EKKO®
MATERIAL HANDLING EQUIPMENT
MOVING AHEAD

EP20LI
Service Manual

Warning

You must read the operation instruction before using the manual:

- Please check the last page of this document and all the current product type identification on the nameplate.
- Keep it for future use.

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5. CURTIS 手持单元 14

1 Regular maintenance

Only qualified and trained personnel should perform maintenance work on this

vehicle.
Before maintenance, remove the cargo from the fork and lower the fork to the lowest position.
If you need to lift the vehicle, use the specified lashing or jacking equipment. Before operation, place safety devices (such as designated jacks, wedges or wood blocks) under the vehicle to prevent accidental drop, movement or sliding.
Use the original parts approved and released by your dealer.
Please consider that hydraulic fluid leakage may lead to machine failure and accidents.
Pressure valve adjustment is only allowed by trained service technician.
If you need to replace wheels, casters must be round and free of abnormal wear.
Check the items on the maintenance list。

1. Maintain List

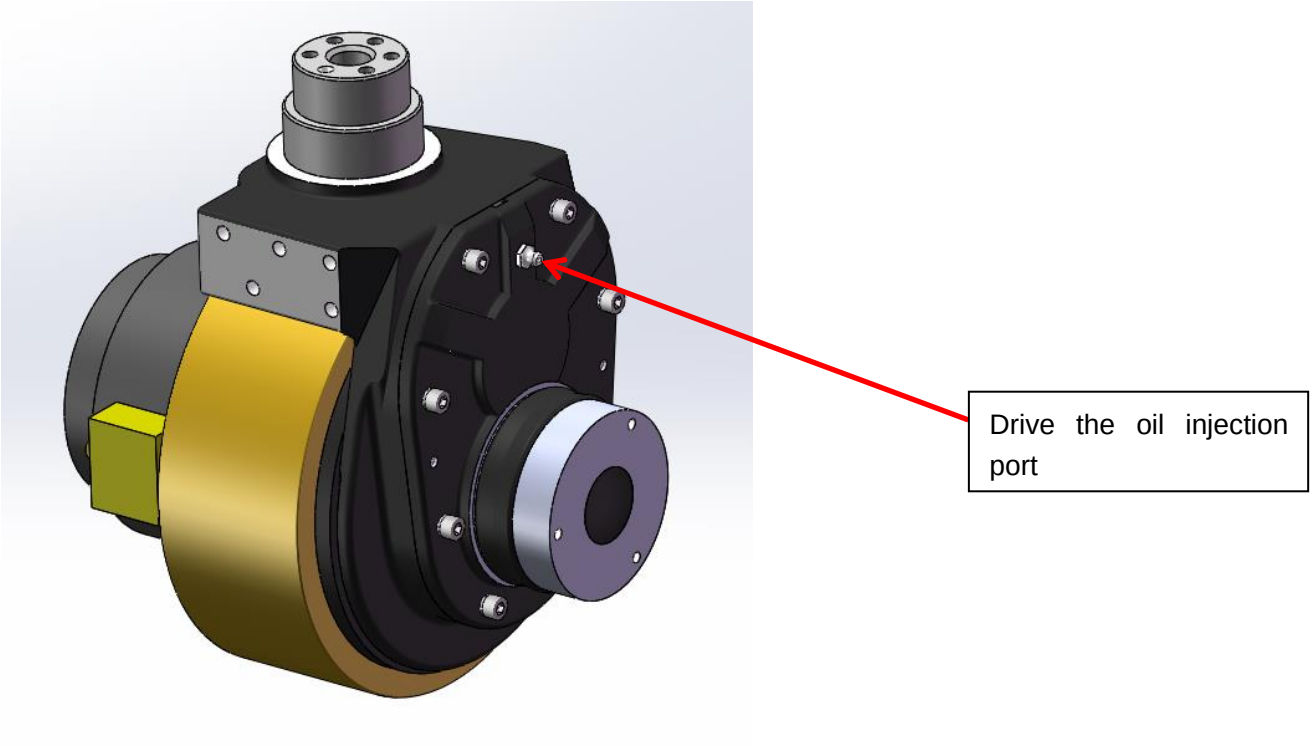
		Time Interval（Month)			
		1	3	6	12
hydraulic system					
1.1	Check the function of hydraulic system		●		
1.2	Check hoses, piping and joints for tightness, sealing and damage		●		
1.3	Inspect cylinder block and piston for damage, sealing and fixation			●	
1.4	Visually inspect the door stand roller and inspect the roller surface for wear			●	
1.5	Inspect forks and loading parts for wear and loss			●	
1.6	Check load chain Settings and re-tensioning if necessary			●	
1.7	Check oil level in fuel tank			●	
1.8	Replacement hydraulic fluid				●
mechanical system					
2.1	Check the fork for deformation and breakage		●		
2.2	Check chassis for deformation and cracking		●		
2.3	Check that all screws are in place		●		
2.4	Check gear box for noise and leakage		●		
2.5	Check wheel for deformation and damage		●		
2.6	Lubricated steering bearing				●
2.7	Check and lubricate the pivot points		●		
2.8	Lubricating grease nozzle	●			
Electric System					
3.1	Check whether electrical wiring is damaged		●		
3.2	Checking Electrical Connections		●		
3.3	Check emergency switch function		●		
3.4	Check electric drive system for noise and damage		●		

