Operator's Manual

DWT 1-300V Thruster

2T01-00018 24/04

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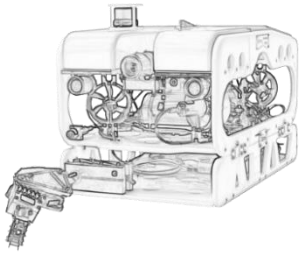


Revision information

Issue	Revisions	Date	Revised	Approver
1	First edition	2024/1/25	LIAO YU TSO	Mike Chen
2	Remove Thruster RS-485 Communication Protocol Watch dog	2024/4/30	LIAO YU TSO	Jerome Huang

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 General

DWTEK releases new range of brushless DC thrusters with the outstanding characters of low-weight, powerful thrust and integral electronic components. The engineering capabilities of DWTEK in subsea application drive our passion to innovate high reliable design and components to our thrusters.

DWT 1 thruster is a heavy-duty electric underwater thruster. The design is in purpose of high efficiency and low noise stealth; meanwhile it is suitable the propulsion system of any underwater robots or high-end surface utility vehicles.

1.2 Precautions

Table 1 - Precautions

	The “DANGER” symbol indicates a hazardous situation which, if not avoided, will result in death or serious injury. Carefully read the message that follows to prevent serious injury or death.
	The “WARNING” symbol indicates a hazardous situation which, if not avoided, could result in death or serious injury. Carefully read the message that follows to prevent serious injury or death.
	The “CAUTION” symbol indicates a hazardous situation which, if not avoided, could result in minor or moderate injury, or equipment damage. Carefully read the message that follows to prevent minor or moderate injury.
	The “NOTICE” symbol alerts to a situation that is not related to personal injury but may cause equipment damage
	Do not put hands near it when machine operating.
	Do not wear electrically conductive jewelry,clothing, or other items while working on the electrical system.
	An electric shock could be fatal.Ensure power to the Thruster is OFF” before opening electrical panels.

2 Specifications

2.1 Thruster

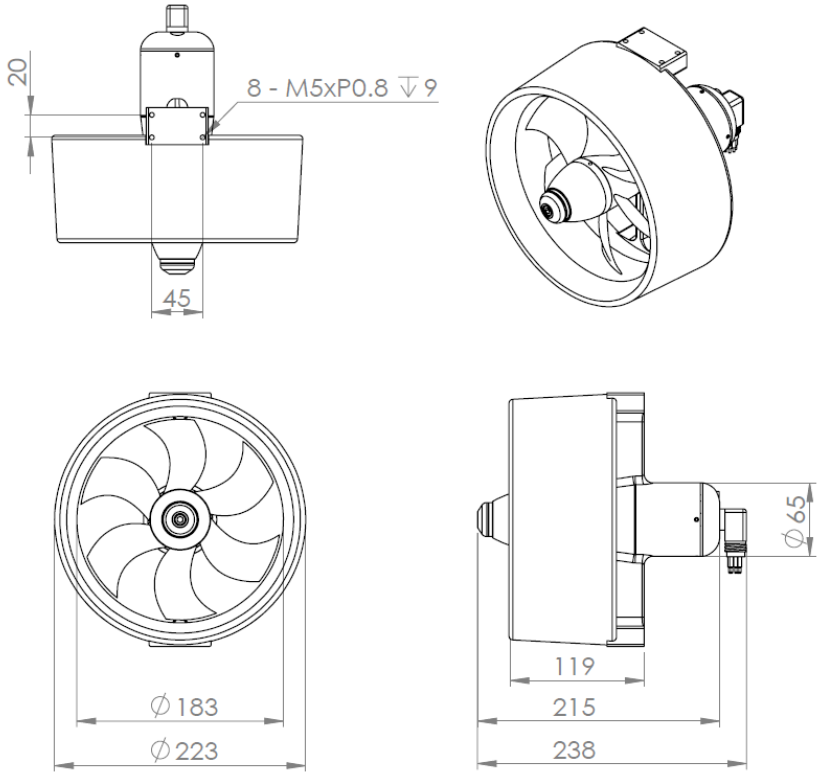


Figure 1 - DWT 1 Thruster

Table 2 - DWT 1 Specification

DWT 1	
MECHANICAL	
Weight in air	3.5 kg
Weight in water	1.5 kg
Standard Housing	AL 6061-T6
Propeller	Engineering Plastic
Nozzle	Nylon
ELECTRICAL	
Operation Voltage	300 VDC
Speed Control	RS485
Drive	Gear Reducer
Watt	500W
Protection	Over-Temp / Over Current / Under Voltage / Abnormal Operation
PERFORMANCE	
Thrust	CW: 15 kgf / CCW: 14 kgf

