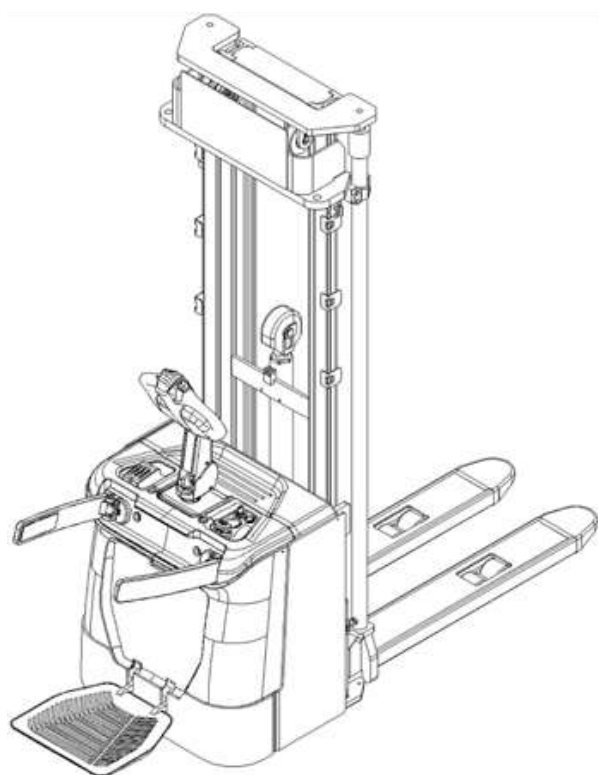


Service Manual

Electric Stacker


PS 12N, PS 16N, PS 20N, PSB 12N, PSB 16N, PSB 20N




Foreword

This specification briefly introduces the technical parameters of our pallet, the structure of the main components, working principle and operation, maintenance, maintenance and other requirements and contents. Please read this manual carefully before operation in order to ensure safe and effective material handling through proper driving and maintenance. At the same time, it can help operators to use battery vehicles reasonably, so that pallet play the maximum efficiency! It is hoped that operators and equipment managers will read carefully before operating battery vehicles! Please strictly abide by the regulations and matters needing attention in this specification, drive carefully, operate carefully and use carefully, so that your pallet can be in the best working condition for a long time and play its best role. When you rent or transfer a vehicle, please rent or transfer this manual with the car.

To highlight, the following icons are used in this manual:

1. ---- Indicates a potentially dangerous state, if not avoided, may cause serious personal injury, serious damage to the pallet or fire, etc.
2. ---- Indicates a potentially dangerous state, if not avoided, that may cause minor injury to the person,  or local damage to the pallet, etc.
3. ---- General considerations and instructions when using

 Most of this product is made of recyclable steel, and the waste produced in the process of use, maintenance, cleaning and disassembly must be recovered and disposed of without pollution according to local regulations. The recycling of such waste must be done by professionals in designated areas, such as hydraulic fluids, batteries and electronic equipment, which, if not handled properly, may be hazardous to the environment and human health.

Special statement:

- 1) this product is strictly prohibited from being used in potentially explosive dangerous environments.
- 2) the noise level of the normal use of this product is in accordance with the international standard EN 12053.
- 3) the normal vibration level of this product conforms to the international standard EN13059.
- 4) the environmental requirements for the normal use of this product are as follows: altitude is not more than 2000 meters, temperature range is -5 °C-40 °C, humidity is not more than 90%, wind speed is not more than 5 m / s.
If you need to use it in cold storage or special environment for a long time, please contact our technical staff if you need to install special accessories.
- 5) implement product recall service in the event of batch problem

Due to the requirement of continuous product improvement, manufacturers reserve the right to change their product design and specifications without prior notice. If you want to know the latest product parameters, please contact us. All parameters of this manual shall be subject to the date of publication of the specification.

1. GENERAL

1.1 INTRODUCTION – MAINTENANCE SAFETY PRECAUTIONS

Maintenance work may cause injuries. Always take care to perform work safe, at least observing the following. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves, others or damage to the equipment. A maintenance program must be followed to ensure that the machine is safe to operate.

The specific precautions to be observed during maintenance are inserted at the appropriate point in the manual. These precautions are, for the most parts, those that apply when servicing hydraulic and larger truck component parts.



MODIFICATION OF THE TRUCK WITHOUT CERTIFICATION BY A RESPONSIBLE AUTHORITY THAT THE TRUCK IS AT LEAST AS SAFE AS ORIGINALLY MANUFACTURED, IS A SAFETY VIOLATION.



SINCE THE TRUCK MANUFACTURER HAS NO DIRECT CONTROL OVER THE FIELD INSPECTION AND MAINTENANCE, SAFETY IN THIS AREA RESPONSIBIUTY OF THE OWNER OR OPERATOR.



FAILURE TO COMPLY WITH SAFETY PRECAUTIONS, LISTED IN THIS SECTION MAY RESULT

- When carrying out any operation or maintenance, have trained and experienced personnel to carry out the work.
- When carrying out any operation or maintenance, carefully read operation and maintenance handbook.
- Read all the precautions given on the decals which are fixed to the truck.
- Be sure you fully understand the content of the operation. It is important to prepare necessary tools and parts for maintain the truck.
- Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.
- It should be noted that the machines hydraulic systems operate at extremely high potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system. Relieve system pressure by cycling the applicable control several times with the engine(motor) stopped and ignition on, to direct any line pressure back into the reservoir. Pressure feed lines to system components can then be disconnected

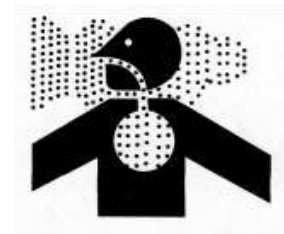
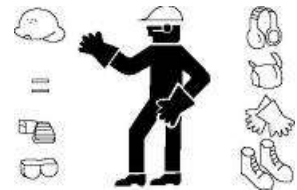


CAUTION HEAVY

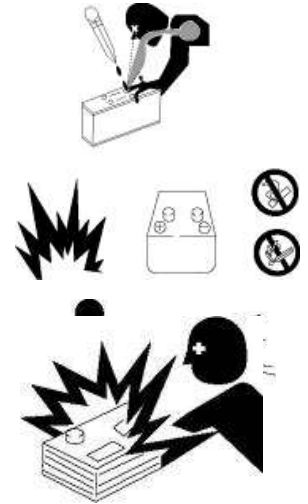


with minimal fluid loss.

- Remove all rings, watches and jewelry when performing any maintenance.
- Wear well-fitting helmet, safety shoes and working Clothes When drilling grinding or hammering always. Wear protective goggles. Always do up safety clothes properly so that they do. Not catch on protruding parts of machines. Do not wear oily clothes. When checking, always release battery plug. **DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE-FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.**
- During maintenance do not allow any unauthorized person, to stand near the machine.
- Flames should never be used instead of lamps. Never use a naked flame to check leaks or the level of oil or electrolyte.
- Immediately remove any oil or grease on the floor of the operator's compartment or on the handrail. It is very dangerous if someone slips while on the machine.
- Always use pure oil or grease, and be sure to use clean containers.
- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire or flame. As preparation for use of fire extinguishers and other fire- fighting equipment.
- Keep the battery away from fire hazards. The generated gases are explosive.
- Store all the oils in a specified place.
- Keep the flammable things away from the machine. Do not smoke at the working place.
- Battery should always be disconnected during replacement of electrical components.
- Always use the grades of grease and oil recommended by NOBLELIFT choose the viscosity specified for the ambient temperature.
- Exhaust gas is dangerous provide ventilation when working in a closed space.
- Avoid breathing dust that may be generated when handling components containing asbestos fibers. Wear a gas mask if necessary.
- When working on top of the machine, be careful not to lose your balance and fall.
- Hand a caution sign in the operator's compartment (for example "Do not start" or "Maintenance in progress"). This will prevent anyone from starting or moving the machine by mistake.
- When welding on the machine or working on the electrical system, **ALWAYS** turn the key switch OFF and remove the battery plug from the battery. Park the machine on firm, flat ground. Lower the fork to the min. height and stop the motor.
- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin and eat holes in clothing. If you spill acid on your clothes or skin, immediately flush with large quantities or water.



- When working on the battery, wear goggles or safety glasses. If splashed into the eyes, flush with water and get medical attention immediately.
- Battery terminals touched by metal objects can cause short circuit and burn you. Keep tools away from the terminals.
- Keep sparks, lighted matches, and open flame away from the top of battery. Battery (hydrogen) gas can explode.
- When disassembling and assembling the battery, make sure that the battery terminals (+, -) are correctly connected.
- If water gets into the electrical system, abnormal operation or failure can result. Do not use water or steam on sensors, connectors and instruments in the cab.
- Do not handle electrical equipment while wearing wet gloves, or in wet places, as this can cause electric shock.
- When working with other, choose a group leader and work according to his instructions. Do not perform any maintenance beyond the agreed work.
- Unless you have special instructions to the contrary, maintenance should always be carried out with the motor stopped. If maintenance is carried out with the motor running, there must be two technicians present: One operating the stacker and the other one performing the maintenance. In such a case, never touch any moving part.
- Before making adjustment, lubricating or performing any other maintenance, shut off all power controls.
- When removing parts containing O-ring Gaskets or seal clean the mounting surface and replace with new sealing parts.
- Thoroughly clean the machine. In particular, be careful to clean the grease fittings and the area around the dipsticks. Be careful not to let any dirt or dust into the system.
- Use only approved nonflammable cleaning solvents.
- When changing the oil or filter, check the drained oil and filter for any signs of excessive metal particles or other foreign materials.
- Always use NOBLELIFT genuine parts for replacement. ENSURE REPLACEMENT PARTS OR COMPONENTS ARE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.
- When checking an open gear case, there is a risk of dripping things in. Before removing the covers to inspect such cases, empty everything from your pockets. Be particularly careful to remove wrenches and nuts.



1.2 MEASUREMENT CONVERSIONS

Length

Unit	cm	m	km	in	ft	yd	mile
cm	1	0.01	0.00001	0.3937	0.03281	0.01094	0.000006
m	100	1	0.001	39.37	3.2808	1.0936	0.00062
km	100000	1000	1	39370.7	3280.8	1093.6	0.62137
in	2.54	0.0254	0.000025	1	0.08333	0.02777	0.000015
ft	30.48	0.3048	0.000304	12	1	0.3333	0.000189
yd	91.44	0.9144	0.000914	36	3	1	0.000568
mile	160930	1609.3	1.6093	63360	5280	1760	1

1mm=0.1cm, 1 m=0.001mm

Area

Unit	cm ²	m ²	km ²	a	ft ²	yd ²	in ²
cm ²	1	0.0001	–	0.000001	0.001076	0.000012	0.155000
m ²	10000	1	0.000001	0.01	10.764	1.1958	1550.000
km ²	–	1000000	1	10000	1076400	1195800	–
a	0.01	100	0.0001	1	1076.4	119.58	–
ft ²	–	0.092903	–	0.000929	1	0.1111	144.000
yd ²	–	0.83613	–	0.008361	9	1	1296.00
in ²	6.4516	0.000645	–	–	0.006943	0.000771	1

1ha=100a, 1mile²=259ha=2.59km²

Volume

Unit	cm ³ = cc	m ³	l	in ³	ft ³	yd ³
cm ³ = m l	1	0.000001	0.001	0.061024	0.000035	0.000001
m ³	1000000	1	1000	61024	35.315	1.30796
l	1000	0.001	1	61.024	0.035315	0.001308
in ³	16.387	0.000016	0.01638	1	0.000578	0.000021
ft ³	28316.8	0.028317	28.317	1728	1	0.03704
yd ³	764529.8	0.76453	764.53	46656	27	1

1gal(US)=3785.41 cm³=231 in³=0.83267gal(US)

Weight

Unit	g	kg	t	oz	lb
g	1	0.001	0.000001	0.03527	0.0022
kg	1000	10	0.001	35.273	2.20459
t	1000000	1000	1	35273	2204.59
oz	28.3495	0.02835	0.000028	1	0.0625

lb	453.592	0.45359	0.000454	16	1
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1 tone (metric)= 1.1023 ton(US)=0.9842 ton(UK)

Pressure

Unit	kgf/cm2	bar	Pa=N/m2	kPa	lbf/in2	lbf/ft2
kgf/cm2	1	0.98067	98066.5	98.0665	14.2233	2048.16
bar	1.01972	1	100000	100	14.5037	2088.6
Pa=N/m2	0.00001	0.001	1	0.001	0.00015	0.02086
kPa	0.01020	0.01	1000	1	0.14504	20.886
lbf/in2	0.07032	0.0689	6894.76	6.89476	1	144
lbf/ft2	0.00047	0.00047	47.88028	0.04788	0.00694	1

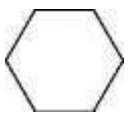
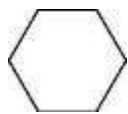
kgf/cm2=735.56 Torr(mmHg)=0.96784atm

Standard tightening torque

The following charts give the standard tightening torques of bolts and nuts.

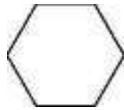
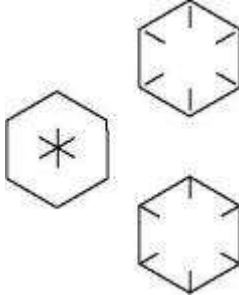
Exceptions are given in sections of “Disassembly and Assembly”

METER TABLE

Classification	4T, 5T	10T
Bolt type		 10.9
Bolt size	Torque kgf · m (lbf · ft)	Torque kgf · m (lbf · ft)
M4	0.2 ± 0.02	0.4 ± 0.04
M5	0.3 ± 0.03	0.8 ± 0.08
M6	0.5 ± 0.05	1.4 ± 0.14
M8	1.2 ± 0.12	3.3 ± 0.3
M10	2.3 ± 0.23	6.5 ± 0.7
M12	4.0 ± 0.4	11.3 ± 1.1
M14	6.4 ± 0.6	17.9 ± 1.8
M16	9.5 ± 0.9	26.7 ± 2.7
M18	13.5 ± 1.4	38.0 ± 3.8
M20	18.6 ± 1.9	52.2 ± 5.2
M22	24.7 ± 2.5	69.4 ± 6.9
M24	32.1 ± 3.2	90.2 ± 9.0
M30	62.6 ± 6.3	176.1 ± 17.6

M36	108.2 ± 10.8	304.3 ± 30.4
M42	171.8 ± 17.2	483.2 ± 48.3
M45	211.3 ± 21.1	594.3 ± 50.4

INCH TABLE

	4T, 5T	10T
Classification Bolt type		
Bolt size	Torque kgf · m (lbf · ft)	Torque kgf · m (lbf · ft)
1/4	0.6 ± 0.06	1.7 ± 0.2
5/16	1.2 ± 0.12	3.0 ± 0.3
3/8	2.0 ± 0.20	5.6 ± 0.5
7/16	3.2 ± 0.32	8.9 ± 0.9
1/2	4.7 ± 0.47	13.4 ± 1.3
9/16	6.8 ± 0.68	19.0 ± 1.9
5/8	9.3 ± 0.93	26.1 ± 2.6
3/4	16.0 ± 1.60	45.1 ± 4.5
7/8	25.5 ± 2.55	71.6 ± 7.2
1	38.0 ± 3.80	106.9 ± 10.7
1-1/8	54.1 ± 5.41	152.2 ± 15.2
1-1/4	74.2 ± 7.42	208.9 ± 20.9
1-3/4	98.8 ± 9.88	277.8 ± 27.8
1-1/2	128.2 ± 12.82	360.7 ± 36.1

The torque in above table shall not be applied to nylon or nonferrous bolts or washer. The same is valid for not standardized ones.

H Newton meter : 1 Nm = 0.1kgfm

TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

The following torque shall be applied to the split flange bolts.

