



# User's Manual

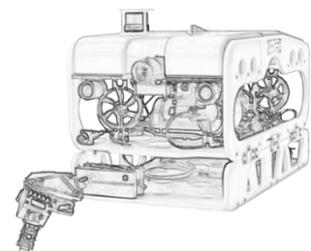
*I-90 ROV*

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# 1. General

## A. Introduction

Thank you for purchasing DWTEK I-90 Remotely Operated Vehicle. I-90 ROV is a well-designed and robust subsea platform which can carry sonars, various acoustic devices, and high-definition cameras. The integrated skid provides extension for multi-function manipulators and further system integration.

This manual intends to serve as a “point-of-reference” for operator for safe operation, maintenance, repair, and the identification of the manufacturer’s proprietary replacement parts.

If the purchaser or the end user is not familiar with underwater ROV systems, it is recommended to receive product and system maintenance trainings for operation from the manufacturer.



**This manual is written assuming that the operator has competent knowledge of electricity, electronic and hydraulic principles and fully understands ROV operation.**

## B. Safety

Guidance on high voltage and heavy load safety are recognized as key issues for operation. Warnings and Cautions would be marked throughout the manual.



**I-90 ROV is fed 300 VDC. Operator should receive competent trainings for system operation and maintenance.**



**I-90 ROV surface control unit supplies 300 VDC output to the vehicle. Please carefully and thoroughly read this manual before attempting to power up and operate the system.**



**Potential dangers of high VDC voltages are present throughout the system. To prevent the risk, make sure to disconnect the power to the surface transformer module and to lock up the isolation switch before attempting to maintain or repair any parts of ROV system.**



**Thruster propellers rotate at high speed and torque. Blades could cause serious injuries to hands and fingers. No one is allowed to touch thrusters when its power connected.**



**ROV tether carries high voltage. Operators should wear protective gloves and gears to handle tether when LIM is switched off.**



Safety procedures are of critical importance for the operation of Remotely Operated Vehicles. Operators should carefully study and follow the procedures and apply them to ROV system operation.

A permit is required and controlled by ROV supervisors before maintaining and repairing ROV system. Always make sure the power is isolated before maintaining or repairing the system. The appointed ROV supervisor is the only person who can power up ROV.

Always remove rings, jewelry and watches before operating electrical equipment and troubleshooting the system.

Always isolate the system from power supply before opening or operating any parts of the ROV system.

Always make sure to switch off the power before lifting or moving the vehicle.

Ensure that all personnel in the proximity to the system are notified when power is applied to the system.

## **C. Important Notices**

DWTEK reserves the right to change the specification at any time without prior notice and without incurring any obligation whatsoever to incorporation any new features in any of its previous products.

Each new product is carefully examined, inspected, and checked before dispatch. It should be carefully examined and operationally tested on receipt by the receiving party. If the product is damaged in any way, then a claim should be lodged with the carrier. New or repaired products damaged in transit should not be returned to DWTEK without prior specific shipping instruction from DWTEK.

Faults or errors may arise in I-90 system in any conditions. It is necessary to notify DWTEK of faults or errors in details and model type and serial number of the particular system that encounters functional difficulties. Once receipt of the notification, DWTEK would offer troubleshooting solutions to the faulty parts or errors. The client has the responsibility to describe the faulty part or errors in actual condition and report the result after implementing troubleshooting.

## 2. System Overview

### A. General System Descriptions

I-90 is an advanced electric powered ROV system. Supplied voltage to power the ROV is 300 VDC. The vehicle is capable of wide ranges of equipment installation such as cameras, LEDs, sonars, manipulators, and skid, etc. for various applications. I-90 with the tooling skid allows itself to extend the operation further.

A brief technical description of the system is as follows. Please refer to the appropriate section of the Manual for detailed descriptions of each system and components.

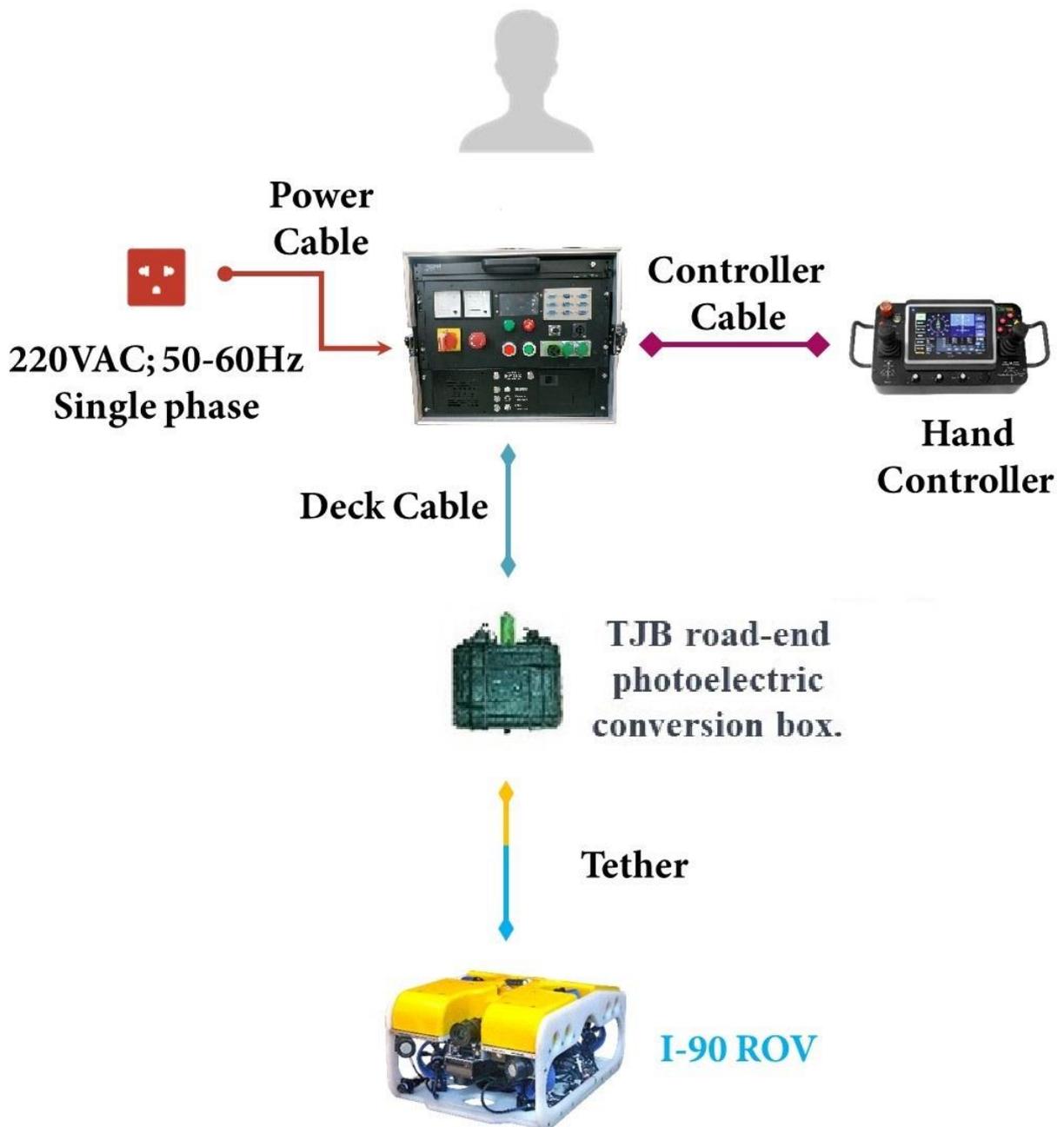


Figure 1 - I-90 ROV structure overview



## B. I-90 ROV General Specifications

Depth Rating	500 meters
Propulsion System	6 * DWT6537 Thrusters
Thrust Forward	60 kgf
Thrust Lateral	33.5 kgf
Thrust Vertical	31 kgf

Table 1 - I-90 ROV General Specifications

Weight in Air	~132 kg (excl. skid and optional equipment)	
Height	490 mm	with skid: 680 mm
Width	700 mm	
Length	1150 mm	

Table 2 - I-90 Weight and Dimensions

<p>Top view</p>	
<p>Front view</p>	
<p>Rear view</p>	

Table 3 - ROV left/right blade config

<p>Auto-Heading</p>	<p>Accuracy 5°</p>
<p>Auto-Depth</p>	<p>±10 cm</p>
<p>Auto-Altitude</p>	<p>±10 cm</p>

Table 4 - I-90 Automatic Functions



### 3. I-90 Maintenance Table

#### A. General

The components installed in I-90 require different levels of maintenance. This chapter contains general information of maintenance, repair, and replacement info for operator. Though all procedures and instructions are given step by step, confusion might arise to the operator who approaches this maintenance handbook initially. Should the operator have any doubts and confusions, please kindly contact DWTEK.

#### B. Maintenance Check List and Dive Log

I-90 system and individual components require check and inspection before and after each dive. The recommended basic services check list.

	Color	Description
	Yellow	Wash by fresh water after each dive
	Red	Service check annually
	Black	Request routine replacement check
	Brown	System check before deployment
	Blue	High voltage
	White	Apply Silicon grease regularly
	Green	Refer to Operator Manual
	Orange	Fuse inside

Figure 2 - Description of Color

No.	Component	Check Articles							
1	Frame	●			●				
2	Buoyancy Block	●			●				
3	Thruster	●	●	●	●	●	○		
4	MCC/TLC	●	●		●	●	○		●
5	Tether I Junction Box	●	●		●	●			
6	Tilt Motor	●	●	●	●				●
7	Right Angle Gear Box	●	●	●	●				
8	Tilt Assy	●	●						
9	Sea Observer	●	●		●				●
10	Mini Camera	●	●		●				
11	Skid	●			●				
12	Anodize	●		●					
13	Underwater Connector	●		●	●	●	○		
14	Sonar	●	●		●			●	
15	Manipulator	●	●		●	●	○	●	
16	Main Console		●		●	●	○		●
17	Hand Controller		●		●				●
18	Deck Cable Junction Box		●		●				●

Figure 3 - Check Articles



## 4. I90 Frame Structure Standard

Part No :	2B0120001-00003
Title :	I-90 Frame Structure
Service Check :	Check after each dive
Tool :	1. 3mm Allen Key 2. 4mm Allen Key 3. 5mm Allen Key 4. 6mm Allen Key 5. 13mm Socket Wrench

### A. General

The frame is made from Polypropylene sheet to form a strong corrosion and maintenance-free structure. The frame contains several attachment points for additional equipment mountings. The Polypropylene sections are secured together with stainless steel socket flathead screw M8 and SS Nylon Nuts M8.

I-90 main chassis, the top frame, top rear bracket and side panels provide mounting points for ballast and other equipment.

### B. Adjustment of Lifting Position

1. Release Stainless Steel Socket Head Cap Screw M10xP1.5x30mm and SS Nylon nut M10 from the Lifting Track with 8mm Allen and 17mm Spanner.
2. Select proper position to insert the bolt and secure the SS Nylon Nut.

### C. Lifting Track and Latch Bullet Installation

The allowed swinging angle of Lifting Track is about 60 degrees. Several mounting positions in the Lifting Track can be selected to adjust I-90 lift balance. Buoyancy Block Locking Bolt pass through Front and Rear Buoyance Block to install the Lifting Track. Use 13mm Socket to secure SS Flange Nut M8 in the I-90 Hanger Bolts.

Operator may select DKTEK Latch Bullet System, please refer to following instruction.



The W500 Latch Bullet is bolted to the Lifting Track by using Stainless Steel Socket Head Cap Screw M10 × P1.5 × 40mm with SS Nylon Nut M10. The Latch Bullet is divided into 2 parts, which would be combined together with (3) SS Socket Head Cap Screw M4x16 Tether is kept inside the bore of the Latch Bullet.



**Make sure to install the pulling grip on the tether before assembling the Latch Bullet. It is important that the pulling grip covers the tether and situates between the Latch Bullet entirely. The Pulling Grip can be armor against cutting on the edges of Latch Bullet!**



## 5. Buoyancy

Part No :	2B0010002-00007
Title :	Buoyancy Material Assy
Service Check :	Check after each dive
Tool :	1. 5 mm Allen Key 2. 13 mm wrench or 13 mm Socket Wrench

### A. General

With syntactic foam, depth rated to 500 meters, the vehicle has a standard payload of 27 kg+. Additional buoyancy blocks can increase the payload to approx. 50 kg by deploying below the Top Frame Assy and Tooling Skid. The payload derives from lead ballast and if optional equipment is installed, the lead ballast will be removed. The buoyance is made up of 2 sections from syntactic foam that consists of microspheres cast into an epoxy shell. The air-filled spheres individually provide buoyancy, and damaged buoyancy can be repaired with 2-part epoxy adhesives or fillers. The outer coating is tough yellow polyurethane painted in yellow.

Make sure the buoyancy blocks are bolted to the frame before deployment. Never deploy the vehicle with any released parts of the buoyancy block. It is critically important not to puncture or make a hole on the buoyancy block. The buoyancy block with punctures or holes would reduce the buoyancy originally given and reduce the vehicle payload in return.

### B. Removal of Front and Rear Buoyancy Blocks

The (2) buoyancy blocks are secured by (12) Buoyancy Block Locking Bolts M8\*165 and (4) in M8\*128 on the I-90 Top Frame Assy. The hollow design of Buoyancy Block Locking Bolts reduces the weight of ROV. Please use 5 mm Allen Key to release the bolts to remove Buoyancy Block.

### C. Removal of Additional Buoyancy Blocks from Top Frame Assy

If the I-90 ROV adopts the additional buoyancy blocks, there are (16) I90 Top Frame Nut Assy to be removed from the Top Frame Assy. Unlike the I-90 ROV Front and Rear Buoyancy Blocks attached on the I-90 Top Frame Assy, the additional buoyancy blocks are fitted into the available spaces below the I-90 Top Frame Assy. All buoyancy blocks are secured by (16) SS Buoyancy Block Locking Bolts and (24) SS Nylon Nut M5. Please use 5 mm Allen Key and 13 mm Socket Wrench to release the bolts and the nuts before removing the additional buoyancy blocks.



#### **D. Removal of Additional Buoyancy Blocks in the Skid**

If I-90 ROV attaches the tool skid, there are (2) SS Socket Head Cap screw M6x20 on each additional buoyancy block. Please use 5mm Allen key to release the bolts before removing the additional buoyancy blocks.

#### **E. Pantone Color**

The Pantone color of paint on the Buoyancy Blocks is “FFFF00”.



## 6. Thruster

Part No : 2B0040002-00003 、 2B0040002-00004  
2B0040002-00005 、 2B0040002-00006  
Title : DWT6537-1KM 750W Thruster  
Service Check : Check after each dive  
Tool : Please refer to each section below.

### A. General

The I-90 ROV is propelled by DWTEK 750W Brushless DC thrusters, 4 vectored horizontals and 2 verticals. Thrusters have integral motor drivers and are easy to be replaced by simple setting procedure through the Hand Controller setup page. The thrusters adopt 300VDC and digital control signals. The propulsion of 750W is a magnetically coupled system that allows a magnet array in the hub of the propeller to be driven by a matching magnet array attached to the driver motor.

The static seals to the 750W thruster prevent the frequent leakage scenario in the mechanical linkage driven thrusters. Furthermore, the magnetic coupling will ratchet if overloaded, preventing damage by objects jammed in the propeller. The propeller support bearings are installed to the external part of the pressure housing that can be replaced in just few minutes.

The thruster is designed for operating at depth of 1000 meters.

### B. Maintenance and Removal

Part No : 2B0040002-00003 、 2B0040002-00004  
2B0040002-00005 、 2B0040002-00006  
Title : DWT6537-1KM 750W Thruster  
Service Check : Check after each dive  
Tool : 1. 4mm Allen Key

I-90 ROV has internal clocks and calculators to inform the basic Thruster service information. Due to unpredictable operating environment, operators have responsibility for damage and abrasion inspection and cleanness before and after each dive.



To remove a thruster from the vehicle, please follow below steps.

Disconnect the cable.

Remove 4 SS Socket Head Cap Screw M5x30, and secure the thruster with horizontal and vertical hanger with 4mm alley key.

THRUSTER FIELD & DEPOT REPAIR PROCEDURES listed below should be carried out.

**Warning!!**



**Whenever the system is on the surface, make sure to always switch off the thruster power and auto-functions to prevent accidental operations of the thrusters.**

**Caution!!**



**The replacement of the O-rings and resealed 750W Thruster would be recommended including in the annual maintenance. DWTEK offers complete annual inspection and maintenance service to clients, and guarantee reliability and performance.**

**Caution!!**



**The Thruster is designed as a simple maintenance unit. After each dive, please release the Propeller Assembly of thrusters and wash with fresh water.**

## 7. Nozzle

Part No :	2D004-00047
Title :	Nozzle - Blue
Service Check :	Replace if damaged
Tool :	1. 4 mm Allen Key 2. Small Flat Screw Driver

### A. General

The nozzle is designed to improve the thrust performance in water. Without the nozzle, there would be a drastic result in thrust reduction and ROV control failure. Operator can test thrusters in air, but this might reduce the lifetime of the support bearing. 750W thrusters are designed to be water-cooling and for underwater operations. Concerning safety, it is of vital importance that no operator is allowed to run the thruster either in air or in water without nozzle.

The Nozzle is made from a cast Nylon material that is high impact resistant. The Nozzle is a field level replacement item.

### B. Indications for Replacement

Replace the Nozzle if broken or damaged to the point that it fouls the propeller.

### C. Removal Procedures

1. Please refer to Thruster Maintenance Removal procedures.
2. Remove last two (2) SS Socket Head Cap Screw M5x25mm securing in the thruster using 4mm alley key.
3. Remove (2) Wedges in the Nozzle with a small flat screw driver.

### D. Installation Procedures

1. Install (2) Wedges in the slots of Nozzle. Make sure to align the hole in the Nozzle and the screw holes in the wedges.
2. Place the new Nozzle and fit the arms of Thruster Motor Assy into notches.
3. Put (2) SS Socket Head Cap Screw M5x25mm into the middle holes in the arms of the Thruster Motor Assy and secure the Nozzle in the arms.
4. Install the thrusters in Horizontal Hanger and I90 Vertical Fixers using screws.



Figure 4 - Wedges



## 8. Thruster Trouble Shooting

If thruster has the following state:

1. RPM Unsteady
2. Vibration,

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

1. Power Output.
2. Consumption parts and determine the replacement.

### A. Detection Procedure of Case I

1. Please shut down the system power and wait for 5 mins to discharge the capacitors inside TLC Chamber.
2. Make sure the propeller in the thruster is free rotation without resistance or unusual jump.
3. Untighten the locking sleeve in the thruster and pull out the inline cable from Bulkhead.
4. Please follow step 2 again and recheck the propeller rotation. If still free rotation without resistance or unusual jump, please see the step 2 in case II.
5. Under safety and well protection condition, turn on the power. Using multimeter to check the inline cable voltage at Pin 3 (HVDC) against Pin1 (GND), the standard voltage should be between  $300\text{ VDC} \pm 15\text{V}$ . Please record the value as the reference.
6. Under safety and well protection condition, turn on the power. Using multimeter to check the inline cable voltage at Pin 4 (15V) against Pin 1 (GND). The standard voltage should be between 14-16V. Please record the value as the reference.
7. Shut down the system power and wait for 5 mins.
8. Checking the resistance to Pin 2 (PE) are the open loop to rest pins at the bulk head connector onto thruster.
9. Checking the resistance between Pin1 (GND) and Pin 3 (HVDC) over  $500\text{K}\Omega$ .
10. Using positive and negative probes to check Pin4 (15V) and Pin1 (GND). The resistance value should over  $2\text{M}\Omega$ .
11. Pin 1 ~ Pin 4 and Pin 5 ~ Pin 7 belongs to two isolated powers and should be open loop.
12. Checking the resistance to Pin 5 (RS485 A) and Pin 6 (RS485 B). The value should be over  $500\text{K}\Omega$ .

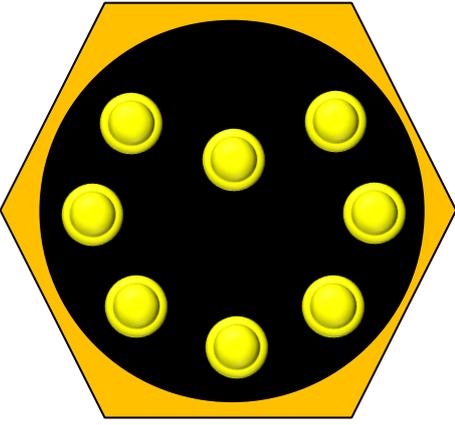
Inline Top View	Pin Assignment	Bulkhead Top View
	<p>1 = HGND                  2 = PE                  3 = +HVDC                  4 = 15V                  5 = RS485 A                  6 = RS485 B                  7 = Iso GND                  8 = NC</p>	

Figure 5 - Thruster Pin Assignment

### B. Detection Procedure of Case II

1. Please shut down the system power and wait for 5 mins to discharge the capacitors inside TLC chamber.
2. Propeller in the thruster is free rotation without resistance or unusual jump.
3. Using Plug Gauge to determine the replacement of support bearing.

## 9. Propeller Assembly

Part No :	2C004-00018 、 2C004-00019
Title :	Rotating Propeller
Service Check :	After Each Dive
Tool :	1. Flat Screw Driver 2. Flat Nose Piler

### A. General

The Propeller Assembly that is driven via magnetic coupling through the Reducer Coupling Assy. Propeller is a duplex die casting part which is highly corrosion resistance stainless steel. The propeller could be damaged in action. The damaged propeller blade significantly influences the diving performance of the ROV. Minor damages on propeller blades could be repaired with a file and coarse sandpaper. It is recommended that qualified technicians trained by DWTEK to replace the damaged parts and that the operators replace the full set of the Rotating Propeller.

The Propeller Assembly allows the operators to do the replacement in the field under the safe condition.

### B. Indications for Replacement

1. Replace if significant wear or damage is apparent on the blades of the Propeller Assembly.
2. Replace if the Propeller Assembly cannot rotate freely by hand.
3. Thruster is unpowered and if interference is detected between the Motor Rotor and the Magnetic Coupling. This indicates damage to the inner surface of the Magnet Driver rotor.

### C. Removal Procedures

1. Remove SS Clip from the stem of the Shaft Reducer Assembly using a small screwdriver.
2. Remove Disc Spring and Stopper Washer with well storage.
3. Remove Propeller Assembly by pulling from exhaust end of Nozzle.

#### Warning!!



**Operator is requested to remove the Propeller Assembly by considerable force (estimated over 3 kg) to escape magnetic pull. This action needs extreme caution to avoid injury from the propeller blades, which have sharp edges. Wearing protection gloves is recommended.**

## **D. Installation Procedures**

1. Lightly lubricate the Support Bearing with Silicone grease.
2. Insert the new Propeller Assembly into the open end of the Nozzle Assembly. Be sure to guide the inner Hub Sleeve Bearing over the stem of the Shaft Reducer Assembly.
3. If the blades of the new Propeller Assembly interfere with the internal diameter of the Nozzle, use a file or coarse sandpaper to remove material from the ends of the blades. Remove materials sufficiently so the Propeller Assembly can rotate without interference while keeping tip clearance less than 1mm. If there are any concerns, please contact manufacturer.
4. Install Disc Spring either by A type or B type in order to eliminate the mating gap.
5. Install Stopper Washer on the stem of the Shaft Reducer Assembly.
6. Install E-clip on the stem of the Shaft Reducer Assembly. Make sure E-clip fully engaged with the groove in the stem of Shaft Reducer Assembly.



### **Caution!!**

**Disc Spring acts as elastic spaces to eliminate the gap and tolerances that appear during manufacturing or operation worn out.**



## 10. Motor Driver

Part No : 2C004-00033  
Title : 750W Thruster  
Service Check : Damaged  
Tool : 1. Multimeter

### A. General

The HV Thruster is mounted in the front bearing cap in the Thruster Motor Assy. The followings are the specific functions which designed for DWT6500 series thruster driver.

1. Temperature Monitor
2. Speed Control
3. Circuit isolation for system and thruster safety protection.

It is not recommended to open End Cap and to check or replace the Motor Driver. Replacement of the Motor Controller PWA is depot-level operation. Only should qualified specialists to perform the work.

### B. Indications for Replacement

Replace, if thruster does not operate correctly or does not function. Difficulty in rotating propeller assembly by hand is an indication of electronics failure. It is tough to tell the difficulty in rotating propeller resulting from either mechanical failure that causes rough rotational drag or electrical failure that causes smooth rotational drag and feels obvious steps in rotation.



#### **Caution!!**

**Prepare a multimeter and follow the instructions below to verify the failure, if operators could roughly identify the electrical failure.**

If there is failure or unknown problems occurs, please contact DWTEK or the authorized agent for service.



## 11. Thruster Connectors and Cable

Part No : 2GW100608M-00001(MCBH8M)  
 MCIL8F/MCIL8M  
 Title : Bulk Head 8Pin Mall Connector  
 Inline 8pin Female Connector  
 Service Check : Regularly  
 Tool : None

### A. General

750W Thrusters function with MCBH8M wet connectors in I-90 ROV.

MCBH8M/MCBH8F cables of various lengths listed below connecting thrusters and the parent ROV.

From TLC To			
Left	Thruster PF	100 cm	MCIL8M/MCIL8F
	Thruster PV	60 cm	MCIL8M/MCIL8F
	Thruster PA	40 cm	MCIL8M/MCIL8F
Right	Thruster SF	100 cm	MCIL8M/MCIL8F
	Thruster SV	60 cm	MCIL8M/MCIL8F
	Thruster SA	40 cm	MCIL8M/MCIL8F

Figure 6 - Connectors of Thrusters from TLC



**Note!!**

**Left and Right is referred to as connecting TLC right / left Cap in the I-90 ROV.**

The MCBH8M connector at the Lid of the Thruster is a depot-level replacement part only should qualified specialists attempt to work on it.

The MCIL8M/MCIL8F cables should be inspected regularly.



## **B. Indications for Replacement**

1. Replace, if cable jacket is cut to let water leak into individual conductors.
2. Replace, if connectors are damaged or deformed.
3. Replace, if the MCBH8M connector is damaged or no longer watertight.

## **C. Removal Procedures**

Slew the locking sleeves and remove the MCIL8M/MCIL8F Cable.

## **D. Installation Procedures**

1. Use Silicone grease to cover the pins and holes of new MCBH8M/MCBH8F Cable.
2. Plug the new cable to the thruster and the parent ROV connector end.



## 12. Removal of Lid and Pressure Relief Valve

Part No :	2D004-00009 2D004-00008
Title :	End Cap Pressure relief valve M6S07
Service Check :	Annual Service or HV Thruster Service
Tool :	1. Flat Screw Driver 2. 4mm Allen Key 3. 1.5mm Allen Key

### A. General

The End Cap is the cover to seal the Thruster Motor Assy. The End Cap is opened to access the HV Thruster and replace the O-ring. The Pressure Relief Valve M6S7 fits in the port of the Lid. DWTEK suggests replacement and maintenance of the O-Rings in the Lid and annual service of Pressure Relief Valve.

Vacuum test and refilling with Nitrogen gas are required during the sealing operation of End Cap.

Please refer to Appendix II, Vacuum and Pressure Relief.

The open of the End Caps doesn't recommend the operator to operate in the field.

### B. Indications for Replacement

Replace O-Rings in annual maintenance.

### C. Removal Procedures

1. Remove Pressure Relief Valve from the End Cap.
2. Remove SS Socket Grub Screw from Thruster Motor Assy.
3. Remove the Lid by hand.



**Caution!!**

**Be careful of wires connecting the motor driver.**

## D. Installation Procedures

1. Replace with new O-rings, SOR-S07N080 and SOR-S55N070 and install them in the Pressure Relief Valve and the End Cap.
2. Put the Lid in the Thruster Motor.
3. Press the Lid into the housing.
4. To install the Pressure Relief Valve, follow Appendix II, Vacuum and Pressure Relief.