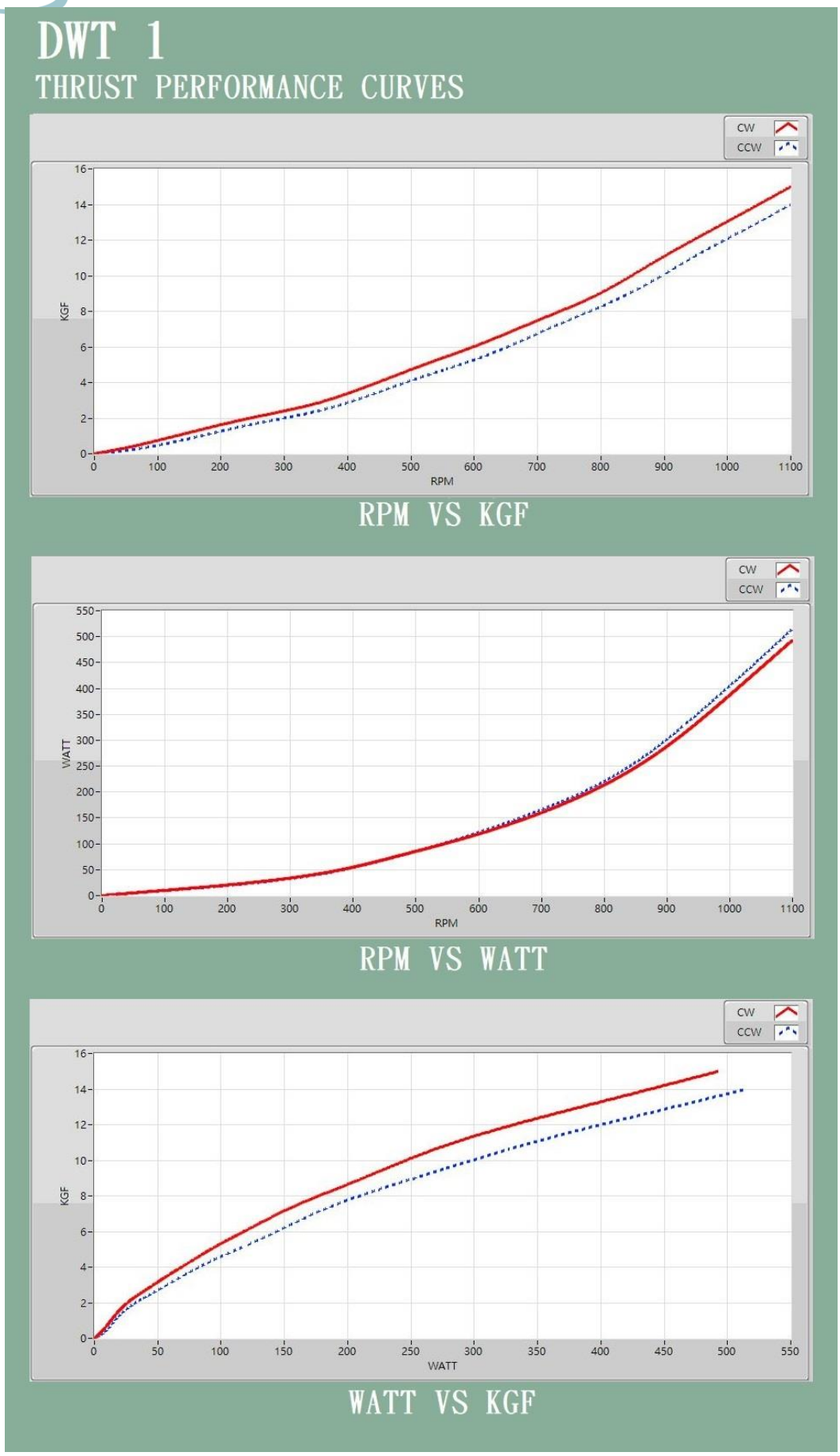


Figure 2 - DWT 1 Thruster performance curve

2.2 Connector

2.2.1 General

Part No.	2GW100708M-00001
Title	Mini Bulkhead Right Angle Connector
Service Check	Regularly

2.2.2 Indications for Replacement

Replace if connector is damaged, deformed or no longer watertight.

2.2.3 Installation Procedures

For greasing and mating above water

1. Connectors must be greased with Molykote 44 Medium before each mating.
2. A layer of grease corresponding to minimum 1/3 of socket depth should be applied to the female connector.
3. The inner edge of all sockets should be completely covered, and a thin transparent layer of grease should be left visible on the face of the connector.
4. After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets.
5. To confirm that grease has been sufficiently applied, de-mate and check for grease on each male pin, then re-mate the connector.

For Cleaning

1. General cleaning and removal of any accumulated sand or mud on a connector should be performed with spray based contact cleaner, Isopropyl Alcohol.
2. New grease must be applied again before mating.

Warning!!
Only the qualified specialist is allowed to proceed the connector replacement.

3 Installation

3.1 Installation Guide

Table 3 - DWT 1 Thruster Electrical

	Nominal	Max	Min
Input Voltage	300 VDC	315 VDC	285 VDC
Input Current	1.67A	1.58A	1.75A
Instrument Power Voltage	15V	16.5V	13.5V
Instrument Power Current	0.08A	0.07A	0.09A

Procedure of electronic Connection:

Step1. Connect Pin3 to +300 VDC

Step2. Connect Pin1 to HGnd

Step3. Connect Pin5 to RS485-A

Step4. Connect Pin6 to RS485-B

Step5. Connect Pin7 to ISO GND

Step6. Connect Pin4 to +15 VDC (instrument)

Step7. Connect Pin1 to HGnd (instrument 15 VDC)

3.2 Pin Assignment

Table 4 - Pin Assignment

Female Inline Top View	Pin Assignment	Male Bulkhead Top View
	1：HGnd 2：PE 3：+300 VDC 4：+15 VDC 5：RS485-A 6：RS485-B 7：ISO GND 8：N/A	

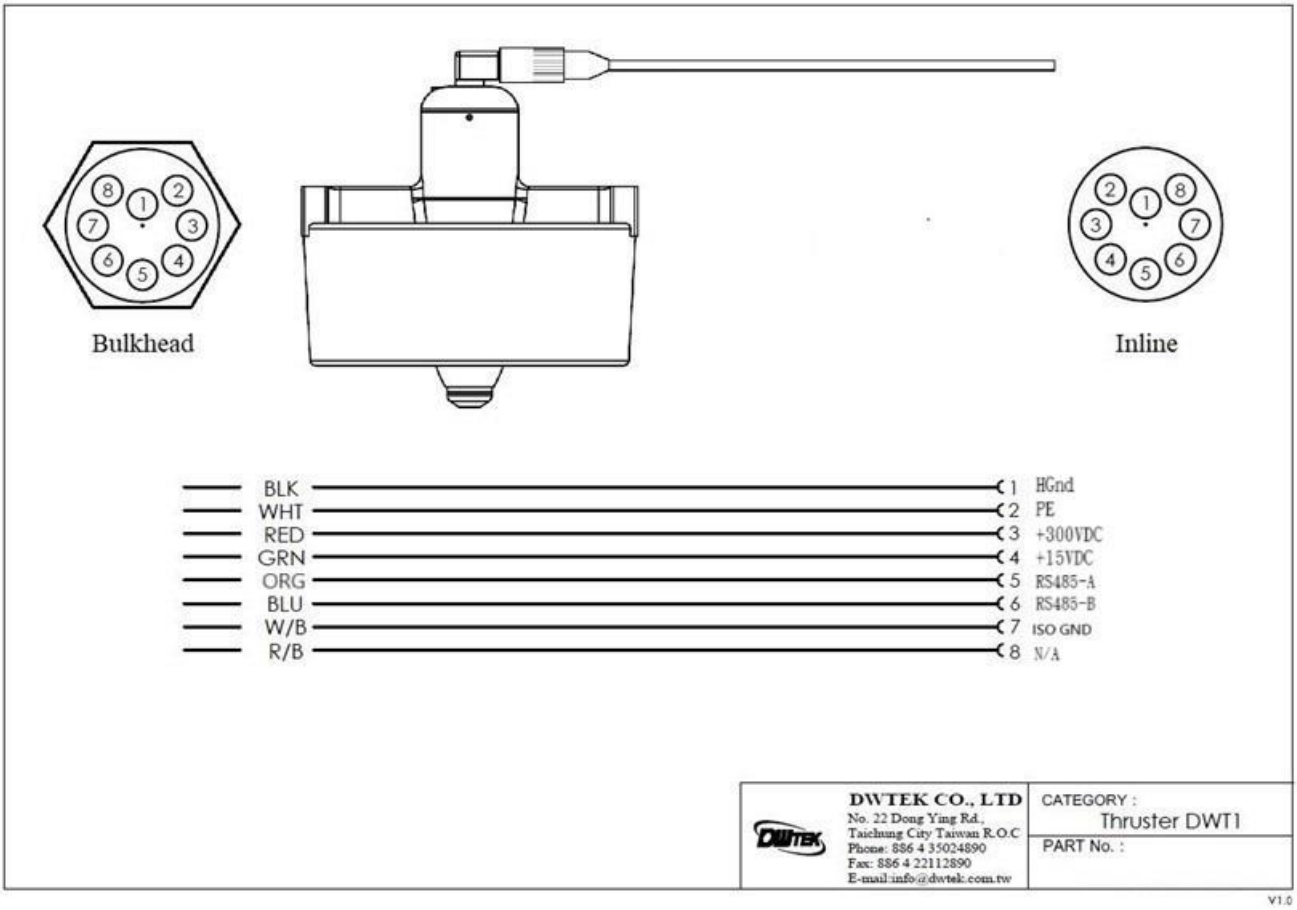


Figure 3 - DWT 1 Thruster Pin Assignment

Make sure all the connections are correct, and follow the instruction listed as below to power the thruster.