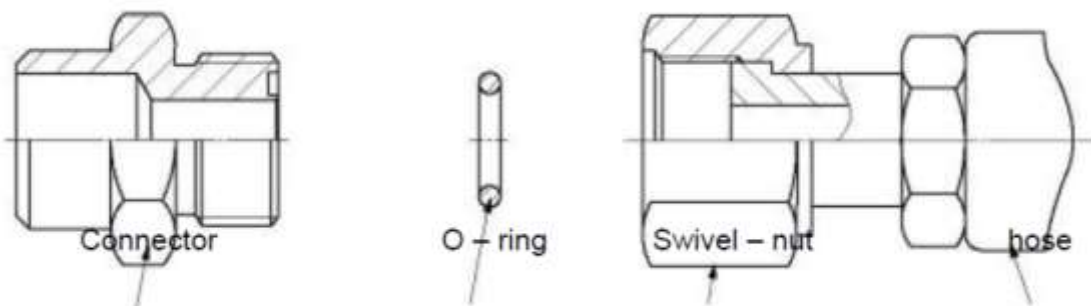
Diameter (mm)	Flat width (mm)	Torque	
		kgf·m	N·m
10	14	6.7 ± 0.7	66.7 ± 6.8
12	17	11.5 ± 1	112 ± 9.8
16	22	28.5 ± 3	279 ± 29



PF THREAD

Thread	Torque (kgf·m)
1/8	1.1 ± 0.1
1/4	2.6 ± 0.2
3/8	4.6 ± 0.3
1/2	8.5 ± 0.4
3/4	19 ± 1.0
1	33 ± 2.0

TORQUE FOR SWIVEL NUT WITH O-RING

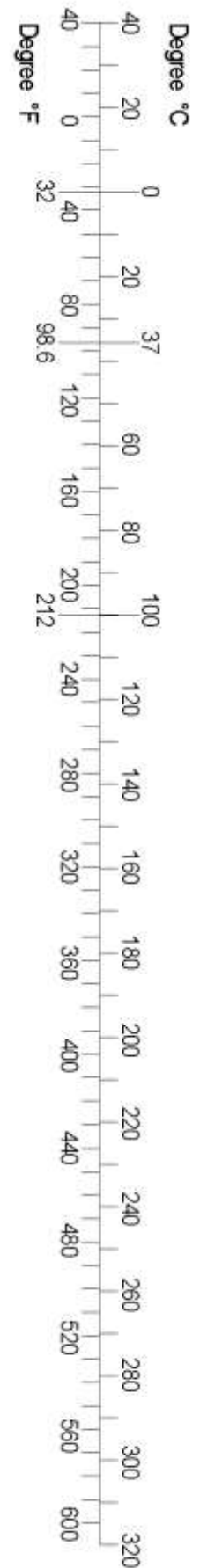


Tube O.D (inch)	Thread (in)	Torque (kgf·m)
1/2	UN 13/16 - 16	9.5 ± 0.95
3/4	UN 1 3/16 - 12	18 ± 1.8
1	UN 1 7/16 - 12	21 ± 2.1

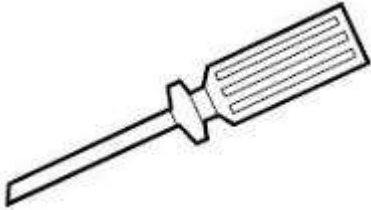
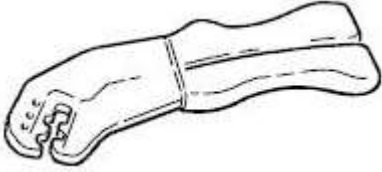
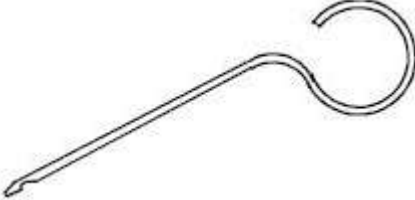
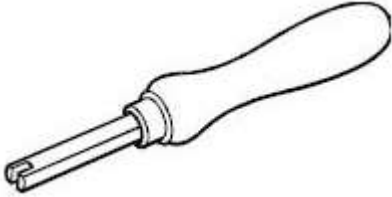
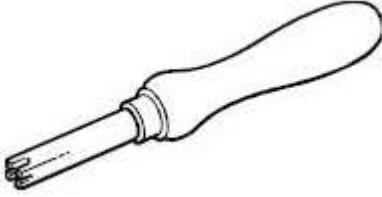
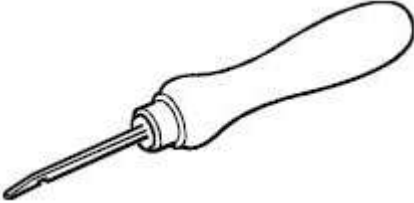
APPROXIMATE CONVERSIONS

SI Unit	Conv Factor	Non-SI Unit	Conv Factor	SI Unit
Torque				
Newton meter (N·m)	× 8.9	= In·in	× 0.113	= N·m
Newton meter (N·m)	× 0.74	= lb·ft.	× 1.36	= N·m
Newton meter (N·m)	× 0.102	= kg·m	× 7.22	= lb·ft.*
Pressure (Pa = N/m ²)				
kiloPascal (kPa)	× 4.0	= in. H ₂ O	× 0.249	= kPa
kiloPascal (kPa)	× 0.30	= in. Hg	× 3.38	= kPa
kiloPascal (kPa)	× 0.145	= psi	× 6.89	= kPa
(bar)	× 14.5	= psi	× 0.069	= bar*
(kg/cm ²)	× 14.22	= psi	× 0.070	= kgf/cm ² *
Newton/mm ²	× 145.04	= psi	× 0.069	= bar*
MegaPascal (MPa) (Pa=N·m ²)	× 145	= psi	× 0.00689	= MPa
Power r (W = J/s)				
kiloWatt (kW)	× 1.36	= PS (cv)	× 0.736	= kW
kiloWatt (kW)	× 1.34	= HP	× 0.746	= kW
kiloWatt (kW)	× 0.948	= Btu/s	× 1.055	= kW
Watt (W) (W=J/s)	× 0.74	= ft·lb/s	× 1.36	= W
Energy (J = N·m)				
kiloJoule (kJ)	× 0.948	= Btu	× 1.055	= kJ
Joule (J) (J=N·m)	× 0.239	= calorie	× 4.19	= J
Velocity and acceleration				
meter per sec ² (m/s ²)	×3.28	= ft/s ²	× 0.305	= m/s ²
meter per sec (m/s)	× 3.28	= ft/s	× 0.305	= m/s
kilometer per hour (km/h)	× 0.62	= mph	× 1.61	= km/h
Horse Power/Torque				
BHP × 5252 R.P.M. = TQ (lb·ft)		TQ Z R.P.M. 5252 = B.H.P.		
Temperature				
°C = (°F-32) ÷ 1.8		°F= (°C Z 1.8) + 32		
Flow Rate				
liter/min (dm ³ /min)	× 0.264	= US gal/min	× 3.785	= l/min

Note : () Non-SI Unit

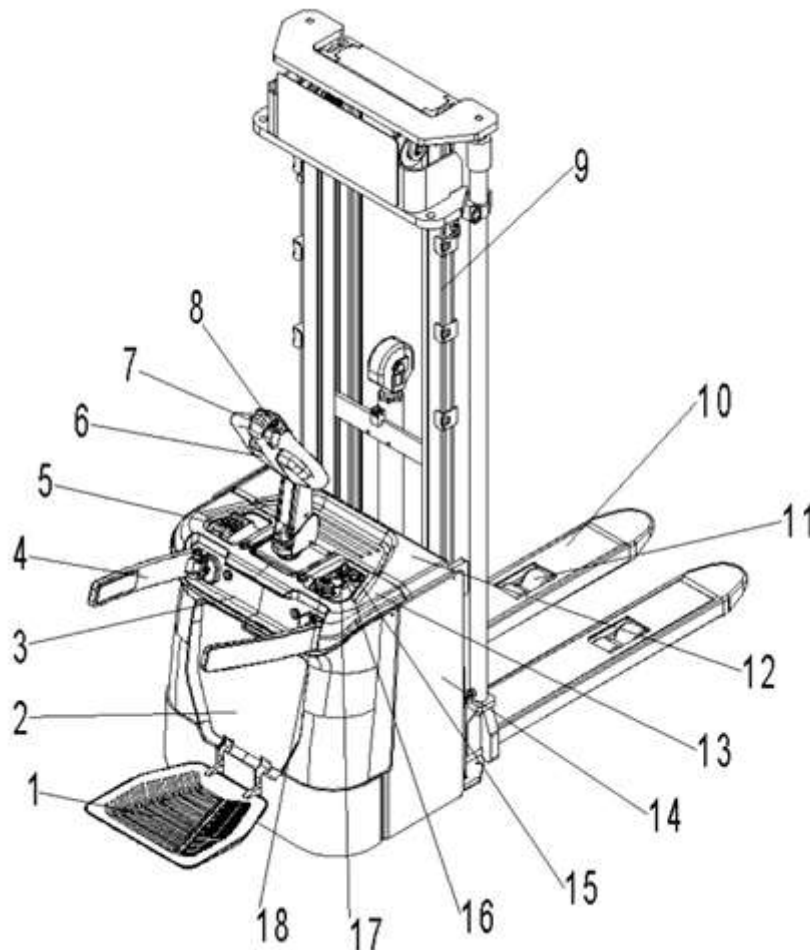


Replacement tool for electrical plug-in connection

No.	Pic	Application
1		Remove pin
2		Install pin
3		Loose lock
4		Two-hole lock
5		Four-hole lock
6		Remove pin

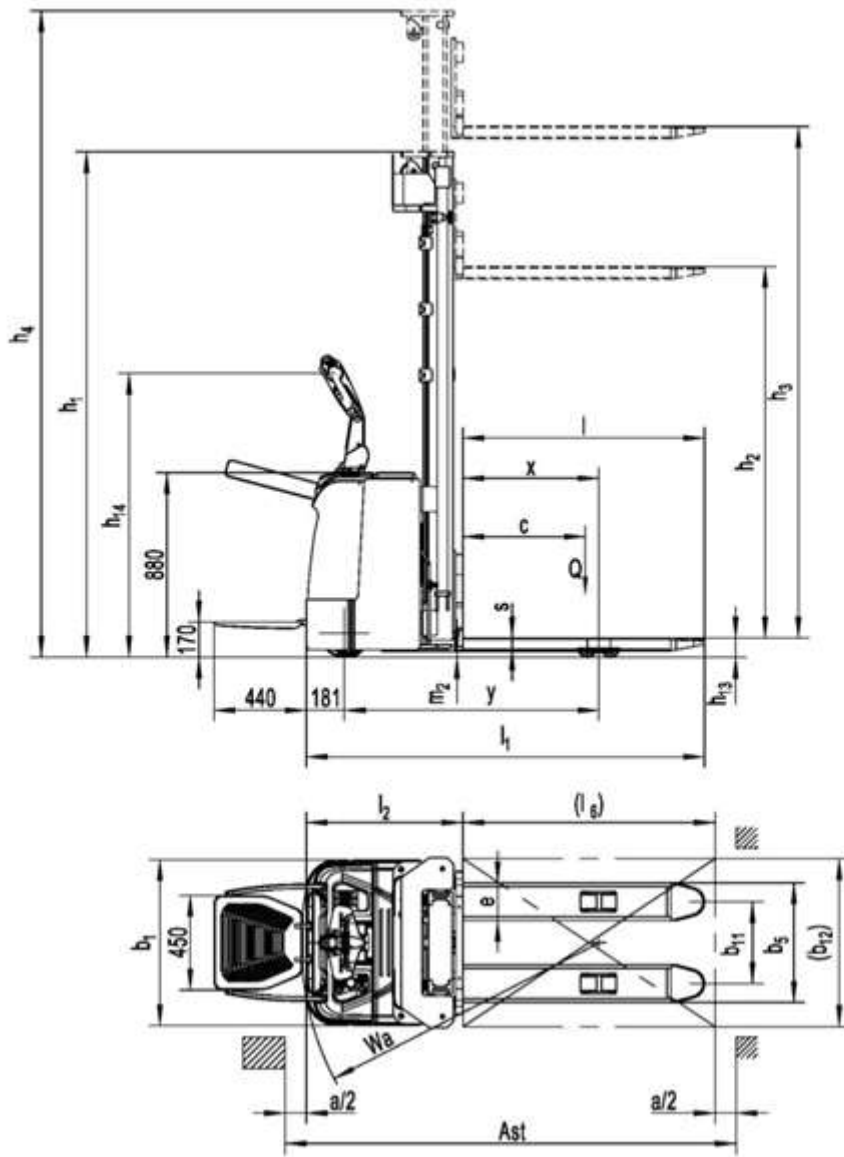
2. Sepcification

2.1 Overview of the main components



1.	Foot plate	10	Fork
2.	Cover	11	Load roller
3.	Protective Arm Cover	12	Battery cover
4.	Protective Arm	13	Upper cover
5.	Coded lock	14	Battery box
6.	knob	15	USB
7.	Bulley button	16	Key
8.	Bulley button	17	Meter
9.	Cylinder	18	Emergency switch

