

Development of Input Output Simulator for Core Protection Calculator System

150

Abstract

The protection systems should be tested periodically to verify that its functions are performed against pre-defined conditions. The Core Protection Calculator System(CPCS) performs the Departure from Nucleate Boiling Ratio(DNBR) and Local Power Density(LPD) trip functions. The CPCS is tested periodically with simulated inputs to verify that the system will function as intended. The input/output simulator has been developed for CPCS testing. The input/output simulator provides analog signals, pulse signals, digital signals, and receives contact signals, digital signals. The generation of analog signals should consider required rate of change, accuracy, etc. for the signal. The pulse signals and digital signals should meet the simulated

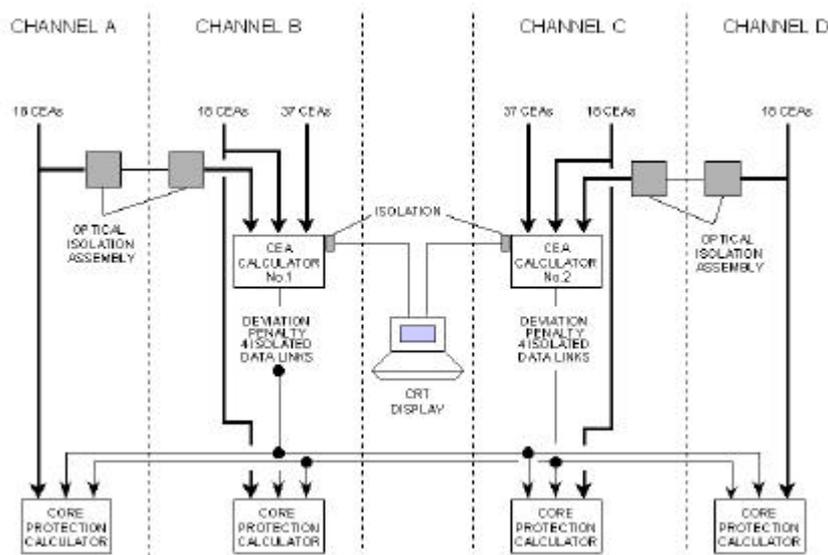
signal characteristics and timing requirements of the target system. The input/output simulator for the real time system should be designed to meet timing requirements of the target system and simulated signal characteristics with through understanding of the target system.

1.



2.

(Anticipated Operational Occurrences)
 가 (Specified Acceptable Fuel Design Limit)
 (Plant Protection System)
 4
 가
 B C 가 (CEA Calculator)
 (CEA Position Optical Isolation Assembly: CPOIA)
 A D CPOIA 2.1



2.1

2 (CEAC)
 DNBR LPD
 (CEA Withdrawal Prohibit)

가

(Reed Switch Position Transmitter : RSPT) 73

. RSPT

(penalty)

(Core Protection Calculator :

CPC)

CPC

CEAC

(Plant Control System : PCS)

가 [1].

CPCS

2-1.

채널당 수량	신 호	신 호 범 위	공 학 단 위
A. 프로세스 계속입력			
1	가압기 압력	0-10V	105-175kg/cm ²
2	고온관 온도	0-10V	250-350°C
2	저온관 온도	0-10V	230-330°C
B. 리드스위치 위치 전송기			
18	CEA 위치	5-10V	0-381cm
C. RCP 축 속도 감지 계통			
4	원자로냉각재 펌프속도	0-44 펄스/sec	0-1,320 RPM
D. 발전소보호계통			
1	시험가능	접점	N/A
E. 노외핵계측기계통			
3	선형 서브채널 출력	0-10V	0-200%
1	우회 허용	접점	출력 ≤ 10 ⁴
F. 제어봉연산기 (CEAC)			
2	채널터 인자	디지털	N/A

DNBR LPD . CPC

2.1

CPC

. CPC

2.2

2-2

채널당 수량	신 호	신 호 범 위	공학단위 (접점열람/접점단합)
A. 발전소보호계통			
1	DNBR Pre-Trip	접 점	Pre-trip/No Pre-trip
1	DNBR Trip	접 점	Trip/No Trip
1	LPD Pre-Trip	접 점	Pre-trip/No Pre-Trip
1	LPD Trip	접 점	Trip/No Trip
1	CWP	접 점	CWP/No CWP
B. 배전반 계기 및 기록계			
1	DNBR 여유도	0-10V	0-10
1	LPD 여유도	0-10V	0-800 watts/cm
1	교정된 중성자속 출력	0-10V	0-200 %
C. 발전소 정보기			
1	CPC 감지기 고장	접 점	Alarm/No Alarm
1	CPC 고장	접 점	Alarm/No Alarm
1	CEAC 운전불능	접 점	Alarm/No Alarm
1	CPCS 우회	접 점	Alarm/No Alarm
D. 발전소 전산기			
32	CPC 입력신호	디지털	N/A
78	중간계산값과 결과	디지털	N/A