**DWT6537 750W Thruster Performance Curve**

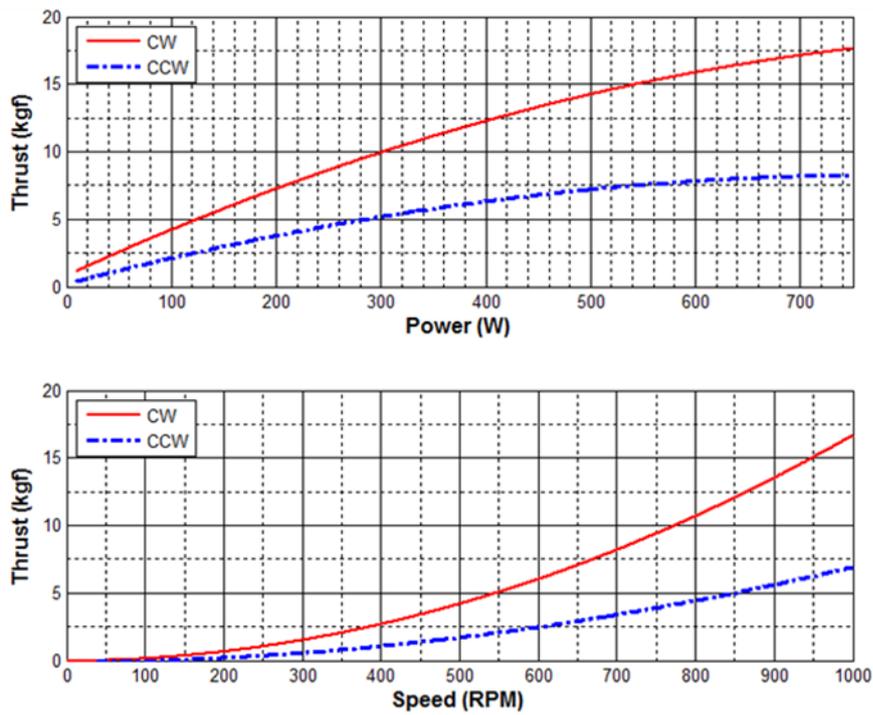


Figure 7 - Rotational Speed of Thruster



**Note!!**

**The speed (RPM) refers to DC brushless motor output speed.**



## 13. Camera

Part No :	2B0020001-00001
Title :	Sea Observer HD Camera
Service Check :	Annual Service
Tool :	1. 2 mm Allen Key 2. 3 mm Allen Key 4. 4 mm Allen Key 5. Adjustable Pin Wrench 6. Refer to Appendix II, Vacuum and Pressure Relief

### A. General

The I-90 ROV has standard interface facilities for (4) SD cameras and 1 Full HD camera. A number of manufacturers can supply units selectable to fit with I-90 ROV vision system. The 4 lead underwater connectors link the MCC Housing with SD cameras.

### B. Full HD Camera – Sea Observer

The standard full HD camera is manufactured by DWTEK. Its power and signal output adopts the Right Angle Mini Connector and the Single Fiber Connector. Through the Single Fiber Receptacles, the F/O Connector links Full HD video output of the Sea Observer, to the MCC Housing. A number of manufacturer's Full HD camera can supply units selectable to fit with I-90 ROV vision system. Please consult DWTEK for system support.

For further technical and electronics enclosure on the cameras refer to I-90 Operator's Manual.



## 14. MCC and TLC

Part No :	2B0100001-00001 2B0100002-00001
Title :	I90 MCC Chamber I90 TLC Chamber
Service Check :	Annual Service or Damage for replacement
Tool :	1. 4mm Allen Key 2. 5mm Allen Key 3. Flat Screw Driver

### A. General

I-90 ROV contains the MCC Chamber and TLC Chamber for Telemetry and power distribution. The MCC and the TLC are the abbreviations of the Main Control Chamber and the Thruster & Light Chamber. Both Pods share the same internal & external design. The main structural differences are the support plates due to magnetic shielding and various PCB mounting.

The Pods are designed double-ended opening. The 32pin connectors with guide pins in the collars can quickly mate and release electronic circuits as separate modules on the Lids. Each Lid allows installing several underwater connectors to connect telemetry interfaces and power terminals in the Pods Housing and TLC.

Both Pods have 1 or 2 extension ports at each Lid covered by Hex Plug 7/16xT20. For applications of extension ports, please consult DWTEK or its agent before use. For further technical and electronics enclosure on the MCC Chamber and TLC Chamber refer to the F.MCC schematics & G.TLC schematics.

Please note that part no. of MCC and TLC are subject to optional equipment upon request. Please refer to the BOM manual for final check.

### B. Preventative Maintenance

To wash out seawater, it is compulsory for the low-maintenance MCC Chamber and TLC Chamber to be cleaned by fresh water after each dive.



### **C. Indication of Maintenance**

The MCC Chamber and TLC Chamber are filled with dry Nitrogen gas and sealed by the Pressure Relief Valve. If the Housings are opened or the hex plug or pressure relieve valve is released, procedures of exhaled moisture air and refilled with dry Nitrogen gas are necessarily performed. Only should qualified specialists perform the work.

### **D. Procedure of Open MCC and TLC Chamber**

1. Disconnect inline cables from the Pod.
2. Loosen the screws in the Heavy Torque Hose Clamp with flat screw driver.
3. Remove the chamber from I-90 ROV.
4. Wash the chamber with fresh water and dry it with compressed air.
5. Put the Power Transformer Housing on the working table and wipe it with a towel or a blanket.
6. Release the Pressure Relief Valve with 4mm Allen Key in the Lid.
7. Use 5mm Allen Key to release (6) SS socket head cap screws M6x16mm.
8. Insert a plastic putty knife to create a gap between the Lids and MCC/TLC Housing.
9. Circle and tie the shoelace into the gap to lift the Lids.
10. Remove the Lids with electronic modules.

### **E. Housing Installation Procedure**

1. Carefully clean the Housing, the O-ring groove of the Lid, and Pressure Relief Valve.
2. Grease and install the (4) new O-rings on the Lids.
3. Fill silicone grease into screw holes in Housing.
4. Slide the Lids into the housing and align the guide pins into the mating holes
5. Slightly pressing the Lids into the housing plugs up 32 pin male and female connectors.
6. Secure (6) SS socket head cap screws M6x16mm with isolated plastic washer using 5mm Allen Key.
7. Put the Pressure Relief Valve with O-Ring on the port of Pressure Relief Valve in the Lid.
8. Consider use DWTEK Vacuum Adapter to exhale the moisture air and refill with dry nitrogen air.
9. Screw the 4mm Allen Key in the DWTEK Vacuum Adaptor to seal the Valve.
10. Remove the Vacuum Adaptor.



**Caution!!**

**It is highly recommended to replace O-rings in each service.**



**Caution!!**

**The power terminals, electronic interfaces, and telemetry modules have been installed and mounted on the Lids. Pay careful attention on the Housing and the Lid installation!**



**Caution!!**

**The guide pins in the collar at the Lid at one side should roughly align with the hole in the collar at the Lid of another side before joining together. Meanwhile, the screw holes on Housing and the Lids should match.**

**The mating with connectors should be smooth with no unexpected resistance.**

## F. MCC schematics

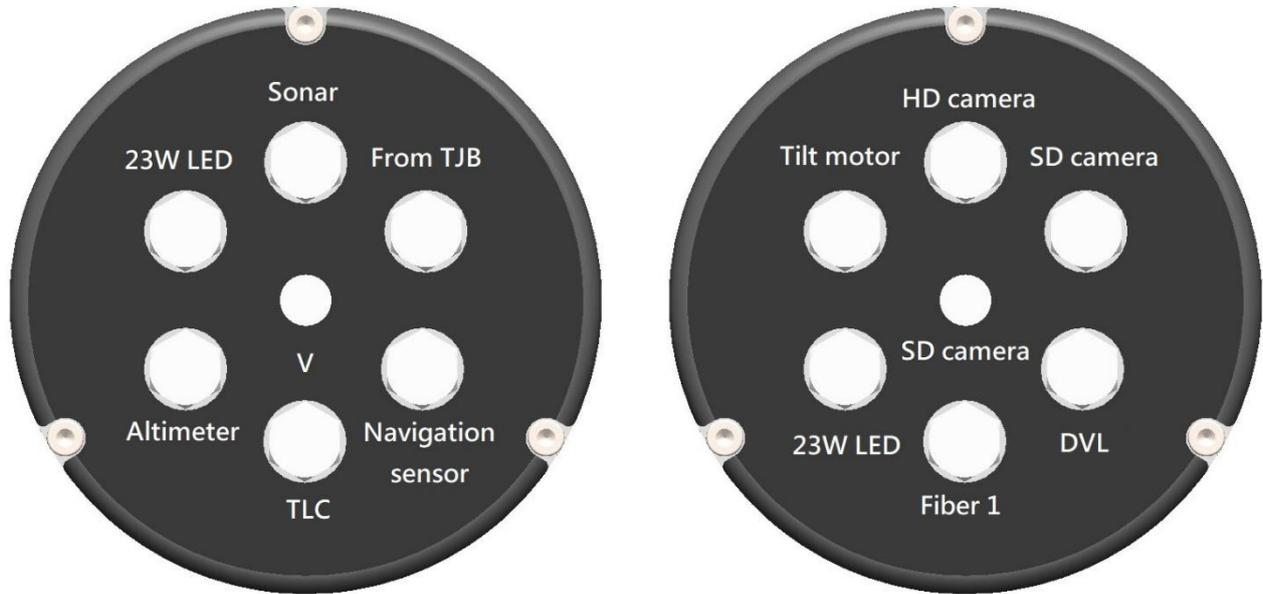


Figure 8 - MCC schematics

HD Camera			Tilt Motor			23W LED		
Num	Pin Assignment	Color	Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	GND	Black	1	GND	Black	1	VCC	Black
2	PE	White	2	PE	White	2	GND	White
3	VCC	Red	3	VCC	Red	3	PE	Red
4	TX	Green	4	TX	Green	4	Dim -	Green
5	RX	Orange	5	RX	Orange	5	Dim +	Orange
6	GND	Blue	6	GND	Blue			

DVL			SD1/SD2 Camera			SD3/SD4 Camera		
Num	Pin Assignment	Color	Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	GND	Black	1	VCC	Black	1	VCC	Black
2	PE	White	2	GND	White	2	GND	White
3	VCC	Red	3	CVBS+	Red	3	CVBS+	Red
4	TX	Green	4	VCC	Green	4	VCC	Green
5	RX	Orange	5	GND	Orange	5	GND	Orange
6	GND	Blue	6	CVBS+	Blue	6	CVBS+	Blue

Altimeter			Sonar (Ethernet)		
Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	GND	Black	1	TX+	Brown
2	PE	White	2	TX-	Brown/White
3	VCC	Red	3	RX+	Blue
4	TX	Green	4	RX-	Blue/White
5	RX	Orange	5	GND	Orange
6	GND	Blue	6	GND	Orange/White
			7	VCC	Green
			8	VCC	Green/White

DVL			TLC			Sensor		
Num	Pin Assignment	Color	Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	GND	Black	1	GND	Black	1	GND	Black
2	PE	White	2	PE	White	2	PE	White
3	VCC	Red	3	VCC	Red	3	VCC	Red
4	TX	Green	4	TX	Green	4	TX	Green
5	RX	Orange	5	RX	Orange	5	RX	Orange
6	GND	Blue	6	GND	Blue	6	GND	Blue

23W LED		
Pin	Assignment	Color
1	VCC	Black
2	GND	White
3	PE	Red
4	Dim -	Green
5	Dim +	Orange

Table 5 - MCC pin assignment

### G. TLC schematics

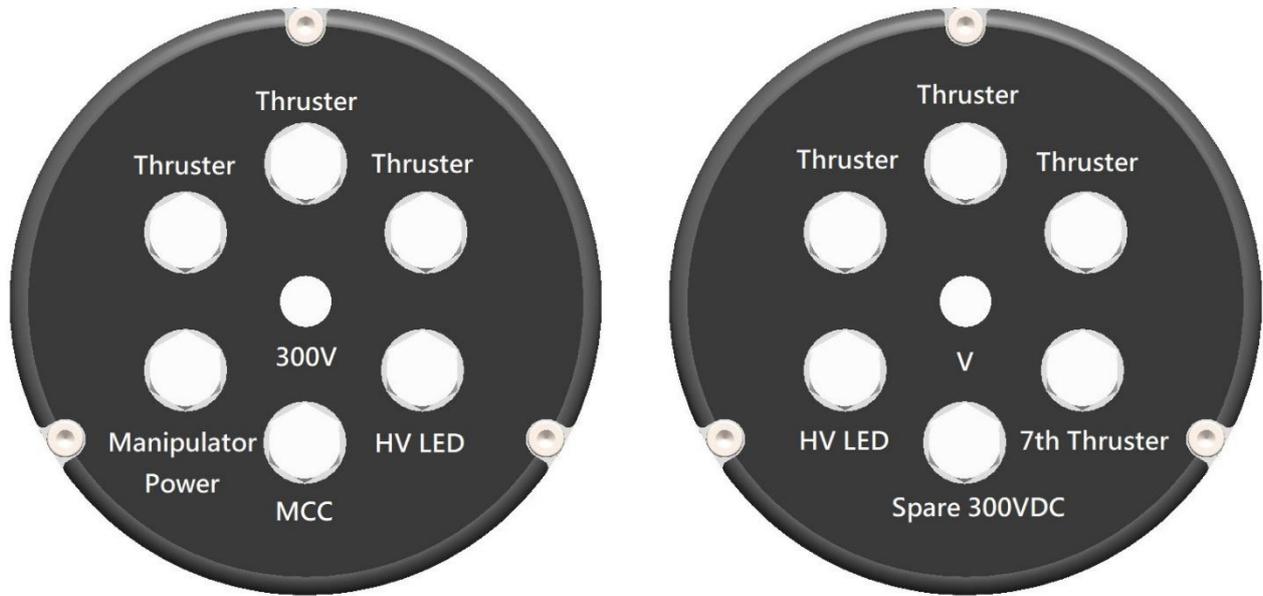


Figure 9 - TLC schematics

HV LED			Spare 300VDC		
Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	HGND	Black	1	GND	Black
2	PE	White	2	PE	White
3	HVCC	Red	3	HVCC	Red
4	Dim +	Green	4	NC	Green
5	Dim -	Orange	5	NC	Orange
			6	NC	Blue

Thruster①			Thruster②		
Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	HGND	Black	1	HGND	Black
2	PE	White	2	PE	White
3	HVCC	Red	3	HVCC	Red
4	15Vdc	Green	4	15Vdc	Green
5	RS485 A	Orange	5	RS485 A	Orange
6	RS485 B	Blue	6	RS485 B	Blue
7	ISO GND	White/Black	7	ISO GND	White/Black
8	NC	Red/Black	8	NC	Red/Black

Thruster③			7th-Thruster		
Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	HGND	Black	1	HGND	Black
2	PE	White	2	PE	White
3	HVCC	Red	3	HVCC	Red
4	15Vdc	Green	4	15Vdc	Green
5	RS485 A	Orange	5	RS485 A	Orange
6	RS485 B	Blue	6	RS485 B	Blue
7	ISO GND	White/Black	7	ISO GND	White/Black
8	NC	Red/Black	8	NC	Red/Black

HV LED			To MCC		
Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	HGND	Black	1	GND	Black
2	PE	White	2	PE	White
3	HVCC	Red	3	VCC	Red
4	Dim +	Green	4	RX	Green
5	Dim -	Orange	5	TX	Orange
			6	GND	Blue

300V			Manipulator		
Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	HGND	Black	1	PE	Black
2	HGND	White	2	HGND	White
3	HVCC	Red	3	HVCC	Red
4	HVCC	Green	4	M-RX	Green
5	PE	Orange	5	M-GND	Orange
			6	NC	Blue

Thruster④			Thruster⑤		
Num	Pin Assignment	Color	Num	Pin Assignment	Color
1	HGND	Black	1	HGND	Black
2	PE	White	2	PE	White
3	HVCC	Red	3	HVCC	Red
4	15Vdc	Green	4	15Vdc	Green
5	RS485 A	Orange	5	RS485 A	Orange
6	RS485 B	Blue	6	RS485 B	Blue
7	ISO GND	White/Black	7	ISO GND	White/Black
8	NC	Red/Black	8	NC	Red/Black

Thruster⑥		
Num	Pin Assignment	Color
1	HGND	Black
2	PE	White
3	HVCC	Red
4	15Vdc	Green
5	RS485 A	Orange
6	RS485 B	Blue
7	ISO GND	White/Black
8	NC	Red/Black

Table 6 - TLC pin assignment



## 15. Tether Junction Box

Part No :	2B0100003-00003
Title :	TJB Oil Compensator
Service Check :	Annual Service or damaged for replacement
Tool :	1. 3mm Allen Key 2. 4mm Allen Key 3. 8mm Allen Key

### A. General

The I-90 ROV communicates and transmits signals to the surface controller via fiber optic links in the tether. The Tether Junction Box acts as a relay station to distribute power and optical signals through wet and metal connectors.

### B. Tether Junction Box Maintenance

(2) ports for single fiber connectors link the MCC Chamber and Sea Observer HD Camera. One SCBH5F is installed in the TLC Chamber and (1) MCBH6F in the MCC Chamber. The tether is molded with the Tether I Receptacle and is secured with (4) SS Socket Head Cap Screw M4x10mm.

The replacement and maintenance of the single fiber connectors and the Receptacle require several professional instruments. Only should qualified specialists attempt to maintain the system.

Damage in tether requires full set change of the Tether Junction box and cutting off certain tether length. Please contact DWTEK or its agent for help.

### C. Removal Procedure

1. Release (2) set socket head cap screw M10x 30mm by 8mm Allen Key.
2. Push Fixer Frame forward to the Top Frame.
3. Remove the Tether Junction Box from the room above the rails.
4. Disconnect cable of the SCIL5M and the SCIL5F inline cable.
5. Disconnect (2) Single Fiber Optics Receptacles.
6. Plug and secure the dummies to the Single Optical Fiber Receptacle and Bulk Head.
7. Plug the dummies to the SCBH5M at the Tether Junction Box.



## **D. Installation Procedure**

1. Check and clean the room above the rail.
2. Clean the TJB.
3. Connect SCIL5M and tight by locking sleeves.
4. Connect (2) Single Fiber Optics Receptacles from HD and MCC Chamber.
5. Install the Tether I Junction box into the room above the rails and push cover plate backward to the Top Frame.
6. Secure (2) Socket Head Cap Screw M8x12mm with 6mm Allen Key.



**Caution!!**

**Please make sure to get correct linkage between HD and MCC Chamber.**

## 16. Tilt Assy Unit Bevel Gear

Part No :	2B0050001-00006
Title :	Tilt Assy Unit Bevel Gear
Service Check :	Annual Service
Tool :	1. 4mm Allen Key 2. Flat Screw Driver

### A. General

I-90 Tilt Assy Unit Bevel Gear consists of several parts. Please refer to drawing.

The parts of unit are manufactured mainly from the engineer plastics and several in stainless steel and aluminum material.

The output torque transmitted via Bevel Gear to tilt up and down the Tilt.

### B. Preventative Maintenance

The TM2408 1KM and Bevel Gear are the major 2 components necessary for maintenance service. Before and after use, it is necessary to test the functionality to ensure it is working properly. Visual inspection should be conducted to check for any damages to the appearance or interference with the mechanism. If any abnormalities are found, please contact DWTEK Co., Ltd. for assistance.

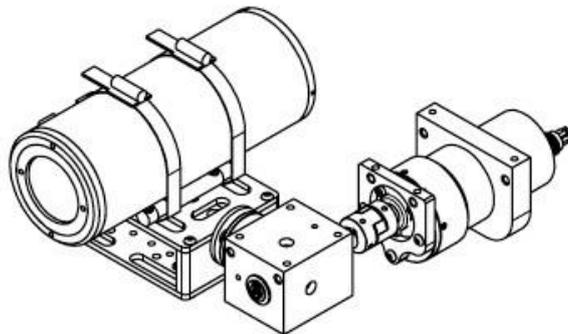


Figure 10 - Tilt Assy Unit Bevel Gear



#### Caution!!

Pay careful attention to parts possible falling off during disassembly and re-assembly.



#### Warning!!

Operator is only allowed to remove under power off condition.



#### NOTE!!

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



## 17. Tilt Motor

Part No :	2B0050001-00007
Title :	TM2408 1KM
Service Check :	Annual Service
Tool:	1. 3mm Allen Key 2. Putty Plastic Knife 3. Shoelace

### A. General

TM-2408 1KM is the tilt motor for I-90 Tilt Assy and provides vertical rotation of camera. It also acts as a servo motor. The position precision can be divided to 0.1 degree in one way rotation. The output signal is fed to the vehicle telemetry, transmitted to the surface, and displayed on both pilot monitor and I-90 ROV Hand Commander Unit. It also allows up-and-down position setting through touch panel on the I-90 ROV Hand Commander Unit. For detailed operation, please refer to the I-90 Operator Manual.

### B. Preventative Maintenance

The Tilt Motor is of low-maintenance. The Rotary Seal should be replaced every 100 hours of use.

### C. Indication of Maintenance

Wash and clean the tilt motor in the ROV with fresh water after each dive.

### D. Clean Rotary Seal

1. Regularly remove Seal Anti-dust Cover from End Cap using screwdriver.
2. Wash and clean the Rotary Seal surface and Seal Anti-dust cover.
3. Clean and grease the Rotary Seal with silicon grease.
4. Press Seal Anti-Dust Cover into Housing.

### E. Remove Tilt Motor

1. Disconnect inline cable from Tilt Motor.
2. Release (4) SS Socket Head Cap Screw M5x20mm that secure Support Front and Tilt Motor Ring from the Top Frame with 4mm Allen Key.
3. Pull out Tilt Motor.



## **F. Removal of Tilt Motor Housing**

1. Release (3) SS Socket Head Cap Screw M4x8mm.
2. Insert the plastic putty knife to remove Housing from End Cap in order to create a gap.
3. Circle and tie the shoelace into the gap to remove Housing.



**Caution!!**

**The Wave Washer and Ball Bearing may fall from Tilt Motor End Cap or the Gear Shaft.**

## **G. Installation Procedures of Tilt Motor Housing**

1. Clean Gear Shaft 48mm and the hole in End Cap.
2. Make sure O-rings SOR-AS020N70 and SOR-AS023N70 are installed in End Cap.
3. Grease O-rings and seals with silicone grease.
4. Put the Wave Washer and the Ball Bearing in End Cap.
5. Fill Silicone grease into the screw holes of End Cap.
6. Install End Cap onto the Gear Shaft 48mm and align it with the screw holes.
7. Secure (3) SS Socket Head Cap Screw M4x8mm on the Housing.



## 18. Navigation Sensor

Part No :	2B0080001-00004
Title :	Navigation Pressure Compass G-Sensor 1000M (Mounting Assy)
Service Check :	Annual Service
Tool :	1. 2.5 mm Allen Key 2. Drive Screw 3. 13 mm Wrench

### A. General

The Navigation Pressure Compass G-Sensor 1000M is an integral unit consisting of depth sensor, G sensor, compass and gyro. The unit situates in one atmosphere housing. The unit requires a 24 VDC supply. The 6 pin wet connector, MCBH6M, is used to transmit RS232 signal to MCC Chamber and link ROV telemetry.

### B. Preventative Maintenance

To wash out seawater and abrasive material, it is compulsory for the low-maintenance Navigation Sensor to be cleaned by fresh water after each dive.

### C. Removal Procedure

1. Remove MCIL6F connectors from the sensor.
2. Use 6mm Allen key and 13mm wrench to release (2) SS Socket Head Screw M8x50 and SS Nylon Nut M8.
3. Remove screw, nut, and PCG-1000 Mounting Bracket.
4. Use flat head screw driver to loosen the clamp in PCG-1000 Mounting Bracket.
5. Remove the Sensor.



## 19. LED Light

Part No :	2B0030001-00001
Title :	Sea Bright 150W LED
Service Check :	Annual Service
Tool :	1. 4 mm Allen Key 2. 3 mm Allen Key 3. 8 mm Socket

### A. General

The standard vehicle I-90 ROV comes with (2) DWTEK manufactured Sea Bright 150W LED locating in the front side of the ROV. The power of each light is 300VDC, and each light consumes 150Watts. The LED Light has an integral driver with dimming protection function allowing “plug-to-use”. 5-pin connector is used for the LED Lights and connect the TLC Housing.

A number of manufacturers can supply units selectable to fit with I-90 ROV. The I-90 ROV might provide extension ports for extra lights. Input voltage, power consumption, and weight should be carefully considered before extra light installation.

### B. Preventative Maintenance

To wash out seawater, it is compulsory for the low-maintenance Sea Bright 150W LED to be cleaned by fresh water after each dive. For detailed maintenance of the Light, please contact DWTEK or our agent. It is recommended all lighting systems receive annual maintenance service.

### C. LED Light Hanger Adjustment

The Sea Bright Searchlights Type is attached to the mounting brackets with the hanger. For fixing the hanger, there are several places as shown in the following drawing for reference. Use the 4mm Allen key and 8 mm spanner to adjust the angle and position, and secure the Lights on the frame.

## 20. Hand Control Unit

Part No :	2B0090002-00001
Title :	I90 ROV Hand Control Unit
Service Check :	Damaged for Repair
Tool :	1. 2.5mm Allen Key 2. Cleanroom Wipe 3. Compressed Gas Can

### A. General

The I90 ROV Hand Control Unit is a highly integrated control unit with user-friendly interface. All ROV basic settings listed below can be performed on the 7" Touch Panel.

1. ID Setting on Thruster Replacement
2. On Screen Display (OSD)
3. Auto Heading
4. Auto Depth
5. Thruster Output Controls
6. Dynamic Corrections to ROV Movement
7. Various Setting for Extensive Ports
8. System Parameter Configuration Setting and Adjustment

### B. Hand Control Function Introduction

#### 1. Hand Control Overview

The functions of the I90 ROV Hand Controller Unit are listed below.

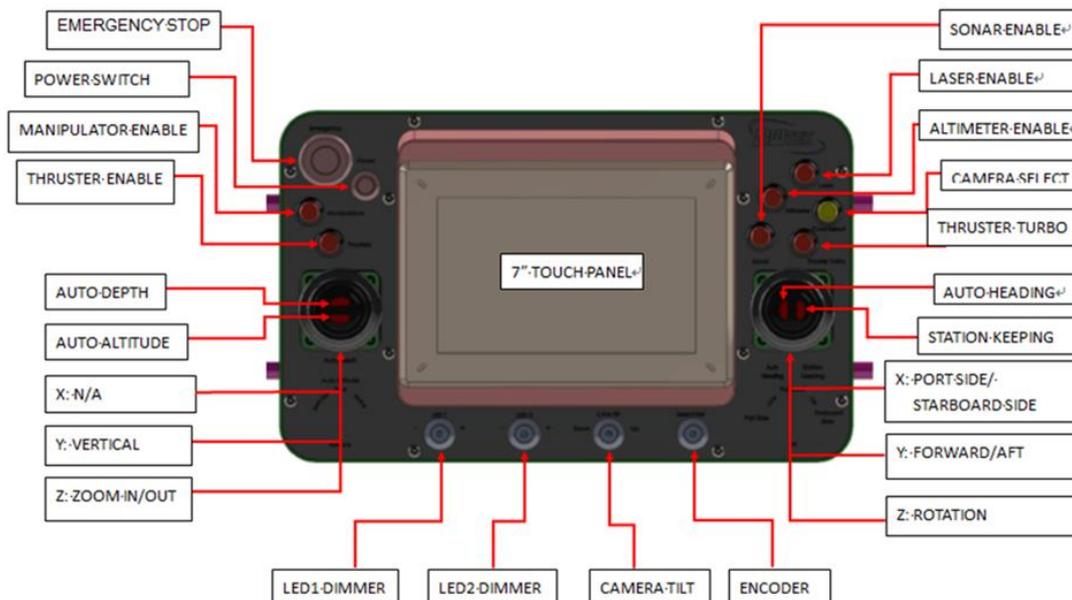


Figure 11 - Overview of Hand Controller Unit

Some buttons are repurposed and will be listed below of their respective new functions.

- Manipulator Enable: 300V On/Off on the TLC Manipulator bulkhead connector.
- Encoder: Controls the value in the ON/OFF page in the Hand Controller. Pushing the Encoder down can switch between different bars.
- Camera Select: Auto Focus ON/OFF of the HD Camera.
- Sonar Enable: No function.
- Laser Enable: Semi Auto Depth.

## 2. Hand Control Software Pages

### a. ROV

In the ROV page, it shows all the feedback information from main console unit, navigation sensor and thrusters. Also, the auto-pilot function (auto-depth, auto-altitude, auto-heading, and station keeping) can be adjusted on this page as well.



Figure 12 - ROV Page

### b. ON/OFF

If the vehicle is equipped optional LED light and instruments, operator can control the optional equipment from ON/OFF page.

Note: AL0 and AL1 is currently assigned to control the LEDs. AL2 is currently assigned to control the 7<sup>th</sup> Thruster.

Controlling the 7<sup>th</sup> Thruster:

- Have to move the cursor to 40-60 to initiate control. Within this range, the thruster will not turn.
- 61-100: Clockwise Rotation. 100 is fastest.
- 0-39: Counter Clockwise Rotation. 0 is fastest.