2.2 Main technical data

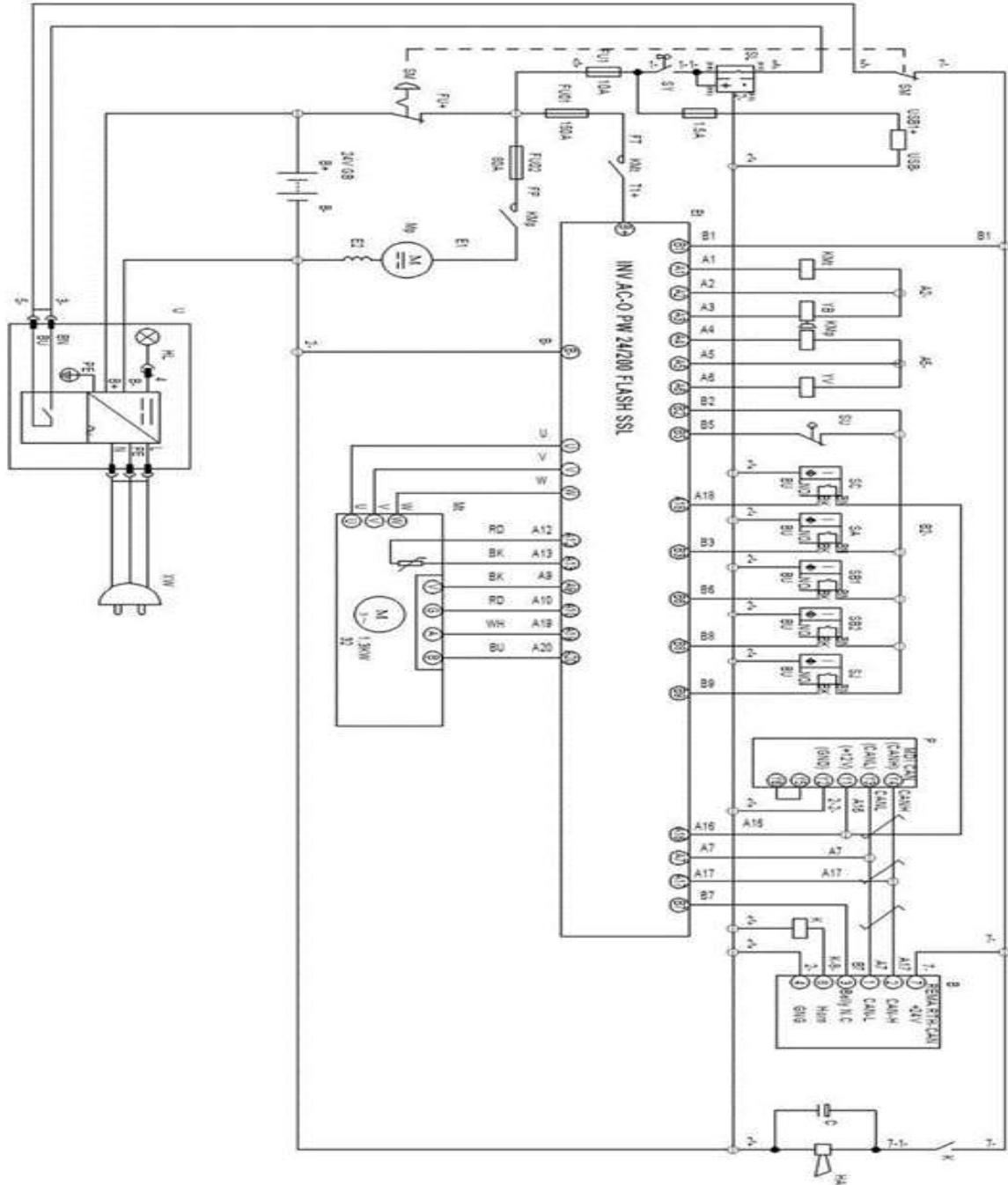


Type sheet for industrial truck acc. to VDI 2198						
General data	1.2	Manufacturer's type designation		PS 12N(3600)	PS 16N(5500)	PS 20N(4600)
	1.3	Power (battery ,diesel, petrol, gas, manual)		Battery		
	1.4	Operator type		Pedestrian		
	1.5	Load Capacity / rated load	Q(t)	1.2	1.6	2.0
	1.6	Load centre distance	C(mm)	600		
	1.8	Load distance ,centre of drive axle to fork	x(mm)	647		
	1.9	Wheelbase	y(mm)	1167	1215	1327
Weight	2.1	Service weight	Kg	1050	1330	1570
	2.2	Axle loading, laden front/rear	Kg	830/1420	990/1940	1160/2410
	2.3	Axle loading, unladen front/rear	Kg	750/300	890 /440	1040/540
Tires, chassis	3.1	Tires		Polyurethane (PU)		
	3.2	Tire size, front	ØxW (mm)	Ø210×70		
	3.3	Tire size, rear	ØxW (mm)	Ø85×75		
	3.4	Additional wheels(dimensions)	ØxW (mm)	Ø150x54		
	3.5	Wheels, number front/rear(x=driven wheels)		1x+1/4		
	3.6	Track, front	b10(mm)	510		
	3.7	Track, rear	b11(mm)	390/502		
Dimensions	4.2	Lowered mast height	h1(mm)	2308	2410	2228
	4.3	Free Lift height	h2(mm)	1760	1820	1520
	4.4	Lift height	h3(mm)	3530	5430	4530
	4.5	Extended mast height	h4(mm)	4088	6110	5208
	4.9	Height of tiller in drive position min./ max.	h14(mm)	950/1350		
	4.15	Height, lowered	h13(mm)	90		
	4.19	Overall length	l1(mm)	1855 ¹⁾	1896 ¹⁾	2025 ¹⁾
	4.20	Length to face of forks	l2(mm)	705 ¹⁾	746 ¹⁾	875 ¹⁾
	4.21	Overall width	b1(mm)	790		
	4.22	Fork dimensions	s/e/l(mm)	60/180/1150		
	4.25	Distance between fork-arms	b5(mm)	570/685		
	4.32	Ground clearance, centre of wheelbase	m2(mm)	28	28	23
	4.33	Aisle width for pallets 1000X1200 crossways	Ast(mm)	2285 ¹⁾	2325 ¹⁾	2455 ¹⁾
4.34	Aisle width for pallets 800X1200 lengthways	Ast(mm)	2250 ¹⁾	2290 ¹⁾	2420 ¹⁾	
4.35	Turning radius	Wa(mm)	1380 ¹⁾	1420 ¹⁾	1550 ¹⁾	
Performance	5.1	Travel speed, laden/ unladen	km/h	7.0/8.0	7.0/8.0	6.0/7.0
	5.2	Lift speed, laden/ unladen	m/s	0.09/0.14	0.13/0.20	0.13/0.20
	5.3	Lowering speed, laden/ unladen	m/s	0.25/0.20	0.28/0.23	0.28/0.23
	5.8	Max. gradeability, laden/ unladen	%	6/12	6/12	6/12
	5.10	Service brake		Electromagnetic		

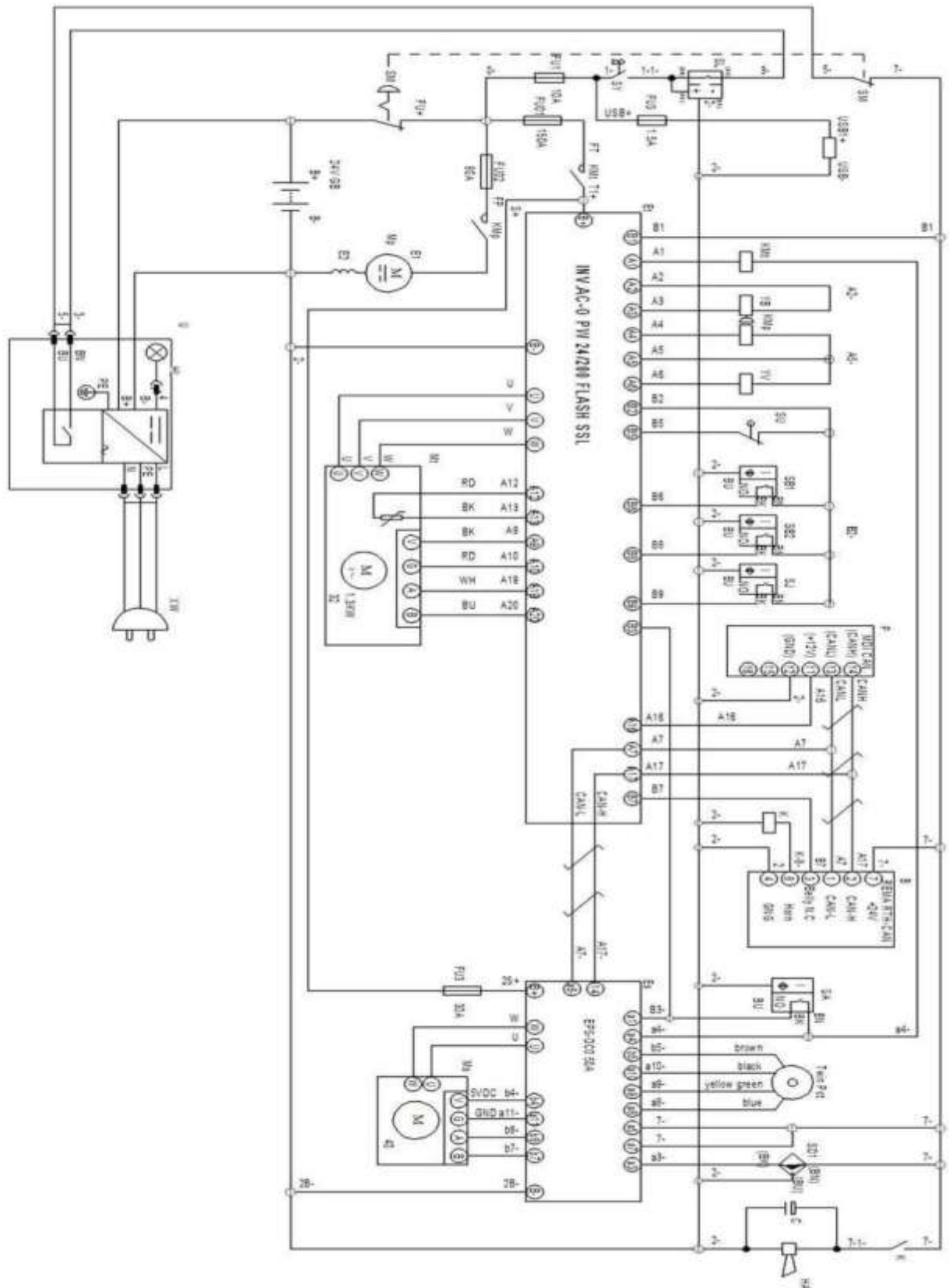
Electric	6.1	Drive motor rating S2 60min	kw	1.4	1.4	1.4
	6.2	Lift motor rating at S3 10%	kw	1.5	3.2	3.2
	6.3	Battery acc. to DIN 43531/35/36 A, B, C, no		2VBS	3VBS	3PZS
	6.4	Battery voltage, nominal capacity K5	V/Ah	24/160-180	24210-/270	24/270-350
	6.5	Battery weight	kg	155-175	185-235	235-285
	6.6	Energy consumption acc: to VDI cycle	kWh/h	0.95	1.34	1.70
Other	8.1	Type of drive control		AC- speed control		
	8.4	Sound level at driver's ear acc. to EN 12053	dB(A)	<69		
1) With unfolded platform: + 440 mm						

3. Electrical system

3.1 Electrical circuit diagram

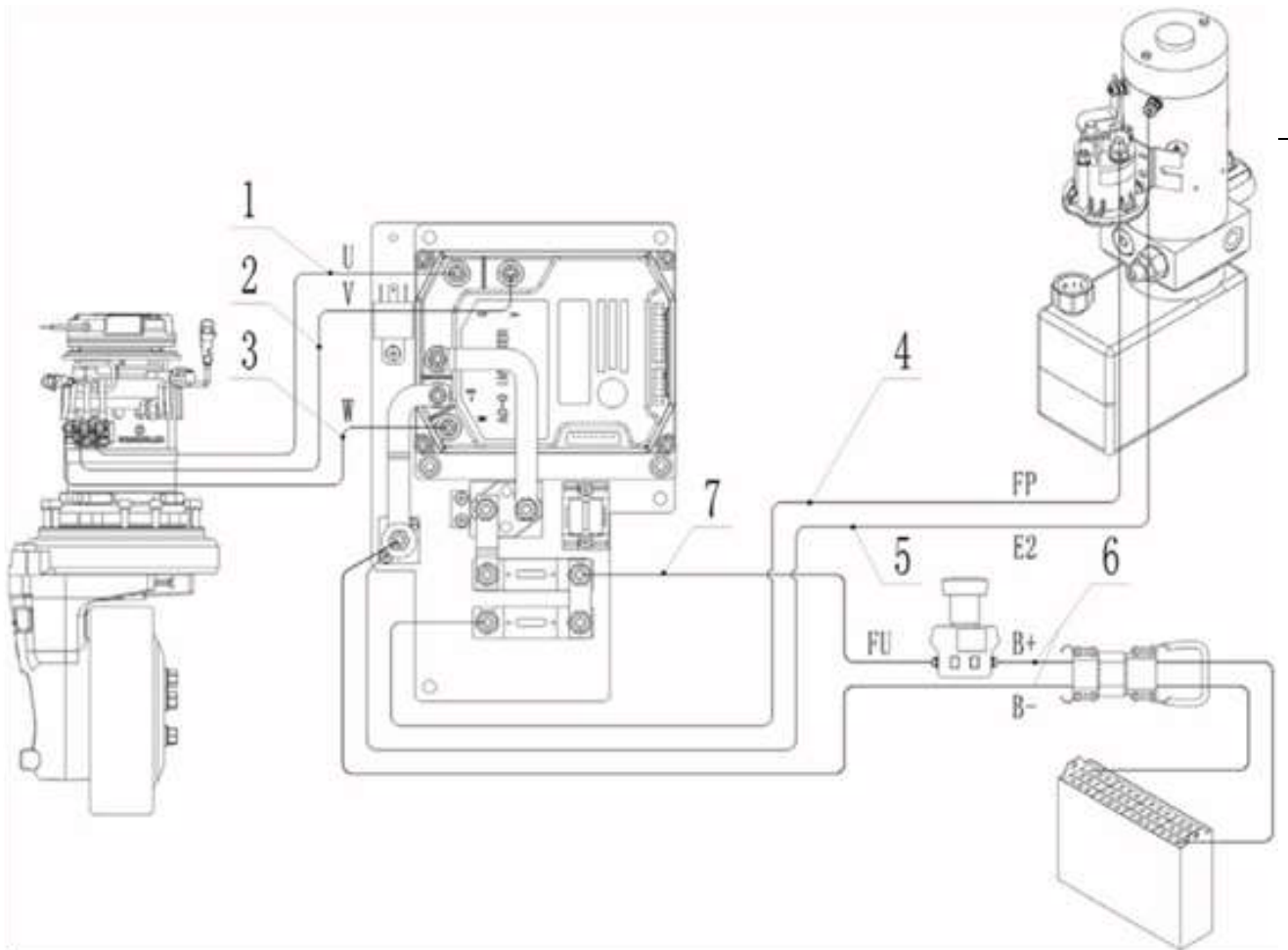


Manual-steering Electrical circuit diagram

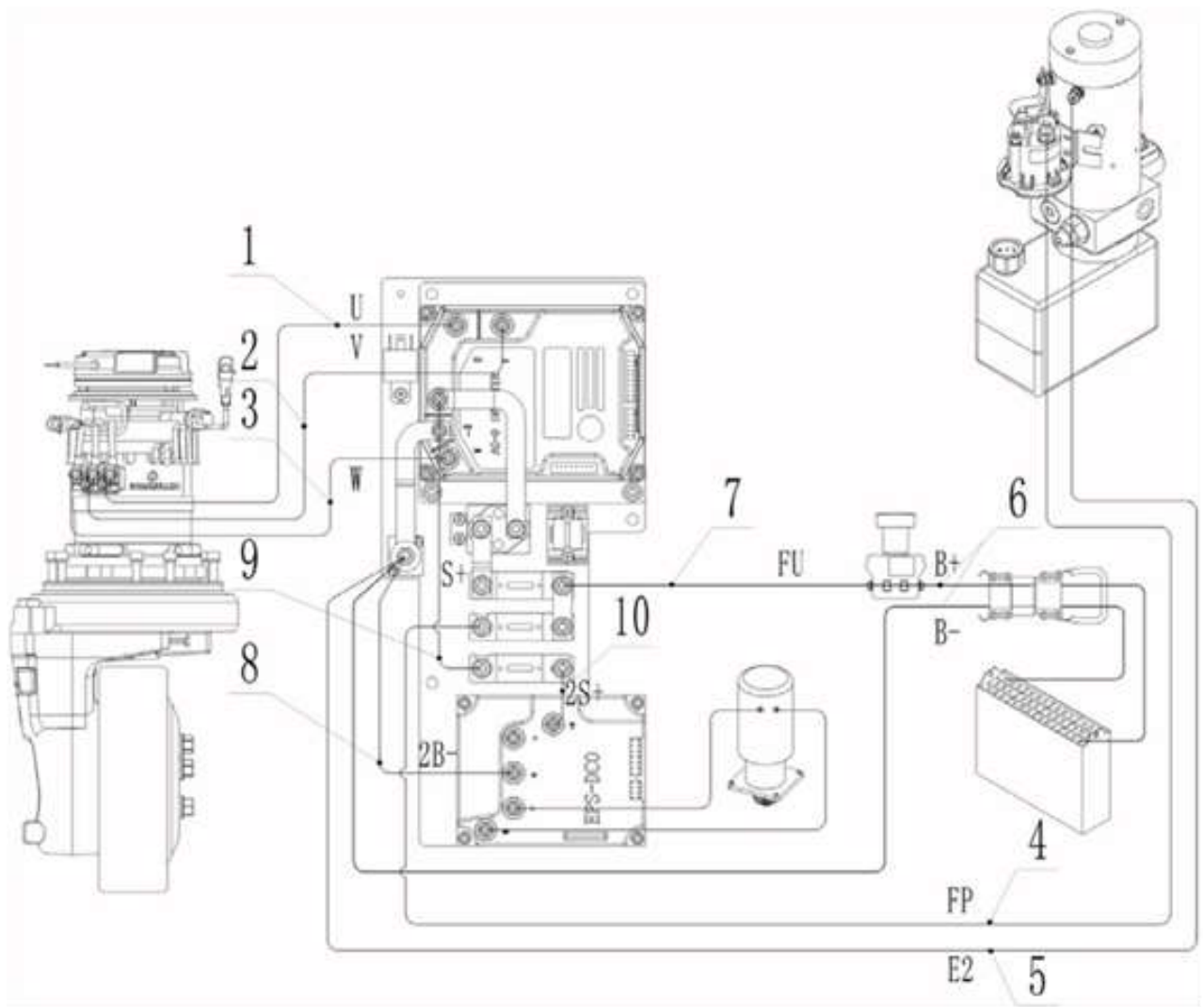


EPS Electrical circuit diagram

3.2 Main circuit harness



Manual-steering



EPS

4. Battery Using

Charging of the battery

The storage battery shall be charged with the original charger, and the operation shall be carried out strictly in accordance with the maintenance instruction.

A) The battery electrolyte shall not be kept too low.



The battery electrolyte shall be kept to the specified level, otherwise the battery will overheat or burn out.

· When the battery electrolyte is insufficient, the battery life will be shortened.

B) Add distilled water, the new storage battery is normally used for 1-1.5 years, only the distilled water needs to be added, and the later stage only needs to be supplemented with the acid solution.

c) Never overcharging

d) The charging place shall be well ventilated



The battery charging process should be carried out in a well-ventilated place and should avoid moisture.

E) Open the battery cover



Hydrogen will be generated in the charging process of the battery, and the battery cover shall be opened during charging.

