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INOVANCE



MAH Series DDL Motors

Minimal force ripples Low noise High force density



FORWARD, ALWAYS PROGRESSING

About Us

Shenzhen Inovance Technology Co., Ltd. (stock code: SZ.300124) was founded in 2003 and has a current stock market value of about RMB 160 billion. Inovance is the key force in developing industrial automation and drive technologies in China and a provider of optical-mechatronics-hydraulic-pneumatic integrated solutions covering drive, control, motor, and precision machineries.

Inovance achieved an annual revenue of RMB 17.943 billion and an operating profit of RMB 3.573 billion in 2021, which grew by 56% and 70% respectively on a YoY basis. Headquartered in Shenzhen, Inovance has established multiple production bases in Suzhou, Changzhou, Yueyang, and Nanjing, as well as subsidiaries, resident offices, and service centers in over 20 countries and regions worldwide. As of 2021, Inovance has obtained 2,186 patents and software copyrights. Through continuous investment in R&D, Inovance has enhanced its technical strength in such fields as motor and drive control, industrial control software, electric drive assembly for new energy vehicles, digitalization, and industrial robots.

Inovance is dedicated to the development of core technologies in motor drive and control, power electronics, and industrial Internet communication, with business covering industrial automation, elevator electrical accessories, new energy vehicles, industrial robots, and rail transit. Inovance aims to provide integrated solutions and industry-tailored products based on various industry needs, creating continuous values for customers.

The core technologies of Inovance not only covers the information layer, control layer, drive layer, execution layer, and perception layer, but also covers such fields as industrial automation, elevator, new energy vehicle, and rail transit, including:

- ① high performance vector control technology, servo control technology, and high-power IGBT drive technology in the drive layer;
- ② small- to large-scale PLC technology, CNC control technology, robot control technology, and high-speed bus technology in the control layer;
- ③ high-performance servo motor technology, high-efficiency motor technology, high-speed motor and magnetic levitation bearing technology, high-precision encoder design and process technology, precision transmission machine design and process technology, and image recognition technology in the execution layer;
- ④ industrial Internet, edge computing, industrial AI technology in the information layer; and
- ⑤ process technologies in industries including new energy vehicle, elevator, air conditioner, air compressor, 3C manufacturing, lithium battery, silicon, crane, injection molding machine, textile, metal product, printing, and packaging.

Inovance has been listed into "CCTV Top 10 Socially Responsible Corporate in Top 50 Listed Companies in China" in 2017, "National Enterprise Technology Center" in 2021, "First Batch of Postdoctoral Workstation in Shenzhen", "Top 100 Innovative Enterprises in Jiangsu", "First Batch of Key R&D Projects in Intelligent Robot in China", and "New Energy Vehicle Power Assembly Engineering Center in Jiangsu".

67 offices in China **400** authorized distributors **2500+** sales and service staff
1020 service centers **6** inventory centers

A comprehensive service network to offer timely response to customer demands



Headquarters in Shenzhen

Headquartered in Shenzhen, with multiple subsidiaries in major cities such as Suzhou and Hong Kong.

Preface

With solid strength in research and development, Inovance empowers servo systems with combination of advanced servo software algorithms, servo hardware design techniques, motor design and manufacturing techniques, and electrical-optical-mechanical integration technology for encoders. In this way, Inovance provides a guaranteed platform for creating outstanding servo products.

The MAH series direct drive linear (DDL) motors are specially designed by Inovance for digital spray printing equipment. They feature minimal force ripples, low noise, and high force density.