1. Connect Pin2 to the Protection Earth point.
2. Deliver +15 VDC to Pin4 and Pin1
3. Deliver RS485 control signal to Pin5 and Pin6
4. Deliver +300 VDC to Pin3 and Pin1
5. Thruster should turn CW and CCW according to the apply RS485 signal.

Note!!

1. The WATT of DWT 1 at the maximum speed is about 500W±10%.

3.3 Maintenance and Removal

To remove the thruster, please follow below steps.

1. Disconnect the cable.
2. Install the protection dummy on the bulkhead connector

THRUSTER FIELD & DEPOT REPAIR PROCEDURES LISTED BELOW SHALL BE CARED.

Warning!!

Make sure to switch off thruster power and auto-functions once the system is on the surface.

Caution!!

It recommends considering the replacement of the O-rings and resealing DWT 1 thruster as annual maintenance. DWTEK offers comprehensive annual inspection and maintenance service to guarantee reliability and performance.

Caution!!

The thruster is designed as a simple maintenance unit. After each dive, please always wash with fresh water.

4 Trouble shooting

4.1 Thruster Trouble shooting

If thruster performed:

I. RPM unsteady.

II. Vibration.

please proceed the initial detection procedure which mainly caused by two type of cases as below:

I. Power output.

II. Consumption parts and determine the replacement.

4.2 Detection Procedure

1. Make sure the propeller is free of rotation and under safety and well protection.
2. Apply +15 VDC to Pin4 and HGnd to Pin1. It recommends using power supply with the current consumption indicator. The nominal current consumption is 0.08Amp +/- 0.02.
   If current consumption is out of the above range without loading, the control PCB need to be examined and replaced.
3. Apply input voltage +300 VDC to Pin3 and HGnd to Pin1.
4. Deliver RS485 control signal to Pin5 and Pin6.
5. Use a current indicator to wire on the power supply in series before delivering +300 VDC.
6. Make sure current output is less than 0.1A when control signal is 0V.

Caution!!

If the current goes higher with short circuit, the power PCB need to be examined and replaced, please do not hesitate to contact DWTEK Co., Ltd.

5 Maintenance

5.1 Nozzle

5.1.1 General

Part No.	2D004-00164
Title	Nozzle
Service Check	Replace if damaged
Tool	4mm Allen Key

The nozzle is designed to improve the performance in water. Without the nozzle, there would be a drastic thrust reduction and control failure. Thruster can be tested in air but it recommends contacting DWTEK if doing enforced dummy load in the shaft of thruster.

The nozzle consists of a cast Nylon material that is high impact-resistant.

5.1.2 Indications for Replacement

Please replace the nozzle if it damages to the point that it fouls the propeller.

5.1.3 Removal the Nozzle from Thruster`

Remove (4) Socket Head CAP Screw M5x30mm (P/N:2P001-D1B2M5-08030) with 4mm Allen Key.

5.1.4 Installation Procedures

1.Put (4) Socket Head CAP Screw M5x30mm (P/N:2P001-D1B2M5-08030) into the Nozzle screw hole.

2.Secure screws with 4mm Allen Key(4.2NM).

NOTE!!

If you have any further queries, please do not hesitate to contact DWTEK Co., Ltd.

5.2 Propeller Assembly

5.2.1 General

Part No. :	2C004-00104
Title :	Paddle Assy
Service Check :	Before and after each dive
Tool	5mm Allen Key

DWT 1 thruster uses Vectus propeller that has outstanding thrust performance in operation. The thrust differences between forward and reverse thruster are within 10%.

5.2.2 Indications for Replacement

Replace it if significant wear or damage is apparent on the blades of the propeller.

5.2.3 Removal Procedures

1.Unscrew Socket Head CAP ScrewM6x12mm (P/N:2P001-D1B2M6-10012) with 5mm Allen Key and Spring Washer (P/N:2P001-W122M6)、Propellor Retainer(P/N:2D004-00122).

2.Remove Paddle Assy (P/N:2C004-00104) from the shaft.

5.2.4 Install Procedures

1.Install Paddle Assy (P/N:2C004-00104) into the shaft.

2.Secure Socket Head CAP Screw M6x12mm (P/N:2P001-D1B2M6-10012) and Spring Washer (P/N:2P001-W122M6)、Propellor Retainer(P/N:2D004-00122) with 5mm Allen Key(7.1NM).

Warning!!

Operator is only allowed to remove propeller assembly under power off condition.

NOTE!!

If you have any further queries, please do not hesitate to contact DWTEK Co., Ltd.

5.3 Gear Shaft Seal Assy

5.3.1 General

Part No. :	2C004-00105
Title :	Reducer + Magnet Hull Assy
Service Check :	Before and after each dive

Operator needs to check the sealing condition before and after each dive. If any damage or leaking are detected,please do not hesitate to contact DWTEK Co., Ltd

NOTE!!

If you have any further queries, please do not hesitate to contact DWTEK Co., Ltd

6 Appendix

6.1 Vacuum and Pressure Relief

All electronic components could generate heat and prohibit system operation with a vacuum condition. Pressure relief port can be used as a vacuum port for testing purpose.

Recommended vacuum test on the pod is -80kPa for a period of 30 to 60 minutes after disassemble and re-assembly. It should be released once the testing is complete. Filling in Nitrogen gas from the Nitrogen bottle with an adaptor would take out the moisture to prevent concentration.

Warning!!

1. Make sure that this process was carried out in a well-organized place.

2. Check and clean the O-rings on pressure relief valve before installation. If they are damaged, please replace it with new one, and greased with Molykote 44 Medium.