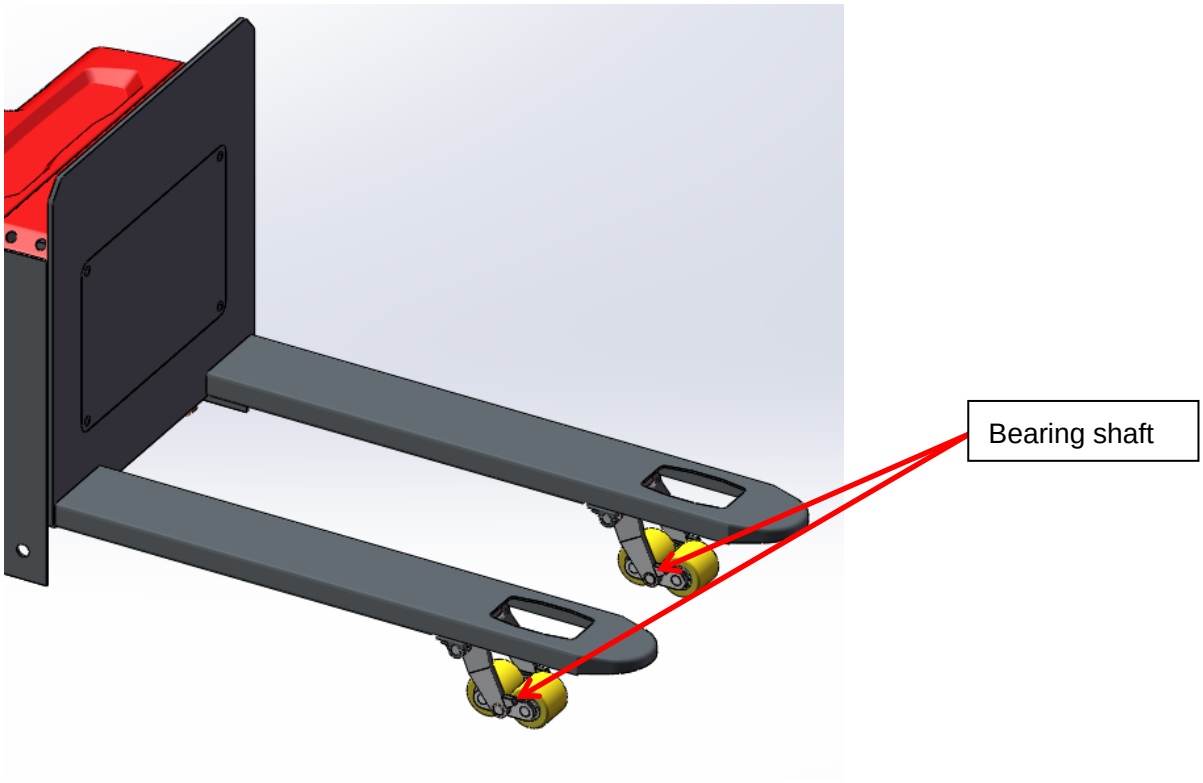
3.5	Detection meter		●		
3.6	Check that the correct fuse is used		●		
3.7	Check alarm system and safety devices		●		
3.8	Check the current contactor		●		
3.9	Check frame for leakage (insulation test)		●		
3.10	Check the function and wear of the drive controller		●		
3.11	Check the electrical system driving the motor		●		
traveling system					
4.1	Check the gearbox for abnormal sound			●	
4.2	Check the driving mechanism and grease it		●		
4.3	Inspect driving and steering wheels for wear and damage			●	
4.4	Check wheel bearing and fastening condition			●	
4.5	Check the air gap of the electromagnetic brake			●	
4.6	Check the lifting, forward and backward tilt and left and right movement of the door frame		●		
4.7	Check and adjust braking effect		●		
energy supply					
5.1	Check the voltage of the battery		●		
5.2	Check that battery cables are securely connected and grease the electrodes if necessary		●		
5.3	Check whether the battery cover is damaged		●		
5.4	Check the main cable for damage			●	
5.5	Check the startup protection program during charging			●	
monolithic component					
6.1	Check all labels for clarity and completeness	●			
6.2	Check the frame for damage		●		
6.3	Check the fixing condition of lifting door frame			●	
6.4	Run a test run	●			

1.2 Lubrication points

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

Figure 1: Steering drive gear





1. 3Check and refill hydraulic oil

Recommended hydraulic oil model according to temperature:

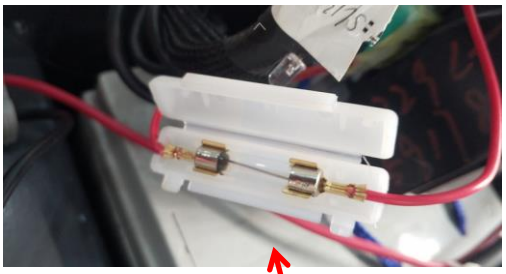
Temperature	-5℃~25℃	>25℃
Model	HVLP 32, DIN 51524	HLP 46, DIN 51524
Viscosity	28.8-35.2	41.4 - 47
Oil volume	2L-2.5L	

Waste materials such as waste oil, waste batteries or other materials must be treated and recycled in accordance with national regulations, and returned to the recycling company for recycling if necessary.