F) Check the terminal, cable and connector.



Check the connector and cable before charging to ensure that there is no damage. Do not charge when the connector electrode is damaged. The terminal and cable line are corroded. These conditions can lead to sparks, burning items and fires and explosions and other accidents.



Check the connector and cable before charging to ensure that there is no damage.

Do not charge when the connector electrode is damaged.

The terminal and cable line are corroded.

These conditions can lead to sparks, burning items and fires and explosions and other accidents.

g) Turn off the key switch and charge it

h) Check specific gravity Before charging, measure the specific gravity of all the single cell electrolyte, so that the abnormal condition of the storage battery can be found. First, understand the specific gravity and then charge to avoid the occurrence of some accidents.

I) The plug-in or handle should be held in the plug-in power connector, and the cable should not be held.

The reference value of battery measurement is as follows:

when the battery is full, the specific gravity is $\rho = 1.28-1.30\text{g/cm}^3$; when the monomer voltage is $\geq 2.1\text{ V}$,

the specific gravity is $\rho = 1.16-1.17\text{g/cm}^3$; the single voltage is less than 1.7 V, and the monomer voltage is less than 1.7 V.

TEM ^o C	-15	0	15	30	45
Gravity g/cm ³	1.31	1.30	1.29	1.28	1.27



Do not unplug the cable.

When the cable and power connector are damaged, you should contact our after-sale department to replace the damaged cable and power connector.

J) disconnect charging process



The steps of disconnecting the charging process must be operated in strict accordance with the maintenance instructions .

Do not unplug the charger when charging, otherwise there will be electric sparks causing danger.

4.1 Battery replacement

When the Pallet uses a working cycle continuously and the battery is completely used up, the battery on the original vehicle should be replaced with another group of fully charged batteries in time, and the replaced batteries should be charged.



When replacing a battery, ensure that the battery matches the pallet. Using a battery that doesn't match the pallet will shorten the working hours or cause the pallet to tip over as it travels.

Replacement batteries shall be carried out on a designated working platform.



When using another forklift as lifting equipment for replacing batteries, appropriate cranes should be used.

Hoisting batteries should be operated by professionals.

The conventional model

a) Unplug the battery plug (23)

b) Open the battery cover and distribute it.

Air springs or other means are used to ensure that the upper cover of the battery is locked to prevent the fall of the upper cover of the battery and injure the human body.

C) when hoisting the battery out of the vehicle, care should be taken not to touch the handle assembly or other pallet parts.

D) after a set of fully charged batteries has been installed, the battery plugs should be firmly connected.

E) cover the battery.

The side pull model (optional)

unplug the battery connector (23) and the dividing pin (24), rotate the battery lock upward and pull the battery

out from the side.

The installation is opposite ways with disassemble.



When covering the top of the battery, be careful not to press your fingers.

When lifting a battery, be careful not to break the body of the battery box.

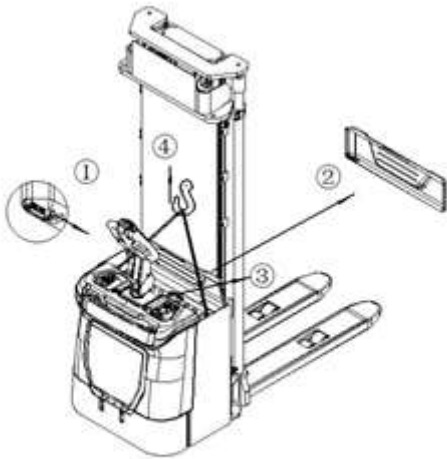


图 12: 蓄电池更换

Replacement of batteries (regular models)

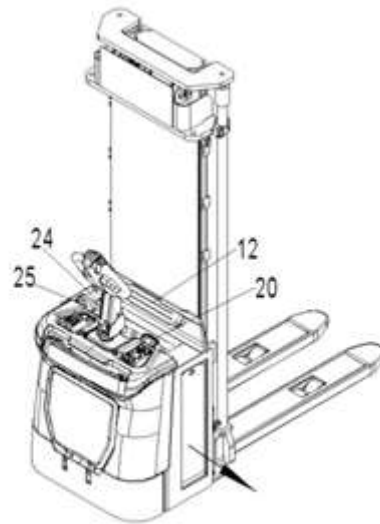


图 13: 侧拉电池更换

Replacement of batteries (side pull model)

4.2 Maintenance of batteries (lead-acid batteries)

1. Cause of water supply of battery

The battery recharge is due to the electrolytic effect of the battery at the later charging stage, which makes the moisture part of the electrolyte electrolyze. After a long period of charge and discharge, the water content of the battery will be more electrolytic, which will increase the electrolyte potency and decrease the liquid level. At this time, it is necessary to supplement distilled water to restore the liquid level to the original height and maintain the normal potency of electrolyte to ensure the service life of lead-acid battery.

2. Note:

(1) Remember not to drop the liquid level below plate before starting to replenish water. Once the plate is exposed to air, the battery performance can be seriously affected.

(2) In order to reduce the number of water recharging, battery charging should be strictly required by the instructions, do not overcharge. Overcharge will aggravate the battery water loss.

3. Distill-Water-adding materials and tools

(1) Water requirements: it is recommended to use battery special supplementary liquid or distilled water. In case of emergency, pure water for drinking water on the market can also be used, but remember not to use tap water, mineral water and other water containing impurities.

(2) Water filling tool: water funnel, water ladle. If the tool used can be made of plastic or glass, it shall not be made of metal.

(3) for users with large amount of water, the self-made water filling device in large bucket is adopted.

4. When the water supply does not lead to the water shortage of the battery in time, it can cause:

- 1) As the electrolyte surface decreases, the temperature rise is high when the battery is charged;
- 2) the capacity of the battery is reduced;
- 3) If the plate is exposed to the air, it can be oxidized
- 4) the specific gravity of the electrolyte is increased, and the corrosion of the polar plate can be easily degraded.



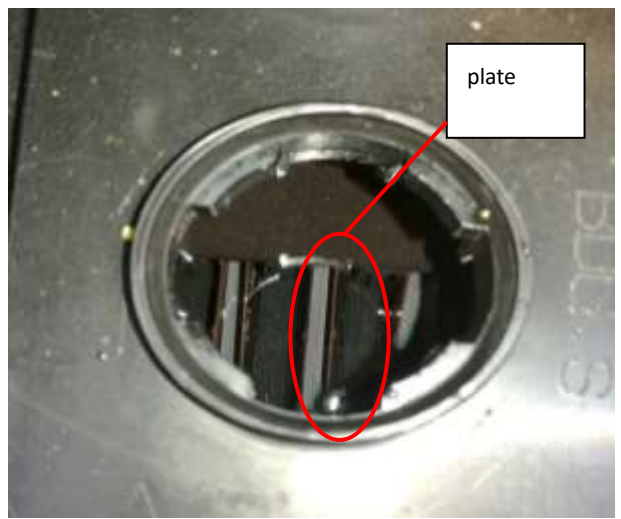
1. Unplug battery switch



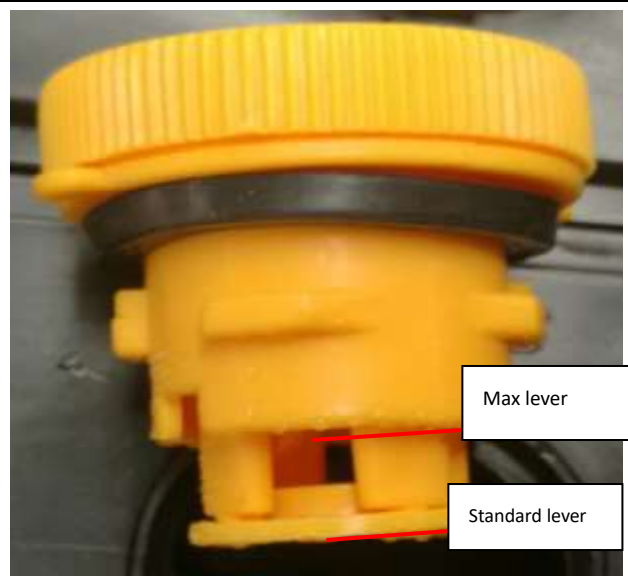
2. Uncap



3. Electrolyte level is lower than bus-bar, then add distill water



4. can't see the bus-bar for some models
Liquid level is 10mm lower than plate, then add distill water



5. Use a plastic funnel to add water.

6. add-water lever

Checking Items	Maintenance requirements	Tool	Daily (8hrs)	Weekly (50h)	Monthly (200h)	Every three months (600h)	Half a year (1200h)
Battery	electrolyte level	See by eye	√	√	√	√	√
	Electrolyte gravity	densimeter		√	√	√	√
	quantity of electricity		√	√	√	√	√
	Whether the pile head is loose or not		√	√	√	√	√
	Whether the connecting wire is loose		√	√	√	√	√
	Clean surface			√	√	√	√
	Is there any impurity on the surface		√	√	√	√	√
	Whether the breathable cover is firm or not			√	√	√	√
	Stay away from the open fire		√	√	√	√	√

4.3 Test of the battery

A. Battery status check

the weak battery may cause or cause problems with the controller and the power circuit. Make sure the battery is in good condition before troubleshooting other areas.

The preliminary step

confirms whether the polarity of the battery connector and the control panel is correct. The positive cable shall be located in the line fuse (fuse) and the negative pole shall be on the negative pole of the control panel.

When the pallet is working

Battery load test

1. Turn the range switch on the multimeter to read the battery voltage.
2. connection battery
3. connects the multimeter lead between b + (1) and b-(2) of the controller.
4. In the safety area, operate the hydraulic system (load) and read the voltage indicated on the multimeter at the same time.
5. If the indication is less than the limit value (19.0v), the battery needs to be charged or repaired before continuing to troubleshoot.



When the pallet is not working and the battery is suspicious.

A battery pressure drop test

1. Measure the voltage of each unit cell when the pallet is energized and the pump motor is running.
2. Normal voltage should be between 1.7 v and 2.1 v per unit cell. If the voltage on each of the individual cells is less than 1.7 v, the electrical pool must be charged or repaired before continuing the troubleshooting.
3. The index between the batteries should not exceed 0.15 volts. If so, the battery must be charged or serviced

B. Battery shell insulation inspection

The resistance between the pallet wiring and any point in the pallet body shall be at least 10,000 Ω or higher.

The short-circuit of the battery case results in a number of faults. A short circuit in the chassis in the pallet wiring may cause a problem as the battery may have a chassis leak. to prevent problems due to a short circuit

Do as following:

1. Disconnect the battery and discharge the controller.
2. Random measurement of any component connections or wiring connections to the pallet chassis with a minimum resistance of 10,000 Ω . Any test point with low resistance must remove the chassis short.
3. Always keep the battery clean to minimize current leakage to the chassis.
4. Ensure that all accessories, such as the horn and the lamp, are designed to have no chassis connection (two-wire system)

5.Charger

5.1 Notes

1. Battery polarity cannot be reversed, otherwise it will damage the smart charger and battery. The intelligent charger should be installed in a special place with good ventilation, dry, no serious dust, no corrosive gas and no strong electromagnetic field interference. The housing shall be reliably grounded (there are grounding bolts in the lower part of the box).
2. the intelligent charger is suitable for indoor and outdoor, water is strictly prohibited in the machine.
3. intelligent charger input power supply for two-phase 110-220V,50HZ, input wire cross section is not less than 62.
4. the output line should depend on the distance far and near, choose the suitable cable, the total line voltage drop is not more than 5%.
5. the intelligent charger is suitable for the ambient temperature of -10°C ~50°C, the altitude is less than 1000 meters, and the obstacles such as the wall which affects the ventilation and heat dissipation from the periphery of the machine should be more than 0.6 meters, so it is necessary to check whether the fan is running normally regularly.
6. When charging, plug in the battery connector and then connect the power supply.

5.2 Instrument description

No.	Item.	Digital tube display status	Error and troubleshooting	Remark
1	Current	The last three digits of the digital tube represent the number of current C-XXX	The four basic states shown by the normal working cycle of the charger are as follows: charging current, output voltage, charging progress and charging time.	normal condition
2	Battery Voltage	The last three digits of the digital tube represent the number of voltage U-XXX		
3	Progress	The last two digits of the digital tube represent the number of progress rate S--XX		
4	Charging intervals	The first two digits of the digital tube represent the "Hour" and the latter two represent the "Minutes". XX-XX		
5	Transformer temperature protection	tr---	The temperature of the transformer is too high, the automatic protection of charging	Automatic recovery

			is stopped, and the normal operation is resumed after the temperature is reduced.	
6	Battery voltage is too low	UOL-L	battery damage or battery mismatch with charger model	beyond retrieve
7	Battery voltage is too high	UOL-H	battery mismatch with charger model	beyond retrieve
8	open circuit	ACOFF	The AC power is not on, or the socket is out of power	
9	End of charge	P-end	Normal charging end	normal condition
10	End of charge	Ovend	Timeout charging is over, battery failure or AC voltage is too low	

5.3 Common faults of charger

1. After the charger turns on the AC, the charger is not shown.

Solution: the external charger, only after the battery is connected, the digital tube will be displayed. If the battery is not shown after connecting the battery, check whether the battery has an open circuit.

Fault 2, after the charger is connected with the battery to open the AC switch of the charger, the ACOFF state is always displayed.

Solution: Please check whether the socket has current, and ACOFF doesn't represent current.

Fault 3, the charger shows OVEND after charging.

Solution: this state is the end of the charging timeout of the charger, the charging time is more than 14 hours, please check whether the battery has a short circuit phenomenon or the AC voltage is too low.

Fault 4: In the process of charging the charger, there is a sound.

Solution: This phenomenon is a normal phenomenon for the charger to automatically adjust the current or the noise of the transformer.

6.Controller

6.1 Controller function

The model is equipped with a drive motor and a pump motor, which is controlled by a controller. It offers powers to controller by turning on the key switch. once the controller is energized, the magnetic coil built in the line contactor receives power from the driven motor controller. then two contact points that work like switches will contact each other and then connect the line between the battery and the controller. therefore, the controller becomes a three-phase three-wire AC power supply and is transmitted to the motor through each group of U/V/W connections. The line contactor is equipped with 150A fuse to prevent overcurrent.

The drive controller

Controller is connected by the following sensors, switches, contactors and actuators.

- Key switch
- Power switch
- Forward / backward Direction switch (Accelerator)
- Handle proximity switch

In hardware, the controller is programmed with different types of firmware to implement different functions. The safety and high efficiency operation performance and complete operation function of the electric vehicle can be realized by correctly setting the technical parameters of each motor of the controller.

1. The speed of pallet can be set. It can make run for a long time at low speed conditions.
2. The acceleration rate can be set. Acceleration is the "soft and hard" feeling of accelerator when operating. By setting the acceleration rate, pallet can meet the requirements of acceleration operation under different working conditions.
3. The anti-slippage function of the ramp. Pallet with AC traction motor has the excellent function of not falling on the ramp.
4. The maximum speed can be set. The maximum running speed of the electric vehicle is set to be reasonable, and the driving motor can be prevented from being overloaded due to the high speed.
5. Safety and protection function. If the part of the controller is damaged in operation, the controller will disconnect the main contactor in the shortest time; when the temperature of the controller is too high, the controller will automatically limit the current of the motor; when the battery voltage is too low, the controller will stop working to ensure safety.
6. The drive motor controller has a self-diagnostic function. In operation, the controller will show the fault code once a fault has occurred and automatically stop working to ensure the security of the operating system.
7. The electric quantity of battery and the working hours will be showed on the display instrument.

6.2 Error code

We can check error code from meter instrument and handle when there is something wrong with pallet. There is Handle-connector to each of controller.

Error code shows on meter, you could find detail information from error code list.

6.3 Controller test

Measure the diode voltage inside the controller and check if there is burnout and damage.

