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Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Qualified Display Processing System (QDPS)

Dear Mr. Knighton:

On July 1, 1985, Houston Lighting & Power Company (HL&P) representatives met with members of the NRC staff to discuss the South Texas Project (STP) Qualified Display Processing System (QDPS) Verification and Validation (V&V) program in preparation for an NRC audit of V&V activities. The information contained in our letter ST-HL-AE-1311, dated August 2, 1985 from M. R. Wisenburg to G. W. Knighton, was submitted to provide additional background information to supplement the QDPS description in STP FSAR Section 7.5.6 to support NRC preparation for the August audit. A subsequent meeting was held with members of the NRC staff on August 15, 1985. This letter contains an update of the information contained in the August 2, 1985, letter which resulted from discussions during the August 15, 1985 meeting. Those pages which have been revised are indicated by a change bar in the margin or, for figures, by the note "Revised 9/85" on the figure. This information will support NRC staff review of the QDPS interfaces with other systems.

The STP QDPS is a microprocessor based system that is primarily designed to meet the NRC requirements for a qualified post-accident monitoring system and to be a valuable data acquisition and display system during normal plant operation. The QDPS is fully qualified for Class 1E application.

In addition, the system has provisions for Class 1E qualified control of several safety related design features, provides signal processing for the parameters essential for safe shutdown to meet the fire separation criteria for a postulated control room/relay room fire, and interfaces with the Protection System to provide density compensation for steam generator water level signals and averaging for reactor coolant system hot leg resistance temperature detector (RTD) signals.

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The following revised attachments are enclosed:

- Attachment A provides a QDPS overview.
- Attachment B provides a matrix identifying each QDPS function and its key applicable regulatory criteria.
- Attachment C provides overview block diagrams of QDPS and its relationship to various plant protection, control and monitoring systems.

If you should have any questions on this matter, please contact Mr. M. E. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

CAA/as

Attachments

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Qualified Display Processing System (QDPS) Overview

System Functions

The STP QDPS provides the following:

(a) Data acquisition and qualified display for Post Accident Monitoring.

(b) Isolation of qualified signals to the Emergency Response Facilities Data Acquisition and Display System (ERF DADS).

(c) Consolidation and integration of control room displays to support the Control Room Design Review.

(d) Isolation necessary to meet fire separation criteria for a postulated control room/relay room fire.

(e) Qualified control of the following:

- o Steam Generator PORVs
- o Reactor Vessel Head Vent Valves
- o AFW Flow Limiting
- o Essential cooling water flow control to safety related HVAC chillers

(f) Steam Generator Water Level Compensation Subsystem (SGWLCS).

(g) The proposed modifications for the Temperature Averaging Scheme (TAS) for the RCS hot leg RTD signals will be implemented in the future.

System Description

The system is composed of three subsystems. These subsystems are described below:

- o Data Acquisition and Display

  To perform the data acquisition and display function, a subsystem referred to as the Plant Safety Monitoring System (PSMS) is used. The PSMS consists of Remote Processing Units (RPUs), Database Processing Units (DPUs), an Auxiliary Shutdown Panel Demultiplexing Unit (ASP DMUX), a Main Control Board Demultiplexing Unit (MCB DMUX), a Recorder Demultiplexing Unit (Recorder DMUX), and eight plasma displays.

The Remote Processing Unit (RPU) is an intelligent, qualified, modular data gathering unit. The RPU can receive inputs from process sensors and from other qualified systems such as the process protection racks. In addition, the RPU can receive inputs from other qualified digital systems via datalink. The RPU samples the input data, converts it to process units, formats the data and transmits it to the Database Processing Units, to the Emergency Response Facility Computer System and to the ASP and MCB DMUX units. The ASP and MCB DMUX units provide signals to non-1E panel indicators. RPU communication is via isolated, redundant RS-422 data links.

The Database Processing Unit (DPU) is an intelligent microprocessor based unit that receives isolated datalink inputs from each RPU and uses the data to provide:

- Analog outputs to drive conventional indicators and recorders
- Contact outputs to provide qualified status information
- Datalink outputs to drive the display modules and recorder demultiplexer

The DPU performs redundant sensor algorithms and other necessary calculations. Each RPU transmits its data to both DPUs in the system. Therefore, each DPU maintains the entire database. Either DPU can provide the operator with the best information available from the entire data base. Comparison of the data between DPUs prevents the possibility of erroneous display information.

The display modules are qualified graphic/alphanumeric devices which provide comprehensive displays without requiring large amounts of control board space. Each display module interfaces with both Database Processing Units to provide full redundancy and meet single failure requirements. The display itself is a 512 by 512 dot matrix plasma display (with an active area of approximately 8.5 inches square) providing a flat screen, extreme ruggedness, and easy to read orange-on-black images that are flicker free.

The display module is human engineered for each operation and provides functional pushbuttons for individual display selections. The functional keys allow the operator to move easily from one page to another to display specific information.

During the design of the graphic display pages, South Texas Nuclear Plant Operations personnel have been involved in the establishment of criteria and mimic design. A checklist was develped that was based upon a review of the Westinghouse Owner's Group Emergency Response Guidelines (ERG's) which stipulated the plant process variable characteristics that must be

displayed. Examples of variable characteristics determined by the review of the guidelines include the following: value, range, prediction, trend, and pattern recognition. Grouping the variables and considering the location of the QDPS displays on the control board determined the structure of the displays that needed to be developed. Many interactions occurred with the South Texas Operations Department during this developement process. Utilizing the plant draft ERGs and the input from Operations personnel ensures that the QDPS will present the data in a clear and concise form.