6.2 Spares and Tools

Table 5 - Spares list

Item No.	Part No.	Description	Qty
1	2P001-D1B2M6-10012	SUS316 M6xP1.0x12 Socket head cap screw	1pcs
2	2P002-SOR-AS117N70	AS-117 O-Ring	1pcs
3	2P002-SOR-AS134N70	AS-134 O-Ring	1pcs
4	2P002-SOR-S55N70	S-55 O-Ring	1pcs
5	2P001-D4N0M4-0706	PEEK M4xP0.7x6 Socket Grub Screw	2pcs
6	2P002-SOR-S7N70	S-7 O-Ring	2pcs

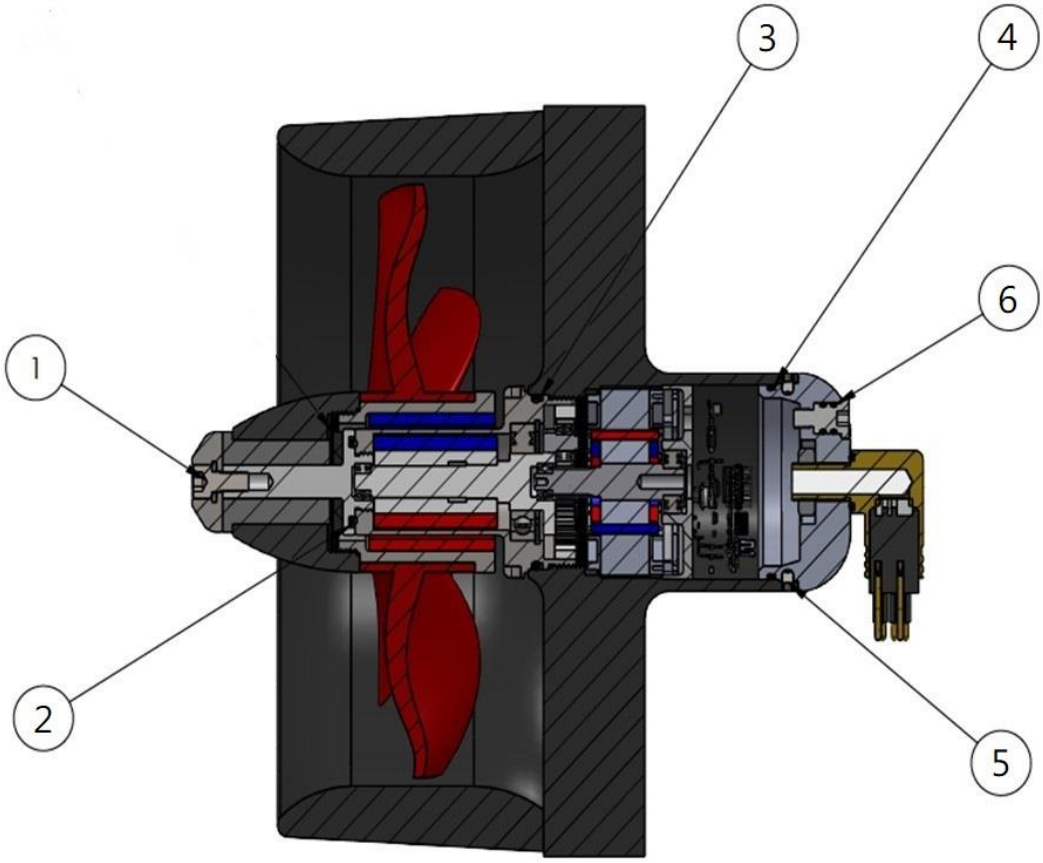


Figure 4 - DWT 1 Thruster Spares

Table 6 - Tools list

Item No.	Part No.	Description	Qty
1	2P001-FLU5M2	M2 Allen Key	1pcs
2	2P001-FLU5M4	M4 Allen Key	1pcs
3	2P999-00027	58-62mm Hook Wrench	1pcs

6.3 Exploded View

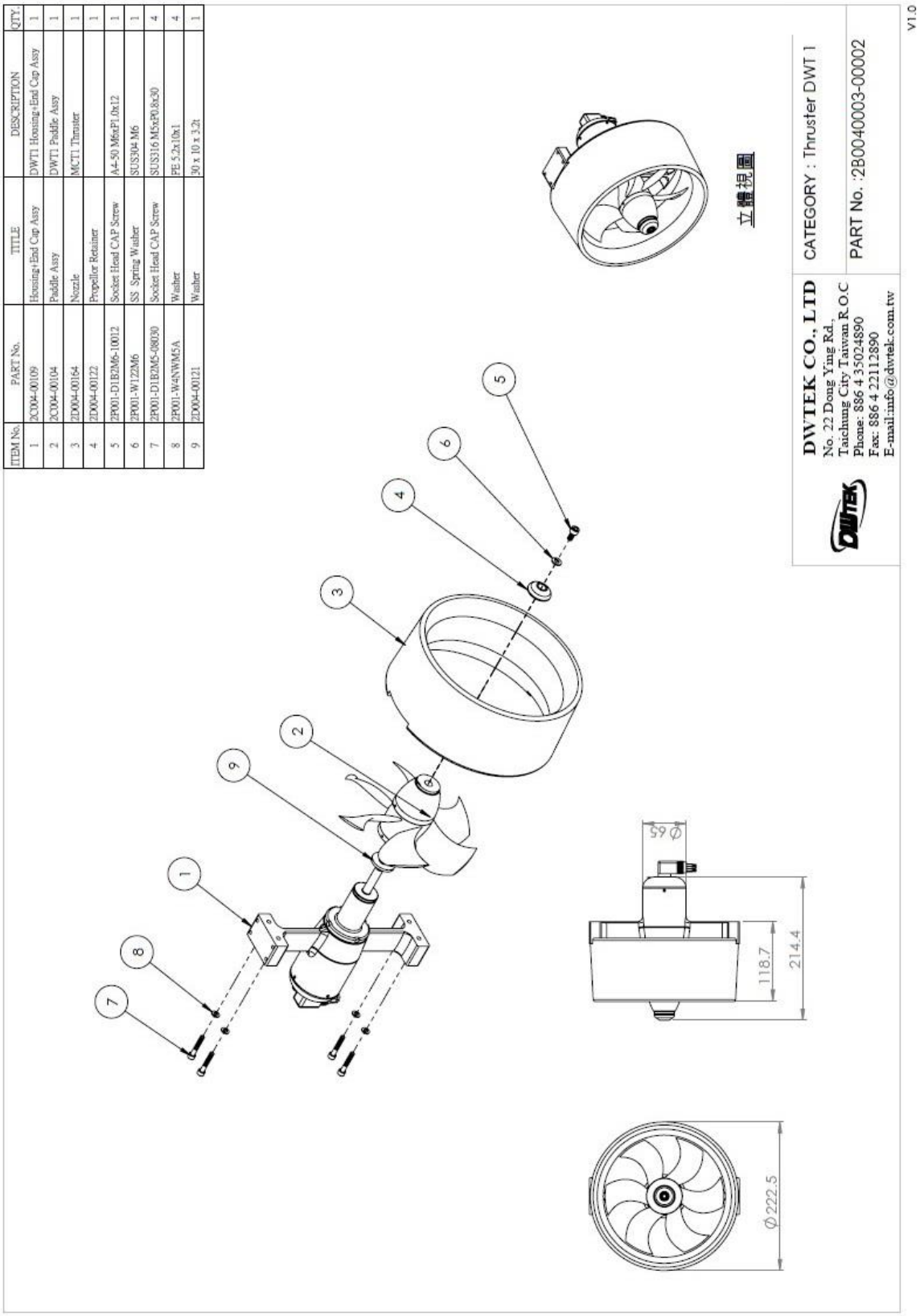


Figure 5 - DWT 1 Thruster (2B0040003-00002)

