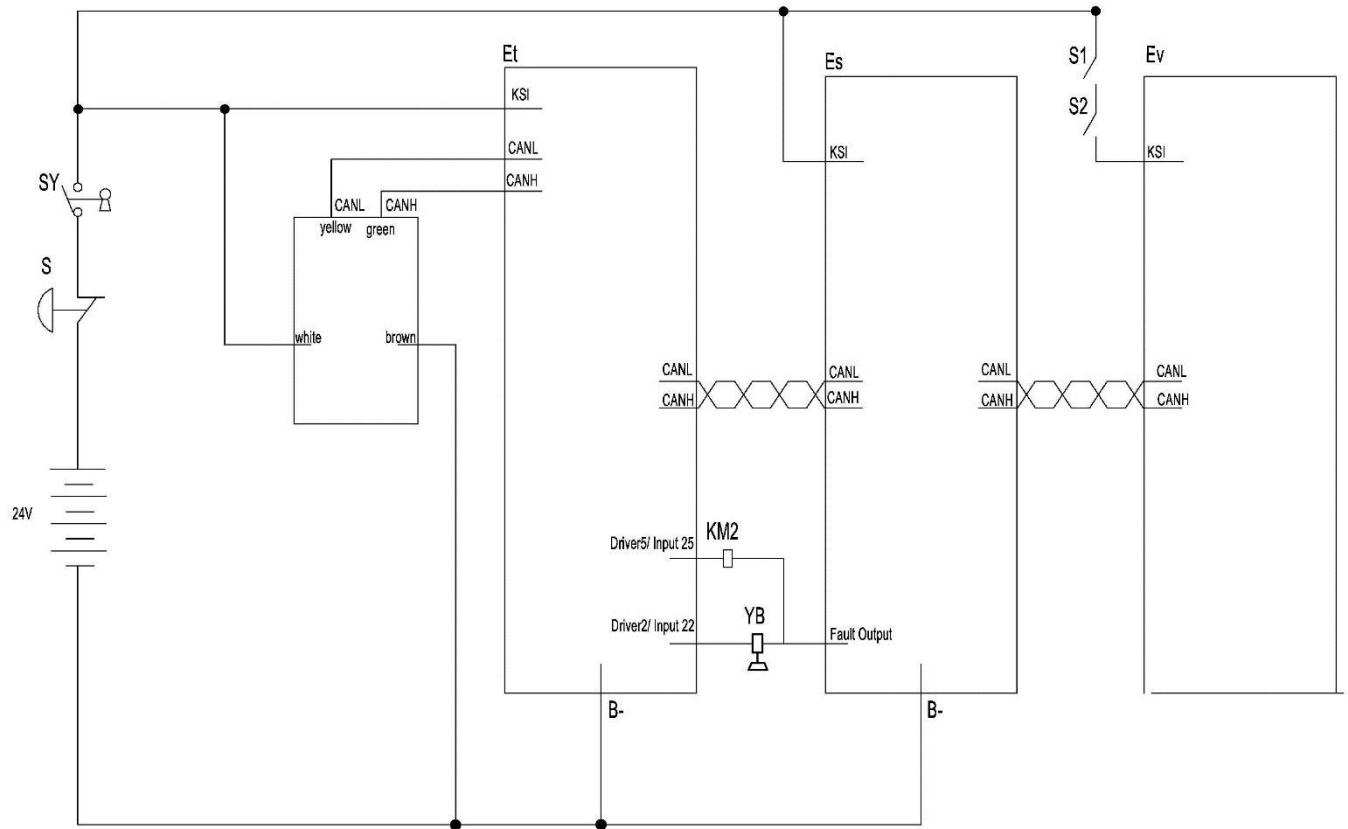
Fuse specifications

	Specification	Quantity
Fuse FU1	10A	7
Fuse FU01	500A	1

5. Schematic diagram of hydraulic system



6. Schematic diagram of brake system



7. Power display and power alarm



Figure 14: Instrument diagram

The battery level is displayed on the right side of the instrument panel. When fully charged, it is displayed as full grid (green), and the level is displayed as 100%. When the remaining battery level is about 20%, it is displayed as two grids (yellow), indicating that the battery needs to be charged. When the remaining battery level is about 10%, it is displayed as one grid (red), and the "Do not lift" indicator light is on (the fourth one from the left in the above figure). At this time, the forklift can't lift the goods, but it can walk slowly.

On the right side of the instrument, you can see the keys H, S and E, and you can switch the driving mode, as shown in the upper left corner of Figure 13:

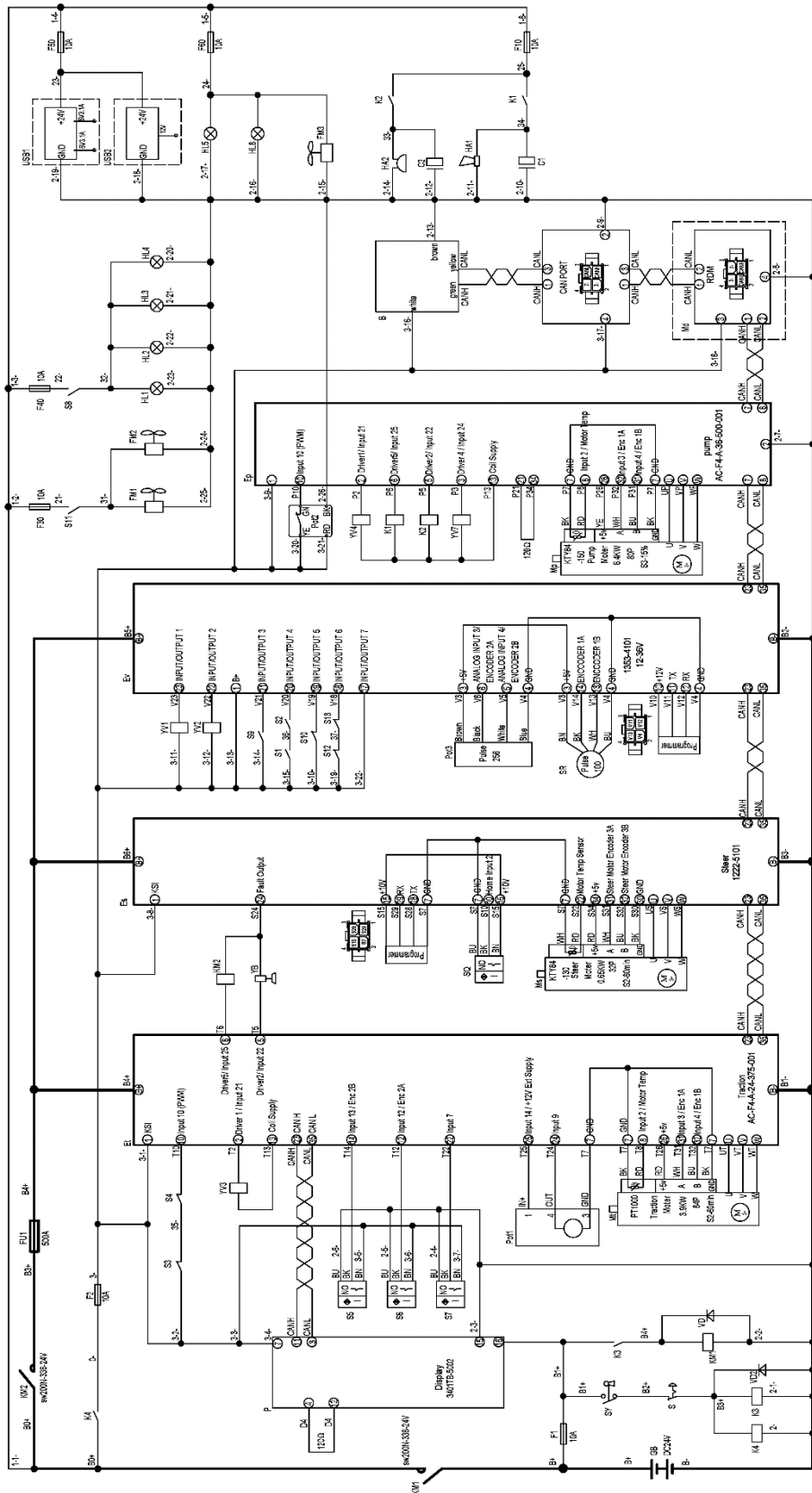
H Mode, high-speed mode, with full speed of 9.0 km/h.

S Mode, normal mode, with full speed of 6.3 km/h.

E Mode, economy mode, with full speed of 4.5 km/h.

After switching to economy mode, the turtle speed indicator will be displayed in the upper left corner of the instrument.

8.Circuit diagram



Symbol description			
Code	Name	Code	Name
GB	Battery 24V	YV4	Shunt proportional valve 2
F2	Fuse 10A	YV7	Regulating switch valve
F1	Fuse 10A	SR	Steering encoder
F30	Fuse 10A	SQ	Zero position switch
F40	Fuse 10A	K1	Horn relay
F50	Fuse 10A	K2	Reverse relay
F60	Fuse 10A	K3	KM1 relay
F10	Fuse 10A	K4	Power supply relay
FU10	Fuse 500A	ET	Traction controller
S	Emergency stop switch	EP	Oil pump controller
S1	Guardrail switch 1	ES	Steering controller
S2	Guardrail switch 2	EV	Valve controller
S3	Chain switch 1	B	Handle accelerator
S4	Chain switch 2	VD	Diode
S5	Lifting speed limit switch	P	Instrument
S6	Lifting limit switch	HL1	Left headlight 1
S7	Travel speed limit switch	HL2	Left headlight 2
S8	Headlight switch	HL3	Right headlight 1
S9	Interlock switch	HL4	Right headlight 2
S10	Descent deceleration switch	HL5	Warning light
S11	Fan switch	HL6	Blue light
S12	Chain switch 3	Pot1	Pressure sensor
S13	Chain switch 4	Pot2	Tilt angle sensor
YV1	Ascending proportional valve	Pot3	Height encoder
YV2	Descending proportional valve	FM1 FM2 FM3	Electric fan
YV3	Shunt proportional valve 1	SY	Key switch
YB	Electromagnetic brake	C1 C2	Electric capacity
USB1	USB	Ms	Steering motor
USB2	Cigarette lighter	Mp	Oil pump motor
Md	IoT modules	Mt	Traction motor
KM1	Main contactor 1	HA1	Horn
KM2	Main contactor 2	HA2	Reverse buzzer

Self-diagnosis and troubleshooting

The fault list is arranged in flash code order, listing fault names, VCL names and CAN object indexes, including fault types; The possible causes, setting and clearing conditions and troubleshooting methods are listed; After the setting conditions are solved, the fault is usually cleared by cycling the key switch, but it can be handled by using the applicable VCL Reset function or Can NMT Reset function.

The diagnosis information can be obtained in the following three ways: (1) Observe the fault code that causes the controller status indicator light to flash; (2) read that status indicator lamp in the programmer tool of the Curtis integrated toolkit; (3) CAN urgent message.

The status indicator is a translucent window on the cover, and the red and yellow LEDs flash. Its lighting displays the following information:

Indicator status	Working status or possible cause
None of the lights are ON	The controller is not powered on; Or the battery of the vehicle is dead; Or severely damaged.
The yellow LED flashes slowly.	The controller works properly.
Yellow or orange	The controller is in flash program mode, or damaged software is preventing the unit from completing the startup sequence (startup process).
Red/yellow blinking mode	Fault code, view fault table.
Red light always on.	The monitoring or main microprocessor detects an internal hardware failure, or the controller is not loaded with software.
Red light blinks rapidly.	Non-production/experimental/custom device profile software

When using the Curtis Integrated Toolkit TM Programmer tool to diagnose a fault, the active fault is located at the top of the menu panel, and if a fault has multiple possible causes, the "type" is displayed.