- Qualified Control

  The second subsystem, Qualified Control, performs the valve control functions, including control for the steam generator Power Operated Relief Valves (PORV), the Auxiliary Feedwater Flow Limiting Valves, and the Reactor Vessel Head Vent Valves. The control units are channel oriented in exactly the same way as the RPUs and share the same cabinets with the RPUs. However, operation of the control unit is independent of the RPU.

- Steam Generator Water level Compensation

  The third subsystem, the Steam Generator Water Level Compensation Subsystem (SGWLCS) temperture compensates the narrow range level signals. The SGWLCS subsystem is housed in the same cabinets with the RPUs and the Qualified Control units. Like the Qualified Control subsystem, the operation of SGWLCS is independent of the RPU.

- RCS T_{Hot} Averaging

  A modification is planned to perform averaging of reactor coolant hot leg resistance temperature detector (RTD) signals. Additional information will be forthcoming on this Temperature Averaging Scheme (TAS).

System Architecture

A block diagram of the complete QDPS is shown in Figure 1. Each of the hardware units depicted contains one or more microprocessors. Each Auxiliary Process Cabinet (APC) shown on the left of Figure 1 contains an RPU, a Qualified Control unit and SGWLCS/TAS unit as shown in Figure 2. Figures 1 and 2 illustrate the various inputs, outputs and data communication paths associated with the QDPS subsystems.

QDPS SYSTEM BLOCK DIAGRAM

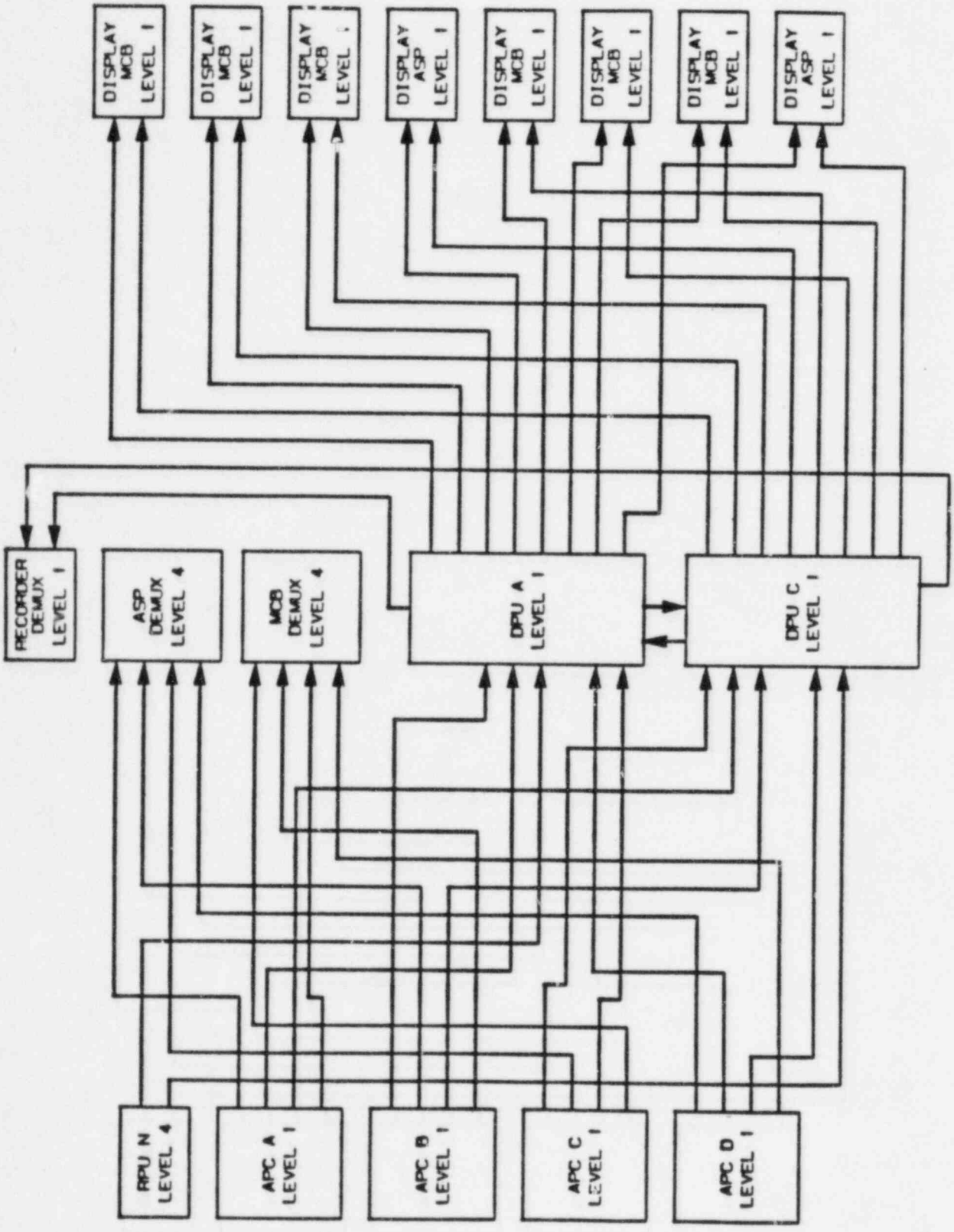


FIGURE 1

BASIC FEATURES AND I/O OF A CLASS IE AUXILIARY
PROCESS CABINET (APC)