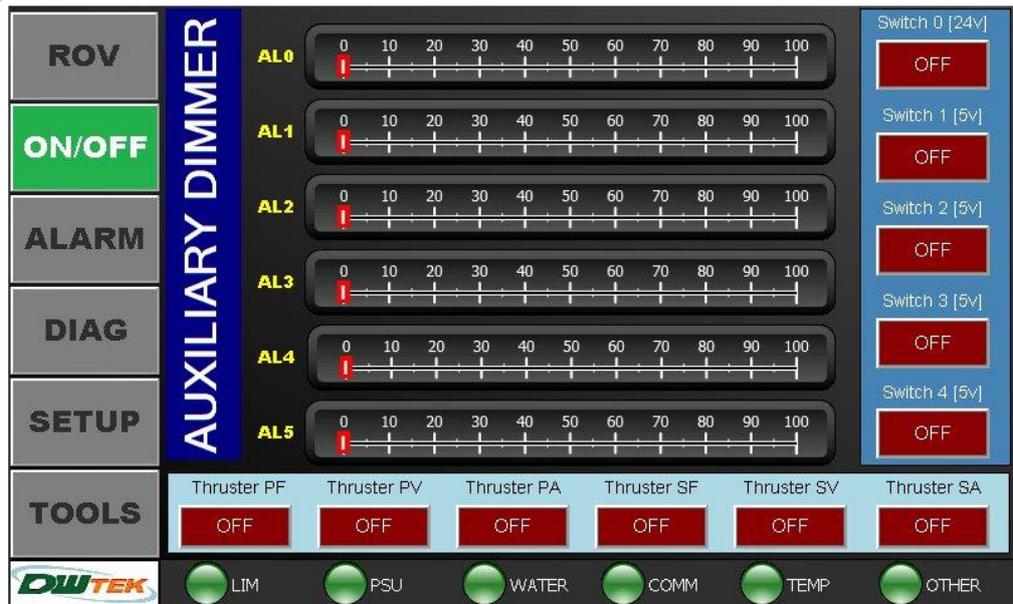


Figure 13 - ON/OFF Page

**c. Alarm**

On the bottom, there is a series of indicator representing the system alarm signal. When the indicator turns yellow, operator can enter the ALARM page to check the detail items of alarm signal.

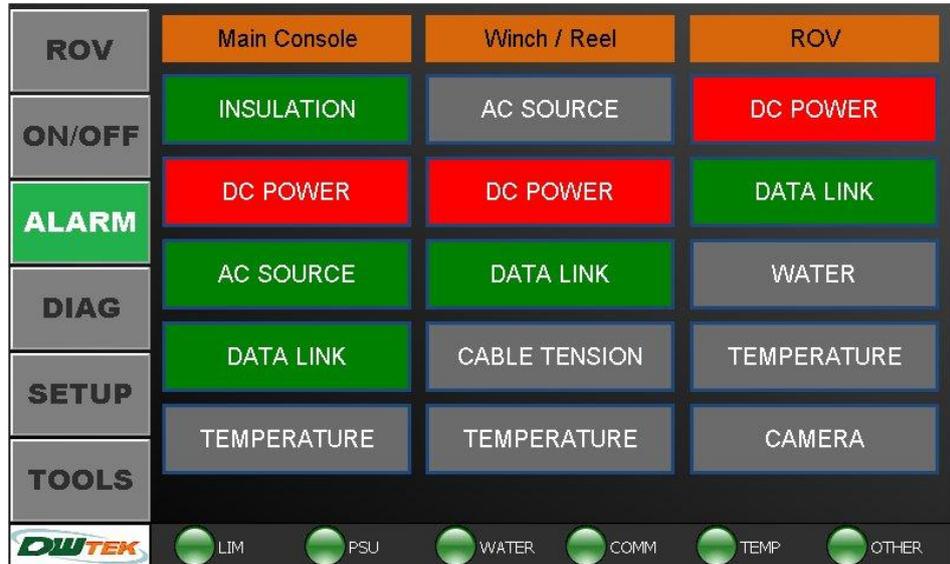


Figure 14 - ALARM Page

**d. Diagnosis**

In the DIAGNOSIS page, operator is able to check the digitized values of analog input devices and the states of switches. It helps operator to judge if there is inconsistency in the control command and the vehicle movement.

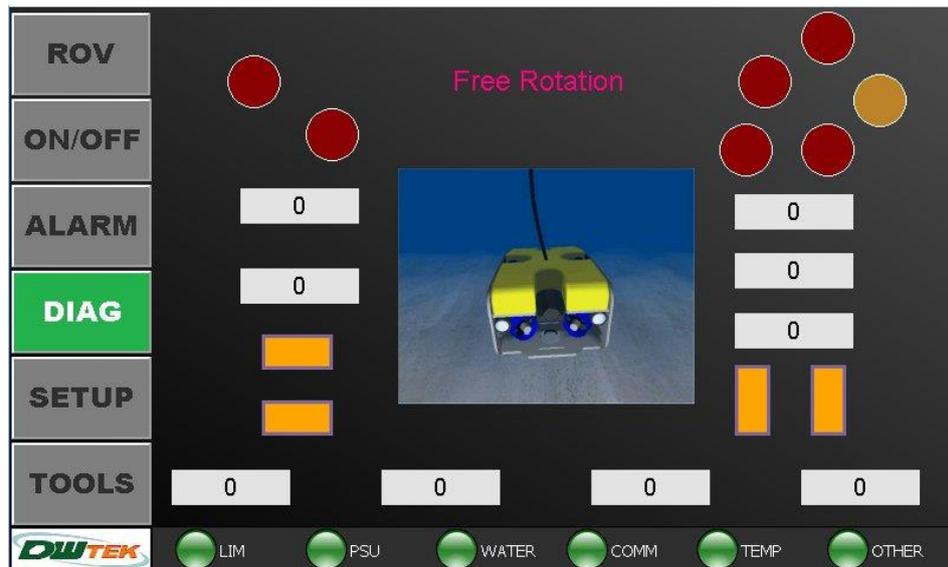


Figure 15 - DIAGNOSIS Page

## e. Setup

### Sensor

The navigation sensor provides the vehicle with pitch, roll, heading and pressure functions. Operator can use G-Zero, C-Zero and P-Zero buttons to zero roll/pitch, heading, and pressure gauge, respectively.

The heading can be calibrated by using Magnetic Calibration buttons. Press 'Start' button and slowly rotate the ROV through two full circles in a gentle motion while not changing roll and pitch. Generally, this procedure will take over 1 minute and then press the 'Stop' button. The quality will show 'Optimal', 'Good' or 'Poor' results. The confidence will show 'High', 'Medium' or 'Low' results. If operator is satisfied with the results, press 'Save' button to save the setup.

### Tilt Platform

Operator can also set the working limit of the tilt motor in this page. Before changing the limit angle, operator must set the free rotation mode by pressing the 'Mode' button. Use UP/DOWN buttons to adjust the boundary of tilt motor and then set the lower/upper limit by U Limit/L Limit buttons. Press the "ZERO" button to confirm the tilt motor return to center. After confirming all the setting is correct, re-enter servo mode by pressing the Mode button again. The maximum set angle is 180° in total. When the set angle is over 180°, the system will automatically set the angle within 180°.

### Thruster setup

The thrusters have to set the corresponding parameters before starting subsea task. Operator can use thruster configuration cable to communicate with thruster via Hand Control. Press the Connect button to enter thruster setup mode, and all the other functions of Hand Control will



temporarily stop until disconnect. The timer zero button is used to clear the thruster rotation counter, which will raise a warning signal when the number of rotations is over 30,000,000.

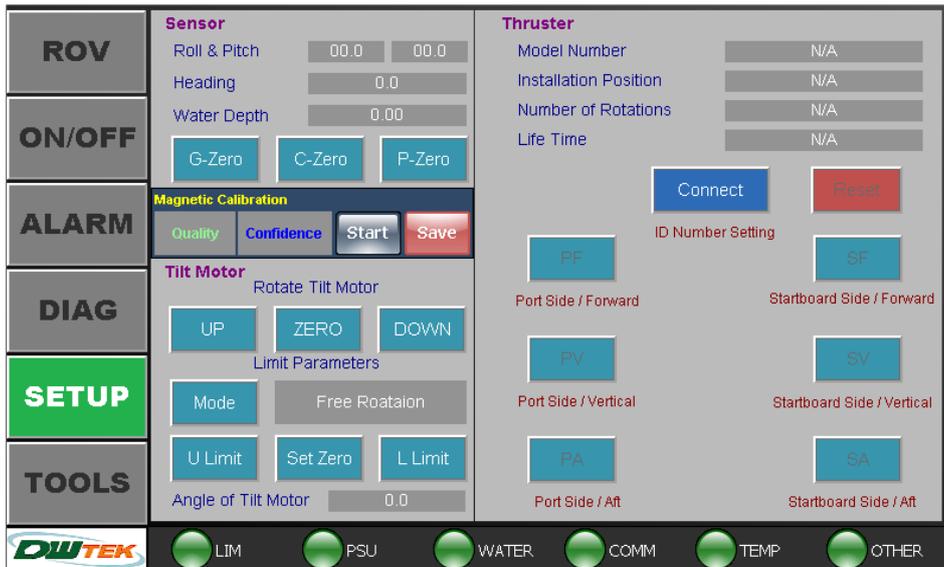


Figure 16 - SETUP Page

**f. Tools**

Four horizontal thrusters can adjust the output power from 0-100 to meet the vehicle's motion control such forward, backward, starboard side and port side movements.

The L/H mode button represents the low speed and high speed mode. If the thruster turbo button on the Hand Control Unit panel is switch off, it indicates the L Mode. The set up values should correspond to L Mode or H Mode.

Presses the query button will load the previous setting values. Press Save button saves the setting values. Press Factory button will restore the original setting for ROV without skid module.

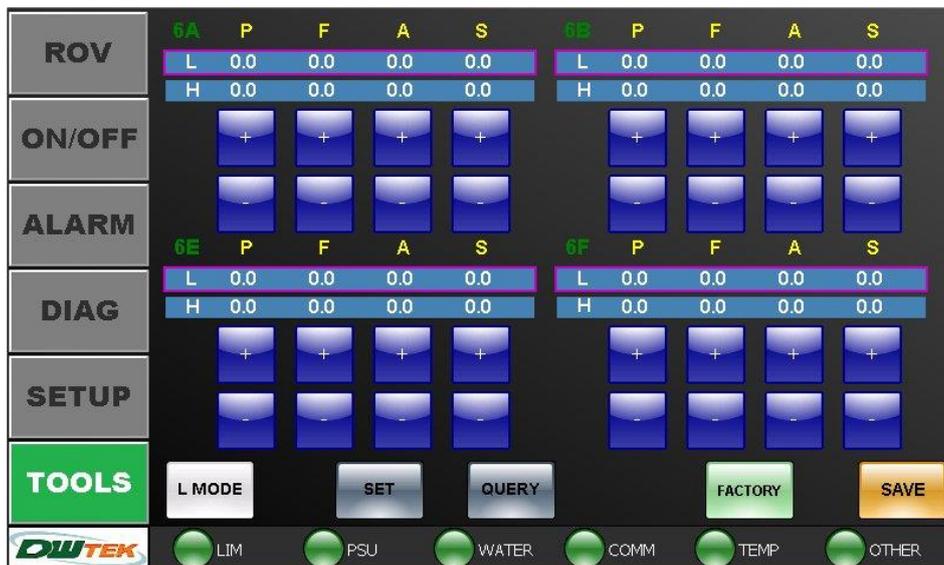


Figure 17 - TOOLS Page



### **C. Operating Environment Conditions**

1. Ambient Temperature: 0°C ~ 50°C, non-freezing.
2. Humidity: Non-condensing.
3. Atmosphere: No corrosive gases or dust.

### **D. Storage Condition**

1. Ambient Temperature: -20°C ~ 60°C, non-freezing.
2. Ambient Humidity: 85% max. (non-condensing).
3. Ambient Environment: Avoid long-term directly exposure to sun.

### **E. Preventative Maintenance**

The commander is the water-resistant unit and it tolerates minor water splash in operation. However, water on buttons and gaps should be wiped out to prevent seawater from leaking into the panel.

Please use cleanroom wipers and compressor gas can (compressor air) to remove dust and moisture. Always keep the hand controller dry and clean when in operation.

## F. Indication for Replacement

Although the most part has protection higher than IP65, without suitable indications, there might be electronic wiring and sealing failure in replacement. Items listed below are the depot-level replacement parts. Before taking any actions on replacement, approval from DWTEK is necessary.

1. Joysticks
2. Touch Panel
3. Apem IP Series Push Button Switch
4. Apem IP Push Button Toggle
5. Encoder Rotary Knob
6. Emergency Stop Button
7. Power Switch

If the handle controller has the following conditions, please contact DWTEK or the agent for service.

1. Abnormal operation of knobs, switches and joysticks.
2. No or slow reactions.
3. Touch panel gives no reaction.
4. Touch panel shows data input and output failures.



### **Caution!!**

**If the Hand Controller shows no response, please check the cable and connectors, and make sure the connectors are properly secured.**

## 21. Specification Introduction System Overview

### A. ROV portable system

#### 1. Dimensions

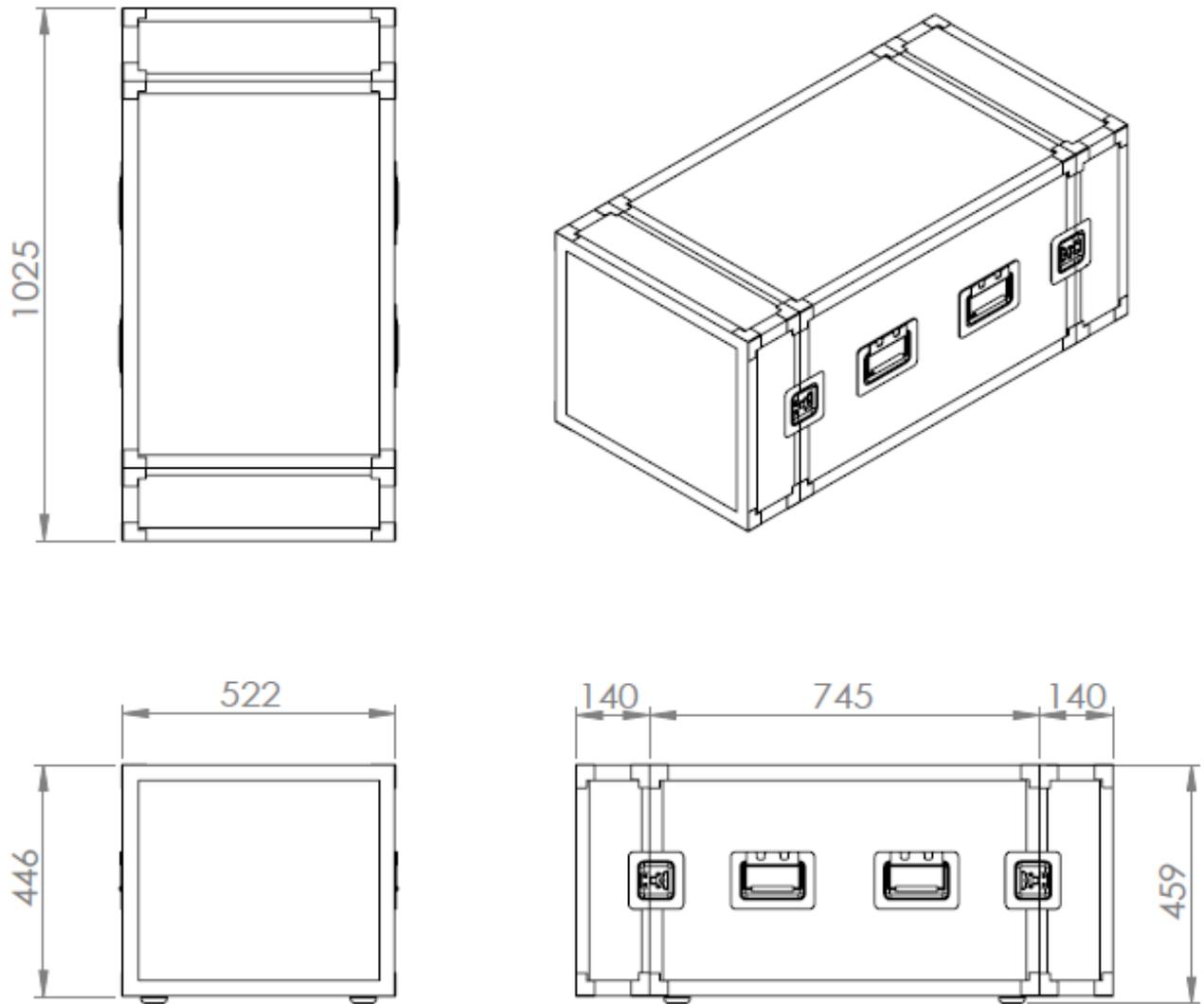


Figure 18 - ROV portable system dimensions



## 2. Specifications

Table 7 - ROV portable system specifications

ROV portable system	
Dimensions	1025*522*459 mm
Weight	92 kgs
5U-Main console	
Input Voltage	200~260VAC 50/60Hz Single-Phase
Input Current	Max:30A
Output Voltage	300VDC -Standard Connector 5 Female
Output Current	Max:20A
Output Power	Max:6KW
Fiber Straight Tip(ST)-1	ROV control signal & SD Video
Fiber Straight Tip(ST)-2	HD Video
Fiber Straight Tip(ST)-3	10/100/1000Mbps Compliant with IEEE 802.3 、IEEE 802.3u 、IEEE 802.3x 、IEEE 802.3z/ab 、IEEE 802.1d standards
3U-Industrial PC	
Watt	80+ GOLD FLEX SPS 500W ATX(FSP) RoHS
CPU	CORE 3G9M 1151P 6CORE I5-8500
HDD 4T	WD Enterprise3.5"4TB 7KRPM SATAIII 256MB
HDD 1T	WD Enterprise 3.5"1TB 7KRPM SATAIII 128MB
SSD 512GB	AMF2.5"512GB 3D TLC BiCS5(0~70 °C)
RAM	8G DDR4-2666 1GbX8 1.2V SAM WIN 10 LTSC 64bit:Win IoT Ent 2019 LTSC MultiLang ORY OEI High
1U- LCD Monitor	
Display Size	17"
Input Voltage	AC 220V

### 3. Exploded view drawing

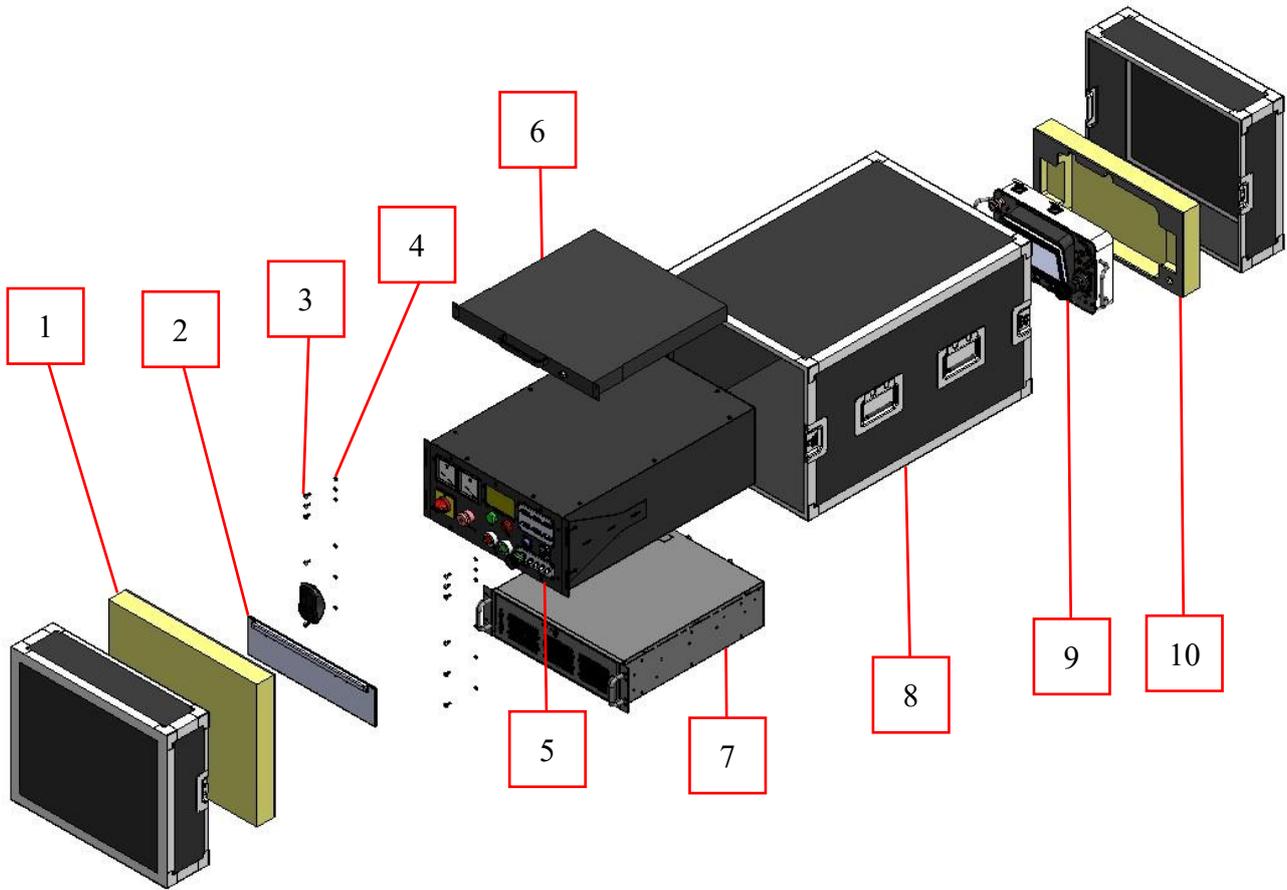


Figure 19 - ROV portable system exploded view drawing

Table 8 - ROV portable system exploded view drawing list

No.	Product Name
1	Component Fixing Plate
2	Keyboard and Mouse Set
3	M5xP0.8x15 Large Flat Head Cross Screw
4	White Plastic Washer
5	5U-Main console
6	1U- LCD Monitor
7	3U-Industrial PC
8	Instrument Case
9	Hand Controller
10	Controller Mounting Plate

## B. 5U-Main console

### 1. Dimensions

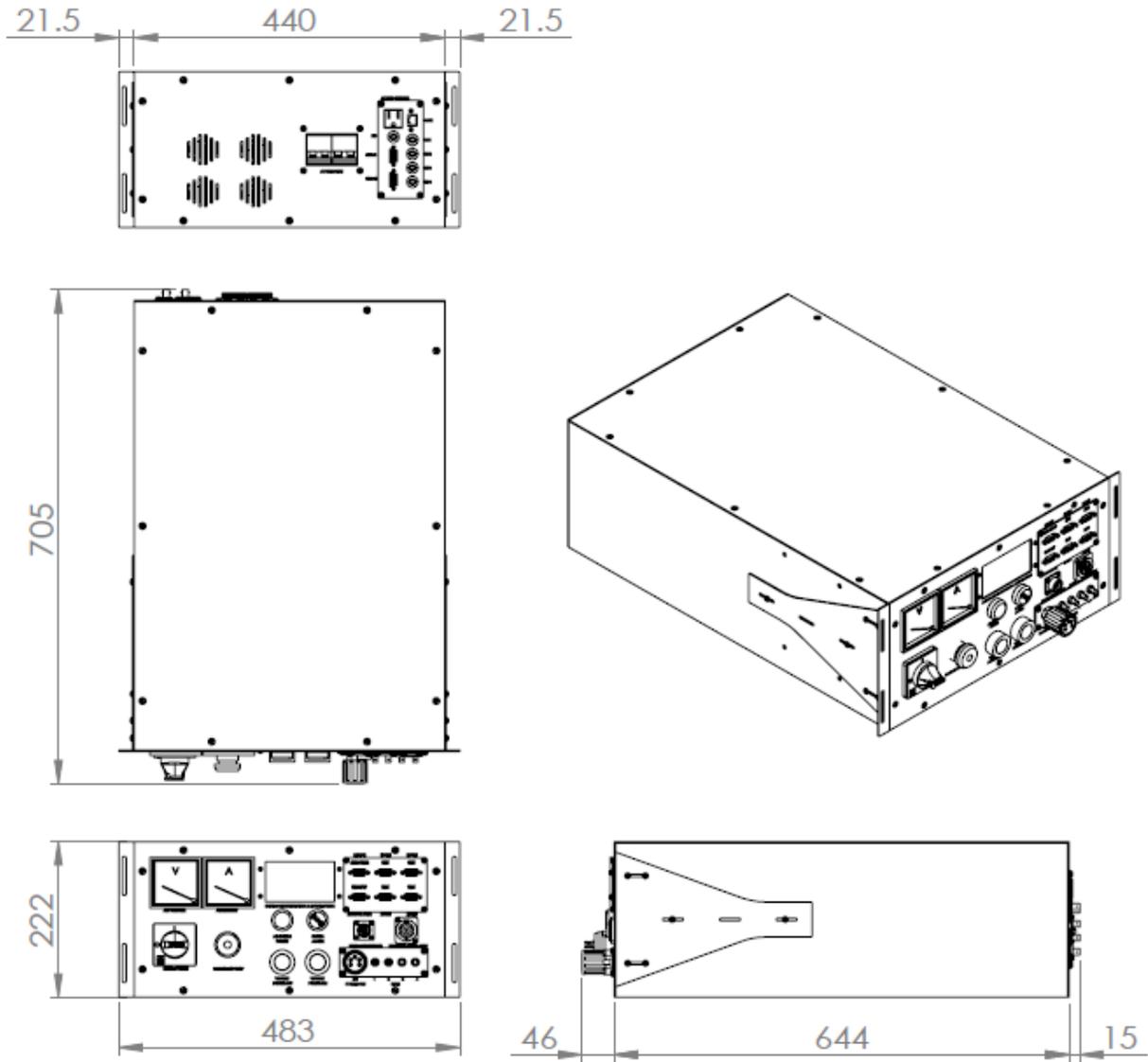


Figure 20 - 5U-Main console dimensions



## 2. Specifications

Table 9 - 5U-Main console specifications

Product Name	5U-Main console
Input Voltage	200~260VAC 50/60Hz Single-Phase
Input Current	Max:30A
Output Voltage	300VDC -Standard Connector 5 Female
Output Current	20A
Input Connectors	
Fiber Straight Tip(ST)-1	ROV control signal & SD Video
Fiber Straight Tip(ST)-2	HD Video
Fiber Straight Tip(ST)-3	10/100/1000Mbps Compliant with IEEE 802.3 、 IEEE 802.3u 、 IEEE 802.3x 、 IEEE 802.3z/ab 、 IEEE 802.1d standards
Fiber Straight Tip(ST)-4	NA
Output Connectors	
BNC-F-1	HD Video-SDI
BNC-F-2	SD Video-NTSC
BNC-F-3	SD Video-NTSC
BNC-F-4	SD Video-NTSC
BNC-F-5	SD Video-NTSC
DB9-A	RS232 for ROV information
DB9-B	NA

I/O	
DB9-1	RS232 for DVL Data Output
DB9-2	RS232 for Manipulator Controller
DB9-3	RS232/485 Spare
DB9-4	RS232 Spare
DB9-5	RS232 Spare
DB9-6	RS232 Spare
RJ45	10/100/1000Mbps Compliant with IEEE 802.3、IEEE 802.3u、IEEE 802.3x、IEEE 802.3z/ab、IEEE 802.1d standards
Display	
AC Voltmeter	0~300VAC
AC Ammeter	0~60A
Display screen	4.3"LCD
Other	
Insulation monitoring	YES
AC Power indicator light	YES
Buzzer	YES
DC emergency switch	YES
AC Earth-leakage circuit breaker	YES
AC power sockets	Input Voltage / 2A