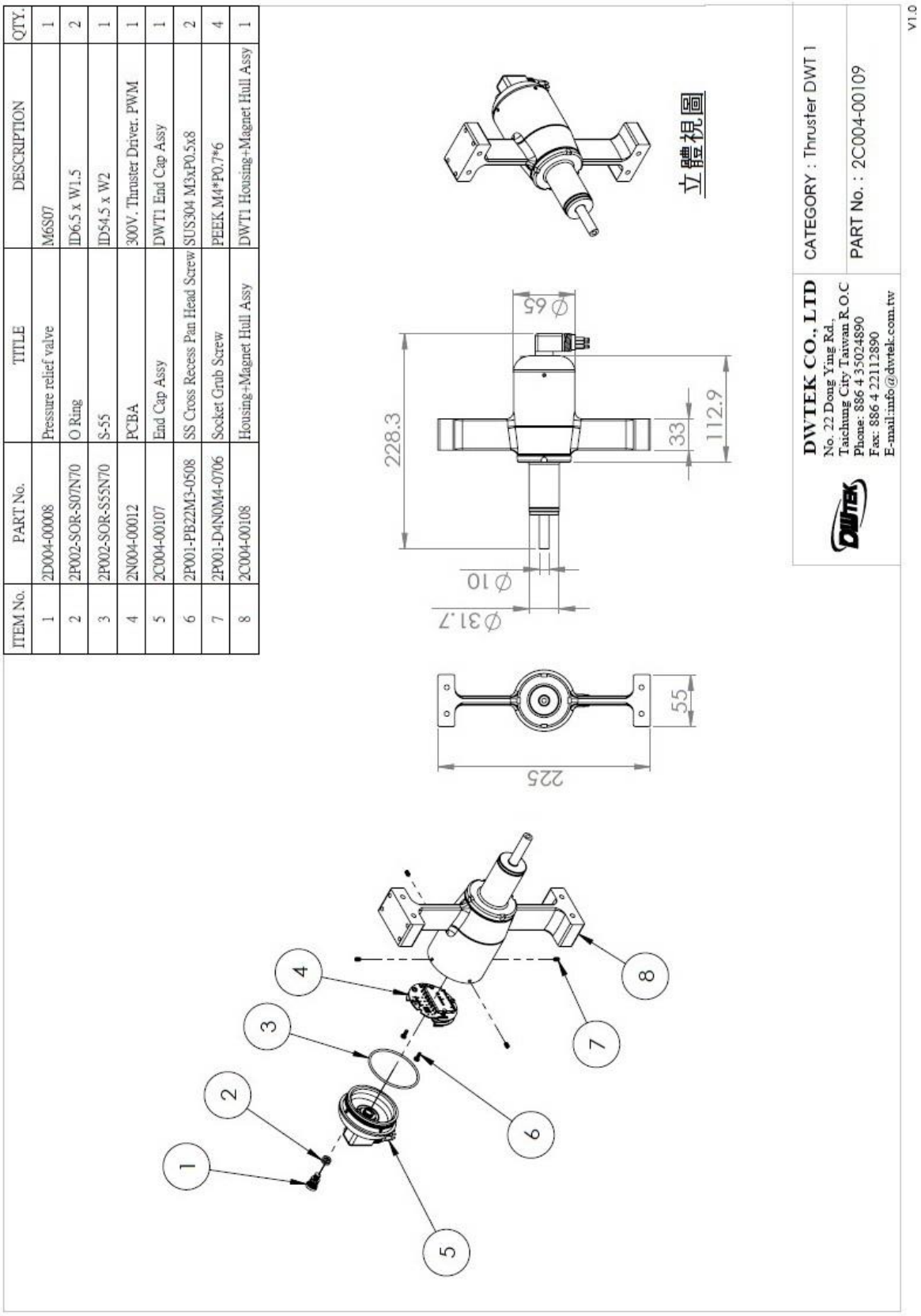


Figure 6 - Housing+End Cap Assy (2C004-00109)

