

**U.S. NRC**

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

# Engineered Safety Features Actuation System

Chapter 10.2

B&W Cross-Training Course

R-326C

# OBJECTIVES

1. List the functions provided by the engineered safety features actuation system (ESFAS).
2. List the ESFAS signals and the accidents that will initiate each.
3. Define the following terms:
  - a. Analog subsystem
  - b. Digital subsystem
  - c. ESFAS channel
  - d. Unit control module

# OBJECTIVES

4. Describe the sequence of events (flowpath) for an ESFAS signal from the sensor to component actuation, including ESFAS logic.
5. List the systems that are actuated by ESFAS signals.
6. Explain when and how the ESFAS is bypassed.
7. Explain how the control room operator gains equipment control after an ESFAS actuation has occurred

# OBJECTIVES

8. Describe the status of the ESFAS following the loss of one train of the vital 120-Vac distribution system.
9. Describe the purpose of the Secondary Protection System and explain how that purpose is accomplished.

# ESFAS Functions

ESFAS actuates & realigns equipment to perform the following functions:

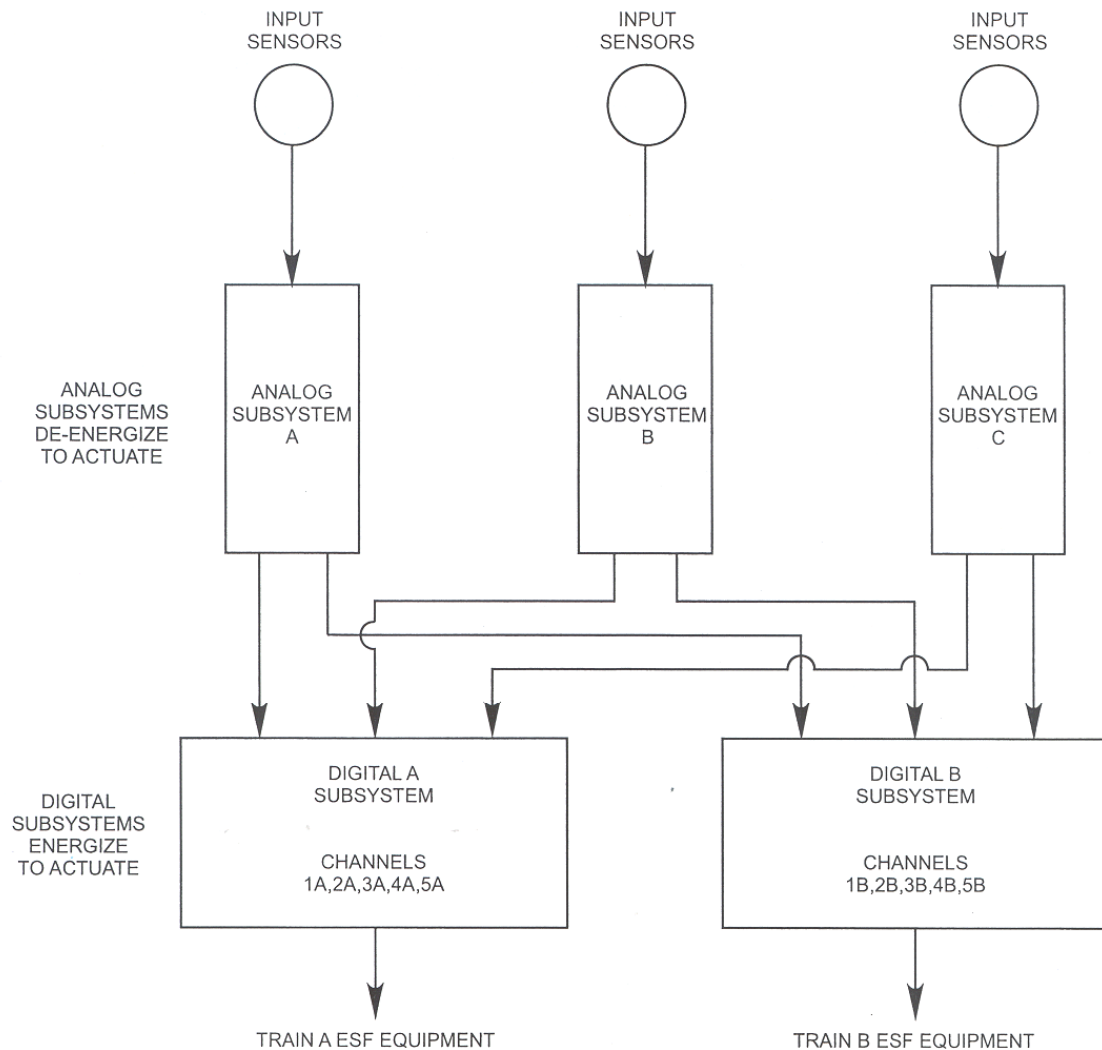
- Minimize fuel cladding damage.
- Provide Rx building isolation.
- Decrease Rx building pressure.
- Remove fission products from Rx building atmosphere.
- Provide long-term core cooling.

