

Controller & Motor System Solution for off-road Electric Equipment



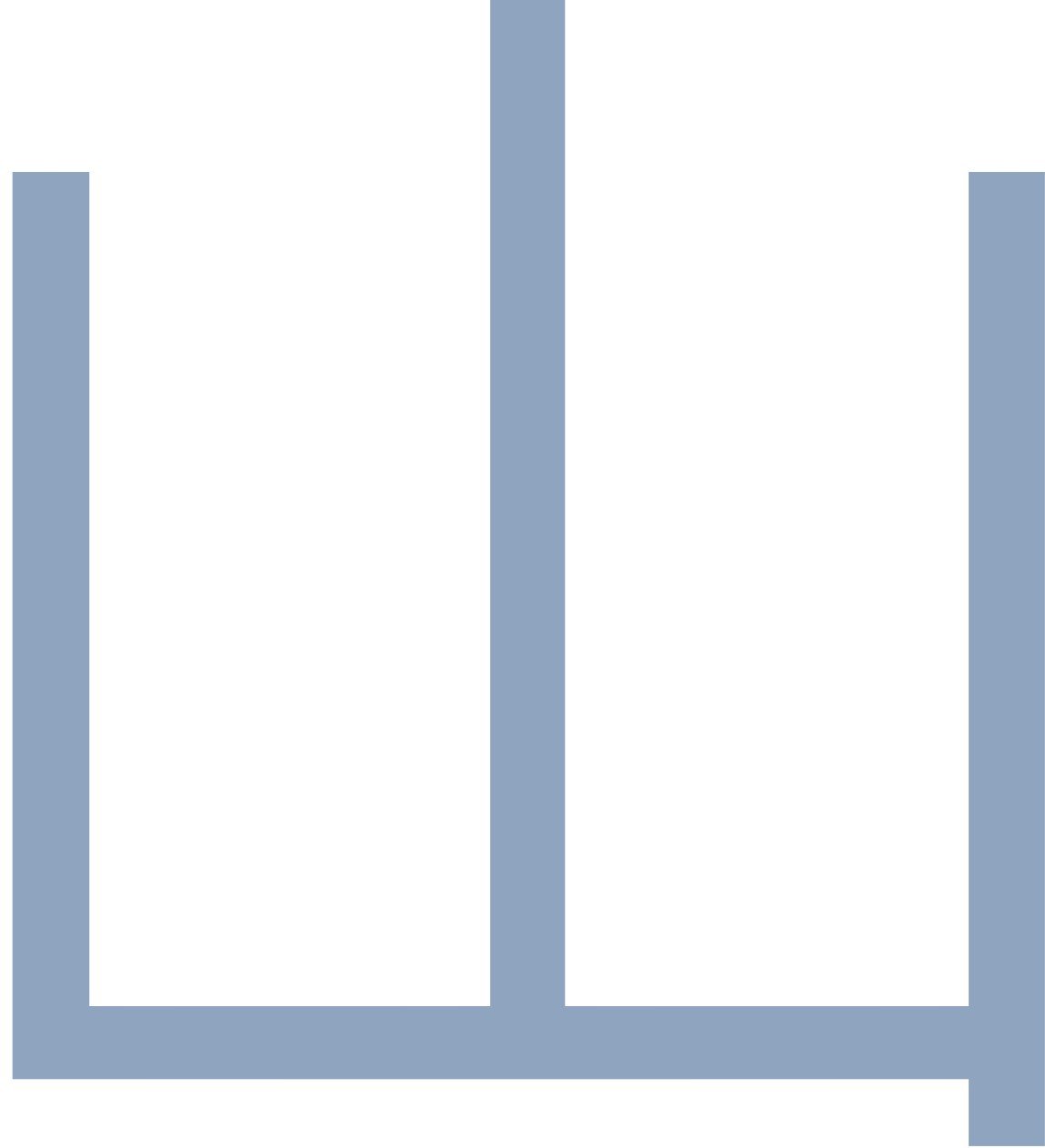
Filium Industries LTD.