Item	Multimeter terminal		range of data	
	Red electroprobe	Black electroprobe	Voltage	Resistance
1	B+	U/V/W/B-		1MΩ 以上
2	B-	U/V/W		1MΩ 以上
3	U/V/W	B+	0.3-0.6V	

4	B-	U/V/W	0.3-0.6V	
---	----	-------	----------	--

Pull the multimeter to Ω (resistance measurement), multimeter to pull it to the diode (measurement of the polarity value)

1. Disassemble controller's wire, release electricity from internal capacitors (by resistant $30\Omega/5W$ to B+ & B-)
2. Using a multimeter to measure the voltage of the diode (0.3 - 0.6 v) and check if it is normal

Test 1: measure diode voltage, red electroprobe to B- , black one to U, V, W

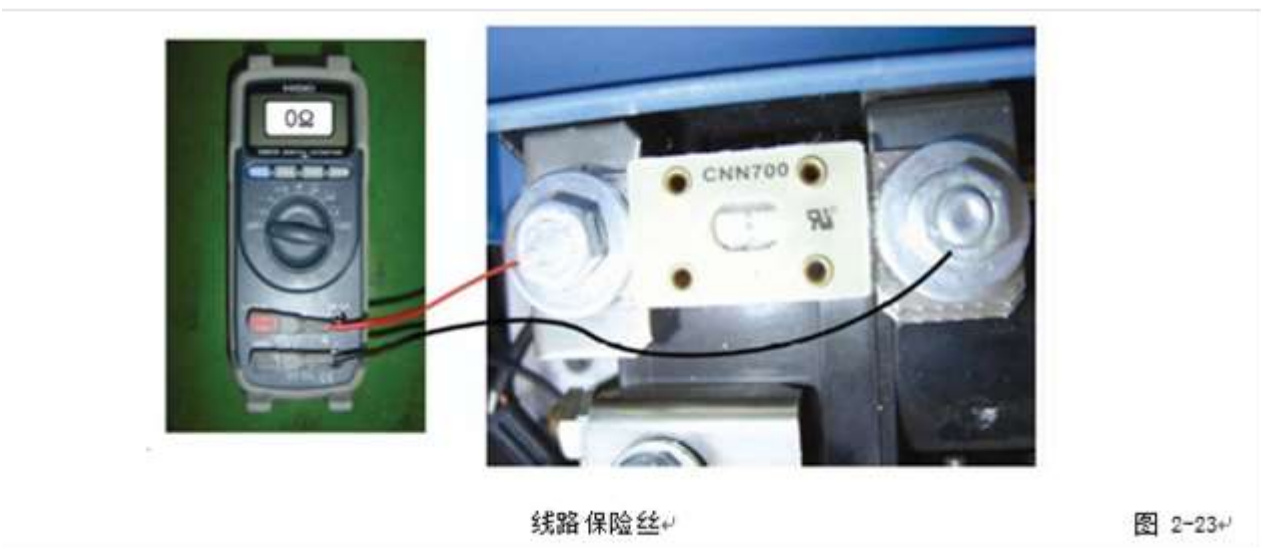


Test 2: red electroprobe to U / V / W , black one to B+



Note: electroprobe of multimeter can't be reversed.

6.4 Contactor and fuse



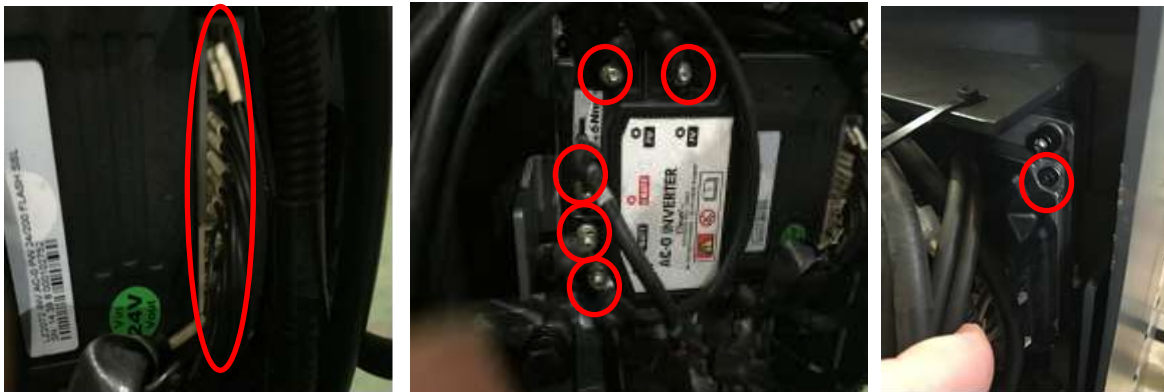
For contactor and fuse, using ohm scale to check if the value is the same.

6.5 controller of driving motor disassemble / assemble

1. cut off battery
2. keep the key on and discharge the power module twice for 30 seconds.
3. Turn off the key
4. Remove the cover and find controller of driving motor

Notes: Controller contains ESD (Electrostatic discharge) sensitive components. Appropriate precautions should be taken when connecting, disconnecting and handling.

5. Disconnect the control harness from the controller.
6. Disconnect u, v and w cables.
Installation torque: $9.5 \pm 1 \text{ n} \cdot \text{m}$ ($7.0 \pm 0.7 \text{ lb ft}$)
7. Remove B+ and B- connectors
8. Remove the drive motor controller.
9. Install the drive motor controller in reverse order



6.6 Contactor and relay Common malfunctions

Fault	Checking items	reasons
Relay don't work	Whether the input voltage meets the rated voltage of the device	<ul style="list-style-type: none"> • Circuit breaker or fuse drops • Wiring error, mission • Screw terminal mounting not tighten
	Whether Relay specification compliance with input voltage	Relays of DC 48v specification were used on the DC 24v voltage line
	Is input voltage descending	Lack of power supply capacity long distance wiring
	Is the relay broken	Coil is but off fell and pound caused mechanical damage
	Is output circuit abnormal	Output side power • Poor load •

		Poor wiring • Poor contact
	Poor contact	Abnormal contact Loss of contact caused by service life - Damage of mechanical properties
Relay not reset	Is the input voltage completely disconnected	Electrical leakage Voltage applied by circuitous circuits Diode control circuits with residual voltage
	Relay abnormal	Contact Oxidation Aging insulation Mechanical breakage Induction voltage
Relay misoperation	Is abnormal voltage applied on the relay input terminal	Induction voltage Circuitous Circuits Caused by Inductive Voltage
	vibration, whether the impact is too large	Bad environment
scaling loss	Is the coil burning	over rated voltage
	Is the point of contact burning	Over-point rated current Poor external contact Short circuit current.

6.7 Error code list

MDI CODE	ALARM	Error code Description	Solution
98	NONE	The instrument hour meter is inconsistent with the controller	In the system used, the fault is reported if the instrument or the traction controller is replaced. After power-on, wait for 5 minutes. After the instrument and the traction controller are in accordance with the hour meter, this problem will be automatically eliminated.
8	WATCHDOG	WATCHDOG	On startup, the watchdog circuit is activated before the software starts. The watchdog signal is invalid (alarm state) at standby or running state. Fault analysis: The watchdog hardware circuit or microcontroller output part is broken. both cases have nothing to do with the external parts, replace the controller

13	EEPROM KO	Memory damage	If the vehicle does not walk, there is a problem in the storage area of the parameter, and the failure causes the vehicle to stop. If the fault persists after the electrical lock is closed repeatedly, the logic card is replaced. If the fault disappears, the previously stored parameters are replaced with the wrong parameter and need to be reset.
15	LOGIC FAILURE #5		
17	LOGIC FAILURE #3	Logic card failure 3	The logic card current protection function is faulty. The controller should be replaced
18	LOGIC FAILURE #2	logical card fault 2	The voltage feedback hardware circuit part of the logic card is faulty and the controller is replaced.
19	LOGIC FAILURE #1	logical card fault 1	"failure in the event of low voltage or overvoltage protection. In a 24v system, the controller detects a voltage exceeding 45V or less than 9v; in a 48v system, the controller detects a voltage exceeding 65V or less than 11v. Possible reasons: 1. There is no short circuit phenomenon in the circuit system, such as dc-dc, brake coil, or whether the input of the controller is good. 2. Whether the battery voltage is too low or too high. 3. Check whether the power cable on b+ & b-, main connector is fastened. 4. Whether the voltage calibration parameters of the controller are consistent with the actual voltage. 5. Replace the controller for the hardware circuit failure on the logic card. "

30	VMN LOW	Low vmn	<p>reason: when starting, the high terminal voltage of mos tube is less than 66% of the capacitance voltage or the voltage is less than the required value during the operation of the motor.</p> <p>Possible reasons:</p> <ol style="list-style-type: none"> 1. There is something wrong with the motor connection, or there is a problem with the motor circuit; check that the three-phase connection of the motor is correct; whether the motor has leakage to the ground, and whether there is a circuit break of the motor coil. 2. Whether the main contact suction is firm or not. Contact is worn or not. 3. Replace the controller
31	VMN HIGH	High VMN	<p>reason: when starting, the low end voltage of mos tube is 10% higher than the normal battery voltage, or the phase voltage is higher than 1 ≤ 2 battery voltage.</p> <p>Possible reason:</p> <ol style="list-style-type: none"> 1, the motor wiring is wrong, or there is something wrong with the motor circuit; check that the three-phase connection of the motor is correct; whether the motor has leakage to the ground, whether there is a circuit break of the motor coil. 2, replace the controller.
37	CONTACTOR CLOSED	Contactor adhesion	<p>before closing the main contact coil, the controller must first detect whether the main contact contact is adhered. Try to discharge the capacitance. If the capacitance voltage reduces the battery voltage by 20%, the failure may occur. 1. It is recommended to check the contactor contact for adhesion, or to replace the contactor</p>
38	CONTACTOR OPEN	Contactor does not absorb and close	<p>the logic card has driven the main contact coil, but the contactor is not closed, which may be due to:</p> <ol style="list-style-type: none"> 1. Contactor mechanical failure, stuck dead, etc. 2. contact point is not good.

			3. If the contactor is working properly, replace the controller
40	BRAKE CONT. OPEN		
49	I=0 EVER		
53	STBY I HIGH	High standby current	The current of sensor output signal detected by the micro-control system is beyond the allowable range of unrunning current. Replace the controller
60	CAPACITOR CHARGE	Capacitance charging error	<p>when the electric lock is turned on, the controller will charge the capacitance through the power resistor and detect whether the capacitance is sufficient within the specified time. If the capacitance voltage is not fully charged, the capacitance voltage is still less than 20% of the battery voltage, the controller will alarm and the main contactor will not be closed.</p> <p>Possible reasons:</p> <ol style="list-style-type: none"> 1. Peripheral equipment, such as dc-dc, motor or other equipment, interferes with the charging process of the controller, and these devices should be eliminated. 2, the charging resistance is disconnected, the charging circuit is open, and there is a problem with the power module. The controller needs to be replaced
61	HIGH TEMPERATURE	controller overtemperature protection	The temperature of the controller itself is reduced to less than 85 °. If this fault still exists, it may be a temperature sensor failure or a logic board failure of the controller itself. At this time, the controller needs to be replaced.

65	MOTOR TEMPERAT.	High temperature of motor	<p>1, this fault occurs if the motor temperature digital switch is turned on, or if the analog signal exceeds the cut value.</p> <p>2, when the motor temperature reaches 120 °C, the controller alarms, at this time the vehicle can still walk, but the maximum current is reduced and the performance of the vehicle is reduced. When the temperature of the motor reaches 125 °C, the motor stops working. Efforts should be made to cool the motor at this time.</p> <p>3. When the motor cools, the fault still exists, check the line. If all are good, replace the controller.</p>
66	BATTERY LOW	Low battery power	<p>If the "battery check" parameter of battery detection function is not set to 0, when the battery power is less than 15%, when there is no grid on the instrument, the fault alarm and the lifting function are locked. Charging should be made in time at this time. If the battery is found to have electricity, the value of the controller's "adjust battery" parameter is detected to be consistent with the battery voltage.</p>
94	CURRENT SENS. KO		
74	DRIVER SHORTED	Drive short circuit	<p>When the electric lock is closed, the controller will detect whether the driver of the main contactor is short circuit and alarm if the short circuit is short. If the positive pole of the main contact coil is to A1 or the power supply negative is short, if everything is normal on the periphery, replace the controller.</p>
75	CONTACTOR DRIVER	Drive short circuit	<p>When the electrical lock is closed, the controller detects whether the driver of the main contactor is short-circuited or alarmed if it is short-circuited.</p> <p>Check if the main contactor coil positive to A 1 or B- is short-circuit. Replace controller if these are no problem.</p>
76	COIL SHORTED		

78	VACC NOT OK	Accelerator failure	<p>Detection time: standby status。</p> <p>this alarm shows that the accelerator voltage is more than 1 v larger than the minimum value set in the accelerator signal range (program vacc).</p> <p>Possible reason:</p> <ol style="list-style-type: none"> 1. The upper and lower limit values of the accelerator voltage are not collected, enter the program vacc menu to collect again. 2. Accelerator error, may acceleration pedal no return position, or accelerator internal error. 3. Controller failure."
79	INCORRECT START	Startup sequence failure	<p>the operate sequence is not correct,</p> <p>Possible reasons:</p> <ol style="list-style-type: none"> 1. The direction switch has been closed before starting. 2. The operation sequence is wrong. 3. The wire connection is incorrect. 4. If the fault cannot be fixed, the controller needs to be replaced."
80	FORW + BACK	The forward and backward signals are present at the same time (direction switch adhesion)	<p>the controller will always detect and alarm when there is a request to run the signal in two directions at the same time.</p> <p>Possible reasons:</p> <ol style="list-style-type: none"> 1. Wire breakage. 2. Directional switch failure 3. Improper operation 4. If the fault cannot be eliminated, the controller needs to be replaced
86	PEDAL WIRE KO	Accelerator positive and negative pole connection failure	Check whether the positive and negative electrodes of the accelerator are connected to the controller;
98	INPUT ERROR #2		
97	INPUT ERROR #1		
99	PROG. TOOTHS	Motor type error	Check that the motor actually used is consistent with the parameters.
90	BMS LOW CAP.	Low lithium battery	
91	BMS VOLT.DIFF	Lithium battery voltage error	
92	BMS MONOMER OV	Lithium battery with incorrect voltage.	
93	BMS		

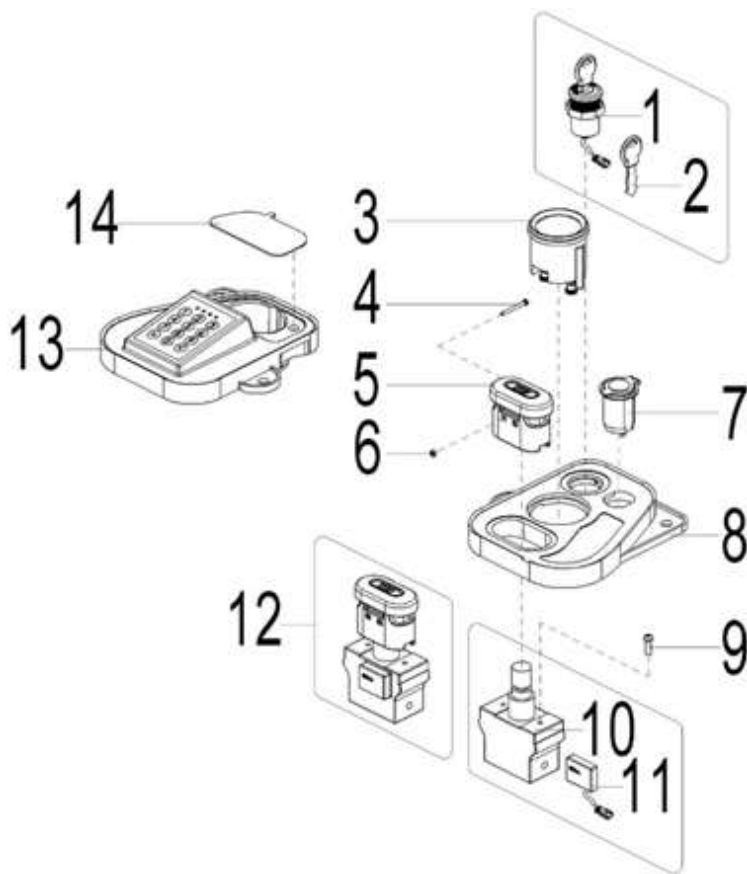
	MONOMER UV		
21	BMS HIGH TEMP.	Lithium battery temperature too high	
46	LIFT+TRAC	Lifting and walking are closed at the same time	Only in the case of lithium batteries.
59	NO CAN MSG. BMS	No CAN info in battery	
64	TILLER ERROR	Interlock , H&S input is not inconsistent	Replace controller
0	ALL. WAITNODE		
22	RESET A15 SENSOR	Reset 1800mm height detection switch a15	Press the down switch, turn the switch(a15) off and close again, or use the magnet to pass through this switch from the top to the bottom.
0	TILLER OPEN	Handle disconnected	when the handle input switch is disconnected, after a period of time, about 30s, the main contactor disconnects and the warning occurs. The next time you run the warning, the warning disappears
92	CAN BUS KO TIL.		
92	TILLER ERROR	Interlock , H&S input is not inconsistent	Replace controller
0	TEACH TIL ERROR		
22	RESET A14 SENSOR	Reset 300mm height detection switch A14	Press the down switch, turn the switch(a14) off and close again, or use the magnet to pass through this switch from the top to the bottom.
0	END TEACH ERROR		
77	END TEACH OK		
99	PROG.ACCELERATOR		
85	EPS RELE OPEN	eps internal contactor open	Check to see if there are any internal failures in traction and eps, and this failure will be eliminated after troubleshooting restarts.
68	CAN BUS KO EPS	EPS without CAN info	Can communication failure between steering and traction. Detect can wiring

			and software settings and version information.
93	WRONG SET BAT.	Battery setting failure	At start-up, the controller detects the battery voltage and checks if it is within the nominal voltage range. 1. Check if the value of the battery voltage parameter in the Tester menu is in line with the value displayed by the voltmeter. If they do not match each other, the battery voltage is changed to the same as the measured value the adjust battery function. 2. Replace the battery
23	TR. SPEED OPEN		After reset 300 mm and 1800 mm switch, this fault is eliminated.
91	LIFT LOW. ACTIVE		
90	LIFT + LOWER	The lifting and lowering signals are present at the same time	the controller will always detect and alarm when there are two request signals at the same time. Possible reasons: 1. Wire breakage. 2. Switch failure 3. Improper operation 4. If the fault cannot be eliminated, the controller needs to be replaced
1	WRONG CONFIG	Configuration error	Check the internal parameters of the controller and whether the software matches the vehicle type.
0	MDI DRV2 SHORT		
11	STALL ROTOR	motor stalling	1. Motor shutdown. 2. Motor encoder failure. 3 wire harness damage or wiring error. 4. Encoder power supply problem.
0	MDI PEV NOT OK		
0	MDI DRV2 OPEN		
0	MDI VALVE2 SHORT		
55	PROG LIFT		