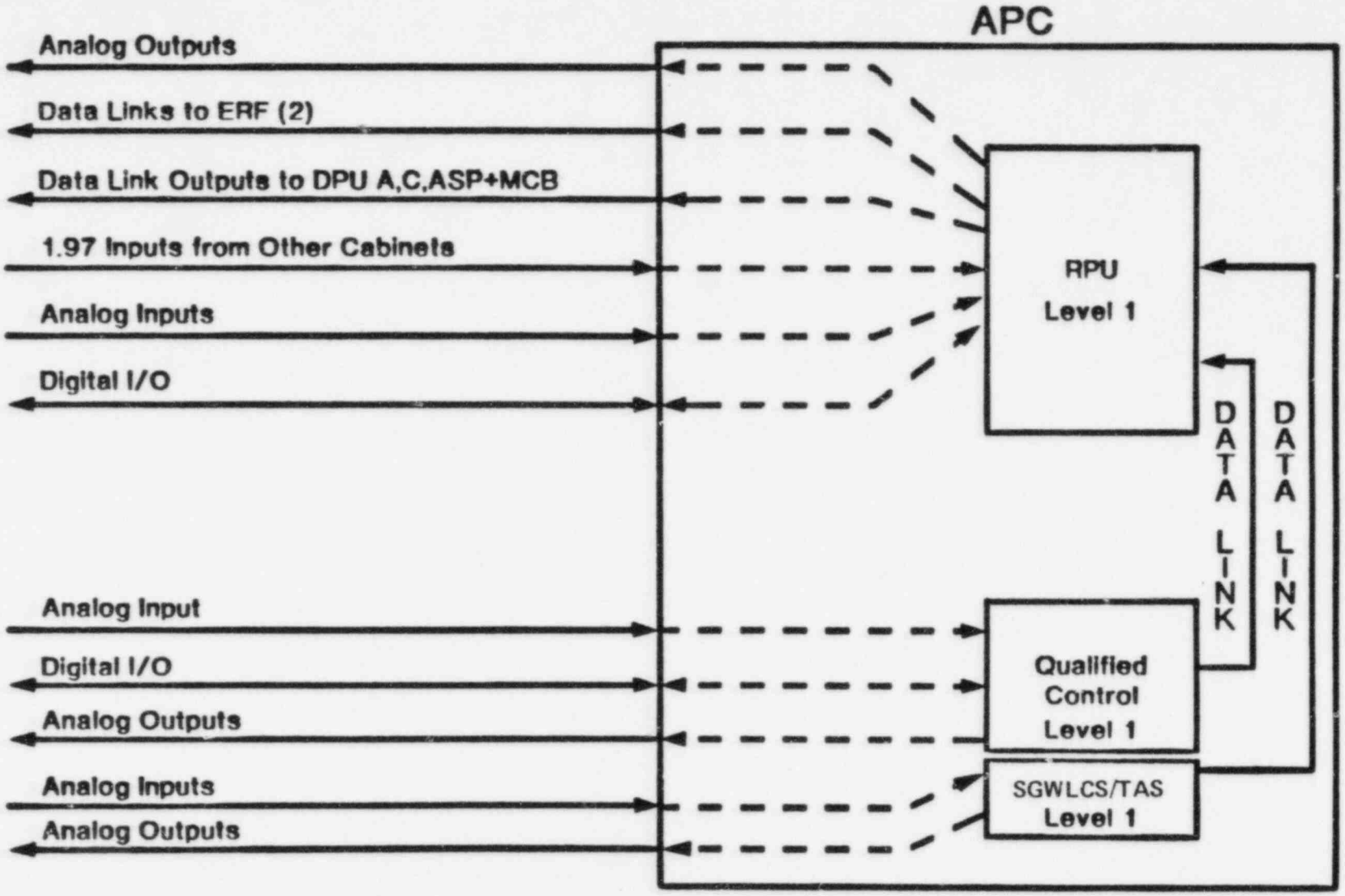


FIGURE 2

	QDPS Function	Key Applicable Regulatory Criteria
MONITORING	Data acquisition and Qualified display for post Accident Monitoring	Regulatory Guide 197 NUREG-0737 II.E.1.2 Part 2 II.F.1 II.F.2 NUREG-0737 Supplement 1 Section 6
	Isolation of qualified signals to ERFDADS	GDC 24 IEEE 279-1971 NUREG 0696 NUREG-0737 III.A.1.1 NUREG-0737 Supplement 1 Section 4
	Consolidation and integration of control room displays	NUREG-0737 I.D.1 NUREG-0737 Supplement 1 Section 5 NUREG-0700
	Isolation for monitoring of essential safe shutdown parameters	GDC 19 PCSB 9.5-1 10CFR50 App. R
QUALIFIED CONTROL	SG PORV control	GDC 19 GDC 34 RG 1.139 nd RSB 5-1
	RV Head Vent Valve control	GDC 19 RG 1.139 and RSB 5-1 NUREG-0737 II.F.1
	AFW flow limiting	IEEE 279-1971 GDC 19 GDC 34
	ECW flow control to essential chillers	IEEE 279-1971 GDC 19 GDC 44 RG 1.139 and RSB 5-1
PROTECTION	Steam Generator Water Level Compensation System (SGWLCS)	IEEE 2799-971 GDC 20 NUREG-0737 II.E.1.2 Part 1
	T_{Hot} RTD averaging (TAS)	IEEE 279-1971 GDC 20

QDPS Relationships to Plant Systems

Block diagrams depicting QDPS relationships to other plant systems are attached as follows:

Figure A	QDPS interfaces (Overview)
Figure B	Data acquisition and qualified display for post accident monitoring including: - isolation for ERF DADS - CRDR display integration
Figures C-1 and C-2	Isolation for monitoring - postulated control room/relay room fire. While no QDPS interface exits, for completeness a block diagram is attached depicting the transfer switch scheme - postulated control room fire.
Figures D-1 D-2 D-3 D-4	Qualified control for - AFW flow limiting - RV head vent valve - SG PORV - ECW flow to safety related HVAC chiller
Figures E-1, E-2 and E-3	Protection channel for - narrow range steam generator level - RCS T_{hot} RTDs For comparison purposes, also attached is a block diagram depicting a typical reactor trip/ESF actuation channel.

