PT. Marine Propulsion Solutions

Subsea Group

Designed for all types of Rov's, Auv's and Manned Submersibles

- **SubSea AC/DC Electric and Hydraulic Thrusters**
- **AUV Propulsor and Fin Actuator Modules**
- **Manned SubSea Propulsion Systems**
- **Pump Jet Propulsion Systems**
- **Electric Podded Propulsors**
- **Integrated Electric/Hydraulic Power Modules**
- **Trencher Jetting Swords and Swivel Manifolds**
- **Excavator and Grabber Systems**

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SubSea Propulsion Technologies

PT. Marine Propulsion Solutions has the pleasure of enclosing our latest product summary for a full range of ***SubSea Propulsion and Thruster Systems,*** designed for manned submersibles, Rov's, Auv's and other SubSea applications.

SubSea Propulsion Systems are produced in a full range of high quality, cost effective, efficient, and compact thrusters designed for professional SubSea use. Designs are based upon over 40 years of experience in the Offshore SubSea Marine Industry.

Our portfolio is divided into Eight main Groups: **SubSea Thrusters - Electric (AC/DC) and Hydraulic, PumpJet Propulsion, AUV Propulsor Modules, Manned Propulsion Modules, Podded Propulsors**, **Electric/Hydraulic Power Modules, Cable Trencher / Excavator / Grabber Systems and Marine SubSea Tidal Turbines** with supporting hardware and control software.

SUBSEA ELECTRIC THRUSTER SERIES

Group 1A … DC Electric Subsea Thruster Systems

Model	Power Range Hp	Power Range Kw	Input Power Volts	Input Power Amps	Bollard Thrust Lbs	Bollard Thrust Kgf	Weight (Lbs) Air	Weight (Lbs) Wet	Feedback mode
SSE050	.50	.50	120	1.8					Models SSE050, SSE100 & SSE200 rated to 600M with motor controllers built into the thruster unit. For greater depths……
SSE100	1.0	1.0	260	3.4	42.5	19.3	10.5	8.5	
SSE200	2.0	1.49	260	6.8	85.0	38.6	12.0	9.0	
SSE300	3.5	2.60	260	11.8	150.0	68.2	18.5	13.9	Motor Controller to be located in a one (1) atmosphere housing available as optional or customer furnished.
SSE500	5.0	3.73	260	15.2	215.0	97.0	24.0	16.5	
SSE800	8.0	5.97	260	22.0	340.0	154.5	34.5	24.4	
SSE1200	12.0	8.95	600	18.5	510.0	231.8	48.5	38.8	Alternative voltages are available – consult engineering department
SSE1500	15.0	11.9	600	21.0	637.5	290.0	60.5	48.4	
SSE2000	20.0	14.9	600	27.5	850.0	386.0	72.0	57.6	

Full ocean depth oil filled/pressure compensated.

The SubSea Propulsion Systems Electric Propulsor breaks new ground in thrust; weight and reliability by the introduction of an internal sealing located between the rotor and stator, creating two separate isolated and sealed sections. Water cannot reach the stator and electronics through the shaft seal. Using sealed bearings the rotor can therefore run in water or oil

Technical Features*:*

All models feature DC brushless rare earth motors for maximum reliability and power. Standard voltages are shown.

The Gold Cup Series will accept DC input voltage options from 140 to 400 Vdc (optional voltages available). The Series feature power & control electronics housed within the thruster motor case for maximum reliability & simplified installation.

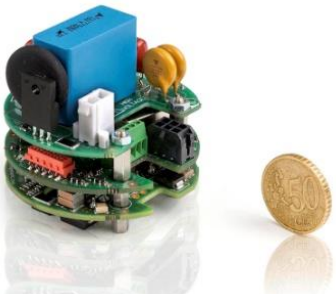
The Gold Cup Series utilize hull sensor feedback motor controller. The Motor Control Modules are normally mounted in a customer or MPS one (1) atmosphere housing. Housings rated up to full ocean depth are available.

All Models feature a Propeller, designed for bi-directional rotation with Kort type nozzles for high bollard thrust & open water efficiency. Clockwise & counterclockwise rotation propellers are available for all models.

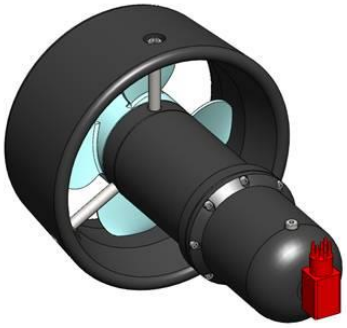
Direct e-motor drives with no planetary gear reduction units resulting in “Silent” and “Reliable” operation with lightweight & compact designs at competitive pricing.

Custom configurations include alternate voltages, subsea connectors, power ratings, mountings & depth ratings as well as open (un-ducted) propellers, etc.

Incorporated by the thruster Drive is the ***Custom Designed Motor Controller*** (DC) incorporating an advanced control system with four-quadrant torque and speed control. Serial & CANopen communication is available with programmable I/O in/outputs, for Speed and Torque Control Modes. Thrust or torque can be controlled and synchronized with other brushless type thrusters resulting in simple coordinated interaction between the thruster units.