	LEVER		
89	PEV NOT OK	PEV failure	See if can 2 connectes with B+ of contactor
67	CAN BUS KO	Communication failure	
99	CHECK UP NEEDED	Communication failure	Maintenance time is up and needs to be overhauled
73	THERMIC SENS. KO	Temperature sensor failure	The output signal from the controller temperature sensor is out of range. The controller is replaced.
71	HANDBRAKE	Handbrake closure	The handbrake switch is always closed.
0	WAITING FOR NODE	Waiting for signal	in the can communication, one controller receives a signal that another controller cannot communicate normally, and the controller is always in a waiting state until the can communication network is all normal. Check that those modules that cannot communicate are not properly wired and see if the software version or parameter settings are correct.
70	ENCODER ERROR	Encoder failure	the controller detects a great difference between the two consecutive speed readings of the encoder: because the internal encoder in the system cannot change the speed greatly in a very short period of time, the encoder may fail (the line of one or two encoders is worn out or disconnected), check the mechanical and circuit functional parts of the encoder, and may alarm caused by electromagnetic interference on the sensor bearing. If none of the above is true, replace the controller. Please note that artificial operation may also cause the controller to display this failure, when power outage is required to restart the vehicle. For example, the following cases: 1, the vehicle suddenly hit an obstacle, making the vehicle unable to walk; 2, when the vehicle is driving at high speed, suddenly slam on the brakes
16	AUX OUTPUT	drive output fault	

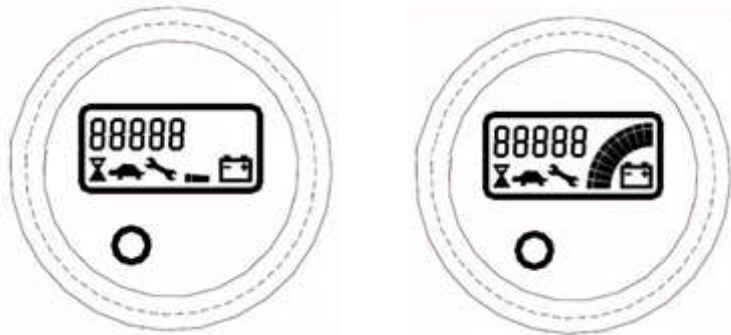
	KO		
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7. Meter



7.1 Coulombmeter

The discharge situation is represented by 10 display segments.



Low battery power

The power of the battery is represented by 10 led display segments, and each grid represents 10% of the electricity. With the gradual discharge of the battery, the led lamp goes out in turn, but only one grid at a time. When the power is insufficient, the battery symbol flashes and the red indicator flashes.

A the second led lamp flashes from the left, indicating "energy reserve" (70 per cent discharge depth).

B the two led lights flashes alternately on the leftmost side, indicating "power empty" (80% discharge depth).

The battery is full of electricity

Common malfunction of electricity meter.

A electricity meter wire harness B+, and B- ,there is a 12 v voltage, the meter does not show.

Replace the power meter with the above fault.

Battery switch common fault

When the battery switch is closed, but it is open-circuit or emergency switch without 24V (meter doesn't show).

Replace the battery switch

Key common fault

Turn key on(meter doesn't show), replace key if it is open-circuit by multimeter

7.2 Meter disassemble/assemble

1. Disconnect the battery connector.
2. Keep the key switch open so that the power module is discharged. Twice for 30 seconds.
3. Turn off the key switch.
4. Remove the housing
5. Disconnect the meter port.
6. Unscrew the two fixed nuts of the meter by hand.
7. Remove the ring of the meter and remove the meter
8. Install the meter in reverse order.

7.3 Battery switch disassemble and assemble

1. Disconnect the battery connector.
2. Keep the key switch open so that the power module is discharged. Twice for 30 seconds.
3. Turn off the key switch.

- 4.Remove the housing
- 5.Remove the top cover
- 6.Remove the blade panel
- 7.Unscrew the power connection cable of the power switch.
8. Remove the mushroom head of the power switch
9. Unscrew the two fixed screws of the power switch and remove the power switch.
- 10.Do the above steps in reverse order to install the power switch.

7.4 Key disassemble and assemble

1. Disconnect the battery connector.
2. Remove the housing
3. Disconnect the key switch connector.
4. Unscrew the fixing screw of the key switch and remove the key switch.
5. Do the above steps in reverse order to install the key switch.

7.5 Coded lock

A. Product introduction

Password ignition switch (password lock) like an electronic alarm electronic system, the machine will not be allowed to start until an authorized password is entered, the main function is to prevent unauthorized people from operating the machine. In addition to easy to use, the product is also of great help to the anti-theft and safety of the machine.

B. Main specification parameters

working voltage range: 12v-60v

working environment:-40 °C to 90 °C p

rotection grade: ip65

C. Main Control Codes and Functions

At present, the password lock supports up to 5 ID cards and 1 group of hand-in password operations. Each group of passwords is mainly composed of four digits with a range of 0-9 digits. Please check the separate instructions for the administrator password. Refer to separate instructions.

D. Operating steps

1. ID card operation

ID card close to the password lock button panel. If the ID card is a valid id card, the password lock will make a brief buzzer, followed by the blue indicator light, indicating that the password lock is working properly, the electric lock switch signal is output normally. (The red light flashes when the card is swiped incorrectly).

2. Password operation

Enter password, and then press the "√" button and release. If the password is correct, the Pallet can start operating. Press the "x" button on the lower board and release and close the pallet. Enter the password again if you want to re-operate

E. Password lock indicator defines

Red light-fault indication

Blue light-status indicator

Yellow light-waiting indication

Green light-power indication

8. Driving motor

On the electric side, the drive motors rotate their drive wheels, allowing pallet to move forward/backward

Controlled by the controller

The drive motor is connected to the controller via U, V and W lines. The controller runs the drive motor according to the input from multiple switches and sensors and the internal parameter settings.

When the following conditions are met, the drive motor is operated:

1. key switch is turned on, then the controller is powered
2. handle is pressed down (the proximity switch is in the induction area),
3. determine the driving direction (accelerator button)
4. twist the accelerator button (accelerator)

8.1 Motor speed sensor

Each drive motor is equipped with an encoder that serves as a speed sensor for the motor. It includes two hole sensors and is equipped with gears on the drive shaft of the motor to interact with the sensors. The gear rotates at the same time as the drive shaft so that the gear teeth periodically pass through the magnetic field of each hole sensor. When the top platform of the gear passes through the magnetic field, it is close to the hole sensor, so the magnetic flux increases. On the other hand, when the bottom platform passes through the magnetic field, the distance increases and the magnetic flux decreases accordingly

The cycle occurs again and the magnetic flux has a waveform that generates a voltage pulse. The amplitude of the pulse is analyzed to calculate the speed of the motor.

Like other sensors, the encoder produces the main signal (signal a) and the signal (signal b) through two-hole sensors. The resulting signal sequence varies according to the direction of rotation.

8.2 Overheat protection

Each drive motor is equipped with a heat sensor to prevent overheating. Once the motor is heated to 145°C (293°F), the overheating alarm is activated and the performance is limited.

Speed sensor

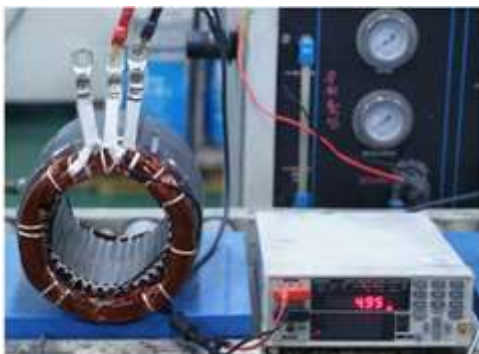
Item	Specification
PPR	64 impulses per turn
connector	4-pins AMP

Heat sensor

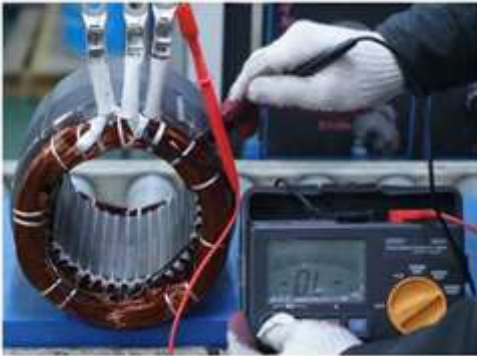
Item	Specification
Part no.	It is inside motor
repellence	Under 25°C (77°F) , 603Ω±3%
connector	2 Pins AMP

8.3 Stator testing

- Carefully wipe contaminants on the stator surface using a clean cloth dipped in alcohol
Notes: Contaminants in the stator may cause damage to the coil and therefore to the stator itself.
- Measurement of resistance per phase (uv,vw,wu) using multimeter
Rated resistance:0.4Ω



- Test insulation at 1000 vac and min.10 MΩ using insulation tester.
If there is insulation problem, please replace the new stator.



8.4 Drive motor disassemble and assemble

1. Remove motor U/V/W connection
2. Remove motor speed sensor, temperature sensor and electromagnetic brake connection
3. Remove drive assembly fixing bolt.
4. Remove drive assembly by lifting equipment.
5. Do above steps in reverse order to assemble drive motor.



8.5 Drive motor common fault

Problem	Reason
Drive motor doesn't work	Switch is not off (battery connector, key switch, proximity switch): Turn off switch. If still not running, use a voltmeter to test the power of the control panel and the current of each switch.
	Bad signal. fuse burned: check battery connection. Check the connection of the battery Check fuse, driver and logic. Replace fuse if burned. Check the drive motor and control panel which possible cause fuse breakage. Some of the reasons are: operating under excessive load, the current limit is too high.

	<p>Battery voltage low: Check the battery terminal voltage. Charge the battery if too low. Check if there is one or more defective cell cells.</p> <p>Incorrect operate</p>
<p>Drive motor doesn't work</p>	<p>Speed sensor fault</p>
<p>Traction does not work during normal operation</p>	<p>The brake is defective, resulting in excessive resistance. The heat increases, causing the motor to stop. Check braking adjustment</p> <p>Too much heat in the control panel for the following reasons: Overweight traction load: Reduced duty cycle load. Heat sensor failure: These may cause malfunction of the drive motor, failure of the control handle or opening of the drive fuse</p>
<p>Traction does not last throughout the normal working period.</p>	<p>The pallet is equipped with too small batteries</p> <p>Battery not charged fully during battery charging: Check if battery charges Check if battery charger is malfunction.</p> <p>Battery replacement interval is too long or battery replacement cooling time is too short.</p> <p>The battery has one or more defective single batteries, causing the rated capacity and capacity of the battery to be below normal:</p> <p>Due to the failure of the drive system, the drive system consumes too much battery power. Check the brake adjustment. Check the wheel bearings, axles and other mechanical parts for correction to eliminate the failure. Replace the smaller friction tire.</p> <p>After a work shift, the pallet capacity exceeds its designed capacity without the power available:</p>
<p>Battery positive (+) or negative (-) is in direct contact with the vehicle frame (body) or drive motor</p>	<p>The battery is dirty, the electrolyte is on top of the battery. The current flows through the battery box, which applies voltage on the forklift frame: clean the battery with baking soda</p> <p>Battery or control panel wire connection in contact with frame: Conduct continuity test and move wire. Remove wire in sequence until troubleshooting. Fault</p>

	will be disconnected at the end of the wire.
	Wet motor
The vehicle did not reach its maximum speed	<p>The battery is not fully charged or the battery is poor charge the battery. Check the cell of battery. If necessary, please replace the cell of battery</p> <p>Failure in driving motor, control handle or transmission system</p> <p>Check speed in both directions. If you need to adjust the controller, follow the corresponding part of the manual programmer.</p> <p>If the drive motor fails, test the motor assembly.</p>
Slow acceleration of vehicles	<p>Drive control overheat, temperature induction switch on.</p> <p>Note: If temperature is 145°C (293°F), heat – sensor will issue warning.</p>

9. Hydraulic system

The hydraulic system operates other hydraulic parts through hydraulic force from pump.

1. The main hydraulic pump is driven by the pump motor controlled by the controller.
2. The main hydraulic pump uses the rotating force output from the motor to pressure the oil in the hydraulic tank and conveys the oil to the lifting cylinder.
3. The hydraulic tank stores the hydraulic oil returned from the cylinder. The stored oil is suctioned by the main hydraulic pump for reuse.