Servo drive

Cutting-edge servo products developed leveraging the ETC performance algorithm and the company's accumulated strengths in hardware and software of electrical and electronic products through years of efforts by the servo product team comprising two doctoral degree holders and over 30 master's or bachelor's degree holders



Linear motor

Cost performance of motor designs guaranteed by the Ansoft electromagnetic simulation and ANSYS Mechanical dynamics simulation technologies, and process quality controlled with international management practices to provide reliable and high-performance products



Optical encoder

Linear optical encoders specially developed for servo products by Inovance in collaboration with Changchun Weton Optoelectronic Technology Co., Ltd., featuring high precision, easy use, and excellent resistance to vibration, high temperature, and interference to ensure the overall performance of your servo system when used as a perfect match with servo motors and drives from Inovance



ZEISS precision measurement system



Automated SMT line

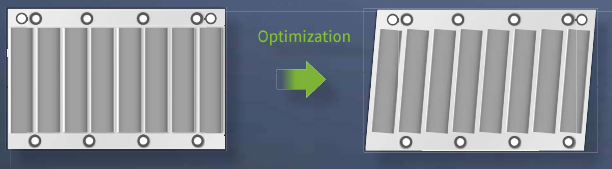


Encoder production line

Product Features

Structure

In the MAH series motors, the rotor is designed with a **convex structure** to make the motor lightweight and enhance force density. The stator is designed with **skewed poles**, which significantly mitigate the cogging effect and reduce the cogging force of the motor. This design reduces the sawing-like noise produced due to the cogging force during high-speed motor operation, realizing **quiet operation**.



Temperature rise

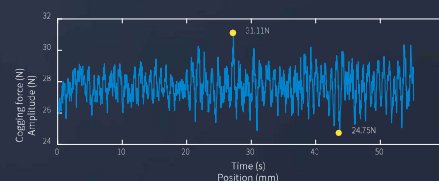
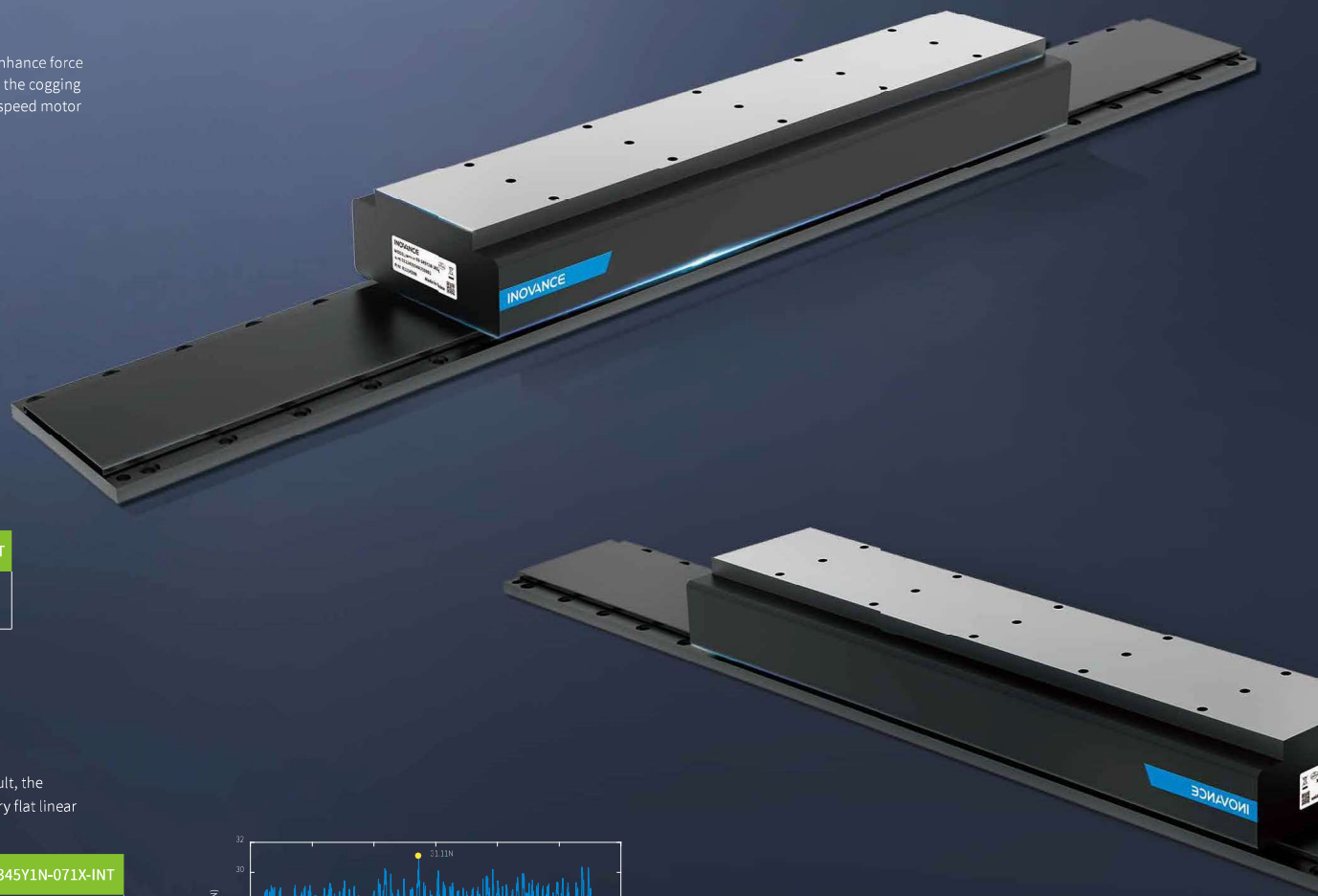
The MAH series motors are designed with low thermal load to minimize winding heating and motor winding temperature rise. The **winding temperature rise of our motors is less than 45 K** when the travel distance is 1 m and the speed is 2 m/s. This satisfies the requirements for long-time reliable motor operation.

