

2.4.25 Signal Conditioning and Distribution System

1.0 Description

The signal conditioning and distribution system (SCDS) provides signal conditioning and distribution of signals.

The SCDS provides the following safety-related functions:

- Receives safety-related signals from Class 1E sensors or black boxes.
- Sends safety-related signals to the protection system (PS) and safety automation system (SAS).
- Sends Type A, B and C post accident monitoring variable signals to the safety information and control system (SICS).

2.0 Arrangement

2.1 SCDS equipment is located as listed in Table 2.4.25-1—SCDS Equipment.

2.2 Physical separation exists between the four divisions of the SCDS.

2.3 Physical separation exists between Class 1E SCDS equipment and non-Class 1E equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.25-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The SCDS receives input signals from the sources listed in Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals.

4.2 The SCDS provides the output signals listed in Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals.

4.3 Bypassed or inoperable SCDS channel status information is retrievable in the MCR.

4.4 Electrical isolation is provided on connections between SCDS Class 1E equipment and non-Class 1E equipment.

4.5 The SCDS equipment listed as Class 1E in Table 2.4.25-1 can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

5.0 Electrical Power Design Features

5.1 Class 1E SCDS components are powered from a Class 1E division in a normal or alternate feed condition.

6.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.25-4 lists the SCDS ITAAC.

Table 2.4.25-1—Signal Conditioning and Distribution System Equipment

Description	Tag Number⁽¹⁾	Location	Seismic Category	IEEE Class 1E⁽²⁾
SCDS Cabinets, Division 1	30CLE51	Safeguard Building 1	I	1 ^N 2 ^A
SCDS Cabinets, Division 2	30CLF51	Safeguard Building 2	I	2 ^N 1 ^A
SCDS Cabinets, Division 3	30CLG51	Safeguard Building 3	I	3 ^N 4 ^A
SCDS Cabinets, Division 4	30CLH51	Safeguard Building 4	I	4 ^N 3 ^A

- 1) Equipment Tag numbers are provided for information and are not part of the design certification.
- 2) ^N denotes the division the component is normally powered from. ^A denotes the division the component is powered from when alternate feed is implemented.

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals (2 Sheets)

Item #	Signal	Source	# Divisions
1	6.9 kV Bus Voltage	Emergency Power Supply System	4
2	Annulus Ventilation System Gamma Activity	Annulus Ventilation System	4
3	Chemical and Volume Control System (CVCS) Boron Concentration	Boron Concentration and Measurement System	4
4	Cold Leg Temperature (NR)	Reactor Coolant System	4
5	Cold Leg Temperature (WR)	Reactor Coolant System	4
6	Containment Equipment Compartment Pressure	Containment Ventilation System	4
7	Containment Equipment Compartment Containment Service Compartment Delta Pressure	Containment Ventilation System	4
8	Containment High Range Activity	Radiation Monitoring System	4
9	Containment Service Compartment Pressure (NR)	Containment Ventilation System	4
10	Containment Service Compartment Pressure (WR)	Containment Ventilation System	4
11	Core Outlet Thermocouples Wide Range Temperature	Incore Instrumentation System	4
12	CVCS Charging Flow	Chemical Volume and Control System	4
13	RCP Differential Pressure	Reactor Coolant System	4
14	Emergency Feedwater Flow	Emergency Feedwater System	4
15	Hot Leg Pressure (NR)	Safety Injection & Residual Heat Removal System	4
16	Hot Leg Pressure (WR)	Safety Injection & Residual Heat Removal System	4
17	Hot Leg Temperature (NR)	Reactor Coolant System	4
18	Hot Leg Temperature (WR)	Reactor Coolant System	4
19	Low Head Safety Injection Flow (WR)	Safety Injection and Residual Heat Removal System	4
20	Main Control Room (MCR) Air Intake Activity	Sampling Activity Monitoring Systems	4
21	Main Steam Line Activity	Main Steam System	4
22	Medium Head Safety Injection Flow (WR)	Safety Injection and Residual Heat Removal System	4

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals (2 Sheets)

