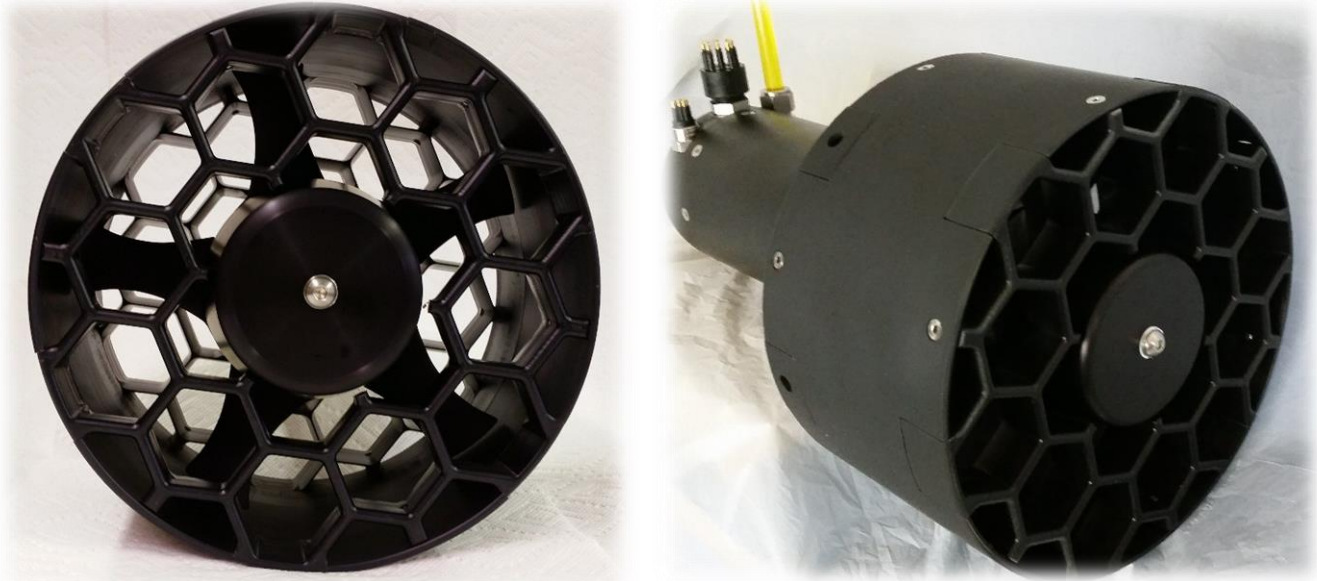




H106 SERIES ELECTRIC THRUSTER WITH 9150 MOTOR



- Streamlined Brushless DC, oil filled and pressure balanced motors.
- The direct drive electric motors simplifying the design and increasing reliability.
- Integrated(Inside the motor) or stand-alone controller that is oil filled and pressure balanced, eliminating the need for a motor controller housed in a separate one atmosphere bottle.
- Small compact and light weight.
- Proven 3 tier seal system that includes Silicone Carbide Face Shaft Seals.
- 90% Reverse Thrust
- Resistant to Cavitation.
- Hexscreens Which Cancel 80% Of The Prop Torque While Reclaiming Thrust.
- Symmetrical Bi-Directional Geometry Including Lenticular Prop Blades Without Camber.
- The Jet is Smaller and Narrower and Thus Easier to Provide Clearance For and Reduces the Coanda Effect.
- Higher Jet Velocity Means Thrust Falls Off More Slowly With Speed.
- All USA made materials, manufacturing and assembly.
- Independently Tested Off-The-Shelf Units that have a proven track record.

Customized Solutions/Systems for R & D Programs or Prototype Vehicles, small or large. These thrusters can be precision matched to each application.



STATE-OF-THE-ART AMBIENT PRESSURE MOTOR CONTROLS FROM 100-550VDC

Just like the 1002 series, the H106 series electric thrusters are offered with a matching integrated or stand-alone controller option, oil filled and pressure balanced, eliminating the need for a motor controller housed in a separate one atmosphere bottle.

Where space allows the Integrated Motor Controller (IMC) option is a two-connection solution to the thruster. The separate HV DC power feed and low voltage digital control connection provide a simple interconnect to vehicle systems, and very low radiated emissions.

Where space does not allow, the Stand-alone Motor Controller (SMC) is offered in a separate bottle with resolver and phase power connections to the motor.

Both the SMC & IMC operate in torque or velocity mode. Torque mode is particularly useful when integration to a vehicle stability control system is anticipated, allowing percentage torque thrust forward and reverse to the RPM limit of the motor. Feedback from the motor to the system controller receipt of the digital commands sent and provides real time RPM and motor current, along with system health and performance monitoring data. Motor acceleration rates and other parameters can be set to suit the motor and application.