Model	MAH1-60-345Y1N-071X-INT	MAH1-90-345Y1N-071X-INT	MAH1-120-345Y1N-071X-INT
Temperature rise (K)	31.1	43.5	44.5

Cogging force and noise

The stator and iron core structures of the MAH series motors are optimized through joint simulation. As a result, the cogging force accounts for only **1.3%** of the continuous force, a significant reduction compared with ordinary flat linear motors. This effectively diminishes the noise caused by cogging force during high-speed motor operation.

Model	A Competitor	MAH1-60-345Y1N-071X-INT	MAH1-90-345Y1N-071X-INT	MAH1-120-345Y1N-071X-INT
Noise level (dB) (2 m/s@1 μ m magnetic scale)	76.9	72.6	73.6	73.0



Product Information

Motor Technical Data

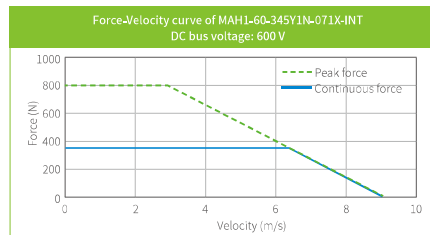
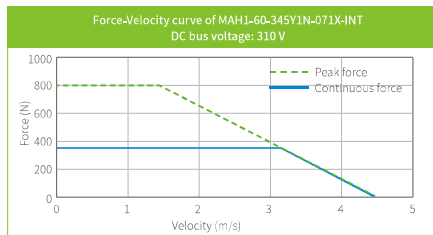
MAH1-60-345Y1N-071X-INT	Symbol	Unit	
Rated Performance			
Continuous force @Tmax	Fc	N	350
Peak force	Fp	N	800
Motor constant @25°C	Km	N/sqrt (W)	33.7
Max coil temp	Tmax	°C	120
Max cont. power diss	Pc	W	140
Electrical Specifications			
Winding topology			Y1
Continuous current @Tmax	Ic	Arms	4.5
Peak current	Ip	Arms	15
P-P resistance @25°C ±10%	RL-L	Ohms	3.5
P-P inductance ±20%	LL-L	mH	50
P-P back EMF @25°C ±10%	KeL-L	V/m/s	65
Force constant @25°C ±10%	Kf	N/Arms	77.8
Electrical cycle time	Te	ms	14.3
Max bus voltage	Vbus	VDC	600
Mechanical Specifications			
Rotor mass	Mc	kg	3.8
Magnetic stator mass	Mw	kg/m	3
Magnetic pole pair pitch	Dp	mm	32
Magnetic attraction	Fa	kN	2.1
Magnetic stator type	MALH1-60-64G, MALH1-60-128G, and MALH1-60-384G		