In the "System Monitor" menu, the "Fault History" menu provides additional information; The "Count" represents the number of occurrences since the execution of clearing history. The menu item "Time" indicates KSI hours when the current fault occurs, and the unit is seconds ($\#sec/3600 = \text{hours}$), while the menu item "First Time" is used to track the time when the fault occurs for the first time, if there are multiple faults before clearing the history. The "Type" listed at the top of the menu panel is repeated, and it is the current "Fault Type" for faults with multiple types.

Troubleshooting

The fault code table provides all the following information:

- Fault code
- Fault name displayed on Curtis programmer
- Fault symptoms
- Possible causes of the fault
- Deep cause of fault
- Status resolution

When a fault occurs, if it is confirmed that it is not a wiring error or a mechanical fault of the vehicle, you can try to restart it through the vehicle key switch. If the fault still exists, please turn off the key switch, check if the 35-pin connector is connected correctly or dirty, repair and clean it, reconnect, and try again.

Traction fault code table

Serial number	The instrument/controller displays fault codes.	Fault Name	Fault Description	Cause or Solution	Fault Source	Remarks
1	1-2	Controller Overcurrent Fault types: 1 = U-phase over current 2 = W-phase over current 3 = V-phase over current 4 = controller current > 135% current limit value.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The external connection of U, V and W phases of the motor is short-circuited; 2. The encoder signal of the motor is disturbed; 3. The motor parameters are misadjusted; 4. The controller is faulty.	Controller	
2	1-3	Current Sensor Fault type: 1	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Leakage from U, V or W phase to vehicle body (short circuit in stator) 2. Controller failure 3. Replace controller.	Controller	
3	1-4	Precharge Failed Fault type: 1. Interrupt 2. Energy limit 3. Time limit	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The load connected to the B+ terminal of the controller suppresses the internal capacitor charging of the controller. 2. Check the voltage displayed on the Programmer \ System Monitor Menu \ Controller \ Capacitor Voltage. 3. Replace the controller.	Controller	
4	1-5	Controller Severe Undertemp	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The controller operates in extreme environments. 2. Check the temperature displayed on the Programmer \ System Monitor Menu \ Controller \ Controller Temperature. If the temperature rises to -40°C or above, restart the key switch or interlock switch. If it fails, replace the controller;	Controller	
5	1-6	Controller Severe Overtemp	Turn off the motor, main contactor, electromagnetic brake, throttle, and perform full power electric braking.	1. The controller works in extreme environment; 2. The load is too heavy; 3. The installation of the controller is unreasonable; 4. Check the temperature displayed by the programmer \ system monitor menu \ controller \ controller temperature. Reduce the temperature to below 95°C. Restart the key switch or interlock switch; if it fails, replace the controller;	Controller	
6	1-7	Severe B+ Undervoltage	No drive torque outputs	1. The battery is exhausted by the non-controller system; 2. The internal resistance of the battery is too high; 3. The battery is not connected when the motor is driven; 4. The fuse connected to B+ is blown or the main contactor is not attracted; 5. The battery parameters of the controller are set incorrectly; 6. Check the voltage displayed by the programmer \ system monitor menu \ controller \ capacitor voltage.	Controller	
7		Severe KSI Undervoltage	None, unless there are specific measures in VCL software.	1. The battery of the non-controller system is exhausted; 2. The resistance of the KSI input line is too high; 3. When the motor is driven, the KSI line is disconnected; 4. The fuse is blown; 5. Check the voltage displayed by the programmer \ system monitor menu \ controller \ key switch voltage.	Controller	

8	1-8	Severe B+ Overvoltage	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	<ol style="list-style-type: none"> 1. The battery parameters of the controller are set incorrectly. 2. Regenerative braking. When the battery is recharged with current, the internal resistance of the battery is too high. 3. The battery is not connected during regenerative braking. 4. Check the voltage displayed by Programmer \ System Monitor Menu \ Controller \ Capacitor Voltage. 	Controller
9		Severe KSI Overvoltage	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	<ol style="list-style-type: none"> 1. The battery voltage at KSI(pin1) terminal of the controller exceeds the set value of severe high voltage. 2. Check the voltage displayed by programmer \ system monitor menu \ controller \ key switch voltage. 	Controller
10	1-9	Speed limit failure detected.	Turn off the interlock and electromagnetic brakes.	<ol style="list-style-type: none"> 1. It is detected that the motor speed exceeds the Max Speed Supervision setting. 2. The Max Speed Supervision setting value is incorrect. 3. Check the values of Programmer\Application Setup\Max Speed Supervision settings 	Controller
11	1-A	<p>Motor not stopped</p> <p>1 = the motor moved more revolutions than the parameter, Motor_Not_Stopped_Position_Error setting. The motor turns more than the set parameter (Motor_Not_Stopped_Position_Error).</p> <p>2 = the motor moved faster than the parameter Motor_Not_Stopped_Speed_Error (RPM) for 160ms. The motor rotates faster than the parameter Motor_Not_Stopped_Speed_Error (RPM) for 160ms.</p> <p>3 = The three-phase drive has applied an electrical frequency greater than the Motor_Not_Stopped_Max_Frequency parameter, and applied an RMS current greater than the Motor_Not_Stopped_Max_Current parameter for 64ms. Three-phase drive applies a parameter that the electrical frequency is greater than the frequency parameter set in Motor_Not_Stopped_Max_Frequency and the effective current applied in 64ms is greater than the parameter set in Motor_Not_Stopped_Max_Current.</p>	Turn off the motor, main contactor, electromagnetic brake, throttle, oil pump and brake at full power.	<ol style="list-style-type: none"> 1. Motor Not Stopped. Maladjustment. 2. View: Programmer » Application Setup » Motor not stopped menu. 3. Failure or conflict of internal controller, which makes the motor rotate when it stops. 	Controller
12	1-B	<p>Critical OS General (<100) Internal Fault. Contact Curtis support.</p> <p>(>100) An ill-formed or corrupted application package was loaded into controller.</p>	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, drive 6, drive 7, proportional drive, oil pump, coil power supply and brake at full power.	<ol style="list-style-type: none"> 1. (<100) Internal failure. 2. (>100) CIT version is too old to fully support FOS version. 	Controller

13	1-C	OS General 2 (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	The controller is inoperable.	1. (<100) Internal failure. 2. (>100) CIT version is too old to fully support FOS version.	Controller
14	1-D	Reset Rejected	Turn off the interlock and throttle.	Restart key switch	Controller
15	1-E	Motor short-circuiting	The controller is inoperable.	Reset controller	Controller
16	2-2	Controller Overtemp Cutback	Reduce driving and braking torque.	1. The controller works in extreme environment; 2. The load is too heavy; 3. The installation of the controller is unreasonable; 4. The performance of the controller is limited at this temperature. 5. Check the temperature displayed by the programmer \ system monitor menu \ controller \ controller temperature. Reduce the temperature to below 85°C. Restart the key switch or interlock switch; if it fails, replace the controller;	Controller
17	2-3	Undervoltage Cutback	Reduce driving torque	1. The battery needs to be charged, and the performance of the controller is limited at this voltage. 2. The parameters of the controller battery are set incorrectly. 3. The non-controller system runs out of batteries. 4. The internal resistance of the battery is too high. 5. The battery is not connected when driving the motor. 6. The fuse connecting B+ is blown or the main contactor is not attracted. 7. Check the programmer\system monitor menu\controller\currents\undervoltage cutback. 8. Check the voltage displayed by programmer\system monitor menu\controller\capacitor voltage.	Controller
18	2-4	Overvoltage Cutback	Reduce the braking torque. Note: This fault can only be detected during regenerative braking.	1. During normal operation, the current generated by regenerative braking is recharged to the battery, and the battery voltage is too high, resulting in failure, and the performance of the controller is limited at this voltage. 2. The battery parameters of the controller are set incorrectly. 3. Regenerative braking. When the battery is recharged with current, the internal resistance of the battery is too high. 4. During regenerative braking, the battery is not connected. 5. Check Programmer\System Monitor Menu\Controller\Currents\Overvoltage Cutback. 6. Check the voltage displayed by programmer\system monitor menu\controller\capacitor voltage.	Controller

19	2-5	Ext 5V Supply Failure. Failure type: 1. The output voltage of 5V is out of range. 2. The current of 5V voltage is out of range.	Turn off the 5V output	1. The external 5V load is too small (pin 16). 2. Check the voltage and current of 5V output displayed by programmer\system monitor menu\outputs.	Controller
20	2-6	Ext 12V Supply Failure. Failure type: 1. The output voltage of 12V is out of range. 2. The current of 12V voltage is out of range.	Turn off the 12V output	1. The external 12V load is too small (pin 23). 2. Check the voltage and current of 12V output displayed by programmer\system monitor menu\outputs.	Controller
21	2-8	Motor Temp Hot Cutback	1. Reduce the driving torque. 2. If MotorBrakingThermal CutBack_Enable = On, reduce the braking torque.	1. The motor temperature is greater than or equal to the set value of Temperature Hot, which causes the controller to output current limit. 2. The motor temperature and sensor parameters are set incorrectly. 3. Check programmer \ AC motor setup \ temperature sensor.	Controller
22	2-9	Motor Temp Sensor	Enter the LOS mode, reduce the motor speed, and turn off the high position reduction function of the motor.	1. The temperature sensor of the motor is not connected properly; 2. The polarity of the sensor is not connected correctly (pin 9 and pin 12). 3. The temperature of the motor and the sensor parameters are set incorrectly. 4. Check the programmer\system monitor menu\AC motor\temperature.	Controller
23	3-1	Main contactor drive fault (Main Driver). Fault Type: 1. Drive Short Circuit. 2. Drive Overcurrent. 3. Open/Short Circuit (High detected, should be Low). 4. Open/Short Circuit (Low detected, should be High). 5. Disconnect	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Driver load is open or short-circuited. 2. Dirty connector pin or contactor coil. 3. Incorrect crimping or wiring of connector.	Controller
24	3-2	EM Brake Driver Fault. Fault Type: 1. Drive Short Circuit. 2. Drive Overcurrent. 3. Open/Short Circuit (High detected, should be Low). 4. Open/Short Circuit (Low detected, should be High). 5. Disconnect	Turn off the electromagnetic brake, throttle, and brake at full power.	1. Driver load is open or short-circuited. 2. Dirty connector pin or contactor coil. 4. Incorrect crimping or wiring of connector.	Controller
25	3-4	Load Hold Driver Fault	Close the currently assigned driver	Equivalent to Driver 1 Fault	Controller
26	3-5	Lower Driver Fault	Close the currently assigned driver	Equivalent to Driver 1 Fault	Controller
27	3-6	Encoder Fault. Failure type: 1. Verification loss. 2. Overcurrent leads to pulse loss. 3. Loss of speed pulse signal. 4. Motor matching. 5. The power supply part of the encoder is faulty.	Turn off the electromagnetic brake, throttle, and brake at full power.	1. Motor encoder fails. 2. Crimping or wiring error. 3. Check programmer\system monitor menu\AC motor\motor rpm. 4. Check Programmer\AC Motor Setup\Quadrature Encoder\Encoder Fault Setup. 5. Check programmer\system monitor menu\hardware inputs: Analog 3 and 4.	Controller

