

## Implementation of the Improved HMI Design for the FTL System

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### 1. Introduction

At present, the I&C system in the HANARO(Highly Advanced Neutron Application Reactor) is being gradually integrated to interface with new experimental facilities. This effort can control and combine each informations of the FTL(3-Pin Fuel Test Loop) and HANARO. It will reduce the probability of operator's errors and make operation more efficient. To access a number of process information asked for in a reliable method, especially, improved HMI(Human-machine interface) design is needed in the view of human engineering. In order to realize the high quality of the HMI, a style guide fitted operator requirements with a user-intimate environment was made. This paper introduces the implement of the HMI design applied for the FTL with sample displays.

### 2. Methods and Results

#### 2.1 FTL Control and I&C system

FTL system under the same operating conditions as the commercial nuclear power plants needs special care. FTL system consists of safety systems and non-nuclear systems. In case of safety systems, it is composed of a triplicate protection system, a safety control system and a safety parameter display system. The HMI for control systems that is installed in the FTL control room and existing reactor hall is set up in the main control room. It means that the FTL control system related physically with the HANARO control system is sharing the HANARO I&C system. But, all the controls and data acquisitions for the FTL facilities are installed in the FTL control room and for this reason, [1] control in a normal operation should be performed remotely in the main control room. Figure 1 shows the HANARO system configuration for the FTL system.

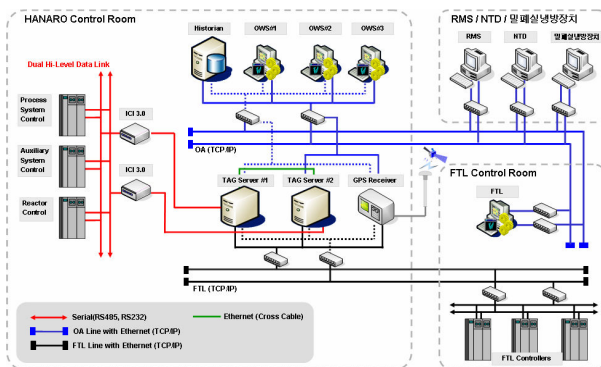


Figure 1 The HANARO system Configuration

So that, the normal operation after a start-up of the FTL is almost done in the main control room. [2]

I&C system of the HANARO is controlled by MLC that is linked with HLL(high level data links) to the control computers and HMI is connected to the MLC through Fast ICI that is a protocol interface. FTL I&C system is almost similar with the HANARO. Figure 1 is the configuration of the FTL and the HANARO.

#### 2.2 HMI design for FTL

The HMI of HANARO displays control information that includes the process values, set point values, alarm, trend and so on. But the current HMI design of OWS doesn't keep pace with the demand for various satisfied display in aspect of human engineering due to it sustaining the same configuration with the original product supplied in 1992 that has a limitation in the performance.[3]

In order to satisfy the human engineering requirements, at first a style guide was made by considering the hardware, HMI tools, and operator requirements. According to the guide, the displays are developed systematically. [4]

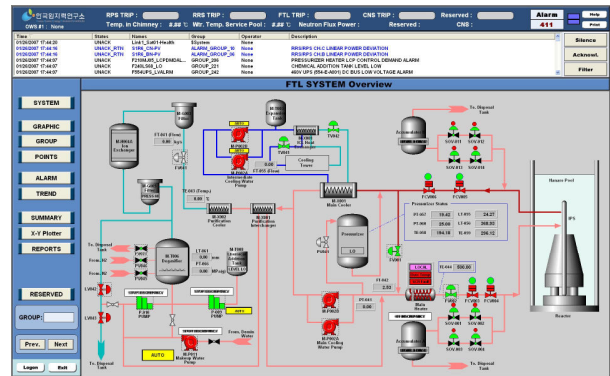


Figure 2 Display of FTL system overview

Figure 2 represents the overall FTL control system briefly and operators can directly control the point that is to be adjusted or to be seen. Through this combined display at once, an operator can easily access the frequently used process parameters and confirm the values and trend. At the top of the normal display, key parameters that are very significant can always be verified.

Figure 3 stands for the FTL protection system that instantly isolates the FTL system automatically in an emergency situation.

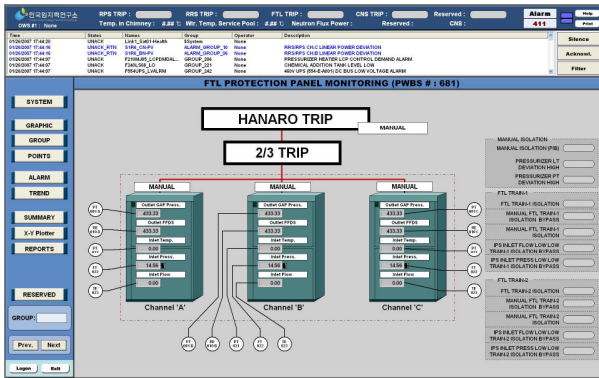


Figure 3 Display of FTL Protection system

The trip parameters of the triplicate protection panel are very important to stabilize the FTL system and have very close relations with HANARO trip. But, it's regrettable that these parameters aren't be displayed at the P&ID. To overcome this, simulated protection panel was created to the display a HANARO trip as well as the FTL isolation status.

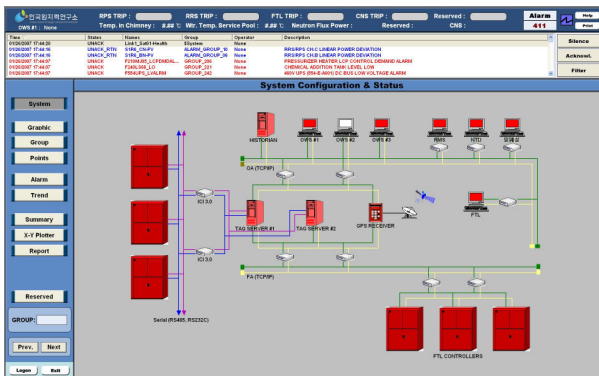


Figure 4 Display of system status

Figure 4 displays the overall status of the HANARO and FTL control system network. Operators can ascertain all the abnormal system information that results from a power fail are of the network equipments, or system error and so on. In addition, a duplicated network system that consist of a primary and secondary line can be directly switched with no problems.

### 3. Conclusion

From last year, the HMI for the FTL system was advanced in so many directions that it finally finished FAT. For a long time, Many improvements have been continuously made to realize an HMI model very close to a actual process with concern for Soperators.

The next procedure will be a HMI upgrading the HANARO and the other experimental facilities.

### REFERENCES

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