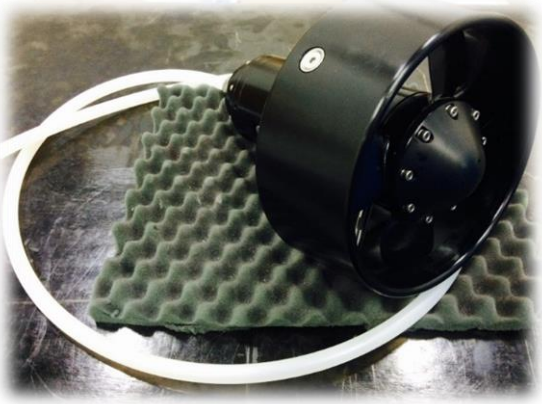


<u>The standard SCE-Control System is as follows</u>:
1. +POWER_SUP
2. -POWER_SUP
3. GND_CONTROL
4. +12V_CONTROL
5. ANALOG_IN+ (+-10 V command)
6. ANALOG_IN- (+-10 V command)
7. ENABLE_IN (digital input: when disabled, motor power is disconnected minimizing loses and possible torque commands)
8. OK_OUT (digital output: ACTIVE = OK, INACTIVE = MOTOR FAULT)



<u>Control boards with the following options</u>:

SCE-A - Main Power, 12Vdc control power, +- 10V speed control
SCE-B - Main Power, RS/485, +-10V speed control
SCE-C - Main Power, RS/485, CANopen



Group 1B ... AC Electric SubSea Thruster Systems

PT. Marine Propulsion Solutions – Subsea Group introduces a range of brushless AC Thrusters ruggidly designed, low weight and extreme reliable. They are available in eight (8) sizes as show below in the specifications.

Subsea AC Propulsion Thrusters					
Model	Units	SAC100-1	SAC200-1	SAC300-01	SAC500-1
Electric Power	Kw (Hp)	1.0 (1.34)	2.0 (2.68)	3.0 (4.02)	5.0 (6.70)
Prop Dia.	MM	150mm	178mm	210mm	250mm
Fwd Thruster @ 60Hz	N	267	536	800	1,341
	Lbs-f (Kgs)	60.0 (27.3)	120.6 (54.8)	180.9 (82.2)	301.5 (137.0)
Rev Thruster @ 60Hz	N	227	456	680	1,140
	Lbs-f (Kgs)	51.0 (23.2)	102.5 (47.0)	152.8 (69.5)	256.3 (116.5)
Voltage	VAC 440/400/60/50 3 Phase				
Weight in Air	Kgs	8.8	13.5	20.2	27.0
Weight in Water	Kgs	6.0	6.5	14.7	19.4

Model	Units	SAC800	SAC1200	SAC1500	SAC2000
Electric Power	Kw (Hp)	8.0 (10.72)	12.0 (16.08)	15.0 (20.11)	20.0 (26.81)
Prop Dia.	MM	275mm	300mm	375mm	450mm
Fwd Thruster @ 60Hz	N	2,146	3,218	4,026	5,367
	Lbs-f (Kgs)	482.4 (219.3)	723.6 (328.9)	905.0 (411.3)	1,206.5 (548.4)
Rev Thruster @ 60Hz	N	1,824	2,736	3,422	4,562
	Lbs-f (Kgs)	410.0 (186.4)	615.1 (279.6)	769.3 (349.6)	1,026.0 (466.1)
Voltage	VAC 440/400 /60/50 3 Phase				
Weight in Air	Kgs	43.2	64.8	81.0	108.0
Weight in Water	Kgs	30.6.	45.5	57.5	76.7
Connector	5-Pin Connector Whip in 500mm or 1000mm Lengths				
Depth Rating	Oil Filled, Pressure Compensated to full ocean depth				
Construction	Aluminum (hard anodized), Stainless Steel, Plastics & Ceramics				

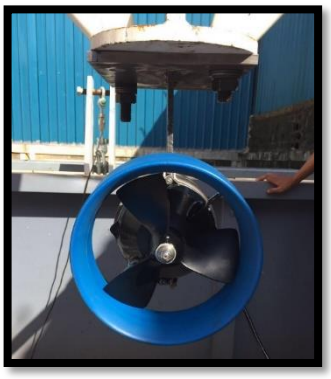
Larger AC Subsea Thrusters available by request – Data subject to change

SUBSEA VARIABLE FREQUENCY (VFD) MOTOR CONTROLLER CARDS

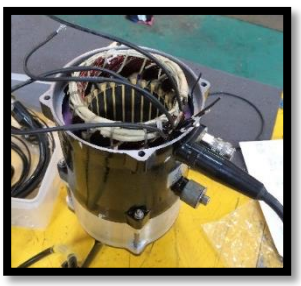
MPS has developed and qualified a subsea Variable Speed Drive (VSD) for operations down to 3000 m. They can be supplied to operate upto six (6) AC Thruster units.

Key characteristics:

- **Small** - competing solutions are many times bigger.
- **Flexible** - operates many types of motors: induction machines, permanent magnet and servo motors.
- **Robust** - tolarates vibration, shock and electrical fluctuations.

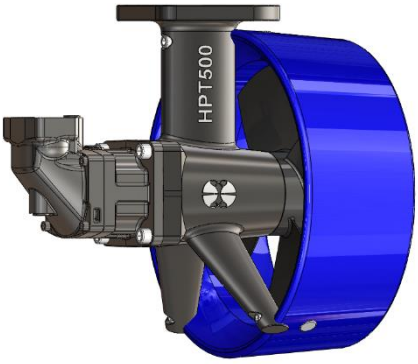


Power transmission to subsea pumps and other power consumers are normally hydraulic from topside. In some cases electric power transmission to a subsea motor is used, with a VSD placed topside. Subsea VSD's has only been available for small electric motors so far, and this has limited the freedom of subsea process/production systems design. With MPS subsea VSD, this limitation is removed.



