EXCORE NUCLEAR INSTRUMENTATION SYSTEM

Section 9.1

HRTD
Human Resources
Training & Development

Objectives

1. List the purposes of the excore nuclear instrumentation system.

2. List the reactor protection system inputs provided by the excore nuclear instrumentation system and the purpose (basis) of each.

Objectives (Cont.)

3. List the interlocks and permissives provided by excore nuclear instrumentation system and the purpose (basis) of each.

4. Explain how the excore nuclear instrumentation system is capable of detecting both axial and radial (azimuthal) power distribution.

5. Explain how the power range signal is calibrated to indicate reactor thermal output.

Objectives (Cont.)

6. Explain why gamma compensation is required only in the source and intermediate ranges.

7. Explain the effects of an improperly compensated intermediate range.

8. Explain why channel test signals are additive to the channel outputs.

Excore NIS Purpose

- Provides indication of Reactor power from shutdown to full power conditions.
- Provides inputs to the Reactor Protection System during start up and power operation.
- Provides reactor power information to Rod Control System (Auto).
- Provides axial and radial power distribution information.

Fig 9.1-1

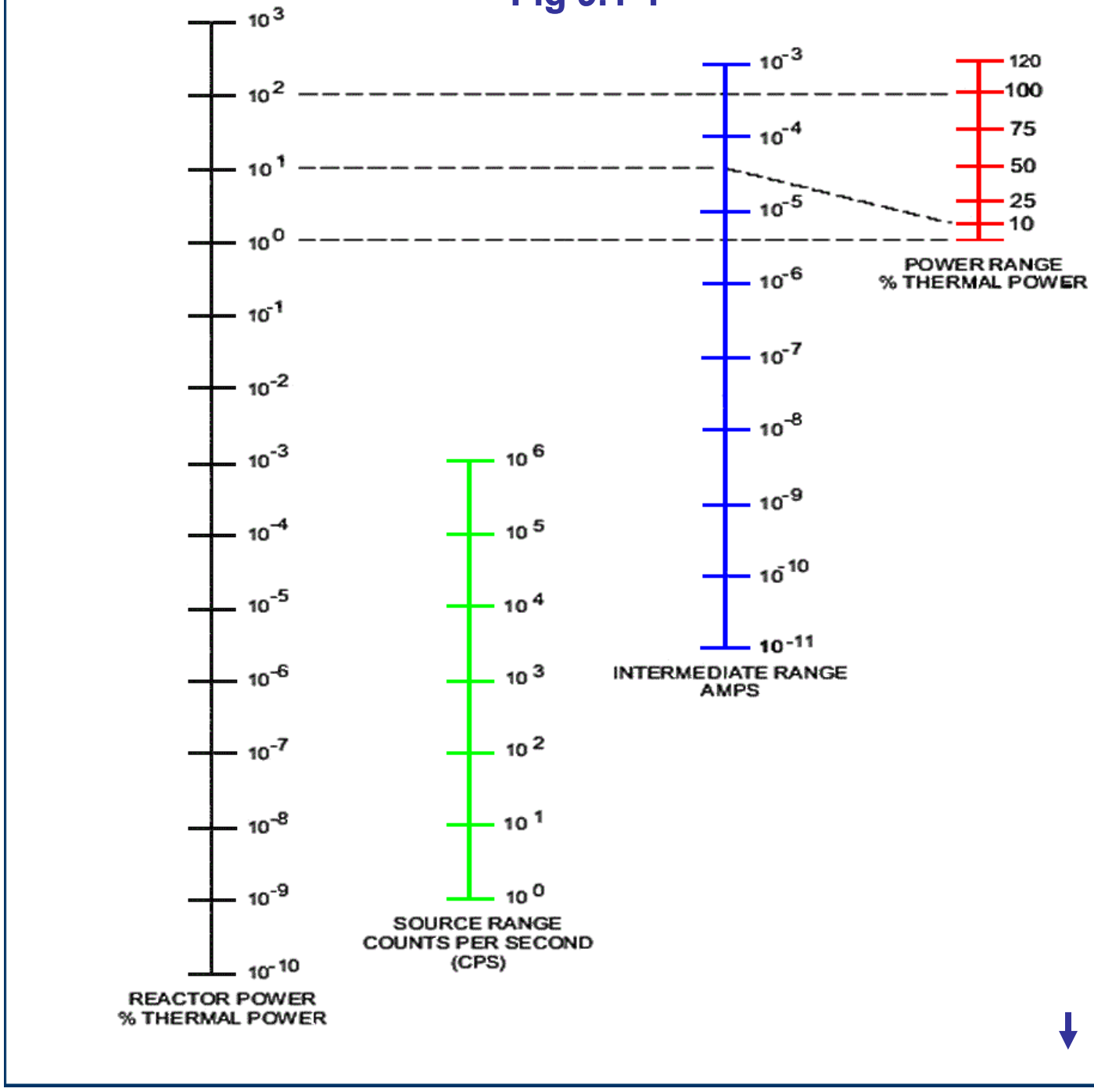
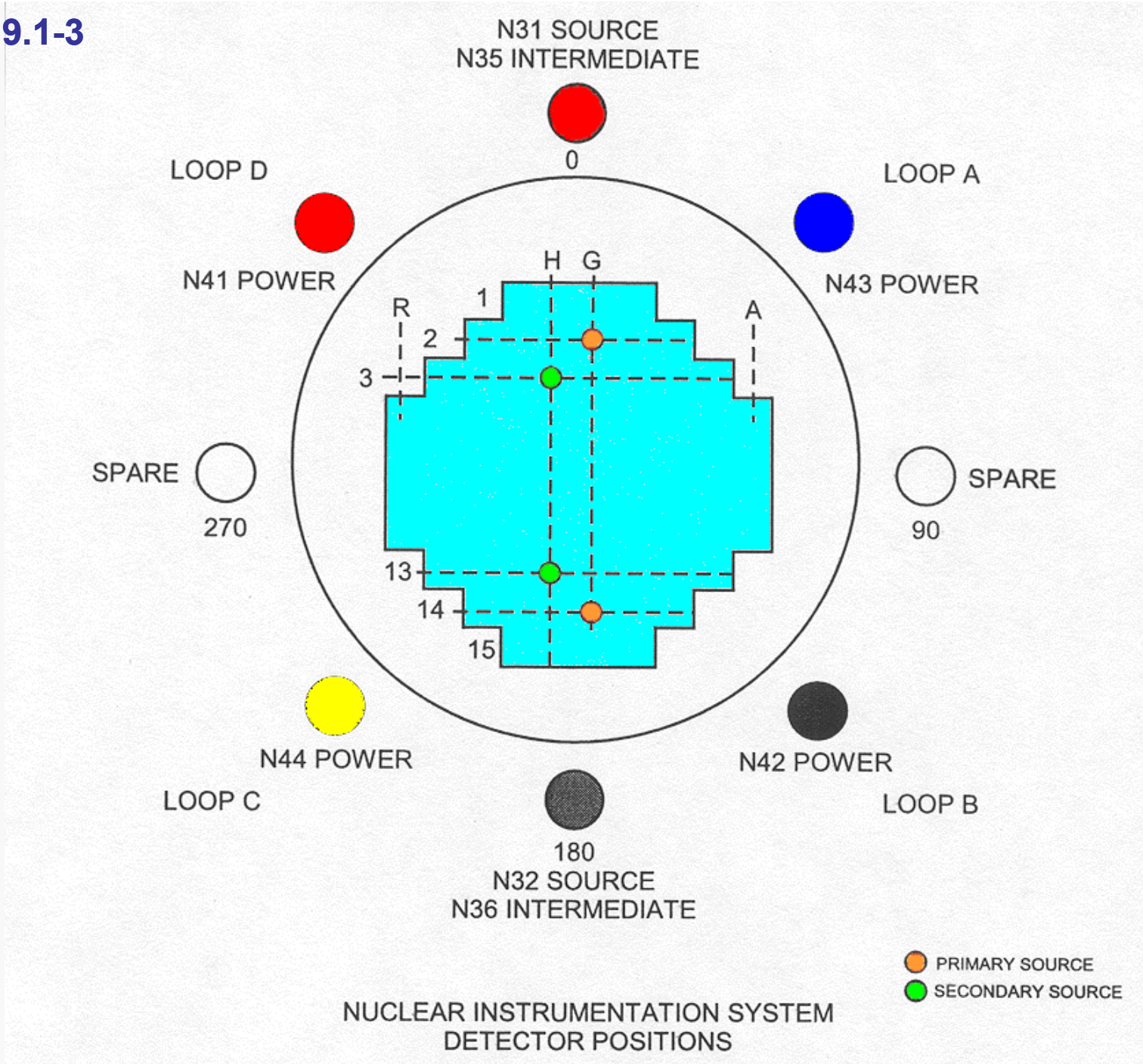
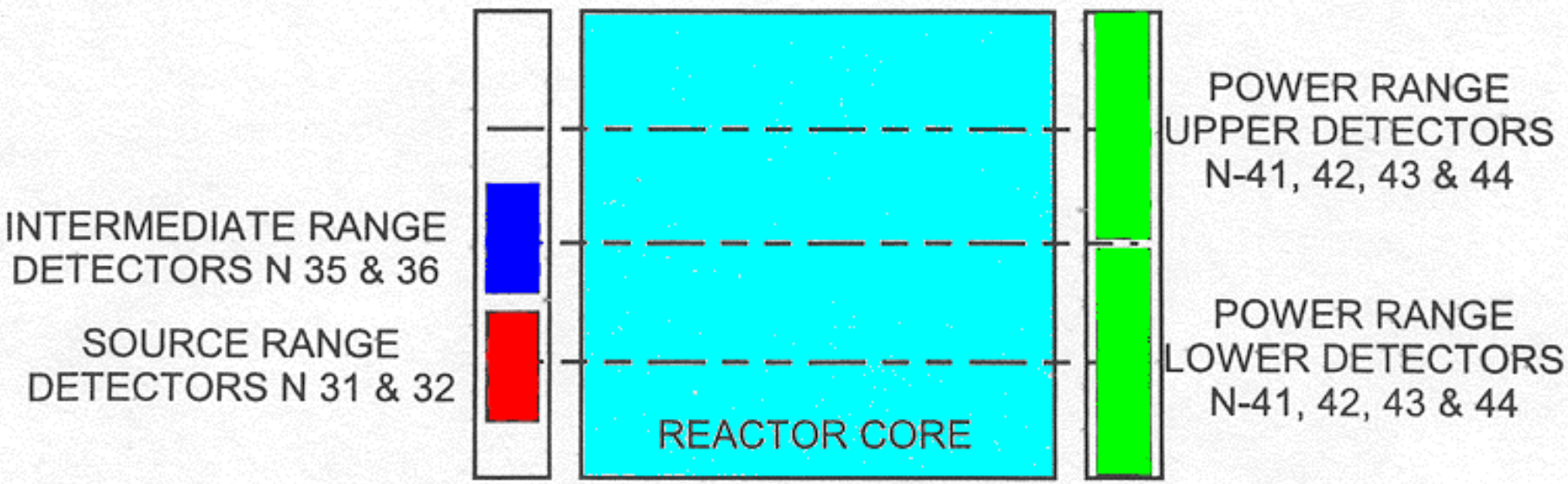