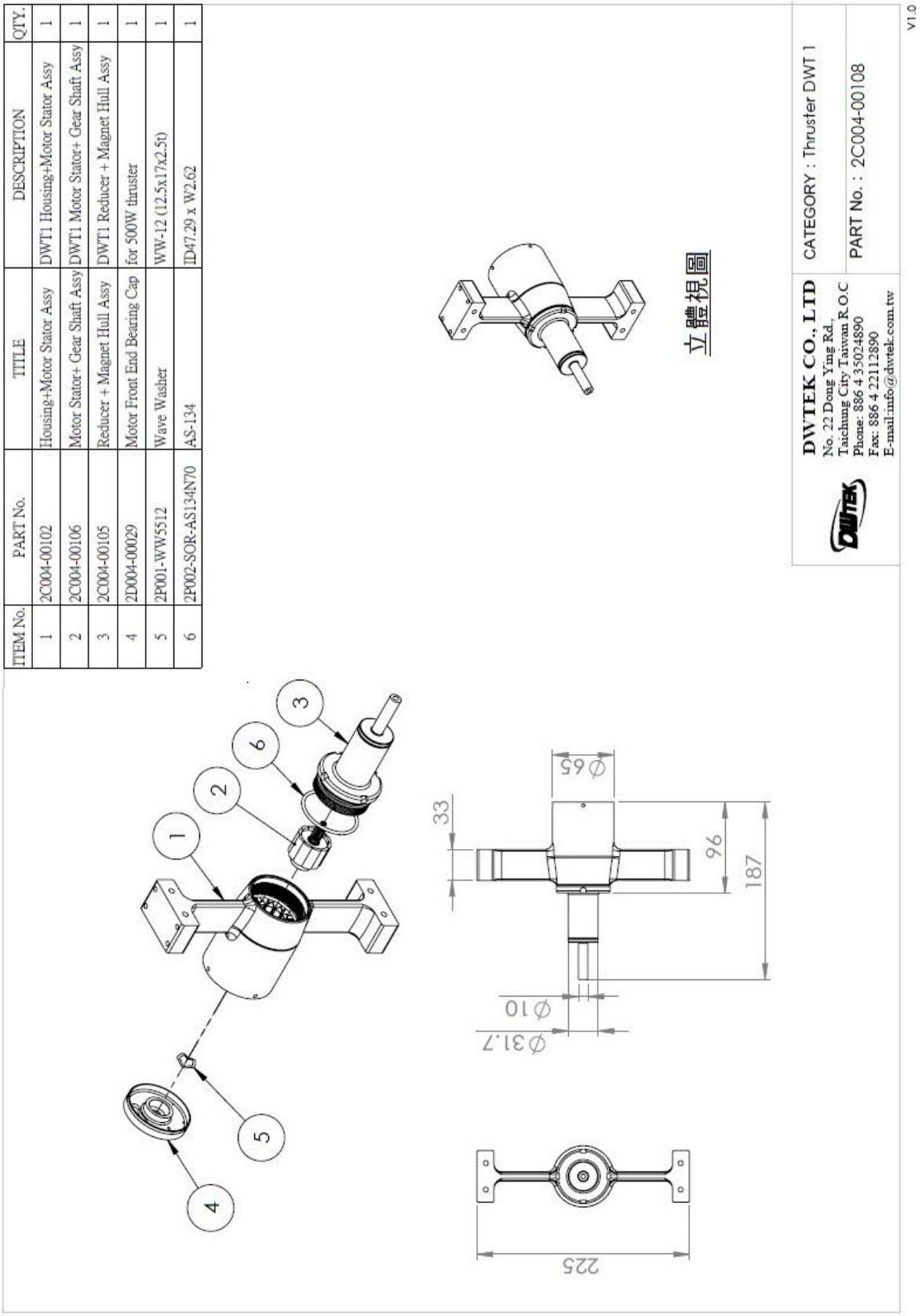


Figure 7 - Housing+Magnet Hull Assy (2C004-00108)

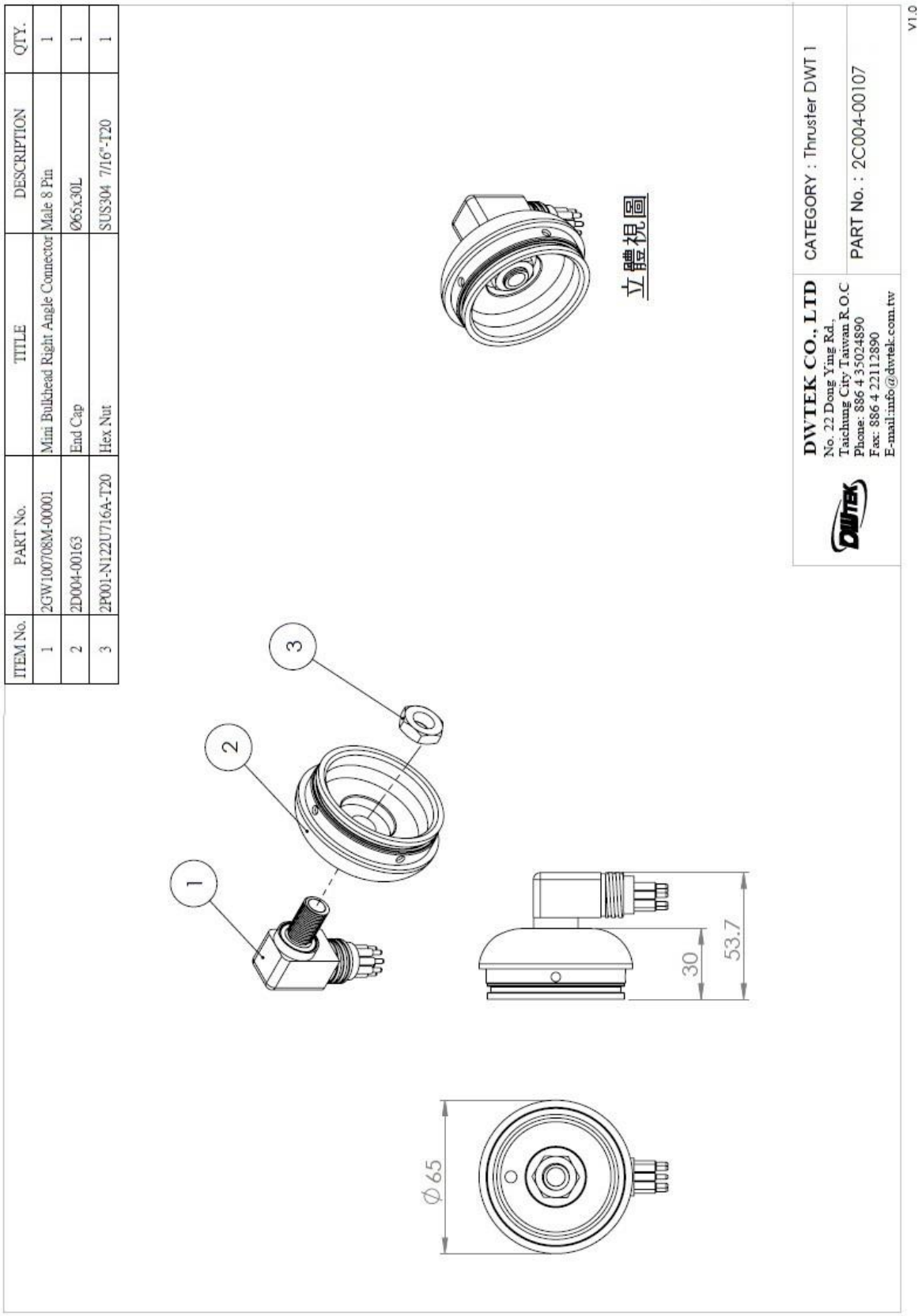


Figure 8 - End Cap Assy (2C004-00107)