28	3-7	Motor Open Circuit	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Open circuit of motor phase. 2. Wrong crimping or wiring.	Controller
29	3-8	Main Contactor Welded	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The contact of the main contactor is always welded; 2. The V-phase or U-phase of the motor is open; 3. External voltage is directly connected to the B+ terminal of the controller.	Controller
30	3-9	Main Contactor Did Not Close. Fault type: 1. After the control command is given, the main contactor does not close. 2. When working, the main contactor is disconnected.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Type 1: 1. The main contactor did not close. 2. The contact of the main contactor is defective. 3. The controller B+ terminal is externally connected with a heavy load, which leads to the inability to effectively charge the capacitor. 4. The large-current fuse is blown. 5. The main contactor parameter is set incorrectly. Type 2: 1. The main contactor is disconnected during operation 2. The contactor coil is disconnected. 3. The contactor is faulty.	Controller
31	4-2	Throttle input fault. Fault type: 1. The external input is too low or too high.	Turn off the throttle.	1. The input voltage of the throttle exceeds the range set by Analog Low and Analog High, and the corresponding analog input is defined as the throttle input. 2. Check Programmer\Controller Setup\Analog Inputs\Analog 1 Type 3. Check Programmer\Controller Setup\Analog Inputs\Configure	Controller
32	4-4	Brake Input Fault	Full power braking	The corresponding fault triggered by the brake input source (assigned analog input). Note: Input troubleshooting may also be an input voltage out of range.	Controller
33	4-6	NV Memory Failure. Fault type: 1. Invalid check; 2. Error in writing data; 3. Data reading error; 4. Data writing was not completed due to power failure.	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, proportional drive and brake at full power.	1. NV Memory Failure. 2. Internal failure of controller.	Controller
34	4-7	HPD Sequencing Protection	Turn off the throttle.	1. The sequence of key switch, interlock, direction switch and throttle input operation is incorrect; 2. Incorrect wiring or crimping of key switch, interlock, direction switch and throttle input; 3. The key switch, interlock, direction switch and accelerator input are damp; 4. Check the programmer \ system monitor menu \ inputs \ switch status; 5. Check the programmer \ system monitor menu \ inputs \ throttle command.	Controller
35		EMR Rev HPD	Turn off the throttle and use the electromagnetic brake.	The emergency reverse operation has ended, but the throttle input, direction switch, and interlock have not returned to their original positions.	Controller

36		Pump HPD Protection. Fault type: 1. Only lifting; 2. Only lowering; 3. Lifting and lowering.	Turn off pump.	Incorrect input conditions for lifting/lowering throttle (>25%). Parameter setting error: 1. Hydraulic suppression type; 2. HPD/SRO determines hardware failure of the oil pump accelerator.	Controller	
37	4-9	Parameter Change Fault. Fault type: CAN ID of recording parameter.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	After the interlock is closed, modify the safety-related parameters (the parameters marked with PCF).	Controller	
38	4-A	EMR Switch Redundancy Fault	Turn off the interlock and use the electromagnetic brake.	1. One or two of the emergency reverse switches do not work, resulting in an invalid state. 2. The switch is wet or dirty.	Controller	
39	5-1	Arm PDo Timeout Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check the handle	Controller	OEM Fault (Custom)
40	5-2	1220 Shutdown Fault	No steering, turn off motor, main contactor, electromagnetic brake, accelerator, full power braking	1. For controller short circuit or controller failure, replace the controller; 2. Steering motor stalled, motor problems or line problems; 3. Controller parameter problem	Controller	OEM Fault (Custom)
41	5-3	1220 limit fault	No steering	1. For controller short circuit or controller failure, replace the controller; 2. Steering motor stalled, motor problems or line problems; 3. Controller parameter problem	Controller	OEM Fault (Custom)
42	5-4	VCL HPD Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Throttle signals come first, and operate in the correct order.	Controller	OEM Fault (Custom)
43	5-5	VCL SRO Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Switch signals come first, and operate in the correct order.	Controller	OEM Fault (Custom)
44	5-6	Display Config Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check display configuration.	Controller	OEM Fault (Custom)
45	5-7	BMS Fault Grade Non-Zero	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check battery	Battery	OEM Fault (Custom)
46	5-8	Remote pdo timeout	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Solve the communication problems with the controller (matching, protocol, line, etc.)	Controller	OEM Fault (Custom)
47	5-9	Steer angle changed	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	180/360 angle mode switch, restart the key switch, eliminate the fault and switch to the corresponding angle mode.	Controller	OEM Fault (Custom)

48	5-A	BMS Temp LOW Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check battery	Battery	OEM Fault (Custom)
49	5-B	Redundance Check Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.		Controller	OEM Fault (Custom)
50	5-C	Battery type mismatch	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Select the correct battery type.	Battery	OEM Fault (Custom)
51	5-D	Wrong 3401 Model Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Select the correct instrument type.	Instrument	OEM Fault (Custom)
52	5-E	Non Curtis Display	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check the display.	Controller	OEM Fault (Custom)
53	5-F	Pump Handshake Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Solve the communication problems with the controller (matching, protocol, line, etc.)	Controller	OEM Fault (Custom)
54	6-2	PDO Timeout BMS	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check battery and communications.	Battery	OEM Fault (Custom)
55	6-3	BMS Temp High Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check battery	Battery	OEM Fault (Custom)
56	6-4	BMS low AH	No action	Charging required	Battery	OEM Fault (Custom)
57	6-5	BMS voltage difference fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check battery	Battery	OEM Fault (Custom)
58	6-6	BMS Severe Overvoltage	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check battery	Battery	OEM Fault (Custom)
59	6-7	BMS Undervoltage	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check battery	Battery	OEM Fault (Custom)

61	6-A	Battery unlock	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Push the battery back into place and lock it	Controller	OEM Fault (Custom)
60	6-B	Throttle Pedal SRO Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	The throttle has an output before interlocking. Check the throttle.	Throttle	OEM Fault (Custom)
61	6-D	Display Config Fault	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Check the instrument.	Instrument	OEM Fault (Custom)
62	7-1	OS General	Turn off all	Reset controller	Controller	
63	7-2	PDO Timeout	Trigger: The time for two adjacent PDOs to receive information exceeds the set PDO timeout. Clear: received the CAN NMT information or reset the controller.	1. The time for two adjacent PDOs to receive information exceeds the set PDO timeout. 2. Adjust the PDO settings and view Programmer/Application Setup/CAN Interface/PDO Setups.	Controller	
64	7-3	Motor Stall Detected	Turn off the motor, electromagnetic brake and throttle, change the control mode to LOS, and the motor output is limited.	1. The motor is stalled; 2. The motor encoder is invalid; 3. Wrong crimping or wiring; 4. The power supply part of the motor encoder is abnormal; 5. Check the Programmer\System Monitor Menu\AC Motor\Motor RPM.	Controller	
65	7-7	Supervision Fault. Fault type: Curtis monitoring code	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, proportional drive and brake at full power.	Controller Internal Fault	Controller	
66	7-9	Supervision Input Check Fault	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, proportional drive and brake at full power.	Controller Internal Fault	Controller	
67	8-2	PDO Mapping Error	Turn off PDO	1. There are too many data bits in PDO mapping, or the target is incompatible; 2. Adjust PDO settings and check Programmer/Application Setup/CAN Interface/PDO Setups.	Controller	
68	8-3	Internal Hardware Fault. Fault type: Curtis hardware code.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Internal fault detected in the controller.	Controller	

69	8-4	Motor Braking Impaired	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Battery overcharge, motor or controller overheating, or inappropriate parameters. Reset the interlock pedal	Controller
70	8-7	<p>Motor characterization error. Fault type:</p> <p>71. Failure to write to memory RAM; 72. Temperature sensor malfunction; 73. Motor overheating; 74. Temperature reduction of the controller; 76. Low pressure reduction; 77. High pressure reduction; 78. No encoder signal; 79. The current verification is out of range; 80. The current verification is out of range; 81. Can detect encoder signals, but cannot automatically detect the number of pulses per revolution (encoder steps); 82. Automatic matching failed; 90/98, unable to detect feedback sine/cosine signals from permanent magnet synchronous motors; 91. Permanent magnet synchronous motor does not rotate; 92. Permanent magnet synchronous motors do not accelerate or experience low acceleration; 94-97. Delay compensation of permanent magnet synchronous motor exceeds the range; 99. The permanent magnet synchronous motor rotates at the beginning of matching; 102. Temperature sensor failure of permanent magnet synchronous motor; 103. High temperature reduction of permanent magnet synchronous motors; 104. Temperature reduction of permanent magnet synchronous motor controller; 106. Low voltage reduction of permanent magnet synchronous motor controller; 107. High voltage reduction of permanent magnet synchronous motor controller.</p>	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Motor matching failed during motor matching process.	Controller
71	8-8	Encoder Pulse Error	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	<ol style="list-style-type: none"> 1. The encoder step setting does not match the actual value; 2. Verify parameter settings and check the Programmer \ AC Motor Setup \ Quadrature Encoder \ Encoder Steps; 3. When the motor loses IFO control and there is no accelerator signal input, the motor accelerates and rotates. 	Controller

72	8-9	Parameter Out of Range. Fault type: Record the target CAN ID.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Parameter value out of range detected. 2. Use CIT tool to check and rewrite parameters	Controller	
73	9-1	Bad Firmware	The controller cannot be fully started.	The controller firmware is incorrect. 1. CRC or OS mismatch; 2. An incompatible OS was used.	Controller	
74	9-2	EM Brake Failed to Set	After activating the electromagnetic brake and throttle interlock, the slope parking function is triggered.	1. The vehicle operation is detected after setting the electromagnetic brake; 2. The electromagnetic brake fails to stop the motor from rotating after braking.	Controller	
75	9-3	Encoder LOS Mode	LOS Mode	1. Encoder failure of 3-6 or 7-3, entering LOS mode; 2. Motor encoder malfunction. 3. Crimping or wiring error. 4. Vehicle stalled.	Controller	
76	9-4	Emer Rev Timeout	Turn off the throttle and use the electromagnetic brake.	1. Emergency reverse trigger and termination, as the emergency reverse time period expires. 2. The emergency reverse input is stuck.	Controller	
77	9-6	Pump BDI Fault	Turn off pump.	1. The battery level is lower than the low battery lock parameter setting value. 2. BDI parameter setting error.	Controller	
78	9-9	Parameter Mismatch. Fault type: 1. Dual-drive function is turned on in torque mode; 2. The encoder is selected for SPMSM motor feedback; 3. Sine and cosine are selected for AC induction motor feedback.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Incorrect motor feedback selection for a different motor technology application; 2. The dual-drive function is turned on in torque mode; 3. The dual-drive function is turned on when the single controller is applied.	Controller	
79	9-A	Interlock Braking Supervision Fault. Fault types: 1. Motor speed exceeds interlock braking monitoring limit; 2. Interlock disconnected, electromagnetic brake not set within specified time for braking; 3. Interlock disconnected, electromagnetic brake not set, rotor position exceeds RPM limit.	Turn off the motor, electromagnetic brake and main contactor.	1. The motor speed exceeds the set parameter for Interlock Braking Supervision during interlocking braking; 2. Check Programmer/Application Setup/Interlock Braking/Supervision Enable. 3. Check Programmer/Application Setup/Interlock Braking/Interlock Braking Supervision.	Controller	
80	9-B	Emergency Reverse Fault (EMR Supervision) detected	Turn off the motor, electromagnetic brake and main contactor.	1. During the emergency reverse process, the motor speed exceeds the parameters set for Emergency Reverse Supervision; 2. Check Programmer/Application Setup/Emergency Reverse/Emergency Reverse Supervision.	Controller	