Group 1C ... Hydraulic SubSea Thruster Systems

An efficient and compact piston type hydraulic motor is designed to be fitted to the thruster strut as part of the thruster hub. This motor has variable horsepower (constant torque) characteristics. The hydraulic motor has optimum running clearances and hydraulic balance to assure sustained high efficiency over the life of the motor. The inertia of rotating parts is low... **parts are symmetrical, providing dynamic balance and free of vibration.**



The hydraulic thruster and propulsion systems are diverse and include a number of unique, high precision systems, ranging from the standard **"Work Horse"** fixed position hydraulic thrusters to the **full Azimuthing/Rotatable Thruster Systems** for all subsea dynamic positioning requirements.

The **HPT *is*** a "unique" series of **SubSea Hydraulic Thruster Systems,** designed to be integrated with an highly efficient piston type hydraulic motor and incorporated to fit to the mounting strut as an integral part of the thruster hub with the Nozzle constructed in fiber composite , high density material. They come complete with Nozzle, mounting bracket and are offered from 12 to 110 horsepower.

The hydraulic motor integrates/mounts to the thruster pod and baring assembly, therefore extremely lightweight and compact. The design speed of the propeller averages 28 meters/sec or less, offering efficient and silent operation. Depending on the Model Series, either a 4 or 5 bladed propellers are used. The thruster systems are pressure compensated and operational to all ocean depths.

All thruster pod assemblies are manufactured from a high density ...fiber composite with all attaching hardware either 316 stainless steel or aluminum (hard anodized).

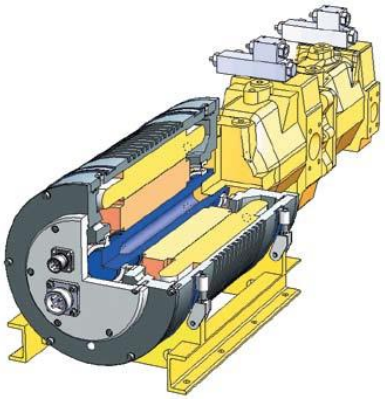
Technical System Specifications

Model	Thrust Max Static (Kgf) @ 250 Bar	Propeller Diameter (MM)	Weight in Air (Kg) Leg Weight	Weight in Water (Kg) Leg Weight	Maximum Operating Pressure (Bar)	Motor Capacity (cc/rev)
HPT230	210 Kgf	230	12.2	8.7	350	10
HPT300	360 Kgf	300	14.3	7.3	300	23 & 32
HPT380	415 Kgf	380	22.8	18.4	300	45
HPT420	570 Kgf	420	25.7	15.7	300	63
HPT500	1075 Kgf	500	48.5	25.5	300	107 & 125
HPT750	1280 Kgf	750	142.4	74.5	400	160 & 180
HPT950	1500 Kgf	950	174.8	90.8	400	250

Thrust figures are "measured" with a type 19A Nozzle Profile at zero speed of advance.

Hydraulic System Accessories:

Marine Propulsion Solutions (Subsea Group) supplies complete Hydraulic Manifold Control Modules, Electric/Hydraulic pressure-compensated Power Packs and compensators.


Group 2 ... *Auv Propulsor / Fin Actuator Modules*

With Positioning Control for the AUV builder

MPS announces a unique **"New Series"** of **AUV Thruster / Fin and Position Modules,** designed as **off-the-shelf** Propulsion, Fin Control and Positioning Modules, providing the AUV builder, a **"major building block"** for maneuverability, position keeping and/or **SubSea Dynamic Positioning capabilities.**

The **AUV Propulsor Module** utilizes a very efficient thruster assembly, arrangement of Fins ***"quad configuration"*** and controllers plus auto-pilot and positioning control, mounted in a light weight (carbon-fiber composite) Module.

The AUV Propulsor Modular is complete with the following major components.

- A Modular designed Propulsor (customized to your vehicle design).
- Fin Actuators + controllers
- Electronic Control Package for simplified integration of propulsion, control and communication.

A ***Modular design approach*** for the AUV manufacture offering ***the basic building block...*** The Propulsor Module is offered (as standard) with single propeller "Fixed" Module and offered (as optional) with a dual ***counter-rotating*** propeller system or a ***Steerable module*** configuration with no body fins required.

Leave Propulsion and Maneuverability to the experts... and use your expertise and imagination in creating the additional building blocks required for Shallow and Deep Water ***operations into*** the 21st Century.

Motor Controllers (ECU) Boards are offered for full speed control functions and incorporated inside the Module. The Fin Actuator Assembly and control electronics are housed within the oil filled, pressure compensated housing, and engineering for building a mock-up C++ application that controls the 8 axis (Thrusters) through Ethernet TCP/IP interface.

