

# Rod Block Monitor System (RBM)

304B Chapter 5.5

# Objectives

1. Identify the purposes of the RBM system.
2. Recognize the purpose, function and operation of major system components:
  - a) Select relay matrix
  - b) Count circuit
  - c) Gain change circuit
  - d) Averaging circuit
  - e) Slope and bias circuit
  - f) Trip reference level select circuit

# Objectives (continued)

3. Describe the operation of the RBM system for the following conditions:
  - a. central control rod withdrawal above 30 percent power
  - b. edge control rod withdrawal above 30 percent power
  - c. any control rod withdrawal below 30 percent power

# Objectives (continued)

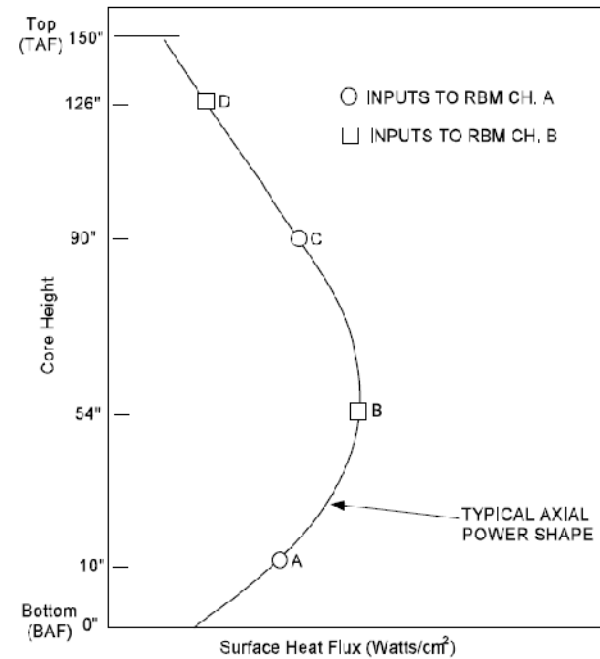
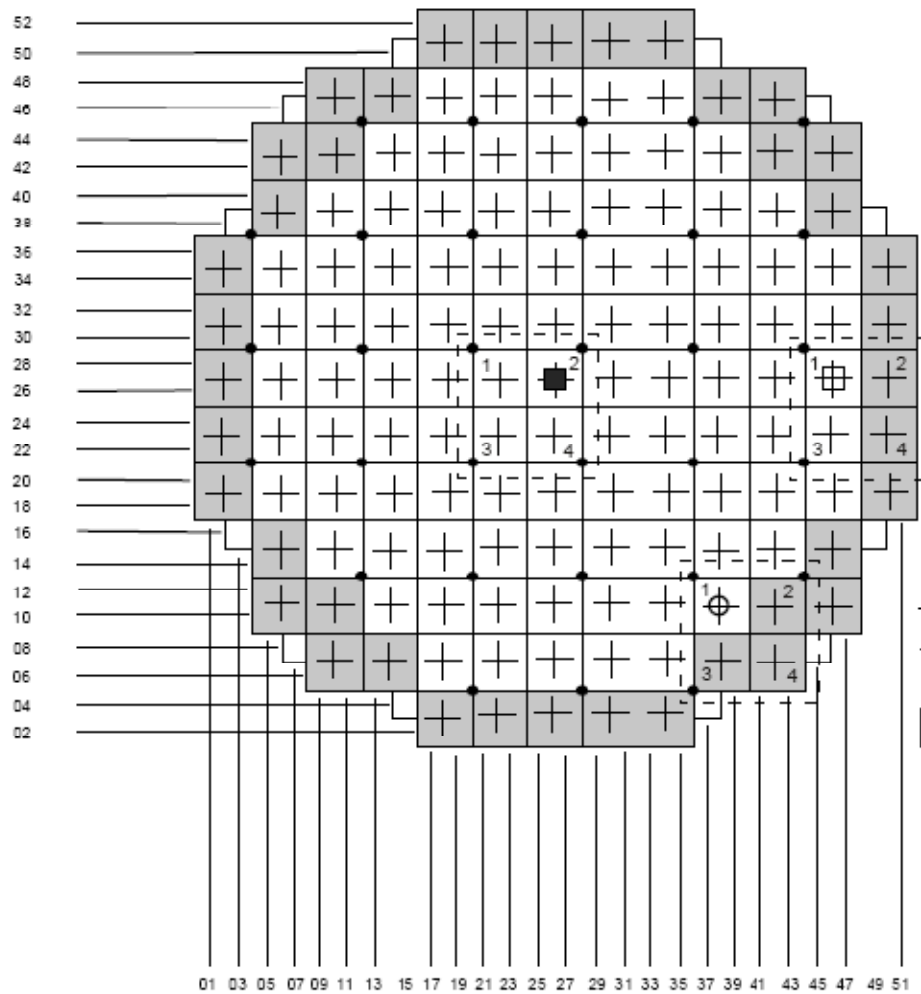
4. Explain the system's interfaces with:
  - a) Local Power Range Monitoring System
  - b) Recirculation System
  - c) Reactor Manual Control System
  - d) Average Power Range Monitoring System

# Purposes

The RBM system has two purposes:

- o Monitor the power around a selected control rod and overall reactor power
- o Prevent control rod withdrawal that could cause a violation of core thermal limits (MCPR)