Notes:

Ambient temperature: 0°C to 40°C (non-freezing) for operation; -20°C to +40°C for storage (non-freezing)

Ambient humidity: 20% to 85% (non-condensing) for operation; 20% to 93% (non-condensing) for storage

Motor Force-Velocity Characteristic Curves



Motor Technical Data

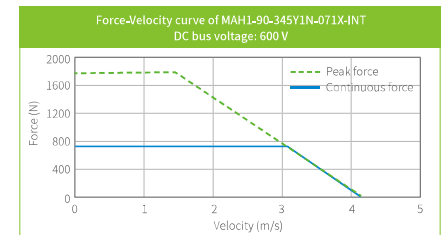
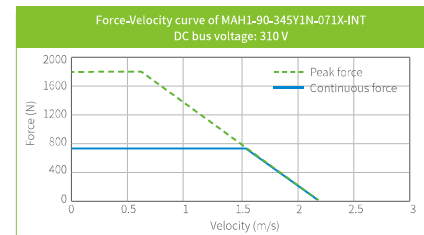
MAH1-90-345Y1N-071X-INT	Symbol	Unit	
Rated Performance			
Continuous force @Tmax	Fc	N	750
Peak force	Fp	N	1750
Motor constant @25°C	Km	N/sqrt (W)	58.0
Max coil temp	Tmax	°C	120
Max cont. power diss	Pc	W	220
Electrical Specifications			
Winding topology			Y1
Continuous current @Tmax	Ic	Arms	4.5
Peak current	Ip	Arms	15
P-P resistance @25°C ±10%	RL-L	Ohms	5.5
P-P inductance ±20%	LL-L	mH	85.9
P-P back EMF @25°C ±10%	KeL-L	V/m/s	141
Force constant @25°C ±10%	Kf	N/Arms	166.7
Electrical cycle time	Te	ms	15.6
Max bus voltage	Vbus	VDC	600
Mechanical Specifications			
Rotor mass	Mc	kg	6.6
Magnetic stator mass	Mw	kg/m	5
Magnetic pole pair pitch	Dp	mm	32
Magnetic attraction	Fa	kN	4.2
Magnetic stator type	MALH1-90-64G, MALH1-90-128G, and MALH1-90-384G		

Notes:

Ambient temperature: 0°C to 40°C (non-freezing) for operation; -20°C to +40°C for storage (non-freezing)

Ambient humidity: 20% to 85% (non-condensing) for operation; 20% to 93% (non-condensing) for storage

Motor Force-Velocity Characteristic Curves



Motor Technical Data

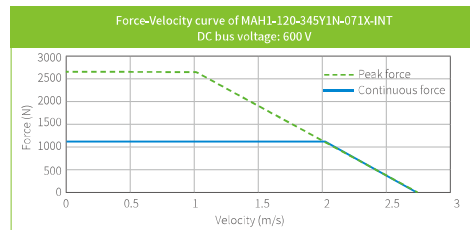
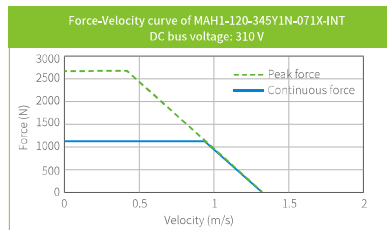
MAH1-120-345Y1N-071X-INT	Symbol	Unit	
Rated Performance			
Continuous force @Tmax	Fc	N	1125
Peak force	Fp	N	2650
Motor constant @25°C	Km	N/sqrt(W)	74.5
Max coil temp	Tmax	°C	120
Max cont. power diss	Pc	W	299
Electrical Specifications			
Winding topology	-	-	Y1
Continuous current @Tmax	Ic	Arms	4.5
Peak current	Ip	Arms	15
P-P resistance @25°C ±10%	RL-L	Ohms	7.5
P-P inductance ±20%	LL-L	mH	121
P-P back EMF @25°C ±10%	KeL-L	V/m/s	216
Force constant @25°C ±10%	Kf	N/Arms	250
Electrical cycle time	Te	ms	16.1
Max bus voltage	Vbus	VDC	600
Mechanical Specifications			
Rotor mass	Mc	kg	9.4
Magnetic stator mass	Mw	kg/m	7
Magnetic pole pair pitch	Dp	mm	32
Magnetic attraction	Fa	kN	6.9
Magnetic stator type	MALH1-120-64G, MALH1-120-128G, and MALH1-120-384G		