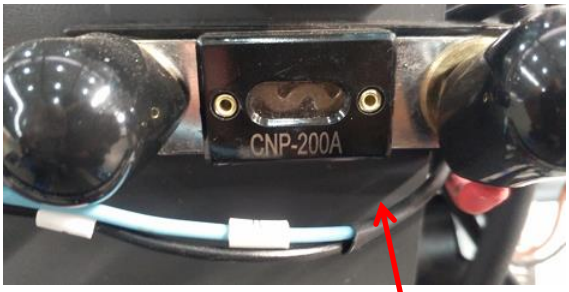
The oil level should not be lower than the minimum amount required to start the vehicle.

Fill up to refueling point if necessary.

1. 4Check the electrical fuse



10A fuse



200A fuse

fuse specification

	specification
Fuse 1	10A
Fuse 01	200A

2. Malfunction Analysis

If the vehicle continues to malfunction, follow the instructions in the manual.

2.1Common fault analysis

Fault	Cause	Processing method
Vehicles cannot move	The battery connector is not connected	Check the battery connector and connect it if necessary
	The electric lock switch is in "OFF" position	The electric lock switch is placed in the "0" position
	The emergency stop switch is not on	Turn on the emergency stop switch
	Battery running out	Check the charging status of the battery and recharge it if necessary
	The forklift is charging	Interrupt charging process
	Fuse damage	Check fuse
Cargo cannot be lifted	The vehicle is not running	Follow the procedure listed in the "Vehicle cannot Move" fault
	There's too little hydraulic fluid	Check hydraulic oil
	Fuse damage	Check fuse
	Load overweight	Note rated load
	The lift micro switch is in bad	Check fuse

	contact or damaged	
Goods cannot be lowered	Dirty oil clogs the control valve	Check the hydraulic oil and clean the control valve and replace the hydraulic oil if necessary
	The descent solenoid valve is not open or damaged	Check the drop solenoid or replace it
can't stop when go up	The lifting micro switch is damaged	Cut off the power supply and replace the lifting micro switch
Moving in one direction	Contact between micro switch and connecting cable is not good	Check the micro switch and connecting cable in the control handle
Traffic moves slowly	The battery power is low or the corresponding cable is in poor contact	Check the battery indicator and corresponding cables
The vehicle started suddenly	Controller damage	Replacing a Controller
	Control forward and backward handle is not reset	To restore or replace

2.2 Display of fault code

Table 4:1212P fault codes

Programmer display	code	The fault phenomenon	fault diagnosis
BATTERY DISCONNECT FAULT	4.5	Battery disconnection	1) Battery disconnection 2) Poor contact of battery end
BRAKE OFF FAULT	3.4	Brake closing fault	1)Electromagnetic brake coil short circuit

			2)Electromagnetic brake drive open circuit
BRAKE ON FAULT	3.2	Brake opening failure	1) Electromagnetic brake coil open 2)Electromagnetic brake drive short circuit
CURRENTSENSE FAULT	4.1	Current detection fault	1) Short circuit of motor or motor wiring 2)The controller is faulty
EEPROM CHECKSUM FAULT	4.3	EEPROM failure	1) EEPROM failure or invalid
HARDWARE FAILSAFE	4.2	Motor voltage is out of range	1) Motor voltage cannot match accelerator input 2) Short circuit of motor or motor matching ring 3) The controller is faulty
HPD FAULT	3.5	HPD fault	1) Accelerator, key switch, promotion or prohibition Input several actions out of order 2) Wrong adjustment of accelerator
MAIN FAULT	2.3	The main contactor is faulty	1) Main contactor adhesion or open 2) Main contactor coil drive error
MAIN OFF FAULT	2.1	Main contactor coil drive 'off' failure	1) Wrong opening of main contactor coil
MAIN ON FAULT	2.4	Main contactor coil drive 'on' failure	1) The main contactor coil is closed incorrectly
OVERVOLTAGE FAULT	1.5	Battery voltage is too high	1) Battery voltage >31V 2) The charger is still connected when the vehicle is running 3) Poor battery contact
PRECHARGE FAULT	3.3	Pre charge failure	1) The controller is faulty 2) Low battery voltage
SPEED POT FAULT	1.3	The speed limiting potentiometer is faulty	1) Open or short circuit connection of speed limiting potentiometer 2) Open speed limiting potentiometer
THERMAL FAULT	1.1	Over/under temperature cut-off	1) Temperature >80℃ or <-10℃ 2) Vehicle overload 3) Operate in extremely harsh environment

			4) The electromagnetic brake is not released normally
THROTTLE FAULT	1.2	Potentiometer slip end or low	1) Accelerator input is open or short 2) Accelerator potentiometer failure 3) Wrong selection of accelerator type
UNDERVOLTAGE FAULT	1.4	The terminal voltage is out of range	1) Battery voltage <17V 2) The battery or controller is not connected properly

Methods for troubleshooting common faults.

Code 4.5 The battery is not connected.