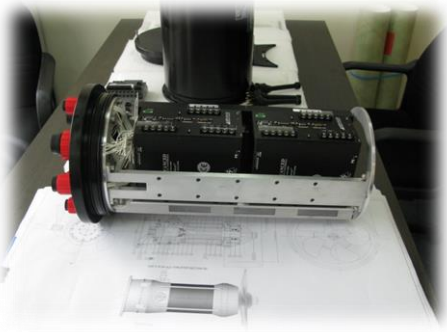
Model	Module Diameter	Thruster Power	Prop RPM	Developed Thrust	Control Fins	Module Power	Control Power R
A9PM	9 inch 228.6 mm	375 watts	575	32 lbs-f	As required by vehicle body design	48 Vdc	12/24 Vdc
		560 watts	500	45 lbs-f		48 Vdc	
A12PM	12 inch 304.8 mm	600 watts	475	48 lbs-f		48 Vdc	
		900 watts	450	75 lbs-f		48 Vdc	
A18PM	18 inch 457.2 mm	1200 watts	425	100 lbs-f		48/72 Vdc	
		1800 watts	400	145 lbs-f		48/72 Vdc	
		2500 watts	385	205 lbs-f		48/72 Vdc	
A21PM	21 inch 533.4 mm	3750 watts	325	300 lbs-f		48/72/140	
		4500 watts	315	365 lbs-f		48/72/140	
		6000 watts	300	485 lbs-f		48/72/140	
Higher Power options, special configurations and voltages offered – please contact engineering							

L&T pioneers torpedo-tube **"ADAMYA"** AUV…. the 850-kg AUV with a diameter of 533-mm and length of 5700-mm is powered by Lithium-polymer batteries with enough charge to keep it going for 8-hr at 4 knots.

The Marine Propulsion Solutions Two contra-rotating propellers give the Adamya a top speed of 6-kt, and a cruise speed of 4-kts. The vehicle is also capable of hovering.

Boeing Echo Voyager

4x SSE1500 Subsea Electric Thriusters, Motor Controllers, Pressure compensated and rated for 4,500M



One Atmosphere Thruster Motor Controller Housings designed to operate MPS Subsea Thrusters.

Housings made from Titanium TI AL6-4V and rated for 6,000M (available in Aluminum + stainless steel for other depths).

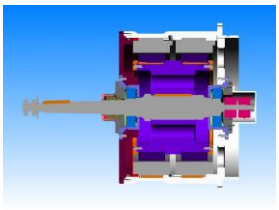
- Design Safety Factor 1.15
- Housings to have a vent plug
- Housings to have a water detector sensor
- Housings to have a vacuum seal test port on each end
- Housing fasteners to be SS316
- Housing end caps drilled and tapped to accept ground straps
- Housing end caps drilled and tapped for jacking bolts for end cap removal

Group 3 … SubSea Propulsion Modules

Designed for Manned Vehicles/Navy SDV's and ASDS applications

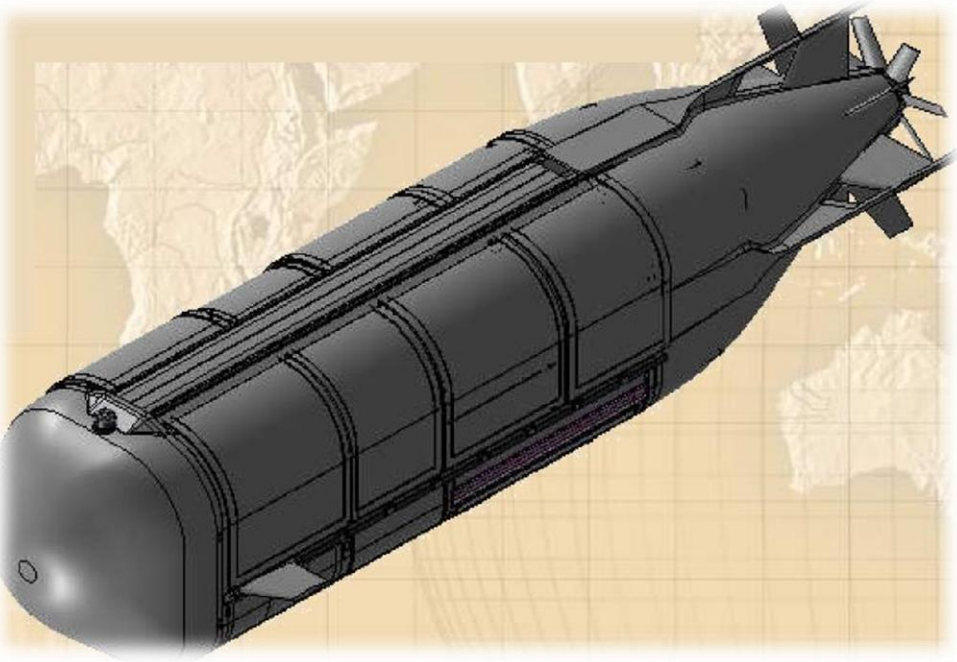
SubSea Electric Propulsion Modules are designed to be used on a manned submersible vehicle. The Drive System consists of brushless motors, feedback devices and control electronics housed to permit submerged operation in water.

The unit uses dual redundant (2) motors on a common shaft, two feedback devices and two sets of Motor Controls**,** sensors and electronics in a single integrated housing – complete **"get home capability".** The unit will accept nominal 150-300 Vdc input power and a speed control command to provide shaft output at the commanded rotational speed.

SubSea Propulsion Modules 20 Hp / 150 Vdc brushless electric motor / Controller assembly. Designed and manufactured for the SDV (Seal Delivery Vehicle) program. Motor has dual 10 Hp windings + controllers in case of failure.			
			

Delivered for the Dolphin Class Swimmer Delivery Vehicle

The motor controller and amplifiers will interface with the Operators Main Control System to control the shaft speed. The Operator provides a speed command to the Motor Controller/amplifiers.



The system is configured such that should one motor or controller fail, the unit shall remain functional with reduced available shaft power.