Notes:

Ambient temperature: 0°C to 40°C (non-freezing) for operation; -20°C to +40°C for storage (non-freezing)

Ambient humidity: 20% to 85% (non-condensing) for operation; 20% to 93% (non-condensing) for storage

Motor Force-Velocity Characteristic Curves



Motor Technical Data

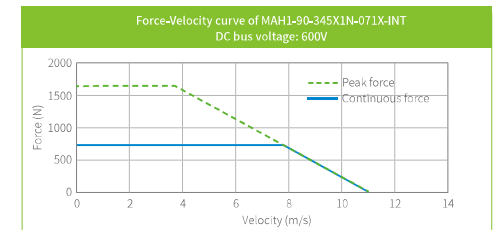
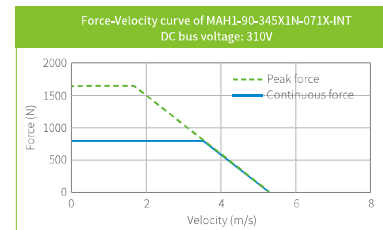
MAH1-90-345X1N-071X-INT	Symbol	Unit	
Rated Performance			
Continuous force @Tmax	Fc	N	750
Peak force	Fp	N	1650
Motor constant @25°C	Km	N/sqrt(W)	40.8
Max coil temp	Tmax	°C	120
Max cont. power diss	Pc	W	443.8
Electrical Specifications			
Winding topology	-	-	X1
Continuous current @Tmax	Ic	Arms	7.8
Peak current	Ip	Arms	23
P-P resistance @25°C ±10%	RL-L	ohms	3.7
P-P inductance ±20%	LL-L	mH	57.3
P-P back EMF @25°C ±10%	KeL-L	V/m/s	81.4
Force constant @25°C ±10%	Kf	N/Arms	96.2
Electrical cycle time	Te	ms	15.6
Max bus voltage	Vbus	VDC	600
Mechanical Specifications			
Rotor mass	Mc	Kg	6.6
Magnetic stator mass	Mw	Kg/m	5
Magnetic pole pair pitch	Dp	mm	32
Magnetic attraction	Fa	KN	4.2
Magnetic stator type	MALH1-90-64G, MALH1-90-128G, and MALH1-90-384G		

Notes:

Ambient temperature: 0°C to 40°C (non-freezing) for operation; -20°C to +40°C for storage (non-freezing)

Ambient humidity: 20% to 85% (non-condensing) for operation; 20% to 93% (non-condensing) for storage

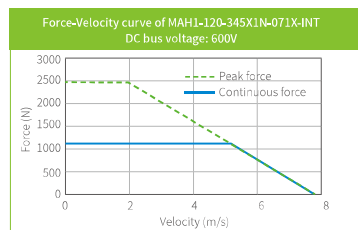
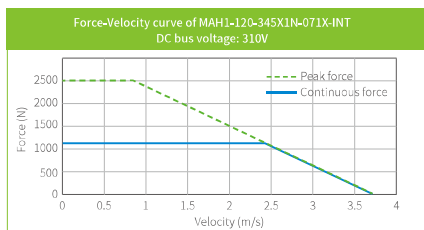
Motor Force-Velocity Characteristic Curves