# Engineered Safety Features Actuation

- Three separate, redundant analog subsystems detect need for ESF actuation. Inputs from:
  - RCS pressure ( $< 1600$  psig)
  - Rx Building pressure ( $> 4$ ,  $>25$  psig)
  - BWST level ( $< 5.1$  ft)
- Two separate, redundant digital subsystems that actually start equipment.

**TABLE 10.2-1 ESFAS ACTUATION SUMMARY**

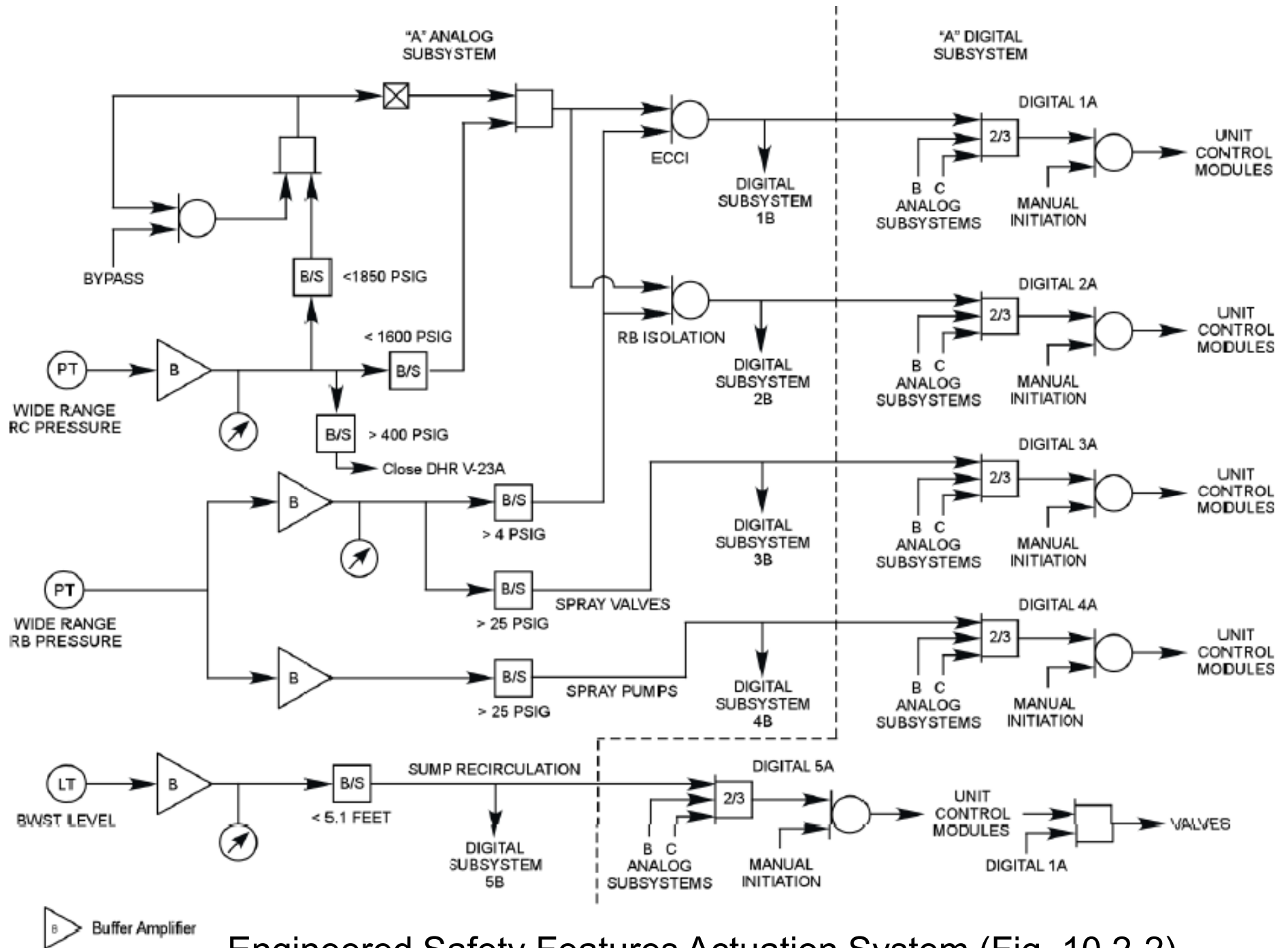
Actuation Signals	Digital Channels	Actuated Systems/Components
Low RCS Pressure (<1600 psig) High RB Pressure (>4 psig)	1A, 1B	High Pressure Injection Low Pressure Injection Makeup System Isolation Auxiliary Feedwater Diesel Generators Turbine Trip
Low RCS Pressure (<1600 psig) High RB Pressure (>4 psig)	2A, 2B	All Nonsafety-related RB Penetrations
High-High RB Pressure (>25 psig)	3A, 3B	RB Spray Header Isolation Valves
High-High RB Pressure (>25 psig)	4A, 4B	RB Spray Pumps
Low BWST Level (<5.1 ft)	5A, 5B	LPI Sump Suction Valves RB Spray Sump Suction Valves



