

SCHILLING HD ROV

TECHNICIAN KNOWLEDGE Q&A

Quick Facts • Technical Systems • Practical ROV Knowledge

A straightforward question-and-answer study reference. Specifications and configurations may vary by vehicle.

Subsea Nodes & IPDS

1. How many subsea nodes are on the ROV?

Answer: Three nodes.

2. How many nodes are on the TMS?

Answer: 1 node

3. How many ports does each subsea node have?

Answer: 16 ports.

4. What is the node supply voltage?

Answer: 26 VDC.

5. What is the maximum total current a node can handle?

Answer: 30 A.

6. What is the maximum current per node port?

Answer: 15 A at 26 VDC.

7. What does IPDS stand for?

Answer: Instrument Power Distribution System

8. What components make up the IPDS?

Answer: The Backbone, the T-Box, the Transformer, and the monitor module

9. What is the purpose of the T-Box?

Answer: Routes PDU power and fiber traffic to and through the IPDS

10. What is the purpose of the Backbone?

Answer: Supports the IPDS modules and distributes two 120 VAC phases through fused AC1/AC2 buses. It has four 120 VAC adapter stations, four 26 VDC node-power stations, a 26 VDC deck-power input, replaceable AC bus fuses, and a relief valve for the atmospheric fuse chamber.

11. How many AC and DC stations are on the IPDS backbone?

Answer: Four 120 VAC stations and four 26 VDC stations.

12. What does the monitoring module do?

Answer: The monitoring module collects input from water-detect sensors, temperature sensors, and the IMD (Insulation Monitoring Device). The monitor module also forwards control system commands to the multi Pak module switching the 120 VAC outputs on and off.

13. What Paks are installed on the IPDS?

Answer: DC Pak and Multi Pak

14. What does the DC Pak do?

Answer: Converts 120 VAC to 26 VDC for the 26 VDC bus

15. What does the DC Multi-Pak do?

Answer: Converts 120 VAC to 26 VDC for the backbone bus and provides switched 48 VDC and two switched 120 VAC stations. The 1-atmosphere distribution chamber has a pressure-relief valve.

16. What does the 240VAC adapter do?

Answer: Converts the two 120 VAC ports to produce 240 VAC for the TMS motors or other devices.

Digital Telemetry & Fiber Optics

17. What does DTS stand for?

Answer: Digital Telemetry System

18. What is the DTS?

Answer: The backbone of the UHD/HD system. All communication and data are transmitted through the DTS. The DTS consists of the control hardware and software as well as the digital information passing over these components.

19. Does the DTS run independently of the client computers and RTC?

Answer: Yes, the DTS system runs independently of the client computers, the server computer and the real time computer (RTC).

20. What are the components that make up the DTS?

Answer: The Core DTS components are 1-surface rack nodes, 2-Subsea nodes, 3-Fiber optic cables in the tether, umbilical, in between nodes and 4-SeaNet cables.

21. What does each component of the DTS do?

Answer: Surface rack nodes link the control station network to subsea nodes. Subsea nodes interface with connected sensors and devices. Fiber-optic cables link surface and subsea telemetry equipment. SeaNet cables connect subsea devices to node interface modules.

22. How do the surface nodes and subsea nodes communicate with each other?

Answer: Communication between surface and subsea nodes are carried through a dual-fiber Gigabit Ethernet backbone connection.

23. What type of fiber is used for the communication?

Answer: Standard Single mode (9/125) optical fiber

24. What two fiber wavelengths are used?

Answer: 1310 nm and 1550 nm (long wavelength)

25. What does RSTP stand for?

Answer: Rapid Spanning Tree Protocol

26. What does Rapid Spanning Tree Protocol (RSTP) do?

Answer: RSTP selects an available network path and helps maintain communications when a redundant Ethernet path fails.