## C. 3U-Industrial PC

### 1. Dimensions

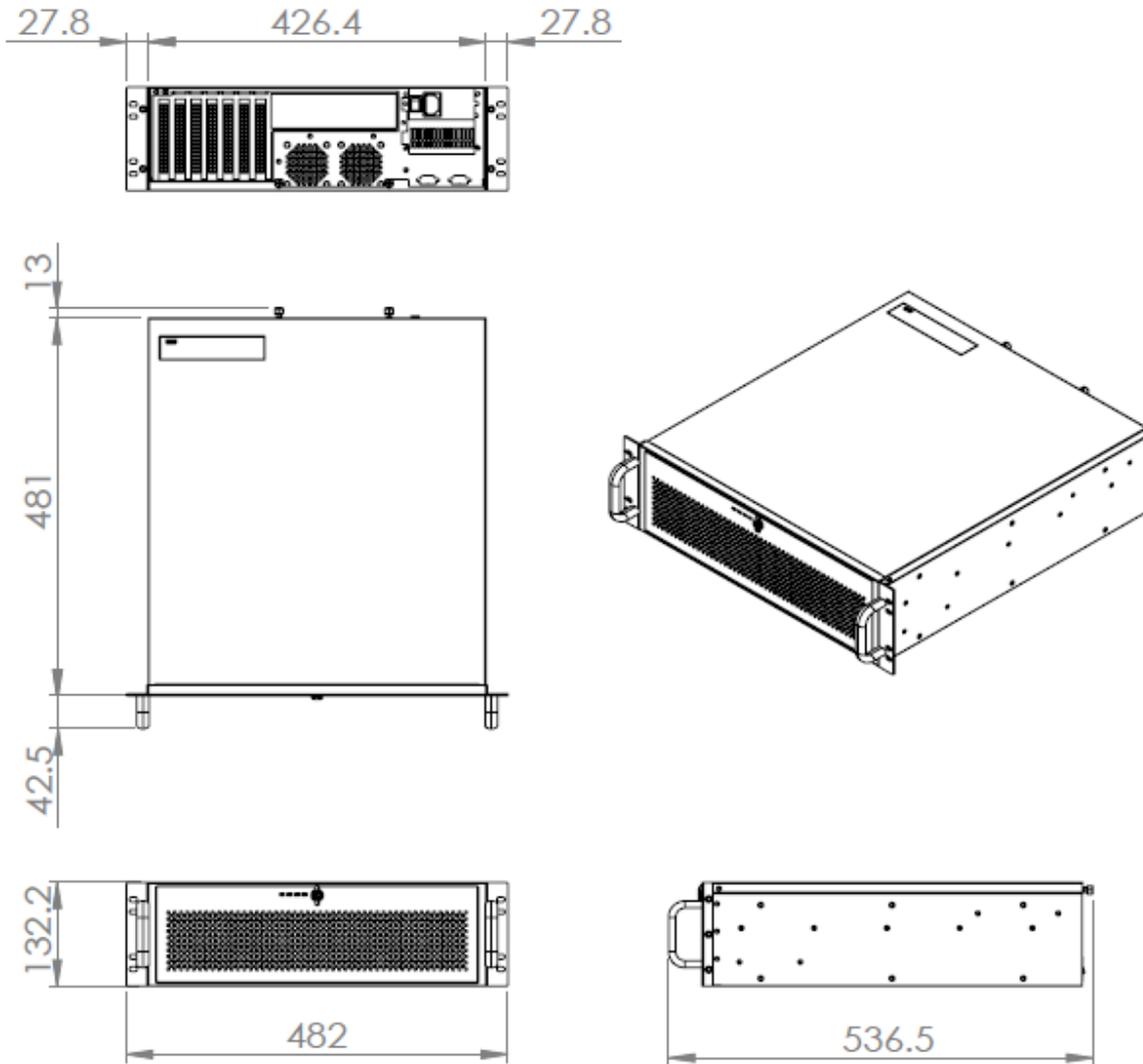


Figure 21 - 3U-Industrial PC dimensions



## 2. Specifications

Table 10 - 3U-Industrial PC Specifications

Product Name	3U-Industrial PC
Watt	80+ GOLD FLEX SPS 500W ATX(FSP) RoHS
Power cable	CABLE/WIRE, Power Cord 3P UL/CSA(USA)125V 10A 1.83M 180D
AIMB-786G2	LGA1151 ATX Q370/2LAN/DP/DVI/VGA w/o LPT(MIT)
CPU	CORE 3G9M 1151P 6CORE I5-8500
Cooler	SHEET METAL, Cooler I--LGA1155 S-95W 90*90*68-SS12V0.35A-HPC
HDD 4T	WD Enterprise3.5"4TB 7KRPM SATAIII 256MB
HDD 1T	WD Enterprise 3.5"1TB 77KRPM SATAIII 128MB
SSD 512GB	AMF2.5"512GB 3D TLC BiCS5(0~70 °C)
SSD Fix	Module to securely fix two 2.5"HDDs in a 3.5"
RAM	8G DDR4-2666 1GbX8 1.2V SAM WIN 10 LTSC 64bit:Win IoT Ent 2019 LTSC MultiLang ORY OEI High
SYSTEM FAN	A Cable 1*4P-2.54/1*4P-2.54*2 10cm
TEST	Standard Assembly +Functional Testing +Software
SATA Cable	M Cable SATA 7P/SATA 7P 60CM C=R180/180

## D. 1U- LCD Monitor

### 1. Dimensions

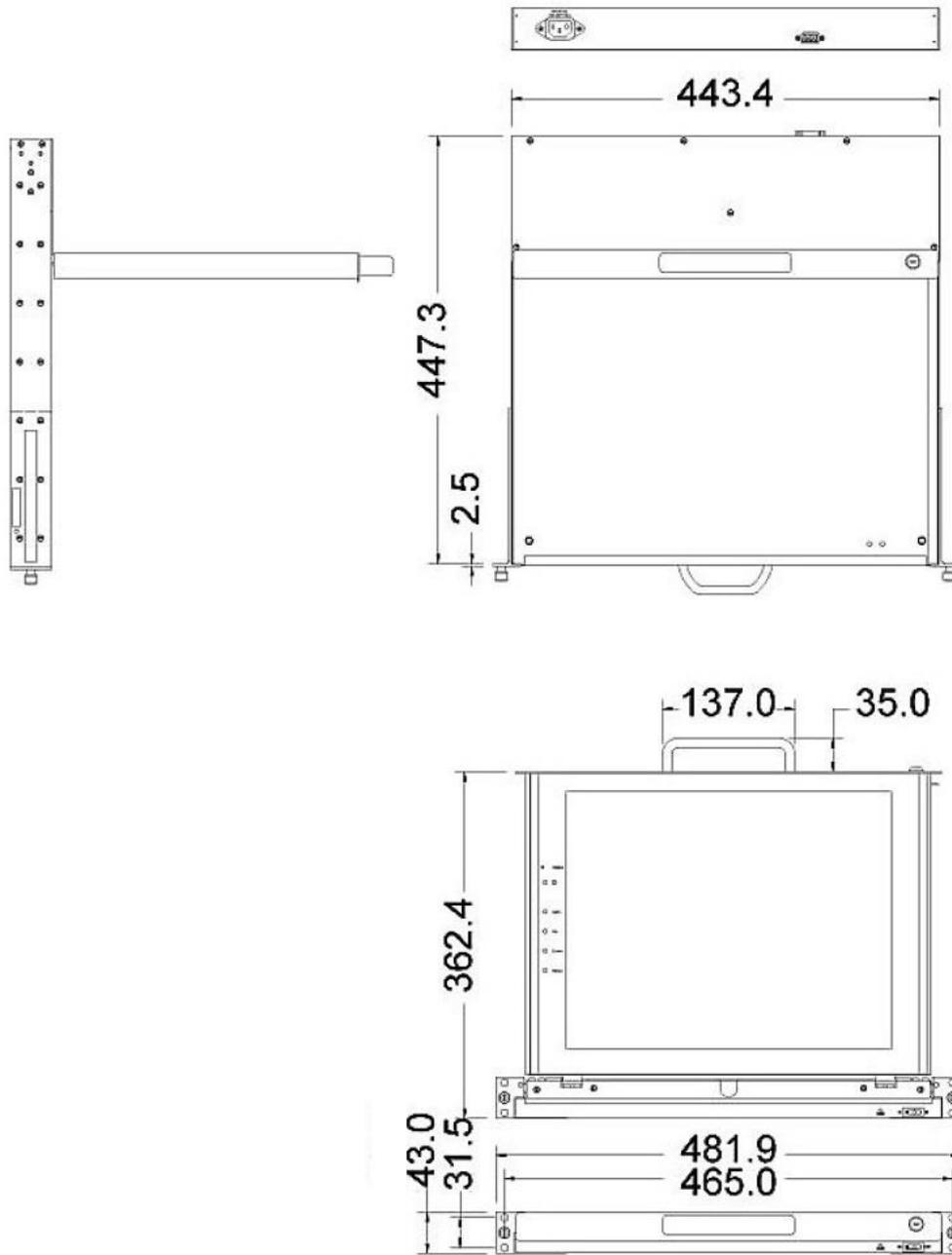


Figure 22 - 1U-LCD Monitor dimensions



## 2. Specifications

Table 11 - 1U-LCD Monitor Specifications

Product Name	1U- LCD Monitor
Display Size	17"
Input voltage	AC 220V
Resolution	SXGA 1280×1024
Pixel Pitch	0.264mmx0.264mm
Viewing Angle	R-L view 60°~70° U-D view 45°~60°
Contrast Ratio	1000:1
Brightness	white 250cd/m2
Interface	DB15 VGA Port
Dimensions	443.4 (W) x 447 (D) x 44 (H) mm 17.5 (W) x 17.6 (D) x 1.7 (H) inches
Gross Weight	14.6kgs

## 22. System Introduction

### A. 5U-Main console front panel

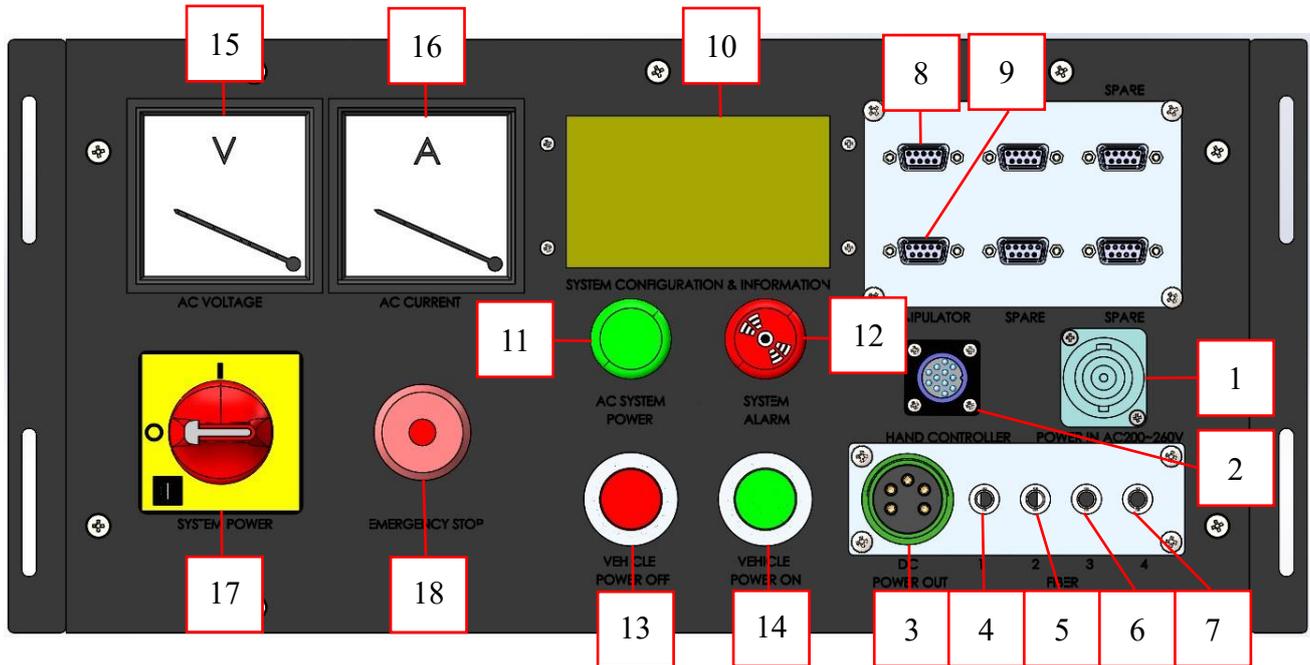


Figure 23 - 5U-Main console front panel

Table 12 - 5U-Main console front panel list

No.	Features	No.	Features
1	Power in AC 200~260V	10	Touch screen
2	Hand controller	11	AC system power
3	DC power output	12	System alarm
4	Fiber 1	13	Vehicle power off
5	Fiber 2	14	Vehicle power on
6	Fiber 3	15	AC voltmeter
7	Fiber 4	16	AC ammeter
8	DVL	17	System power
9	Spare	18	Emergency stop

## B. 5U-Main console rear panel

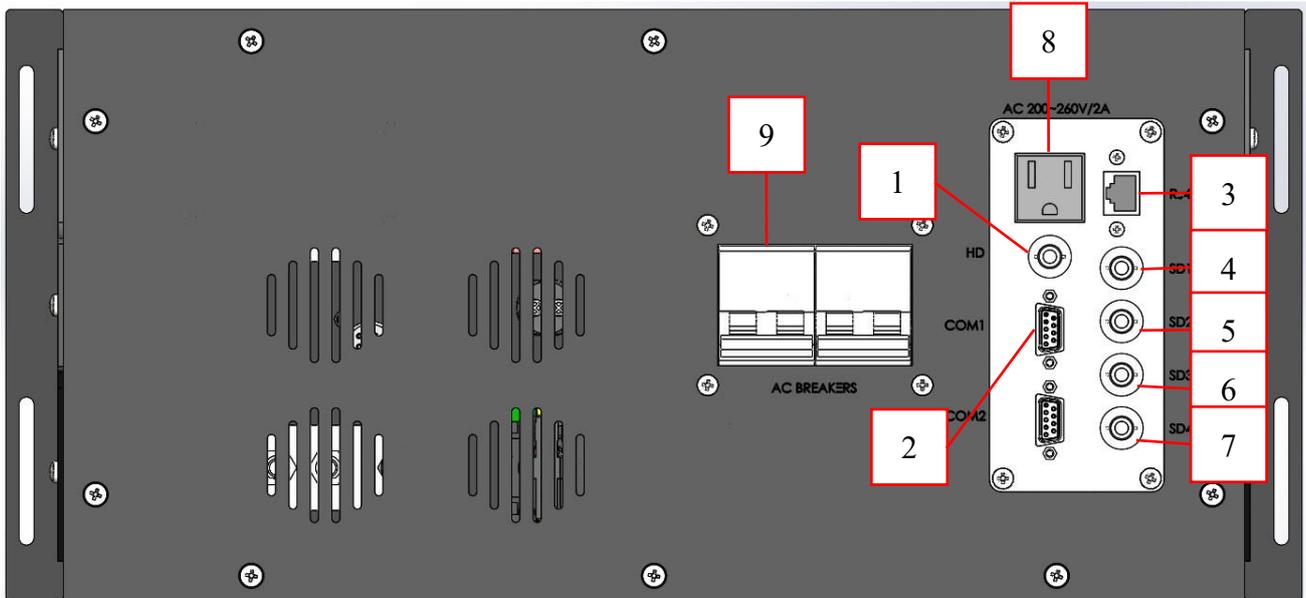


Figure 24 - 5U-Main console rear panel

Table 13 - 5U-Main console rear panel list

No.	Features
1	HD video output
2	ROV data output
3	Multi-beam sonar output
4	SD-1 video output
5	SD-2 video output
6	SD-3 video output
7	SD-4 video output
8	AC 200~260V/2A
9	AC Circuit breakers

### C. 3U-Industrial PC front panel



Figure 25 - 3U-Industrial PC front panel

Table 14 - 3U-Industrial PC front panel list

No.	Features
1	Power button

### D. 3U-Industrial PC rear panel

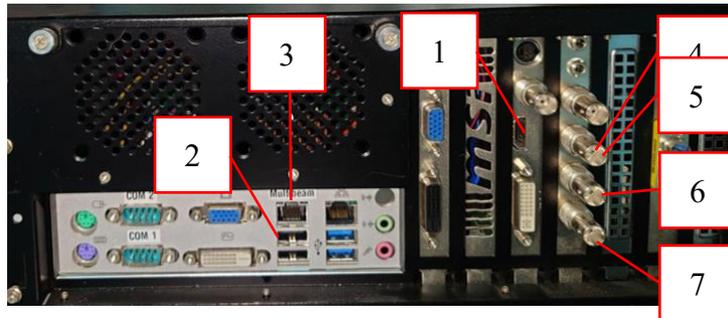


Figure 26 - 3U-Industrial PC rear panel

Table 15 - 3U-Industrial PC rear panel list

No.	Features
1	HD video input
2	ROV data input
3	Multi-beam sonar input
4	SD-1 video input
5	SD-2 video input
6	SD-3 video input
7	SD-4 video input

## 23. Startup process

**Step 1:** After connecting the cables of the 5U-Main console front panel according to figures 1 to 9, further instructions will be provided on the connection method.

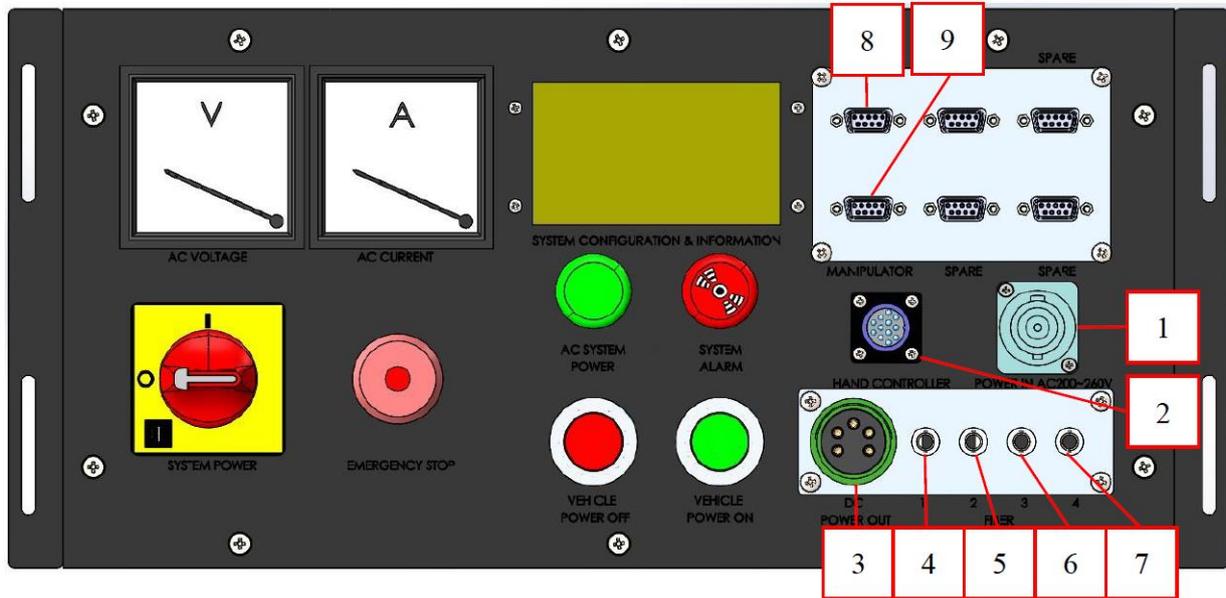


Figure 27 - 5U-Main console front panel pictorial diagram

Table 16 - 5U-Main console front panel pictorial diagram list

No.	Features
1	Power in AC 200~260V
2	Hand controller
3	DC power output
4	Fiber 1
5	Fiber 2
6	Fiber 3
7	Fiber 4
8	DVL
9	Spare

**Step 2:** Connect the high-voltage power cable to 1. AC 200~260V, align the connector with the AC socket holes and rotate clockwise to lock the connector in place.

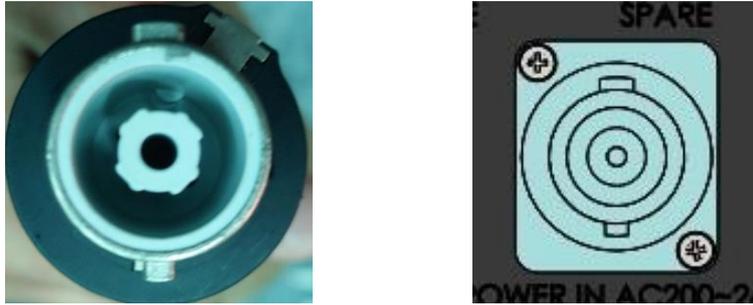


Figure 28 - Left: High-voltage power cable connector. Right: AC socket

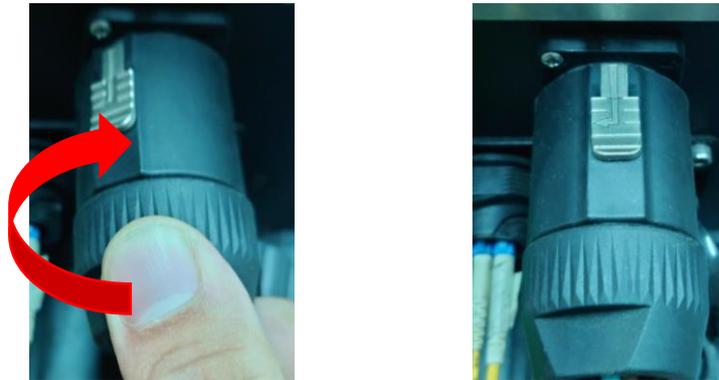


Figure 29 - Left: Insert and rotate clockwise. Right: The connector is in a locked state.



The AC power cable is rated for 220VAC, use with caution and be aware of the risk of electric shock.



Before plugging or unplugging the AC power cable, make sure the fiber optic data and power control module of the underwater vehicle are turned off.

**Step 3:** Connect the hand controller signal cable to 2. Hand controller. Align the connector with the signal socket positioning point, and rotate clockwise to lock the connector in place.



Figure 30 - Hand controller signal cable connector



Figure 31 - Signal socket



Figure 32 - Rotate clockwise to lock the signal connector in place

**Step 4:** Connect the ROV power cable to 3. DC power output. Align the connector with the VDC socket Pin holes and rotate clockwise to lock the connector in place.



Figure 33 - ROV power cable



Figure 34 - VDC socket



Figure 35 - Insert the VDC socket pins into the holes and clockwise secure the fixture



Figure 36 - The connector fixture has been locked securely

**Step 5:** Connect the fiber signal cable to 4~7, fiber 1~ 4. First, align the cable end locator with the corresponding slot on the connector end, then rotate the cable end locking groove to align with the connector end locking point, and finally push in and rotate to secure the connector end locking point onto the cable end locking groove.

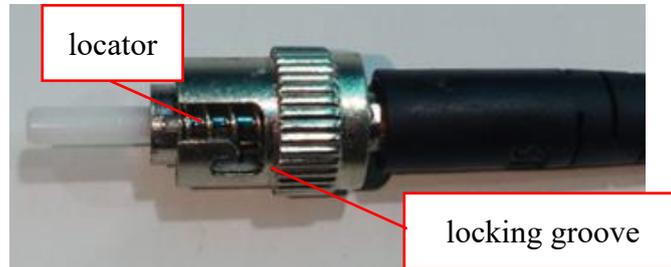


Figure 37 - Fiber signal cable end



Figure 38 - Fiber signal connector end

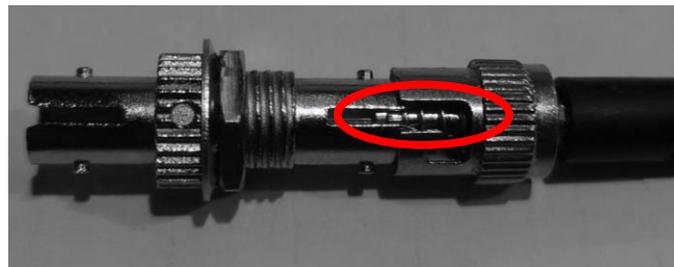


Figure 39 - Align the cable end locator with the corresponding slot on the connector end

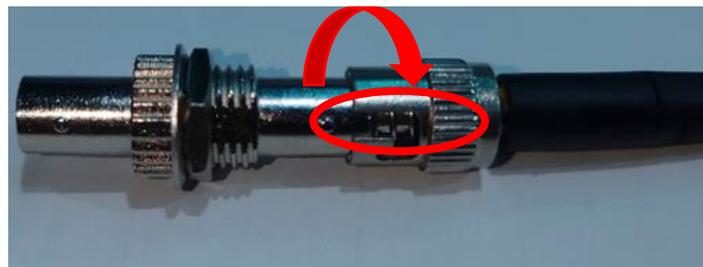


Figure 40 - Rotate the cable end locking groove to align with the connector end locking point

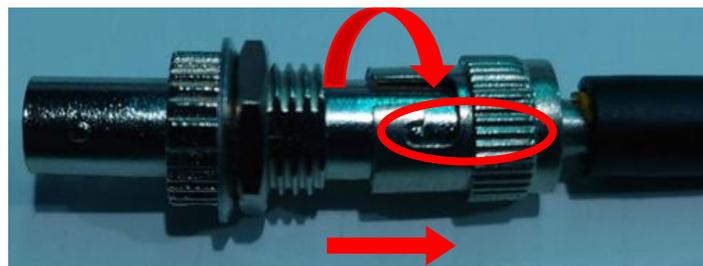


Figure 41 - Secure the connector end locking point onto the cable end locking groove

**Step 6:** After connecting the cables of 5U-Main console rear panel from 1~ 7, connect HD video output and SD-1 ~ SD-4 video output according to the wiring method in step 5. Please refer to the instructions in step 5 for details.

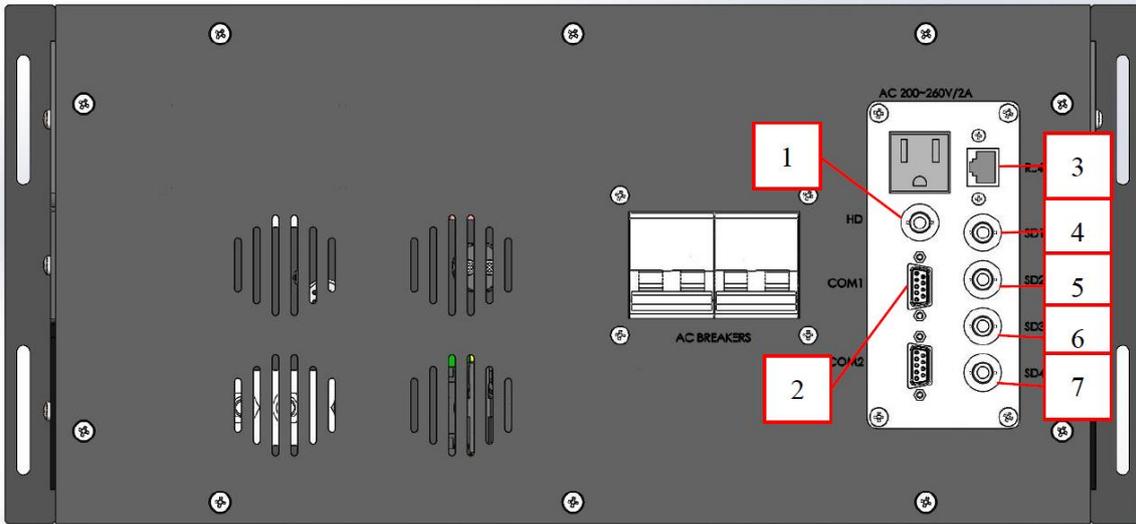


Figure 42 - 5U-Main console rear panel pictorial diagram

Table 17 - 5U-Main console rear panel pictorial diagram list

No.	Features
1	HD video output
2	ROV data output
3	Multi-beam sonar output
4	SD-1 video output
5	SD-2 video output
6	SD-3 video output
7	SD-4 video output

**Step 7:** After connecting the cables of the rear panel of the 3U-Industrial PC shown in Figures 1 ~ 7, please refer to Step 5 for instructions on how to connect the 1. HD Video Input and 4 ~ 7. SD-1 Video Inputs to the SD-4 Video Input.

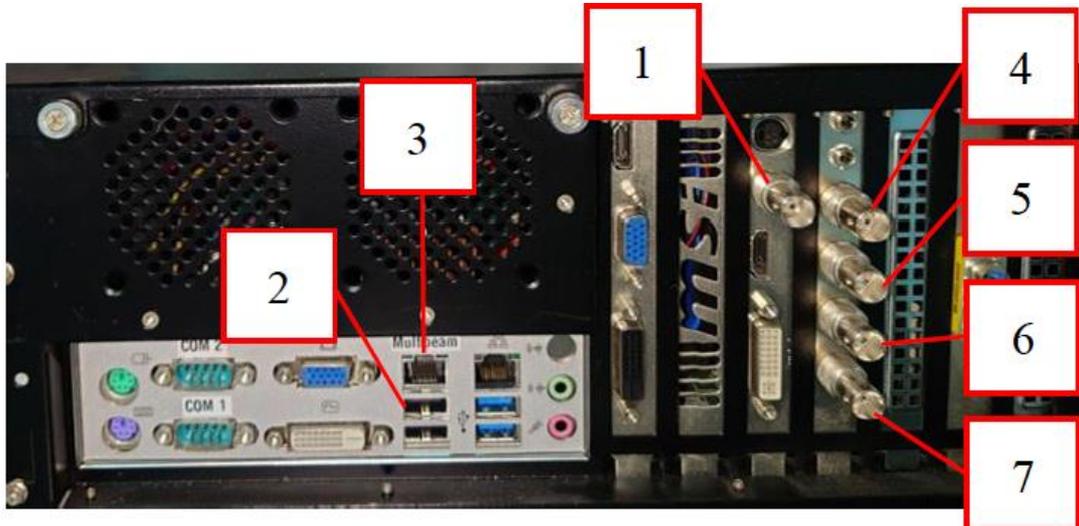


Figure 43 - 3U-Industrial PC rear panel pictorial diagram

Table 18 - 3U-Industrial PC rear panel pictorial diagram list

No.	Features
1	HD video input
2	ROV data input
3	Multi-beam sonar input
4	SD-1 video input
5	SD-2 video input
6	SD-3 video input
7	SD-4 video input

**Step 8:** After confirming that the wiring is correct, you can activate the 9. AC circuit breaker located on the rear panel of the 5U-Main console. When starting up, you need to simultaneously flip up the switches on both sides.

