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Basic design for new electronics of the JARE deep drill and testing of the prototype

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The electronics of the JARE deep drill was previously manufactured through outsourcing and its basic design has already spent quarter century. The electronics of the drill should be installed in the pressure chamber. This implies that size of the electronics is restricted as smaller and difficult to manufacture. Therefore, it needs to be customized by incorporating and the required improvements, such as the addition of some sensor devices and revise of software were not so easy after the building.
Recently, small personal computers (PCs) have been commercially available for cheaper prices. In our proposed idea, a small PC was used as a computer in the drill. We also suggested building the electronics of the drill by assembling some commercial devices, such as the PC, specific types of sensors, motor controller, and the required devices for data acquisition and data communication. The proposed electronics of the drill can be customized after development and is cost-effective.
During the design of the proposed electronics, decision of winch cable was necessary since it was employed to provide the electric power supply and data communication. We decide to use same winch cable with previously our use since spare of it is stocked in Antarctica. Type of the winch cable is armoured cable which consist from the outer wires and inner seven conductor cables. The outer wires and five of the conductor cables were used for power supply, while two of the conductor cables were used for data communication. The voltage of the electric power supply was DC200V during the drilling to rotate the motor and DC24V for the electric devices. Therefore we also employed a secondary cell and an electrical relay to manage these two voltage levels.
Commercial devices such as a stick type PC, AD convertor equipped digital input-output, RS485 transmitter-receiver, electrical relay, and secondary cells constitute the basic design of the proposed electronics. A prototype of main part of the drill electronics was made by assembling these devices. Size of this prototype is smaller than 85 mm in diameter. Therefore, it can be inserted into the pressure chamber of the drill. Temporal control software was developed to check the validity of the prototype. The results confirmed that the prototype functions well. Therefore, we proceeded to apply this design concept for the proposed electronics of the JARE deep drill.

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