# Overview

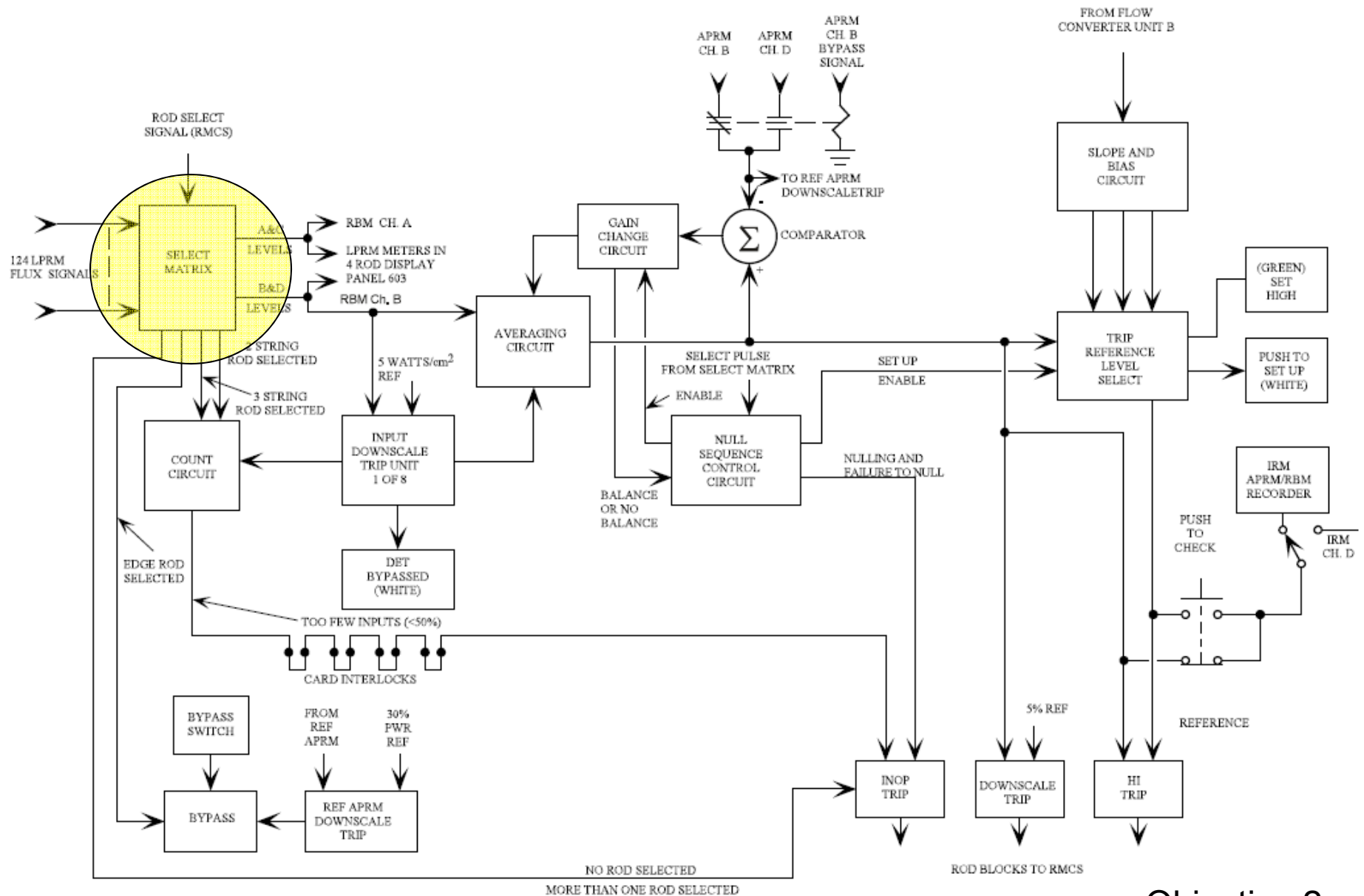


LPRM - Assembly Assigned to RBM

- ⊠ Rcd 46-27 Selected Resulting in Two LPRM Strings Assigned
- ⊙ Rcd 38-11 Selected Resulting in Three LPRM Strings Assigned
- Rcd 22-27 Selected Resulted in Four LPRM Strings Assigned
- ⊕ RBM Automatically Bypassed (Reading Zeroed)

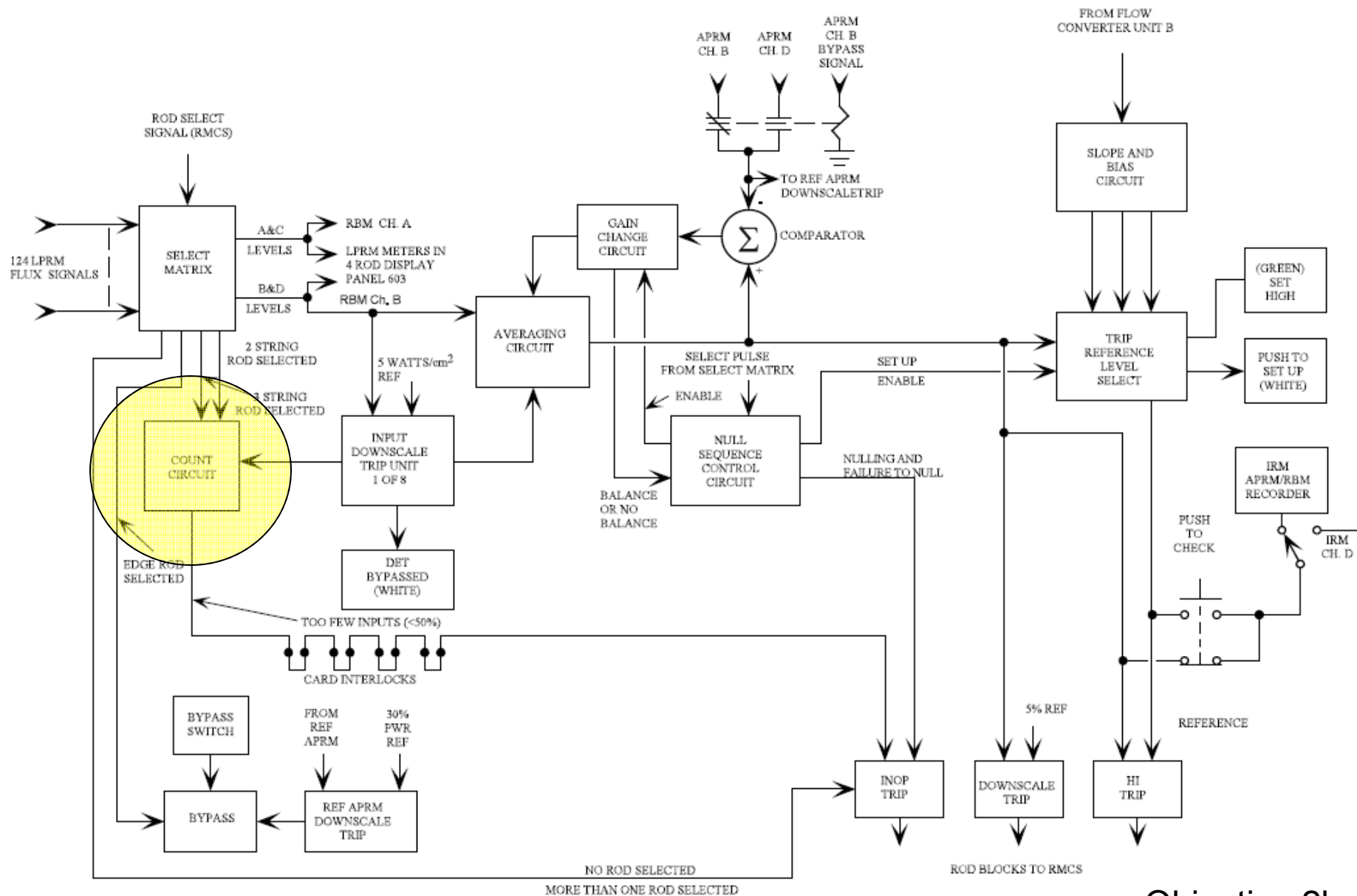
NOTE: Assignment is automatically initiated upon Rod Selection