Motor Technical Data

MAH1-120-345X1N-071X-INT	Symbol	Unit	
Rated Performance			
Continuous force @Tmax	Fc	N	1125
Peak force	Fp	N	2500
Motor constant @25°C	Km	N/sqrt(W)	52.7
Max coil temp	Tmax	°C	120
Max cont. power diss	Pc	W	600
Electrical Specifications			
Winding topology	-	-	X1
Continuous current @Tmax	Ic	Arms	7.8
Peak current	Ip	Arms	23
P-P resistance @25°C ±10%	RL-L	ohms	5
P-P inductance ±20%	LL-L	mH	81
P-P back EMF @25°C ±10%	KeL-L	V/m/s	124.7
Force constant @25°C ±10%	Kf	N/Arms	144.2
Electrical cycle time	Te	ms	16.1
Max bus voltage	Vbus	VDC	600
Mechanical Specifications			
Rotor mass	Mc	Kg	9.4
Magnetic stator mass	Mw	Kg/m	7
Magnetic pole pair pitch	Dp	mm	32
Magnetic attraction	Fa	KN	6.9
Magnetic stator type	MALH1-120-64G, MALH1-120-128G, and MALH1-120-384G		

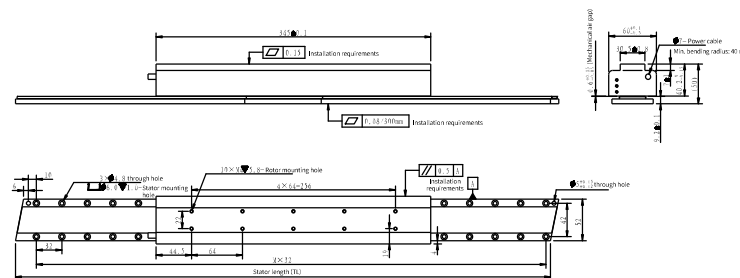
Motor Force-Velocity Characteristic Curves



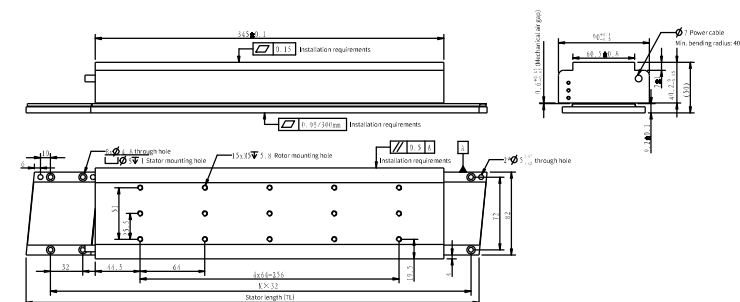
Product Installation

Motor Dimensions

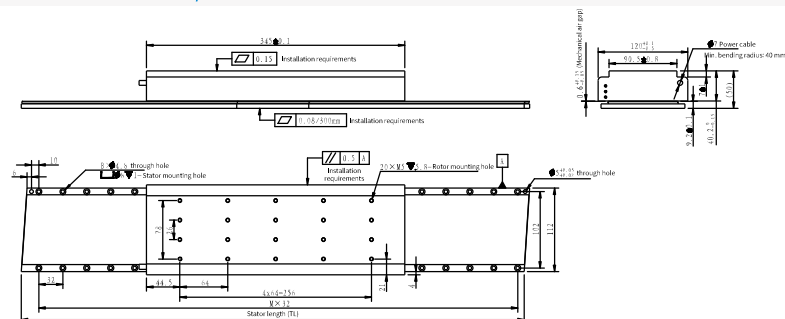
MAH1-60-345Y1N-071X-INT



MAH1-90-345Y1N-071X-INT / MAH1-90-345X1N-071X-INT



MAH1-120-345Y1N-071X-INT / MAH1-120-345X1N-071X-INT

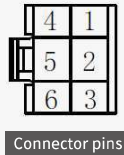


Notes:

- ① See Attachment 1 for flatness inspection standards.
- ② See Attachment 2 for precautions for rotor and stator installation.