IPDS Compensation & Node Interfaces

27. Where do the power cables for the nodes plug into on the IPDS?

Answer: The power cables for the nodes plug into the four 26 VDC stations on the backbone, adapters used to convert the 120 VAC to 26 VDC are the DC Pak (101-7726) and the DC Multi Pak (101-8003)

28. How many compensation ports are on the IPDS?

Answer: There are 3 compensation ports on the IPDS

29. What are the three compensation ports connected to?

Answer: The 3 compensation ports are connected to the backbone, the transformer, and the T-box

30. Are the three compensation components on the IPDS isolated from each other?

Answer: Yes, the backbone, the transformer module, and the T-box/QDs are isolated from one another

31. Is the fuse housing on the IPDS comped?

Answer: No, the fuse housing area is a 1 atmospheric chamber and contains no comp fluid

32. When you fill / comp the backbone, what is it filling?

Answer: You are filling the backbone itself, the interface of the power adapters, and the monitor module.

33. On the ROV, what comp circuit is the T-box tied into?

Answer: Comp circuit 3 is tied to the T-Box. The circuit is also connected to the electric motor and can be bled at the 2 Headplate bleed ports

34. How many compensation circuits are on the ROV?

Answer: There are 8 comp circuits on the ROV (Your system may have modifications or upgrades). The Node circuit, Valve Pack, HPU motor, IPDS, Thruster bearings, T-4, ROV Mains, and ROV Auxiliary circuit.

35. How many compensation circuits are on the TMS (Your system may have modifications or upgrades)?

Answer: Three: node/latch, electric motor, and IPDS.

36. What does SFP stand for?

Answer: Small Form Pluggable

37. Where are the SFP modules located?

Answer: The SFP modules are located on the node boards

38. How many SFP modules are in each node?

Answer: There are 2 SFP modules on each node board

39. What color are the SFP modules and what port do they connect to on the node?

Answer: The SFP modules are Blue and Green. The Blue SFP module goes in the A Slot and the Green goes in the B slot on the node board.

40. What wavelengths do each SFP module TX and RX on?

Answer: The Blue SFP module TX (Transmits) at 1310 and RX (receives) at 1550. The Green SFP module TX at 1550 and RX at 1310.

41. What does the surface / rack node do?

Answer: The surface and rack node allows communication/control from the surface control station to the subsea vehicle and its devices and sensors.

42. How many types of modules do we use on surface / subsea nodes?

Answer: We use 4 types of modules on the nodes.

43. What are the different modules?

Answer: SIM (serial interface modules), VIM (Video Interface module), NIM (Network interface module), and LIM (Latch Interface module).

44. What does each module name stand for?

Answer: SIM (serial interface modules), VIM (Video Interface module), NIM (Network interface module), and LIM (Latch Interface module). Hopefully repeating the names makes you remember. These modules are the same as the cards you install into a computer. Remember, the node is a motherboard.

45. For surface/rack nodes, what type of connections do they take?

Answer: Surface/rack nodes have fiber optic, BNC, RJ-11/12, and RJ-45 connections on the back panel.

46. How many RJ-11 to DB9 adapters do we use on rack nodes?

Answer: We use 4 RJ-11 adapters on the rack nodes. These is for a standard system. You may have upgrades to your system for a 3rd party device/equipment.

47. What colors are the RJ-11 to DB9 adapters?

Answer: Green, Yellow, Red, and Blue

48. What pins on the DB9 are used for comms?

Answer: 2, 3, and 5

49. What are the green and yellow adapters used for and how are they different?

Answer: Devices that connect to a node or directly to a circuit board use a green adapter which is standard wiring and a yellow adapter for reverse/crossover or null modem wiring.

50. What are the blue and red adapters used for and how are they different?

Answer: Devices that connect to the Digi Serial Expander use a blue adapter which is the standard wiring or a red adapter which is reverse/crossover or null modem wiring. A null modem is a communication method used to directly connect two devices (such as computers, terminals, or printers) using an RS-232 serial cable.