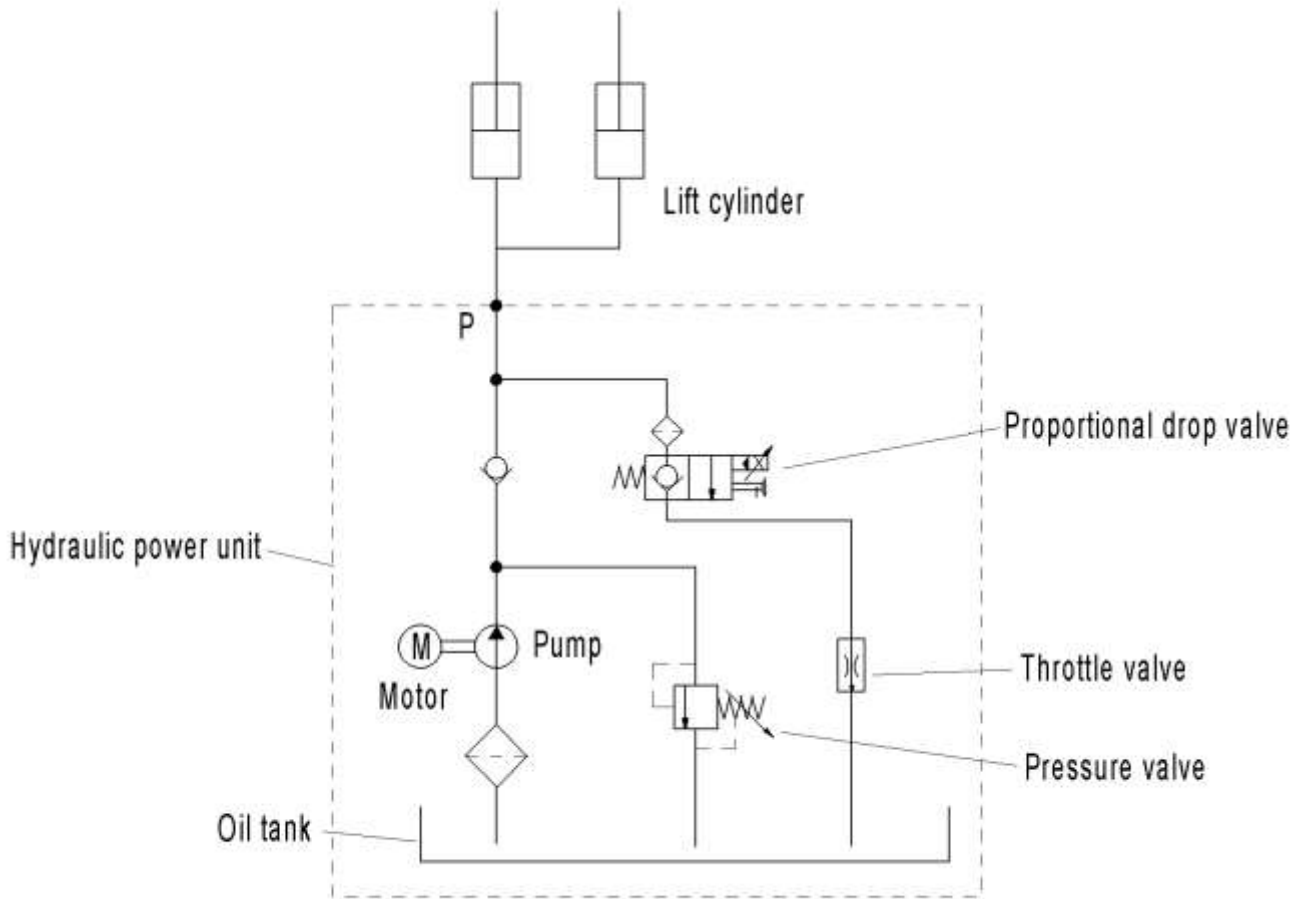
The pump motor transmits the power to the main hydraulic pump by electric mode in order to pump the hydraulic oil to operate the hydraulic system.

The pump motor is connected to the pump motor controller through the pump contactor and (B-)line. The controller runs the pump motor according to the input of the lifting switch and sensor.

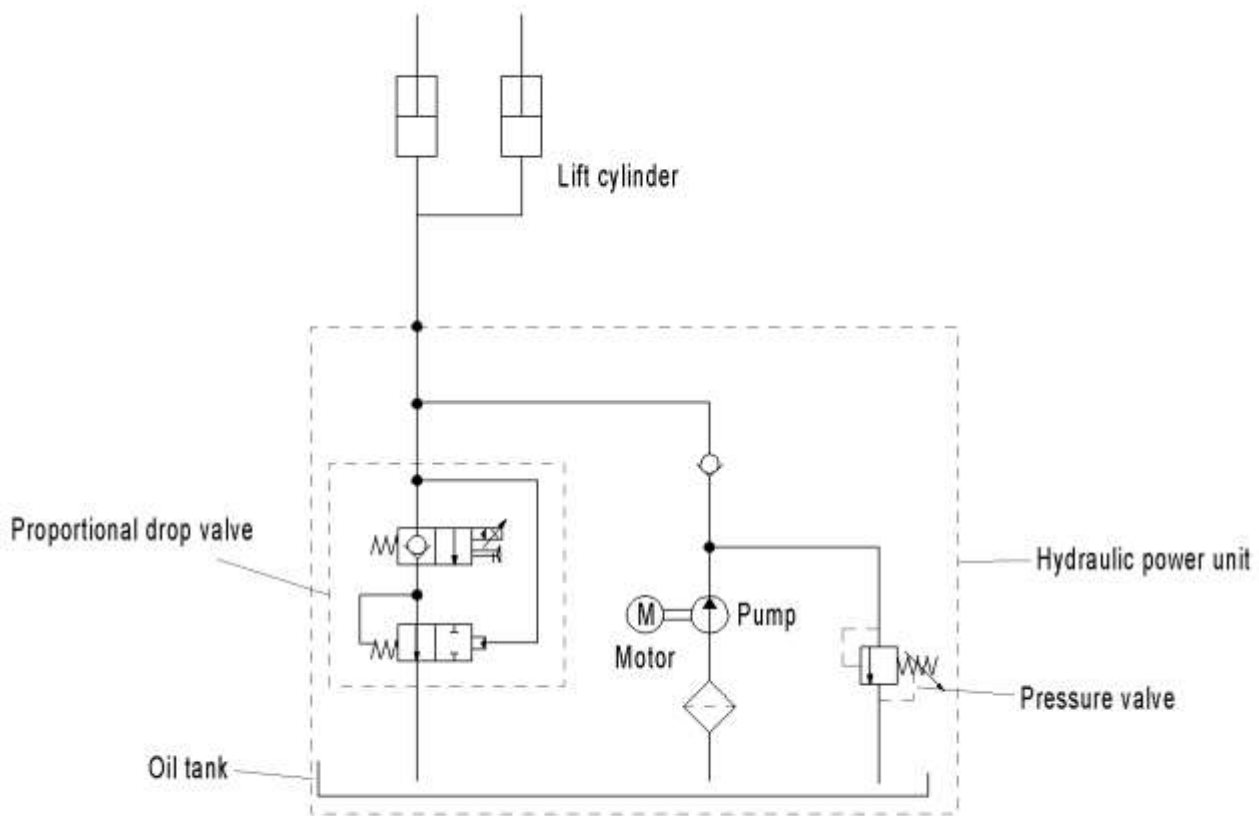
When the following conditions are met, the pump motor runs:

- the key switch is turned on.
- Upper limit switch closing
- handle rising-switch closed
- pump contactor suction

9.1 Hydraulic circuit



Hydraulic circuit of PS12N



Hydraulic circuit of PS16/20N

9.2 Disassembly of pump motor

1. Disconnect pump motor B+ /B- terminal cable.
2. Disconnect hose from hydraulic pump.
3. Remove fixing bolt between pump motor and pump, then remove motor.
Installation torque: $55 \pm 10 \text{ n.m}$ ($40 \pm 7 \text{ lb.ft}$).
4. Install pump motor in reverse order.
5. Add hydraulic oil to tank according to specifications given in manual.

9.3 Replace pump motor brush



1. Unscrew the bolt with a 10mm open wrench



2. Remove the cover



4. Unscrew the screw with a cross screwdriver and take out the carbon brush and replace it.
Installation process and the inverse process of the above process.

9.4 Replace oil seal of lifting cylinder



1. Remove the cylinder head with a crescent wrench



2. Remove piston, then remove retaining ring



4. Remove dustproof seal and shield ring and Y-type seal



5. Remove o-seal and shield ring, then repair hose . Installation way is in reverse sequence

9.5 Hydraulic motor fault

Breakdown	Reason
Hydraulic motor doesn't work	<p>Bad connection or fuse burning. Check the battery connection. Check the key fuse. Check if hydraulic pump motor is likely to cause fuse burning.</p>
	<p>The key switch or pump station contactor is not turned off. Turn off the key switch. Check the power of pump station contact coil and pump station contactor with multimeter. Check the voltage output and upper limit switch of pin-4 in the meter. The key switch must be turned off, the rising button and the pump station connector ,then make the power steering function run.</p>
	<p>Insufficient voltage. Charge or replace batteries. Check for one or more defective battery cells in battery. Check cable terminals are tightly aligned with battery terminals and control panel connectors. Check cable internal wires are broken.</p>
	<p>The lift and drive system is not operating correctly.</p>
The battery will not continue to work properly	<p>The battery installed on the vehicle is too small. According to the working hours, choose the appropriate battery capacity.</p>
	<p>The battery is not fully charged during the battery charging operation. Check if battery is balance-charging (charging makes the proportion of all batteries is the same). Check if battery charger defects</p>
	<p>The battery charging interval is too long or the rechargeable battery cooling time is too short. Reduce battery duration. Please extend the cooling time of the battery before it can be put into use.</p>
	<p>Batteries have one or more defective battery cells, which may result in lower rated capacity and battery</p>

	<p>capacity.</p> <p>Test and identify defective cells. Replace defective cells.</p> <p>Battery units are connected in series. A bad battery causes high resistance in series with other batteries. This reduces the speed of the motor. This may occur when other batteries are almost fully charged.</p>
	<p>The hydraulic pump motor is overheated.</p>

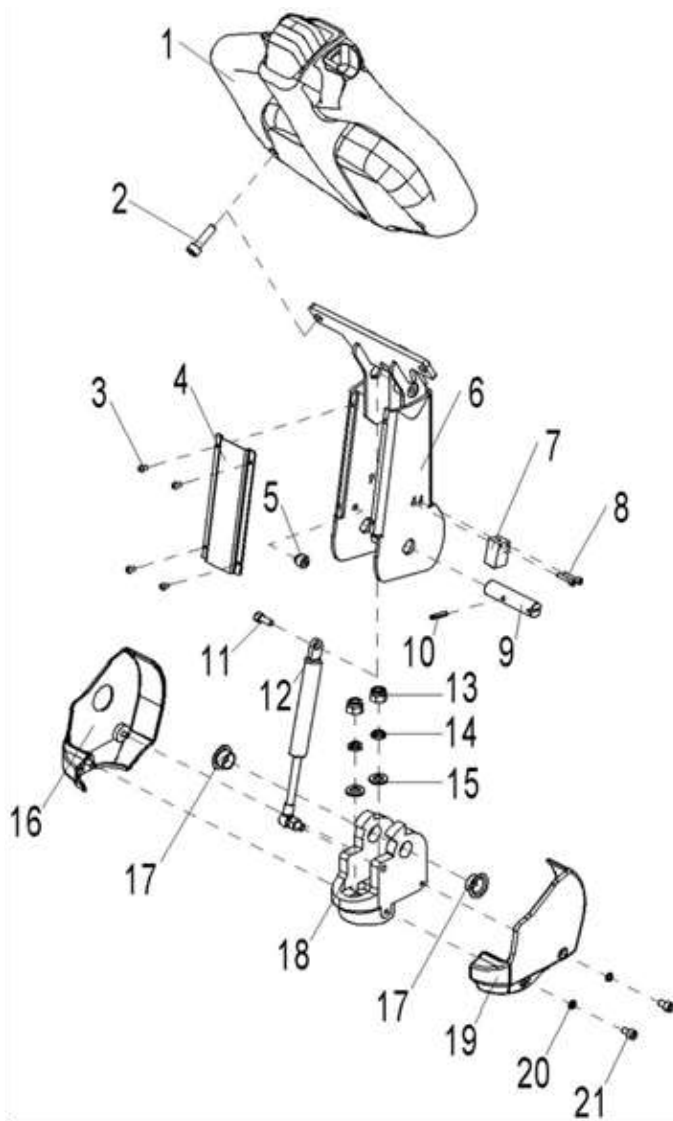
9.6 Hydraulic pump fault

Breakdown	Reason
Pump noise	Low oil level
	oil thick
	limit to the inlet line of the pump
	Worn parts in the pump.
	Oil dirty
	Air leaks into the inlet line
High temperature	Low oil level
	oil channel limited
	Safety valve settings are too low
	Oil thin
	Air leakage in the system
	Pump wear is too high
	The system operates at too high a pressure. The safety valve is too high. Restrictions in flow control valves, check valves and oil routes.
Pump seal oil leakage	Seal is worn
	Pump inside worn
	Too low an oil level in the tank causes the seal to be sucked
	During installation, seal is cut on the shoulder of the pump or keyway.
	Sealed lips dry and hardened by heat.
Pump can't convey hydraulic	Low oil in tank
	Restrictions on the pump inlet pipeline
	air leakage in the inlet pipe. Loose bolts. Defects in the inlet pipe.
	viscosity of the oil is wrong
	Pump worn too much
	pump shaft fault

The bolts of the pump do not have the correct torque

The main safety valve pressure has been adjusted before leaving the factory, and the user is not allowed to adjust and disassemble at will.

10.Tiller



10.1 tiller operate

1. Unscrew the two bolts to remove the proximity switch and replace it



2. Loose bolt , then remove gas spring



3 Replace tiller

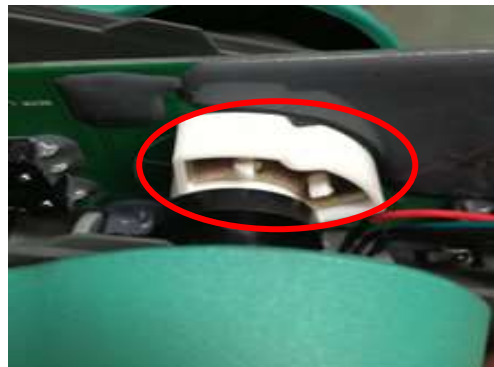


1: loose bolt and remove back cover



2: loose connector

3: loose bolt and remove accelerator cover



4: Remove the switch shaft



5.remove the bolts ,take out connector and replace the board.

11. Mast system

11.1 Disassemble Mast



1.Remove pin



2.Take out pin



3.Remove the fixed bolt on the upside of cylinder



4.Hang up mast



5. Raise tray rack



6. Lower pallet rack



7. Lift the mast and take out tray



11.2 Replace roller

Replace roller after it is broken during working



1. Take out the clip spring



2. Take out shim



3. Take out roller

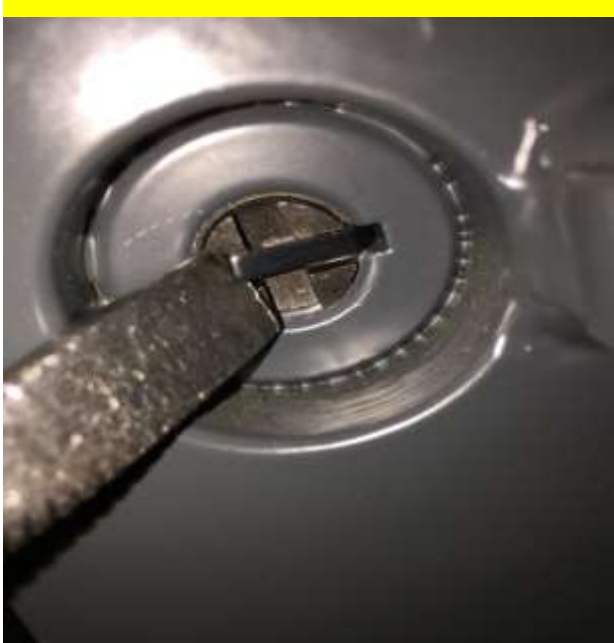




4. Replace the roller

11.3 Adjust roller

The gap between mast will be bigger during working , it needs to be adjusted



1. Remove the fixed pin



2. Use screwdriver to take out of bolt

12.ZAPI programmer

■ Battery

The battery voltage can be used in programmer for pallet. The acid-lead battery voltage is 12V-80V



For batteries with a nominal voltage of more than 80V, the intelligent controller can be powered by an internal battery. Do not connect the source voltage that exceeds the maximum rating, or the controller will be damaged!

Programmer connects

- 1) Wire connects with Zapi , the pic 1 is nuoli-made wire



- 2) Emergency lateral screws to avoid accidental disconnection

3) Zapi connects with Can wire before or when pallet works



4) Red wire connects with positive pole of battery, black wire connects with negative pole of battery



5) Once CN8 get voltage, screen of programmer will show

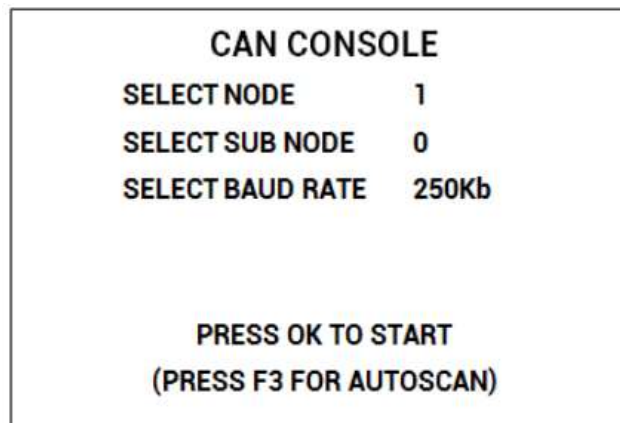
Programmer can access to controller by wire

■ **Screen**

Screen will show as following, LED green will light

**Connecting way : CAN CONSOLE**

Choose CAN CONSOLE, Enter "OK"

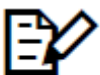


New menu request CAN node and point node connection: current value appears on the right. The third line requests connection speed

Use the up / down key to move between rows and change the value of each item to the left / right.