Model Number	Power Hp	Power Kw	Developed Thrust Lbs-f	Developed Thrust Kgs-f	RPM	Motor Bus Voltage	Control Voltage
SPM10	10	7.5	420	190	420	150vdc	28vdc
SPM20	20	15.0	880	400	300	150vdc	28vdc
SPM35	35	26.0	1575	715	280	150vdc	28vdc
SPM50	50	37.5	2250	1,022	240	150vdc	28vdc
SPM75	75	56.0	3600	1,636	180	150vdc	28vdc

Power will be provided to the (MCs) as 150vdc for motorbus and nominal 28vdc for control electronics.

Dual Propeller - Counter Rotating Propulsion Modules for Stealth “Silent” Operation.

Approximately 18% more thrust and ...the counter rotation design assures that **no gyroscopic moments** are transferred to the vehicle. Very fast response times are assured with ***"Silent and Vibration Free Operation"***.

SubSea Steerable Propulsion Modules providing port/starboard and descend/ascend 30°-0°-30° elevation & steering control...

Group 4 ... PumpJet Propulsion Systems

SubSea Propulsion Technology, offers a "*New Series*" of *PumpJet Propulsion Systems*, providing the AUV builder, a "major building block" for efficient, silent, vibration-free operation, eliminating propeller drag. And no gyroscopic moments are transferred to the vehicle. Very fast response times are assured with...

"Silent and Vibration Free ..... Stealth Operation.

The Systems are offered in an Electric DC configuration with Brushless Permanent magnet motor designed as an integral part of the PumpJet Propulsor and designed as off-the-shelf Propulsion Modules.

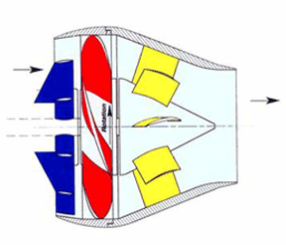
They are lightweight... Silent... Ruggedly Reliable

The module contains the PumpJet system designed as an integral module (carbon-fiber) with dual side intakes and discharge nozzle systems. The module incorporates a "Quad" fin system for vehicle control and incorporates a complete PumpJet and electric fin actuator system.

System Specifications

Model	Power (Max)		Thrust Developed		Discharge Velocity		Module Diameter	
	Hp	Watts	Lbs	Kgf	Ft/Sec	M/Sec	Inch	MM
9PJM	2	1,492	35.0	16.0	As required for vehicle speed and body configuration.		9.0	228.6
12PJM	5	3,730	87.5	39.7			12.0	304.8
18PJM	8	5,968	140	63.6			18.0	457.2
21PJM	12	8,952	210	95.5			21.0	533.4
24PJM	18	13,428	315	143.2			24.0	609.6
28PJM	20	14,920	350	160.0			28.0	711.2

PumpJet Modules are rated for full ocean depth and are bolt-on modules. They are easy to remove and can be replaced within minutes. SubSea Propulsion Pumpjets are manufactured in hard anodized marine grade aluminum bodies (Carbon-Fiber Composite optional) and utilized for the PumpJet suction and nozzle assembly.



Principal PumpJet Propulsor applications include:

- Covert surveillance in harbors and over the horizon in "other side" territory.
- Security related "obstacle" detection, positioning, classification and ultimately destruction.
- Shallow water autonomous control/operation of vehicle for vessel under hull attachment of obstacles such as mines or inspection for drugs packages. Harbor or at-sea operations.

Group 5 …SubSea Electric Podded Propulsors with Nozzle Assemblies

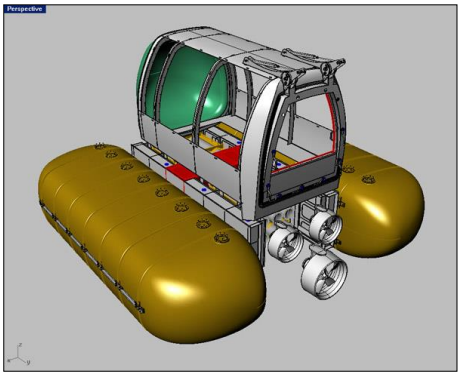
"Fixed and Steerable Configurations" designed for Manned Submersibles and Tourist Submarine applications.

A "Unique" Series of Electric Propulsors incorporating a brushless dc electric motor as an integral part of the thruster hub. Introducing ***"Silent Propulsion Systems"*** that are, efficient, compact and lightweight using carbon-fiber propeller technology. The drives utilize variable speed motor controllers. The thruster pod ratios are idealized for maximum flow conditions.

The ***"Podded Wet"*** Propulsor systems are designed to prevent leakage. Typical subsea thruster systems are prone to water entering or oil leaking through the propeller shaft seals. The "***Wet" Propulsor design*** eliminates this problem by the introduction of an internal sealed diaphragm located between the rotor and stator, creating two separate isolated and sealed compartments. Water cannot reach the stator and electronics through the shaft seal. By incorporating Kort type nozzles – a 30% increase in bollard thrust is achieved.

High Power SubSea Podded Propulsors with Kort Nozzles

Model	Power		Thrust		Prop Dia		Input Voltages to the Controller		Current @ 440vac
	Hp	Kw	Lbs	Kgf	Inch	mm	AC	DC	I
P20E	20	15	720	325	15.0	381.0	380vac 440vac 50 to 400 Hertz - 3 phase	500 to 600 Vdc	26.5
P30E	30	22	1080	490	18.0	457.2			49.4
P50E	50	37	1800	800	24.0	609.6			74.0
P75E	75	56	2700	1225	28.0	711.2			96.0
P100E	100	75	3600	1635	30.0	762.0			137.0
P150E	150	112	5400	2450	32.0	812.8			188.0



The Sea-Bug Project – New Zealand

Model P75E Podded Propulsor

Motor Controller:

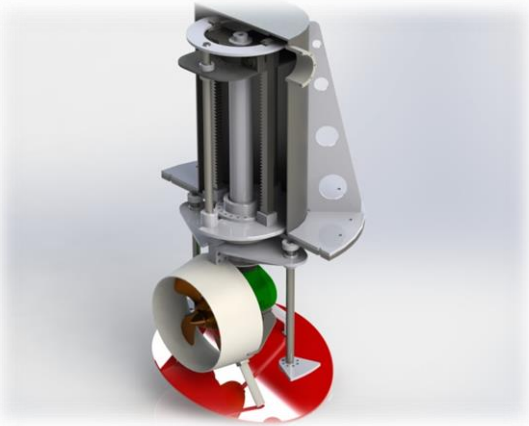
The Drive System is a fully proportional drive with Serial Link capabilities if required.