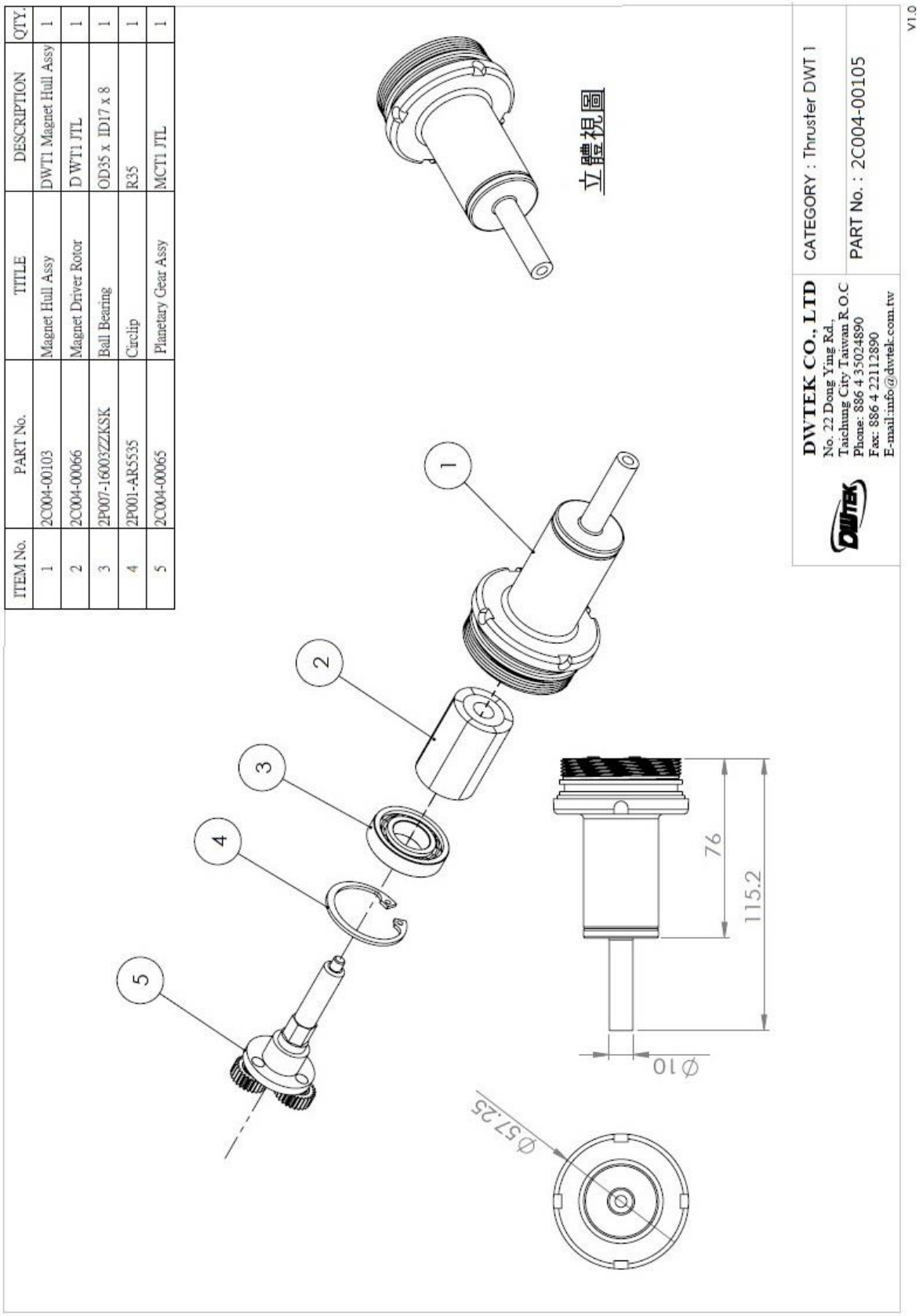


Figure 9 - Reducer + Magnet Hull Assy (2C004-00105)

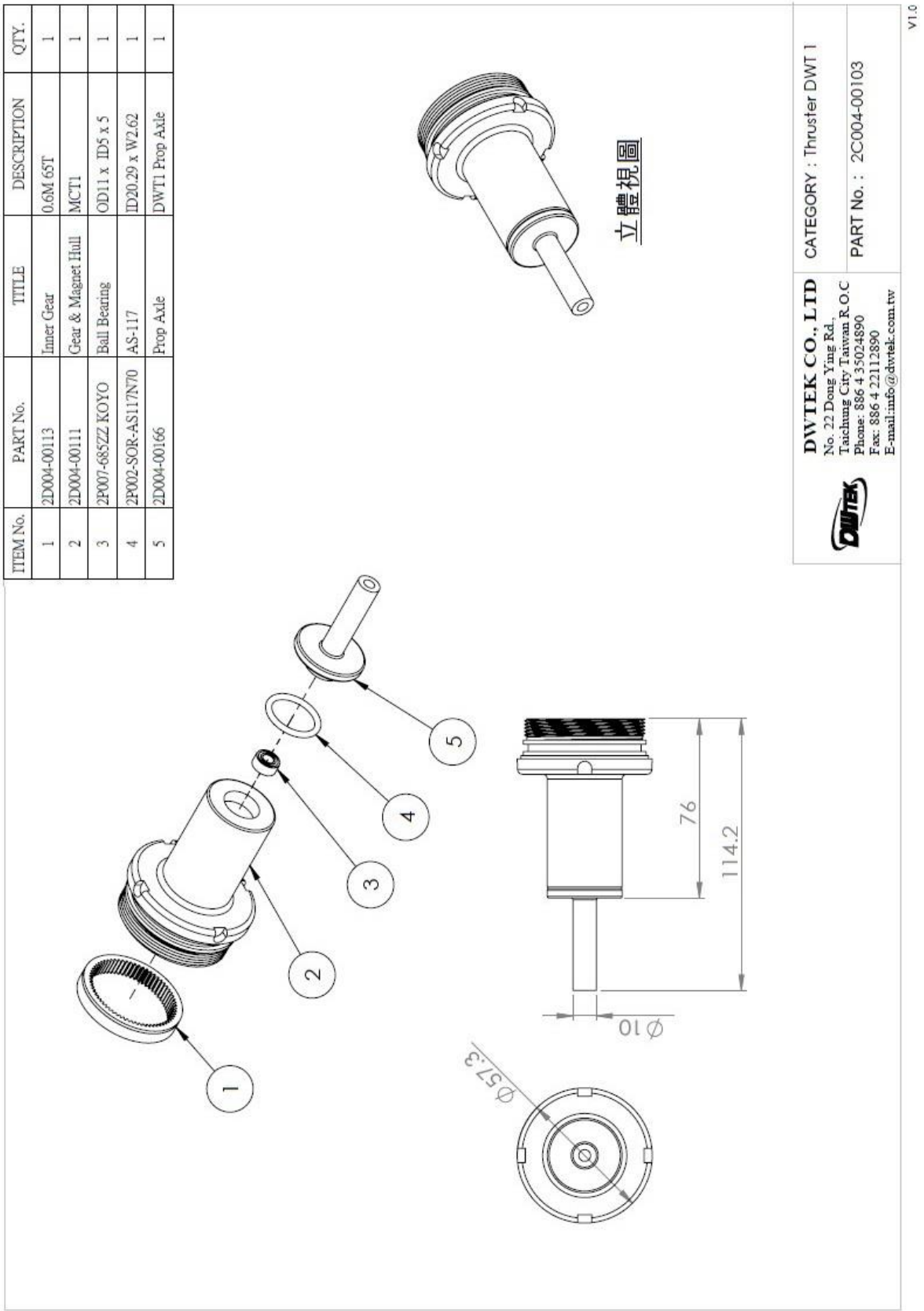


Figure 10 - Magnet Hull Assy (2C004-00103)