81	A-1	<p>Drive 1 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 1	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 1 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 1 / Driver 1 Overcurrent. 	Controller
82	A-2	<p>Drive 2 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 2	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 2 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 2 / Driver 2 Overcurrent. 	Controller
83	A-3	<p>Drive 3 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 3	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 3 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 3 / Driver 3 Overcurrent. 	Controller
84	A-4	<p>Drive 4 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 4	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 4 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 4 / Driver 4 Overcurrent. 	Controller

85	A-5	<p>Drive 5 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. Fault types 3-5 require drive fault detection to be enabled. 	Turn off the drive 5	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 5 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 5 / Driver 5 Overcurrent. 	Controller
86	A-6	<p>Drive 6 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. Fault types 3-5 require drive fault detection to be enabled. 	Turn off the drive 6	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 6 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 6 / Driver 6 Overcurrent. 	Controller
87	A-7	<p>Drive 7 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. Fault types 3-5 require drive fault detection to be enabled. 	Turn off the drive 7	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 7 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 7 / Driver 7 Overcurrent. 	Controller
88	A-8	<p>Driver Assignment. Fault type: 5. The serial number of the driver caused the fault.</p>	Turn off the driver.	<ol style="list-style-type: none"> 1. One driver is used for two or more functions. 2. Check Programmer / Controller Setup / IO Assignments / Coil Drivers: Main contactor driver; Electromagnetic brake drive; Pump contactor drive. 	Controller
89	A-9	<p>Coil Supply Fault. Fault type:</p> <ol style="list-style-type: none"> 1. Short circuit with B- or hardware failure; 2. A short circuit occurs inside the drive, resulting in the power supply of the coil being cut off; 3. The coil power supply startup detection fails; 4. The detection of coil power supply startup prohibition is invalid. 	Turn off all outputs of the controller	<ol style="list-style-type: none"> 1. Driver load is short-circuited. 2. Dirty connector pin or contactor coil. 3. Incorrect crimping or wiring of connector. 4. The controller is faulty. 	Controller

90	B-1	Analog input 1 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 1 is higher than the set value of Analog 1 High; 2. The input voltage of analog 1 is lower than the set value of Analog 1 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 1; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 1 Low/Analog 1 High.	Controller
91	B-2	Analog input 2 out of range. Fault type: 1 Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 2 is higher than the set value of Analog 2 High; 2. The input voltage of analog 2 is lower than the set value of Analog 2 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 2; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 2 Low/Analog 2 High.	Controller
92	B-3	Analog input 3 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 3 is higher than the set value of Analog 3 High; 2. The input voltage of analog 3 is lower than the set value of Analog 3 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 3; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 3 Low/Analog 3 High.	Controller
93	B-4	Analog input 4 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 4 is higher than the set value of Analog 4 High; 2. The input voltage of analog 4 is lower than the set value of Analog 4 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 4; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 4 Low/Analog 4 High.	Controller
94	B-5	Analog input 5 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 5 is higher than the set value of Analog 5 High; 2. The input voltage of analog 5 is lower than the set value of Analog 5 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 5; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 5 Low/Analog 5 High.	Controller
95	B-6	Analog input 6 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 6 is higher than the set value of Analog 6 High; 2. The input voltage of analog 6 is lower than the set value of Analog 6 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 6; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 6 Low/Analog 6 High.	Controller
96	B-7	Analog input 7 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 1 is higher than the set value of Analog 7 High; 2. The input voltage of analog 7 is lower than the set value of Analog 7 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 7; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 7 Low/Analog 7 High.	Controller
97	B-8	Analog input 8 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 8 is higher than the set value of Analog 8 High; 2. The input voltage of analog 8 is lower than the set value of Analog 8 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 8; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 8 Low/Analog 8 High.	Controller

98	B-9	Analog input 9 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 9 is higher than the set value of Analog 9 High; 2. The input voltage of analog 9 is lower than the set value of Analog 9 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 9; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 9 Low/Analog 9 High.	Controller
99	B-B	Analog input 14 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 14 is higher than the set value of Analog 14 High; 2. The input voltage of analog 14 is lower than the set value of Analog 14 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 14; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 14 Low/Analog 14 High.	Controller
100	B-C	Analog Assignment Fault. Fault type: 9. The serial number of the analog caused the fault.	None, unless VCL adds a special handling program.	1. One analog quantity is used for two or more functions; 2. One analog input is out of range; 3. Check Programmer / Controller Setup / IO Assignments / Controls.	Controller
101	B-D	Analog input 18 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 18 is higher than the set value of Analog 18 High; 2. The input voltage of analog 18 is lower than the set value of Analog 18 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 18; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 18 Low/Analog 18 High.	Controller
102	B-E	Analog input 19 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 19 is higher than the set value of Analog 19 High; 2. The input voltage of analog 19 is lower than the set value of Analog 19 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 19; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 19 Low/Analog 19 High.	Controller
103	C-1	Branding Error	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Software and hardware brands do not match; 2. Contact local Curtis technical support to resolve the issue.	Controller
104	C-2	BMS Cutback. 1. The battery current decreases; 2. Insufficient voltage reduction in battery cells; 3. Excessive voltage reduction in battery cells.	None, unless VCL adds a special handling program.	Resolve battery issues.	Battery
105	C-5	PWM Input 10 Out of Range	None, unless VCL adds a special handling program.	Reset the controller by restoring the voltage to the allowable range.	Controller
106	C-7	Analog input 31 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 14 is higher than the set value of Analog 31 High; 2. The input voltage of analog 14 is lower than the set value of Analog 31 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 31; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 31 Low/Analog 31 High.	Controller

107	C-8	Invalid CAN Port	No action	1. Mistuned dual driver CAN parameters; 2. CAN node ID conflicts due to dual drive.	Controller
108	C-9	VCL Watchdog	No action	Kick_Watchdog(). Start and reset the specified watchdog timer.	Controller
109	C-B	<p>PWM Input 28 Out of Range.</p> <ol style="list-style-type: none"> 1. The input is disconnected; 2. The measured input frequency is lower than $(PWM_Input_28_Low_Frequency) - (PWM_Frequency_Input_28_Frequency_Fault_Tolerance)$; 3. The measured input frequency is higher than $(PWM_Input_28_High_Frequency) + (PWM_Input_28_Frequency_Fault_Tolerance)$; 4. The measured duty cycle is lower than the set limit, $(PWM_Input_28_Low_Duty_Cycle) - (PWM_Input_28_Duty_Cycle_Fault_Tolerance)$; 5. The measured duty cycle is higher than the set limit, $(PWM_Input_28_High_Duty_Cycle) + (PWM_Input_28_Duty_Cycle_Fault_Tolerance)$. 	None, unless VCL adds a special handling program.	<ol style="list-style-type: none"> 1. The execution cycle for this fault diagnosis is every 4 milliseconds. If no PWM signal is generated within 16 milliseconds, or if the measured value is not updated every 16 milliseconds, the input is considered disconnected. 2. Parameter imbalance; 3. Wiring error 	Controller
110	C-C	<p>PWM Input 29 Out of Range.</p> <ol style="list-style-type: none"> 1. The input is disconnected; 2. The measured input frequency is lower than $(PWM_Input_29_Low_Frequency) - (PWM_Frequency_Input_29_Frequency_Fault_Tolerance)$; 3. The measured input frequency is higher than $(PWM_Input_29_High_Frequency) + (PWM_Input_29_Frequency_Fault_Tolerance)$; 4. The measured duty cycle is lower than the set limit, $(PWM_Input_29_Low_Duty_Cycle) - (PWM_Input_29_Duty_Cycle_Fault_Tolerance)$; 5. The measured duty cycle is higher than the set limit, $(PWM_Input_29_High_Duty_Cycle) + (PWM_Input_29_Duty_Cycle_Fault_Tolerance)$. 	None, unless VCL adds a special handling program.	<ol style="list-style-type: none"> 1. The execution cycle for this fault diagnosis is every 4 milliseconds. If no PWM signal is generated within 16 milliseconds, or if the measured value is not updated every 16 milliseconds, the input is considered disconnected. 2. Parameter imbalance; 3. Wiring error 	Controller

11 1	C-D	<p>Primary State Error. These are internal problems that occur during startup, parameter initialization, secondary micro-update or other runtime problems.</p> <p>1 = PRIMARY_DEVICE_STARTUP = 0, 2 = PRIMARY_WAIT_KSI_STABLE, 3 = PRIMARY_DEVICE_STARTUP_VALID, 4 = PRIMARY_INITIALIZE_PARAMETERS, 5 = PRIMARY_WAIT_FOR_FIRTSIGNALS, 6 = PRIMARY_WAIT_FOR_SUPERVISOR, 7 = PRIMARY_RESTORE_PARAMETER_FAIL, 8 = PRIMARY_SUPERVISOR_FIRST_SIGNALS_ERROR, 9 = PRIMARY_SUPERVISOR_STARTUP_ERROR, 10 = PRIMARY_STARTUP_TIMER_FAILURE, 11 = PRIMARY_WAIT_CANDHANDSHAKING_DONE, 12 = PRIMARY_RUNNING</p>	The controller is inoperable.	Internal error in controller, please reset the controller.	Controller
11 2	D-1	Lift Input Fault	Turn off lift	The fault diagnosis associated with the lift input source will trigger the fault. For example, if the lift input source is an analog input, all faults related to that analog input will be collected into that fault and reported Cleared: any allocation conflicts will be resolved, or the input will exceed the range, and then the controller will be reset.	Controller
11 3	D-2	Phase PWM Mismatch. 0 = U phase. 1 = V phase. 2 = W phase.	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	The difference between the measured phase PWM duty cycle and the measured phase PWM duty cycle is greater than the allowable value. Clear: reset controller	Controller
11 4	D-3	Hardware Compatibility Fault	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	Incompatible OS and controller; The downloaded software and controller hardware are incompatible.	Controller
11 5	D-4	Lower Input Fault	Turn off Lower	The fault diagnosis associated with the Lower input source will trigger the fault. For example, if the Lower input source is an analog input, all faults related to that analog input will be collected into that fault and reported Cleared: any allocation conflicts will be resolved, or the input will exceed the range, and then the controller will be reset.	Controller

11 6	D-6	<p>Hazardous Movement.</p> <p>1=The motor speed is opposite to the required speed direction, and the motor cannot accelerate in the correct direction within the time set by the program. If the programming time for the motor to accelerate to zero speed is changed to neutral, this hazardous will be detected.</p> <p>2=The direction of the difference between the acceleration and the operator's speed requirements and the motor speed will be opposite. A parameter in the program time (Hazardous_Throttle_Response_Time) where the speed in the instruction direction is greater than the instruction speed by more than one parameter (Hazard_Speed)</p>	Turn off interlock.	<p>When the motor is required to move, the fault detects hazardous movement.</p> <p>The first danger is that if the throttle drops to zero or the direction switch is not in the driving direction, the motor will not be able to slow down.</p> <p>The second danger is that the motor accelerates in the wrong direction or too fast.</p> <p>Note: This fault only occurs when the control mode is selected in Speed_Mode, Speed_Mode_Express or Servo_Mode.</p> <p>Clear: Resets the controller.</p> <p>Set Discoverous_Direction_Response_Time=0 will disable these checks.</p>	Controller	
11 7	D-D	<p>IMU Failure.</p> <p>1=SPI communication failure;</p> <p>2=Curtis factory self inspection failure;</p> <p>3=runtime check fault, incorrect data received from IMU;</p> <p>4=The calibration test of the gyroscope is out of range, with a maximum calibration deviation exceeding.</p>	No action	<p>Check whether the configuration is correct or whether the vehicle is moving during calibration.</p> <p>Restart the key switch.</p>	Controller	