QUALIFIED DISPLAY PROCESSING SYSTEM INTERFACES

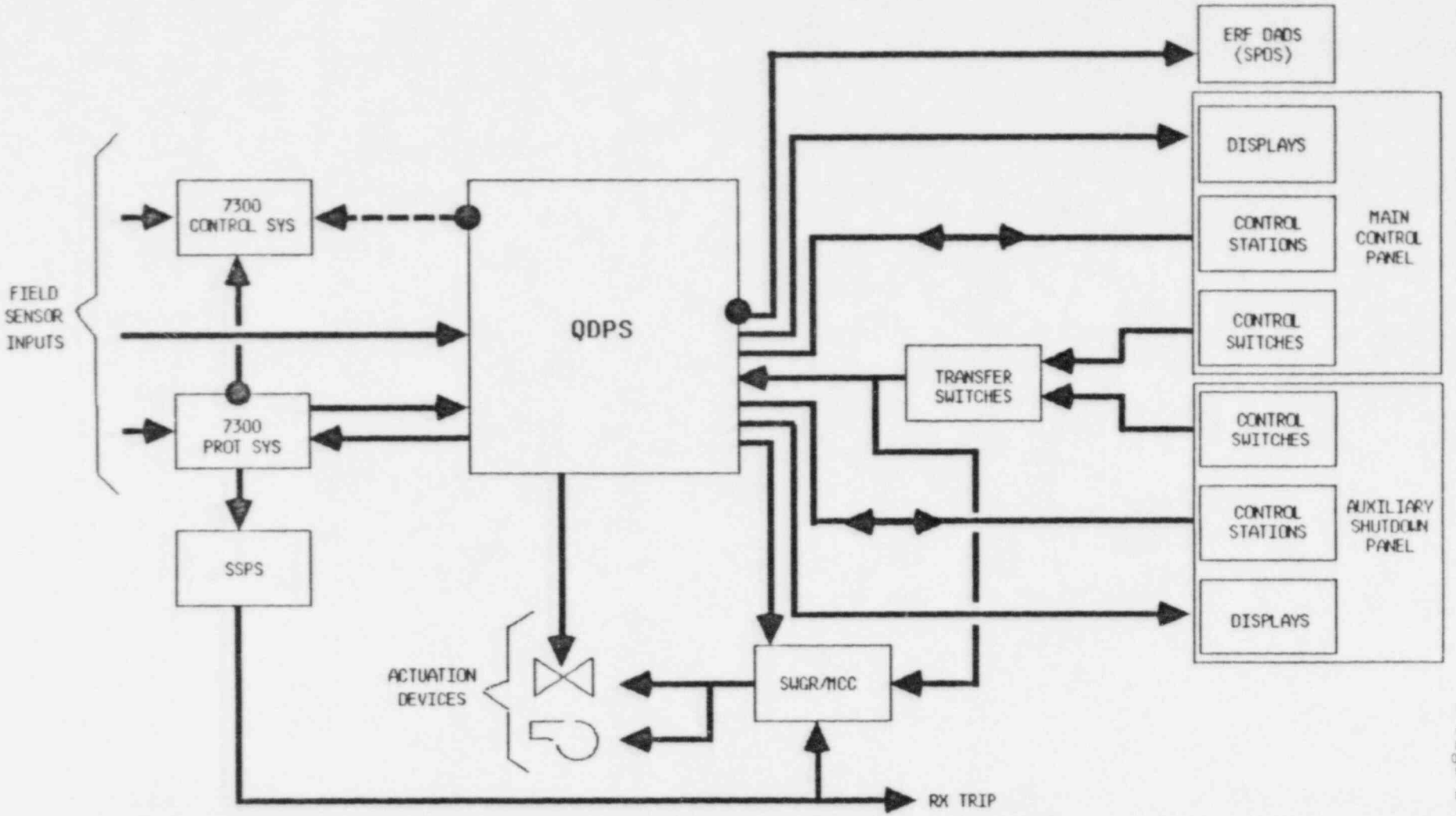
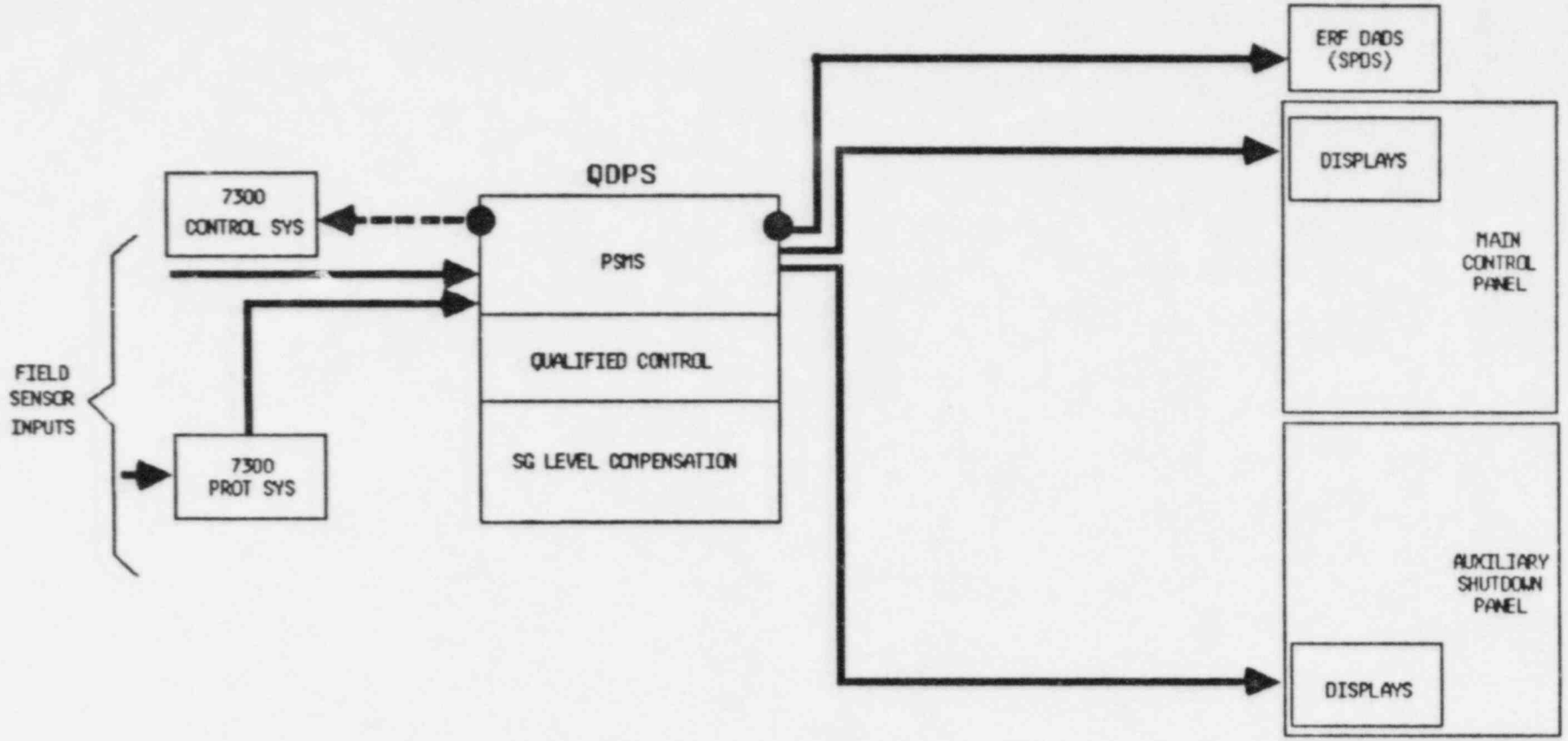