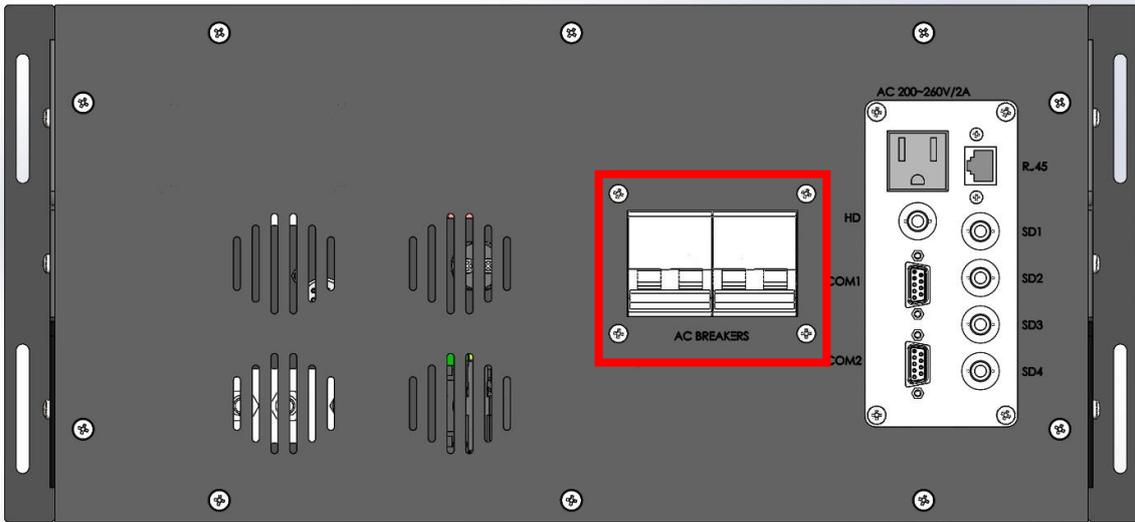


Figure 44 - Schematic diagram of the AC circuit breaker location

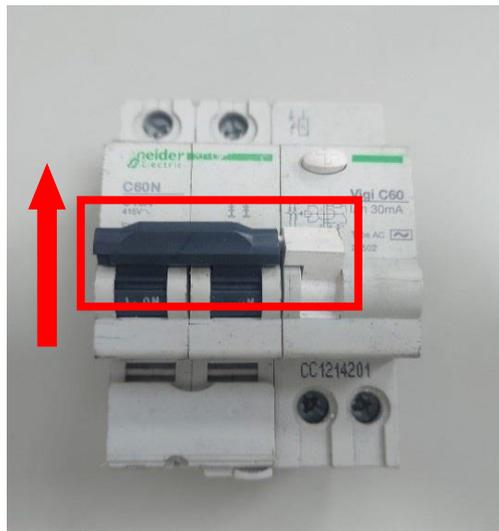


Figure 45 - Schematic diagram of the AC circuit breaker activation

**Step 9:** Turn the 17. System start knob located on the front panel of the 5U-Main console clockwise to the start position.

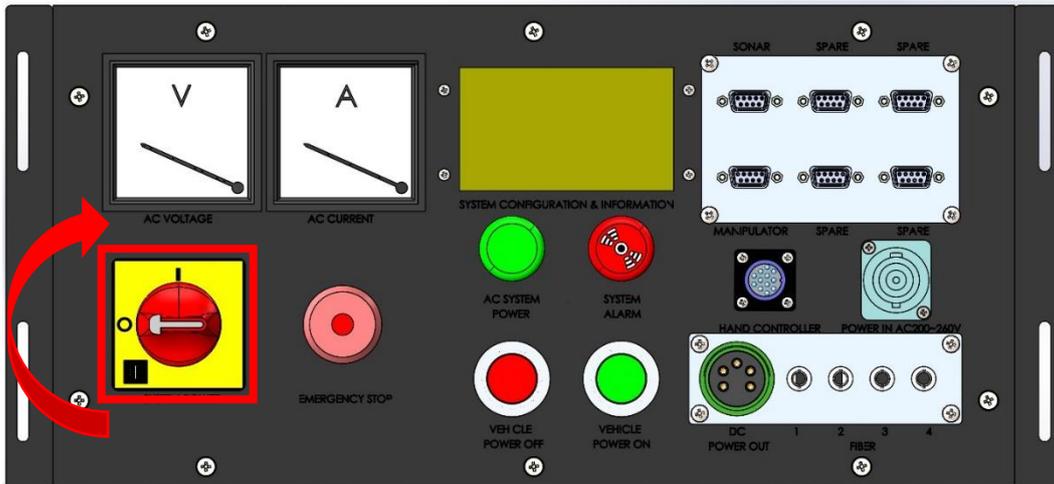


Figure 46 - System Start Knob pictorial diagram

**Step 10:** Check if the 18. Emergency Stop Switch has been released. If it has not been released, the "Emergency Stop" icon will be displayed on the 10. Touch screen. Rotate the Emergency Stop Switch clockwise to release it.

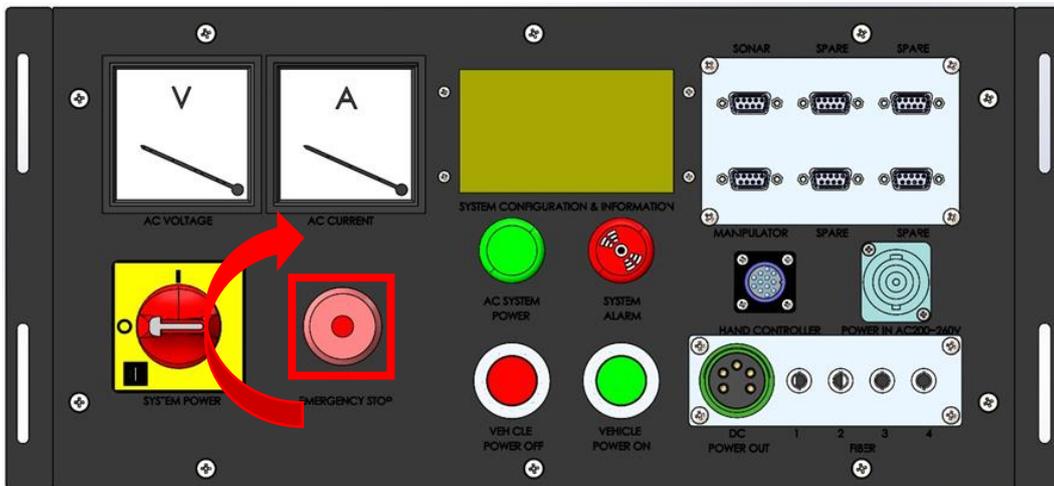


Figure 47 - Emergency stop switch release pictorial diagram



Figure 48 - Emergency Stop icon



**Step 11:** After turning the emergency stop switch clockwise to release it, wait for the LIM to start up and self-test, which takes about 40 seconds.

**Step 12:** Please check whether the set voltage, current, and power comply with the specifications. Refer to the table below for the specification values.

Table 19 - 5U-Main Console Voltage, Current, and Power Specifications

items	Specification Value
VOLTAGE	300V
CURRENT	20A
POWER	6000W

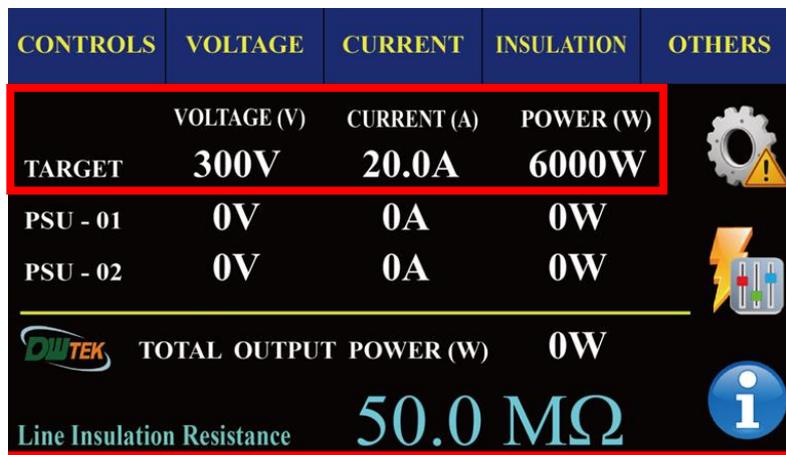


Figure 49 - 5U-Main Console Voltage, Current, and Power Numeric Display

**Step 13:** If the value does not comply with the specification, enter the settings screen, modify the value to comply with the specified value, and then click "Confirm."



Figure 50 - 5U-Main Console Settings Screen Buttons

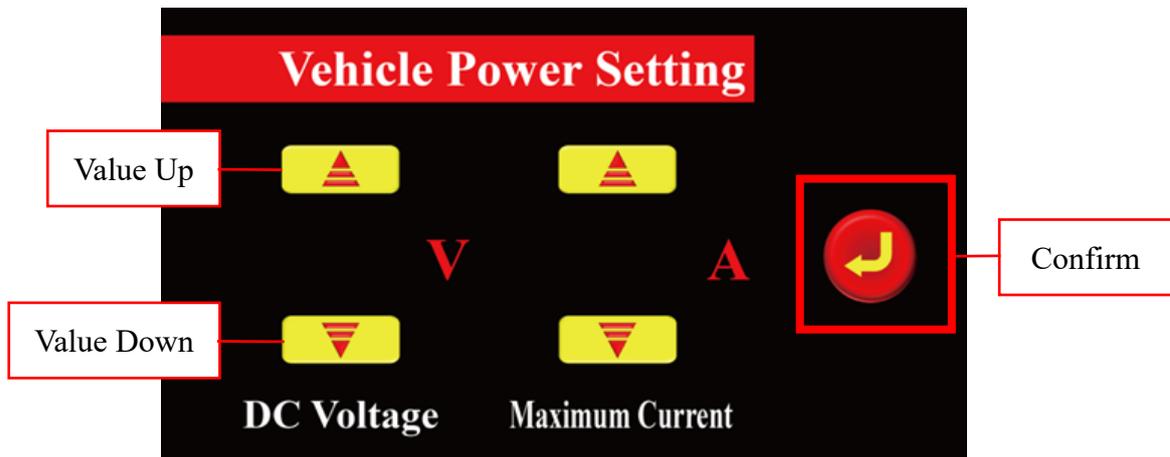


Figure 51 - 5U- Main Console Settings Screen Function Introduction

**Step 14:** Press the power switch on the Hand controller to turn on the power.



Figure 52 - Hand controller power switch pictorial diagram

**Step 15:** Check if the emergency stop switch is released, and rotate it counterclockwise to release it.



Figure 53 - Diagram of emergency stop switch on manual controller.



If encountering any emergency situation, please press the emergency switch to cut off power to the ROV. This action is equivalent to pressing the emergency stop switch on the 5U-main control console.

**Step 16:** Press the power switch on the 3U-Industrial computer host to turn on the power.



Figure 54 - 3U-Industrial PC power switch

**Step 17:** Press the power-on button labeled "14" on the front panel of the 5U-main control console to output 300 VDC to the ROV.

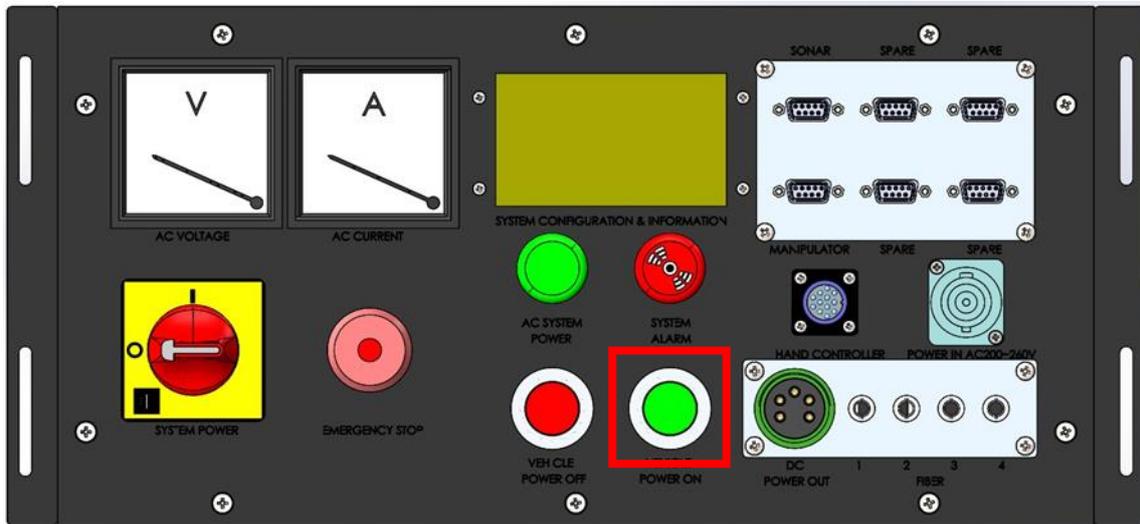


Figure 55 - Diagram of power-on button.



Make sure there are no personnel working around the ROV before proceeding with power delivery.



At this point, the ROV is in a powered state. Please be aware of the risk of propeller blades causing lacerations and avoid looking directly at the bright illumination devices. Also, do not attempt to perform any ROV maintenance operations before disconnecting the power supply.

**Step 18:** Check if there is an image (HD & SD) on the main screen of the 1U-monitor and if the values of the attitude sensors are normal. If there are no abnormalities, the startup process is complete.

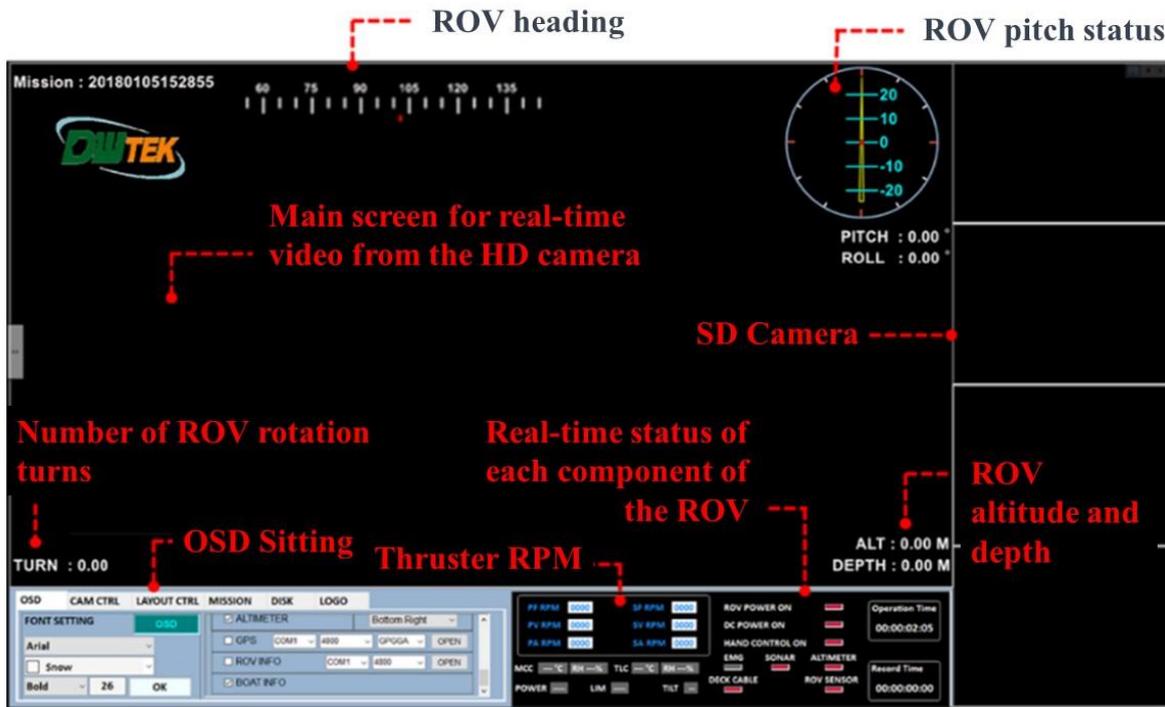


Figure 56 - Illustration of the main screen for the 1U-monitor

## 24. Closing process

**Step 1:** Pressing the power off button, labeled as number 13 on the front panel of the 5U-main console, will stop the output of 300 VDC to the ROV.

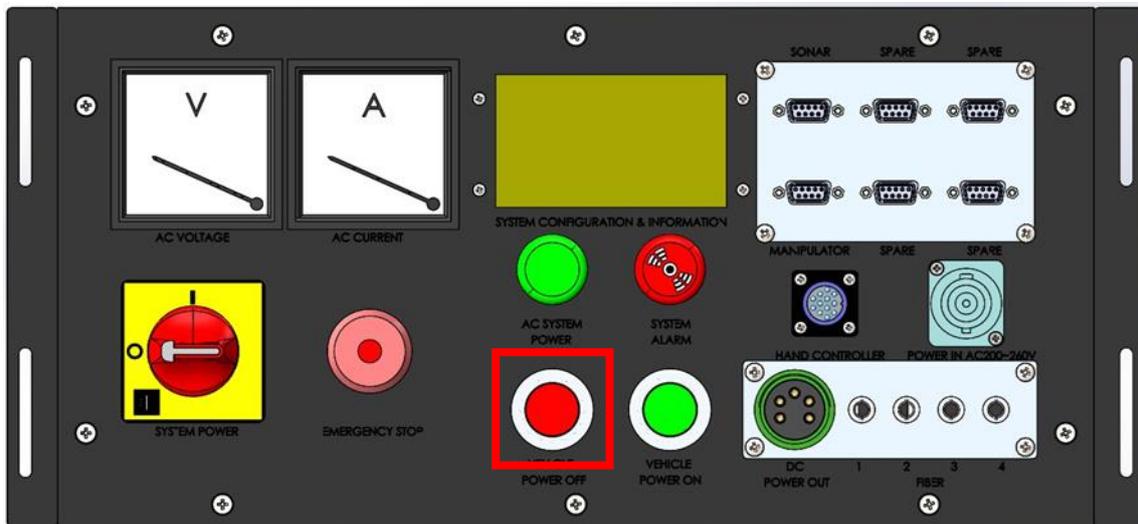


Figure 57 - Power off button diagram

**Step 2:** Click on the Start option on the Windows taskbar, select the Shutdown option from the Open/Close options, and turn off the power of the 3U-Industrial Computer host.



Figure 58 - Flowchart for shutting down the power of the 3U industrial computer host

**Step 3:** Press the power switch on the manual controller to turn off the power.



Figure 59 - Handheld controller power off icon

**Step 4:** Turn the system start knob located on the front panel of the 5U-main control console counterclockwise to the off position.

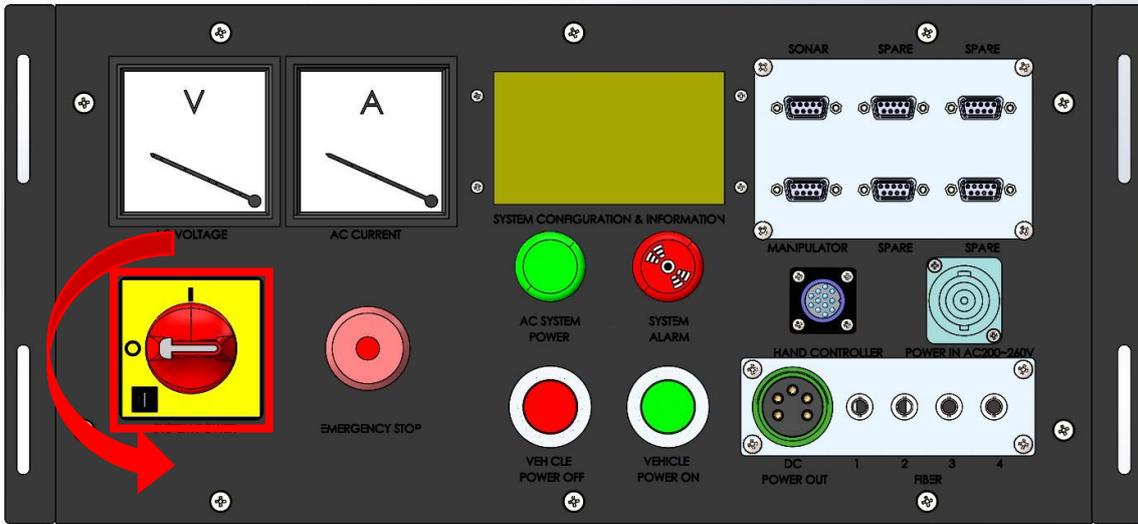


Figure 60 - Diagram of System Shutdown Knob

**Step 5:** Turn off the AC power switch located at the back panel of the 5U main console. When turning off the switch, pull down both switches on the left and right sides at the same time. If there is no abnormality, the shutdown process is completed.

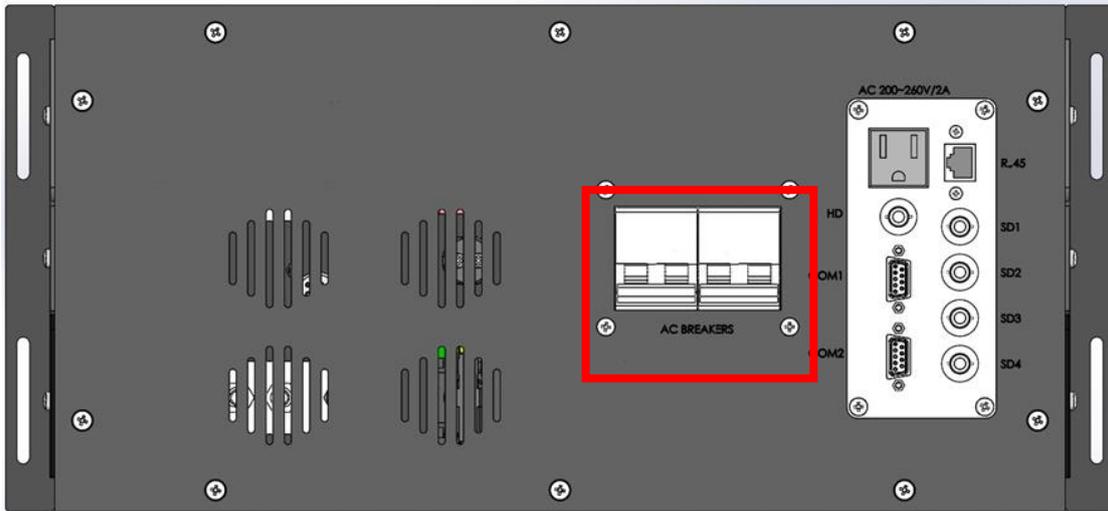


Figure 61 - AC power switch in OFF position diagram



Figure 62 - AC Power Switch Off position diagram

## 25. Position diagram

### A. Control alerts

#### 1. Manual controller connection abnormality

Check whether the cable connecting 5U-main control panel to the manual controller is damaged and whether the port is damaged.

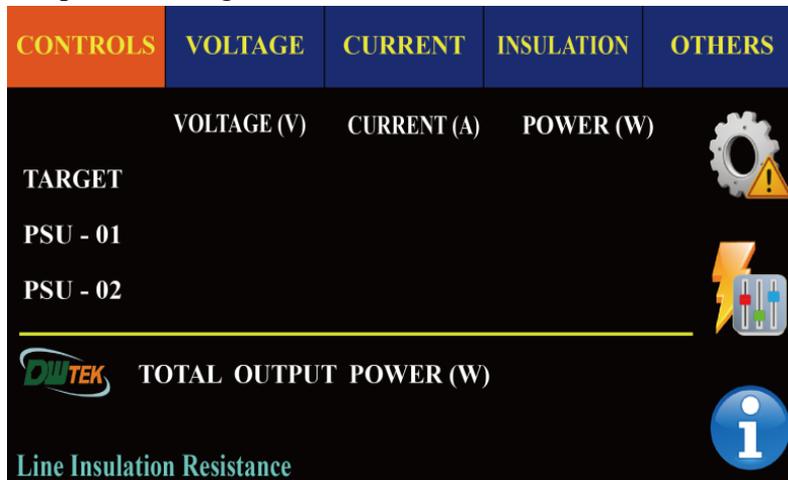


Figure 63 - Control the alarm.



Figure 64 - Manual controller connection abnormal



Figure 65 - Manual controller connection diagram.

## B. Voltage alarm.

### 1. AC input voltage is too high/low.

Please follow **step 13 of the III. Startup Procedure** to restart the system after adjusting the voltage. If abnormalities still occur after restarting, please lower/raise the input voltage to AC200~260V.

CONTROLS	VOLTAGE	CURRENT	INSULATION	OTHERS
	VOLTAGE (V)	CURRENT (A)	POWER (W)	
TARGET				
PSU - 01				
PSU - 02				
	TOTAL OUTPUT POWER (W)			
Line Insulation Resistance				

Figure 66 - Voltage alarm

CONTROLS	VOLTAGE	CURRENT	INSULATION	OTHERS
<b>AC Over Voltage</b>				
<p>AC input over voltage Please check the input voltage. Ensure the Input voltage is between AC 200 ~ 260V</p>				
	Web Site : <a href="http://dwtekmarine.com">dwtekmarine.com</a> Tel : +886-4-35024890			

Figure 67 - AC Over Voltage

CONTROLS	VOLTAGE	CURRENT	INSULATION	OTHERS
<b>AC Under Voltage</b>				
<p>PSU Output over voltage. PSU Output over control voltage. Enter to I-100 ROV protection function and ROV input power off.</p>				
	Web Site : <a href="http://dwtekmarine.com">dwtekmarine.com</a> Tel : +886-4-35024890			

Figure 68 - AC Under Voltage

## C. Current alarm

### 1. High current of power supply

**Step 1: Remove the 300V DC output cable from the 5U main control console and check for short circuits by powering it separately.**

**Step 2: Check for short circuits in the ROV equipment and cables.**

CONTROLS	VOLTAGE	CURRENT	INSULATION	OTHERS
	VOLTAGE (V)	CURRENT (A)	POWER (W)	
TARGET				
PSU - 01				
PSU - 02				
 TOTAL OUTPUT POWER (W)				
Line Insulation Resistance				

Figure 69 - Current alarm

CONTROLS	VOLTAGE	CURRENT	INSULATION	OTHERS
<div style="background-color: red; color: white; padding: 10px;"> <h1 style="margin: 0;">PUS Over Current</h1> </div>				
<p>PSU Output over current.            PSU Output over control current.            Enter to I-100 ROV protection function and ROV            input power off.</p>				
 Web Site : <a href="http://dwtekmarine.com">dwtekmarine.com</a> Tel : +886-4-35024890				

Figure 70 - Over current of power supply



When removing and inspecting the 300V DC input cable and power line, use caution and be aware of the risk of electric shock.

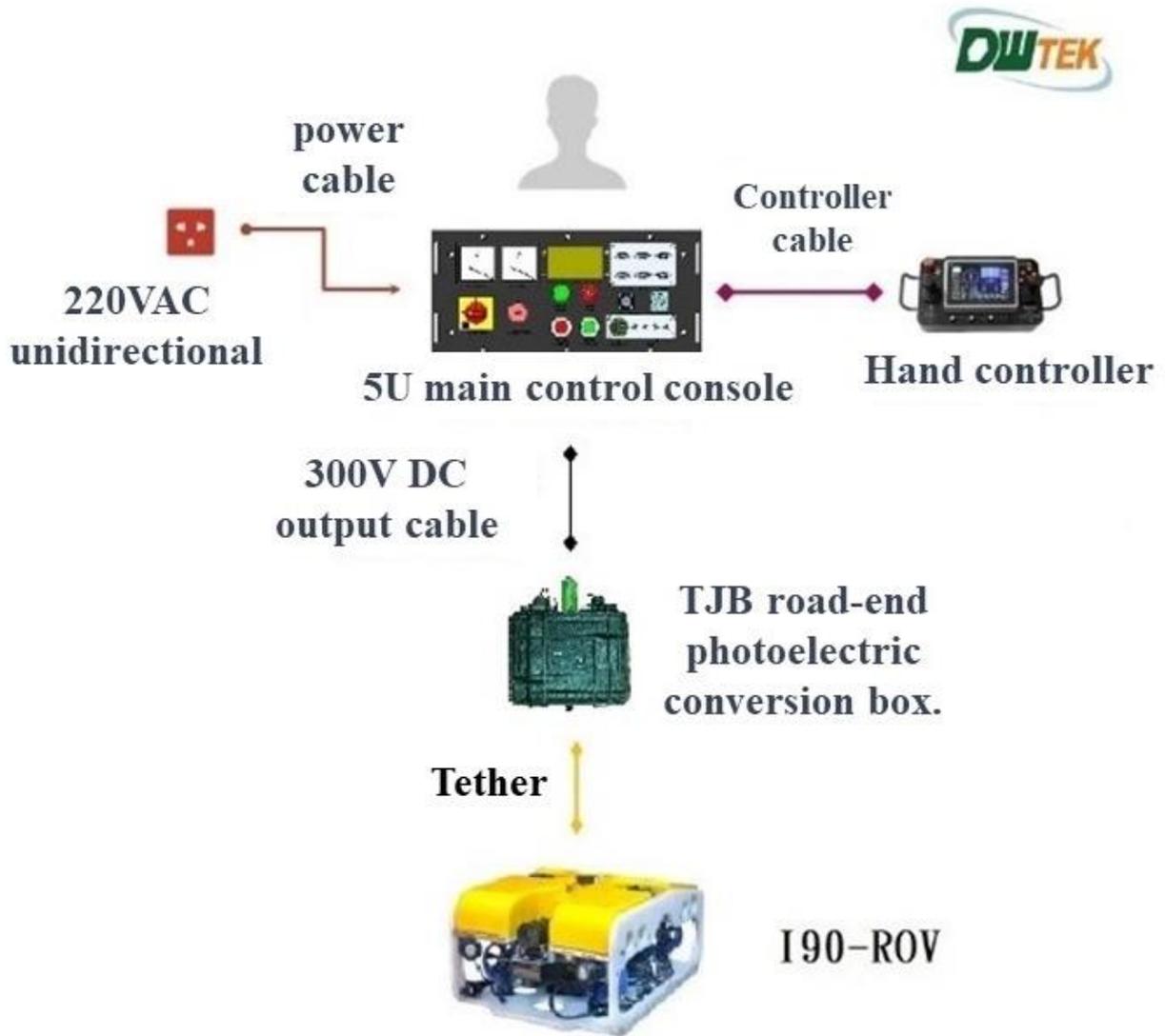


Figure 71 - Diagram of ROV connection to the 5U main control console



When removing and inspecting the 300V DC input cable and power line, use caution and be aware of the risk of electric shock

## D. Insulation alarm

### 1. Insulation resistance too low/abnormal/monitoring device abnormal

**First step:** Move the ROV out of the underwater environment and remove the 300V DC input cable at the ROV end.

**Second step:** Remove the high voltage equipment (LED, thruster) one by one and wait for 1-2 minutes to observe whether the insulation impedance value of the line returns to normal (specification: above 1 megaohm).