# Select Relay Matrix



Objective 2a

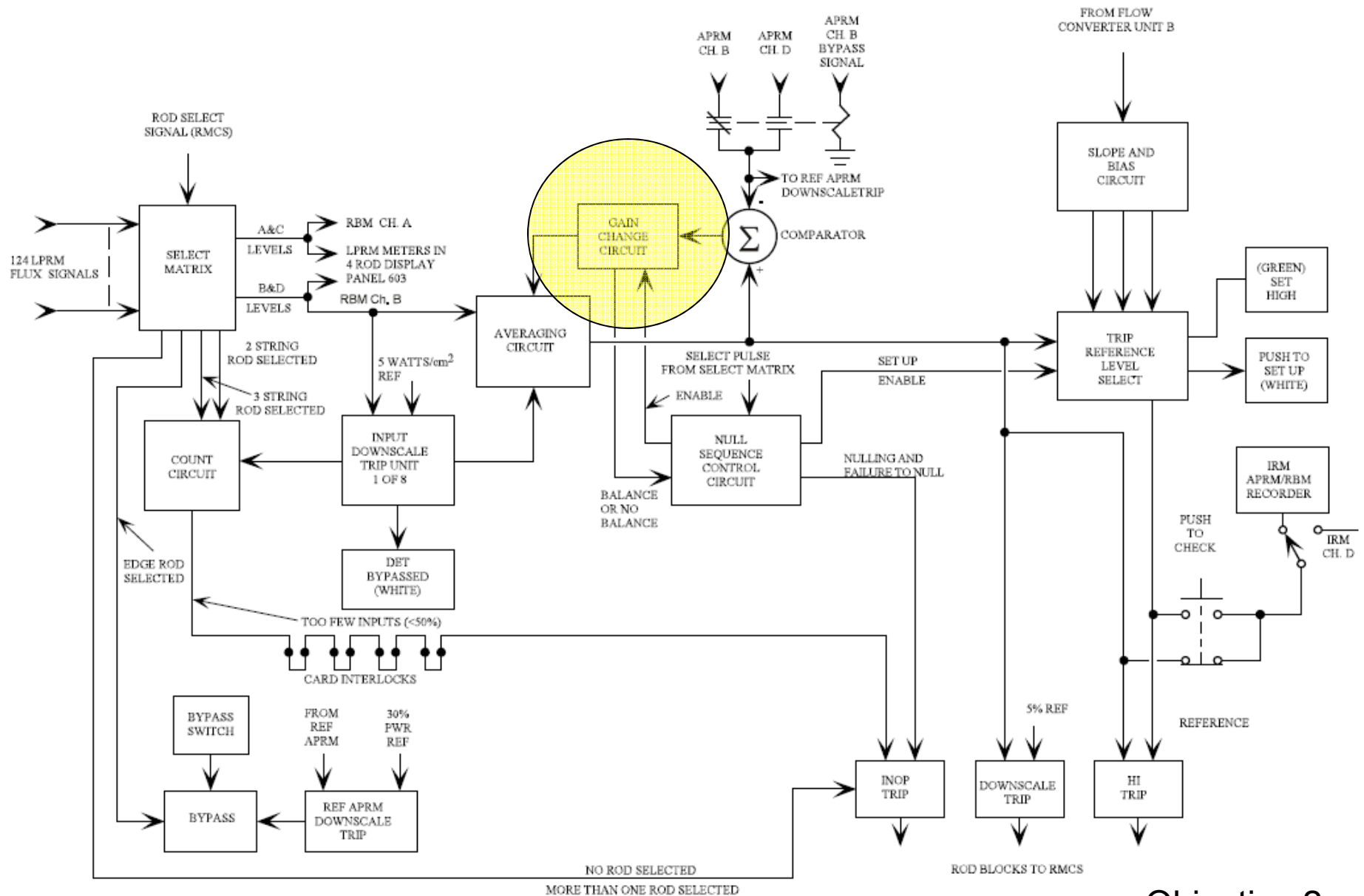
# Count Circuit



Objective 2b

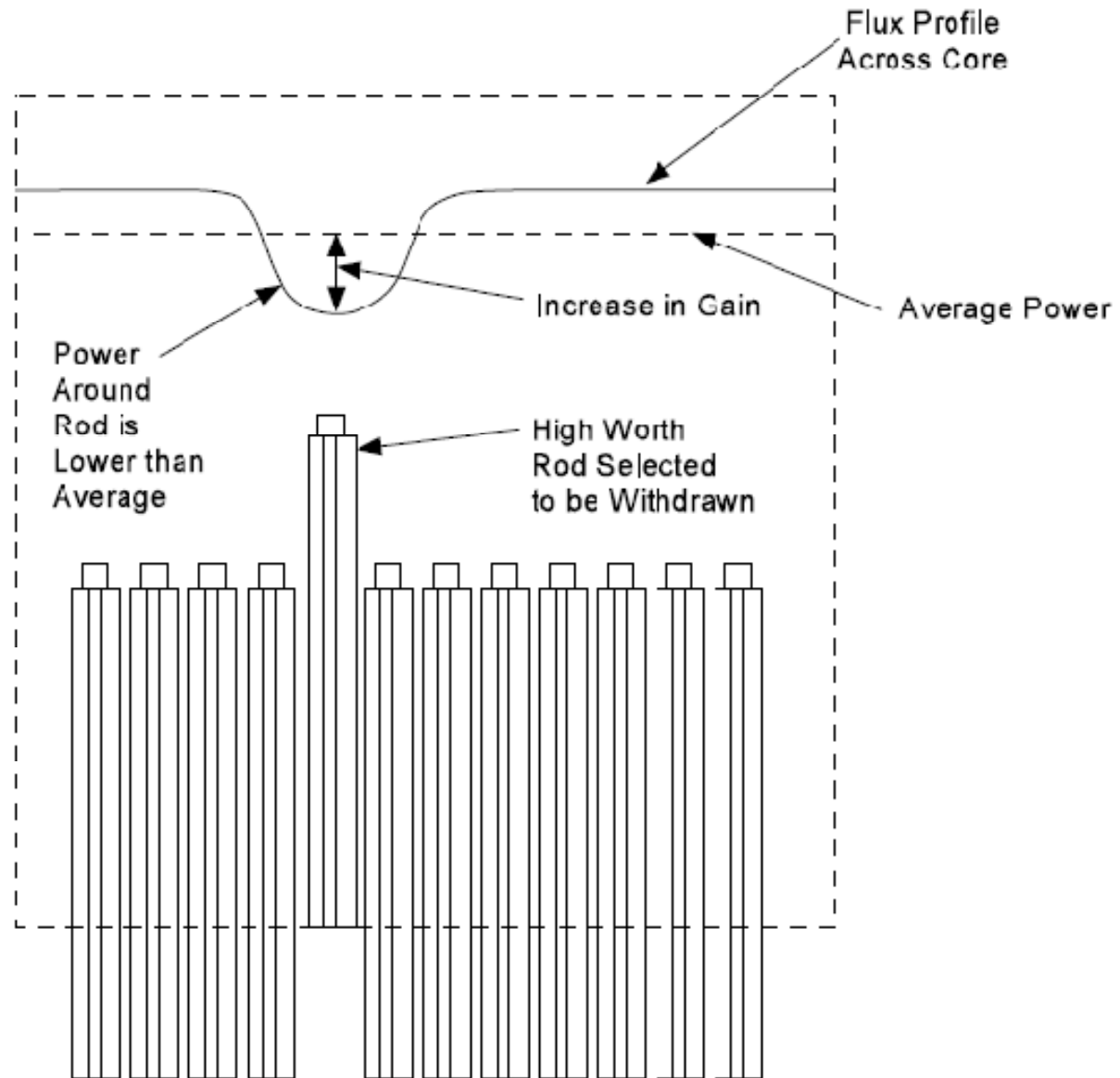


# Gain Change Circuit

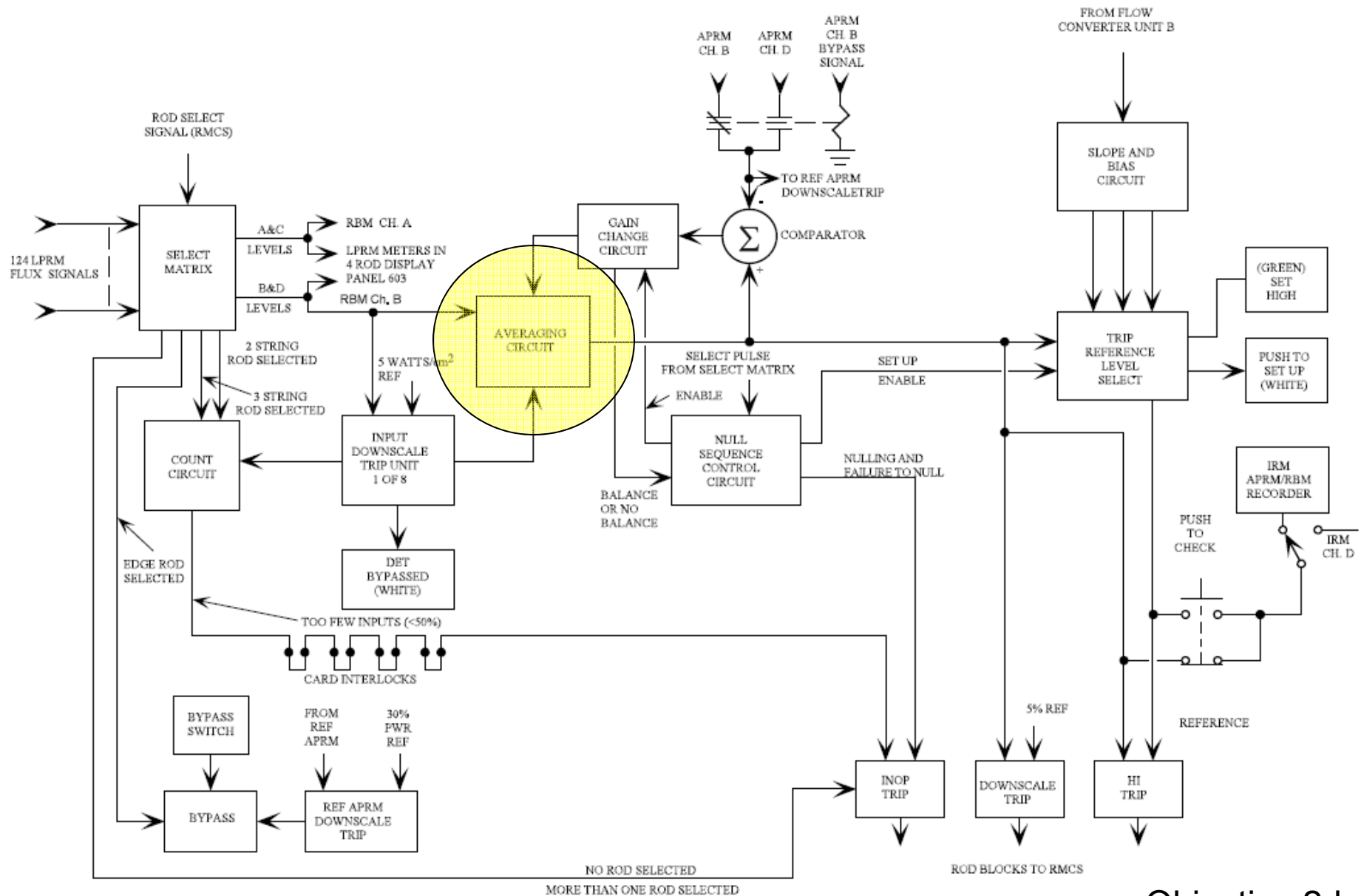


Objective 2c

# Gain Change Circuit

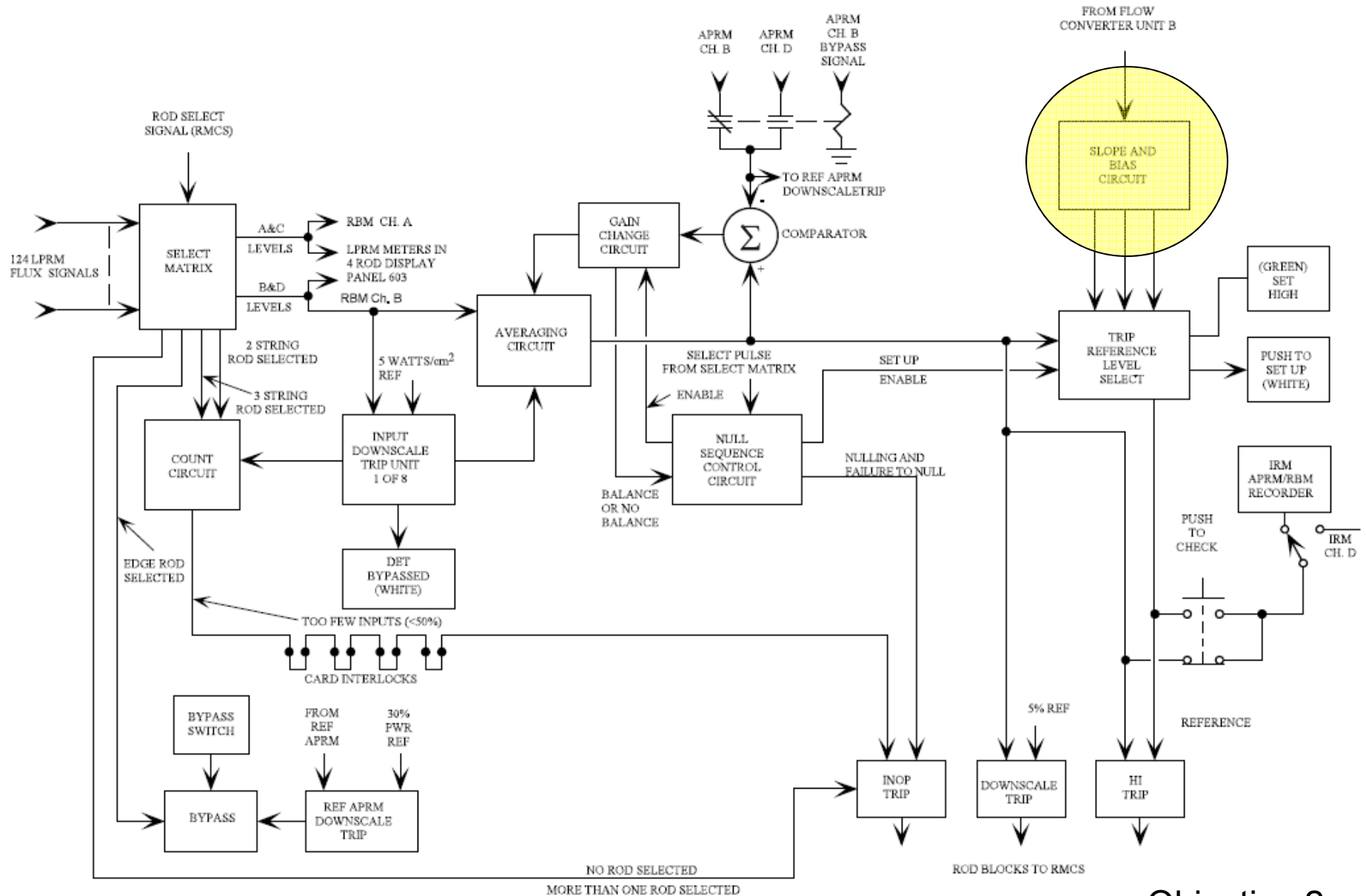


# Averaging Circuit



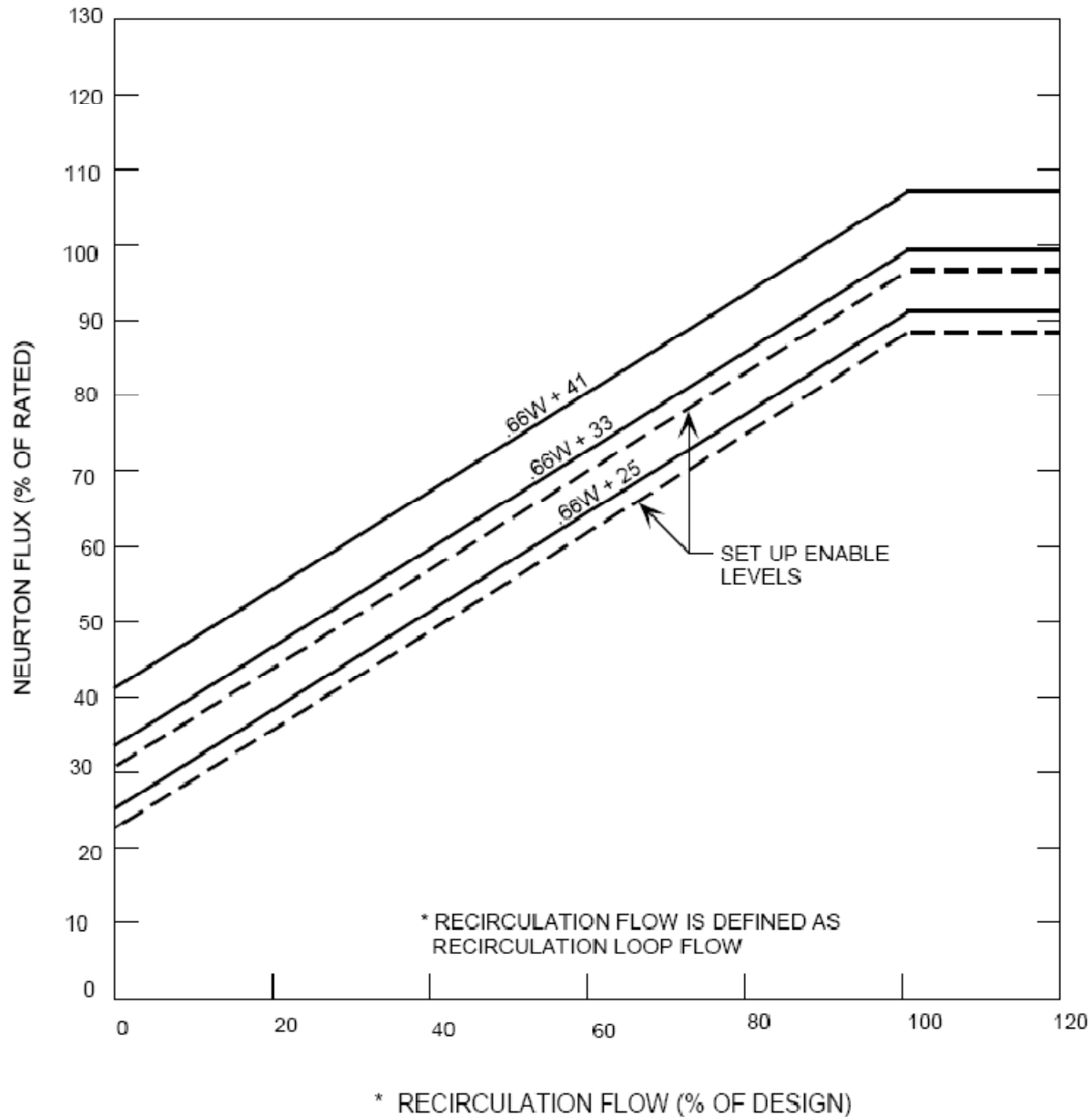
Objective 2d