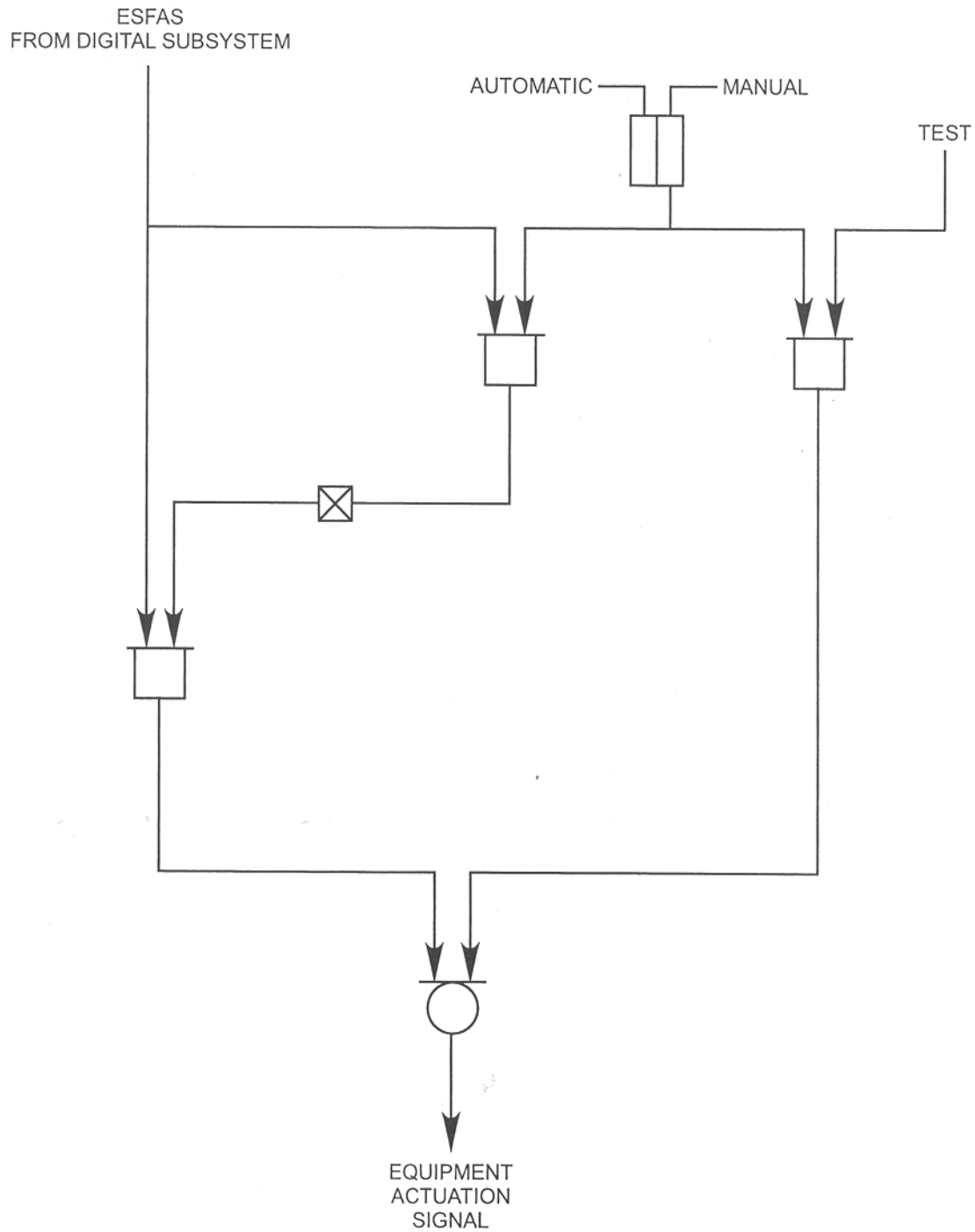
CHANNEL	EQUIPMENT
1A, 1B	HPI, LPI, EDGs, AFW, TURBINE TRIP, M/U SYSTEM ISOLATION
2A, 2B	RB ISOLATION AND COOLING
3A, 3B	RB SPRAY ISOLATION VALVES
4A, 4B	RB SPRAY PUMPS
5A, 5B	SUMP RECIRCULATION