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Production Facility





Filium Industries

Controller & Motor System Solution for Off-Road Electric Equipment





Application

- **Electric Garden Tools/equipment**

Electric Garden Tools



Blower



Chainsaw



Grass Trimmer



Hedge Trimmer



Push Mower



Controller



BLDC Motor

Controller & Motor

Controller			
Power	800W	1000W	1200W
Voltage	40V	40V	40V
Current	25A	28A	35A
Communication method	Serial port	Serial port	Serial port /CAN
Working temperature	85°C	85°C	85°C
Control method	BLDC	BLDC	BLDC
IP Level	IP65	IP65	IP65
Applicable blade	17"	19"	21"

BLDC Motor			
Power	800W	1000W	1200W
Voltage	40 - 48V	40 - 48V	40 - 60V
Torque	2.31N.m	2.89N.m	3.47N.m
Peak torque	4.7N.m	6.0N.m	7.0N.m
Speed	3,300rpm	3,300rpm	3,300rpm
Insulation level	F	F	F
Applicable blade	17"	19"	21"



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Electric Ride-on Mower



ZTR



Riding tractor



Driving controller



2 in 1 blade controller



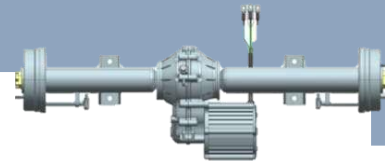
3 in 1 blade controller



Drive-train with gearbox and brake



Blade motor



Transaxle



User interface



Lap bar position hall sensor



Charger

Controller Generation I

Driving controller

Power	1.2KW	1.5KW	2.5KW
Voltage	48V/60V/72V	48V/60V/72V	48V/60V/72V
Current	35A/30A/25A	35A/30A/25A	60A/50A / 45A
Communication method	Serial port / CAN	Serial port /CAN	Serial port /CAN
Working temperature	85°C	85°C	85°C
Control method	BLDC	BLDC	BLDC
IP Level	IP65	IP65	IP65
Applicable blade	21"	24"	26"

Blade controller

Power	1.2KW	1.5KW	2.2KW
Voltage	48V	60V	72V
Current	25A	30A	40A
Communication method	Serial port /CAN	Serial port /CAN	Serial port /CAN
Working temperature	85°C	85°C	85°C
Control method	BLDC	BLDC	BLDC
IP Level	IP65	IP65	IP65
Applicable blade	21"	24"	26"



Controller Generation II



Parameter	Small power single driving controller	Large power single driving controller	Two-in-one controller	Three-in-one controller
Application	Zero turn lawn mower	Zero turn lawn mower	Mower with two blades	Mower with three blades, riding tractor
Rated voltage	DC48 / 72V			
Rated output current	50A	175A	35A X 2	35A X 3
2 minutes output current	100A	350A	100A X 2	100A X 3
10 seconds output current	120A	400A	120A X 2	120A X 3
Driving motor type	Permanent magnet synchronous motor	Permanent magnet synchronous motor / asynchronous motor	Permanent magnet synchronous motor	Permanent magnet synchronous motor
Encoder	HALL / Magnetic encoder	Incremental encoder / magnetic encoder	Non-inductive	Non-inductive / HALL
Input/output	9 channels I/O, 3 channels analog qty/3 channels @2A	14channels, 8channels analog qty / 5 channels @2A	4 channels I/O, 2 channels analog qty	10 channels I/O, 3 channels analog qty / 3 channels @2A
Communication method	CAN, apply boot loader programming for whole equipment			
Working temperature	-40-50°C			
IP level	IP65			
Protection function	Over-voltage / under-voltage / over-current / over-temperature / over-load / locked-rotor / losing phase			
EMC compliance	EN 55014-1、EN55014-2、EN12895 : 2015			
Software compliance	IEC 60730			
Safety function compliance	EN 13849			
Environment protection	CP65、ROSH、REACH			