1. Check whether the fastening of cable terminals of the car body is loose, as shown below:

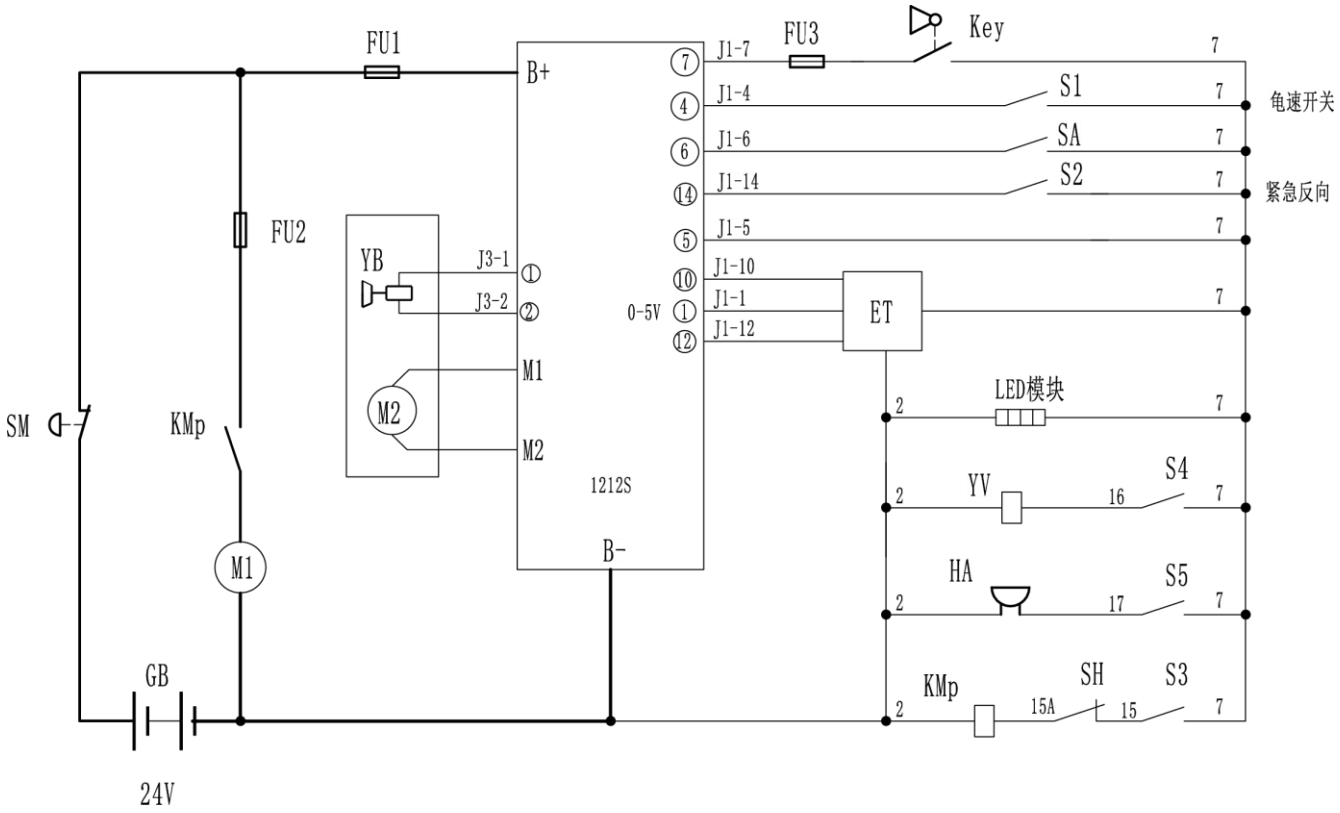
Check whether the cable connection (including other secured parts) is loose

1、Use a multimeter to measure the monomer voltage of the battery with load. The specific operation is shown as follows:

Cell with load measurement, cell voltage drop should be between 2 and 3V

3 Circuit/circuit diagram

3.1Electrical schematic diagram

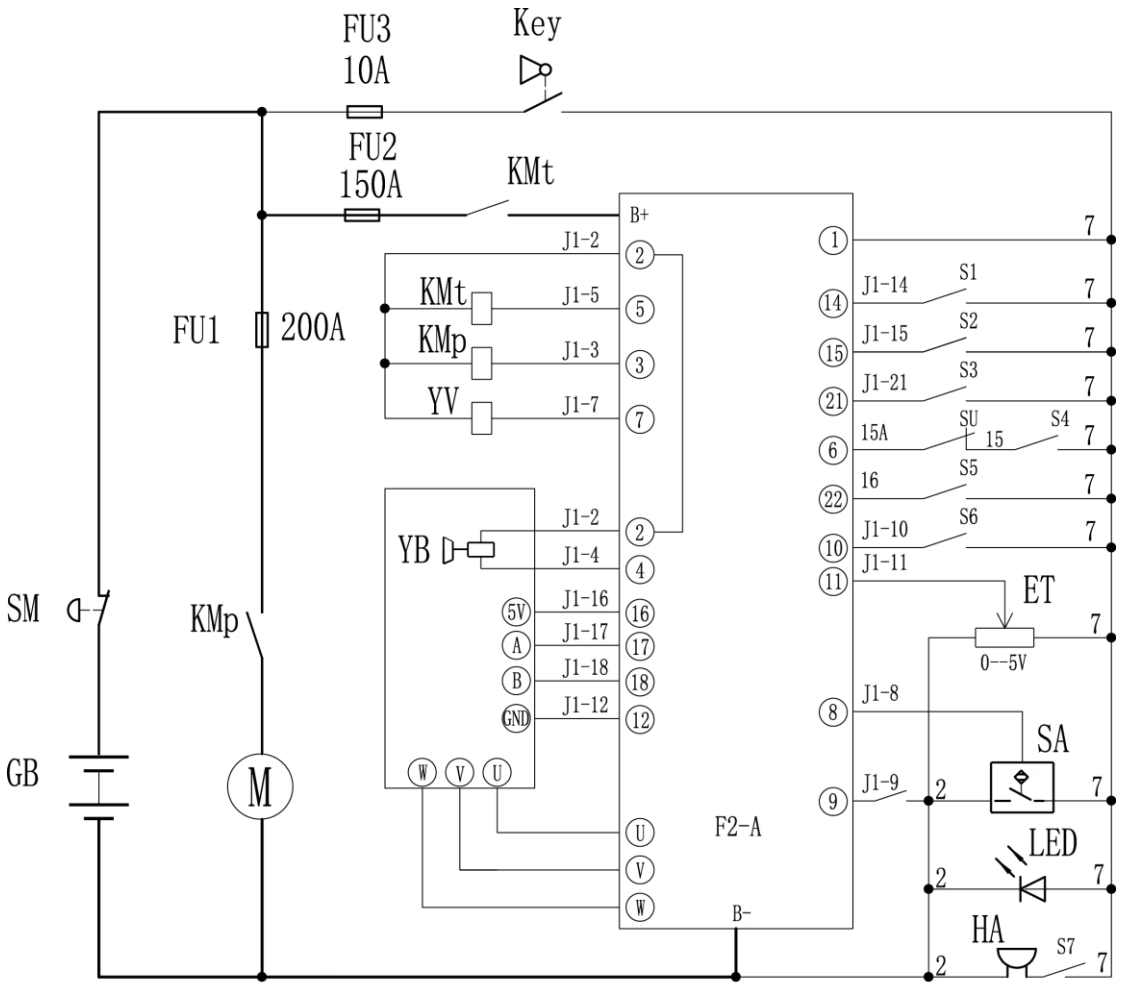


S1	龟速开关	S2	紧急反向
S3	起升开关	S4	下降开关
SH	限高开关	S5	喇叭开关
YV	下降电磁阀	KMp	泵接触器
LED	电源指示灯	HA	喇叭
ET	加速器	SA	互锁开关
YB	电磁刹车	Key	钥匙开关
GB	电池	M2	行走电机
SM	急停开关	SA	互锁开关
FU1 FU2 FU3	保险丝		

（Dc normal handle）

code	English name	中文名称
12	Controller Overcurrent	控制器过流
13	Current Sensor	电流传感器故障
14	Precharge Failed	预充失败
15	Controller Severe Undertemp	控制器温度过低
16	Controller Severe Overtemp	控制器过温
17	Severe B+ Undervoltage	B+欠压
17	Severe KSI Undervoltage	KSI 欠压
18	Severe B+ Overvoltage	过压
19	Speed Limit Supervision	最大速度受限
1A	Travel Control Supervision	行走控制监控异常
22	Controller Overtemp Cutback	控制器过温导致性能降低
23	Undervoltage Cutback	控制器欠压导致性能降低
24	Overvoltage Cutback	控制器过压导致性能降低
25	Ext 5V Supply Failure	5V电源故障
26	Ext 12V Supply Failure	12V电源故障
28	Motor Temp Hot Cutback	电机过热导致性能降低
29	Motor Temp Sensor	电机温度传感器故障
31	Main Driver	主接触器驱动异常
32	EM Brake Driver	电磁刹车驱动异常
35	Proportional Driver	比例阀驱动异常
36	Encoder Fault	电机编码器故障
37	Motor Open	电机开路
38	Main Contactor Welded	主接触器主触点粘连
39	Main Contactor Did Not Close	主接触器不吸合
42	Throttle Input	加速器输入异常
46	NV Memory Failure	控制器存储异常
47	HPD Sequencing	（上电）操作顺序故障
47	EMER Rev HPD	紧急反向操作顺序故障
49	Parameter Change	参数修改故障
4A	EMR Switch Redundancy	紧急反向开关冗余异常
51	User_1_Fault	（上电）紧急反向有效
52	User_2_Fault	（上电）互锁有限
53	User_3_Fault	BMS 报文超时
54	User_4_Fault	锂电故障
55	User_5_Fault	锂电过温告警
56	User_6_Fault	锂电过温故障
57	User_7_Fault	锂电漏液告警
58	User_8_Fault	锂电漏液故障
59	User_9_Fault	前拓CAN仪表通讯故障