**Third step:** Remove the TLC high voltage cabin, TJB photoelectric conversion box 300V power cable, and observe whether the insulation impedance value of the line returns to normal.

**Fourth step:** Remove the 300V power cable of the TJB photoelectric conversion box on the land side and observe whether the insulation impedance value of the line returns to normal.

**Fifth step:** Remove the 300V DC output cable of the 5U main control console and observe whether the insulation impedance value of the line returns to normal

**Sixth step:** If abnormality persists, please contact DWTEK.

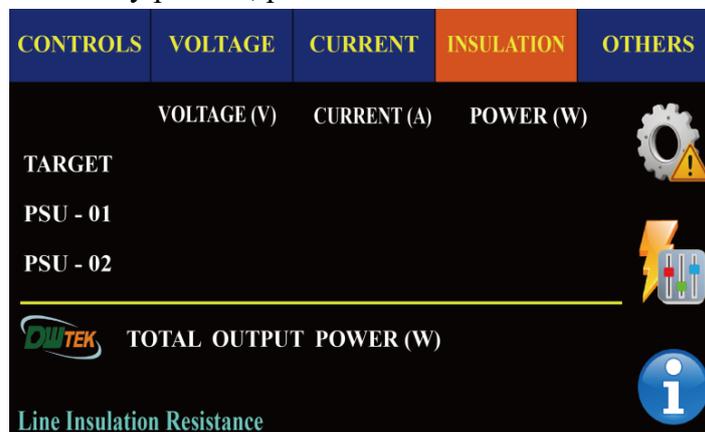


Figure 72 - Insulation alarm

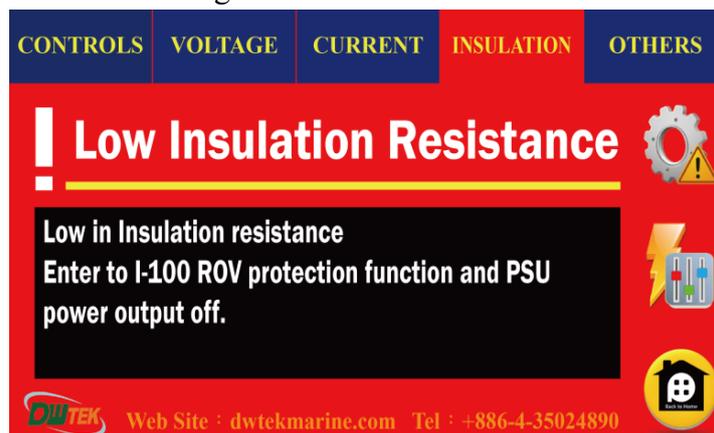


Figure 73 - Insulation impedance too low alarm



When removing and inspecting the 300V DC input cable and power line, use caution and be aware of the risk of electric shock



Figure 74 - Insulation impedance abnormal

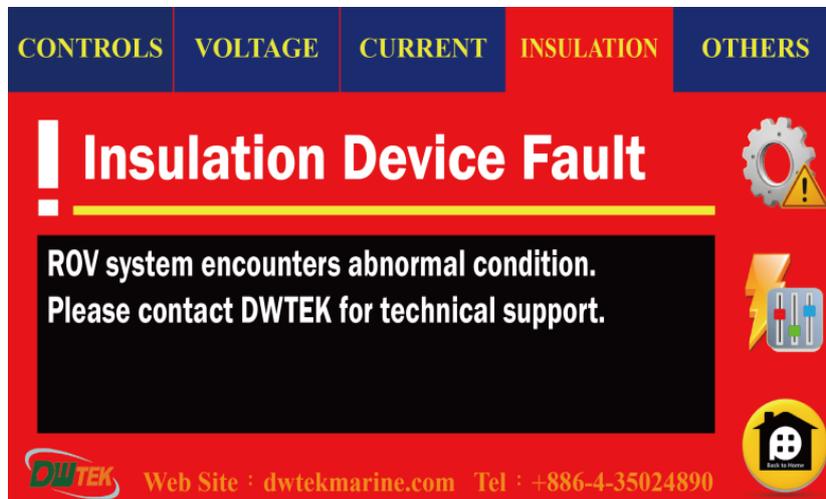


Figure 75 - Insulation monitoring device abnormal



When removing and inspecting the 300V DC input cable and power line, use caution and be aware of the risk of electric shock

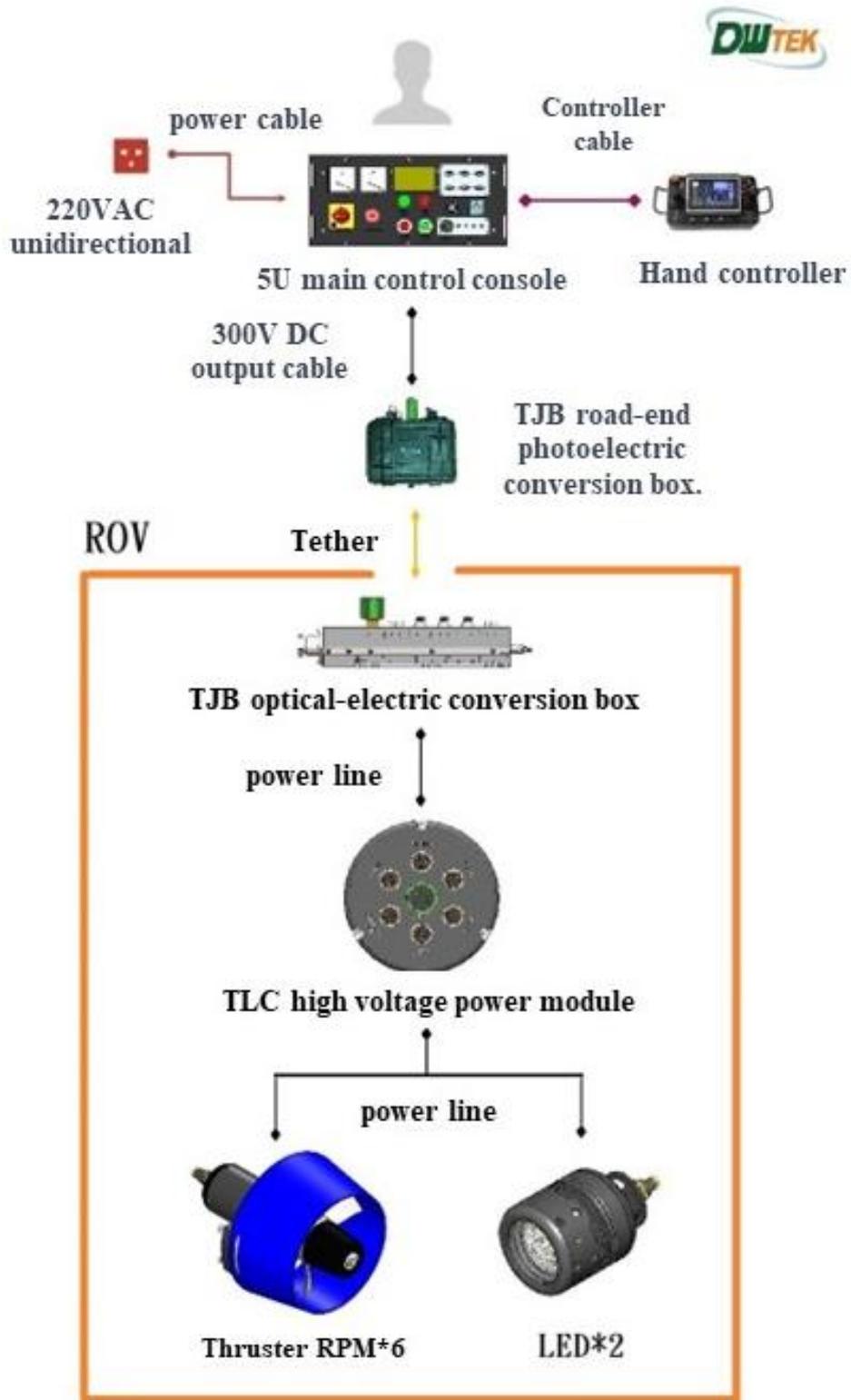


Figure 76 - Schematic diagram for detecting circuit insulation impedance values



When removing and inspecting the 300V DC input cable and power line, use caution and be aware of the risk of electric shock

## E. Other alarms

### 1. Disabling Insulation Monitoring

**Step 1:** This is the status where insulation monitoring is not activated. Press the configuration button to enter the insulation monitoring activation screen.

**Step 2:** Click the "Skip Insulation Monitoring" button to activate insulation monitoring. The activation status is displayed as a locked icon, as shown in **Figure 87 - Insulation Monitoring Activation**.

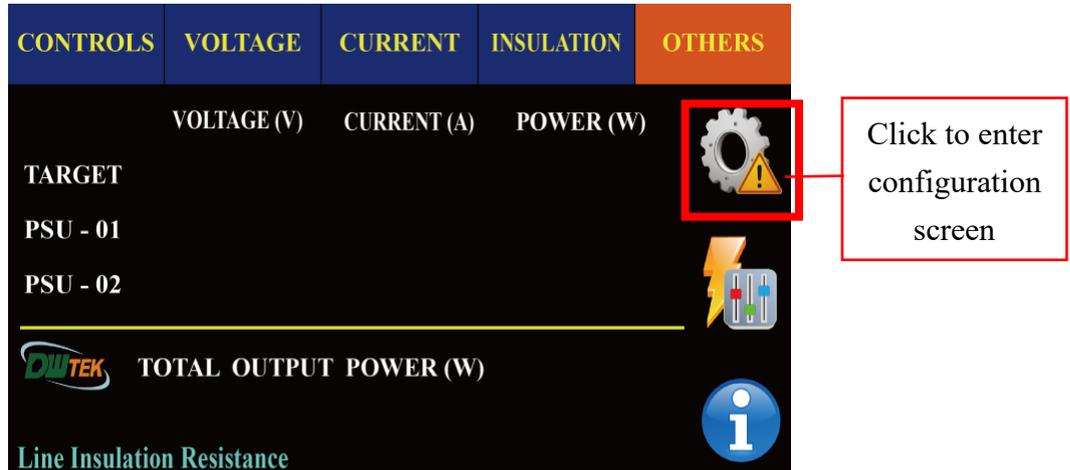


Figure 77 - Other alarms

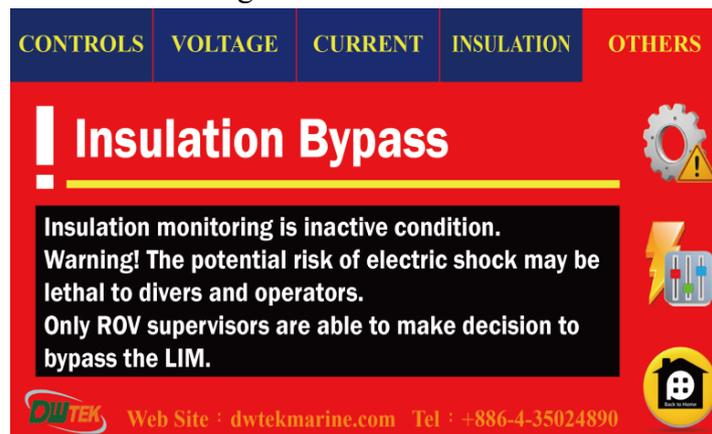


Figure 78 - Cancel insulation monitoring

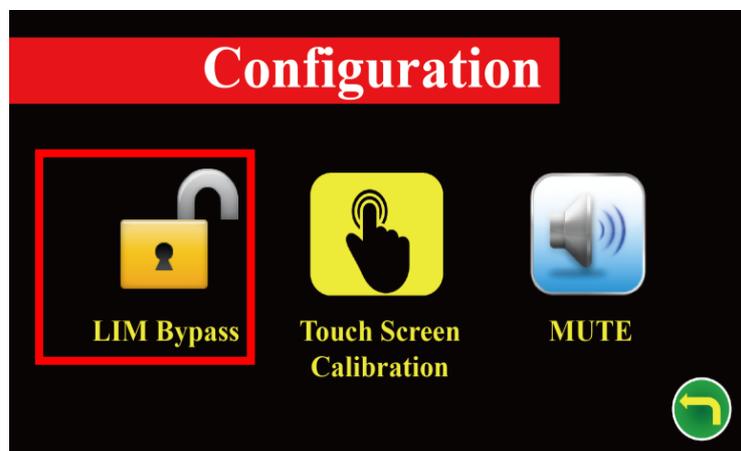


Figure 79 - Insulation monitoring not activated

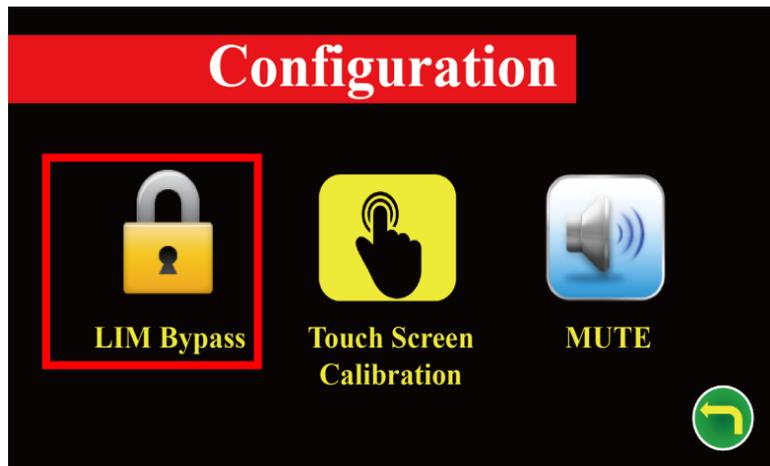


Figure 80 - Insulation monitoring activated

## 2. Over temperature of power supply

**Step 1:** Press the 5U Main Console Button 13 to turn off the power of ROV, and follow the **shutdown procedure in section IV** to close the 5U Main Console. Wait for 10 minutes before continuing.

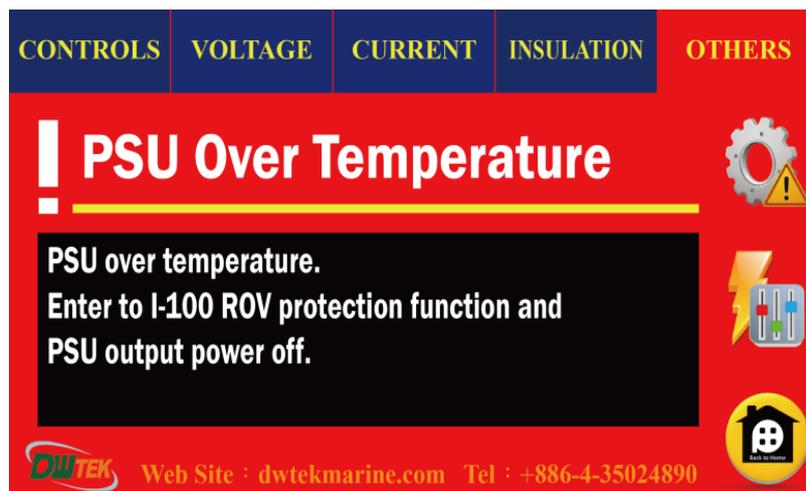


Figure 81 - Power supply temperature too high



When removing and inspecting the 300V DC input cable and power line, use caution and be aware of the risk of electric shock

## 26. Accessories

### A. Spare parts information

Control console control board (official part number: 2F009-00002): Spare fuse (quantity used: 1pcs)

Table 20 - Backup Fuse Information Table

product name	Product number	Specification	Quantity of spare parts
Fuse	2E008-00019	125Vac 、 3A 、 Little fuse 、 Fast 、 SMD	5pcs



Figure 82 - Backup Fuse

### B. List of Spare Replacement Tools

Table 21 - List of Spare Replacement Tools

Tool Name	Description	Diagram
Cross Screwdriver Tighten	Tighten/loosen cross screws	
Solder	Takes part in soldering operations with a soldering iron	
Soldering Iron	Takes part in soldering/desoldering operations with solder	
Antistatic Pliers	Used to grip fuses	

### C. Replacement procedure for spare parts

**First step:** Turn off the AC power switch located on the rear panel of the 5U control console and disconnect the front and rear panel cables of the 5U control console.

**Second step:** Use a crosshead screwdriver to loosen the four M5xP0.8x15 flat head cross screws\* and remove the 5U control console from the instrument box. This process requires two people to carry out together to avoid injury during transportation.

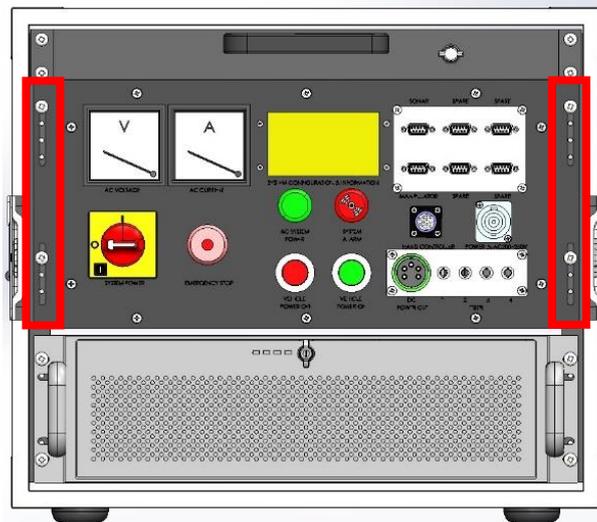


Figure 83 - Location diagram of large flat head cross screws

**Step 3:** Use a cross-head screwdriver to loosen the 10 M4xP0.7x10 cross recessed screws on the top cover of the 5U main control panel.

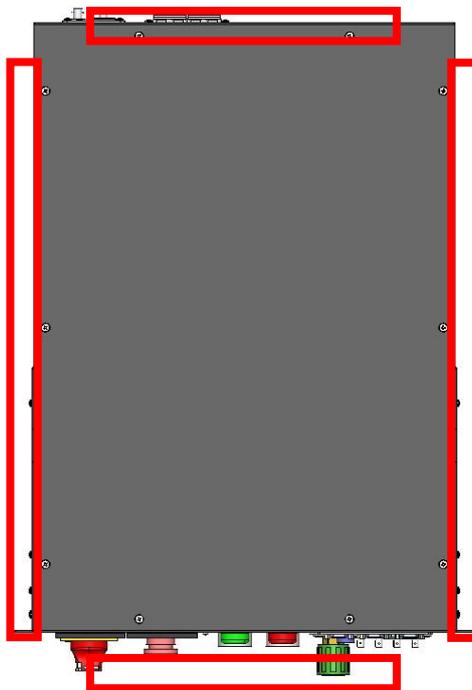


Figure 84 - Location diagram of the cross recessed pan head screws on the upper cover plate

**Step 4:** After removing the top cover of the 5U main control panel, the main control panel control board can be seen.

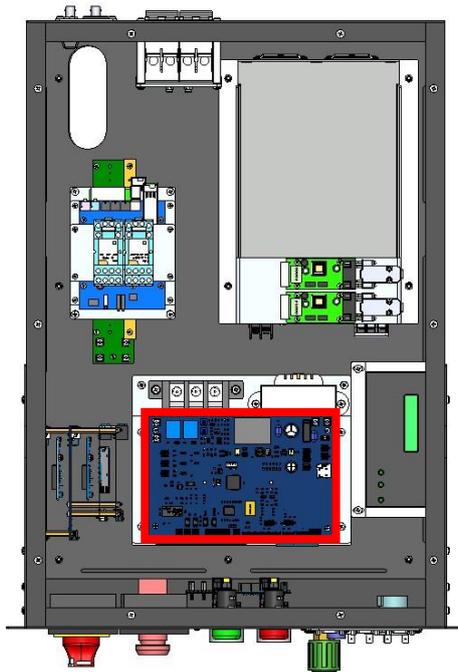


Figure 85 - Diagram showing the location of the main control console control board.

**Step 5:** Use a soldering iron to desolder the fuse located on the control board of the main console, and use anti-static pliers to remove the fuse.

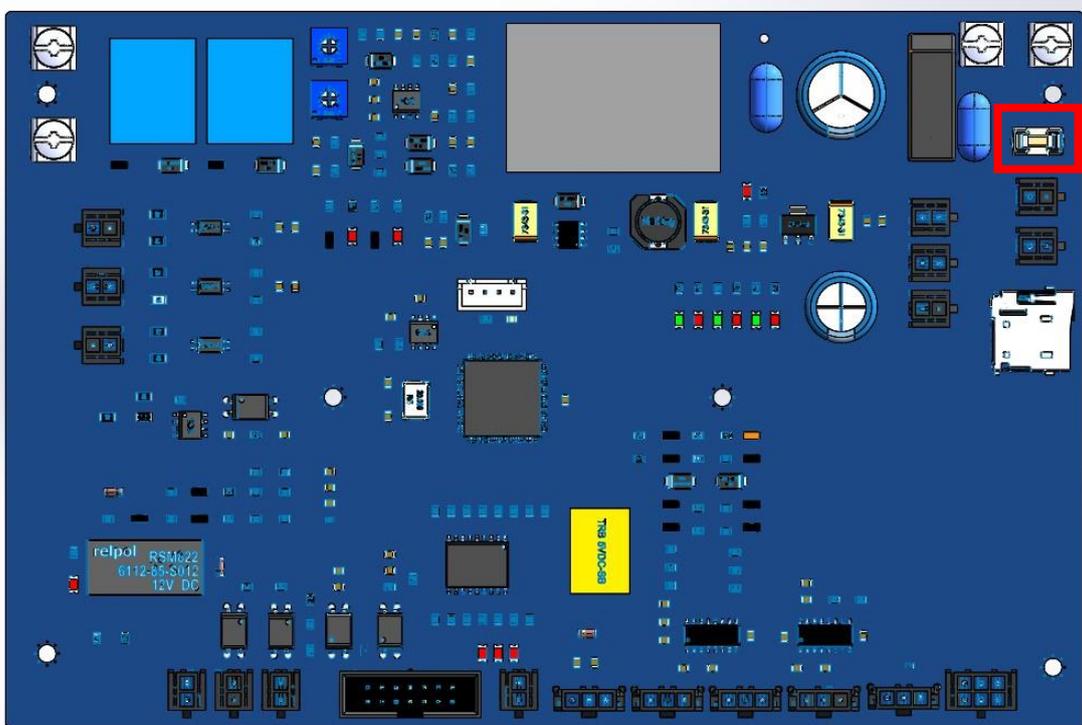


Figure 86 - Illustration of Spare Fuse Location



**Caution:** Risk of high-temperature burns when using the electric soldering iron.



**Step 6:** Use an anti-static pliers to grip the spare fuse and place it back in its original position, then use a soldering iron and solder to weld it in place.

**Step 7:** After the fuse is welded, use a cross screwdriver to tighten the M4xP0.7x10 cross recessed screws\*10pcs on the top cover of the 5U main control console

**Step 8:** Two people should lift the 5U main control console together and install it back into the instrument box. Use a cross screwdriver to tighten the M5xP0.8x15 large flat head cross screws\*4pcs that attach the 5U main control console to the instrument box.

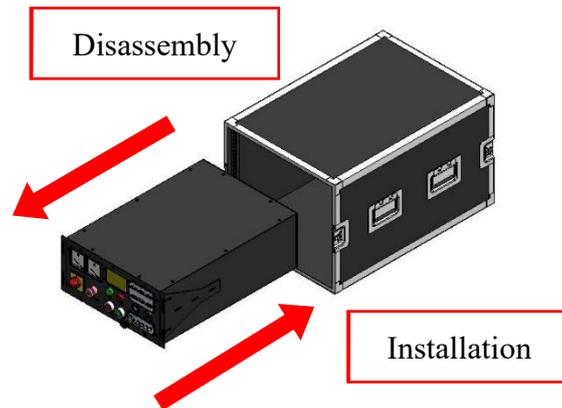
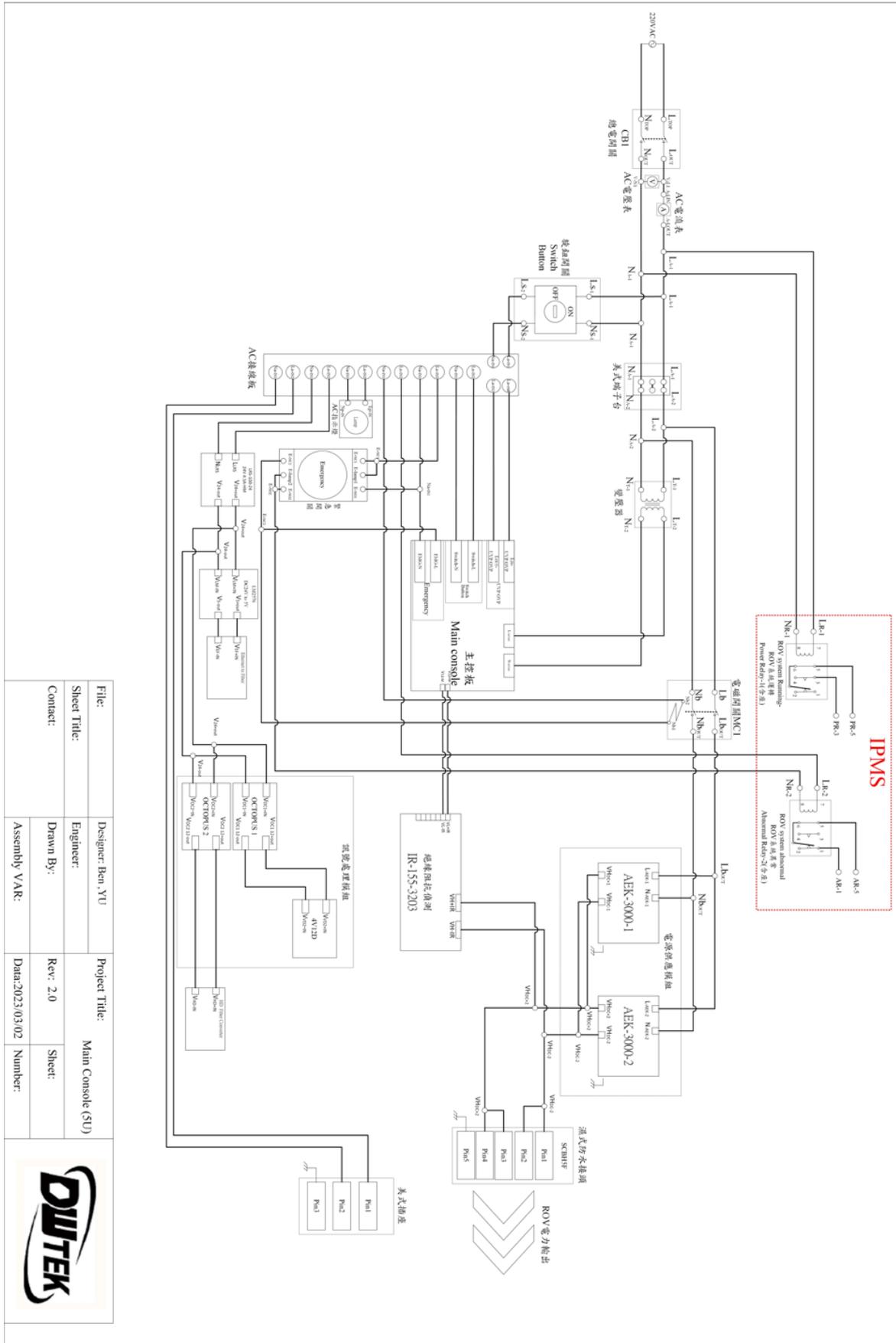


Figure 87 - 5U Main Control Console Installation/Removal Schematic

**Step 9:** Connect the front and rear panel cables of the 5U Main Control Console and turn on the AC power switch located at the rear panel of the 5U Main Control Console.