10^{3}
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-10}
REACTOR POWER
% THERMAL POWER
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10^{1}
10^{0}
SOURCE RANGE
COUNTS PER SECOND
(CPS)
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-10}
10^{-11}
INTERMEDIATE RANGE
AMPS
120
100
75
50
25
10
POWER RANGE
% THERMAL POWER

Fig 9.1-3



NUCLEAR INSTRUMENTATION SYSTEM
DETECTOR POSITIONS

Fig 9.1-3



CROSS SECTION

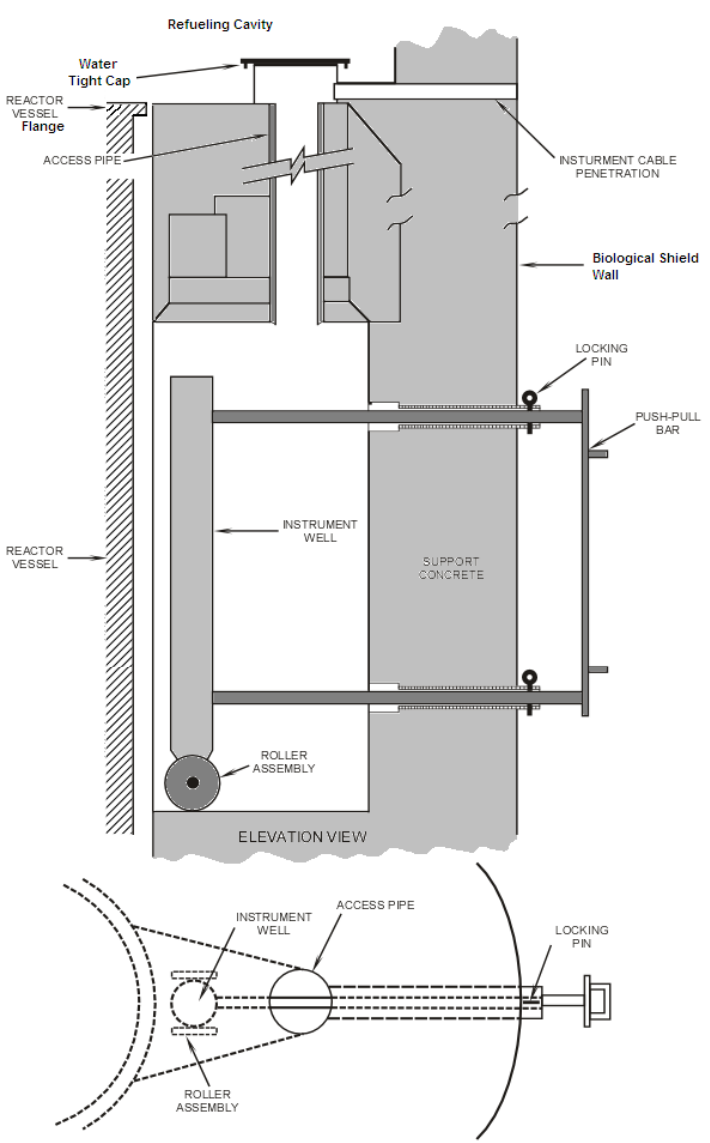
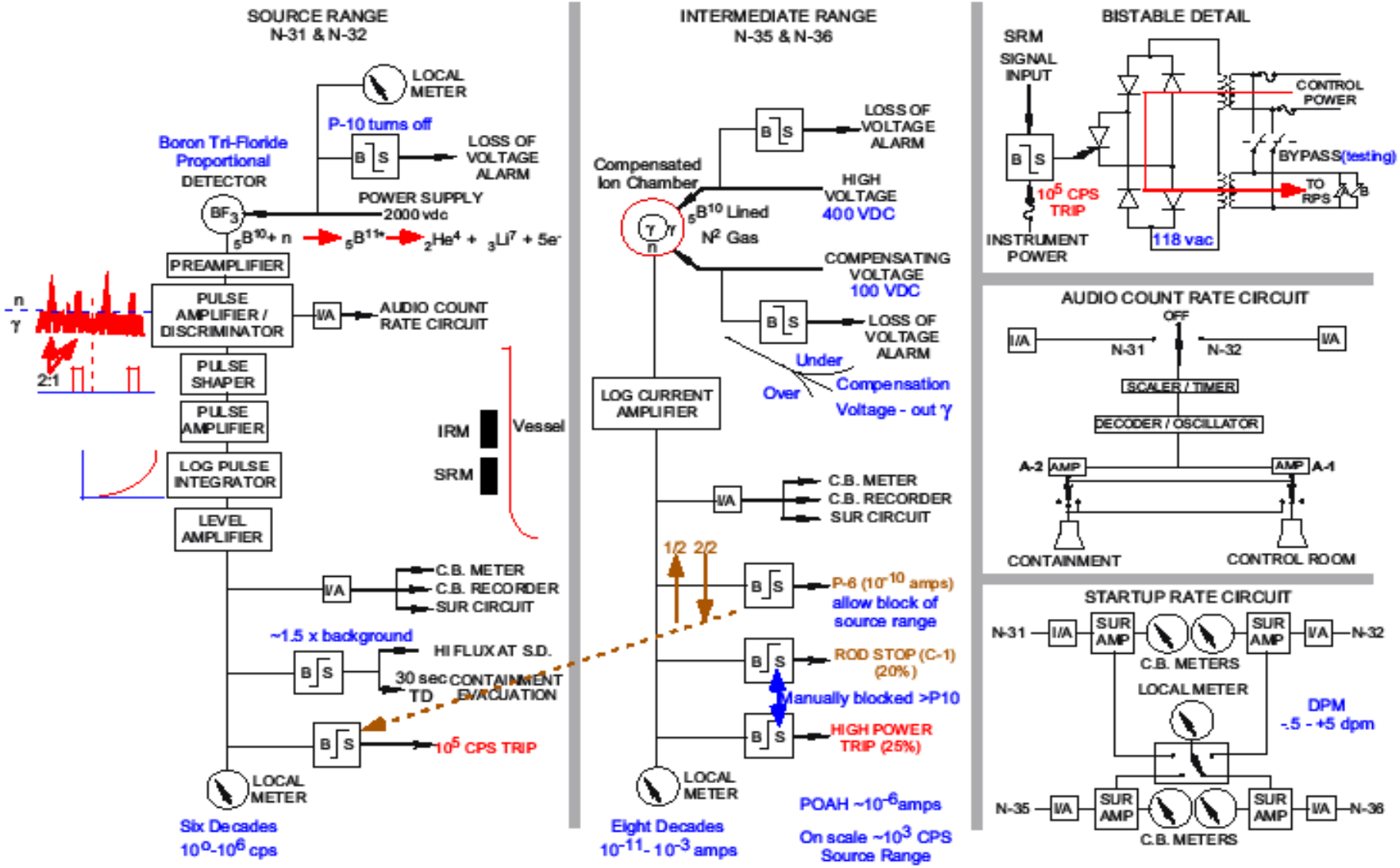
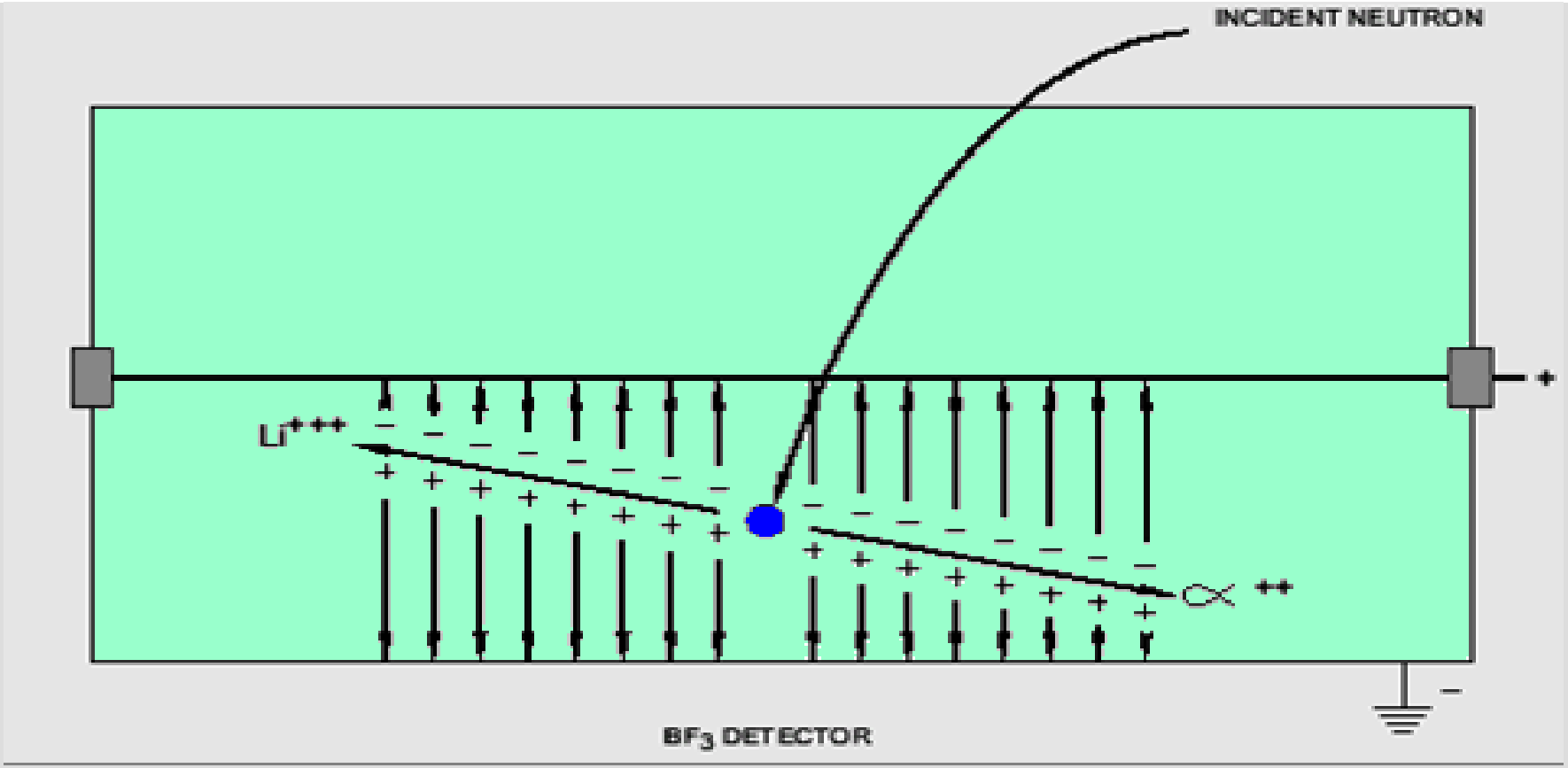


