TG2000S Electric joggers

- With a function of real–time telescopic position detection, power–off self–locking of telescopic positions is achieved.
- An ultra–high repeated accuracy
- User–defined length of pushrods
- RS485, RS422 and CAN communication protocols are provided for selection to control rotation directions and speeds of the motor; and users can use software commands to customize communication addresses and terminal resistance values of products.
- With built–in functions of overheating protection, current–limiting protection and stalling protection, users can reset protection functions by virtue of program commands.
- A hidden oil pocket is designed to provide pressure compensation and can be effectively protected from being damaged.

Truster / Speed	Power / Voltage	Distance / Precision	Control / RPM control	Auxiliary functions
2000kg 10mm/s	200W 12~36VDC	0~100mm 1~0.5mm	①CAN ②RS485 ③RS422	①Off–position self–locking (standard) ②Off–position memory(optional) ③Electronic limit (optional)

Housing	Environment	Driving	Pressure	Depth rating	Weight in air & water	Connector model (Detailed to 106 page)
Stainless steel	Freshwater	Built in	Oil filled seal	0~4000m	5.5kg & 4.0kg	12~36VDC(Micro 6–core)
Titanium alloy	Seawater	Built in	Oil filled seal	0~4000m	4.8kg & 3.5kg	12~36VDC(Micro 6–core)

CAN control wiring Instruction

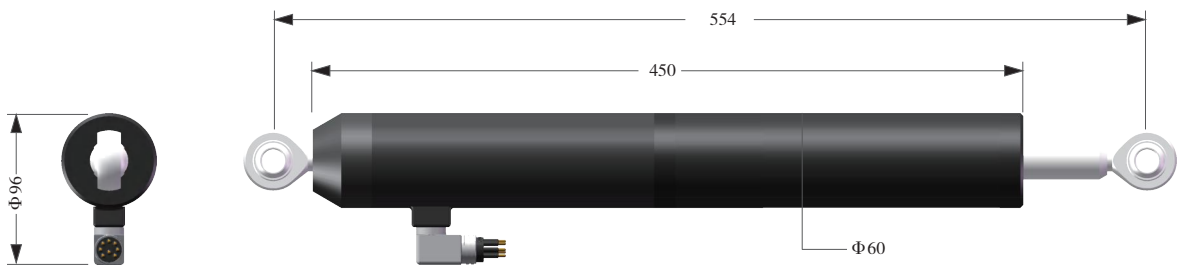
Item	Definition
1	PGND
2	+VDC
3	SGND
4	+12VDC
5	CANH
6	CANL

RS485/RS422 control wiring Instruction

Item	Definition
1	PGND
2	+VDC
3	SGND
4	+12VDC
5	RS485/422–A
6	RS485/422–B

Built in driving dimension

Unit:mm



Model Selection Table

Thrust	Power/Voltage	Weight	Dimension
TD06A			
Forward thrust 6.6kg Reverse thrust 3kg	500W 32~300VDC	Weight in air 1.1~1.8kg Weight in water 0.7~1.1kg	Outer dia 100mm Length 186~214mm
TD06B			
Forward thrust 6.6kg Reverse thrust 6.6kg	450W 32~300VDC	Weight in air 1.1~1.8kg Weight in water 0.7~1.1kg	Outer dia 116mm Length 184~213mm
TD08A			
Forward thrust 8.4kg Reverse thrust 5.1kg	580W 32~300VDC	Weight in air 1.1~2.0kg Weight in water 0.8~1.4kg	Outer dia 116mm Length 186~213mm
TD08B			
Forward thrust 8.2kg Reverse thrust 8.2kg	450W 32~300VDC	Weight in air 1.2~1.9kg Weight in water 0.9~1.4kg	Outer dia 130mm Length 186~213mm
TD09B			
Forward thrust 9kg Reverse thrust 9kg	500W 24~300VDC	Weight in air 1.7~2.1kg Weight in water 1.2~1.6kg	Outer dia 135mm Length 190~228mm
TD10A			
Forward thrust 10.7kg Reverse thrust 6.5kg	500W 24~300VDC	Weight in air 1.6~2.0kg Weight in water 1.1~1.5kg	Outer dia 134mm Length 201~238mm
TD15B			
Forward thrust 15kg Reverse thrust 15kg	950W 48~300VDC	Weight in air 2.2~2.9kg Weight in water 1.3~1.7kg	Outer dia 146mm Length 232~270mm
TD18B			
Forward thrust 18kg Reverse thrust 18kg	1.1KW 48~300VDC	Weight in air 2.2~3.2kg Weight in water 1.4~2.2kg	Outer dia 158mm Length 241~280mm

Notes: Dimensions of the connector are excluded; and for other relevant dimensions, please refer to a model selection table of connectors.
For more information, please contact our technical support department.

