

SOIL MACHINE DYNAMICS LIMITED



**MONTEREY BAY AQUARIUM RESEARCH
INSTITUTE**

**TIBURON II, QUANTUM ROV SYSTEM
DOCUMENTATION**

**SURFACE CONTROL
SPECIFICATION MANUAL**

VOL.2 PART 1

SMD Reference: C903V2P1 Surface Control Spec.Iss0

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1 DESCRIPTION

1.1 General

The control system is designed to fit in with Tiburon's existing control room to enable MBARI to utilize as much of their existing equipment as possible.

1.2 Control Room

1.2.1 Pilots chair

The main component of the control room is the Pilots active chair. This chair houses the following items: -

- Pilots touch screen
- Auto function activation buttons
- Hydraulic valve control joystick
- ROV vertical thrust joystick
- Pilots communication headset port
- Main system joystick
- Emergency stop
- Three track roller ball

From here the pilot can: -

- Control the ROV
- Navigate around the control system
- Control the system surveillance equipment and lights
- Stop the ROV in an emergency

1.2.2 Co-Pilot Station

The co-pilot station consists of: -

- Touch screen
- Vehicle start/stop buttons
- Emergency stop

From here the co-pilot can: -

- Navigate the control system
- Control the system surveillance equipment and lights
- Start and stop the vehicle
- Stop the vehicle in an emergency
- Access the control software for the purpose of calibrating instruments.

1.2.3 Science Officer

The science officer has a touch screen from where he has access to the ROV control system and surveillance system controls.



1.2.4 Control System 19" rack equipment

MBARI are integrating the 19" rack equipment into their existing control room. Therefore, the following equipment is provided as stand alone: -

- 4 x 19" TFT LCD monitors (Pilot, Co-Pilot, Science and Advanced Navigation)
- 1 x Pilot PC
- 1 x Co-pilot PC
- 1 x Science PC
- 1 x Advanced Navigation PC
- 9 Way D Type connectors for use with serial comms equipment.
- Multiplexer

All circuit breakers, powers supplies and control equipment necessary for the surface control room are provided as individual items for MBARI to locate as required on the Western Flyer.

1.3 Power Distribution Unit (PDU)

1.3.1 General

The sub-sea power circuits for sub-sea equipment are supplied from independent, dedicated transformers.

The sub-sea safety system has been designed in accordance with the "Code of Practice for the Safe Use of Electricity Underwater" produced by the UK Department of Energy.

The safety system consists of two main elements;

- the Line Insulation Monitors (LIM) and
- the Earth Continuity Monitors (ECM).

A Motor Protection Relay (MPR) that detects prolonged overloading and phase imbalance protects the motor.

The PDU is a single stand alone unit comprising of the Power Distribution Panel (PDP), main incoming and auxiliary supplies together with the various power distribution equipment and instrumentation, the transformers, and the outgoing sub-sea HV supply terminals.

Amongst the power distribution equipment are the Pod and Motor circuit breakers, contactors, transformers and HV terminals.

1.3.2 Line Insulation Monitor and Earth Continuity Monitor

The Line Insulation Monitoring system continuously monitors the insulation value between all live conductors of the sub-sea power supply lines and earth.

- If the insulation resistance falls below a pre-set warning limit, an alarm is given.
- If the insulation resistance breaks down to a dangerous level, the sub-sea power is disabled.
- In the event of a trip, the Line Insulation Monitors must be reset manually in the Cabin.



The Line Insulation Monitoring system relies upon a reliable earth conductor connecting the Control Cabin earth to the sub-sea equipment chassis.

- To ensure a reliable earth path, an Earth Continuity Monitor continuously monitors the integrity of the earthing system.
- If there is no path, the ECM prevents the POD, and hence the motor, from being started.

The LIM units are wired such that in the event of any alarm status being reached,

- The alarm can only be manually reset.
- This is done using the reset button on the front of the LIM unit.

The LIM units can be tested using the test button on the front of each unit.

There is also a Line Insulation Monitoring system in place to monitor the sub-sea 110VAC & 240VAC.

For more details on the LIM and ECM circuits, please consult the Control Cabin Operations and Maintenance Manual.

1.3.3 Motor Protection Relay

The secondary side of the motor circuit is coupled to a Motor Protection Relay, which monitors the motor current via two current transformers on two of the motor phases, respectively.

- The relay has several adjustable settings, including current trip and trip delay settings.
- These can be set up to operate in accordance with the current transformers employed.
- The status of the MPR protection system is indicated by the corresponding illuminating reset push-button housed in the Power Display Panel. And the supply status display on the system diagnostic screen of the control system.

Note: The minimum time the MPR can be reset after being in a fault detection status is one minute. This delay time is settable between 1 - 20 minutes.

For more details on the MPR, please consult the Control Cabin Operations and Maintenance Manual.

1.3.4 Vehicle Isolation

The Pod and Motor circuit breakers, CB1 and CB2, respectively, can each be individually isolated and locked off, see [Figure 1](#).

The cabinet also has a lockable handle to prevent unauthorised access to the high voltage terminals and a limit switch to cut the high voltage supply to the subsea pod and motor if the cabinet door is opened.