Subsea Node Diagnostics & SeaNet

51. What does the subsea node do?

Answer: The Subsea Node 101-7306 controls, evaluates, and routes telemetry and 26 VDC power for attached devices through 16 individual node ports. This model is enabled for RSTP (Rapid Spanning Tree Protocol), which allows it to seek the best of two redundant fiber paths (F1 and F2) to the surface nodes.

52. How many lights are visible on the node power cable?

Answer: Two lights are visible on the node power cable.

53. What are the colors seen and what do they mean?

Answer: The two lights on the node power cable are green and red. Red is for 26V power and Green is for Health.

54. What does five flashes of the green node-power LED indicate?

Answer: Node ID 5. So, if it blinks 5 times when it's powered on it's node 5.

55. What does four flashes of the green node-power LED indicate?

Answer: Node ID 4.

56. What two types of software fuses are there?

Answer: Slow fuse and Fast fuse

57. What triggers a slow software-fuse alarm?

Answer: Current exceeding 15 amps for approximately 100–200 milliseconds (0.1–0.2 seconds).

*Note: Schilling HD Volume 3 lists different delay values on pages 228/231 and 260.

58. What triggers a fast software fuse alarm?

Answer: The fast software fuse is triggered instantaneous when the trip threshold is approximately 19.8A.

59. Are all the subsea nodes equipped with a water detect (Y / N)?

Answer: Yes, all the subsea nodes are equipped with a water detection sensing.

60. Is each node equipped with ground fault monitoring (Y / N)?

Answer: Yes, each node is equipped with ground fault monitoring.

61. What two ground-fault conditions can a node report?

Answer: Low-side and high-side ground faults. Investigate either fault and follow the approved isolation and safety procedures.

62. What is a Low Side GFD?

Answer: The resistance between the vehicle frame (chassis) and the 26V Return drops below 100 kilohms.

63. What is a High Side GFD?

Answer: The resistance between the vehicle frame (chassis) and the 26V power drops below 100 kilohms.

64. At what drop in resistance will trigger the GFD alarm?

Answer: 100 Kilohms will trigger the GFD alarm.

65. Which node on the ROV reports all GFD's?

Answer: Node 4. If nodes are in a chain (or same bus) the line isolation monitor in the software-designated first node in each vehicle is enabled, and those on the additional nodes are set to standby mode.

66. How would you change the id / # of a node?

Answer: The Node changer software is used to change the ID number of the node.

67. What cable is used to connect a device to the node?

Answer: The SeaNet cable is used to connect a device to a node. There are interface modules with burton connectors, but we are talking about SeaNet cables right now.

68. How many pins are on the SeaNet cable?

Answer: 7 pins

69. What is the pinout of the SeaNet cable?

Answer: Pin 1: switched +26 VDC; Pin 2: switched 26 VDC return; Pin 3: chassis; Pins 4–6: signals 1–3; Pin 7: signal 4/video.

70. What is pin number of the outer most ring on the penetrator?

Answer: Pin 1. +26 VDC switched and (bonus answer) The inner most Pin is Pin 7, Signal 4 video

71. How many lights can you see on the SeaNet cable?

Answer: 4 different lights

72. What does the red LED on the SeaNet cable indicate?

Answer: Supply power is present. The source says 12 V, but the SeaNet pinout specifies switched 26 VDC; verify the LED indication against the manual.

73. What does an amber light indicate on the SeaNet cable?

Answer: Video signal present

74. What do the two lights in the center of the SeaNet show?

Answer: The communication activity show RS-232 transmitting up and down

75. Of the two center lights, what does the top and bottom light represent?

Answer: Top center light is the signal up, slave to master. Bottom center light is the signal down, master to slave.

Acronyms & PDU Electrical Systems

76. What does UCM stand for?

Answer: Universal Control Module

77. What does PSA stand for?

Answer: Position Sensor Array

78. What does PLC stand for?

Answer: Programmable Logic Controller

79. What does PDU stand for?

Answer: Power Distribution Unit

80. What does TCU stand for?

Answer: Thruster Control Unit

81. What does HMI stand for?

Answer: Human Machine Interface

82. What does LOTO stand for?

Answer: Lockout/Tagout.