# Slope and Bias Circuit



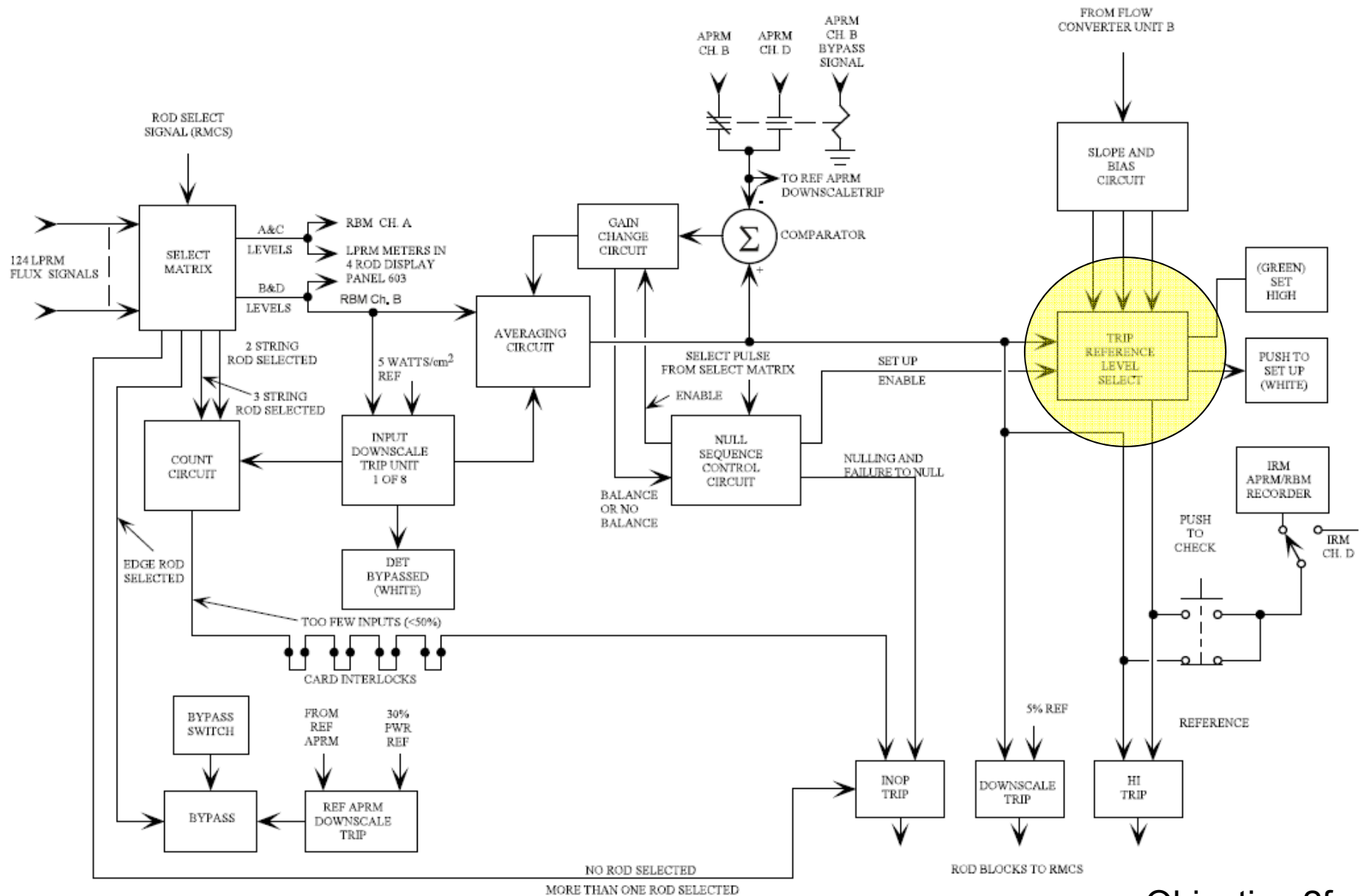
Objective 2e

# Slope and Bias Circuit



Objective 2e

# Trip Reference Level Select Circuit



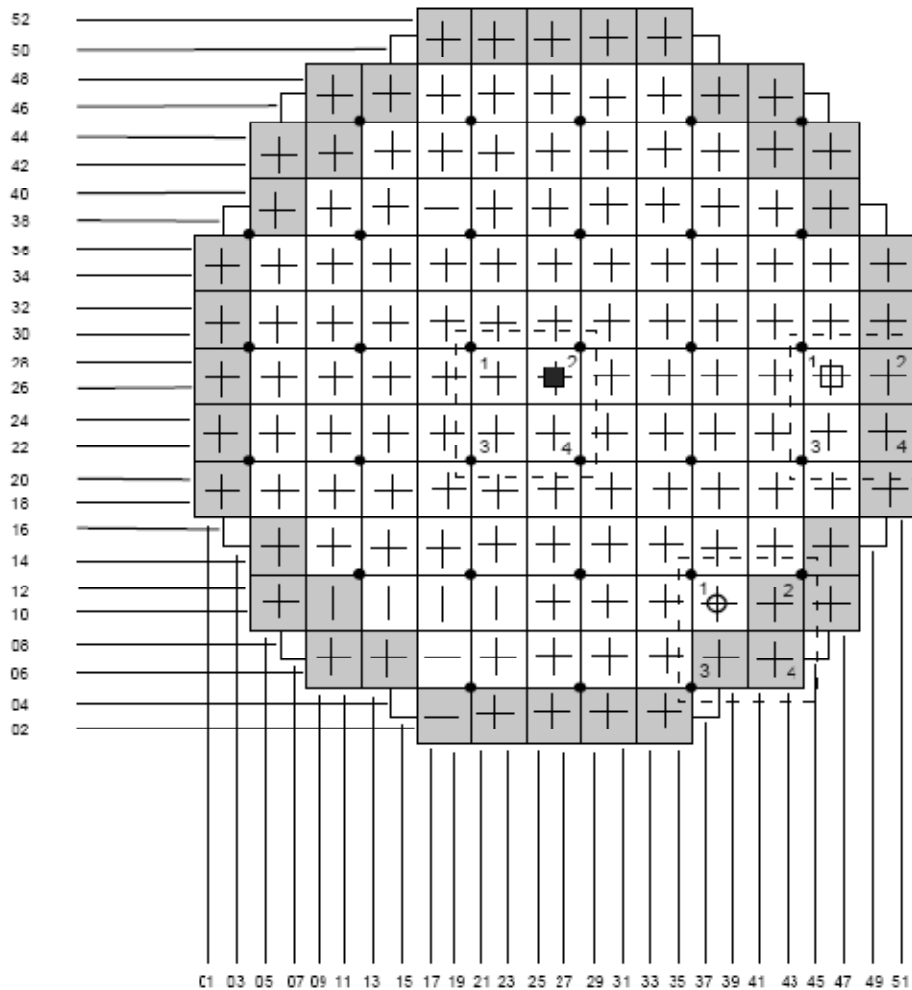
# Protective Trips

ALARM or TRIP	SETPOINT	ANNUNCIATOR	ACTION	AUTO BYPASS
RBM Upscale	.66W + 41 .66W + 33 .66W + 25 % Power	RBM UPSCALE /INOP	Rod Withdraw Block Signal to RMCS	APRM Reference Low Level (30% Power) or Edge Rod Selected