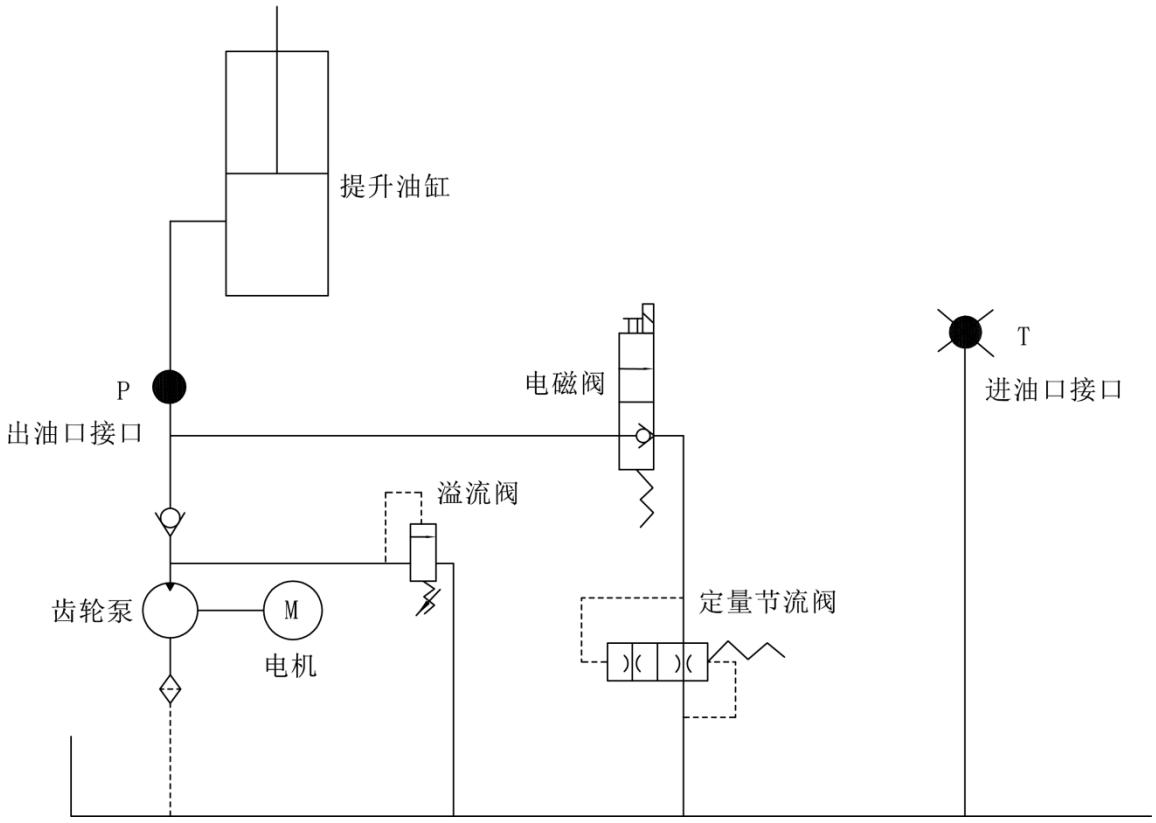
61	User_10_Fault	前拓CAN仪表低电量
62	User_11_Fault	前拓CAN仪表继电器开路
68	VCL Run Time Error	程序或参数设置异常
72	PDO Timeout	PDO超时
73	Stall Detected	电机堵转
77	Supervision	（外部）监控故障
87	Motor Characterization Error	电机匹配故障
88	Encoder Pulse Error	电机编码器脉冲异常
89	Parameter Out Of Range	参数超限
92	EM Brake Failed To Set	电磁刹车松闸失败
94	Emer Rev Timeout	紧急反向超时
99	Parameter Mismatch	参数不匹配
A1	Driver 1 Fault	驱动1故障（下降电磁阀）
A2	Driver 2 Fault	驱动 2 故障 （电磁刹车）
A3	Driver 3 Fault	驱动3故障（主接触器）
A4	Driver 4 Fault	驱动4故障
A5	Driver 5 Fault	驱动 5 故障（起升接触器）



S1	前进开关	S5	下降开关
S2	后退开关	S6	龟速开关
S3	紧急反向	S7	喇叭开关
S4	起升开关	GB	蓄电池
Key	钥匙开关	SM	急停开关
LED	电量指示灯	ET	加速器
YV	电磁阀	HA	喇叭
KMp	泵接触器	SA	互锁开关
Mp	泵电机	S5	龟速
Mt	牵引电机	S4	紧急反向
YB	电磁刹车	SU	起升限位
FU1、FU2、FU3	熔断器	KMp	泵接触器

（Ac normal handle）

3.2Hydraulic diagram



Hydraulic oil inspection

appearance	smell	situation	The results of
Clear and non-discoloration	good	good	You can use
Color transparent	good	Mix with other oils	Check viscosity, if qualified can continue to use
The color changes like milk	good	Mixed with air and water	Separate moisture or replace hydraulic oil
The color turns dark brown	bad	oxidation	Replacement of hydraulic fluid
The color is clear but there are small black spots	good	Mix it with other particles	Use after filtering