83. What does the PDU do?

Answer: It converts, distributes, and monitors the ship's electrical power for the ROV system.

84. What PDU do we use (Brand)?

Answer: Tinitron

85. What are the incoming voltage requirements for the PDU?

Answer: It's 380 to 480 VAC, 3 phase, 50 or 60 Hz

86. What are the incoming amperage requirements for the PDU?

Answer: 232 amps, 460 VAC, 3 phase

87. What is meant by 3 phase power?

Answer: Three-phase power uses three AC voltage waves spaced 120 degrees apart to provide smooth, continuous power.

88. What should you do before working on any electrical / hydraulic component?

Answer: Isolate the energy and perform LOTO. For hydraulics, also verify zero pressure and relieve any stored pressure before opening anything. *Make sure your gauges are at 0 PSI if the circuit has one installed.

89. In what order do you turn on the PDU?

Answer: First, verify 480 VAC is present, confirm the E-stops are released and all doors or panels are closed. Then turn on Control Power, turn the Main Power breaker ON, then bring up the ROV IPDS, the ROV HPU, and finally the TMS.

90. When you turn on control power, what does that do?

Answer: Control Power ON energizes the PDU's control-power circuitry (24 VDC). That control power is required before the Main Power Breaker can be turned on; the green CONTROL POWER ON LED illuminates when it is active.

91. What are the three wheels on front panel of PDU?

Answer: ROV HPU, ROV IPDS, and TMS PWR ground switch wheels.

92. What door on the PDU are the Ground Fault Indicators located on?

Answer: The right door of the PDU.

93. What door on the PDU are the breakers located on?

Answer: The left door of the PDU.

94. What safety devices are installed on each PDU door?

Answer: Safety interlock switches.

95. What will happen if you open any PDU door with power on?

Answer: All circuit breakers will trip, disabling the ROV IPDS, HPU, and TMS high-power circuits.

96. What will stay on if you open any PDU door?

Answer: The 230 VAC and 24 VDC control power supplies will remain on.

97. If you activate the emergency stop button, what does that do?

Answer: Trips the main power circuit breaker and removes power from all high-power contactor coils.

98. What will stay on if you activate the emergency stop?

Answer: The PLC and control power remain energized.

99. What components make up the ROV HPU, ROV IPDS, and TMS power circuits in the PDU?

Answer: Each circuit contains a branch circuit breaker, contactor, step-up transformer, high-voltage monitor, ground fault monitor, and grounding switch.

100. If any component in those circuits is off or shows a fault, what will happen?

Answer: The entire circuit will not operate.

101. If any component in those circuits has a fault during operations, what will happen?

Answer: The entire circuit will shut down.

102. Where can you monitor / see main voltage, current, and frequency on the PDU?

Answer: On the Clean Power Meter.

103. What does the PQube in the PDU do?

Answer: The PQube monitors power quality and records power-quality faults based on user-defined thresholds. It monitors the line-to-line and line-to-neutral voltages.

104. What are the devices/meters called on the PDU that monitor ground faults?

Answer: Megacon Ground Fault Detection (GFD) meters.

105. What do those devices/meters do?

Answer: They monitor the line-to-ground resistance of the three 4,160 VAC subsea power circuits—ROV HPU, ROV IPDS, and TMS Power—to detect insulation breakdowns and ground faults.

106. What resistance to ground will trigger a ground fault alarm on the Megacon?

Answer: Below 500 k Ω (kilohms). The red ALARM light illuminates and an audible alarm sounds.

107. What resistance to ground will trigger the breakers to trip?

Answer: 300 k Ω (kilohms) or less. At that resistance, the affected circuit breaker automatically trips.