FIGURE A

DATA ACQUISITION AND QUALIFIED DISPLAY FOR POST ACCIDENT MONITORING
(Including Isolation for ERF DADS and CRDR Display Integration)



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● ISOLATION

FIGURE B

ISOLATION FOR MONITORING - POSTULATED CONTROL ROOM/RELAY ROOM FIRE

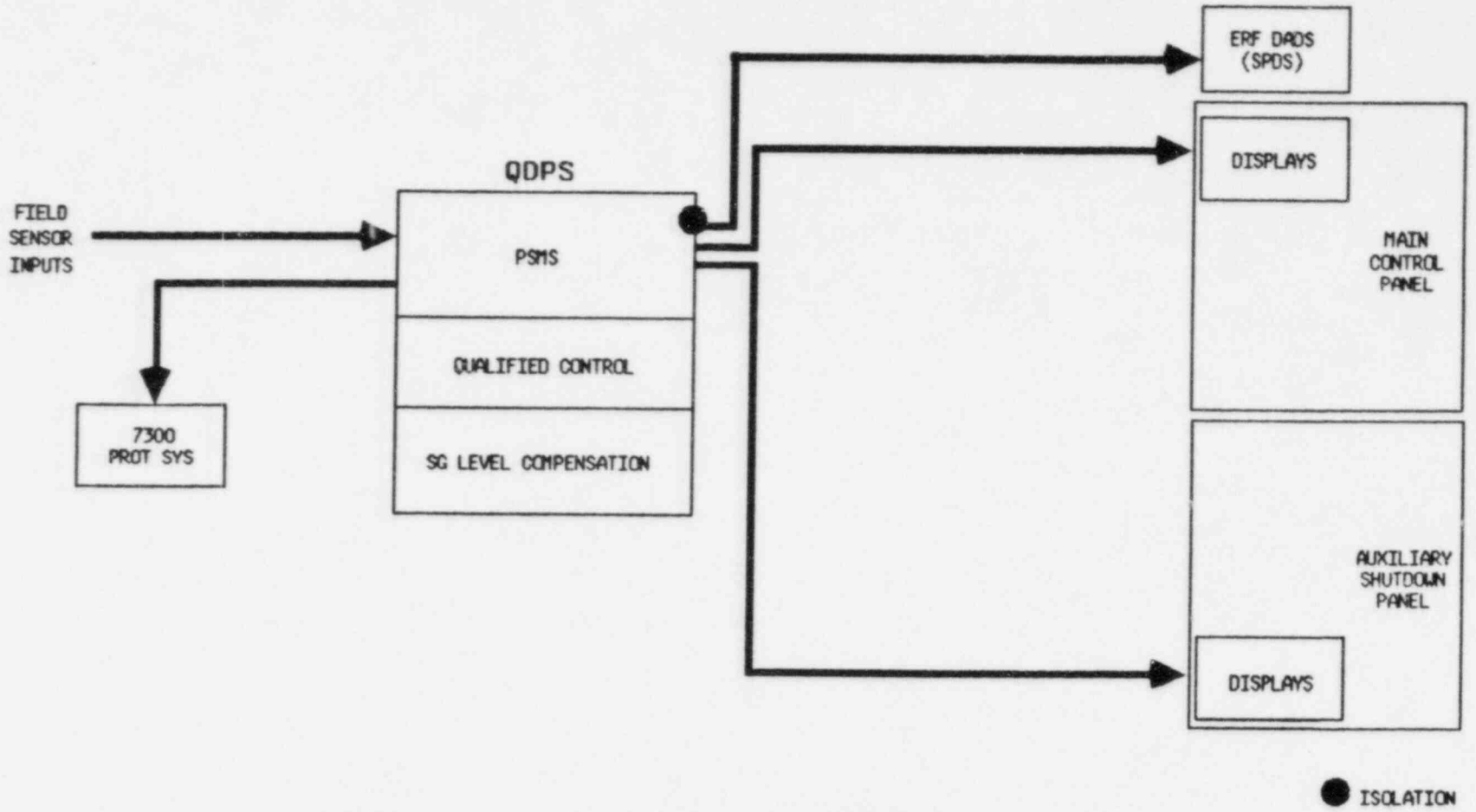

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FIGURE C-1

TRANSFER SWITCH SCHEME - POSTULATED CONTROL ROOM FIRE