CAUTION

There will still be high voltage in the cabinet even though the breakers are off

It should be noted that, there will be high voltage electricity in the PDU even though the breakers are in the off position, for this reason the PDU should only be accessed by a competent person, familiar with the wiring and layout and only after the power to both incoming supplies has been isolated further up the circuit.

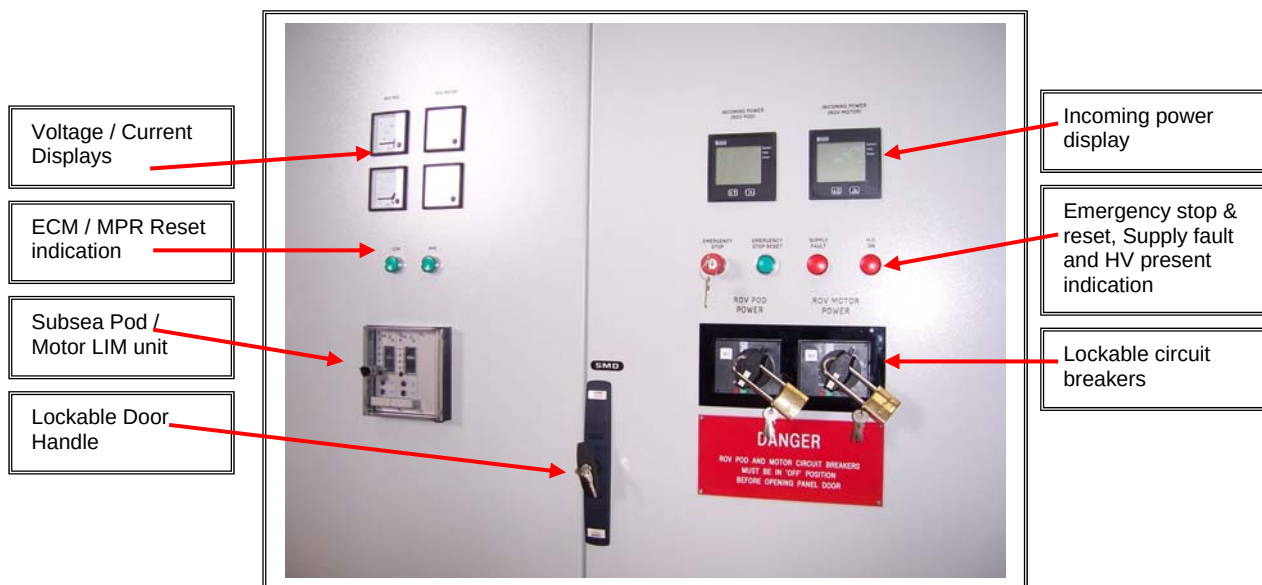


Figure 1 – Power Distribution Unit

1.3.5 Umbilical Connections

The outgoing HV supplies, earth conductors, fibre optics, and ECM loop wires and are fed from the Control Cabin, via a deck cable, to the Winch Umbilical External Termination Box.

In the Control Cabin, the deck cable is terminated in the High Voltage Umbilical Termination Panel on the back panel of the PDU, see [Figure 2](#)

The insulation resistance of the power cores of the deck cable must be checked each time it is disconnected and re-connected before power is switched on.

Before any work is carried out on the umbilical system, the vehicle must be isolated in the Control Cabin and each of the terminals checked with a calibrated High Voltage test probe before being connected to earth.



Figure 2 - High Voltage Umbilical Termination Unit

1.3.6 Umbilical Discharging

Even when the sub-sea power is switched off or isolated, dangerous voltages remain in the umbilical power conductors due to the capacitance of the cable holding a residual charge.

Although the charge leaks away over a certain period of time, it is important to discharge the umbilical after isolating the system and check each terminal with a calibrated High Voltage Test probe.

This is a mandatory requirement prior to any work being conducted on any part of the power system.

WARNING

Always ensure that the sub-sea power is isolated before commencing a task.

2 CONTROL CABIN SPECIFICATION

2.1 General

Cabin	:	Non Required
Standards / Testing	:	Compliant to BSEN 12079. Tested in accordance to AWS D 1.1. Lifting shackles & strops compliant to DNV 2.7-1.
Operational Console	:	Pilots active Chair C/W Pilots touch screen One, Co-Pilot control desk c/w ROV Start/Stop buttons, USB port, emergency stop.
Equipment Scope of Supply	:	Four, flat screen 19" monitors. Four, industrial PC's (1 x Pilot, 1 x Co-Pilot & 1 x Science, 1 x Advanced Nav)
Deck Connections	:	Two High Voltage Junction Boxes
Power Distribution Unit	:	Single Floor mounted unit One, Vehicle instruments power train. One, Vehicle HPU power train One, incoming voltage, frequency, and current meter. One, Voltage Monitor Relay. Two, Line Insulation Monitors for umbilical supplies. One, Motor Protection Relay safety systems. One, Earth Continuity Monitoring safety systems. Safety interlocks.
Surface Power Transformers	:	One 15KVA Vehicle Instrument Transformer Primary Tappings: - 110 / 120 / 130VAC Secondary Tappings : - 3000 / 3100 / 3200VAC One 100KVA Vehicle Motor Transformer Primary Tappings: - 480VAC Secondary Tappings: - 3300/3700/3800/3900VAC