Recording of lifetime performance data including total shaft revolutions, hours since overhaul and power cycles provide data points for operation and maintenance purposes are standard.



Integrated Controller (IMC)
Mounts on rear of motor body

Stand-alone Motor Controller (SMC)
Bottle w/o connectors $\phi 4.72'' \times 5.86''$

SPECIFICATIONS

IMC (Integrated Motor Controller) or SMC (Stand-alone Motor Controller):



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Type: Oil filled, Pressure Balanced Three Phase BLDC motor controller.

Available Configurations:

Integrated (IMC): Directly attached to motor - includes all control elements within motor housing.

Stand Alone (SMC): Independent control unit with cable connections to motor - phase (power) and sensing (resolver).

Motor Power Rating: Integrated: 1hp (750W) to 25hp (18kW)
Stand Alone: 1hp (750W) to 25hp (18kW) with options to 55hp (41kW)

General Characteristics:

Voltage: DC, 100VDC to 550VDC, Positive, Negative, Isolated from Frame Ground.

Current: Maximum Continuous 50A (in water - limited by connector capability)

Motor Type: Suitable for Three Phase water cooled BLDC Permanent Magnet motors

Integrated Controller: End effect magnetic shaft position sensor and direct commutation

Stand Alone Controller: Sine/CoSine resolver and direct commutation

Operating Parameters: Controller parameter matched to associated motor.

Connections - Integrated Option

Power: Three Pin Rated for Applicable Current - Positive, Negative and Frame Safety Ground

Data: Five Pin (e.g. SubConn Micro Circular) - +12V, 0V, CAN+, CAN-, Frame Safety Ground

Connections - Stand Alone Option

Power: Three Pin Rated for Applicable Current - Positive, Negative and Frame Safety Ground

Data: Five Pin (e.g. SubConn Micro Circular) - +12V, 0V, CAN+, CAN-, Frame Safety Ground

Motor Phase: Phase A, B, C, Frame Ground/Shield

Motor Sensor: Sensor SIN+/-, COS+/-, EXC+/- Frame Ground/Shield

Control

Electrical: CAN bus point to point electrical connection.

A separate 12VDC LV supply used with the CAN bus allows independent powering of the control electronics. This enables the condition of the controller (and for the IMC the controller/motor) to be known without the HV being present. Communication of all of the motor parameters is possible, and RPM is also reported.

Command: MOD bus command set with defined command set including:

Query Commands, Action Commands and Maintenance Commands.

Command

Action Commands: RPM setting (velocity mode) - Forward and Reverse, to rated motor RPM
Power setting (torque mode)- Forward and Reverse, 0% to 100% of maximum rated/programmed torque
Safety Lockout (Manual)

Status Messages: Status query
Shaft RPM
Motor Current
Throttle/Thrust setting
Temperature

Safety State Action: Condition warnings (temperature, voltage, current)
Control System Connectivity Failure - Automatic shutdown

Notes:

- Optional External Control Interfaces: Test interface and development example code (for use in development)
- For safety and security purposes, the CAN communications bus is point to point, not multi-drop.
- DC supply cables must meet minimum length/inductance requirements to eliminate requirement for an external HVDC soft start switch.
- Adequate DC bus capacitance and reverse EMF/Overvoltage protection must be used.



PERFORMANCE DATA & THRUSTER DIMENSIONS

H106 with 9150 Motor Specifications.				
INPUT VOLTAGE	Max Thrust	RPM	Input Power	Shaft Power
150 VDC MAX	142lbsf (64 kgf)	1,250	5.8 HP (4.3 kW)	4.7 HP (3.5 kW)
Reverse Thrust				
150 VDC MAX	130 lbsf (59 kgf)	1,250	5.8 HP (4.3 kW)	4.7 HP (3.5 kW)