Figure 9.1-2 Detector Instrumentation Wells

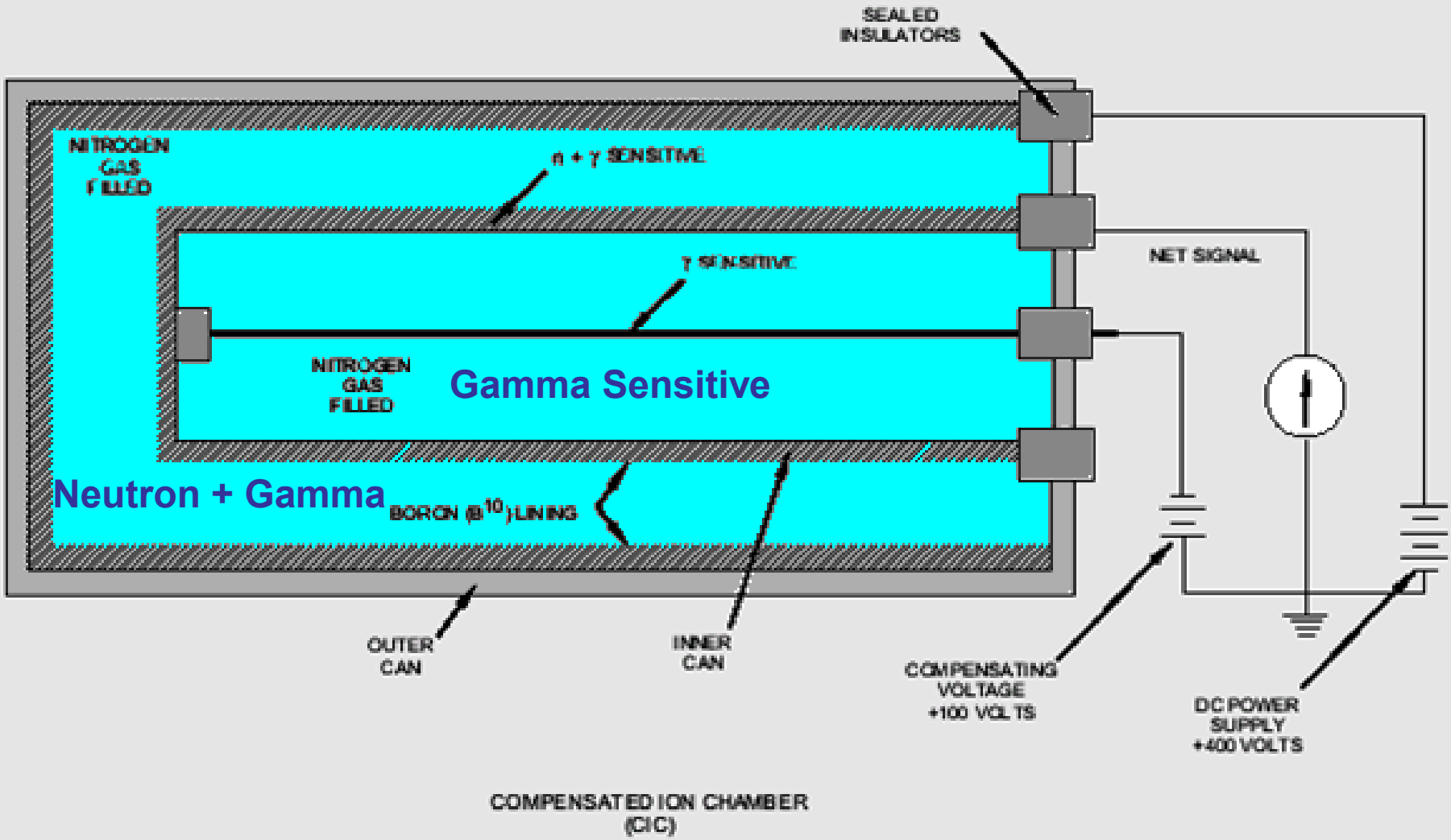
Figure 9.1-4 Source and Intermediate Range Block Diagrams





$$ {}^{1}_{0}n + {}^{10}_{5}B \rightarrow {}^{11}_{5}B \rightarrow {}^{7}_{3}Li + \alpha + energy $$

Fig 9.1-14



COMPENSATED ION CHAMBER
(CIC)