Oil pump controller fault code table

Serial number	The instrument/controller displays fault codes.	Fault Name	Fault Description	Cause or Solution	Fault Source	Remarks
1	1-2	Controller Overcurrent Fault types: 1 = U-phase over current 2 = W-phase over current 3 = V-phase over current 4 = controller current > 135% current limit value.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The external connection of U, V and W phases of the motor is short-circuited; 2. The encoder signal of the motor is disturbed; 3. The motor parameters are misadjusted; 4. The controller is faulty.	Controller	
2	1-3	Current Sensor Fault type: 1	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Leakage from U, V or W phase to vehicle body (short circuit in stator) 2. Controller failure 3. Replace controller.	Controller	
3	1-4	Precharge Failed Fault type: 1. Interrupt 2. Energy limit 3. Time limit	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The load connected to the B+ terminal of the controller suppresses the internal capacitor charging of the controller. 2. Check the voltage displayed on the Programmer \ System Monitor Menu \ Controller \ Capacitor Voltage. 3. Replace the controller.	Controller	
4	1-5	Controller Severe Undertemp	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The controller operates in extreme environments. 2. Check the temperature displayed on the Programmer \ System Monitor Menu \ Controller \ Controller Temperature. If the temperature rises to -40°C or above, restart the key switch or interlock switch. If it fails, replace the controller;	Controller	
5	1-6	Controller Severe Overtemp	Turn off the motor, main contactor, electromagnetic brake, throttle, and perform full power electric braking.	1. The controller works in extreme environment; 2. The load is too heavy; 3. The installation of the controller is unreasonable; 4. Check the temperature displayed by the programmer \ system monitor menu \ controller \ controller temperature. Reduce the temperature to below 95°C. Restart the key switch or interlock switch; if it fails, replace the controller;	Controller	
6	1-7	Severe B+ Undervoltage	No drive torque outputs	1. The battery is exhausted by the non-controller system; 2. The internal resistance of the battery is too high; 3. The battery is not connected when the motor is driven; 4. The fuse connected to B+ is blown or the main contactor is not attracted; 5. The battery parameters of the controller are set incorrectly; 6. Check the voltage displayed by the programmer \ system monitor menu \ controller \ capacitor voltage.	Controller	

7		Severe KSI Undervoltage	None, unless there are specific measures in VCL software.	<ol style="list-style-type: none"> 1. The battery of the non-controller system is exhausted; 2. The resistance of the KSI input line is too high; 3. When the motor is driven, the KSI line is disconnected; 4. The fuse is blown; 5. Check the voltage displayed by the programmer \ system monitor menu \ controller \ key switch voltage. 	Controller
8	1-8	Severe B+ Overvoltage	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	<ol style="list-style-type: none"> 1. The battery parameters of the controller are set incorrectly. 2. Regenerative braking. When the battery is recharged with current, the internal resistance of the battery is too high. 3. The battery is not connected during regenerative braking. 4. Check the voltage displayed by Programmer \ System Monitor Menu \ Controller \ Capacitor Voltage. 	Controller
9		Severe KSI Overvoltage	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	<ol style="list-style-type: none"> 1. The battery voltage at KSI(pin1) terminal of the controller exceeds the set value of severe high voltage. 2. Check the voltage displayed by programmer \ system monitor menu \ controller \ key switch voltage. 	Controller
10	1-9	Speed Limit Supervision Fault	Turn off the interlock and electromagnetic brakes.	<ol style="list-style-type: none"> 1. It is detected that the motor speed exceeds the Max Speed Supervision setting. 2. The Max Speed Supervision setting value is incorrect. 3. Check the values of Programmer\Application Setup\Max Speed Supervision settings 	Controller
11	1-A	<p>Motor not stopped</p> <p>1 = the motor moved more revolutions than the parameter, Motor_Not_Stopped_Position_Error setting. The motor turns more than the set parameter (Motor_Not_Stopped_Position_Error).</p> <p>2 = the motor moved faster than the parameter Motor_Not_Stopped_Speed_Error (RPM) for 160ms. The motor rotates faster than the parameter Motor_Not_Stopped_Speed_Error (RPM) for 160ms.</p> <p>3 = The three-phase drive has applied an electrical frequency greater than the Motor_Not_Stopped_Max_Frequency parameter, and applied an RMS current greater than the Motor_Not_Stopped_Max_Current parameter for 64ms. Three-phase drive applies a parameter that the electrical frequency is greater than the frequency parameter set in Motor_Not_Stopped_Max_Frequency and the effective current applied in 64ms is greater than the parameter set in Motor_Not_Stopped_Max_Current.</p>	Turn off the motor, main contactor, electromagnetic brake, throttle, oil pump and brake at full power.	<ol style="list-style-type: none"> 1. Motor Not Stopped. Maladjustment. 2. View: Programmer » Application Setup » Motor not stopped menu. 3. Failure or conflict of internal controller, which makes the motor rotate when it stops. 	Controller

12	1-B	Critical OS General (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, drive 6, drive 7, proportional drive, oil pump, coil power supply and brake at full power.	1. (<100) Internal failure. 2. (>100) CIT version is too old to fully support FOS version.	Controller
13	1-C	OS General 2 (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	The controller is inoperable.	1. (<100) Internal failure. 2. (>100) CIT version is too old to fully support FOS version.	Controller
14	1-D	Reset Rejected	Turn off the interlock and throttle.	Restart key switch	Controller
15	1-E	Motor short-circuiting	The controller is inoperable.	Reset controller	Controller
16	2-2	Controller Overtemp Cutback	Reduce driving and braking torque.	1. The controller works in extreme environment; 2. The load is too heavy; 3. The installation of the controller is unreasonable; 4. The performance of the controller is limited at this temperature. 5. Check the temperature displayed by the programmer \ system monitor menu \ controller \ controller temperature. Reduce the temperature to below 85°C. Restart the key switch or interlock switch; if it fails, replace the controller;	Controller
17	2-3	Undervoltage Cutback	Reduce driving torque	1. The battery needs to be charged, and the performance of the controller is limited at this voltage. 2. The parameters of the controller battery are set incorrectly. 3. The non-controller system runs out of batteries. 4. The internal resistance of the battery is too high. 5. The battery is not connected when driving the motor. 6. The fuse connecting B+ is blown or the main contactor is not attracted. 7. Check the programmer\system monitor menu\controller\currents\undervoltage cutback. 8. Check the voltage displayed by programmer\system monitor menu\controller\capacitor voltage.	Controller

18	2-4	Overvoltage Cutback	Reduce the braking torque. Note: This fault can only be detected during regenerative braking.	<ol style="list-style-type: none"> 1. During normal operation, the current generated by regenerative braking is recharged to the battery, and the battery voltage is too high, resulting in failure, and the performance of the controller is limited at this voltage. 2. The battery parameters of the controller are set incorrectly. 3. Regenerative braking. When the battery is recharged with current, the internal resistance of the battery is too high. 4. During regenerative braking, the battery is not connected. 5. Check Programmer\System Monitor Menu\Controller\CURRENTS\Overvoltage Cutback. 6. Check the voltage displayed by programmer\system monitor menu/controller\capacitor voltage. 	Controller
19	2-5	Ext 5V Supply Failure. Failure type: 1. The output voltage of 5V is out of range. 2. The current of 5V voltage is out of range.	Turn off the 5V output	<ol style="list-style-type: none"> 1. The external 5V load is too small (pin 16). 2. Check the voltage and current of 5V output displayed by programmer\system monitor menu\outputs. 	Controller
20	2-6	Ext 12V Supply Failure. Failure type: 1. The output voltage of 12V is out of range. 2. The current of 12V voltage is out of range.	Turn off the 12V output	<ol style="list-style-type: none"> 1. The external 12V load is too small (pin 23). 2. Check the voltage and current of 12V output displayed by programmer\system monitor menu\outputs. 	Controller
21	2-8	Motor Temp Hot Cutback	<ol style="list-style-type: none"> 1. Reduce the driving torque. 2. If MotorBrakingThermal CutBack_Enable = On, reduce the braking torque. 	<ol style="list-style-type: none"> 1. The motor temperature is greater than or equal to the set value of Temperature Hot, which causes the controller to output current limit. 2. The motor temperature and sensor parameters are set incorrectly. 3. Check programmer \ AC motor setup \ temperature sensor. 	Controller
22	2-9	Motor Temp Sensor	Enter the LOS mode, reduce the motor speed, and turn off the high position reduction function of the motor.	<ol style="list-style-type: none"> 1. The temperature sensor of the motor is not connected properly; 2. The polarity of the sensor is not connected correctly (pin 9 and pin 12). 3. The temperature of the motor and the sensor parameters are set incorrectly. 4. Check the programmer\system monitor menu\AC motor/temperature. 	Controller
23	3-1	Main contactor drive fault (Main Driver). Fault Type: 1. Drive Short Circuit. 2. Drive Overcurrent. 3. Open/Short Circuit (High detected, should be Low). 4. Open/Short Circuit (Low detected, should be High). 5. Disconnect	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	<ol style="list-style-type: none"> 1. Driver load is open or short-circuited. 2. Dirty connector pin or contactor coil. 3. Incorrect crimping or wiring of connector. 	Controller
24	3-2	EM Brake Driver Fault. Fault Type: 1. Drive Short Circuit. 2. Drive Overcurrent. 3. Open/Short Circuit (High detected, should be Low). 4. Open/Short Circuit (Low detected, should be High). 5. Disconnect	Turn off the electromagnetic brake, throttle, and brake at full power.	<ol style="list-style-type: none"> 1. Driver load is open or short-circuited. 2. Dirty connector pin or contactor coil. 4. Incorrect crimping or wiring of connector. 	Controller
25	3-4	Load Hold Driver Fault	Close the currently assigned driver	Equivalent to Driver 1 Fault	Controller