Motor

Blade motor

Power	1.2KW	1.8KW	2.2KW
Voltage	48 - 72V	48 - 72V	60 - 72V
Torque	3.18N.m	4.80N.m	5.83N.m
Peak torque	7.90N.m	12.0N.m	14.5N.m
Speed	3,600rpm	3,600rpm	3,600rpm
Insulation level	F	F	F
IP Level	IP65	IP65	IP65
Applicable blade	21"	24"	26"

Drive-train with gearbox and brake

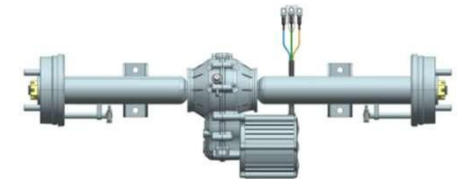
Power	1KW	1.2KW
Voltage	48 - 72V	48 - 72V
Torque	2.51N.m	3.0N.m
Peak torque	5.0N.m	6.0N.m
Speed	3,800rpm	3,800rpm
Insulation level	F	F
IP Level	IP65	IP65

Transaxle

Rated power	1.2KW
Motor type	BLDC
Rated torque	3.18Nm
Rated speed	3,600rpm
IP Level	IP65
Working method	S2 (60mins)
Gear reduction ratio	22:1
Max output torque	300Nm
Braking method	Drum Brake T > 360Nm

Planetary gear box

Power	2.5KW	5KW
Voltage	72V	72V
Torque	5.7N.m	11.4N.m
Max torque	17.1N.m	34.2N.m
Speed	4,200rpm	4,200rpm
Insulation level	F	F
IP Level	IP65	IP65



Advantages of controller & motor

- ☐ **Double chips certification**
- ☐ **Easier to pass EMC test**
- ☐ **Wire harness removal of vehicle**
- ☐ **Easier to adjusting parameter, driving experience through PC interface system**
- ☐ **Use for both consumer and commercial applications**
- ☐ **Higher controller efficiency 93%**
- ☐ **Higher motor efficiency 92% to 94%**
- ☐ **IP65 Rating**

Battery charger



Output power	300W	500W	750W	900W
Output voltage	12V20A/24V10A	24V20A/36V10A/ 48V10A/ 60V8A/72V6A	24V20A/ 48V12A/60V10A/72V8A	24V30A/48V18A/60V15A/72V12A
Power factor	≥0.99	≥0.98	≥0.99	≥0.99
Input voltage	Single phase 90- 264VAC(rated)	Single phase 90- 264VAC(rated)	Single phase 220V±15%	Single phase 220V±15%
Efficiency	92%	93%	≥91%	≥91%
Working temperature	-20°C - 55°C	-20°C - 60°C	-30°C - 60°C (forced air cooling)	-30°C - 60°C (forced air cooling)
IP Level	IP66	IP67	Housing IP66, fan IP55	Housing IP66, fan IP55
Communication method	/	CAN communication	/	/
Output protection	Over-voltage/under-voltage/over-current /short-circuit/over-temperature/battery reversed polarity protection			
Applicable battery	Lead-acid battery /lithium battery			

Battery charger



Output power	1200W	2000W	3300W
Output voltage	24V40A/48V20A/60V15A/72V12A	24V50A/48V35A/60V30A/ 72V25A/80V25A	24V110A/ 36V80A/48V60A/72V40A/96V25A/ 144V20A/200-430V10A
Power factor	≥0.99	≥0.98	≥0.99
Input voltage	Single phase 90-264Vac	Single phase 180-260VAC	Single phase 90-264VAC(rated)
Efficiency	≥94%	≥93%	≥95%
Working temperature	-20°C - 85°C (forced air cooling)	-30°C - 60°C (forced air cooling)	-20°C - 85°C
IP Level	IP67	Housing IP66, fan IP55	IP67
Communication method	CAN communication	CAN communication	CAN communication/485 communication
Output protection	Over-voltage/under-voltage/over-current /short-circuit/over-temperature/battery reversed polarity protection		
Applicable battery	Lead-acid battery/lithium battery	Lead-acid battery/lithium battery	Lead-acid battery /lithium battery/super capacitor