Fig 9.1-15

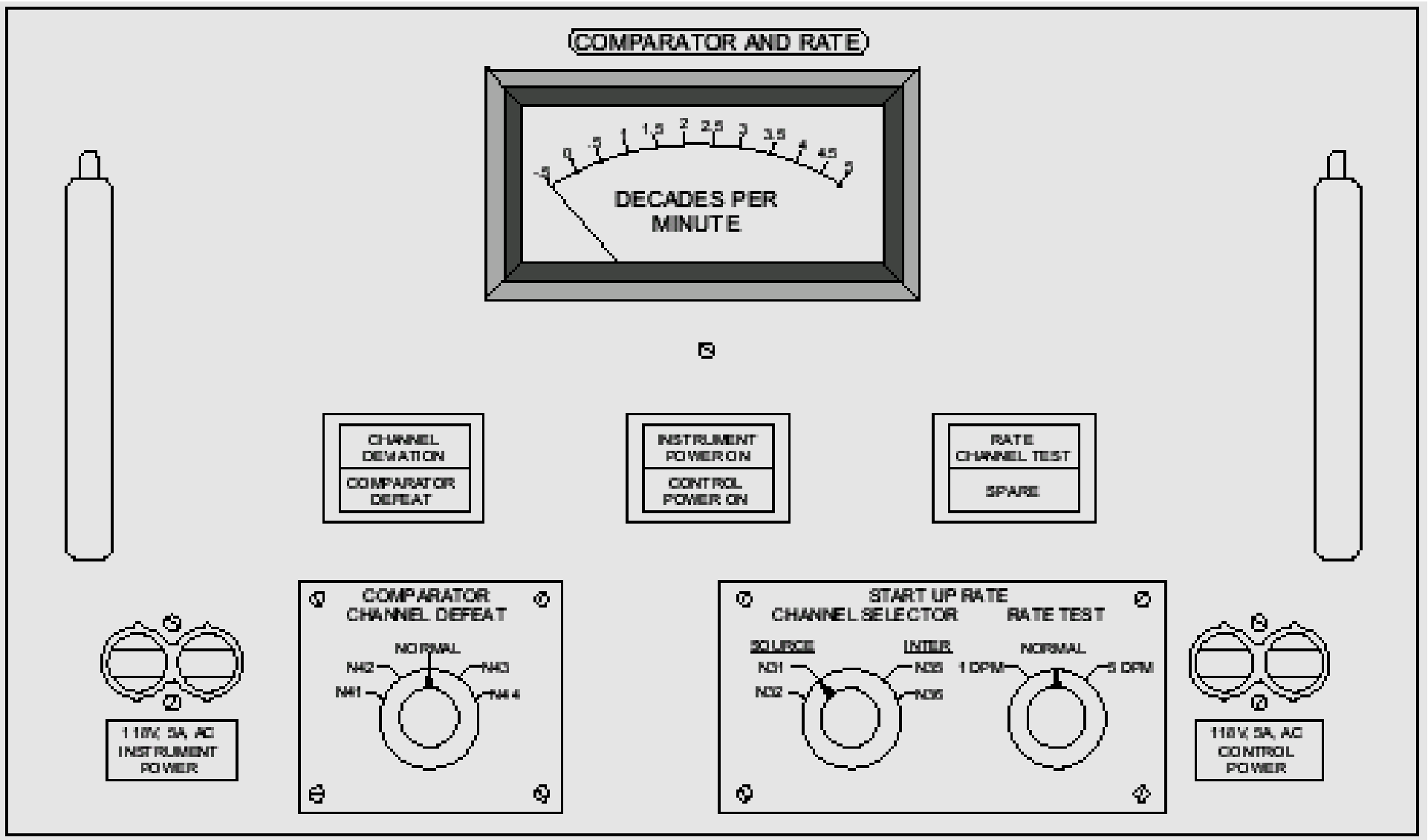