Model Selection Table

Thrust	Power/Voltage	Weight	Dimension
TD19A			
Forward thrust 19kg Reverse thrust 10kg	1.1KW 48~300VDC	Weight in air 2.2~3.3kg Weight in water 1.4~2.2kg	Outer dia 158mm Length 243~280mm
TD20B			
Forward thrust 20kg Reverse thrust 20kg	1KW 48~300VDC	Weight in air 2.7~3.1kg Weight in water 1.6~2.0kg	Outer dia 173mm Length 244~280mm
TD25A			
Forward thrust 25kg Reverse thrust 13kg	1.25KW 48~300VDC	Weight in air 3.5~4.6kg Weight in water 2.0~3.0kg	Outer dia 190mm Length 226~254mm
TD27A			
Forward thrust 27kg Reverse thrust 14kg	950W 48~300VDC	Weight in air 6.9~9.4kg Weight in water 5.3~7.5kg	Outer dia 272mm Length 314~348mm
TD28B			
Forward thrust 28kg Reverse thrust 28kg	1.4KW 110~300VDC	Weight in air 5.0~6.0kg Weight in water 3.5~4.3kg	Outer dia 217mm Length 269~301mm
TD40B			
Forward thrust 41kg Reverse thrust 41kg	1.4KW 80~300VDC	Weight in air 7.5~8.8kg Weight in water 4.4~5.1kg	Outer dia 285mm Length 273~305mm
TD48A			
Forward thrust 48kg Reverse thrust 24kg	2.3KW 72~300VDC	Weight in air 6.0~8.3kg Weight in water 4.0~5.1kg	Outer dia 235mm Length 294~356mm
TD48B			
Forward thrust 48kg Reverse thrust 48kg	2.2KW 72~300VDC	Weight in air 6.8~9.1kg Weight in water 3.7~5.2kg	Outer dia 242mm Length 294~356mm

Notes: Dimensions of the connector are excluded; and for other relevant dimensions, please refer to a model selection table of connectors.
For more information, please contact our technical support department.

Model Selection Table

Thrust	Power/Voltage	Weight	Dimension
TD88B			
Forward thrust 88kg Reverse thrust 88kg	6.5KW 260~330VDC	Weight in air 10.4~12.6kg Weight in water 7.8~9.3kg	Outer dia 254mm Length 366~487mm
TD110B			
Forward thrust 116kg Reverse thrust 116kg	6.5KW 260~330VDC	Weight in air 13.3~15.5kg Weight in water 8.5~10.0kg	Outer dia 296mm Length 366~487mm
TD120A			
Forward thrust 122kg Reverse thrust 60kg	6.5KW 260~600VDC	Weight in air 12.6~16.3kg Weight in water 8.6~10.4kg	Outer dia 323mm Length 366~487mm
TD130A			
Forward thrust 132kg Reverse thrust 70kg	6.5KW 260~330VDC	Weight in air 14.0~17.4kg Weight in water 8.9~10.7kg	Outer dia 358mm Length 366~487mm
TD160B			
Forward thrust 166kg Reverse thrust 166kg	14.3KW 300VDC	Weight in air 18.3~23.0kg Weight in water 13.3~16.2kg	Outer dia 340mm Length 472~609mm
TD230A			
Forward thrust 230kg Reverse thrust 131kg	14.3KW 300VDC	Weight in air 24.9~35.8kg Weight in water 16.9~25.2kg	Outer dia 410mm Length 472~609mm
TD240B			
Forward thrust 240kg Reverse thrust 240kg	12.8KW 300VDC	Weight in air 37.0~44.1kg Weight in water 22.0~27.0kg	Outer dia 400mm Length 499~647mm
TA14N AUV			
Forward thrust 14.5kg Reverse thrust 8.5kg	900W 48~300VDC	Weight in air 1.8~2.9kg Weight in water 1.3~2.1kg	Outer dia 152mm Length 251~290mm

Notes: Dimensions of the connector are excluded; and for other relevant dimensions, please refer to a model selection table of connectors.
For more information, please contact our technical support department.