Once the correct value is set, press ok to try to communicate with the node / Point

SELECT NODE 2 Drive module , SELECT NODE 3 Pump module

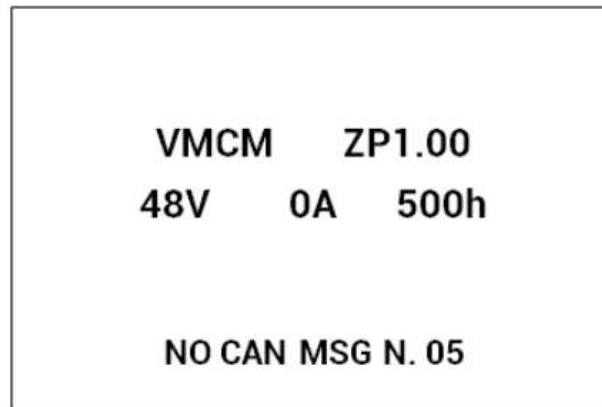


Press "ESC" cancel connecting

If the connection fails, "no communication" warning appears: press the ESC key to find out why the connection is blocked

■ **Connected**

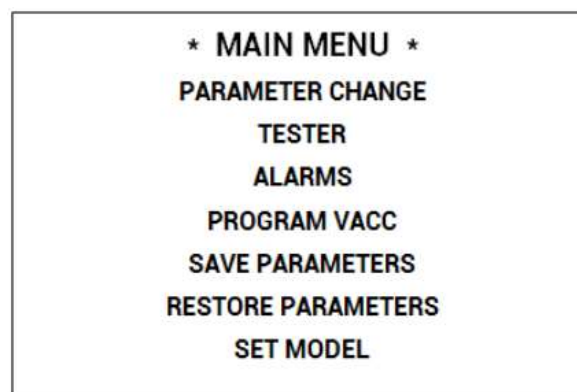
If connecting well, screen will show



This menu presents basic information about the controller, similar to the super controller.

- The first line describes the controller firmware
- The second line presents the controller voltage, the current and the hourly meter
- The last line presents the current alarm code

Press "OK", Enter into main menu



The main menu includes a complete list of menus available. Contrary to the supercontroller, only the controller does not have a hidden menu. The hidden menu needs to be accessed by pressing multiple buttons immediately: now all menus are visible.

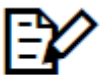
Browse the list using the up and down keys: press "OK" to enter when you find the desired menu.

■ Change parameters

Enter the parameter change menu from the main menu.

PARAMETER CHANGE	
ACCELER DELAY	1.0
E. ACCELER. DELAY	1.5
SPEED LIMIT BRK	2.2
E. SPD. LIMIT BRK	2.2
RELEASE BRAKING	4
E. RELEASE BRAKING	2.5
CURVE BRAKING	3

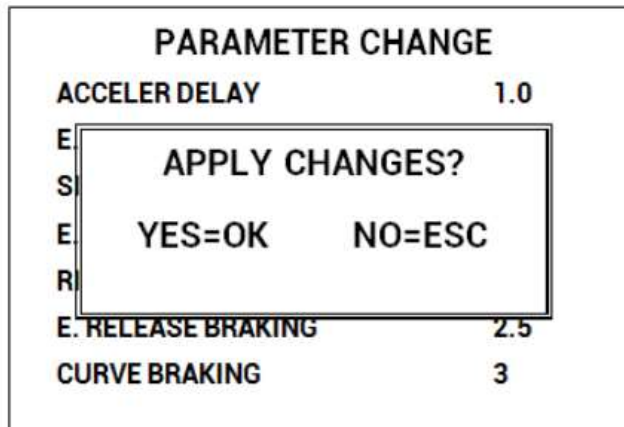
Use up and down keys to scroll through the list: Once you have selected the parameter you want to change, use left or right-click to reduce or increase the parameter value.



Press left/right button to change the value repeatedly.

(" Auto-Repeat "function): If you have to change many parameter values, this function will accelerate the program.

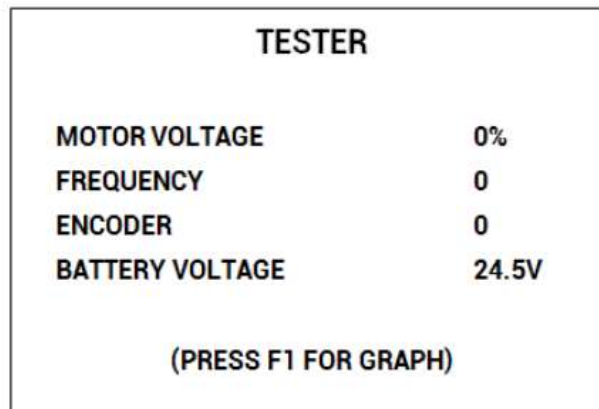
You can press the ESC key at any time to exit the menu. If certain parameters have been changed, the controller prompts for confirmation/delete of the change.



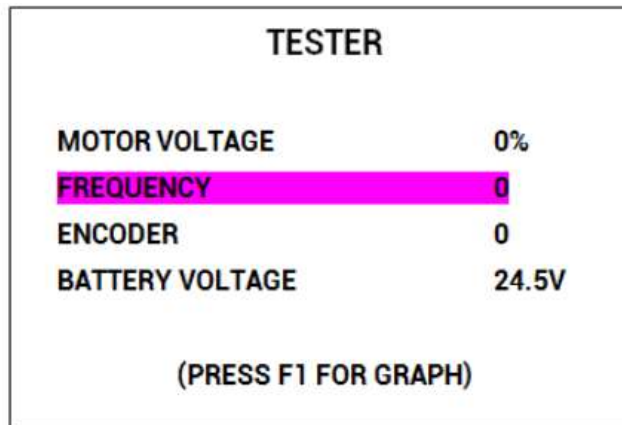
The above instructions are valid for each menu that contains parameters and options such as setting options, adjustments, hardware settings

Tester

Compared with standard handheld, the monitoring menu has changed significantly. Four variables are displayed immediately: scrolling the menu with the up / down keys as usual

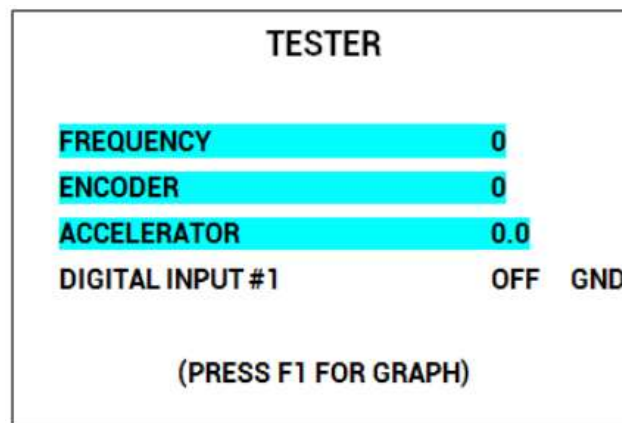


The variable may be “stuck” and then the variable will always appear in the scroll. Once the desired variable is selected, right-click: it will be shown in a different color.



Once you start scrolling up or down again, the "stuck" variable appears on the top first line: from now on, it will no longer move, but will be the current value as usual. "stuck: the variable will be highlighted in light blue.

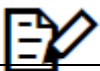
It is possible to repeat the blocking program up to three times, so that when the fourth variable scrolls, three variables are fixed on the screen. See the following example.



Thus, it is possible to record four variables, and in a single view, the four variables in the complete list are far apart.

Press the left button to "unlock" the last locked variable. Pressing the left button up to three times will unlock all variables.

Press ESC to return to the main menu.



Note that pressing F1 activates the graphical representation of the selected variable in excess

of time.



The function of the graphics tester is not yet fully operational: it will be activated in the future firmware.

Alarm

The alarm menu is different from the old handheld programmer. The display immediately presents all alarms of the controller.

ALARMS	
NO CAN MESSAGE	10h
INCORRECT START	2h
NONE	0h
NONE	0h
NONE	0h
F1 TO CLEAR LOGBOOK	



The maximum number of alarm codes stored in the controller is 5

Use different colors to distinguish between recurrent alarm code and rare events. In order of increasing frequency alarm name:

- White: maximum 5 events
- Yellow: maximum 20,
- Orange: maximum 40,
- Red: greater than 40.

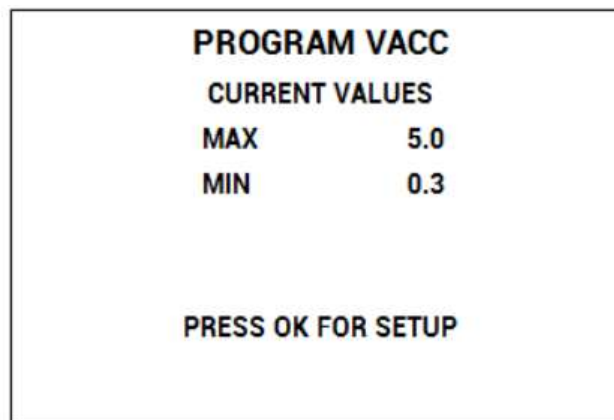
Use the up / down key to select an alarm in the list: if you press OK, additional information about the alarm will be showing.

Press F1 to delete the controller alarm log: when you press button, the controller will request confirmation.

■ Program VACC

Compare with old controller , the menu of Program VACC changes little

As soon as you enter this menu, the controller presents the current set value.



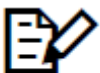
When the ok key is pressed, the program vacc program will start: the controller will invite you to select the boot switch,

Choose start switch

Choose direction switch (forward or backward)

Hold down the pedal until its farthest journey.

The display value varies with the operator's input.



The above order can be slightly changed according to the controller firmware. In any case, the logic is consistent: perform any necessary startup order before setting the minimum / maximum value, and then press the pedal / push lever

PROGRAM VACC		
FORWARD	0.0	4.5
BACKWARD	0.2	4.4
SEL. ENABLE AND DIRECTION THEN PRESS PEDAL (ESC TO FINISH)		

When the ESC is pressed, the controller asks to store or delete the set value.

End of connection

Return to the home screen to end the connection: at this point, the cable may be removed from controller.

If the cable is removed from another menu, the controller returns no communication alarm status.

Controller shutdown

Once the cable is removed, the controller will automatically shut down.

9. Periodic maintenance



- Only qualified and trained personnel are allowed to carry out maintenance work
- Before maintenance, remove the goods from the fork and put down fork to minimum position
- For lifting the vehicle, use the specified binding or lifting equipment in accordance with Chapter IV. Before operation, place the safety device (e.g. specified lifting jack, wedge or wood block) under the car to prevent its accidental falling, moving or sliding
- Pay attention to the maintenance of the handle lever. By compression, the gas pressure spring has been pre-installed. Carelessness may cause injury
- Use approved and dealer-issued original spare parts
- Please consider possible machine failures and accidents caused by leakage of hydraulic oil
- Allow only trained maintenance technician to adjust the pressure valve

If you need to replace the wheel • Please follow the above instructions. The casters must be round and free

from abnormal wear.

Check the key items on the maintenance list.

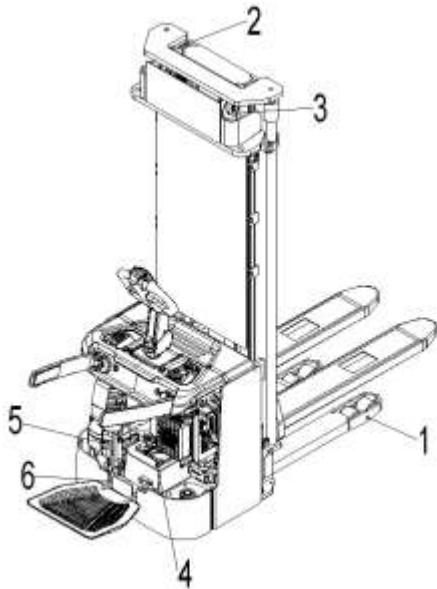
12.Maintenance list

		Intervals (Month)			
		1	3	6	12
Hydraulic system					
1	Check hydraulic cylinder if there is noise and leakage of piston		•		
2	Check hydraulic connectors and tubing if there is damage and leakage		•		
3	Check hydraulic oil level and recharge if necessary		•		
4	Add hydraulic oil after 12 months or 1500 hours of work				•
5	Check and adjust the function of hydraulic valve (1600/2000/2500kg +0/+10%)				•
Mechanical system					
6	Check if there is deformation and damaged on fork		•		
7	Check if there is deformation and damaged in chassis		•		
8	Check if all bolts are tightened		•		
9	Check if push rod is deformation and damaged		•		
10	Check if there is noise and leakage in transmission		•		
11	Check if there is deformation and damaged for tire		•		
12	Steering bearing				•
13	Check and lubricate spindle center points		•		
14	Lubricating grease nozzle	•			
Electrical system					
15	Check if there is wire damaged		•		
16	Check wire connecting		•		
17	Check emergency switch		•		
18	Check if there is noise and damaged in driving system		•		
19	Check monitor		•		
20	Check if correct fuse is used		•		
21	Check warning signal		•		
22	Check contactor		•		
23	Check if frame is leakage (insulation test)		•		
24	Check the function and wear of the drive controller		•		
25	Check the electrical system		•		
Brake system					
26	Check brake function, replace brake shoe or adjust if necessary		•		
Battery					
27	Check battery volatge		•		
28	Check if wiring end is corrosion and damage, lubricate the wiring end		•		

29	Check if battery cover is damaged		•		
Charger					
30	Check if main cable is damage			•	
31	Check startup protection procedures during charging			•	
Function					
32	Check Horn	•			
33	Check electromagnetic valve	•			
34	Check emergency brake	•			
35	Check reverse braking and regenerated braking	•			
36	Check belly button	•			
37	Check steering	•			
38	Check Lift up and down	•			
39	Check proximity switch of tiller	•			
Summary					
40	Check label	•			
41	Check bearing wheel and adjust height , replace if worn out		•		
42	Test one more time	•			

Lubrication

Maintain according to maintenance list. Spec of grease: DIN 51825



- 1 Load roller bearing
- 2 Mast
- 3 Chain
- 4 Hydraulic system
- 5 Steering bearing
- 6 Platform rotating part

Lubricate point

Check and add hydraulic

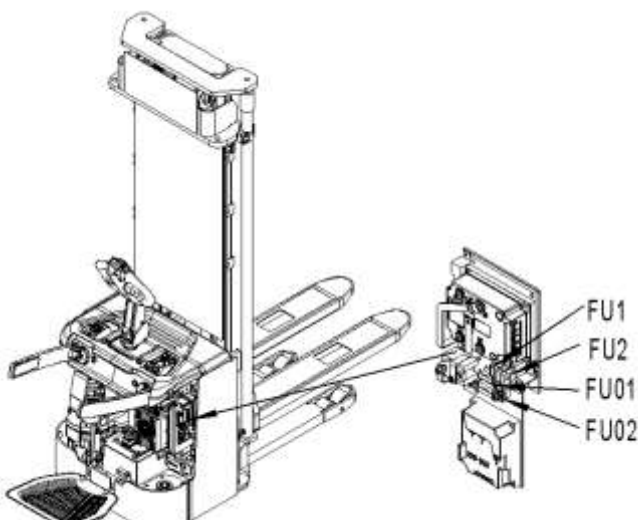
Spec of hydraulic:

- H-LP 46, DIN 51524
- Viscosity: 41.4 - 47

The amount of oil is 0,7L(PT 16/20L) & 1L (PT 25L)

Waste materials such as waste oil, batteries or other materials must be treated and recycled in accordance with national regulations and, if necessary, submitted to the recycling company for recovery. The oil level should not be lower than the minimum amount of fuel required to start the vehicle. Add oil to the filling point if necessary.

Check fuse



Pic 4: Fuse Spec

	Rate
FU1	10A
FU2	10A
FU01	350A
FU02	30A