RBM Downscale	5% Power	RBM Downscale	Rod Withdraw Block Signal to RMCS	APRM Reference Low Level (30% Power) or Edge Rod Selected
RBM INOP	(1)	RBM UPSCALE /INOP	Rod Withdraw Block Signal to RMCS	APRM Reference Low Level (30% Power) or Edge Rod Selected
RBM Bypassed	Bypass Switch on Panel 603 (2)			

1. Produced by:
  - a. Local panel mode switch not in operate.
  - b. Module unplugged.
  - c. Less than required number at LPRM inputs.
  - d. RBM fails to null.
  
2. Only one RBM may be bypassed.

# Operation

## Central Control Rod Withdrawal Above 30% Power



**RBM A uses the A & C detectors in the 2, 3, or 4 LPRM strings around the selected rod.**

**RBM B uses the B & D detectors in the 2, 3, or 4 LPRM strings around the selected rod.**

**If either gain-adjusted RBM power level exceeds a valid flow-biased setpoint, a rod withdrawal block signal is sent to RMCS.**

Objective 3

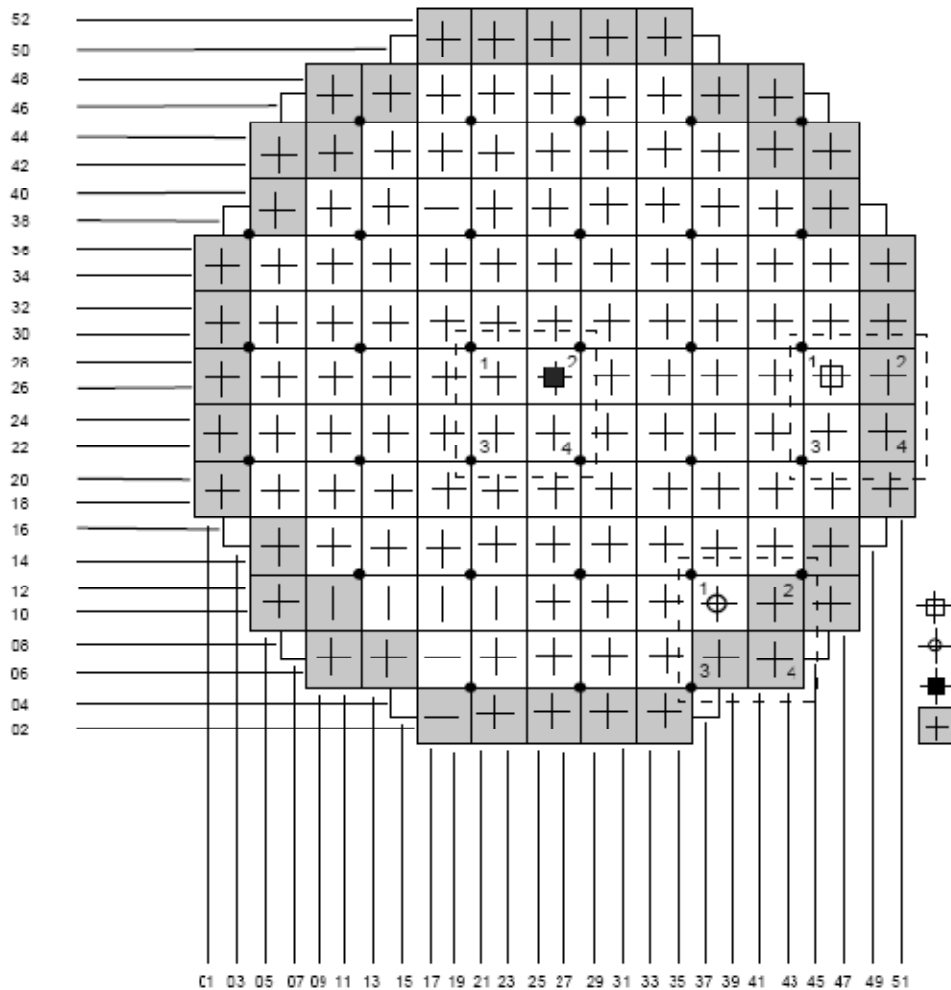


# Operation

## Edge Control Rod Withdrawal Above 30% Power

RBM A & RBM B are both bypassed upon selection of an edge (shaded) control rod above 30 percent power.

An edge control rod can always be withdrawn above 30 percent power without a RBM rod withdrawal block ever being sent to the RMCS.