Lap Bar Position Hall Sensor



Model	TJ563A-1	TJ563C	TJ563B	TJ563
Linear degree	≤1.5%	≤1.5%	≤1.5%	≤1.5%
Working voltage	DC 5V±2%	DC 5V±2%	DC 5V±2%	DC 5V±2%
Working current	≤10mA	≤10mA	≤10mA	≤10mA
Working temperature	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Storage temperature	-50°C to 105°C	-50°C to 105°C	-50°C to 105°C	-50°C to 105°C
IP Level	IP67	IP67	IP67	IP67
Starting voltage	0.3±0.05V	0.1±0.03V	0.2±0.05V	0.8±0.1V
Middle voltage	2.4±0.05V	2.45±0.05V	2.04±0.05V	/
Ending voltage	4.5±0.1V	4.8±0.1V	4.8±0.1V	4.3±0.2V
Application	Greenworks zero turn lawn mower	Ryobi zero turn lawn mower	Ryobi zero turn lawn mower	Greenwroks zero turn lawn mower

Lap Bar Position Hall Sensor

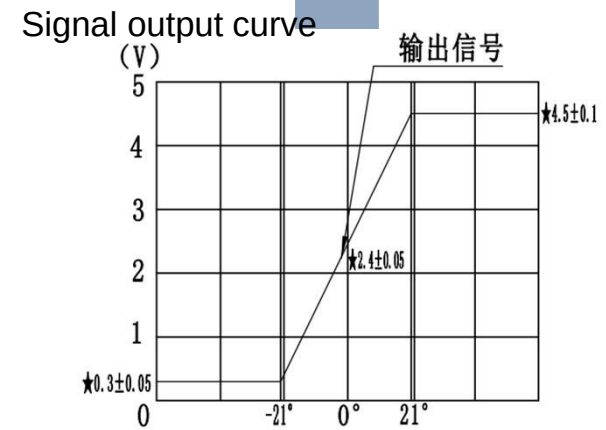
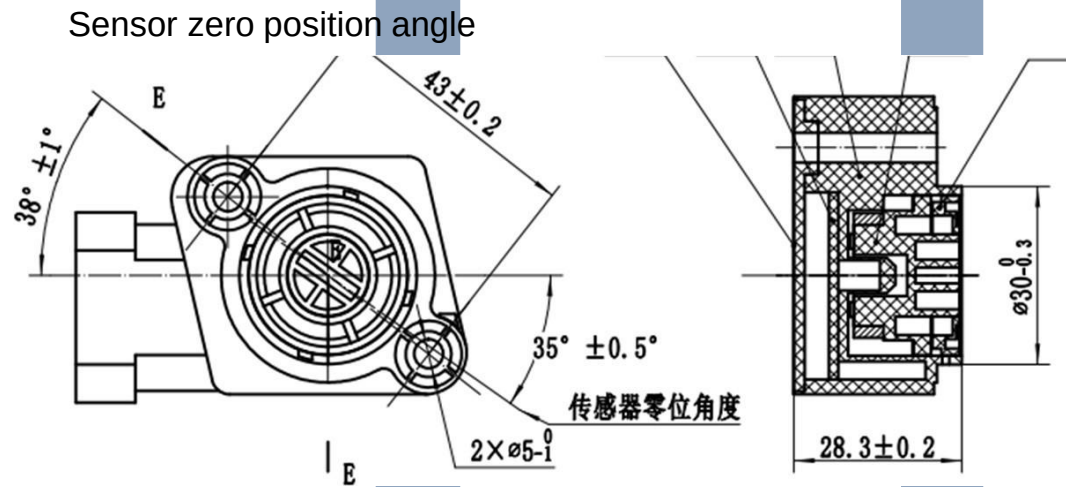
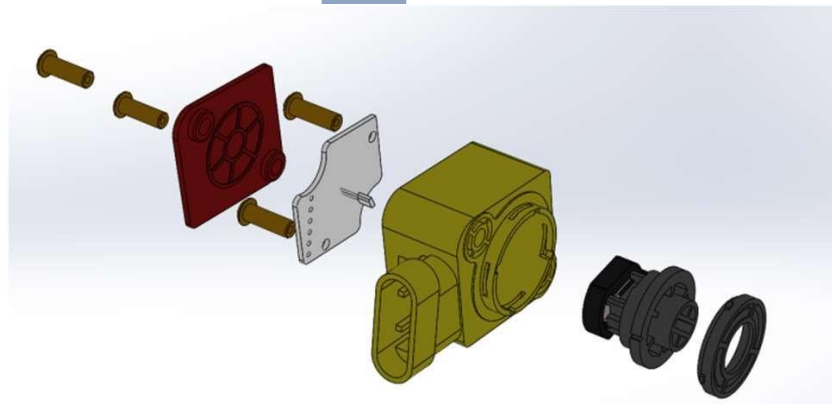