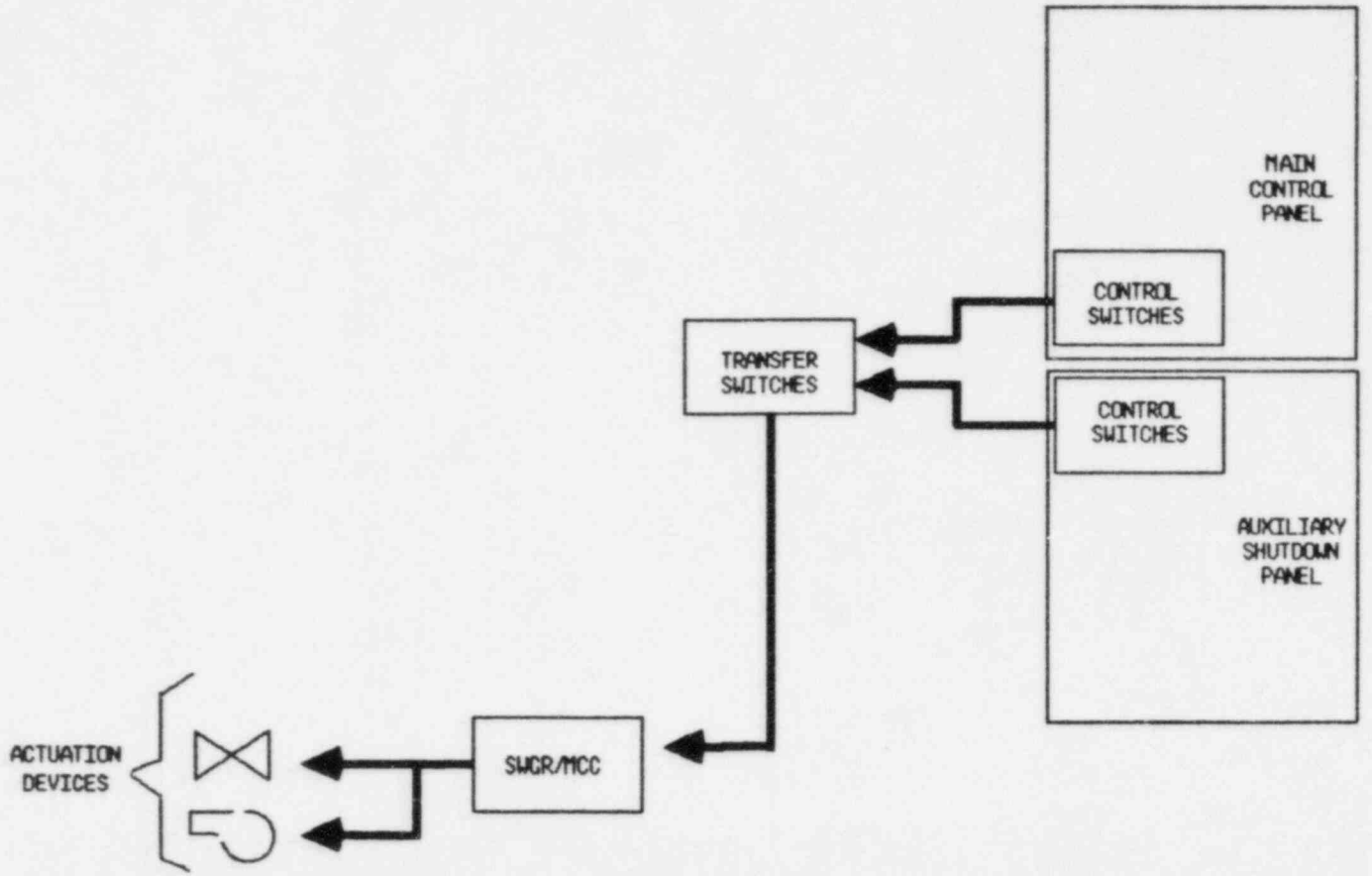

FIGURE C-2

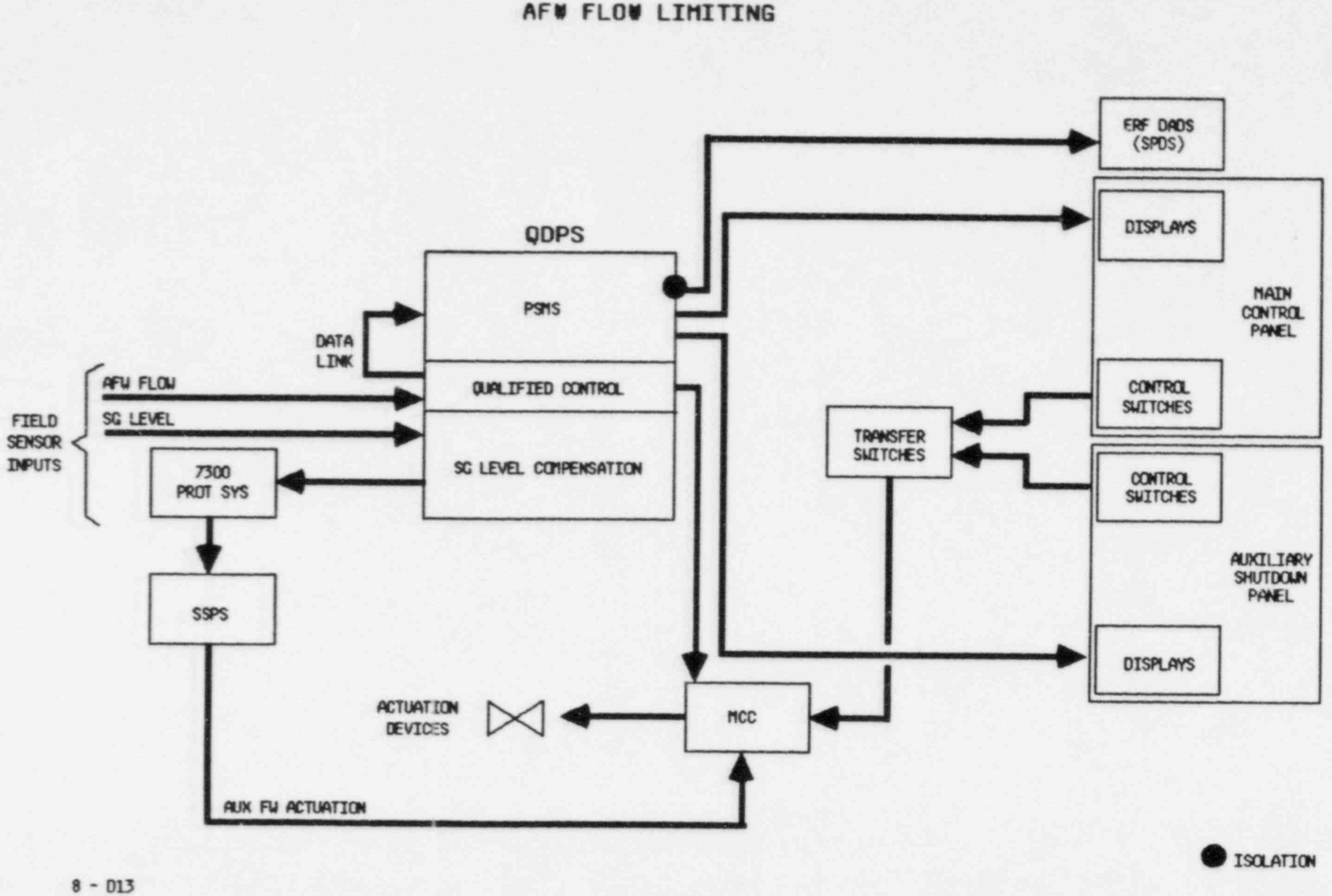
AFW FLOW LIMITING
QDPS
PSMS
DATA LINK
QUALIFIED CONTROL
SG LEVEL COMPENSATION
AFW FLOW
SG LEVEL
FIELD SENSOR INPUTS
7300 PROT SYS
SSPS
AUX FW ACTUATION
ACTUATION DEVICES
MCC
ERF DADS (SPDS)
DISPLAYS
MAIN CONTROL PANEL
CONTROL SWITCHES
TRANSFER SWITCHES
CONTROL SWITCHES
AUXILIARY SHUTDOWN PANEL
DISPLAYS
ISOLATION
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FIGURE D-1