DTS Diagnostics & Network Addresses

108. What is the IP address for the right client computer?

Answer: 192.168.0.102

109. What is the IP address for the left client computer?

Answer: 192.168.0.101

110. What is DTS viewer?

Answer: DTS Network Viewer is a diagnostic and configuration software application used to view, test, and troubleshoot the Digital Telemetry System (DTS) network.

111. What is DTS viewer used for?

Answer: It is used to inspect DTS configuration and status, create temporary tunnels between SIMs/VIMs, troubleshoot DTS network and device faults, diagnose video issues, and test/configure serial or video devices.

112. What IP address does the test computer need to be set to, to run DTS viewer?

Answer: Any fixed IP address between 172.16.1.220 and 172.16.1.250.

113. What does the subnet mask need to be set to?

Answer: 255.255.0.0

114. What program/test software can you use to find the IP addresses of each node?

Answer: DTS Network Viewer. Use Scan ALL to scan the network and retrieve the nodes' configuration information.

115. What are the node IP addresses for Nodes 1–6?

Answer: Node 1: 172.16.1.17; Node 2: 172.16.2.17; Node 3: 172.16.3.17; Node 4: 172.16.4.17; Node 5: 172.16.5.17; Node 6: 172.16.6.17. Verify against the DTS configuration before publishing; the pasted draft lists .1 addresses.

116. What does this IP address reference 172.16.3.4?

Answer: Node 3, Port 4 (N3, P4).

117. What does this IP address reference 172.16.5.15?

Answer: Node 5, Port 15 (N5, P15).

118. What program/test software do we use to change a node's ID?

Answer: NodeChanger.exe

Hydraulic Power & Tooling

119. What does HPU stand for?

Answer: Hydraulic Power Unit

120. Where does the HPU receive the HV power from?

Answer: From the PDU (Power Distribution Unit), through the ROV-HPU high-voltage circuit/transformer.

121. What is the horsepower output for the Schilling HD HPU motor?

Answer: 150 HP

122. What is the operating voltage for the HPU motor?

Answer: 4,160 VAC (3-phase).

123. How many pumps are installed on the motor?

Answer: Two pumps.

124. What are the two pumps called?

Answer: Main Pump and Auxiliary (Aux) Pump.

125. What is used to control each pump / circuit?

Answer: A hydraulic control manifold — one for the Main circuit and one for the Aux circuit.

126. What components make up the Aux / Main control manifolds?

Answer: UCM, pressure sensor, pressure control valve, and temperature sensor.

127. What does the main pump / circuit do?

Answer: Provides hydraulic pressure and flow for vehicle propulsion (the thrusters) and the manipulators.

128. What side of the motor is the main pump installed?

Answer: Port side of the motor.

129. What is the max pressure and flow the main pump can output?

Answer: 4,000 PSI (275 bar) at 64 GPM (242 LPM).

130. What does the Aux pump / circuit do?

Answer: Provides hydraulic pressure and flow for auxiliary tooling and functions.

131. What side of the motor is the Aux pump installed?

Answer: Starboard side of the motor.

132. What is the max pressure and flow the Aux pump can output?

Answer: 3,000 PSI (207 bar) at approximately 20 GPM (78 LPM).

133. How many manifolds are connected to the Aux circuit?

Answer: Two manifolds.

134. Which two auxiliary tooling manifolds are described for the Aux circuit?

Answer: Pressure/Return/Relief manifold and optional 3-Function manifold. Confirm which are fitted to the specific vehicle.

135. What are the valve packs used for?

Answer: A valve pack controls hydraulic functions for manipulators, tooling, and other hydraulic equipment connected to that circuit. The manual describes the valve packs as containing proportional and/or solenoid valves used to control individual hydraulic functions.

136. What are the two types of external adjustable valves on the valve pack?

Answer: Pressure-reducing valves and flow-control valves.

137. How many filters are located on the Main circuit?

Answer: Two filters, the pressure and return filter.

138. How many filters are located on the Aux circuit?

Answer: Two filters, the pressure and return filters.