图1 信号输出曲线

Exploded view of sensor



User Interface



CAN user interface



CAN user interface



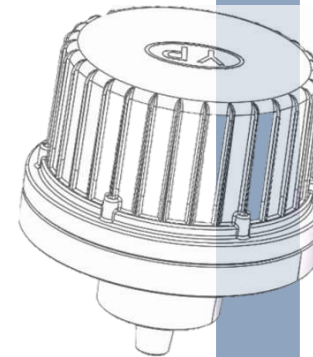
Electric sweeper



Electric sweeper



Controller



Motor

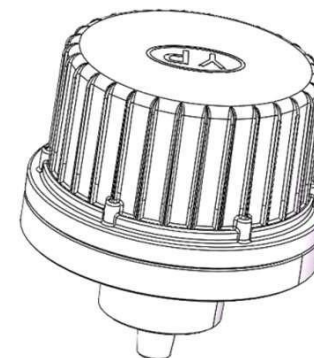
Controller & motor

Controller

Power	1.7KW	3KW
DC voltage	48V	48V
Rated current	45amp	75amp
Max current	90amp (60s)	150amp (60s)
Driving method	FOC	FOC
Working temperature	-45°C to 105°C	-45°C to 105°C

Motor

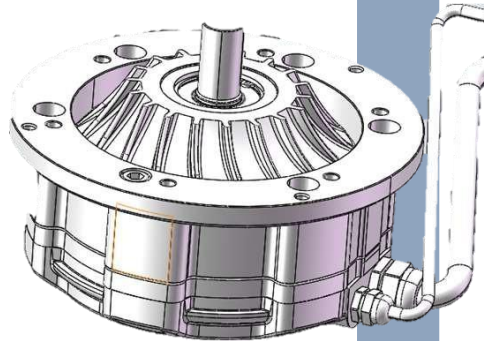
Power	1.7KW	3KW
Voltage	48V	48V
Speed	500 to 3,000rpm	500 to 3,000rpm
Ratio	10:1	10:1
IP Level	IP66	IP66



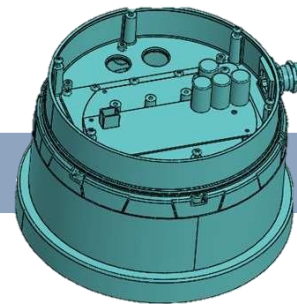
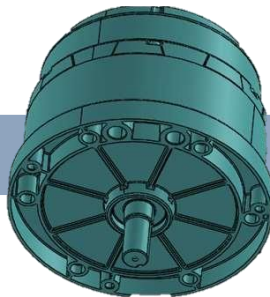
Electric high pressure washer