The drive uses EUPEC IGBT modules, which have continuous ratings from 50 amps to 350 amps. The middle boards are a gate drive from CONCEPT and the control board sits on top. Situated behind the IGBT module is a capacitor or power board. Input power, either AC or DC input power comes in from this side.

The capacitor board comes in different designs depending on the input power requirements, whether the power needs to be rectified, the magnitude of the voltages, the types of control power available, required inrush suppression and the amount of transient and ripple suppression required on the DC bus. The Motor Controller is designed to be heat sink mounted in a dry compartment.

SubSea Propulsion Technology use Modbus for our serial interface and can work with a wide range of different Input and Output requirements.

SubSea Naval Propulsion and Maneuvering Electric Drive Systems



Naval Auxiliary Propulsion Units -APUs

For Naval Frigates - Cruisers - Carriers - Submarines

Marine Propulsion Group, is recognized as one of the worlds leading Electric Podded Thruster and Propulsion Systems Manufacturer and introduces its unique Auxiliary Electric Podded Azimuthing / Retractable Propulsion Units for all types of Naval Vessels.

.... Naval Solutions ...

Offering "Dynamic Electric Propulsion"....with its "Electric-Podded Technology", MPS offers compact designs, silent operation with low maintenance costs which are only a few of the Remarkable properties....

FEATURES

- High Thrust to HP Ratio
- Azimuthing and Retractable
- High reliability – Rugged design
- Direct Drive reliability (no gearbox)
- Lightweight Design
- Environmentally Friendly
- Proportional Thrust with VFD Low Harmonic Drives…

Ease of Installation with reduced costs…

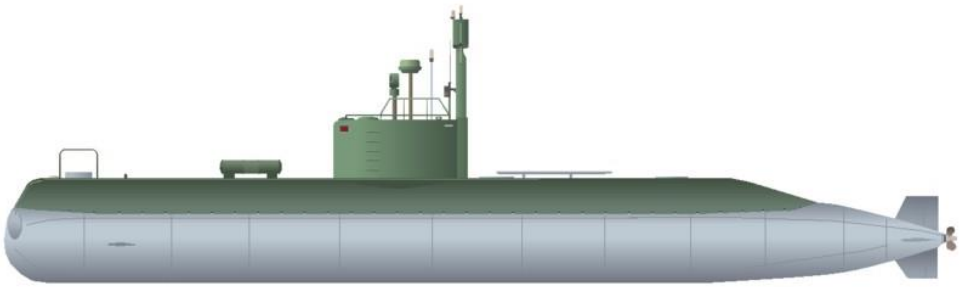
With the electric motor designed as part of the thruster pod and water cooled, there are no requirements for forced air ventilation of the electric motor, no shafting requirements for couplings and alignments…..

Noise Suppression Technology…

Because the electric motor is designed as an integral part of the thruster hub and attached directly to the propeller shaft, there are no gears boxes or gear reductions providing maximum system efficiency with lower noise and vibration levels produced.

Meets or exceeds Mil-S-901D Shock Specifications…

Designed For …….
Midget Submarines



The Standard Single Propeller Electric Drive with Motor Controllers (ECU) is offered for full speed control functions. Depending on the application and customer requirements the stator/rotor housing can be part of the pressurized hull or outside the pressurized housing, oil filled and pressure compensated.

The "New" Counter Rotation design assures that No Gyroscopic Moments are transferred to the vehicle. Very fast response times are assured with

…"Silent & Vibration Free Operation"…

Excellent Maneuvering with Emergency Steering…..

The MPS SubSea Retractable/Azimuthing Electric thruster Systems combines full Maneuverability with effective propulsion during those difficult periods of slow speed maneuvering or dynamic positioning. The system is ROBUST with little required maintenance and is … **RUTHLESSLY RELIABLE**

Group 6 … Electro/Hydraulic Power Modules

MPS SubSea introduces a new series of Electric/Hydraulic Power Modules designed to provide hydraulic power to remotely operated vehicles, subsea tool kits or any submersible hydraulic requirement that requires, Efficient. *Intelligent,* Silent *and Reliable* operation....

Rated from 75 to1000 Horsepower (56 - 705 Kw)
… In Single or Dual Modules …

Fast Control of Magnitude - Constant Torque Control
Silent - Robust - Ruthless Reliable

The ***HPM Series of Hydraulic SubSea Power Modules*** is a "unique" series**,** designed with a piston type variable displacement hydraulic pump incorporated as an integral part of the electric power module. Each system comes complete with electric motor, hydraulic pump, and electric control unit, mounting brackets offered from 75 to 1000 horsepower.

They are designed for subsea operation. They are oil filled and pressure compensated for full ocean depth operation. Units are complete with electric motor, single or dual hydraulic pumps, pump to motor mounting block, bulkhead power connectors with water ingress and motor winding temperature sensors.