139. What is the 3-function manifold used for?

Answer: Controlling auxiliary hydraulic tooling, including adjustable pressure and flow for the applicable functions.

140. How many circuits are on the 3-function manifold?

Answer: Three hydraulic circuits.

141. How are the three circuits on the 3-function manifold labeled?

Answer: Circuit 1, Circuit 2, and HIGH FLOW (Hi-Flow). Circuits 1 and 2 use valves rated at 60 L/min each; the Hi-Flow valve is rated at 160 L/min. Actual available flow depends on the hydraulic supply.

142. How many valves are in the 3-function manifold?

Answer: Five valves — two proportional directional valves, two proportional pressure-reducing valves, and one proportional high-flow control valve.

Thrusters & Thruster Control

143. How many thrusters does the ROV have?

Answer: Seven (7) hydraulic thrusters.

144. What are the thrusters controlled by?

Answer: Thruster Control Units (TCUs).

145. How many TCUs are installed on the ROV?

Answer: Two: Forward and Aft.

146. How many thrusters are connected to the Forward TCU?

Answer: Four (4) thrusters.

147. How many thrusters are connected to the AFT TCU?

Answer: Three (3) thrusters.

148. What are the components that make up the TCU?

Answer: Proportional pressure-reducing valves, a hydraulic relief valve, a control PCB (printed circuit board), and a water detection sensor, housed in a pressure-compensated manifold.

149. What type of valve is in the TCU to control the thrusters?

Answer: Proportional pressure-reducing valves.

150. How many relief valves are installed in the TCU?

Answer: One (1) hydraulic relief valve per TCU.

151. What color LEDs are visible on the TCU control PCB?

Answer: Green, amber, and red. Green indicates 5 VDC microprocessor power; amber (A coil) indicates clockwise control; red (B coil) indicates counterclockwise control. For amber/red pairs, the LED closest to green indicates 26 VDC coil power and the farther LED indicates a 5 V command.

152. What is installed on each thruster to provide feedback to the control system?

Answer: A shaft speed sensor.

153. What does the feedback from the speed sensor enable?

Answer: Precise closed-loop thruster control and automatic functions such as station-keeping, displacement, auto-depth, and auto-altitude.

154. Will a thruster still work with a sensor failure?

Answer: Yes. The thruster can still operate in open-loop mode, but some automatic functions may be unavailable.

155. What mode do you have to run the thruster in if you have a sensor failure?

Answer: Open-loop mode.

AC Junction Box & Lighting Control

156. What is the AC J-Box used for?

Answer: To distribute 120 VAC power to externally connected ROV devices through four individually controlled and protected circuits.

157. How many circuits does the AC J-Box have?

Answer: Four. Circuits 1–3 are rated at 2 A each (250 W); Circuit 4 is rated at 20 A.

158. How many fuses are in the AC J-Box?

Answer: Two (2) physical fuses — one for the 120 VAC line and one for neutral.

159. What amperage are the fuses?

Answer: 20 amps each.

160. From where is the AC J-Box supplied 120 VAC?

Answer: From the Instrument Power Assembly (IPA), through a Burton power cable. You may also use a Mux bottle which has power and fiber optic communication.

161. What does LCU stand for?

Answer: Lighting Control Unit.

162. From where is the LCU supplied 120 VAC?

Answer: From the Instrument Power Assembly (IPA) or the IPDS.

163. How many 120 VAC lights can the LCU control?

Answer: Up to twelve (12) lights.

164. If the AC J-Box is connected to the LCU, what data can the LCU collect from the AC J-Box?

Answer: AC power usage, water detection, and line-isolation data.

165. What waveform does the LCU use to power the lights?

Answer: A full-wave rectified waveform.

166. What is used for dimming and turning on / off each light?

Answer: An Insulated Gate Bipolar Transistor (IGBT).

167. What does IGBT stand for?

Answer: Insulated Gate Bipolar Transistor.