Item #	Signal	Source	# Divisions
23	Neutron Flux from Intermediate Range Detector (IRD)	Excore Instrumentation System	4
24	Neutron Flux from Power Range Detector (PRD)	Excore Instrumentation System	4
25	Neutron Flux from Self Powered Neutron Detectors (SPND)	Incore Instrumentation System	4
26	Neutron Flux from Source Range (SRD)	Excore Instrumentation System	4
27	Pressurizer Level (NR)	Reactor Coolant System	4
28	Pressurizer Pressure (NR)	Reactor Coolant System	4
29	RCP Bus Breaker Position	Normal Power Supply System	4
30	RCP Breaker Position	Normal Power Supply System	4
31	RCS Loop Flow	Reactor Coolant System	4
33	RCS Loop Level	Reactor Coolant System	4
34	RCP Speed	Reactor Coolant System	4
35	SG Level (NR)	Reactor Coolant System	4
36	SG Level (WR)	Reactor Coolant System	4
37	SG Pressure	Main Steam System	4
38	Temperature compensated rod cluster control assembly (RCCA) positions	Rod Position Measurement System	4

Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals (2 Sheets)

Item #	Signal	Destination	# Divisions
1	6.9 kV Bus Voltage	Protection System	4
2	Annulus Ventilation System Gamma Activity	Safety Information and Control System	4
3	Chemical and Volume Control System (CVCS) Boron Concentration	Protection System	4
4	Cold Leg Temperature (NR)	Protection System	4
5	Cold Leg Temperature (WR)	Protection System, Safety Information and Control System	4
6	Containment Equipment Compartment Pressure	Protection System	4
7	Containment Equipment Compartment Containment Service Compartment Delta Pressure	Protection System	4
8	Containment High Range Activity	Protection System, Safety Information and Control System	4
9	Containment Service Compartment Pressure (NR)	Protection System	4
10	Containment Service Compartment Pressure (WR)	Protection System, Safety Information and Control System	4
11	Core Outlet Thermocouples Wide Range Temperature	Safety Information and Control System	4
12	CVCS Charging Flow	Protection System	4
13	RCP Differential Pressure	Protection System	4
14	Emergency Feedwater Flow	Safety Automation System, Safety Information and Control System	4
15	Hot Leg Pressure (NR)	Protection System	4
16	Hot Leg Pressure (WR)	Protection System, Safety Information and Control System	4
17	Hot Leg Temperature (NR)	Protection System	4
18	Hot Leg Temperature (WR)	Protection System, Safety Information and Control System	4
19	Low Head Safety Injection Flow (WR)	Safety Information and Control System	4
20	Main Control Room (MCR) Air Intake Activity	Protection System	4

Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals (2 Sheets)

Item #	Signal	Destination	# Divisions
21	Main Steam Line Activity	Protection System, Safety Information and Control System	4
22	Medium Head Safety Injection Flow (WR)	Safety Information and Control System	4
23	Neutron Flux from Intermediate Range Detector (IRD)	Protection System, Safety Information and Control System	4
24	Neutron Flux from Power Range Detector (PRD)	Protection System, Safety Automation System	4
25	Neutron Flux from Self Powered Neutron Detectors (SPND)	Protection System	4
26	Neutron Flux from Source Range (SRD)	Safety Information and Control System	4
27	Pressurizer Level (NR)	Protection System	4
28	Pressurizer Pressure (NR)	Protection System, Safety Information and Control System	4
29	RCP Bus Breaker Position	Protection System	4
30	RCP Breaker Position	Protection System	4
31	RCS Loop Flow	Protection System	4
33	RCS Loop Level	Protection System	4
34	RCP Speed	Protection System	4
35	SG Level (NR)	Protection System	4
36	SG Level (WR)	Protection System, Safety Information and Control System, Safety Automation System	4
37	SG Pressure	Protection System, Safety Information and Control System, Safety Automation System	4
38	Temperature compensated rod cluster control assembly (RCCA) positions	Protection System	4

Table 2.4.25-4—Signal Conditioning and Distribution System ITAAC (4 Sheets)