Model Selection Table

Thrust	Power/Voltage	Weight	Dimension
TA19S AUV			
Forward thrust 19kg Reverse thrust 10kg	1KW 48~300VDC	Weight in air 2.0~3.0kg Weight in water 1.4~2.2kg	Outer dia 177mm Length 242~281mm
TA28N AUV			
Forward thrust 28kg	1.5KW 72~300VDC	Weight in air 5.0~7.3kg Weight in water 3.8~5.2kg	Outer dia 203mm Length 294~356mm
TA44S AUV			
Forward thrust 44kg	1.8KW 72~300VDC	Weight in air 6.3~8.2kg Weight in water 4.8~6.4kg	Outer dia 245mm Length 294~356mm
TA90N AUV			
Forward thrust 92kg Reverse thrust 50kg	5.4KW 260~330VDC	Weight in air 11.1~14.5kg Weight in water 8.6~10.4kg	Outer dia 300mm Length 366~487mm
TA120S AUV			
Forward thrust 125kg Reverse thrust 70kg	6.5KW 260~330VDC	Weight in air 14.0~17.8kg Weight in water 10.8~12.8kg	Outer dia 358mm Length 366~487mm
TA240N AUV			
Forward thrust 242kg Reverse thrust 99kg	14KW 300VDC	Weight in air 30.9~36.7kg Weight in water 24.2~28.2kg	Outer dia 500mm Length 572~708mm
TR07B RIM			
Forward thrust 7kg Reverse thrust 7kg	800W 300VDC	Weight in air 2.1~2.7kg Weight in water 1.6~2.1kg	Outer dia 132mm Length 158mm
TR20B RIM			
Forward thrust 20kg Reverse thrust 20kg	1.7KW 48~300VDC	Weight in air 3.9~5.4kg Weight in water 2.9~3.7kg	Outer dia 160mm Length 178mm

Notes: Dimensions of the connector are excluded; and for other relevant dimensions, please refer to a model selection table of connectors.
For more information, please contact our technical support department.

Model Selection Table

Thrust	Power/Voltage	Rudder plate	Dimension
W124-6 power sections			
Forward thrust at 2 knot 4.0kg Forward thrust at 4 knot 3.2kg	160W 32~300VDC	Height 86.8mm Width 130mm	Caliber 124mm Length 350mm
W150-6 power sections			
Forward thrust at 2 knot 7kg Forward thrust at 4 knot 6kg	500W 24~300VDC	Height 105mm Width 158mm	Caliber 150mm Length 400mm
W180-6 power sections			
Forward thrust at 2 knot 7kg Forward thrust at 4 knot 6kg	500W 24~300VDC	Height 126mm Width 189mm	Caliber 180mm Length 450mm
W200-6 power sections			
Forward thrust at 2 knot 15kg Forward thrust at 4 knot 12kg	1KW 48~300VDC	Height 140mm Width 210mm	Caliber 200mm Length 550mm
W324-6 power sections			
Forward thrust at 2 knot 23kg Forward thrust at 4 knot 18kg	950W 48~300VDC	Height 227mm Width 340mm	Caliber 324mm Length 900mm
W533-6 power sections			
Forward thrust at 2 knot 90kg Forward thrust at 4 knot 75kg	4.5KW 260~330VDC	Height 373mm Width 560mm	Caliber 533mm Length 1500mm
W200-35 High-speed power sections			
Maximum speed at 35 knot	30KW 500~600VDC	Height 140mm Width 210mm	Caliber 200mm Length 500mm
W324-35 High-speed power sections			
Maximum speed at 35 knot	60KW 256~428VDC	Height 227mm Width 340mm	Caliber 324mm Length 1000mm

Notes: Dimensions of the connector are excluded; and for other relevant dimensions, please refer to a model selection table of connectors.
For more information, please contact our technical support department.