Product Installation

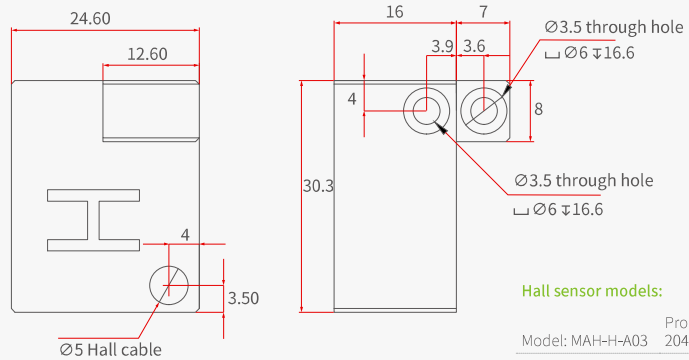
Terminal Pins and Assignment



Wiring:

6-Pin Socket	1	2	4	5
Wire color	Red	White	Black	Yellow/Shield
Assignment	U	V	W	PE
Remarks	/	/	/	Soldered with the shield

Hall Sensor Dimensions

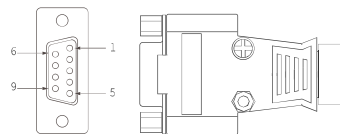


Hall sensor models:

Model: MAH-H-A03	Product No.: 20490270	Lead wire length: 0.3 m
Model: MAH-H-A30	Product No.: 20490271	Lead wire length: 3.0 m

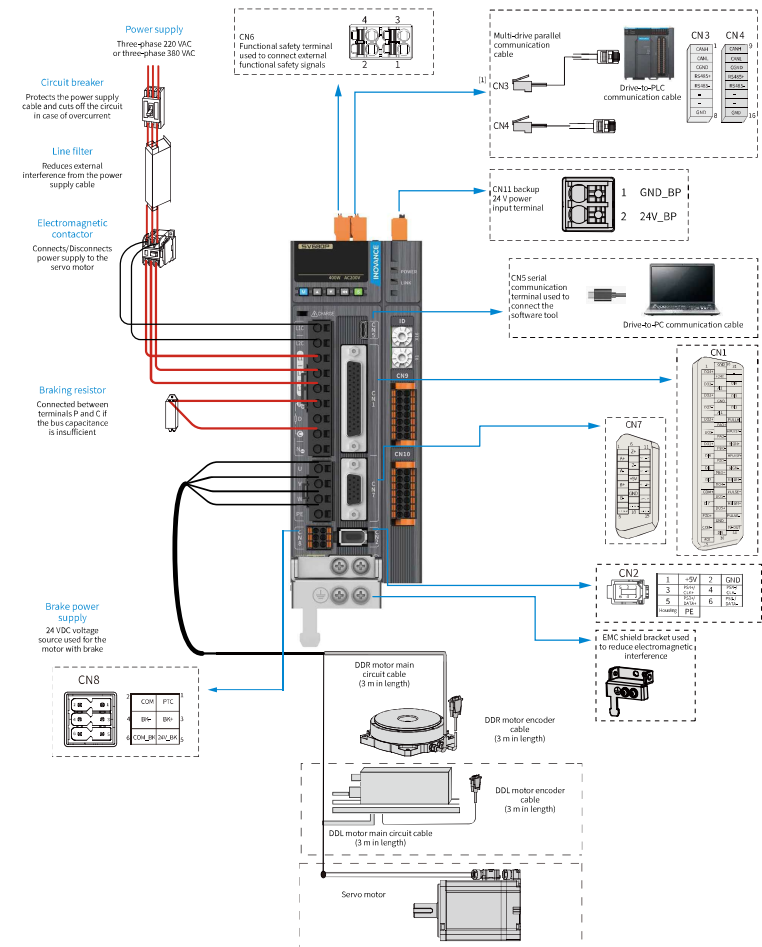
Output Pins

Terminal A	1	2	3	4	5	Enclosure
Wire color	Green	Blue	Yellow	Red	Black	Shield
Assignment	U+	V+	W+	+5V	GND	/



Product Wiring

Connection Between the DDL Motor and Peripheral Devices



Note 1: To install a braking resistor, remove the jumper between terminals P and D on the servo drive.