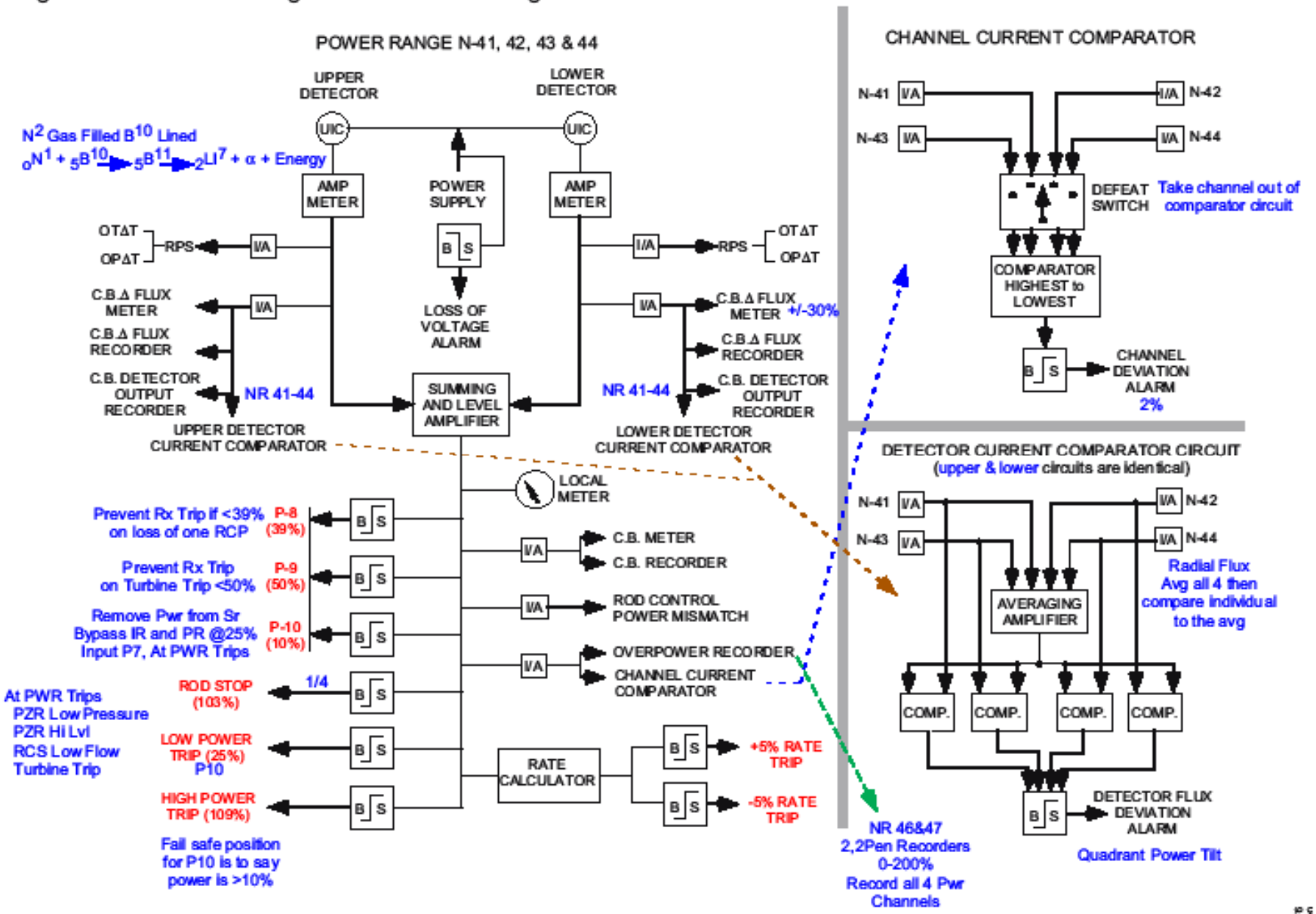
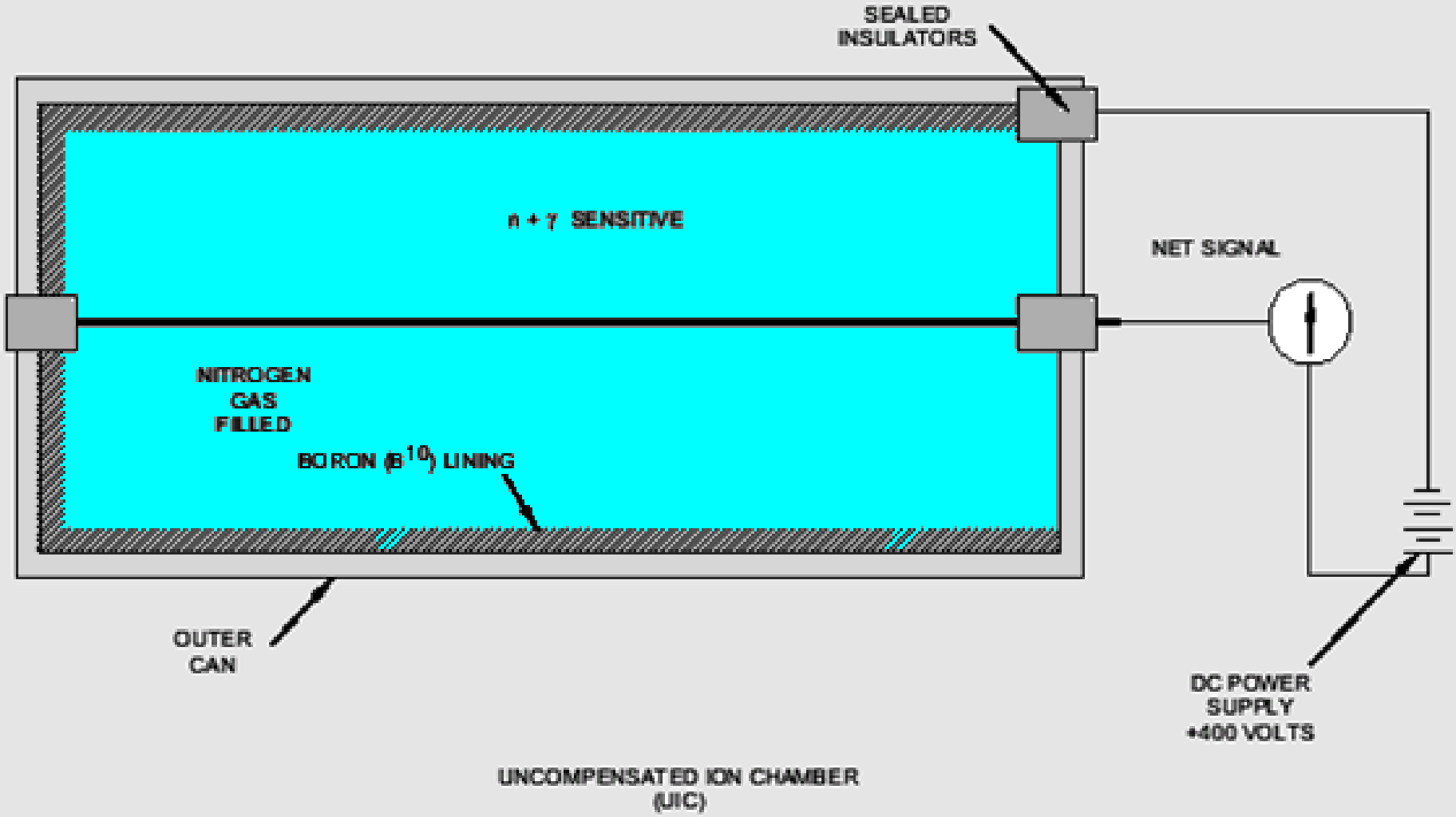