Electric high pressure washer



Permanent magnet synchronous motor & controller

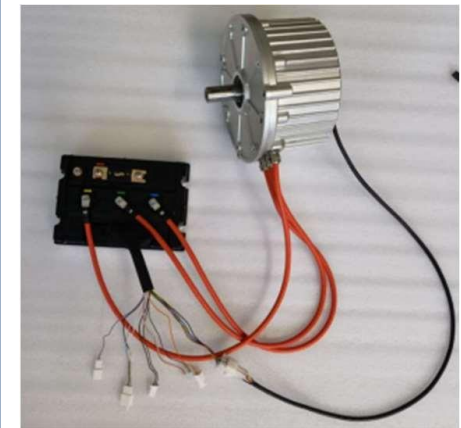


Motor with controller integration

Controller & motor

Controller		
Power	1.8KW	4KW
Max current	15 amp	80 amp
Driving method	Non-inductive control	Non-inductive control
Working temperature	-45°C to 105°C	-45°C to 105°C
Protection function	Current-limit, speed-limit, over-voltage, over-current and locked-rotor	

BLDC Motor		
Power	1.8KW	4KW
Voltage	120V AC	60V AC
Speed	3,400rpm	3,400rpm
Max current	15 amp	80 amp
IP Level	IP65	IP65



Garden Industry Customers





Application

- commercial vehicle & recreational vehicle**

Controller & motor



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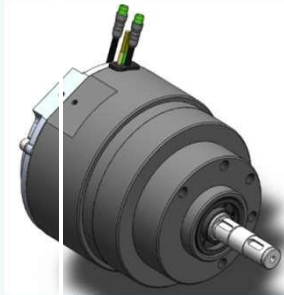
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Controller



2 minutes power	48V/90A 72V/70A	24V/280A 48V/240A 80V/160A	48V/450A 80V/300A	80V/450A 96V/450A
60 minutes power	48V/35A 72V/30A	24V/150A 48V/80A 80V/60A	48V/175A 80V/135A	80V/175A 96V/175A
Driving motor	BLDC motor / PMSM	Asynchronous motor / PMSM	Asynchronous motor / PMSM	Asynchronous motor / PMSM
Encoder	Hall-free induction / Hall / Magnetic encoder	Incremental encoder / Magnetic encoder	Incremental encoder / Magnetic encoder / rotary encoder	Incremental encoder / Magnetic encoder / rotary encoder
MOSFET quantity	1*6	2*6	4*6	6*6
Dimension (mm)	150*95*54	155*120*53	180*140*75	212*155*78