26	3-5	Lower Driver Fault	Close the currently assigned driver	Equivalent to Driver 1 Fault	Controller
27	3-6	Encoder Fault. Fault type: 1. Verification loss. 2. Overcurrent leads to pulse loss. 3. Loss of speed pulse signal. 4. Motor matching. 5. The power supply part of the encoder is faulty.	Turn off the electromagnetic brake, throttle, and brake at full power.	1. Motor encoder fails. 2. Crimping or wiring error. 3. Check programmer\system monitor menu\AC motor\motor rpm. 4. Check Programmer\AC Motor Setup\Quadrature Encoder\Encoder Fault Setup. 5. Check programmer\system monitor menu\hardware inputs: Analog 3 and 4.	Controller
28	3-7	Motor Open Circuit	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Open circuit of motor phase. 2. Wrong crimping or wiring.	Controller
29	3-8	Main Contactor Welded	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. The contact of the main contactor is always welded; 2. The V-phase or U-phase of the motor is open; 3. External voltage is directly connected to the B+ terminal of the controller.	Controller
30	3-9	Main Contactor Did Not Close. Fault type: 1. After the control command is given, the main contactor does not close. 2. When working, the main contactor is disconnected.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Type 1: 1. The main contactor did not close. 2. The contact of the main contactor is defective. 3. The controller B+ terminal is externally connected with a heavy load, which leads to the inability to effectively charge the capacitor. 4. The large-current fuse is blown. 5. The main contactor parameter is set incorrectly. Type 2: 1. The main contactor is disconnected during operation 2. The contactor coil is disconnected. 3. The contactor is faulty.	Controller
31	4-2	Throttle input fault. Fault type: 1. The external input is too low or too high.	Turn off the throttle.	1. The input voltage of the throttle exceeds the range set by Analog Low and Analog High, and the corresponding analog input is defined as the throttle input. 2. Check Programmer\Controller Setup\Analog Inputs\Analog 1 Type 3. Check Programmer\Controller Setup\Analog Inputs\Configure	Controller
32	4-4	Brake Input Fault	Full power braking	The corresponding fault triggered by the brake input source (assigned analog input). Note: Input troubleshooting may also be an input voltage out of range.	Controller
33	4-6	NV Memory Failure. Fault type: 1. Invalid check; 2. Error in writing data; 3. Data reading error; 4. Data writing was not completed due to power failure.	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, proportional drive and brake at full power.	1. NV Memory Failure. 2. Internal failure of controller.	Controller

34	4-7	HPD Sequencing Protection	Turn off the throttle.	1. The sequence of key switch, interlock, direction switch and throttle input operation is incorrect; 2. Incorrect wiring or crimping of key switch, interlock, direction switch and throttle input; 3. The key switch, interlock, direction switch and accelerator input are damp; 4. Check the programmer \ system monitor menu \ inputs \ switch status; 5. Check the programmer \ system monitor menu \ inputs \ throttle command.	Controller	
35		EMR Rev HPD	Turn off the throttle and use the electromagnetic brake.	The emergency reverse operation has ended, but the throttle input, direction switch, and interlock have not returned to their original positions.	Controller	
36		Pump HPD Protection. Fault type: 1. Only lifting; 2. Only lowering; 3. Lifting and lowering.	Turn off pump.	Incorrect input conditions for lifting/lowering throttle (>25%). Parameter setting error: 1. Hydraulic suppression type; 2. HPD/SRO determines hardware failure of the oil pump accelerator.	Controller	
37	4-9	Parameter Change Fault. Fault type: CAN ID of recording parameter.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	After the interlock is closed, modify the safety-related parameters (the parameters marked with PCF).	Controller	
38	4-A	EMR Switch Redundancy Fault	Turn off the interlock and use the electromagnetic brake.	1. One or two of the emergency reverse switches do not work, resulting in an invalid state. 2. The switch is wet or dirty.	Controller	
39	5-1	Pump_SRO_Fault	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	Operate in the correct order of operation	Controller	OEM Fault
40	5-2	Lift_Pot_Open_Fault	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	Check lift sensor	Controller	OEM Fault
41	5-3	Arm PDO Fault	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	Solve the communication problems with the controller (matching, protocol, line, etc.)	Controller	OEM Fault
	5-5	PDO Fault 1353	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	Check PDO 1353	Controller	OEM Fault
	5-6	Angle limit lift fault	Turn off pump.	Lifting is prohibited due to excessive tilt angle	Controller	OEM Fault
	5-7	Chain open fault	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	Check if four chain switches are disconnected.	Controller	OEM Fault

42	6-8	VCL Run Time Error	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, proportional drive and brake at full power.	1. The runtime fault is defined by VCL. Please refer to the system information. 2. The drive command and model do not match when VCL is used for control.	Controller
43	7-1	OS General	Turn off all	Reset controller	Controller
44	7-2	PDO Timeout	Trigger: The time for two adjacent PDOs to receive information exceeds the set PDO timeout. Clear: received the CAN NMT information or reset the controller.	1. The time for two adjacent PDOs to receive information exceeds the set PDO timeout. 2. Adjust the PDO settings and view Programmer/Application Setup/CAN Interface/PDO Setups.	Controller
45	7-3	Motor Stall Detected	Turn off the motor, electromagnetic brake and throttle, change the control mode to LOS, and the motor output is limited.	1. The motor is stalled; 2. The motor encoder is invalid; 3. Wrong crimping or wiring; 4. The power supply part of the motor encoder is abnormal; 5. Check the Programmer\System Monitor Menu\AC Motor\Motor RPM.	Controller
46	7-7	Supervision Fault. Fault type: Curtis monitoring code	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, proportional drive and brake at full power.	Controller Internal Fault	Controller
47	7-9	Supervision Input Check Fault	Turn off the motor, main contactor, electromagnetic brake, throttle, interlock, drive 1, drive 2, drive 3, drive 4, drive 5, proportional drive and brake at full power.	Controller Internal Fault	Controller
48	8-2	PDO Mapping Error	Turn off PDO	1. There are too many data bits in PDO mapping, or the target is incompatible; 2. Adjust PDO settings and check Programmer/Application Setup/CAN Interface/PDO Setups.	Controller
49	8-3	Internal Hardware Fault. Fault type: Curtis hardware code.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Internal fault detected in the controller.	Controller
50	8-4	Motor Braking Impaired	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	Battery overcharge, motor or controller overheating, or inappropriate parameters. Reset the interlock pedal	Controller

51	8-7	<p>Motor characterization error. Fault type: 71. Failure to write to memory RAM; 72. Temperature sensor malfunction; 73. Motor overheating; 74. Temperature reduction of the controller; 76. Low pressure reduction; 77. High pressure reduction; 78. No encoder signal; 79. The current verification is out of range; 80. The current verification is out of range; 81. Can detect encoder signals, but cannot automatically detect the number of pulses per revolution (encoder steps); 82. Automatic matching failed; 90/98, unable to detect feedback sine/cosine signals from permanent magnet synchronous motors; 91. Permanent magnet synchronous motor does not rotate; 92. Permanent magnet synchronous motors do not accelerate or experience low acceleration; 94-97. Delay compensation of permanent magnet synchronous motor exceeds the range; 99. The permanent magnet synchronous motor rotates at the beginning of matching; 102. Temperature sensor failure of permanent magnet synchronous motor; 103. High temperature reduction of permanent magnet synchronous motors; 104. Temperature reduction of permanent magnet synchronous motor controller; 106. Low voltage reduction of permanent magnet synchronous motor controller; 107. High voltage reduction of permanent magnet synchronous motor controller.</p>	<p>Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.</p>	<p>Motor matching failed during motor matching process.</p>	Controller	
52	8-8	Encoder Pulse Error	<p>Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.</p>	<ol style="list-style-type: none"> 1. The encoder step setting does not match the actual value; 2. Verify parameter settings and check the Programmer \ AC Motor Setup \ Quadrature Encoder \ Encoder Steps; 3. When the motor loses IFO control and there is no accelerator signal input, the motor accelerates and rotates. 	Controller	
53	8-9	<p>Parameter Out of Range. Fault type: Record the target CAN ID.</p>	<p>Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.</p>	<ol style="list-style-type: none"> 1. Parameter value out of range detected. 2. Use CIT tool to check and rewrite parameters 	Controller	

54	9-1	Bad Firmware	The controller cannot be fully started.	The controller firmware is incorrect. 1. CRC or OS mismatch; 2. An incompatible OS was used.	Controller
55	9-2	EM Brake Failed to Set	After activating the electromagnetic brake and throttle interlock, the slope parking function is triggered.	1. The vehicle operation is detected after setting the electromagnetic brake; 2. The electromagnetic brake fails to stop the motor from rotating after braking.	Controller
56	9-3	Encoder LOS Mode	LOS Mode	1. Encoder failure of 3-6 or 7-3, entering LOS mode; 2. Motor encoder malfunction. 3. Crimping or wiring error. 4. Vehicle stalled.	Controller
57	9-4	Emer Rev Timeout	Turn off the throttle and use the electromagnetic brake.	1. Emergency reverse trigger and termination, as the emergency reverse time period expires. 2. The emergency reverse input is stuck.	Controller
58	9-6	Pump BDI Fault	Turn off pump.	1. The battery level is lower than the low battery lock parameter setting value. 2. BDI parameter setting error.	Controller
59	9-9	Parameter Mismatch. Fault type: 1. Dual-drive function is turned on in torque mode; 2. The encoder is selected for SPMSM motor feedback; 3. Sine and cosine are selected for AC induction motor feedback.	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Incorrect motor feedback selection for a different motor technology application; 2. The dual-drive function is turned on in torque mode; 3. The dual-drive function is turned on when the single controller is applied.	Controller
60	9-A	Interlock Braking Supervision Fault. Fault types: 1. Motor speed exceeds interlock braking monitoring limit; 2. Interlock disconnected, electromagnetic brake not set within specified time for braking; 3. Interlock disconnected, electromagnetic brake not set, rotor position exceeds RPM limit.	Turn off the motor, electromagnetic brake and main contactor.	1. The motor speed exceeds the set parameter for Interlock Braking Supervision during interlocking braking; 2. Check Programmer/Application Setup/Interlock Braking/Supervision Enable. 3. Check Programmer/Application Setup/Interlock Braking/Interlock Braking Supervision.	Controller
61	9-B	Emergency Reverse Fault (EMR Supervision) detected	Turn off the motor, electromagnetic brake and main contactor.	1. During the emergency reverse process, the motor speed exceeds the parameters set for Emergency Reverse Supervision; 2. Check Programmer/Application Setup/Emergency Reverse/Emergency Reverse Supervision.	Controller

62	A-1	<p>Drive 1 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 1	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 1 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 1 / Driver 1 Overcurrent. 	Controller
63	A-2	<p>Drive 2 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 2	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 2 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 2 / Driver 2 Overcurrent. 	Controller
64	A-3	<p>Drive 3 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 3	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 3 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 3 / Driver 3 Overcurrent. 	Controller
65	A-4	<p>Drive 4 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. <p>Fault types 3-5 require drive fault detection to be enabled.</p>	Turn off the drive 4	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 4 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 4 / Driver 4 Overcurrent. 	Controller