# D. 5U-Main Control Console Power Wiring Diagram

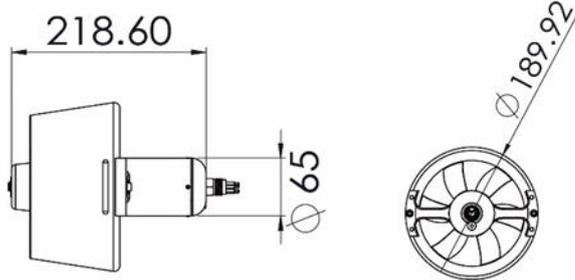


File:	Designer: Ben, YU	Project Title:	Main Console (5U)
Sheet Title:	Engineer:	Rev: 2.0	Sheet:
Contact:	Drawn By:	Data: 2023/03/02	Number:
	Assembly VAR:		



Figure 88 - 5U Main Control Console Power Wiring Diagram

## 27. Thruster Specification

Mechanical	
Weight	3.2 kg in air, 1.9 kg in water (incl. duct)
Thrust-Forward	18 kgf
Thrust-Reversed	9 kgf
Standard Housing	AL 6061-T6
Propeller	Stainless Steel
Nozzle/Duct	MC Nylon
Connector	MCBH8M
Drawing with dimension	



Electrical		Environmental	
Input Power	2.5 A @ 300 VDC	Depth Rating	1000 m
Speed Control	RS485	Operation Temp.	-10°C ~ 50°C

Table 22 - Thruster specification

## A. Thruster Control Interface

The thruster control is via RS-485 telemetry signal. The thruster is able to provide the current RPM reading and accumulate motor working rotations for operator's reference.

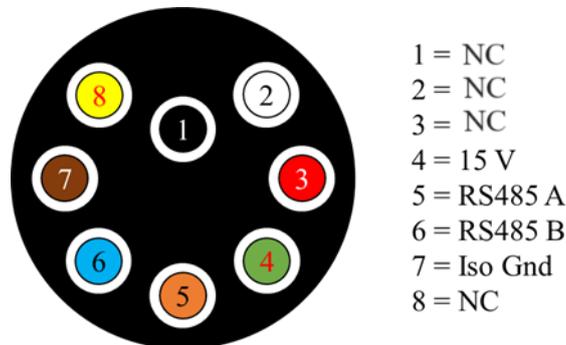


Figure 89 - Thruster connector pin assignment

## B. Thruster ID Setup Procedure

Press the Setup button on the HCU 7" touch panel. Operators can use thruster configuration cable to communicate with thruster via Hand Control Unit. Connect the thruster configuration cable to the thruster connector on HCU.

Press the connect button to enter thruster setup mode, and all the other functions of Hand Control Unit will temporarily stop until disconnect the linkage with thrusters. The timer zero button is used to clear the thruster rotation counter, which will raise a warning signal when the number of rotations is over 30,000,000.

Press the thruster position (PF, PV, PA, SF, SV and SA) for new installation. The thruster ID will change to the setting ID.

## 28. Navigation Pressure Compass G-Sensor Specification

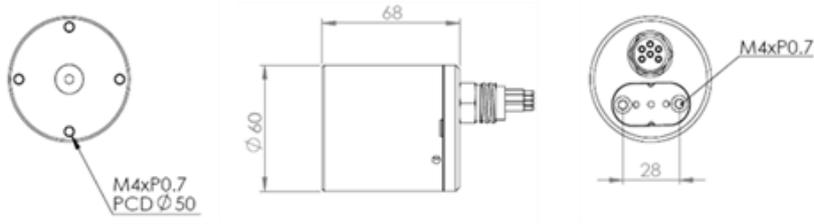
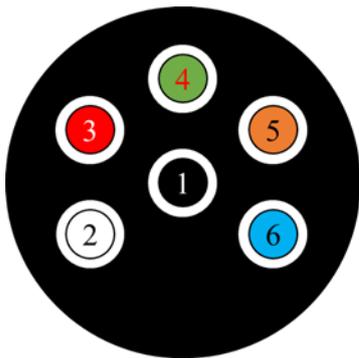
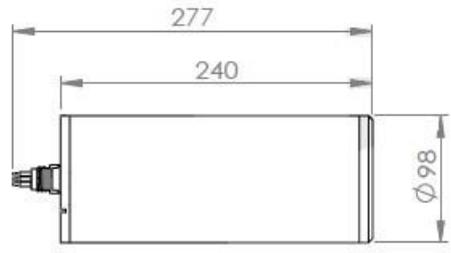
Supply	24 VDC	
Pressure Accuracy	$\pm 0.05$ % FS	
Heading Resolution	$0.01^\circ$	
Roll/Pitch Resolution	$0.01^\circ$	
Depth Rating	1,000 m	
Communication	RS-232	
Material	AL 6061-T6	
Heading Accuracy	$2^\circ$	
Roll/Pitch Accuracy	$\pm 0.5^\circ$	
Roll/Pitch Repeatability	$\pm 0.2^\circ$	
Net weight	416g in air ; 230 g in water	
Connector	MCBH6M	
Drawing with Dimension		
Pin Assignment	 <ul style="list-style-type: none"> <li>1 = Gnd</li> <li>2 = Chassis</li> <li>3 = VCC</li> <li>4 = RS232 Signal In</li> <li>5 = RS232 Signal Out</li> <li>6 = Signal Gnd</li> </ul>	

Table 23 - Navigation Pressure Compass G-Sensor Specification

## 29.HD Sea Observer Specification

Electrical		
Image Sensor	1/2.8" Type CMOS	
WDR	Digital	
DNR	Yes	
White Balance	Auto / ATW / Manual	
Auto Gain Control (AGC)	Automatic	
Day & Night	True D/N ICR	
Back Light Compensation	Yes	
Motion Detection	Yes	
Privacy Masking	Yes	 <p>(mm)</p>
Gamma	Standard / Straight	
Power Input	12~30 VDC; 7.2 W	
Video Output	Fiber	
Resolution	1080P/30	
Communication	Sony VISCA	
S/N Ratio	50 dB	
Electronic Shutter	1/1 ~ 1/10,000 S	
Mini Illumination	0.01 Lux	
Optics		
Lens	F1.6 ~ 4.7, f4.3 ~ 129 mm, 30X Optical Zoom	
Iris Control	Auto	
Focus	Auto / Manual	
View of Angle	63.7°~ 2.3°	
Digital Zoom	12X (360X with Optical Zoom)	
Environmental & Mechanical		
Depth Rating	2,000 m	
Operation Temp	-10 °C ~ +50 °C	
Dimension	240 mm (L) / 98 mm (D)	
Weight	2.7 kg in air; 1.3 kg in water	
Standard Housing	Hard Anodized 6061-T6 Aluminum	
Window Material	Acrylic	
Pan/Tilt	N/A	
Connector	MCBHRA6M + MSS-OP-BCR	

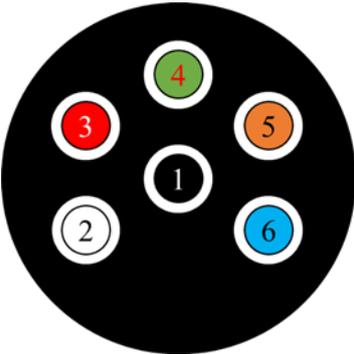
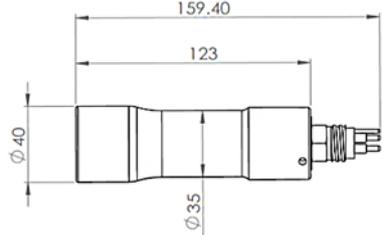
MECHANICAL	OPTICS
Pin Assignment	 <ul style="list-style-type: none"> <li>1 = Gnd</li> <li>2 = Chassis</li> <li>3 = VCC</li> <li>4 = RS232 Signal In</li> <li>5 = RS232 Signal Out</li> <li>6 = Signal Gnd</li> </ul>

Table 24 - HD Sea Observer Specification

## 30. Mini Camera Specification

Electrical	
Image Sensor	1/3" Super HAD CCD II
WDR	Digital
DNR	YES
White Balance	Automatic
Auto Gain Control(AGC)	Automatic
Day & Night	Digital / Automatic
Back Light Compensation	YES
Motion Detection	YES
Privacy Masking	YES
Gamma	0.45
Power Input	10~30 VDC 1.2 W
Resolution	700 TVL
Communication	N/A
S/N Ratio	48 dB (AGC off)
Video Output	Composite 1.0 Vp-p/ 75 Ohms
Electronic Shutter	1/60 (1/50)~ 1/120,000 sec (Auto/ Fixed)
Mini Illumination	0.01 Lux

(mm)

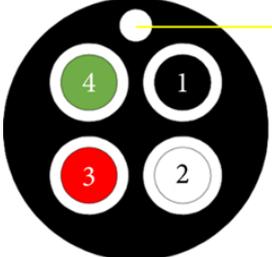
MECHANICAL		OPTICS	
Dimension	123 mm (L)/ 38 mm (D)	Lens	F3.6 mm/ F2.0
Weight in Air	0.29 kg	Iris Control	Fixed
Weight in Water	0.16 kg	Focus	Fixed
Standard Housing	Hard Anodized 6061-T6 Aluminum	View of Angle	72.5°
		Digital Zoom	N/A
Window Material	Acrylic	ENVIRONMENTAL	
Pan / Tilt	N/A	Depth Rating	2,000 m
Connector	MCBH4M	Operating Temp.	-10 °C ~ +50 °C
Pin Assignment	 <p>Guide</p> <p>1 = 12~36V +            2 = 24V (Gnd)            3 = Video +            4 = Video (Gnd)</p>		

Table 25 - Mini Camera Specification

### 31. TM2408 Specification

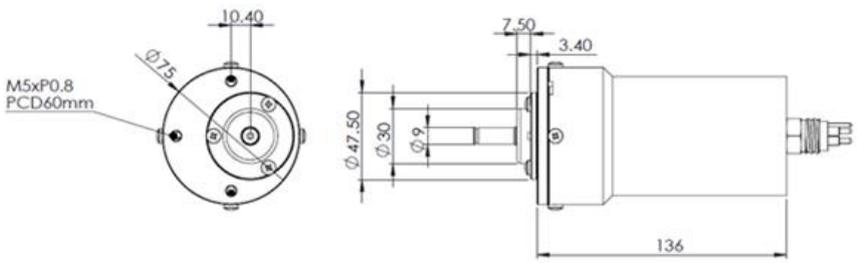
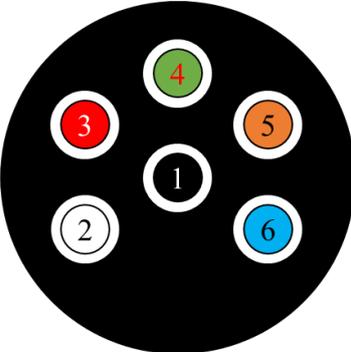
<b>Supply</b>	24 VDC @ 0.6 A (max)	
<b>Speed</b>	8 RPM (max)	
<b>Torque</b>	7 Nm	
<b>Precision</b>	0.1°	
<b>Depth Rating</b>	1,000 m	
<b>Material</b>	AL 6061-T6	
<b>Communication</b>	RS232	
<b>Weight</b>	989g in air; 486g in water	
<b>Operation Temperature</b>	-10°C ~ 50°C	
<b>Connector</b>	MCBH6M	
<b>Drawing with Dimension</b>		
<b>Pin Assignment</b>	 <ul style="list-style-type: none"> <li>1 = Gnd</li> <li>2 = Chassis</li> <li>3 = VCC</li> <li>4 = RS232 Signal In</li> <li>5 = RS232 Signal Out</li> <li>6 = Signal Gnd</li> </ul>	

Table 26 - TM2408 Specification

## 32.Sea Bright 150W LED Specification

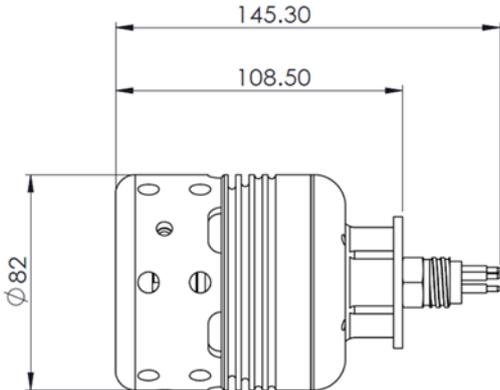
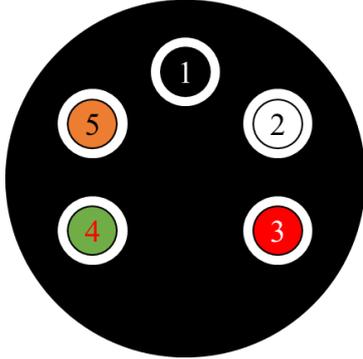
<b>Input</b>	150-380 VDC, 150W	
<b>Dimming</b>	0-100% PWM	
<b>Lumens in Integrating sphere</b>	6,957 Lumens @ 150 VDC	
<b>Luminous Efficacy</b>	46 lm/W	
<b>Color Temp</b>	5606 K°	
<b>Current Draw</b>	1.07A @ 150 VDC	
<b>Beam Pattern</b>	72°	
<b>Body Material</b>	AL 6061-T6	
<b>Window Material</b>	Acrylic	
<b>Depth Rating</b>	6,000 m	
<b>Weight</b>	820g in air; 400g in water	
<b>Operating Temp</b>	-10°C ~ 40°C	
<b>Connector</b>	MCBH5M	
<b>Drawing with Dimension</b>		
<b>Pin Assignment</b>	 <ul style="list-style-type: none"> <li>1 = Gnd</li> <li>2 = Chassis</li> <li>3 = 150 – 380 VDC</li> <li>4 = Dimming+</li> <li>5 = Dimming-</li> </ul>	

Table 27 - Sea Bright 150W LED Specification



### 33. Altimeter PA500 Specification

<b>Operating frequency</b>	500kHz
<b>Beamwidth</b>	6° conical
<b>Peak Source</b>	197dB re 1µPa @ 1m
<b>Pulse Length</b>	100µs
<b>Range</b>	0.3 to 50m (0.1 to 10m optional)
<b>Digital resolution</b>	1mm
<b>Analogue resolution</b>	0.025% of range
<b>Power supply</b>	24V DC at 80mA or 12V DC at 160mA
<b>Analogue output</b>	0 to 10V DC (with 24V power supply), 0 to 5V DC or 4 to 20mA
<b>Data communications</b>	RS232 or RS485
<b>Output modes</b>	Free running, interrogated or part of multidrop network

Table 28 - Altimeter PA500 Specification



## 34.IDS (Integrated Digital-Recording System)

### A. General

Provide system information for displaying real-time video and integration, allowing users to monitor the devices they operate.

### B. Install and start

#### 1. System requirement

Parameter	Recommended Specifications
Memory	4G or above
Processor	Core i5 2GHz or higher
System	Microsoft Windows 7 (64-bit) Microsoft Windows 10 (64-bit)

Table 29 - System requirement

#### 2. Installation steps

Right-click the setup.exe file and select System Administrator.

### C. Function introduction

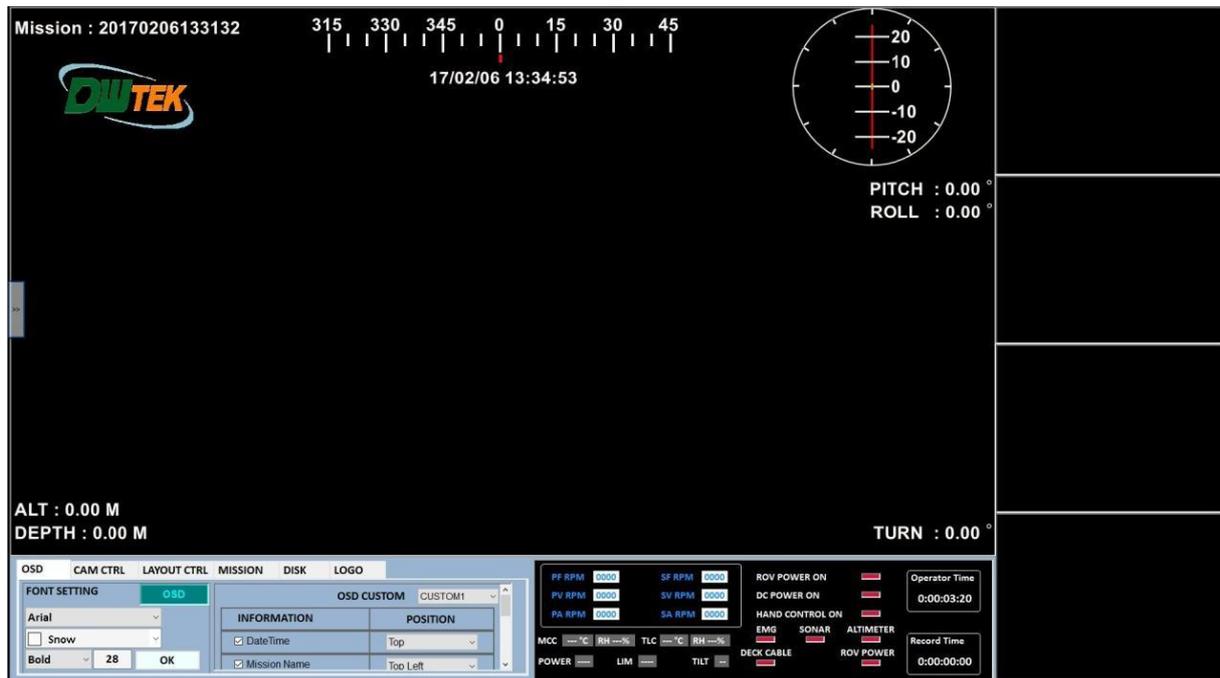


Figure 90 - IDS Function introduction

### 1. OSD

- (1). OSD: ON/OFF the OSD display on the video.
- (2). FONT SETTING: Change the displayed OSD font size and color.
- (3). OSD CUSTOM: There are nine fields in total, you can check whether to display and select the display position.



Figure 91 - OSD

### 2. Cam ctrl

- (1). Snapshot: capture the images of all current cameras (stored in D:\SNAP\_CAM).
- (2). Event Stamp: mark the current event, and then you can search for the mark on the Player.
- (3). OSD: ON/OFF the OSD display on the video.
- (4). Record: ON/OFF video recording function.



Figure 92 - Cam ctrl

### 3. Layout ctrl

- (1). LAYOUT1-3: The layout of the camera screen.
- (2). LEFT CYCLE: All screens move counterclockwise.
- (3). RIGHT CYCLE: All screens move clockwise.

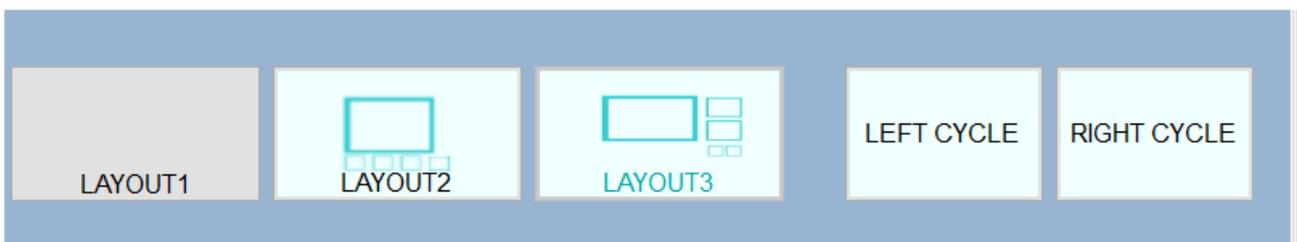


Figure 93 - Layout ctrl

#### 4. Mission

- (1). MISSION NAME: The mission name is preset to the time when the system starts.
- (2). RENAME: Enter a new task name and press the Rename button to update the task name.
- (3). New Mission: Add new missions.

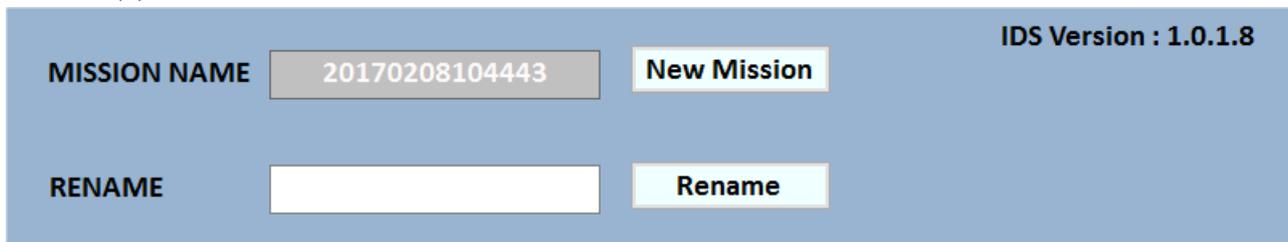


Figure 94 - Mission

#### 5. Disk

Display the usage of each slot of the hard disk, and slot D is the video slot.



Figure 95 - Disk

#### 6. Logo

- (1). The Logo icon can be moved by the horizontal and vertical axes or selected by the mouse.
- (2). Select Logo: Select the Logo icon to be displayed.



Figure 96 - Logo

## 7. Image adjusts

Adjust the Brightness, Contrast, Hue, Saturation of the current picture.

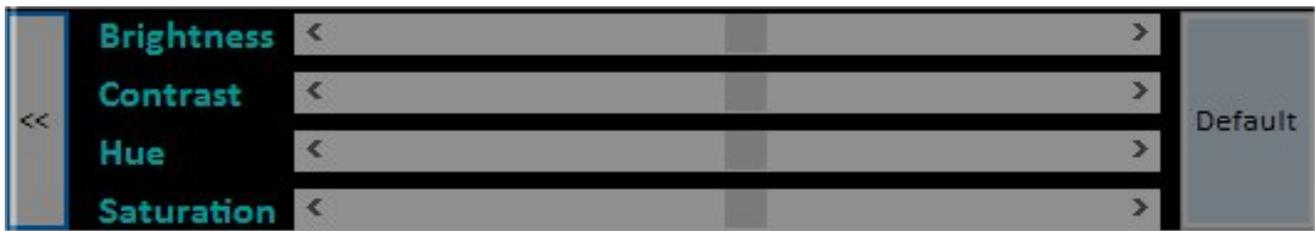


Figure 97 - Image adjusts

## 8. System information

- (1). PF, PV, PA, SF, SV, SA : Thruster speed (R.P.M.) ◦
- (2). Operator Time : Total time the IDS system was active (DD:HH:MM:SS) ◦
- (3). Record Time : Total time of recording (DD:HH:MM:SS) ◦

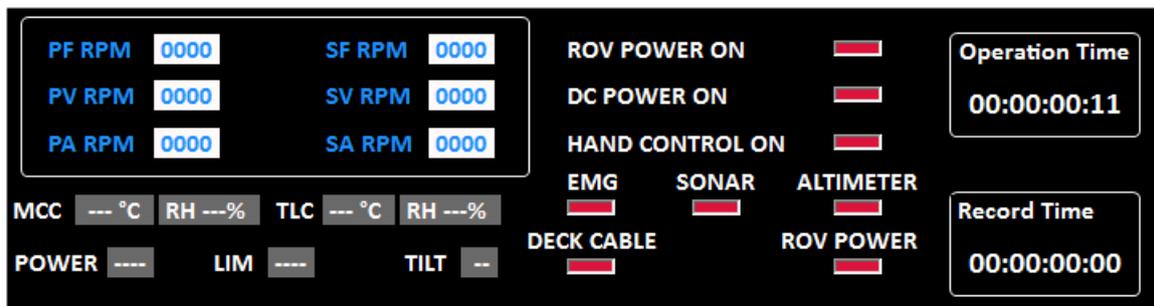


Figure 98 - System information

## 9. Control panel

Click the right mouse button on the screen to display the system control menu.

- (1). Swap To: Swap the main screen with other screens.
- (2). Logo Display: Display the Logo icon.
- (3). Auxiliary Attitude: Display the attitude of the vehicle for auxiliary navigation.
- (4). CAM Source: Display the current video source and installation name settings of each screen.
- (5). Exit Program: Close the program (Ctrl + Q is the shortcut key\*).
- (6). IDS Shut Down: Shut down the entire system directly (Ctrl + S is the shortcut key).

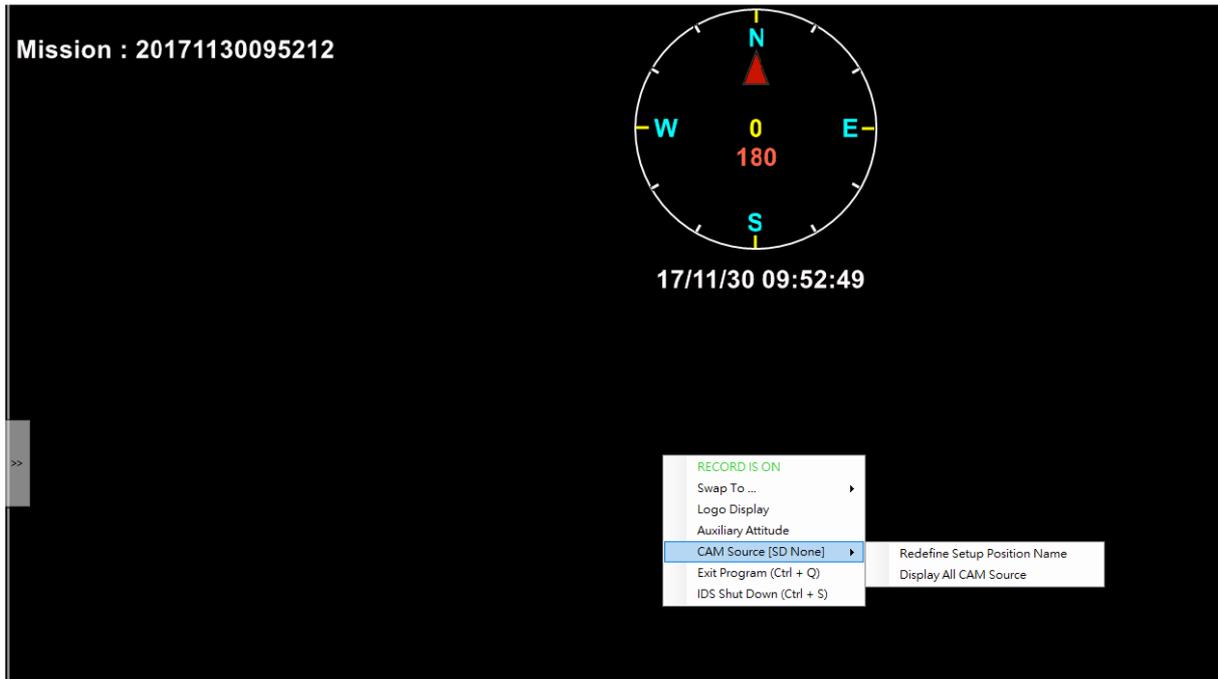


Figure 99 - Control panel



Please press the Exit Program button or use the shortcut key Ctrl + Q to end the program normally, otherwise it may cause data loss and The system is unstable.



This control item is located at the upper right corner of the screen, "X" is to end the program, "S" is to close the IDS system.

## D. Troubleshooting and maintenance

- (1). Video files will be overwritten due to insufficient hard disk space. To avoid video loss, please use IDS Player Export to back up and manually clear the video files in slot D.
- (2). When the program fails to start or an abnormality occurs, please restart the program; if the abnormality persists after restarting, please select the file with the latest date in the path D:\SysLogs, and return the E-mail to DWTEK for assistance as soon as possible.

## 35.IDS Player

### A. Function introduction

If the target has more than one record in the computer, when entering the program, a menu will appear for the user to choose (according to the starting time point) the record to be played.

