

Study on the Diagnostic Method Using Thermal Sensing Technology of Nuclear Power Plant Digital Electronic Cards

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1. Introduction

The recently constructed nuclear power plant is operating by applying digital electronic cards with digital devices, not analog devices, to the nuclear power plant control system. In addition, as the discontinuation or facility improvement of analog electronic cards is applied, the range of nuclear power plant facilities to which digital devices are applied is increasing. As the scope of application increases, there are cases of facility failure and sudden stop due to failure of digital electronic cards. Therefore, I would like to consider the methodology of applying thermal sensing technology for diagnosing digital electronic cards to which digital devices are applied.

2. Previous electronic circuit card diagnostic method

Korea Hydro & Nuclear Power (KHNP) has been continuously checking electronic circuit cards in various ways.

The first method was ICT (In-Circuit Test) to check the characteristic values and operating status of each device. An inspection device was constructed to test each device terminal short-circuit, opening, and circuit function without mechanically separating the device soldering section of the electronic card using a jig. At the time of inspection, each part characteristic was evaluated and the integrity of the part was evaluated by comparing it with the characteristic of the part.

The second method is an inspection using pin-point equipment. The main function of the equipment is to check the logic of the electronic circuit card. This is a method of evaluating the integrity of electronic cards with equipment that can automatically recognize and test the output value according to the input stage with software by converting the data of electronic cards into a Data Base. Connection terminals, wiring, circuit functions inside electronic circuit boards, and electrical characteristics analysis equipment were applied.

Various diagnostic methods have been applied to confirm the integrity of electronic cards

3. Diagnostic Method Using Thermal Sensing Technology

Previous nuclear power plant electronic card diagnosis was a method of checking the electrical characteristics of analog devices.

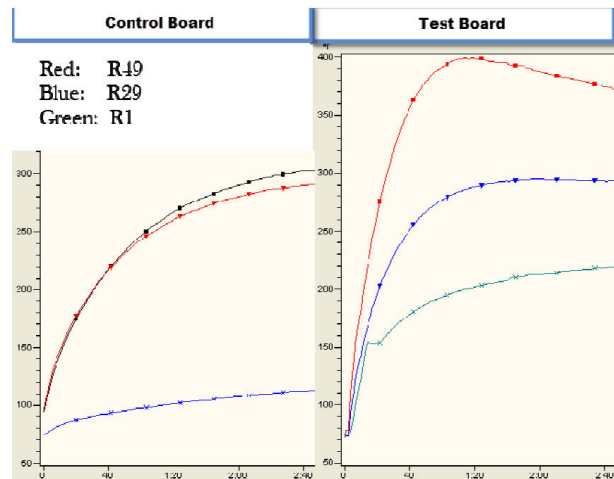


Fig. 1. Temperature profiles of the two boards [1]

The diagnosis method using thermal sensing technology can diagnose the integrity of the electronic card for each device based on the heat of the device and find a defective device based on the heat of the device. In addition, the temperature distribution can be checked by comparing the normal and abnormal conditions of the electronic card, and after making it a database, it is determined whether or not there is a failure. This diagnosis method is simpler than the previous electrical signal-based inspection method and can be applied to various electronic cards. In particular, it is judged that identifying the heating phenomenon through temperature distribution analysis can diagnose the failure more accurately and that it will be easier to automate by applying the acquired data to AI technology.

4. Conclusion

Digital electronic cards to which digital devices are applied need to develop new diagnostic methods. The inspection method of the control card of the previous nuclear power plant is not optimized for electronic cards to which digital devices are applied, so a new diagnostic method that can check digital devices should be developed and applied.

The diagnosis method using thermal sensing technology is a method that can diagnose by checking the temperature distribution of various devices, and it is expected to contribute to the stable operation of nuclear

power plants by discovering failures that are not found in existing methods such as ICT and Pin-point.

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