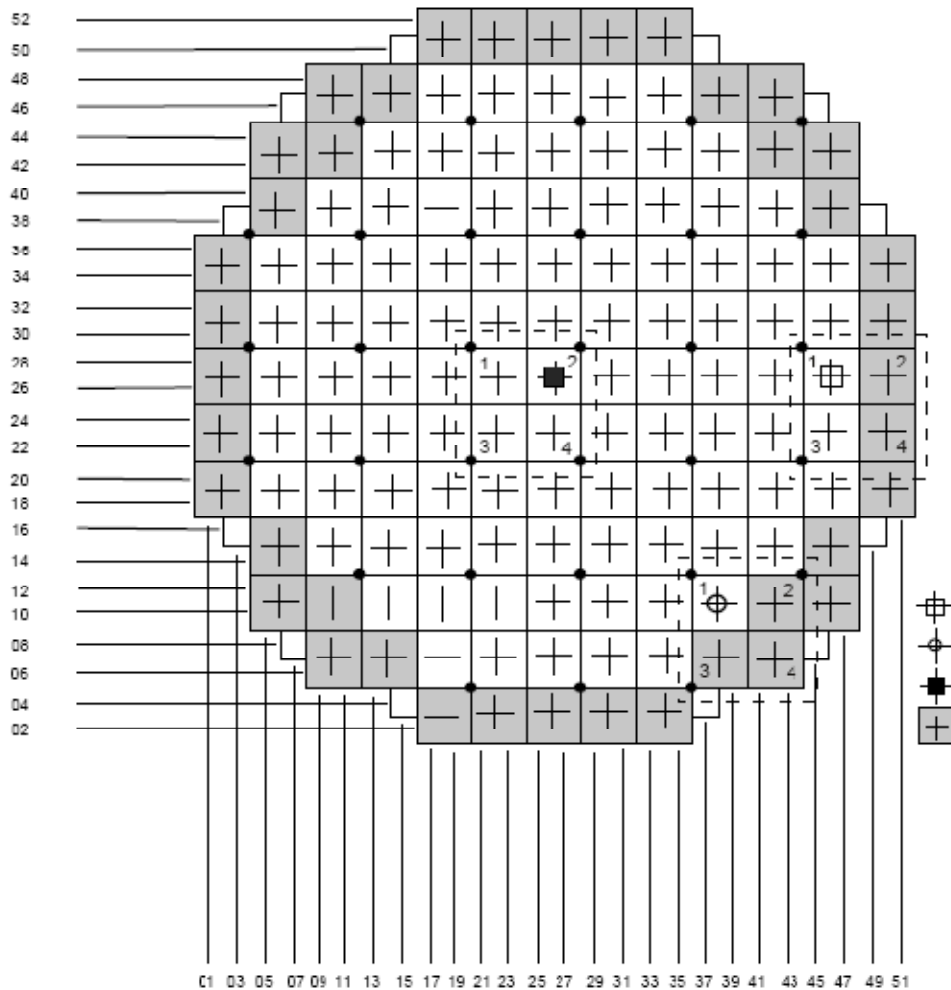
# Operation

## Any Control Rod Withdrawal Below 30% Power

RBM A & RBM B are both bypassed upon selection of any control rod below 30 percent power.

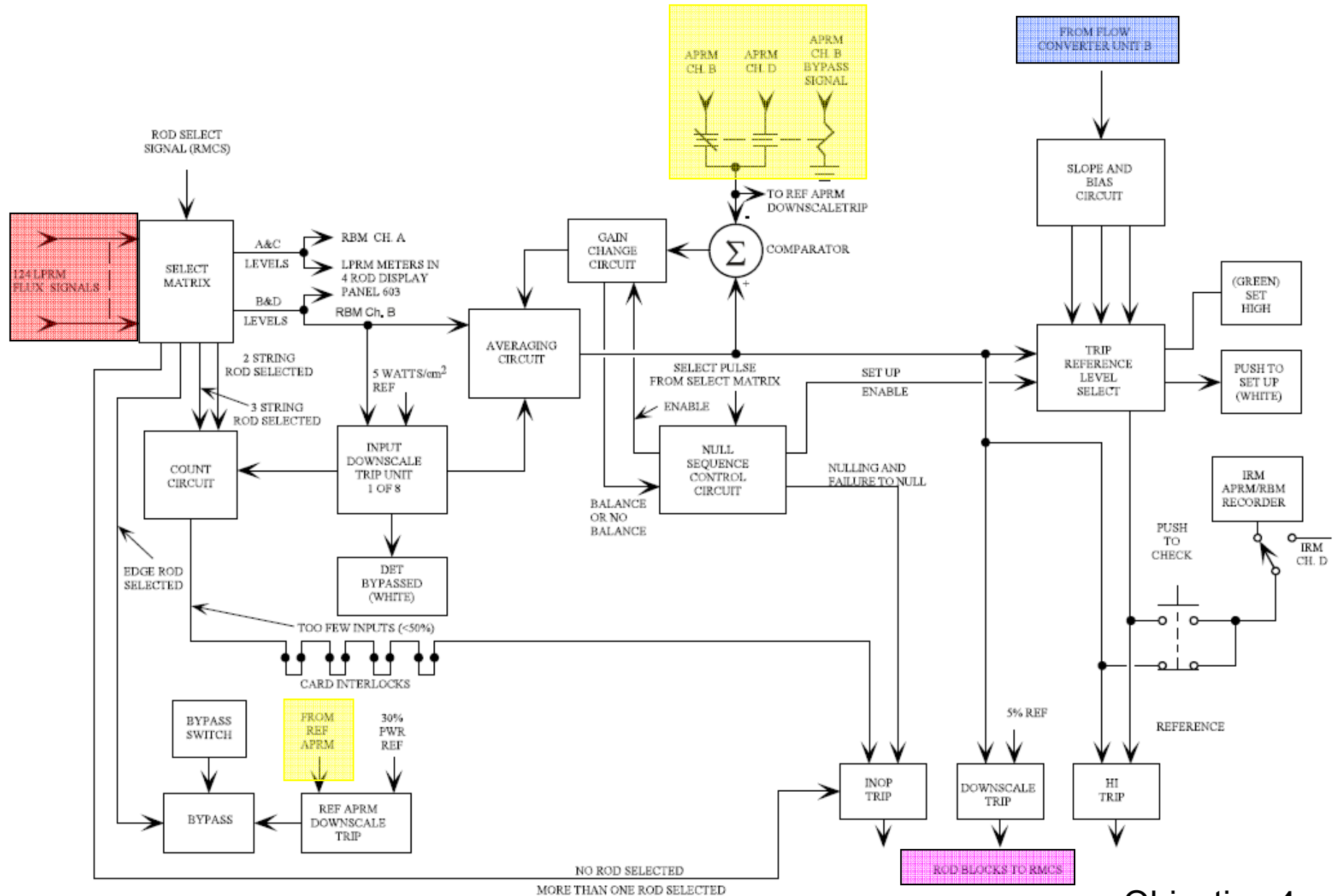
Any control rod can always be withdrawn below 30 percent power without a RBM rod withdrawal block ever being sent to the RMCS as long as APRM power remains below 30%.

If APRM power rises above 30% during rod withdrawal, the applicable case above applies.



Objective 3

# System Interfaces



Objective 4

# Review Objectives

1. Identify the system's purposes.
2. Recognize the purpose, function and operation of major system components:
  - a) select relay matrix
  - b) count circuit
  - c) gain change circuit
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  - e) slope and bias circuit
  - f) trip reference level select circuit

# Review Objectives (continued)

3. Describe the operation of the RBM system for the following conditions:
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# Review Objectives (continued)

## 4. Explain the system's interfaces with:

- a) reactor manual control system
- b) recirculation system
- c) local power range monitoring system
- d) average power range monitoring system

Are there any questions?