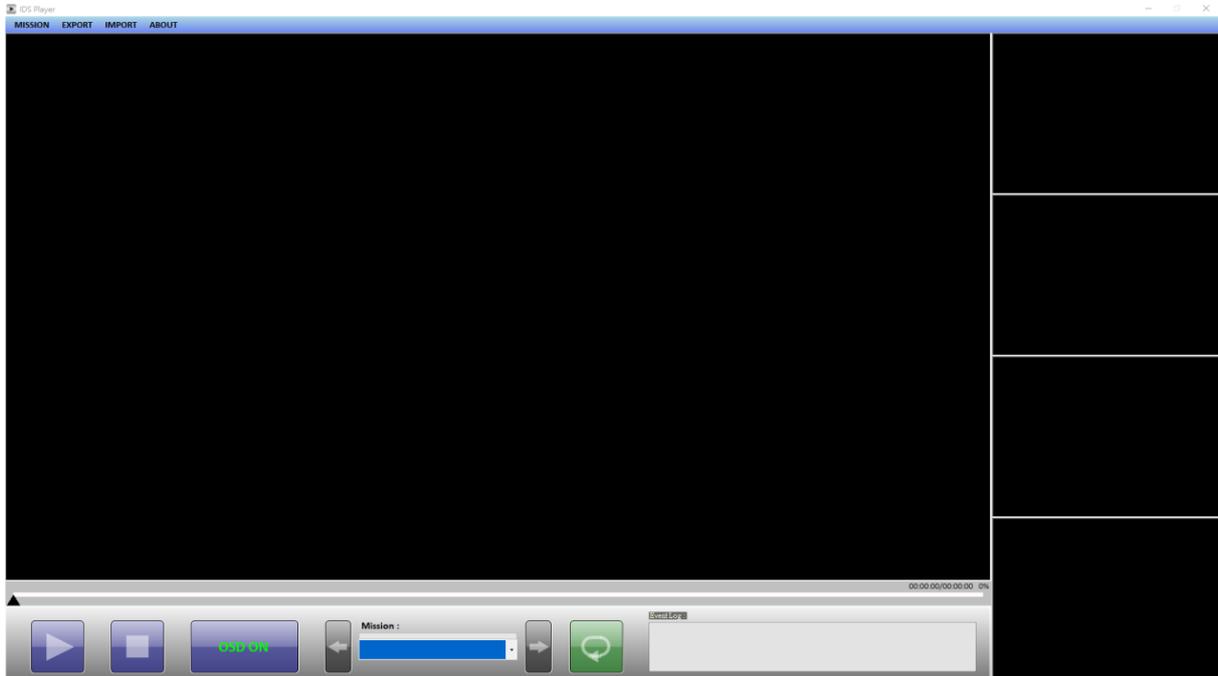


Figure 100 - Function introduction

### B. Mission

- (1). Click MISSION to select the desired task name by date.
- (2). Mission Filter: Filter all missions according to the checked conditions for easy search.
- (3). Event Stamp: Enter a search keyword in the Keyword field and press Mission Filter to find the mission where the relevant video clip is located in the Mission drop-down menu.

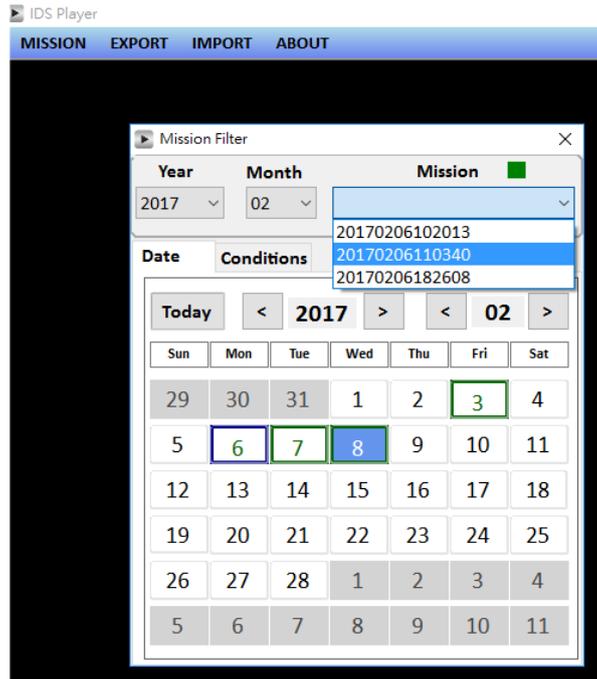


Figure 101 - Mission Filter

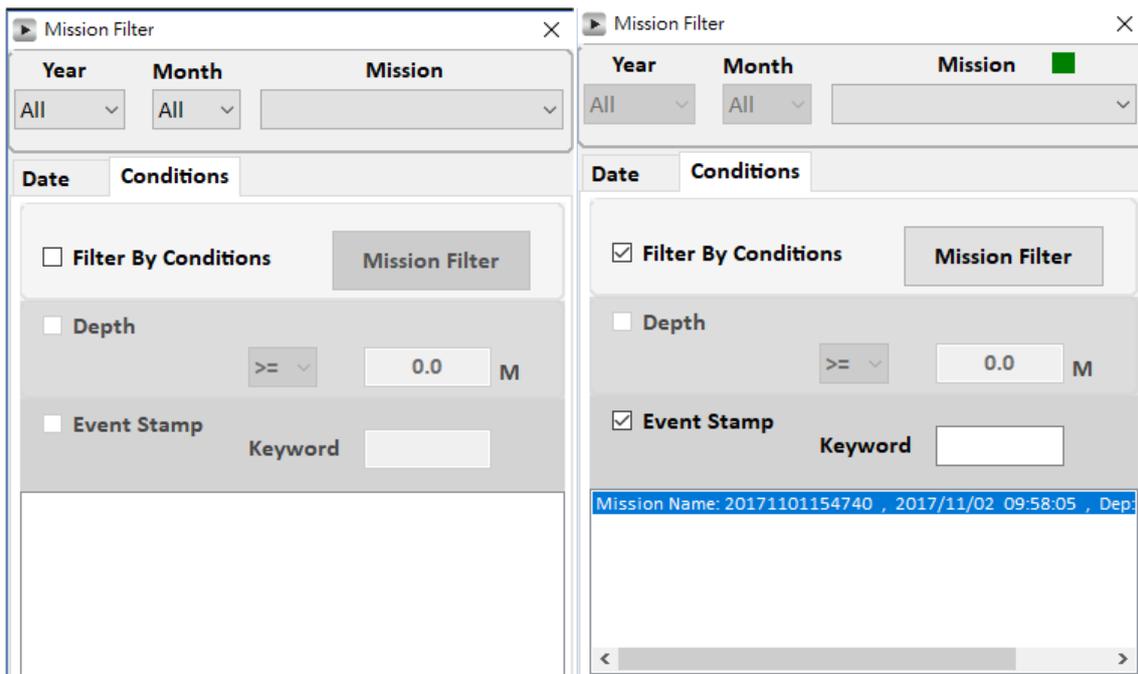


Figure 102 - Event Stamp

## C. Export

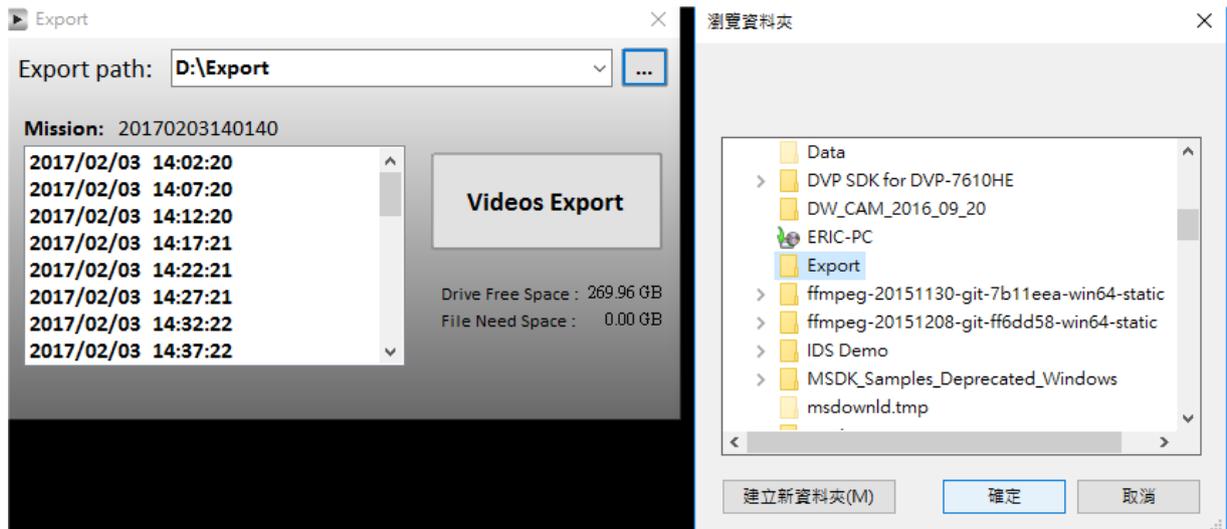


Figure 103 - Create an exported folder.

Click the right mouse button in the list to select all videos, or use Ctrl + left mouse button to select individual videos, and click Videos Export to export.

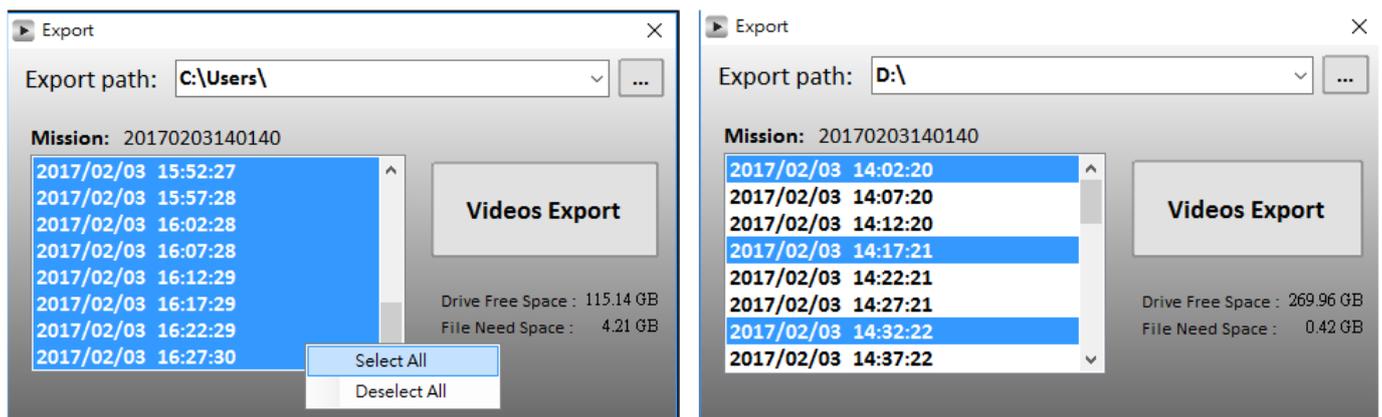


Figure 104 - Videos Export

## D. Import

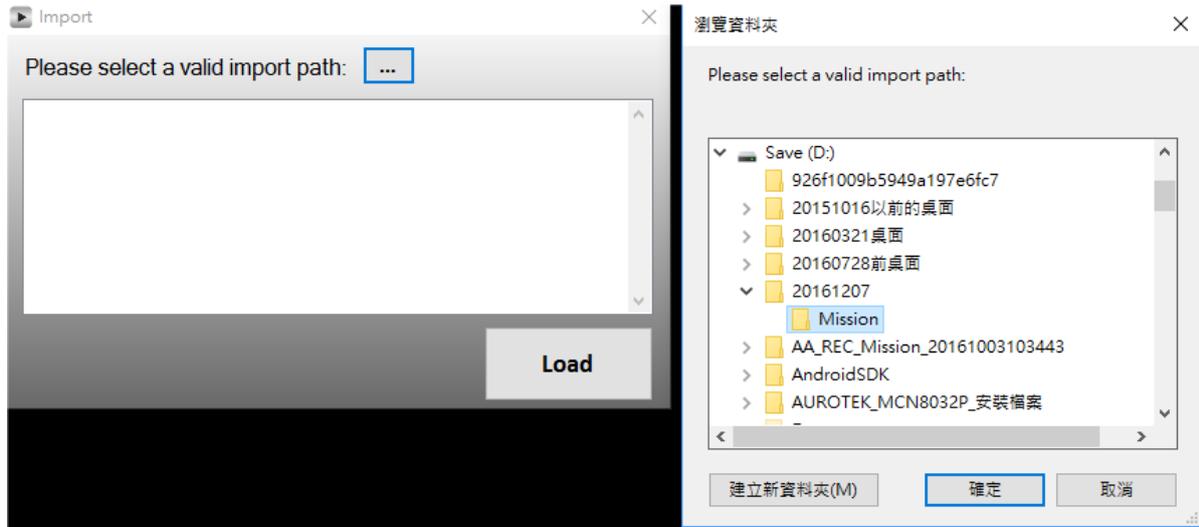


Figure 105 - Select the folder path to import.

Click the right mouse button in the list to select all videos, or use Ctrl and left mouse button to select individual videos, and press Load to import.

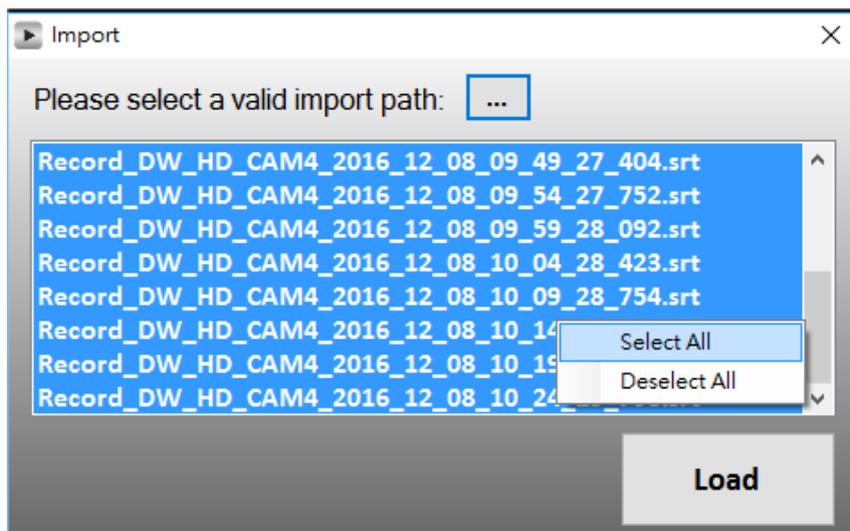
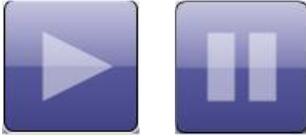


Figure 106 - Import

## E. Control panel



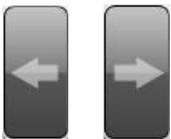
(1). Play/Pause: Start playing or pause playing.



(2). Stop: Stop playing the task.



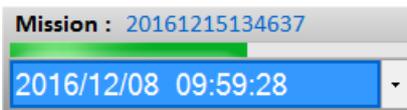
(3). OSD ON/OFF: OSD display switch.



(4). Play previous/next: Play the previous or next video.



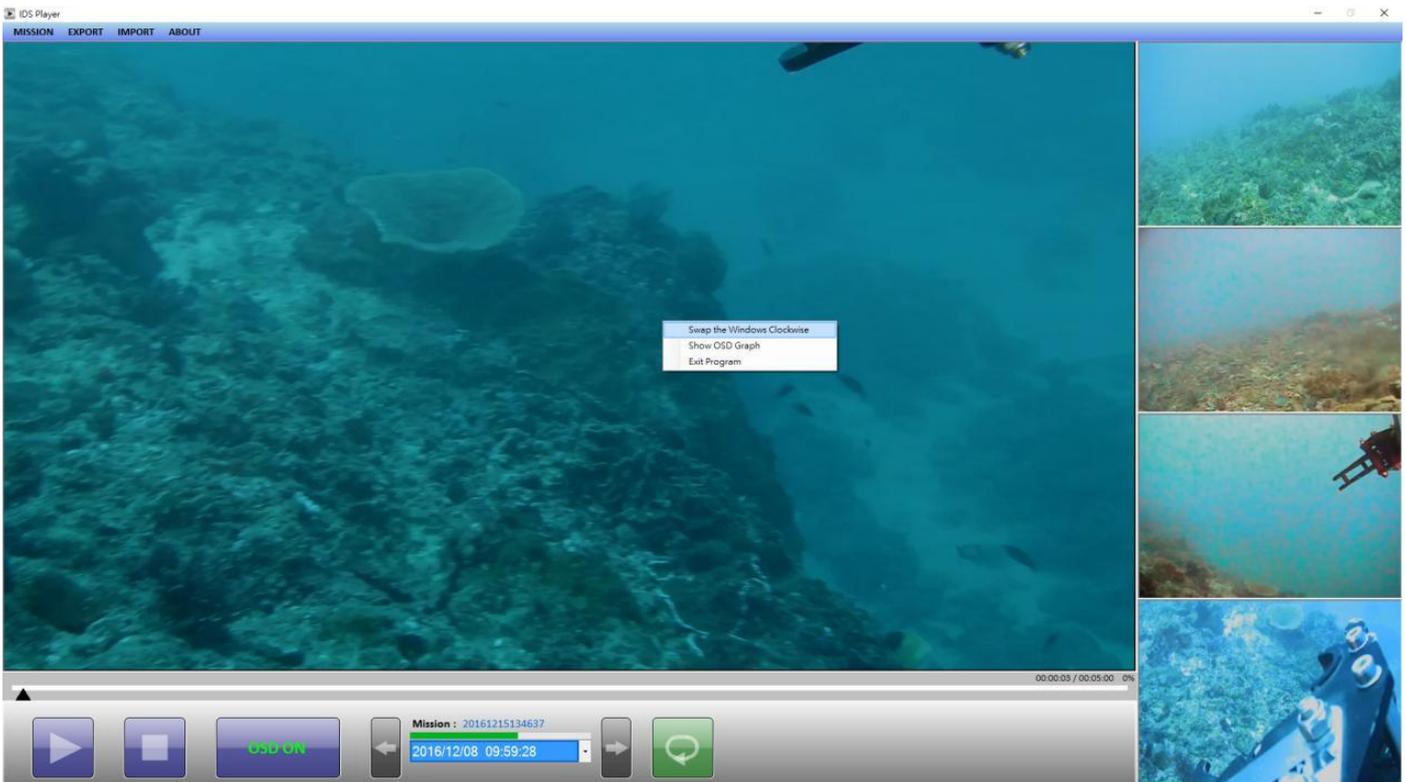
(5). Repeat All: The task is played in a loop.



(6). Display the task name and the progress of the current playback.

- 2016/12/08 08:19:16
- 2016/12/08 08:25:31
- 2016/12/08 08:30:31
- 2016/12/08 09:32:31
- 2016/12/08 09:34:26
- 2016/12/08 09:39:26
- 2016/12/08 09:44:27
- 2016/12/08 09:49:27
- 2016/12/08 09:54:27
- 2016/12/08 09:59:28
- 2016/12/08 10:04:28
- 2016/12/08 10:09:28
- 2016/12/08 10:14:29
- 2016/12/08 10:19:29
- 2016/12/08 10:24:29
- 2016/12/08 09:59:28

(7). Directly select the video to play.



(8). Swap the Windows Clockwise: Move all screens clockwise.

(9). Show OSD Graph: Whether to display the OSD graph.

(10). Exit Program: Close the program.

## 36. Appendix

### A. DWTEK Connector Maintenance

#### For greasing and mating above water:

Connectors must be greased with Silicone Grease before each mating. A layer of grease corresponding to minimum 1/10 of socket depth should be applied to the female connector.

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. After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets. 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:

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

### B. Vacuum and Pressure Relief

All electronic components could generate heat and prohibit system operation with a vacuum. 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 ones.**
- 3. Improper installation or skipping installation in secure fasteners and pressure relief valve after re-assembly would bring catastrophic ROV system failure.**



**Task**

ROV Type:	Serial No.:	Date:
Project Description:		

POST-OPERATIONAL CHECKS		Tick
	SWITCH OFF ALL SUPPLIES TO THE MAIN CONSOLE UNIT (IE MAIN ISOLATOR PADLOCKED IN THE OFF POSITION) AND CHECK ALL INDICATORS ARE EXTINGUISHED	
<b>Physical Checks</b>		
Switch off the LED		
Wipe camera lens clean and replace lens cap(s)		
Remove Thruster Retaining Bolts and clean the motor shaft, space washer and internal propeller components. Refit the Thruster Propeller and Propeller Retaining Bolts, and check they are secure		
Check Thruster and Tilt Platform are free fouling		
Confirm the following vent plugs are securely fitted:		
NOTE: If carrying out several dives in a day and the vehicle remains wet, a visual check of the vent plugs can be carried out after the first dive's security check. This ensures that there is no water ingress into the vent plug screw hole.	HD Sea Observer PCG-1000 Navigation Sensor TM2408 (Tilt Motor) Sea Bright Searchlight Type	
<b>Remove any debris from structure</b>		
Confirm ALL lamp glasses and covers are undamaged		
Check ALL connectors are properly mated, sleeved and all cables secure and clear of propellers		
Check ALL Thrusters, fitted equipment, crash bars, buoyancy foam and fairing are secure and undamaged		
Check ALL Thrusters are free to move in both direction		
Check ALL Camera/sensors are correctly fitted and secure		
Release screws of gear box and clean with fresh water using a pressure hose, dry by airing		
<b>Storage Checks</b>		
Ensure stored away from direct sunlight and water ingress		
If exposed to high temperatures or for air transportation remove Pressure Relief Valve and store in plastic bag taped in a prominent position for later use		
Fit dust caps where applicable		

Project Manager (sign and print name): \_\_\_\_\_

Supervisor (sign and print name): \_\_\_\_\_





### Mobilization Check List

ROV S/N: \_\_\_\_\_ Date: \_\_\_\_\_ Project Ref: \_\_\_\_\_

Description	Tick	Checked By
Power Supply Unit with surface electronics module		
Pilot Monitor with keyboard module		
Sonar Monitor with Surface Unit modules		
All connecting cabling for above modules and power lead		
Umbilical		
ROV		
Cutter skid for ROV complete with electronics interface pod to		
ROV tool box		
Consumables box		
Hydraulic oil pressure can for cutter ski		
Spare lead ballast		
Any other auxiliary equipment required		
ROV Manual and Maintenance Manual		
Sonar Manual		
Cutter skid Manual		
System paper work and maintenance log		
ROV System set up		
Surface Units		
Video Suite		
Umbilical		
ROV Complete pre dive checks completed		
Five / single function Manipulator		



## Weekly Maintenance Schedule Report

ROV S/N: \_\_\_\_\_ Date: \_\_\_\_\_

Complete checks where applicable.

Do not strip parts down if it is not necessary. Project Ref: \_\_\_\_\_

Description	Tick
<b>Thruster</b>	
Function check – reconfigure if needed	
View for any signs of damage or corrosion	
Spray WD40 onto end cone / magnetic coupling	
Check security of end cone bolt to the drive shaft	
Check for any bodies in the thruster	
Check for damage on the propellers	
Check for security of thrusters to the ROV	
Check angle of main thrusters are the same	
Check for any signs of damage to the thrusters whips to the Junction Box (JB)	
Check connection point to the JB	
Clean with fresh water and lubricate	
<b>Lights</b>	
Function check	
Check coupling is secure	
Check security of lights to the ROV	
Check shroud orientation	
Check for any signs of damage to the lights whips to the Junction Box (JB)	
Check connection point to the JB	
Check for any signs of damage or corrosion	
Clean with fresh water	
<b>Tilt Platform</b>	
Function test – reconfigure if needed for full 180 degree axis	
Check security of platform to the ROV and Tilt motor	
Check grease coupling	
Check security of tilt motor to the ROV	
Check for any damage or corrosion to moving parts and tilt motor	
Check for any signs of damage to the tilt motor whip to the Junction Box (JB)	
Check connection point to the JB	



Check for any signs of damage or corrosion	
Clean with fresh water	
<b>Auxiliary Equipment</b>	
Function test	
Check for any damage or corrosion	
Check whip connection point	
Check security to ROV	
Clean with fresh water	
<b>Camera</b>	
Function test	
Check security of cameras to the tilt platform	
Check orientation of cameras	
Check whip connection point to the camera for any damage or chaffing	
Check for any signs of damage or corrosion on the cameras / jubilee clips	
Check for any signs of damage to the camera whips to the Junction Box (JB)	
Check connection point to the JB	
Check for any signs of water ingress through camera ports	
Check camera clear ROV body when tilt platform is operated	
Clean with fresh water	
<b>Other nodes, auxiliary nodes, junction box (JB) and power pod</b>	
Function test	
Check for any signs of damage or corrosion	
Check for any signs of damage to the node whips to the Junction Box (JB)	
Check connection point to the JB	
Check for security	
Clean with fresh water	
<b>ROV</b>	
Check security of all fixings	
Check all strength bars for slackness – tighten where applicable	
Check for any signs of damage, corrosion or distortion	
Check ROV frame for damage and security	
Check all buoyancy is secure, undamaged and painting coating is in place	
Check all whips and cables are secure to the ROV body	
Check lifting point is not damaged	



Check all whips and cables are secure to the ROV body	
Check lifting point is not damaged	
Check cowling for damage and fixing posts	
Clean with fresh water	
<b>Umbilical</b>	
Check grip is in place and is not damaged	
Check connection point to the power pod	
Check for any cuts in the umbilical	
Complete Full Function Checks (Pre dive Checks)	

## D. MCC Configurations for DVL

Under the current configuration in the MCC, the DVL can only send data up, but cannot receive data. In order to solve this situation, please follow the steps below:

1. Open the port side of the MCC pod.
2. Pull off the green connector on the CH9 (J6).
3. Use a small flat head screwdriver to remove the black and red cable.
4. Take out a “2E010-00008 Connector for MCC/TLC” from the spare package.
5. Move the black and red cable from CH9 (J6) to the connector as shown in the picture below.
6. Insert the green connector onto CH11 (J12).
7. Swap the blue and green cable on the MCBH6F side.

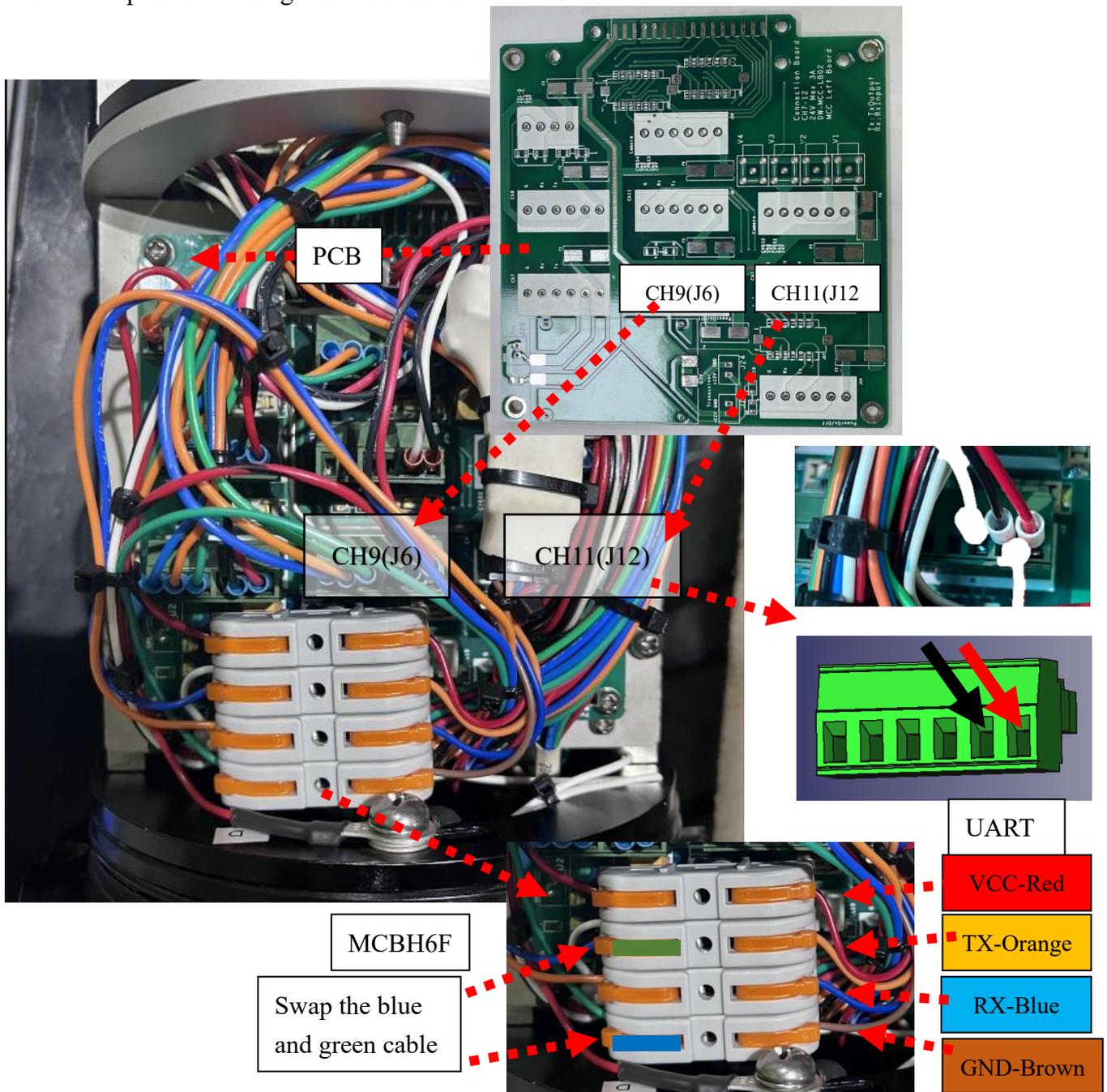


Figure 107 - How to change configuration of MCC



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