Engineered Safety Features Actuation System (Block Diagram)  
Fig. 10.2-1





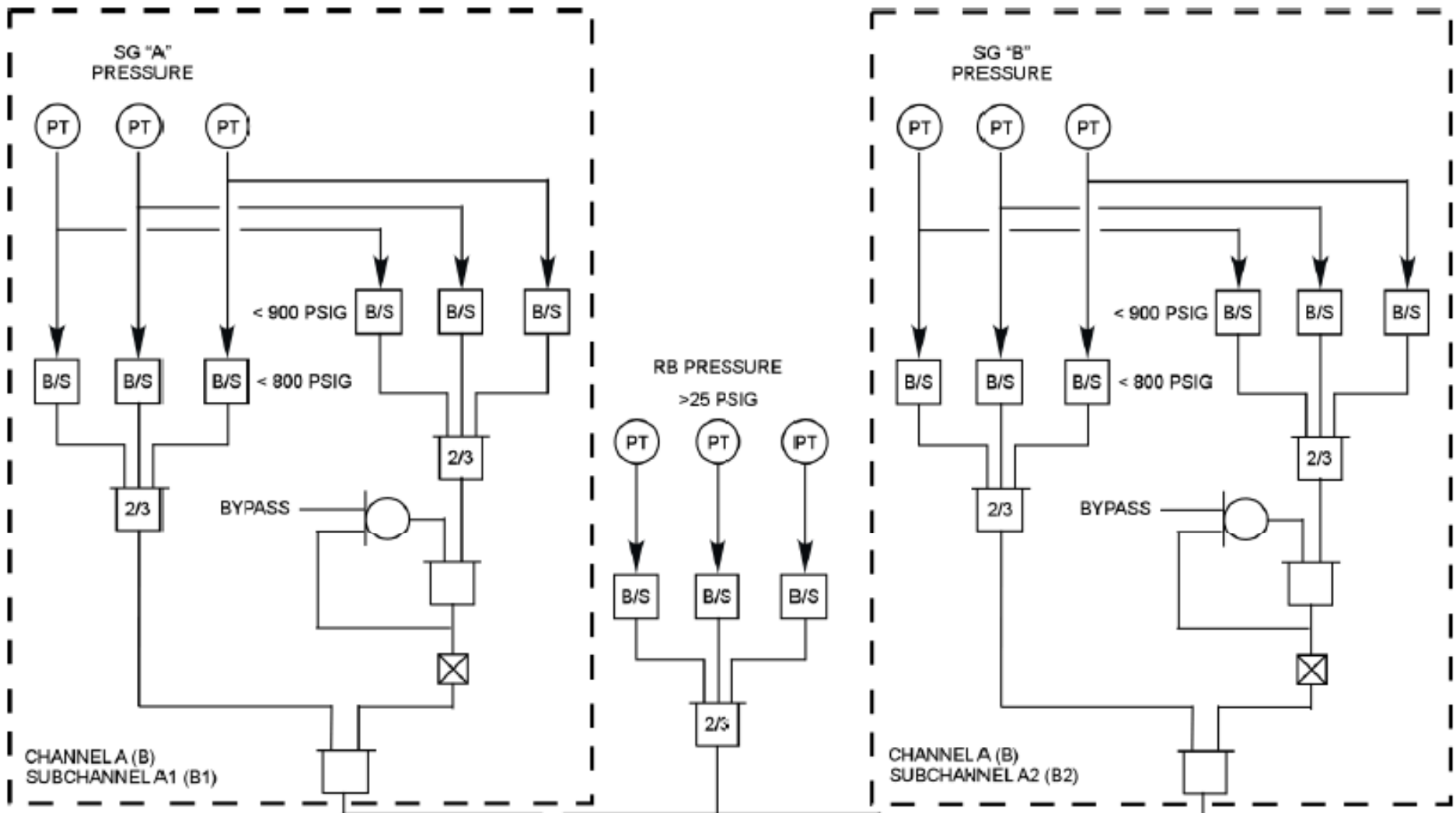
Engineered Safety Features Actuation System (Fig. 10.2-2)



Unit Control Module  
Logic  
Fig. 10.2-3

**TABLE 10.2-2 SECONDARY PROTECTION SYSTEM SUMMARY**

CHANNEL A		CHANNEL B	
Sub-Channel A1 A-OTSG	Sub-Channel A2 B-OTSG	Sub-Channel B1 A-OTSG	Sub-Channel B2 B-OTSG
Close MSIVs Close MFIV - V17A Start 1A & 3C AFW Trip both MFPs	Close MSIVs Close MFIV - V29A Start 1A & 3C AFW Trip both MFPs	Close MSIVs Close MFIV - V16B Start 2B & 3C AFW Trip both MFPs	Close MSIVs Close MFIV - V28B Start 2B & 3C AFW Trip both MFPs



# Secondary Protection System

Fig. 10.2-4