A separate pressure compensator is required to maintain pressure of oil in the motor at 1 bar (15 psi) above ambient to depth.

Dual shaft-ended drives allow use of two hydraulic pumps. This allows the option of separate propulsion and tooling hydraulics using separate hydraulic circuits.

Applications include:

- ROV and TMS hydraulic power packs
- Tooling hydraulic power packs
- Drives for Water Jetting power packs for pipe and cable burial tools

Model Sizes: 460V to 4160V, 3PH, 60HZ

Other SubSea Propulsion Hydraulic Products:

Electric/Hydraulic Power Packs can be offered as complete power modules including electric motor, single/dual hydraulic pump, servo valve control package, pressure compensated oil reservoir with mounted compensation system, all in one compact package with shock absorbing mounting frame.

SubSea Propulsion Solenoid Valve Modules (HCU)

Hydraulic Solenoid valve packs can be furnished to perform a number of functions on the ROV, such as rate control manipulators, actuators, pumps, cutters etc. They can be configured in a number of versions and include a oil filled/pressure compensated housing, complete with manifold block with each valve fitted with a pilot check and cross over relief valve to protect the circuit with an integral pressure reducing valve, manifold over pressure relief valve, water ingress alarm, diode steering with diagnostic LEDs visible through a clear manifold cover.

SubSea Propulsion Thruster Servo Control Modules (TCU)

MPS SubSea offers a wide range of *Thruster Servo Control Valve Modules*. They are normally configured for variable speed control of hydraulic thrusters fitted to the ROV or other applications that require variable speed functions. Valve Modules can be configured using both Servo or uni or bi-directional functions.

MPS SubSea Servo Valve Manifolds can accommodate a number of valves (4, 6, 7 or 8) One valve is required for the operation of one thruster unit. Other stations can be utilized to operate variable speed tools etc.

Servo Control Valves are sized to maintain the least pressure drop across the valve at full rated flow and pressure. The valves are mounted to the manifold that includes a combined soft start and over pressure relief valve block. The soft start valve is designed to off-load the electric motor on initial startup and is completely automatic, with no electric input. The over pressure valve provides system protection in the event of failure of the pump pressure compensator and is fully adjustable.

The valve manifold lid cavity is isolated from the main system and separately pressure compensated. This allows the lid to be drained and removed on deck for maintenance of the valve pack without disturbing the main system hydraulics.

The Thruster Servo Control Module is fitted with an electric subsea connector (number of pins determined by valve stack)

Group 7 … SubSea ROV Excavation Modules

Underwater Site Preparation/Excavation and Dredging Modules

Primary Nozzle	**High Mass/Low Velocity - Discharge for large area of sand/debris removal.**
Secondary Nozzle	**Low Mass/High Velocity discharge or removal of Marine growth, cleaning and trench tunneling.**

The modules come complete with Jetting nozzles. Other uses include:

- Seabed Leveling with Port/Harbor dredging and clearance capabilities.
- Treasure Hunting and is ideal for removal of sand in large areas with digging capabilities.

Maneuverability in strong currents – Tracking

Models are available in 25, 50, 75, 135, 175 and 250 Horsepower Modules. They are complete with electric/hydraulic pressure compensated drives in a Stationary or Maneuverable Option. The operator can combine Underwater Camera Systems with Lighting, and can incorporate manipulator arms, and a sub-bottom profiler. The module can incorporate a flotation collar with full ship-based control systems.

Electric Excavator Modules available up to 1000Kw in various voltages – pressure compensated for SubSea use.

SubSea Remote Recovery Module

(Maneuverable Grab/Excavator Module – from 25 - 250 Hp)

The remotely operated grab excavator system is an electro/hydraulic operated multi-jaw grab module incorporating thrusters for maneuverability, a jetting system and lights with cameras. The module can be lowered and maneuvered over a target for recovery using the hydraulically actuated jaws.

The unit can be winched to the surface for unloading or maneuvered to a waiting contained located on the ocean bottom for later recovery.

Description:

This unit is designed as a general-purpose grab that can be used for any material handling operation. The grabber assembly can be used for wreck demolition, boulder clearance and cargo recovery operations. This system incorporates – 3000m depth rating −four propulsion thrusters − steel transformer frame design – from 1 to 25t payload – multiple camera, lights, Hi-Power Jet Pump Excavator and Interfaces − auto-heading and depth.

Her unique deep water system has been purposely designed to provide efficient deployment, operation and recovery of various subsea tools. A heave compensating winch holding 1000m (maximum capacity 3000m) of armoured umbilical provides the load bearing REX with power and lift. She can be fitted out with the latest equipment in subsea navigation and survey, plus there is a range of various applications available with survey equipment and 20Ft Control Container.

Her duties include:
Salvage - Cargo Recovery is the removal of content from sunken vessels, usually valuable metals and aircraft salvaging.

S**urvey / Video and Inspection**
Surveys are done as a prerequisite to any work being carried out subsea. It builds up information for the user so they have a better understanding of what there is and how to tackle a problem.