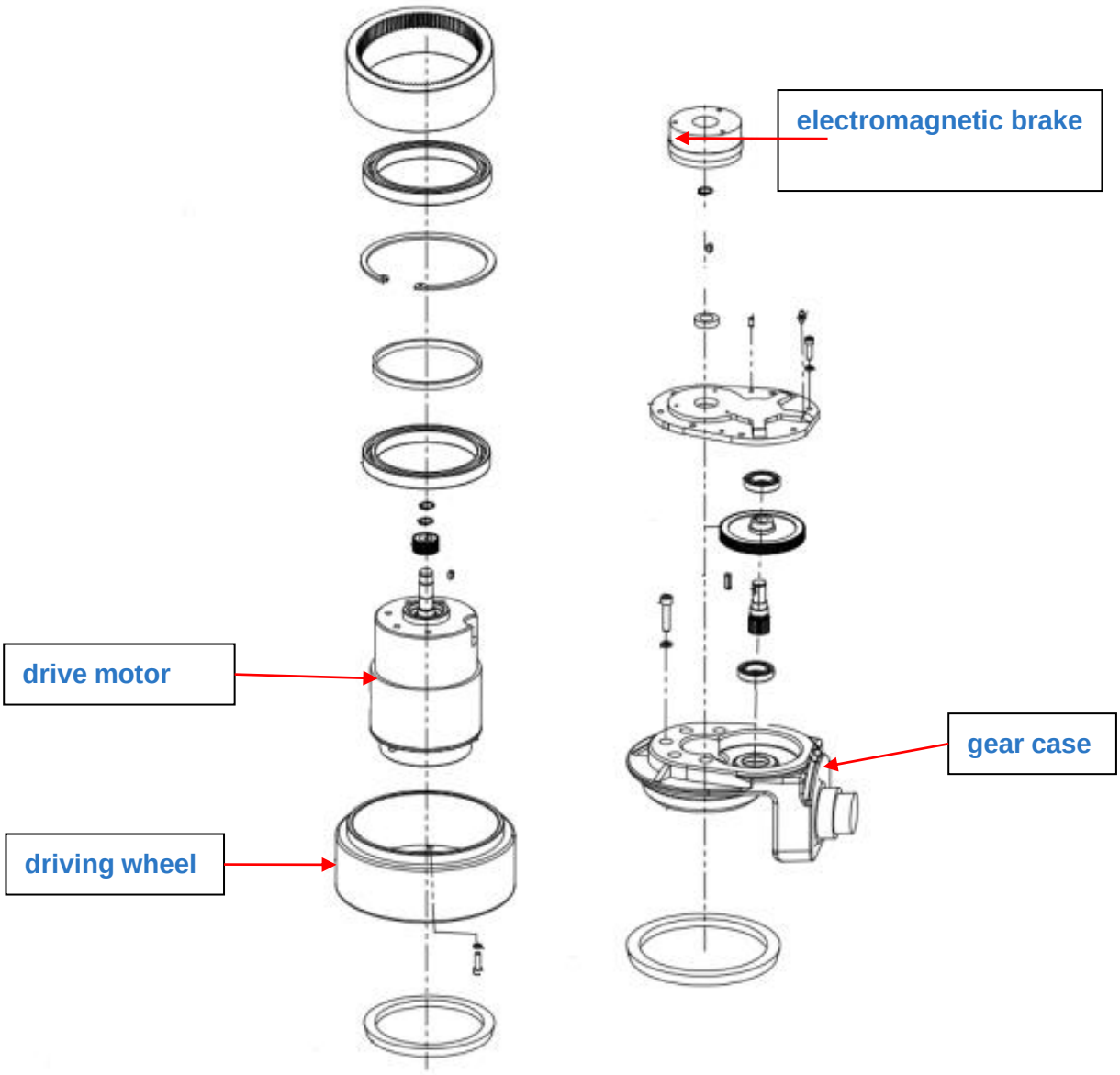
4、Disassembly of main parts

a、electromagnetic brake adjustment

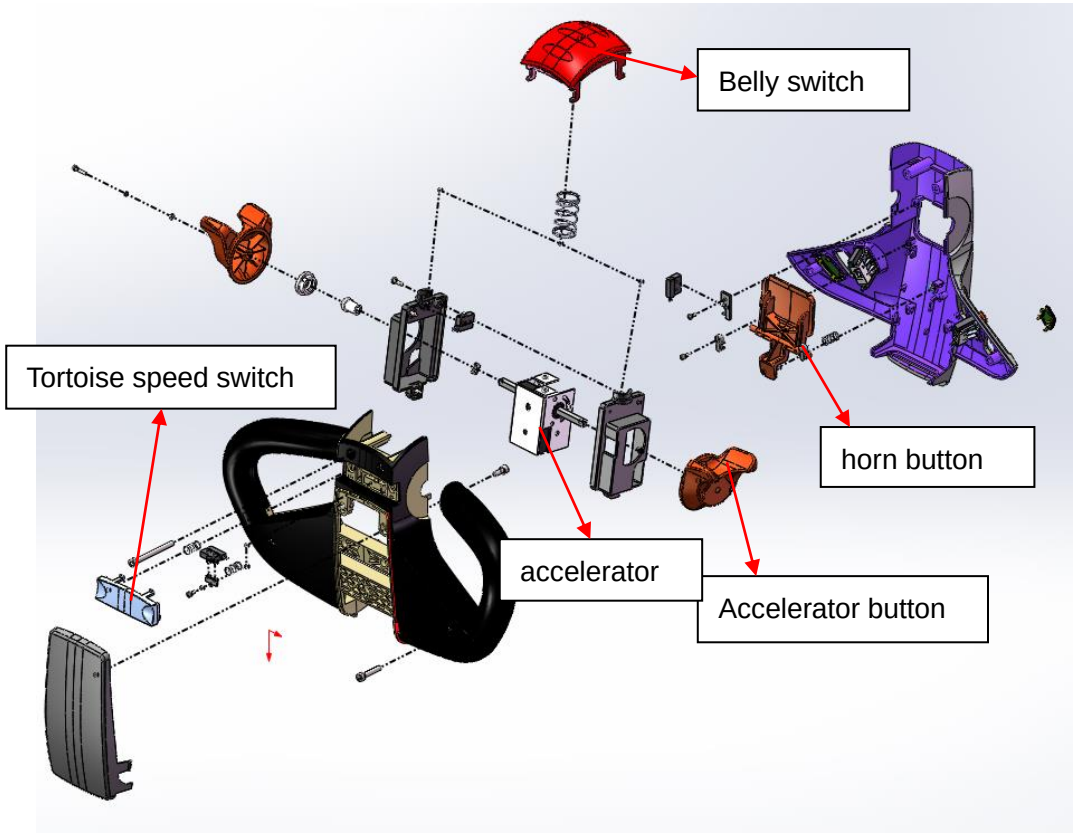
Note: electromagnetic brake can't pull properly when it is powered on in free state, it needs external force or installation to pull