66	A-5	<p>Drive 5 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. Fault types 3-5 require drive fault detection to be enabled. 	Turn off the drive 5	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 5 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 5 / Driver 5 Overcurrent. 	Controller
67	A-6	<p>Drive 6 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. Fault types 3-5 require drive fault detection to be enabled. 	Turn off the drive 6	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 6 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 6 / Driver 6 Overcurrent. 	Controller
68	A-7	<p>Drive 7 Fault. Fault Type:</p> <ol style="list-style-type: none"> 1. Drive short circuit; 2. Drive overcurrent; 3. Open circuit/short circuit (detected as high, it should be low); 4. Open circuit/short circuit (detected as low, it should be high); 5. Disconnection; 6. The output is limited to no current. Fault types 3-5 require drive fault detection to be enabled. 	Turn off the drive 7	<ol style="list-style-type: none"> 1. The driver load is open or short-circuited; 2. The pin or contactor coil of the connector is dirty; 3. Incorrect crimping or wiring of connectors; 4. Drive overcurrent, which exceeds the setting parameter value of Driver 7 Overcurrent; 5. Check Programmer / Controller Setup / Outputs / Driver 7 / Driver 7 Overcurrent. 	Controller
69	A-8	<p>Driver Assignment. Fault type: 5. The serial number of the driver caused the fault.</p>	Turn off the driver.	<ol style="list-style-type: none"> 1. One driver is used for two or more functions. 2. Check Programmer / Controller Setup / IO Assignments / Coil Drivers: Main contactor driver; Electromagnetic brake drive; Pump contactor drive. 	Controller
70	A-9	<p>Coil Supply Fault. Fault type:</p> <ol style="list-style-type: none"> 1. Short circuit with B- or hardware failure; 2. A short circuit occurs inside the drive, resulting in the power supply of the coil being cut off; 3. The coil power supply startup detection fails; 4. The detection of coil power supply startup prohibition is invalid. 	Turn off all outputs of the controller	<ol style="list-style-type: none"> 1. Driver load is short-circuited. 2. Dirty connector pin or contactor coil. 3. Incorrect crimping or wiring of connector. 4. The controller is faulty. 	Controller
71	B-1	<p>Analog input 1 out of range. Fault type:</p> <ol style="list-style-type: none"> 1. Exceeding the upper limit; 2. Below the lower limit. 	None, unless VCL adds a special handling program.	<ol style="list-style-type: none"> 1. The input voltage of analog 1 is higher than the set value of Analog 1 High; 2. The input voltage of analog 1 is lower than the set value of Analog 1 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 1; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 1 Low/Analog 1 High. 	Controller

72	B-2	Analog input 2 out of range. Fault type: 1 Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 2 is higher than the set value of Analog 2 High; 2. The input voltage of analog 2 is lower than the set value of Analog 2 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 2; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 2 Low/Analog 2 High.	Controller
73	B-3	Analog input 3 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 3 is higher than the set value of Analog 3 High; 2. The input voltage of analog 3 is lower than the set value of Analog 3 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 3; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 3 Low/Analog 3 High.	Controller
74	B-4	Analog input 4 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 4 is higher than the set value of Analog 4 High; 2. The input voltage of analog 4 is lower than the set value of Analog 4 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 4; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 4 Low/Analog 4 High.	Controller
75	B-5	Analog input 5 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 5 is higher than the set value of Analog 5 High; 2. The input voltage of analog 5 is lower than the set value of Analog 5 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 5; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 5 Low/Analog 5 High.	Controller
76	B-6	Analog input 6 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 6 is higher than the set value of Analog 6 High; 2. The input voltage of analog 6 is lower than the set value of Analog 6 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 6; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 6 Low/Analog 6 High.	Controller
77	B-7	Analog input 7 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 1 is higher than the set value of Analog 7 High; 2. The input voltage of analog 7 is lower than the set value of Analog 7 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 7; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 7 Low/Analog 7 High.	Controller
78	B-8	Analog input 8 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 8 is higher than the set value of Analog 8 High; 2. The input voltage of analog 8 is lower than the set value of Analog 8 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 8; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 8 Low/Analog 8 High.	Controller
79	B-9	Analog input 9 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 9 is higher than the set value of Analog 9 High; 2. The input voltage of analog 9 is lower than the set value of Analog 9 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 9; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 9 Low/Analog 9 High.	Controller

80	B-B	Analog input 14 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 14 is higher than the set value of Analog 14 High; 2. The input voltage of analog 14 is lower than the set value of Analog 14 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 14; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 14 Low/Analog 14 High.	Controller
81	B-C	Analog Assignment Fault. Fault type: 9. The serial number of the analog caused the fault.	None, unless VCL adds a special handling program.	1. One analog quantity is used for two or more functions; 2. One analog input is out of range; 3. Check Programmer / Controller Setup / IO Assignments / Controls.	Controller
82	B-D	Analog input 18 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 18 is higher than the set value of Analog 18 High; 2. The input voltage of analog 18 is lower than the set value of Analog 18 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 18; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 18 Low/Analog 18 High.	Controller
83	B-E	Analog input 19 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 19 is higher than the set value of Analog 19 High; 2. The input voltage of analog 19 is lower than the set value of Analog 19 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 19; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 19 Low/Analog 19 High.	Controller
84	C-1	Branding Error	Turn off the motor, main contactor, electromagnetic brake and throttle, and brake at full power.	1. Software and hardware brands do not match; 2. Contact local Curtis technical support to resolve the issue.	Controller
85	C-2	BMS Cutback. 1. The battery current decreases; 2. Insufficient voltage reduction in battery cells; 3. Excessive voltage reduction in battery cells.	None, unless VCL adds a special handling program.	Resolve battery issues.	Battery
86	C-5	PWM Input 10 Out of Range	None, unless VCL adds a special handling program.	Reset the controller by restoring the voltage to the allowable range.	Controller
87	C-7	Analog input 31 out of range. Fault type: 1. Exceeding the upper limit; 2. Below the lower limit.	None, unless VCL adds a special handling program.	1. The input voltage of analog 14 is higher than the set value of Analog 31 High; 2. The input voltage of analog 14 is lower than the set value of Analog 31 Low; 3. Check Programmer / Controller Setup / Analog Inputs / Analog 31; 4. Check Programmer / Controller Setup / Analog Inputs / Configure / Analog 31 Low/Analog 31 High.	Controller
88	C-8	Invalid CAN Port	No action	1. Mistuned dual driver CAN parameters; 2. CAN node ID conflicts due to dual drive.	Controller
89	C-9	VCL Watchdog	No action	Kick_Watchdog(). Start and reset the specified watchdog timer.	Controller

90	C-B	<p>PWM Input 28 Out of Range.</p> <ol style="list-style-type: none"> 1. The input is disconnected; 2. The measured input frequency is lower than $(PWM_Input_28_Low_Frequency) - (PWM_Frequency_Input_28_Frequency_Fault_Tolerance)$; 3. The measured input frequency is higher than $(PWM_Input_28_High_Frequency) + (PWM_Input_28_Frequency_Fault_Tolerance)$; 4. The measured duty cycle is lower than the set limit, $(PWM_Input_28_Low_Duty_Cycle) - (PWM_Input_28_Duty_Cycle_Fault_Tolerance)$; 5. The measured duty cycle is higher than the set limit, $(PWM_Input_28_High_Duty_Cycle) + (PWM_Input_28_Duty_Cycle_Fault_Tolerance)$. 	None, unless VCL adds a special handling program.	<ol style="list-style-type: none"> 1. The execution cycle for this fault diagnosis is every 4 milliseconds. If no PWM signal is generated within 16 milliseconds, or if the measured value is not updated every 16 milliseconds, the input is considered disconnected. 2. Parameter imbalance; 3. Wiring error 	Controller	
91	C-C	<p>PWM Input 29 Out of Range.</p> <ol style="list-style-type: none"> 1. The input is disconnected; 2. The measured input frequency is lower than $(PWM_Input_29_Low_Frequency) - (PWM_Frequency_Input_29_Frequency_Fault_Tolerance)$; 3. The measured input frequency is higher than $(PWM_Input_29_High_Frequency) + (PWM_Input_29_Frequency_Fault_Tolerance)$; 4. The measured duty cycle is lower than the set limit, $(PWM_Input_29_Low_Duty_Cycle) - (PWM_Input_29_Duty_Cycle_Fault_Tolerance)$; 5. The measured duty cycle is higher than the set limit, $(PWM_Input_29_High_Duty_Cycle) + (PWM_Input_29_Duty_Cycle_Fault_Tolerance)$. 	None, unless VCL adds a special handling program.	<ol style="list-style-type: none"> 1. The execution cycle for this fault diagnosis is every 4 milliseconds. If no PWM signal is generated within 16 milliseconds, or if the measured value is not updated every 16 milliseconds, the input is considered disconnected. 2. Parameter imbalance; 3. Wiring error 	Controller	

92	C-D	<p>Primary State Error. These are internal problems that occur during startup, parameter initialization, secondary micro-update or other runtime problems.</p> <p>1 = PRIMARY_DEVICE_STARTUP = 0, 2 = PRIMARY_WAIT_KSI_STABLE , 3 = PRIMARY_DEVICE_STARTUP_VALID, 4 = PRIMARY_INITIALIZE_PARAMETERS, 5 = PRIMARY_WAIT_FOR_FIRST_SIGNALS, 6 = PRIMARY_WAIT_FOR_SUPERVISOR, 7 = PRIMARY_RESTORE_PARAMETER_FAIL, 8 = PRIMARY_SUPERVISOR_FIRST_SIGNALS_ERROR, 9 = PRIMARY_SUPERVISOR_STARTUP_ERROR, 10 = PRIMARY_STARTUP_TIMER_FAILURE, 11 = PRIMARY_WAIT_CANDSHAKING_DONE, 12 = PRIMARY_RUNNING</p>	The controller is inoperable.	Internal error in controller, please reset the controller.	Controller
93	D-1	Lift Input Fault	Turn off lift	The fault diagnosis associated with the lift input source will trigger the fault. For example, if the lift input source is an analog input, all faults related to that analog input will be collected into that fault and reported Cleared: any allocation conflicts will be resolved, or the input will exceed the range, and then the controller will be reset.	Controller
94	D-2	Phase PWM Mismatch. 0 = U phase. 1 = V phase. 2 = W phase.	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	The difference between the measured phase PWM duty cycle and the measured phase PWM duty cycle is greater than the allowable value. Clear: reset controller	Controller
95	D-3	Hardware Compatibility Fault	Turn off the motor, main contactor, electromagnetic brake, throttle, and brake at full power, turn off the oil pump.	Incompatible OS and controller; The downloaded software and controller hardware are incompatible.	Controller
96	D-4	Lower Input Fault	Turn off Lower	The fault diagnosis associated with the Lower input source will trigger the fault. For example, if the Lower input source is an analog input, all faults related to that analog input will be collected into that fault and reported Cleared: any allocation conflicts will be resolved, or the input will exceed the range, and then the controller will be reset.	Controller

97	D-6	<p>Hazardous Movement.</p> <p>1=The motor speed is opposite to the required speed direction, and the motor cannot accelerate in the correct direction within the time set by the program.</p> <p>If the programming time for the motor to accelerate to zero speed is changed to neutral, this hazardous will be detected.</p> <p>2=The direction of the difference between the acceleration and the operator's speed requirements and the motor speed will be opposite.</p> <p>A parameter in the program time (Hazardous_Throttle_Response_Time) where the speed in the instruction direction is greater than the instruction speed by more than one parameter (Hazard_Speed)</p>	Turn off interlock.	<p>When the motor is required to move, the fault detects hazardous movement.</p> <p>The first danger is that if the throttle drops to zero or the direction switch is not in the driving direction, the motor will not be able to slow down.</p> <p>The second danger is that the motor accelerates in the wrong direction or too fast.</p> <p>Note: This fault only occurs when the control mode is selected in Speed_Mode, Speed_Mode_Express or Servo_Mode.</p> <p>Clear: Resets the controller.</p> <p>Set Discoverous_Direction_Response_Time=0 will disable these checks.</p>	Controller	
98	D-D	<p>IMU Failure.</p> <p>1=SPI communication failure;</p> <p>2=Curtis factory self inspection failure;</p> <p>3=runtime check fault, incorrect data received from IMU;</p> <p>4=The calibration test of the gyroscope is out of range, with a maximum calibration deviation exceeding.</p>	No action	<p>Check whether the configuration is correct or whether the vehicle is moving during calibration.</p> <p>Restart the key switch.</p>	Controller	