Model Selection Table

Thrust/Speed	Power/Voltage	Weight	RPM/Dimension/ Distance/Precision
ST005 Steering engine			
Torque 5Nm(Max 7Nm)	20W 15~36VDC	Weight in air 3.2~3.4kg Weight in water 2.5~2.7kg	RPM 20° /s Length 103*94*89mm
ST020 Steering engine			
Torque 20Nm(Max 28Nm)	40W 24VDC	Weight in air 1.2~1.3kg Weight in water 1.0kg	RPM 60° /s Length 75*60*154mm
ST030 Steering engine			
Torque 30Nm(Max 40Nm)	60W 24VDC	Weight in air 1.8~2.0kg Weight in water 1.4~1.5kg	RPM 60° /s Length 70*53*99mm
ST180 Steering engine			
Torque 140Nm(Max 180Nm)	70W 48VDC	Weight in air 7.3kg Weight in water 5.8kg	RPM 20° /s Length 115*110*200mm
DM500 Gear motors			
RPM 29~70r/min Torque17~40Nm	500W 24~300VDC	Weight in air 4.0~5.8kg Weight in water 2.6~4.2kg	Outer dia 80mm Length 200mm
DM2000 Gear motors			
RPM 285~600r/min Torque 25~60Nm	2KW 72~300VDC	Weight in air 6.0~7.8kg Weight in water 3.2~3.6kg	Outer dia 85mm Length 376mm
TG050 Electric joggers			
50KG 10mm/s	200W 12~36VDC	Weight in air 1.2~1.9kg Weight in water 1.0~1.5kg	Distance 0~100mm Precision 1~0.5mm
TG250 Electric joggers			
250KG 40mm/s	320W 12~36VDC	Weight in air 3.4~6.1kg Weight in water 2.0~4.8kg	Distance 0~100mm Precision 1~0.5mm

Notes: Dimensions of the connector are excluded; and for other relevant dimensions, please refer to a model selection table of connectors.
For more information, please contact our technical support department.

Model Selection Table

Thrust/Speed	Power/Voltage	Weight	Distance/Precision
TG1000 Electric joggers			
1000KG 40mm/s	500W 12~36VDC	Weight in air 9.5~15kg Weight in water 6.4~12kg	Distance 0~100mm Precision 1~0.5mm
TG050S Electric joggers			
50KG 10mm/s	200W 12~36VDC	Weight in air 1.5~2.3kg Weight in water 1.2~1.8kg	Distance 0~100mm Precision 1~0.5mm
TG250S Electric joggers			
250KG 40mm/s	320W 12~36VDC	Weight in air 4.1~7.3kg Weight in water 2.4~5.8kg	Distance 0~100mm Precision 1~0.5mm
TG1000S Electric joggers			
1000KG 40mm/s	500W 12~36VDC	Weight in air 11.4~18.0kg Weight in water 7.7~14.4kg	Distance 0~100mm Precision 1~0.5mm
TG2000S Electric joggers			
2000KG 10mm/s	200W 12~36VDC	Weight in air 9.5~15kg Weight in water 6.4~12kg	Distance 0~100mm Precision 1~0.5mm

Notes: Dimensions of the connector are excluded; and for other relevant dimensions, please refer to a model selection table of connectors.
For more information, please contact our technical support department.

Technical information

Overview of underwater thrusters

Underwater thrusters are core power units of submersible vehicles. They can be mainly divided into ship thrusters, submarine thrusters, robotic thrusters and underwater ordnance thrusters, etc. according to their application scenarios. As different types of energy are selected for different thrusters, they are classified into nuclear-powered thrusters, thermodynamic thrusters and electrodynamic thrusters, etc.

Selection of underwater thrusters

During model selection for underwater thrusters, parameters that need to be taken into consideration consist of thrust, efficiency, dimensions, weight, noise, control modes, operating depth and service life. In this process, different application scenarios are different priorities of model selection. For example, users usually select thrusters of "small volumes-light weight-and high thrust" during the model selection of small-sized ROV thrusters for the purpose of avoiding negative influences of excessively large sizes of thrusters on the layout of ROV parts. Moreover, they even don't think much about efficiency. Regarding model selection for medium-sized ROV thrusters, multiple thrusters are incorporated in a single system and the full-scale input power exceeds 10KW. In this case, users have to consider thruster efficiency with an aim to reduce the negative influence of thick and strong umbilical cables caused by excessively high umbilical cable current. As a result, a thruster featured with "low weight-low current consumption-high thrust" is an ideal selection. During model selection for conventional AUV thrusters, users generally attach great importance to thruster efficiency to improve the single voyage capability of AUV provided that the thrust of the selected thruster meets the corresponding requirements of cruising speed. Under this circumstance, the dimensions or weight of a thruster are less important. In terms of underwater ordnance thrusters, noise is the most critical index. In a word, different application scenarios have different priorities for model selection.