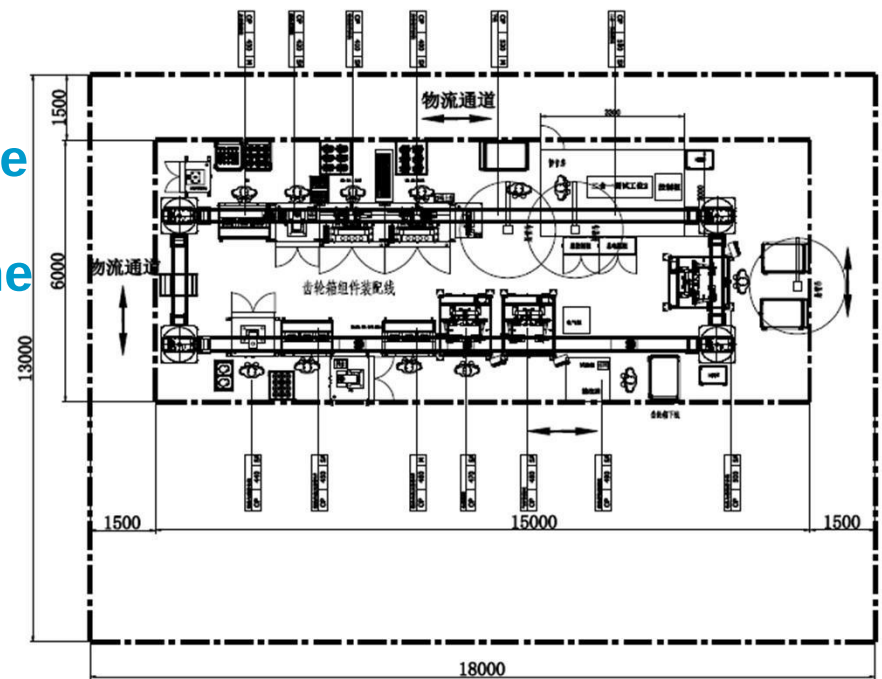
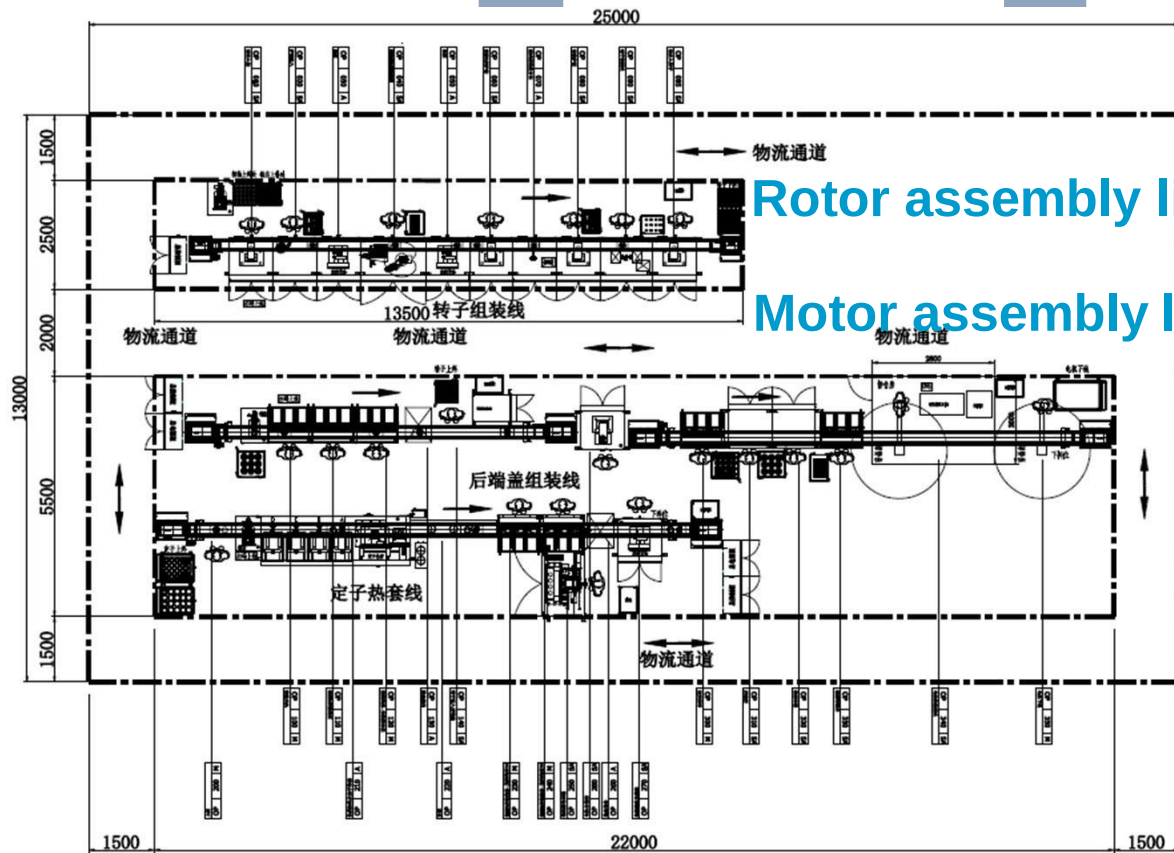
Motor