Steering controller fault code table

Serial number	Fault code	Fault Name	Possible causes	Solution	Steering measures	Travel measures
1	B	Hardware fault	Internal hardware failure	Restart key switch	Turn off	Stop
2	C	Controller overcurrent	Motor UVW short circuit	Restart key switch	Turn off	Stop
3	D	Current sensor fault	1. UVW leakage to vehicle body 2. Controller fault	Restart key switch	Turn off	Stop
4	E	Precharge failed	1. The external load prevents the capacitors from charging. 2. Controller fault	Restart key switch	Turn off	Stop
5	F	Controller severe undertemp	Controller operates in harsh environments	Keep sensor temperature above -35°C	Alarm	No response is required
6	10	Controller severe overtemp	1. The controller is not properly fixed. 2. The vehicle is extremely overloaded. 3. The controller operates in harsh environments	Restart key switch	Alarm and then turn off	Stop
7	11	Severe undervoltage	1. Battery malfunction or poor wiring 2. Other devices on the power supply circuit are pulling down the voltage. 3. The battery was disconnected during the operation. 4. B+fuse burned out or steering contactor not closed	Restart key switch	Turn off	Stop
8	12	Severe overvoltage	1. The internal resistance of the battery or battery cable is too large during regenerative braking. 2. The battery is not connected during regenerative braking	Restart key switch	Turn off	Stop
9	16	Controller overtemp	1. Improper controller fixation or inadequate cooling. 2. Excessive load on the vehicle. 3. The controller is operating in a harsh environment.	The temperature is less than 85 °C	Alarm only	Decelerated operation
10	19	5V supply failure	The external load impedance of 5V power supply is too small	Restart key switch	Hold, then turn off	Stop
11	1A	10V supply failure	External load impedance of 10V power supply is too small	Restart key switch	Alarm and then turn off	Stop
12	1B	Severe motor overtemperature	1. Motor is running in extreme environment 2. Motor temperature control parameters are wrongly set	Restart key switch	Alarm and then turn off	Stop
13	1C	Motor Temp Hot Cutback	1. Motor is running in extreme environment 2. Motor temperature control parameters are wrongly set	Sensor temperature drops to below fault value	Alarm only	Decelerated operation
14	1D	Motor Temp Sensor Fault	1. The sensor is not properly connected 2. If the motor temperature sensor is not used, the sensor enabling parameter should be disabled	Restore the temperature of the motor to its normal range.	Alarm only	Decelerated operation

15	1F	Contactor Open/Short	1. The connected load is open or short circuit 2. The connection pin is dirty 3. Wrong wiring	Restart key switch	Alarm and then turn off	Stop
16	23	Fault Output Open/Short	1. The external impedance of the fault output port is too low. 2. The controller is malfunctioning.	Restart key switch	Alarm and then turn off	Stop
17	24	Motor Stalled	1. The steering motor is stalled. 2. Encoder malfunction. 3. Cable curling or wiring error. 4. Encoder power supply malfunction	Restart key switch	Alarm and then turn off	Stop
18	25	Motor Open	1. Open circuit in a certain phase of the motor 2. Cable curling or wiring fault 3. Controller failure	Restart key switch	Alarm and then turn off	Stop
19	26	Contactor Welded	1. The steering contactor is welded. 2. There are other voltage sources (such as external pre-charging resistors) that are providing current to the forward capacitor	Restart key switch	Turn off	Stop
20	27	Contactor Opened	1. The steering contactor closed for a short time period but then opened again. 2. The steering contactor is oxidized. 3. The capacitor's charging process is impeded by an external load.	Restart key switch	Alarm and then turn off	Stop
21	27	Contactor Did Not Close	1. Contactor did not close 2. Steering contactor is oxidized 3. The capacitor's charging process is impeded by an external load.	Restart key switch	Turn off	Stop
22	29	Command Analog 1 Out of Range	Command device analog 1 input (Pin 8) out of range	Restart key switch	Hold, then turn off	Stop
23	2A	Command Analog 3 Out of Range	Command device analog 3 input (Pin 19) out of range	Restart key switch	Hold, then turn off	Stop
24	2B	Feedback Analog 5 Out of Range	Position feedback device analog 5 input (Pin 16) out of range	Restart key switch	Hold, then turn off	Stop
25	2C	Feedback Analog 6 Out of Range	Position feedback device analog 6 input (Pin 17) out of range	Restart key switch	Hold, then turn off	Stop
26	2D	CAN Not Operational	1222 CAN NMT status does not run within 80ms after enabling interlock	Restart key switch	Alarm and abandon	Stop
27	2E	EEPROM CRC Fault	1. New software has been written in. 2. Use "restore factory defaults" to clear the malfunction. 3. Controller malfunction.	Restart key switch	Turn off	Stop
28	2F	Sin/Cos Command Sensor	1. The Sin/Cos sensor is faulty. 2. The parameters of the Sin/Cos sensor are incorrectly set	Restart key switch	Hold, then turn off	Stop
29	2F	Sawtooth Command Sensor	1. The sawtooth sensor is faulty. 2. The parameters of the sawtooth sensor are incorrectly set	Restart key switch	Hold, then turn off	Stop
30	30	Sin/Cos Feedback Sensor	1. The Sin/Cos sensor is faulty. 2. The parameters of the Sin/Cos sensor are incorrectly set	Restart key switch	Hold, then turn off	Stop
31	30	Sawtooth Feedback Sensor		Restart key switch	Hold, then turn off	Stop
32	31	Parameter Change Fault	After changing parameters or software, it is necessary to perform a power-off restart. From a safety perspective, the fault automatically	Restart key switch	Turn off	Stop

			requires the vehicle to be shut off and restarted.			
33	33	Interlock Switch Supervision	1. The interlock switch is configured using a cross-wiring configuration (normally open and normally closed). Check both inputs, if switch 1 (Pin 9) = switch 3 (Pin 11), an error will be reported. 2. Interlock switch malfunction	Interlocking 1 is not equivalent to interlocking 3	Interlock disabled	Stop
34	34	Home Switch Supervision	1. The wheel position is not close to the home position, and redundant home switch inputs are detected. An error is reported if they are inconsistent. 2. There is a home switch malfunction. 3. If the picker performs a 360° steering, it means the "Homing Cam Angle(deg)" is set incorrectly.	Restart key switch	Alarm and then turn off	Stop
35	35	Home Position Not Found	The home switch is faulty	Restart key switch	Turn off	Stop
36	36	Home Reference Tolerance Fault	1. The home switch is faulty 2. If the picker performs a 360° steering, it means the "Homing Cam Angle(deg)" is set incorrectly.	Restart key switch	Alarm and then turn off	Stop
37	37	Steer Command Supervision	Command input device malfunction	Restart key switch	Hold, then turn off	Stop
38	38	Wheel Position Supervision	Position feedback device is faulty	Restart key switch	Hold, then turn off	Stop
39	45	5V Current Out of Range	5V external load current is too large or too small	Restart key switch	Hold, then turn off	Stop
40	47	Software Fault 1	Spare			
41	47	Software Fault 2	1. Software failure 2. Controller failure	Restart key switch	Turn off	Stop
42	47	Software Fault 3	Spare			
43	47	Software Fault 4	1. Software failure 2. Controller failure	Restart key switch	Turn off	Stop
44	47	Software Fault 5	1. Software failure 2. Controller failure	Restart key switch	Turn off	Stop
45	48	PDO1 Timeout	Communication between travel controller and 1222 is interrupted.	Restart key switch	Alarm and then turn off	Stop
46	48	PDO2 Timeout	When the CAN device is transmitting PDO2 information to 1222, an interruption is triggered.	Restart key switch	Alarm and then turn off	Stop
47	48	PDO3 Timeout	When the CAN device is transmitting PDO3 information to 1222, an interruption is triggered.	Restart key switch	Alarm and then turn off	Stop
48	48	PDO4 Timeout	When the CAN device is transmitting PDO4 information to 1222, an interruption is triggered.	Restart key switch	Alarm and then turn off	Stop
49	49	Following Error	1. The position feedback device is faulty. 2. The steering motor is stalled. 3. The steering motor encoder has failed.	Restart key switch	Alarm and then turn off	Stop
50	4A	Hardware Software Mismatch	1. The new software has been downloaded.	Restart key switch	Turn off	Stop

			2. The controller hardware does not support the new software.			
51	4B	Parameter Conflict	1. Parameter settings conflict with each other 2. Parameter settings exceed the range	Restart key switch	Turn off	Stop
Serial number	Fault code	Fault Name	Possible causes	Solution	Steering measures	Travel measures
1	B	Hardware fault	Internal hardware failure	Restart key switch	Turn off	Stop
2	C	Controller overcurrent	Motor UVW short circuit	Restart key switch	Turn off	Stop
3	D	Current sensor fault	1. UVW leakage to vehicle body 2. Controller fault	Restart key switch	Turn off	Stop
4	E	Precharge failed	1. The external load prevents the capacitors from charging. 2. Controller fault	Restart key switch	Turn off	Stop
5	F	Controller severe undertemp	Controller operates in harsh environments	Keep sensor temperature above -35°C	Alarm	No response is required
6	10	Controller severe overtemp	1. The controller is not properly fixed. 2. The vehicle is extremely overloaded. 3. The controller operates in harsh environments	Restart key switch	Alarm and then turn off	Stop
7	11	Severe undervoltage	1. Battery malfunction or poor wiring 2. Other devices on the power supply circuit are pulling down the voltage. 3. The battery was disconnected during the operation. 4. B+ fuse burned out or steering contactor not closed	Restart key switch	Turn off	Stop
8	12	Severe overvoltage	1. The internal resistance of the battery or battery cable is too large during regenerative braking. 2. The battery is not connected during regenerative braking	Restart key switch	Turn off	Stop
9	16	Controller overtemp	1. Improper controller fixation or inadequate cooling. 2. Excessive load on the vehicle. 3. The controller is operating in a harsh environment.	The temperature is less than 85 °C	Alarm only	Decelerated operation
10	19	5V supply failure	The external load impedance of 5V power supply is too small	Restart key switch	Hold, then turn off	Stop
11	1A	10V supply failure	External load impedance of 10V power supply is too small	Restart key switch	Alarm and then turn off	Stop
12	1B	Severe motor overtemperature	1. Motor is running in extreme environment 2. Motor temperature control parameters are wrongly set	Restart key switch	Alarm and then turn off	Stop
13	1C	Motor Temp Hot Cutback	1. Motor is running in extreme environment 2. Motor temperature control parameters are wrongly set	Sensor temperature drops to below fault value	Alarm only	Decelerated operation
14	1D	Motor Temp Sensor Fault	1. The sensor is not properly connected	Restore the temperature of	Alarm only	Decelerated operation

			2. If the motor temperature sensor is not used, the sensor enabling parameter should be disabled	the motor to its normal range.		
15	1F	Contactator Open/Short	1. The connected load is open or short circuit 2. The connection pin is dirty 3. Wrong wiring	Restart key switch	Alarm and then turn off	Stop
16	23	Fault Output Open/Short	1. The external impedance of the fault output port is too low. 2. The controller is malfunctioning.	Restart key switch	Alarm and then turn off	Stop
17	24	Motor Stalled	1. The steering motor is stalled. 2. Encoder malfunction. 3. Cable curling or wiring error. 4. Encoder power supply malfunction	Restart key switch	Alarm and then turn off	Stop
18	25	Motor Open	1. Open circuit in a certain phase of the motor 2. Cable curling or wiring fault 3. Controller failure	Restart key switch	Alarm and then turn off	Stop