Note 2: The motor power cable connector cannot be put into the drag chain.

Drive and Cable Models Applicable to the DDL Motors

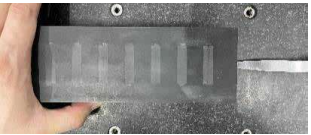
Motor Model	Applicable Drive	3 m Extension Cable	5 m Extension Cable	8 m Extension Cable	10 m Extension Cable	12 m Extension Cable
MAH1-60-345Y1N-071X-INT	SV680PSSR5I-GINT	Power cable model: S6-L-M160-3.0-TTS-2-INT Power cable code: 1504QJ54	Power cable model: S6-L-M160-5.0-TTS-2-INT Power cable code: 1504QJ55	Power cable model: S6-L-M160-8.0-TTS-2-INT Power cable code: 1504QJ56	Power cable model: S6-L-M160-10.0-TTS-2-INT Power cable code: 1504QJ57	Power cable model: S6-L-M160-12.0-TTS-2-INT Power cable code: 1504QK17
	SV680PT5R4I-GINT					
	SV680NSSR5I-GINT					
	SV680NT5R4I-GINT					
MAH1-90-345Y1N-071X-INT MAH1-90-345X1N-071X-INT	SV680PSSR5I-GINT	Power cable model: S6-L-M160-3.0-TTS-2-INT Power cable code: 1504QJ54	Power cable model: S6-L-M160-5.0-TTS-2-INT Power cable code: 1504QJ55	Power cable model: S6-L-M160-8.0-TTS-2-INT Power cable code: 1504QJ56	Power cable model: S6-L-M160-10.0-TTS-2-INT Power cable code: 1504QJ57	Power cable model: S6-L-M160-12.0-TTS-2-INT Power cable code: 1504QK17
	SV680PT5R4I-GINT					
	SV680NSSR5I-GINT					
	SV680NT5R4I-GINT					
MAH1-120-345Y1N-071X-INT MAH1-120-345X1N-071X-INT	SV680PSSR5I-GINT	Power cable model: S6-L-M160-3.0-TTS-2-INT Power cable code: 1504QJ54	Power cable model: S6-L-M160-5.0-TTS-2-INT Power cable code: 1504QJ55	Power cable model: S6-L-M160-8.0-TTS-2-INT Power cable code: 1504QJ56	Power cable model: S6-L-M160-10.0-TTS-2-INT Power cable code: 1504QJ57	Power cable model: S6-L-M160-12.0-TTS-2-INT Power cable code: 1504QK17
	SV680PT5R4I-GINT					
	SV680NSSR5I-GINT					
	SV680NT5R4I-GINT					

Commissioning

- The DDL motors are applicable to the SV680N and SV680P series drives from Inovance.
- For the servo system commissioning procedure, see the "SV680N Series Servo User Guide" and "SV680P Series Servo User Guide" from Inovance. The system can be operational once the commissioning is completed.
- Observe the personnel safety precautions when using the equipment. Maintain a safe distance from the equipment during operation and be attentive to personal safety.

Flatness measuring methods

To prevent difference in the measurement results of different measuring methods, inspect the mounting surface and air gap surface based on the following standards.

Inspection position	Inspection standard	Inspection diagram	Conclusion
Mounting surface	The feeler gauge of 0.15 mm cannot fit in or can fit into a range of 5 mm in the end edge.		Pass
	The feeler gauge of 0.15 mm can fit into a range above 5 mm in the end edge.		Fail
Air gap surface	The feeler gauge of 0.15 mm cannot fit in.		Pass
	The feeler gauge of 0.15 mm can fit in.		Fail

NOTE