Motor type	PMSM	PMSM	PMSM	PMSM
Rated power	1,000W - 1,500W	2,200W - 4,500W	5,000W - 10,000W	11,000W - 20,000W
Rated voltage	48V DC	48V DC	48V DC / 80V DC	80V DC / 96V DC
Lamination stack outer diameter	110mm	150mm	180mm	200mm
Encoder	Hall-free induction / Hall / Magnetic encoder	Hall-free induction / Hall / Magnetic encoder	Magnetic encoder / rotary encoder	Magnetic encoder / rotary encoder
Rated speed	2700rpm/3000rpm/3600rpm	3000rpm/3600rpm/4300rpm	3000rpm/3600rpm/4300rpm	3000rpm/3600rpm/4300rpm

Capacity

Motor workshop layout and full automatic assembly line



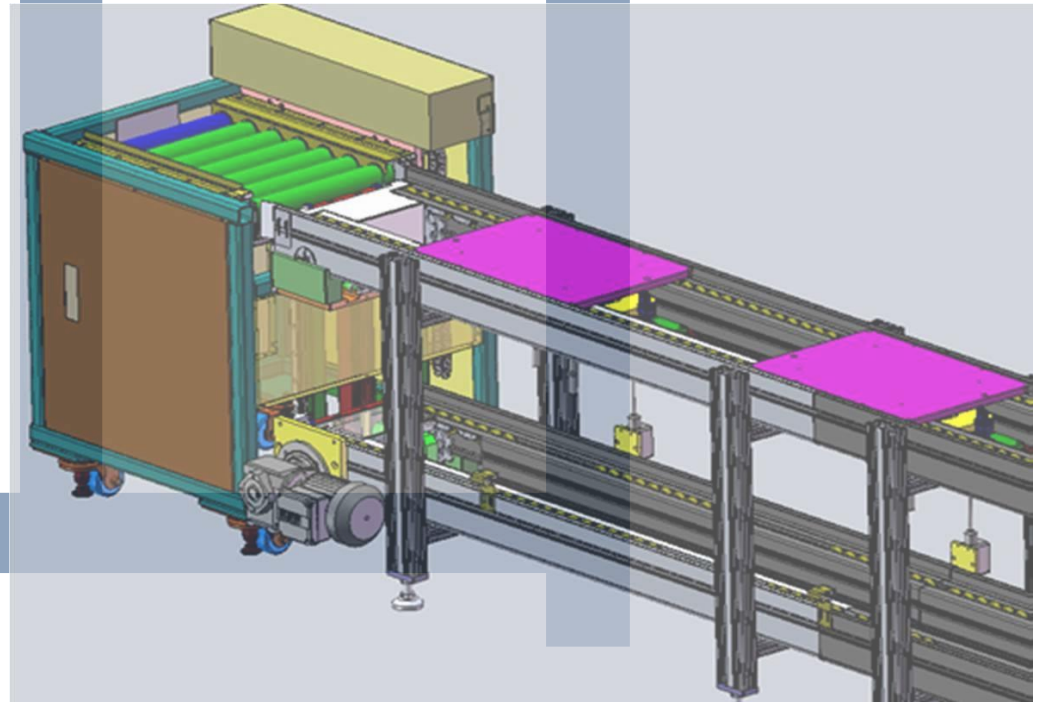
Gearbox assembly line

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Capacity

Controller workshop layout and full automatic assembly line



Capacity

- **Equipment cycle time: ≤ 60 seconds/piece, capacity 60pcs/hour**
- **Product percent of pass: $\geq 99.5\%$**
- **Equipment combined efficiency: $\geq 85\%$**
- **Applicable to all the kinds of controller & motor**

Product	Capacity / hour / line	Production line	Capacity / hour	Working period	Daily capacity	Monthly capacity	Yearly capacity
Motor	60pcs	1	60pcs	20 hours	1,200pcs	28,800pcs	345,600pcs
Controller	36pcs	2	72pcs	20 hours	1,440pcs	34,560pcs	414,720pcs



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