Commitment Wording		Inspection, Tests, Analyses	Acceptance Criteria
2.1	SCDS equipment is located as listed in Table 2.4.25-1.	Inspections will be performed for the location of the SCDS equipment.	The SCDS equipment listed in Table 2.4.25-1 is located as listed in Table 2.4.25-1.
2.2	Physical separation exists between the four divisions of the SCDS.	Inspections will be performed to verify that the divisions of the SCDS are located in separate Safeguard Buildings	The four divisions of the SCDS are located in separate Safeguard Buildings as listed in Table 2.4.25-1.
2.3	Physical separation exists between Class 1E SCDS equipment and non-Class 1E equipment.	<p>a. Design analyses will be performed to determine the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between Class 1E SCDS equipment and non-Class 1E equipment.</p> <p>b. Inspections will be performed to verify that the required safety-related structures, separation distance, barriers, or any combination thereof exist between the Class 1E SCDS equipment and non-Class 1E equipment.</p>	<p>a. A report exists and defines the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between Class 1E SCDS equipment and non-Class 1E equipment.</p> <p>b. The required safety-related structures, separation distance, barriers, or any combination thereof exist between Class 1E SCDS equipment and non-Class 1E equipment. Reconciliation is performed of any deviations to the design.</p>

Table 2.4.25-4—Signal Conditioning and Distribution System ITAAC (4 Sheets)

Commitment Wording		Inspection, Tests, Analyses	Acceptance Criteria
3.1	Equipment identified as Seismic Category I in Table 2.4.25-1 can withstand seismic design basis loads without loss of safety function.	<p>a. Type tests, analyses or a combination of type tests and analyses will be performed on the equipment listed as Seismic Category I in Table 2.4.25-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.</p> <p>b. Inspections will be performed of the Seismic Category I equipment listed in Table 2.4.25-1 to verify that the equipment including anchorage is installed as specified on the construction drawings.</p>	<p>a. Test/analysis reports exist and conclude that the as designed equipment listed in Table 2.4.25-1 can withstand seismic design basis loads without loss of safety function.</p> <p>b. Inspection reports exist and conclude that the Seismic Category I equipment listed in Table 2.4.25-1 including anchorage is installed as specified on the construction drawings.</p>
4.1	The SCDS receives input signals from the sources listed in Table 2.4.25-2.	Tests will be performed to verify the existence of input signals.	The SCDS receives the input signals listed in Table 2.4.25-2.
4.2	The SCDS provides the output signals listed in Table 2.4.25-3	Tests will be performed to verify the existence of output signals.	The SCDS provides output signals to the recipients listed in Table 2.4.25-3.
4.3	Bypassed or inoperable SCDS channel status information is retrievable in the MCR.	A test of the SCDS will be performed.	Bypassed or inoperable SCDS channels status information is retrievable in the MCR.

Table 2.4.25-4—Signal Conditioning and Distribution System ITAAC (4 Sheets)

	Commitment Wording	Inspection, Tests, Analyses	Acceptance Criteria
4.4	Electrical isolation is provided on connections between SCDS Class 1E equipment and non-Class 1E equipment	<ul style="list-style-type: none"> a. Analyses will be performed to determine the test specification for electrical isolation devices on connections between the Class 1E equipment and non-Class 1E equipment. b. Type tests, analyses, or a combination of type tests and analyses will be performed on the electrical isolation devices between SCDS Class 1E equipment and non-Class 1E equipment. c. Inspections will be performed on the connections between the SCDS Class 1E equipment and non-Class 1E equipment. 	<ul style="list-style-type: none"> a. A test plan exists that provides the test specification for determining whether a device is capable of preventing the propagation of credible electrical faults on connections between the SCDS Class 1E equipment and non-Class 1E equipment. b. A report exists and concludes that the Class 1E isolation devices used between the SCDS Class 1E equipment and non-Class 1E equipment prevent the propagation of credible electrical faults. c. Class 1E electrical isolation devices exist on connections between the SCDS Class 1E equipment and non Class 1E equipment.
4.5	The SCDS equipment listed as Class 1E in Table 2.4.25-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.	Type tests, tests, analyses or a combination of these will be performed on the Class 1E equipment listed in Table 2.4.25-1.	A report exists and concludes that the equipment listed as Class 1E in Table 2.4.25-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.

Table 2.4.25-4—Signal Conditioning and Distribution System ITAAC (4 Sheets)

	Commitment Wording	Inspection, Tests, Analyses	Acceptance Criteria
5.1	Class 1E SCDS components are powered from a Class 1E division in a normal or alternate feed condition.	<ul style="list-style-type: none"> a. Testing will be performed for components identified as Class 1E in Table 2.4.25-1 by providing a test signal in each normally aligned division. b. Testing will be performed for components identified as Class 1E in Table 2.4.25-1 by providing a test signal in each division with the alternate feed aligned to the divisional pair. 	<ul style="list-style-type: none"> a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.4.25-1. b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E components identified in Table 2.4.25-1.

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