The thrust-deadweight ratio

The thrust-deadweight ratio, an important index for underwater thruster evaluation, is a specific value of thrust produced by a thruster in the condition of inputting standard operating voltage and the maximum signal intensity to their self-weight in the air. In the case where other parametric indexes of the thruster remain unchanged, a higher thrust-deadweight ratio corresponds to better performance of this thruster. There are many methods that can be used to improve this ratio. For example, a gear motor with a high power density may be designed and selected to ensure motor weight reduction on the premise of no torque or revolving speed changes; or, more light-weight screw propellers and shells, etc. can be designed as well. To exaggerate the thrust-deadweight ratio, some manufacturers select to adopt some false parameters for their products. They may employ a specific value greater than the thrust-dead-weight ratio in the air generated by inputting the standard operating voltage and the maximum signal intensity, or even select a specific value above the thrust-deadweight ratio in the water which is obtained in the same condition as that described above. Therefore, it is suggested that users pay particular attention to this during model selection.

Rated thrust of the thruster

Rated thrust of the thruster usually refers to its maximum mooring thrust in a condition of the standard power supply and the maximum input signal intensity. In general cases, mooring thrust produced under the circumstance of the given maximum signal intensity of a thruster is above its rated thrust when the input voltage is greater than the standard operating voltage (e.g., power supply when the battery is fully charged). If the input voltage of below the standard operating voltage of a thruster, such as the power supply when the battery is under voltage, the mooring thrust produced by the maximum signal intensity of a given thruster is smaller than its rated thrust. Regarding thrusters of the same type, different water intake velocities result in different thrusts in a condition of a particular revolving speed of the screw propeller. Generally, the higher the water intake velocity is, the greater the thrust attenuation will be. Based on the thrust characteristics of thrusters, a user who is selecting among main AUV thrusters may pay close attention to the thrust curves of thrusters, including relation curves of thrust and screw propeller speed, curves of thrust and motor input power, and thrust curves of thrusters at various voltage grades in different power supply conditions. In this way, it can be guaranteed that the user can select an appropriate product.

The efficiency of a thruster

The efficiency of a thruster is represented by specific values between the output power of screw propellers and the input power of motors, which is expressed in $\eta = FV/UI$. Moreover, thruster efficiency relates to the efficiency of screw propellers, mechanical transmission efficiency, motor efficiency, and motor controller efficiency. In line with different designs, a rather high efficiency can be achieved for thrusters in conditions of high and low water intake velocities.

Thruster encapsulation

Thruster encapsulation refers to the seal of thruster components, such as motors and electric controls. Generally, it consists of static and motive seals. Magnetic coupling seal, mechanical rotary seal, seal ring rotary seal and seal ring static seal are all common seal forms. Furthermore, the application of magnetic coupling in thrusters means that the motive seal of thrusters is abandoned, which substantially increases their operating depth. As for mechanical and seal ring rotary seals, they are frequently applied in sealing in a shallow water conditions; and both seal forms select an oil charge compensation scheme to fulfill deep-water sealing of devices.

Underwater thruster control mode

Commonly used thrusters are provided with two analogue signal control modes, that is 5VDC voltage-based analogue control and PWM control, and three digital signal control modes of CAN bus control, RS485 control and RS422 control. In recent years, users prefer digital signal control for the reason that such a control mode requires less complicated hardware and makes control signals more stable. As for industrial power products of Hydrocean, users can use the upper computer software offered by us to self-define CAN addresses and terminal resistance values. Therefore, it becomes much more convenient and simpler for users to change spare parts and perform debugging.

The uniformity of thrusters

The uniformity of thrusters is a key index to evaluate the pros and cons of a thruster. If a thruster performs rather poorly in uniformity, users may need to invest much energy in product debugging. Even so, no ideal products are probably manufactured at last. In addition to pursuing high uniformity of products by virtue of more detailed drawings, more advanced techniques and more strict inspection methods, etc., Hydrocean selects a more rapid and accurate closed-loop algorithm as the uniformity compensation scheme, ensuring better uniformity of thrusters.

The reliability of thrusters

Mature seal structures, reliable materials and techniques, and comprehensive and rigorous quality control standards all lay a solid foundation for reliability improvement among thrusters. In order to ensure the high reliability of thrusters, practical application scenarios should be taken into account. If they are used to clean ships or net cages, shaftless propulsion is selected to effectively avoid obstruction and minimize risks of motor stalling. To effectively prevent external damage, titanium alloy materials resistant to scraping, wear and corrosion are adopted. Moreover, Hydrocean thrusters are provided with built-in functions of power isolation, current-limiting protection, overheating protection and stalling protection, etc. to boost the reliability of thrusters.