H106 Electric Thruster with 9150 Motor Performance Table

SPEED	VOLTAGE	CURRENT	THRUST (Lbf) at Bollard Condition (0 kts) to 6 kts vehicle speed							REVERSE Thrust (lbf)	POWER		
			0 kts	1 kts	2 kts	3 kts	4 kts	5 kts	6 kts		SHAFT (HP)	IN (HP)	Pout/Pin
RPM	(VDC)	(A rms)											
100	100.0	1.4	1	-	-	-	-	-	-	1	0.02	0.0	88.2%
200	100.0	2.0	4	-	-	-	-	-	-	3	0.05	0.1	91.5%
300	100.0	2.9	8	8	8	7	7	7	6	8	0.11	0.1	91.7%
400	100.0	4.2	15	14	13	13	12	12	12	13	0.21	0.2	91.1%
500	100.0	5.8	23	22	21	20	19	19	18	21	0.37	0.4	90.1%
600	100.0	7.8	33	31	30	29	28	27	26	30	0.60	0.7	89.1%
700	100.0	10.2	45	43	41	40	38	37	35	41	0.91	1.0	87.9%
800	100.0	12.9	58	56	54	52	50	48	46	53	1.32	1.5	86.8%
900	100.0	16.0	74	71	68	66	63	61	58	68	1.85	2.2	85.6%
1000	106.8	19.5	91	87	84	81	78	75	72	83	2.50	3.0	84.5%
1050	113.3	21.4	100	96	93	89	86	83	80	92	2.87	3.4	83.9%
1100	119.9	23.3	110	106	102	98	94	91	87	101	3.28	3.9	83.3%
1150	126.7	25.4	120	116	111	107	103	99	95	110	3.74	4.5	82.8%
1200	133.5	27.5	131	126	121	117	112	108	104	120	4.23	5.1	82.2%
1250	140.4	29.8	142	137	132	127	122	117	113	130	4.76	5.8	81.6%

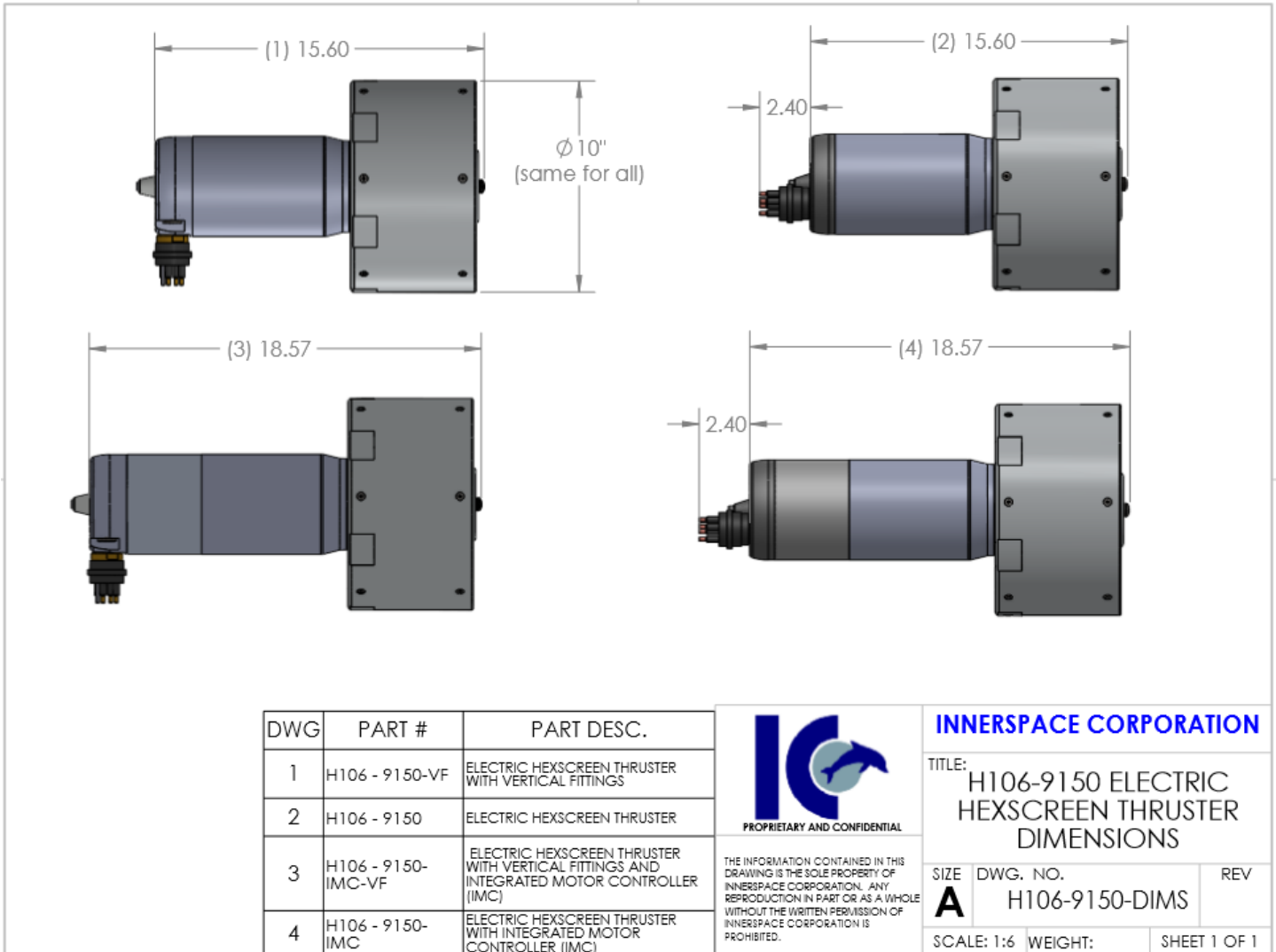
Table Information:

- 1) Voltage in the above chart shows the minimum voltage needed to achieve the performance at that given propeller rpm
- 2) The system voltage should typically be 20-40 VDC higher than the minimum voltage referenced above.
- 3) The Current shown represents the continues RMS current to the motor to achieve the torque at the corresponding propeller rpm.
- 4) The Shaft HP developed is a function of the propeller and increases with propeller rpm.
- 5) The maximum performance achieved will depend on the limitations of customers system voltage and driver current capacity.
- 6) For Thrust at Forward Vehicle Speed (kts), anything lower than 500 rpm varies greatly with vehicle design.



- 7) Thrust at forward vehicle speed from 1 kts to 6 kts is based on a local water speed with a very conservative vehicle wake factor. Basically, estimated conservatively at worst case from test results of various customer vehicles
- 8) The current/rpm might need to be limited depending on customer connector spec and or system current limitations.
- 9) Performance based on the Innerspace 6 Blade Lenticular Propeller. Other props are available upon request.

H106-9150 Dimensions with different configurations.

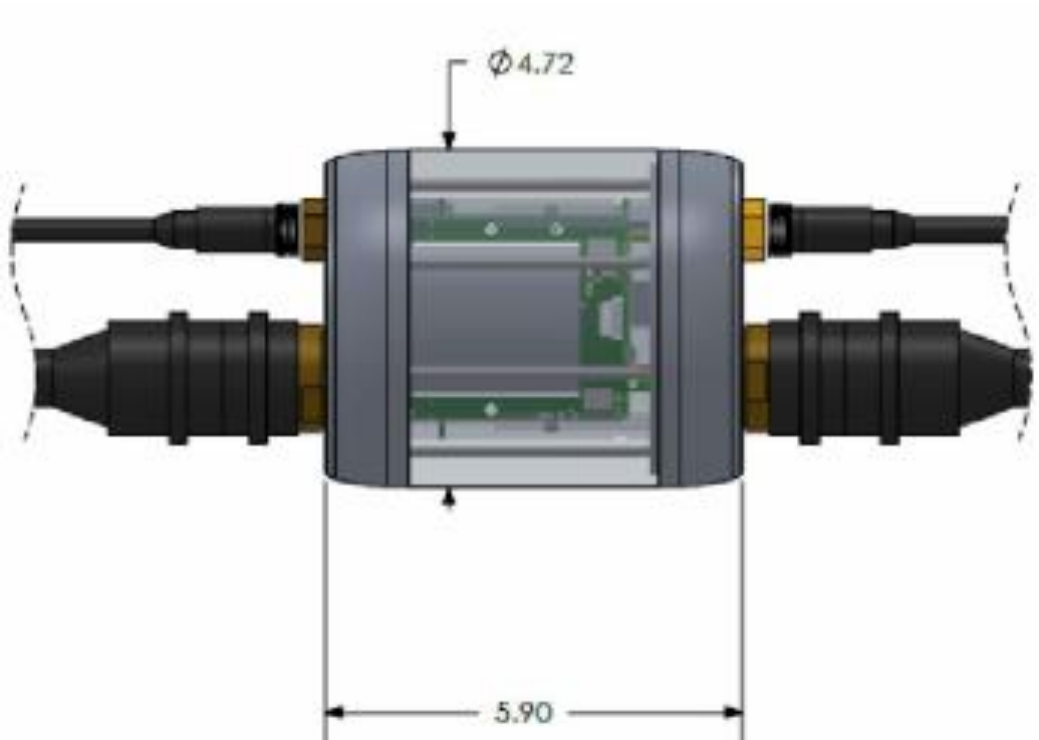


The Electric Thrusters can be ordered with almost any customer preferred connectors if current ratings are taken into consideration.

The above Drawing shows the H106 Thruster Dimensions with and without the IMC (Integrated Motor Controller) and with two different connector orientations. The SMC(Stand-alone Motor Controller is shown below.



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Stand-alone Motor controller option that is not mounted on the back of the motor. Electronics are inside a separate oil filled housing that is connected to the back of the motor via a power cable and feedback cable.