6.4 RS485 Signal Control

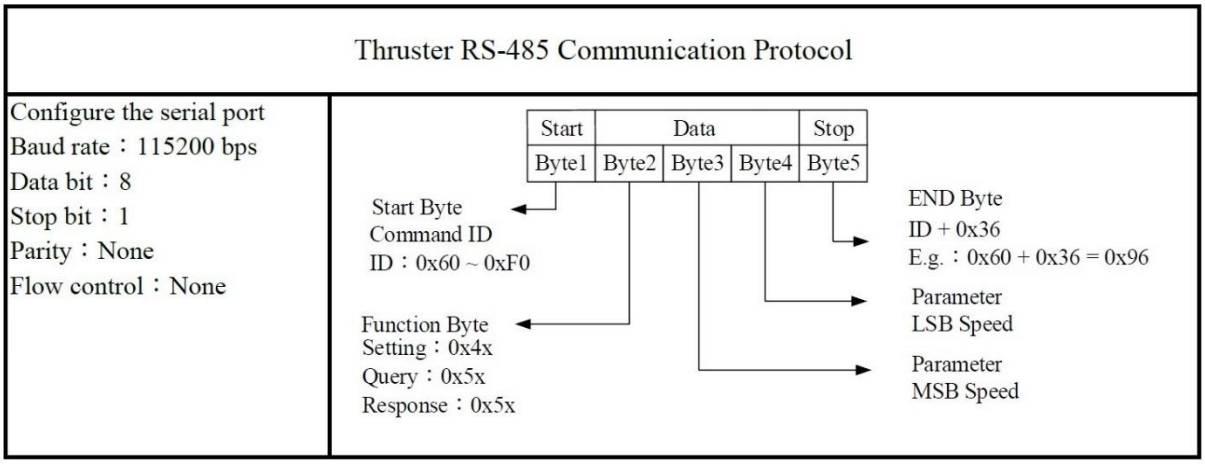


Figure 11 - Thruster RS-485 Communication Protocol

*Setting for CW/CCW Speed & ID

Command Set	Command	Command Packet	Comments
Setting	CW Speed	60 41 03 E8 96	$03E8_{16} = 1000\ RPM$
	CCW Speed	60 42 17 70 96	$1770_{16} = 6000\ RPM$
	Stop	60 40 00 00 96	$0000_{16} = 0000\ RPM$
	ID	F0 4F 00 61 AA	Set unknown device， ID = 0xF0，END = 0xAA "0x61" is symbol for ID.

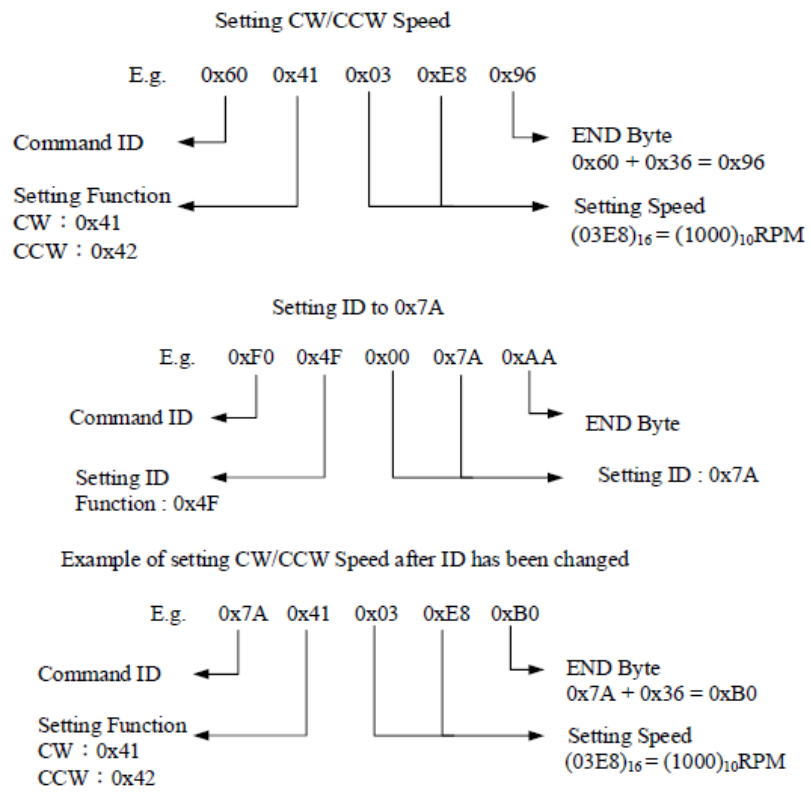
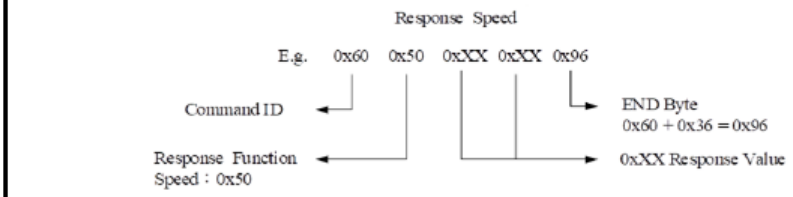
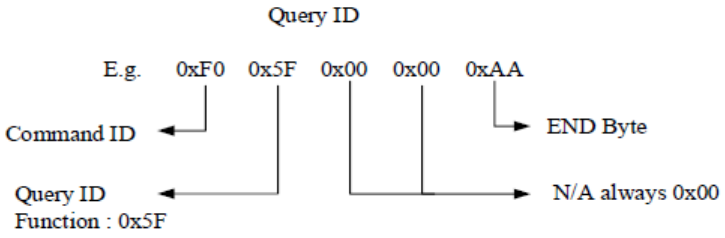


Figure 12 - Setting for CW/CCW Speed & ID

*Query for Speed & ID

Command Set	Command	Command Packet	Comments
Query	Speed	60 50 00 00 96	Ask Speed
	ID	F0 5F 00 00 AA	Ask unknown device， ID = 0xF0，END = 0xAA



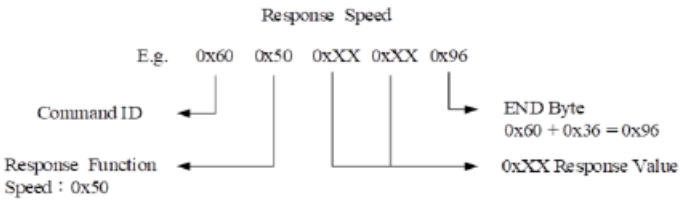


NOTE : When query thruster IDs, please refer to the Response command set.

Figure 13 - Query for Speed & ID

*Response for Speed & ID

Command Set	Command	Command Packet	Comments
Response	Speed	60 50 03 E8 96	e.g. Speed : $03E8_{16} = 1000\ RPM$
	ID	F0 5F 00 61 AA	"0x61" is symbol for ID.



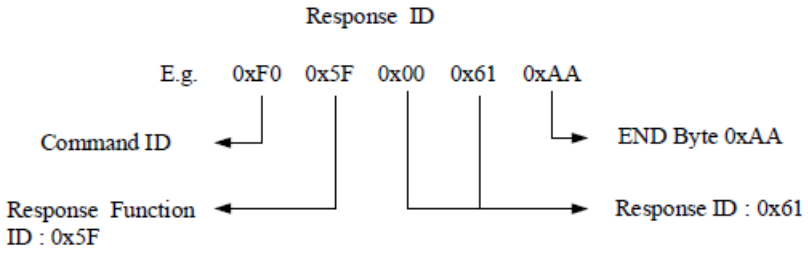


Figure 14 - Response for Speed & ID

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