Underwater steering gears

In comparison with extremely lightweight indexes for steering gears of aircraft, requirements proposed for underwater steering gears are more comprehensive and complex. According to relevant requirements, lots of underwater equipment such as AUV and AUG, especially those for long voyages, should be equipped with highly efficient spare parts. The steering gears of Hydrocean have a turbine and worm structure built-in, support a power-off self-locking function, and provide a steering mode and a power-saving mode for selection. Therefore, the power consumption of steering gears can be very low. Angle detection for all steering gears in Hydrocean is entirely completed by an angle sensor deployed at the root segment of the output shaft, which can be both practical and accurate. In terms of deep-water steering gears, their transmission compartments are provided with an oil charge compensation structure; and their operating depth reaches 6,000 meters.

Underwater electric joggers

Underwater electric joggers, also known as "underwater linear motors", are linear actuators mainly composed of motors, pushrods and control devices. They are capable of implementing remote and centralized control. Within a certain stroke range, electric joggers move to and fro. In general cases, their standard strokes are 100mm, 150mm, 200mm, 250mm, 300mm, 350mm and 400mm. Regarding their special strokes, they can be customized according to different requirements for application conditions. If position sensors cannot be properly arranged in electric joggers with large water depth because of withstand voltage, repeated accuracy of electric joggers stretching out and drawing back fails to be effectively ensured. In addition, positions, where blackout records are made, are also frequently somewhat deviated from the actual locations. In Hydrocean, a self-developed sealing technique is utilized to design a particular position sensor and build a positioning algorithm in motor drivers. Hence, underwater electric joggers manufactured in Hydrocean feature high repeated accuracy, strong reliability, an off-position memory function, and a user-defined position limit function.

Underwater gear motors

Different from industrial gear motors, underwater gear motors should be provided with higher power density. To minimize the dimensions and weight of motors, not only is thermolysis made on them, but comprehensive water cooling tests are carried out. In this way, excellent external characteristics and thermal treatment are obtained through debugging, so that even small-sized motors possess rather large torques. Under the circumstance that motors of high power density are equipped with different gear motors, different parameters of torques and revolving speeds can be offered. Considering that motor drivers are provided with functions of built-in power isolation, current-limiting protection, overheating protection and stalling protection, etc., it is guaranteed that underwater gear motors of Hydrocean can operate reliably in multiple working conditions.

About Hydrocean

Hydrocean Intelligent Tech. Industry (Jiangsu) Co., Ltd. is a high-tech enterprise specializing in domestic R & D and manufacturing of underwater intelligent equipment, it owns three production lines of industrial underwater actuators, consumer-grade underwater power equipment and educational underwater robots. Our full range of products has independent intellectual property rights and has won many domestic and international awards. Subsidiaries and branch offices of Hydrocean have been established in Shanghai, Tianjin and Sanya, giving full play to regional industrial resource advantages, and attracting reliable suppliers, outstanding employees occupied in production and professional talents in various disciplines such as water power, acoustics, electrical engineering and motor control, mechanical engineering and material sciences. The core R&D team comes from Shanghai Jiaotong University, Harbin Engineering University, Zhejiang University and other marine-related universities and research institutes.

In the last 10 years, national brands keep upgrading, which reflects progress in products and technology on the whole. However, user experience is not satisfactory in most cases.In this respect, we communicate with users of underwater power products on their feelings about model selection, most of them feel satisfied if the equipment does not malfunction.Clearly, a strong psychological discrepancy exists in these users.

Therefore, we are committed to creating such domestically produced independent products: more comprehensive optional catalog, higher performance indicators, design closer to actual application scenarios, more convenient and reliable installation, more intelligent control, higher precision, faster speed, longer life, better consistency, more efficient production, more stringent testing, more comprehensive traceability, more advanced materials and processes, higher cost performance, more professional and timely technical support, more effective and fast after-sales service...

This manual covers industrial products of Hydrocean,including underwater thrusters,underwater steering gears,underwater gear motors,underwater electric joggers and under-water AUV power sections.They manifest wisdom and hard work contributed by Hydrocean engineers in Thousands of days and nights,and our ambitions and determination to dedicateour whole life to coastal defense career.

We hope that this manual may help you find an ideal product that can be both reliable and user-friendly.We also expect to become your trust worthy partner.We,all the engineers of Hydrocean,will keep striving.Our blessings will be with you all along!