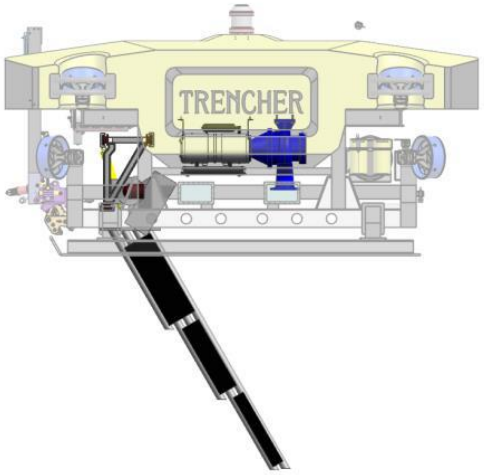
Full Operational Voltage from 400 to 4160VAC for the Hydraulic Power Pack (HPU) with built-in pressure compensation.

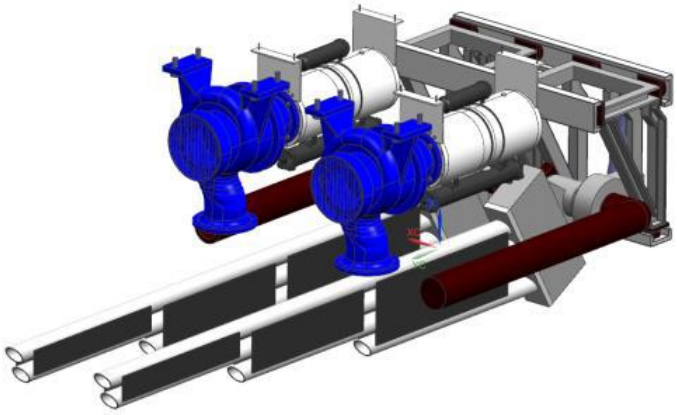
Wind Farm Support / Boulder & seabed clearance / Supply
Seabed/Boulder Clearance is the removal or repositioning of unwanted organic obstacles from the seabed.

- **UXO removal**
- **Trenching operations support**
- **Cable recovery**
- **Mattress and stone bag laying and recovery**
- **Subsea Demolition**
- **Hydrography**
- **Subsea excavating**
- **Deep ocean operations**
- **Precision subsea manipulation**
- **Ship Wreck Cargo & Treasure Recovery**

SubSea Cable Trencher Components...

PT. Marine Propulsion Solutions (Subsea) is a supplier of Cable Trencher major sub-assembly components and specializes in the following equipment:





As Supplied to (KIRO) Korean Institute of Robot and Convergence for New 2,500M Cable Trencher Project 2016

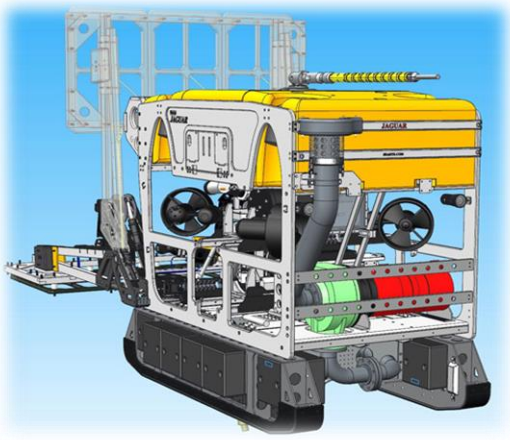
- Subsea Electric Motor / Water Pumps
- Jetter Assemblies
- Jetter Manifold Assemblies
- Sudsea Hydraulic Cylinders with position feedback
- Pressure & Flow Sensors
- Hydraulic Subsea Thrusters
- Pressure Compensated Main Hydraulic Reservoirs
- Hydraulic Valve Packs (Proportional Flow & Proportional Pessure)
- Pressure Compensated Electric Connection Enclosures
- Heave Compensating Winches (LARS)
- Heave Compensating Docking Heads

Optional Supplied Equipment....

Pressure Compensators

Pressure Housings

Subsea Electric Driven Waterpumps



The Company:

PT. Marine Propulsion Solutions, specializes in thruster and propulsion systems for all types of manned/unmanned underwater vehicles. This includes both hydraulic and electric thruster systems. Marine Propulsion Solutions was formed in 1998 in the USA and now has in Main offices in Singapore and Batam, Indonesia with sales offices in Paris, the UAE (Dubai), Korea and Russia.

Full Testing facilities including water tank and pressure chamber.

PT. Marine Propulsion Solutions

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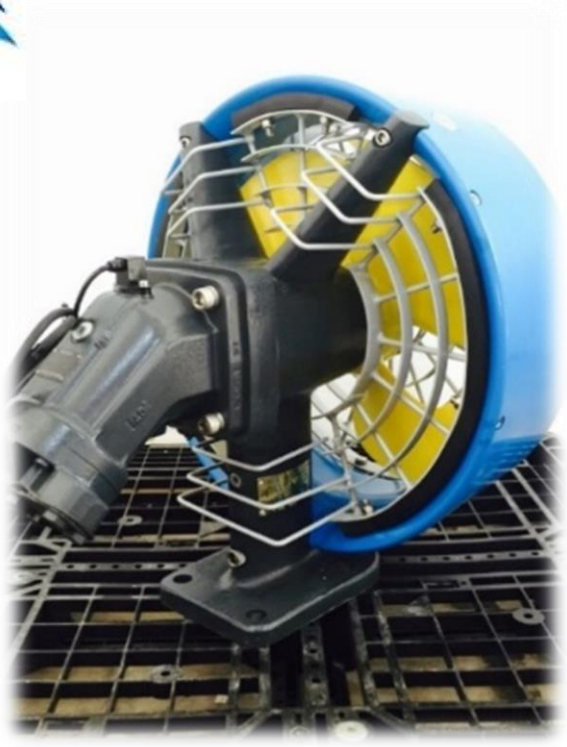

www.marinepropulsionsolutions.com