3.

settling time
PLC(Programmable Logic
Controller)

(differential signal vs. single-ended signal)

가 가

(aliasing)

(Nyquist Frequency)

2

(settling time)

가

, A/D

가

가

(slew rate),

(resolution)

D/C

(converter)가

가

가

(gate),

(source),

(output)

가

(clock)

, PLC 가 . PLC On-
 Off
 (controller)
 , CPU
 , PID
 . PLC
 ROM
 . PLC
 (Ladder Logic Language)가
 (Function Block Language) . PLC
 [2], [3].
 CPU
 가 가 ,
 가
 가
 (bandwidth),
 가
 (throughput) 가 ,
 3.1

3.1

Bus	Bus Clock	Bandwidth (Megabyte/sec)	Number of Address bits	Number of Data Bits
6U VME	N/A	40	16/24/32	8/16/32
ISA	8 MHz	4 – 5	24	16
PCI	33 MHz	132	16/32	8/16/32
Compact PCI	33 MHz	132	16/32	8/16/32

VME 가

, 1980, ANSI, IEEE, ISA

PC/AT가

가, 14

(edge trigger) 가, 7 DMA

. PCI 가

가

가

가 4-5

. PCI 256

ROM timer)

가 . PCI

(latency

가

(level trigger)

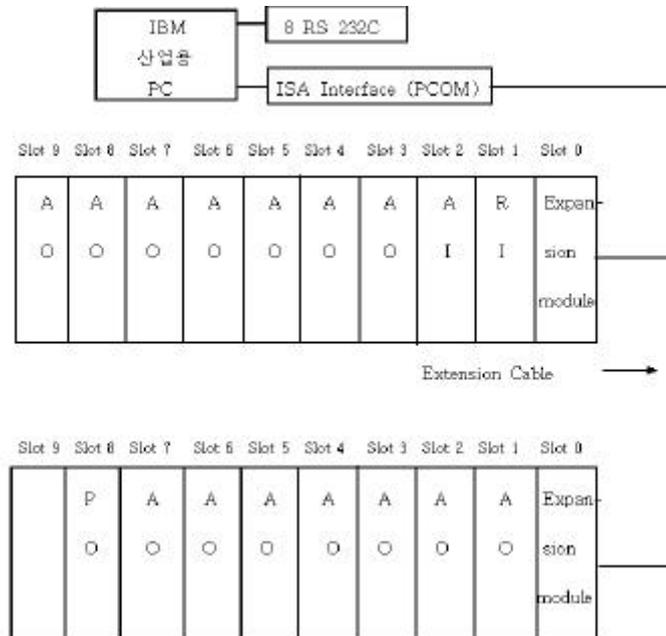
가

. CPCI PCI

(embedded)

가

8



3.1

IBM (compatible) PC ISA
 가 , 120 가
 , PLC 가
 , PLC
 3-1 ISA 가
 [4].

(Analog Input)

(Self Test), , (calibration)
 A/D 14 (bit), 8
 (differential) 16 (single ended)
 0 ~ 10 volt -10 ~ +10 volt

(Analog Output)

(Relay Input)

(Dry Contact) , (Sync) (Source)
 10 ~ 30Vdc . 16

RS232C

(7 8), 1 2 (stop) , 1 (start) ,
 (parity) , 300 ~ 38400 bps (Loop
 Back) , 8

(Pulse Output)

(Time Duration) . 23
 0 to 5Vdc 0 to 10Vdc
 10 ì sec 4 가
 (level) TTL .

(CITECT)

MMI(Man-Machine Interface)

MMI

MMI

2.1 , CEAC , CPC-PMS , CEAC-PMS , CPC
(ramp) (step)
[5]. 가

100% (Point to Point Continuity)

가

(Integrated System Test)

(Stability Test)

48

(drift)

가

가

가

가

infant mortality

(Factory Acceptance Test : FAT)

CPCS가 DNBR

LPD

가

가

가

(signal overshoot)

, CPCS

3.2

CPCS

입력 \ 시험결과	시험결과	시운전 허용기준
RCP Speed	+/- 1 count	+/- 1.73 RPM
Cold Leg Temperature	0.00 ~ 0.02	+/-1.03 °C
Hot Leg Temperature	0.00 ~ 0.02	+/-1.03 °C
Pressurizer Pressure	0.01 ~ 0.03	+/-0.723 Kg/cm ²
Neutron Flux Power	0.00 ~ 0.025	+/-1.127 %
CEA position	0.14 ~ 0.41	4.3 cm

4.

ISA

(cutoff frequency),

References

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