Electromagnetic brake clearance is about 0.25-0.35mm, about the thickness of a piece of paper. Need to be adjusted carefully repeatedly, ensure that three adjustment surface clearance is consistent, electricity will give out a crisp sound.

b、Drive the disassembly diagram.



c、Handle assembly



5、CURTIS Handheld unit

Precautions for operation:

The attention function of the hand-held unit is to facilitate vehicle inspection and maintenance. It is not allowed to adjust the controller parameters without the approval of the vehicle manufacturer, to avoid vehicle and personal safety accidents.

The hand-held unit will automatically save the modification parameters, just need to close the key switch, restart.

The CURTIS handheld unit can be connected in the event of a controller power or power failure.

Vehicle fault reading process:

1. After connecting the handheld unit with the controller, open the key switch

2, From the menu list of CURTIS handheld units, find: Faults...

3. When the vehicle is running and the hand-held cursor flashes, there will be English fault content, which can be interpreted by referring to the fault code table

Vehicle signal detection:

1. After connecting the handheld unit with the controller, open the key switch

2, According to the menu list of CURTIS handheld unit, find: Monitor.....

3. According to requirements, open the corresponding sub-item of the detection menu, run the vehicle, and

observe the change of the hand-held value.

。

CURTIS Contents of handheld unit menu:

The Curtis 1313 handheld programmer is used to configure the Curtis electric control system. Through this programmer, you can adjust and save the set parameters, real-time monitoring of controller data and fault diagnosis.

Warning: The control system can affect the vehicle's acceleration rate, deceleration rate, hydraulic system, and braking. A dangerous situation can occur if the vehicle control system is not programmed correctly or exceeds safety. Only the vehicle manufacturer or an authorized service agent can program the control system.

The programmer has two interfaces, one is used to communicate with the electric control, the other is used to communicate with the PC, the programmer has a battery box and a memory card slot

当编程器加载完控制器的信息后，编程器上会显示主菜单。

The programmer is powered on.

The connection line of the handheld programmer can be connected to the controller by inserting the programming port of the controller. After connecting the controller, the handheld programmer will be powered on automatically and the control information will be displayed on the programmer.

The function keys

Since the function of the three keys is determined by the specified content, the three keys are blank. At any given time, the function of the button is displayed on the LCD screen above.

Direction arrow key

The displayed information can be selected up, down, or left by four directional buttons.

+ / - buttons

You can add and subtract parameters by using these two keys. In addition, "+" can mean "Yes" and "-" can mean "No". In some cases, it can also be used as a scrolling option.

Power key

When the programmer inserts a controller that has been powered on, the programmer does not have to press the power button to use it. The programmer will start up automatically. When you hold it down for a few seconds, the programmer will prompt you whether to turn it off. You can decide whether to turn it off by selecting the "Yes" and "No" represented by the function key. After closing the programmer, press for a few seconds and the programmer will restart.

Collect keys

There are two ways to enter the Favorites menu. You can enter Favorites from the main menu or press this key

Menu structure

The main menu consists of nine sub-menus, and each sub-menu is displayed with a specific icon. Each item in the

sub-menu is arranged by hierarchy.

Some menus contain only one item of information, but most menus contain more than one item of information, and open each item folder to access the next level of sub menus. Expand the table through the grid option, enter a group of execution commands through the dialog box option, and return to the upper menu regardless of the interface by pressing the left direction button.

The names of all nine sub menus are shown in bold on the main menu and below the icon. When entering the stepped menu, the name of the sub menu or the path you are in is displayed at the top of the screen.

Nine menu

Fault Diagnosis menu

On the main menu, Select Diagnostics and press Select to access the Fault diagnosis menu. The Fault diagnosis menu contains Present Errors current faults and Fault History historical faults.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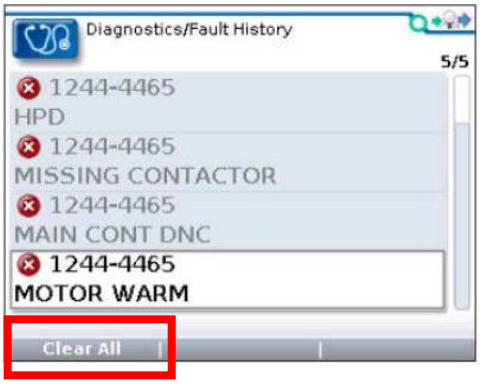
Note: Sometimes a fault caused by a temporary event captured in the circuit is not a system fault. You can determine whether the fault exists by restarting the system and observing whether the fault disappears automatically.

The historical faults folder lists all faults encountered after the last historical fault is cleared. By clearing the fault content in the entire folder, you can record the historical faults again.



Clear All is used to Clear historical fault folders. A function key is highlighted only when there are historical failures in the historical failures folder and grayed out when there are no historical failures.

Programming menu

On the main menu, Select The Programming icon and press Select to access the menu.Save and restore parameter

Save.cpf File (Save.cpf File)

Use the save. CPF file function in the programming menu to back up the currently set parameters.You can save as many.cpf files as you want, and you need to

Settings files (.cpf files) through programming menus