COMPARATOR AND RATE
DECADES PER MINUTE
CHANNEL DEVIATION
COMPARATOR DEFEAT
INSTRUMENT POWER ON
CONTROL POWER ON
RATE CHANNEL TEST
SPARE
COMPARATOR CHANNEL DEFEAT
NORMAL
START UP RATE CHANNEL SELECTOR
RATE TEST
SOURCE
INTER
NORMAL
1 DPM
5 DPM
118V, 5A, AC INSTRUMENT POWER
118V, 5A, AC CONTROL POWER

Fig 9.1-12

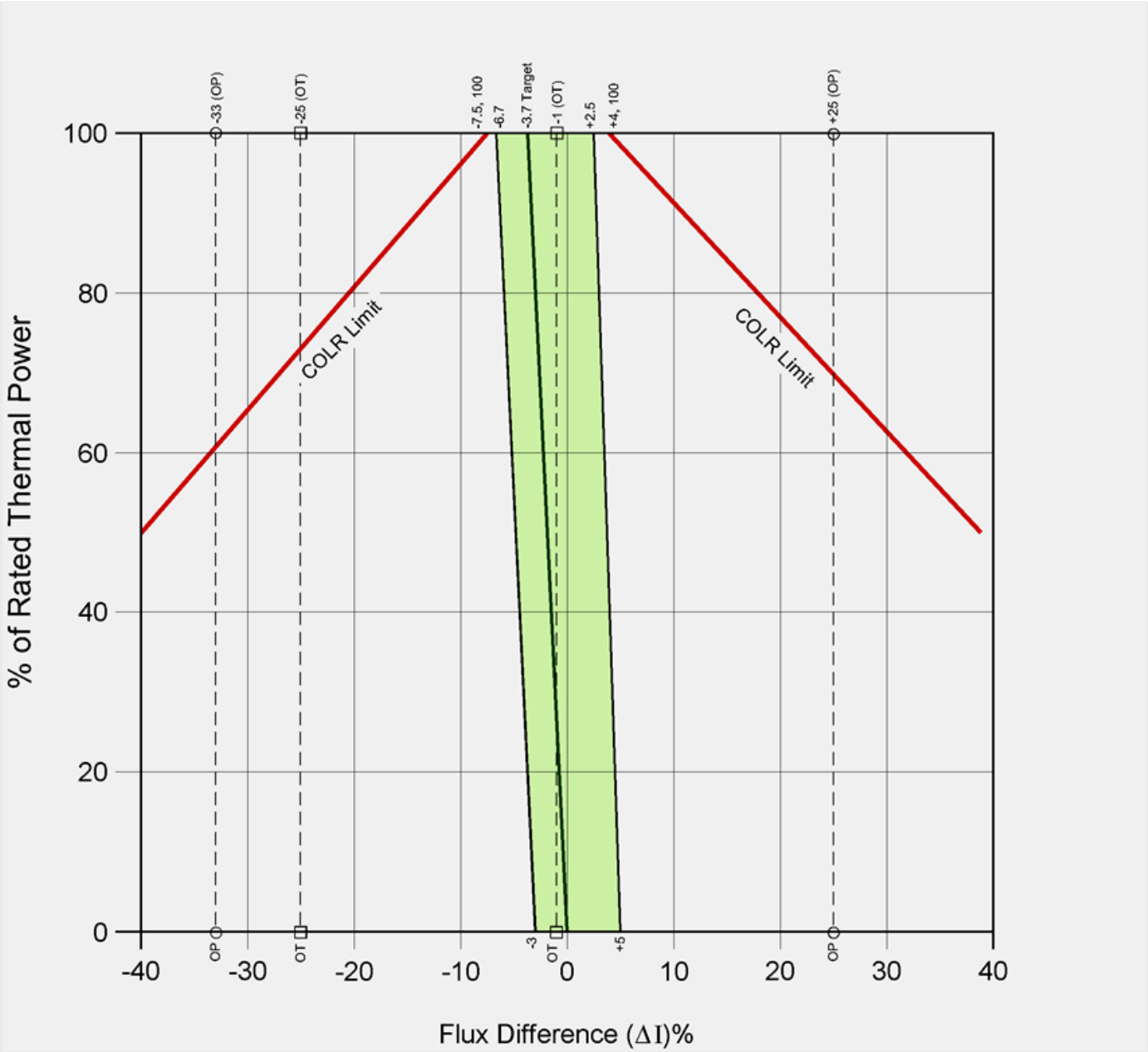
Figure 9.1-5 Power Range Channel Block Diagram





UNCOMPENSATED ION CHAMBER
(UIC)

Fig 9.1-17


-33 (OP)
-25 (OT)
-7.5, 100
-6.7
-3.7 Target
-1 (OT)
+2.5
+4, 100
+25 (OP)
100
80
60
40
20
0
COLR Limit
COLR Limit
% of Rated Thermal Power
OP
OT
-3
OT
+5
OP
-40
-30
-20
-10
0
10
20
30
40
Flux Difference (ΔI)%

AFD Limits