RV HEAD VENT VALVE CONTROL

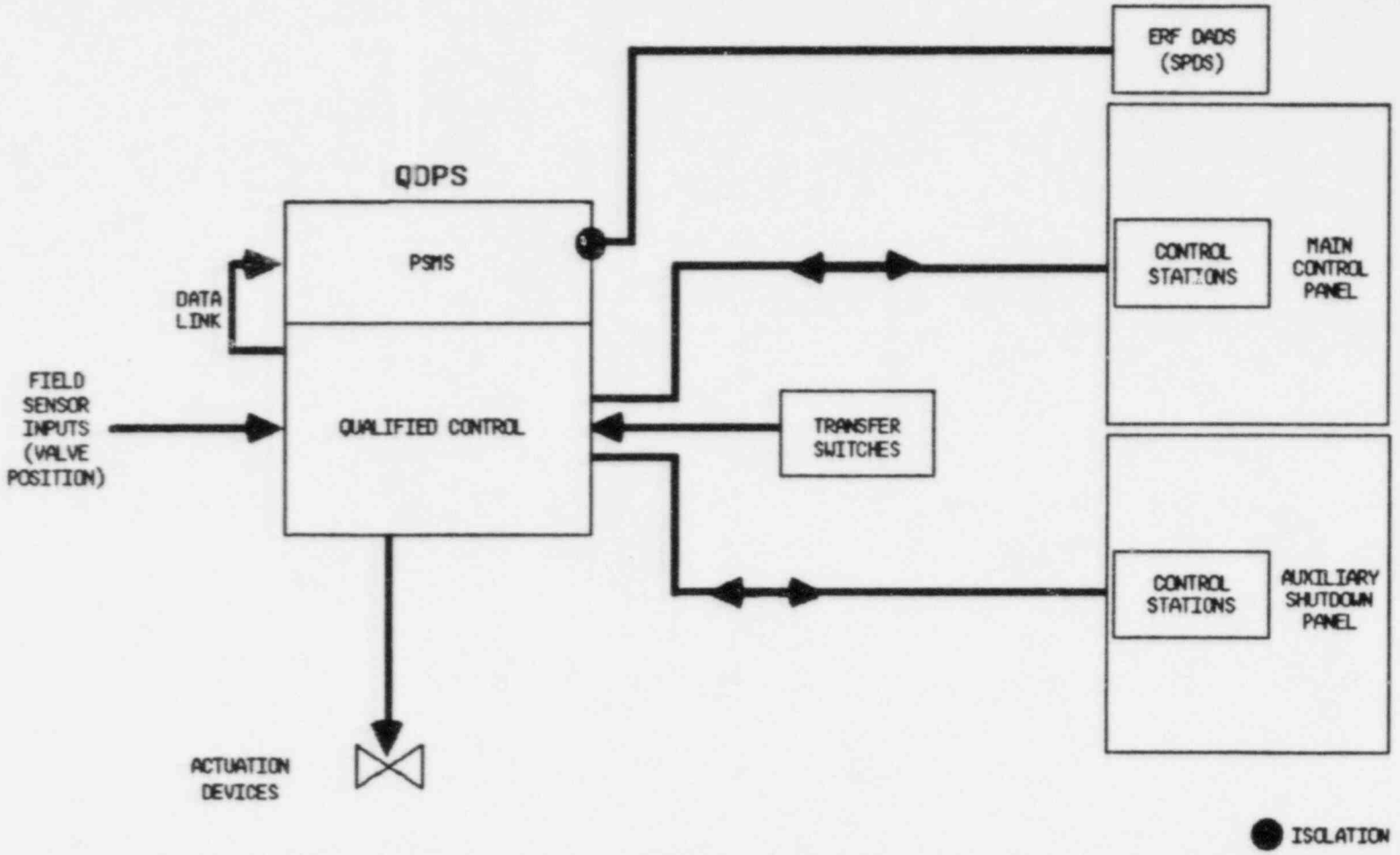

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FIGURE D-2

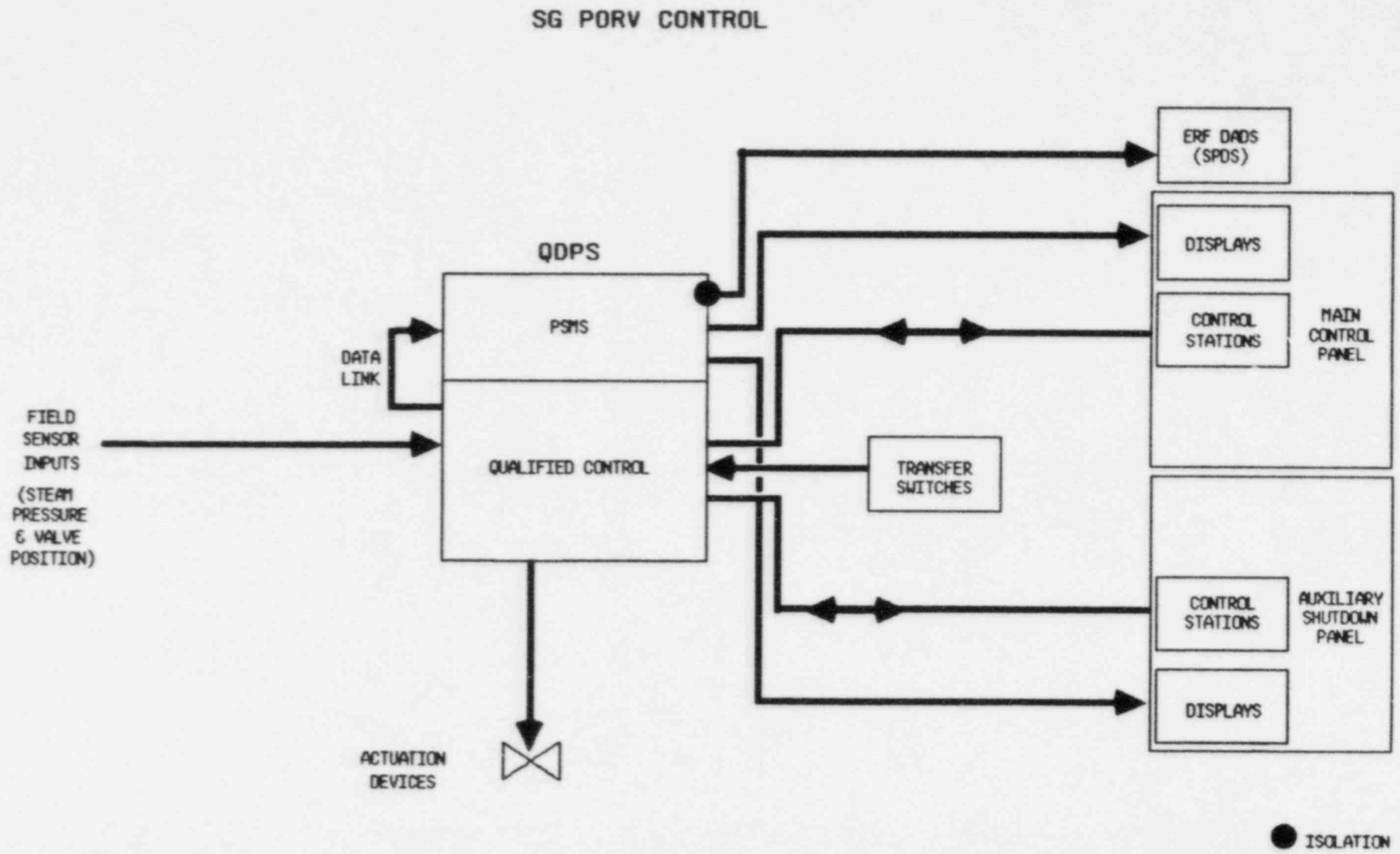
SG PORV CONTROL
QDPS
PSMS
QUALIFIED CONTROL
DATA LINK
FIELD SENSOR INPUTS
(STEAM PRESSURE & VALVE POSITION)
ACTUATION DEVICES
ERF DADS (SPDS)
DISPLAYS
CONTROL STATIONS
MAIN CONTROL PANEL
TRANSFER SWITCHES
CONTROL STATIONS
AUXILIARY SHUTDOWN PANEL
DISPLAYS
ISOLATION
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FIGURE D-3

ECW FLOW CONTROL TO SAFETY RELATED HVAC CHILLERS

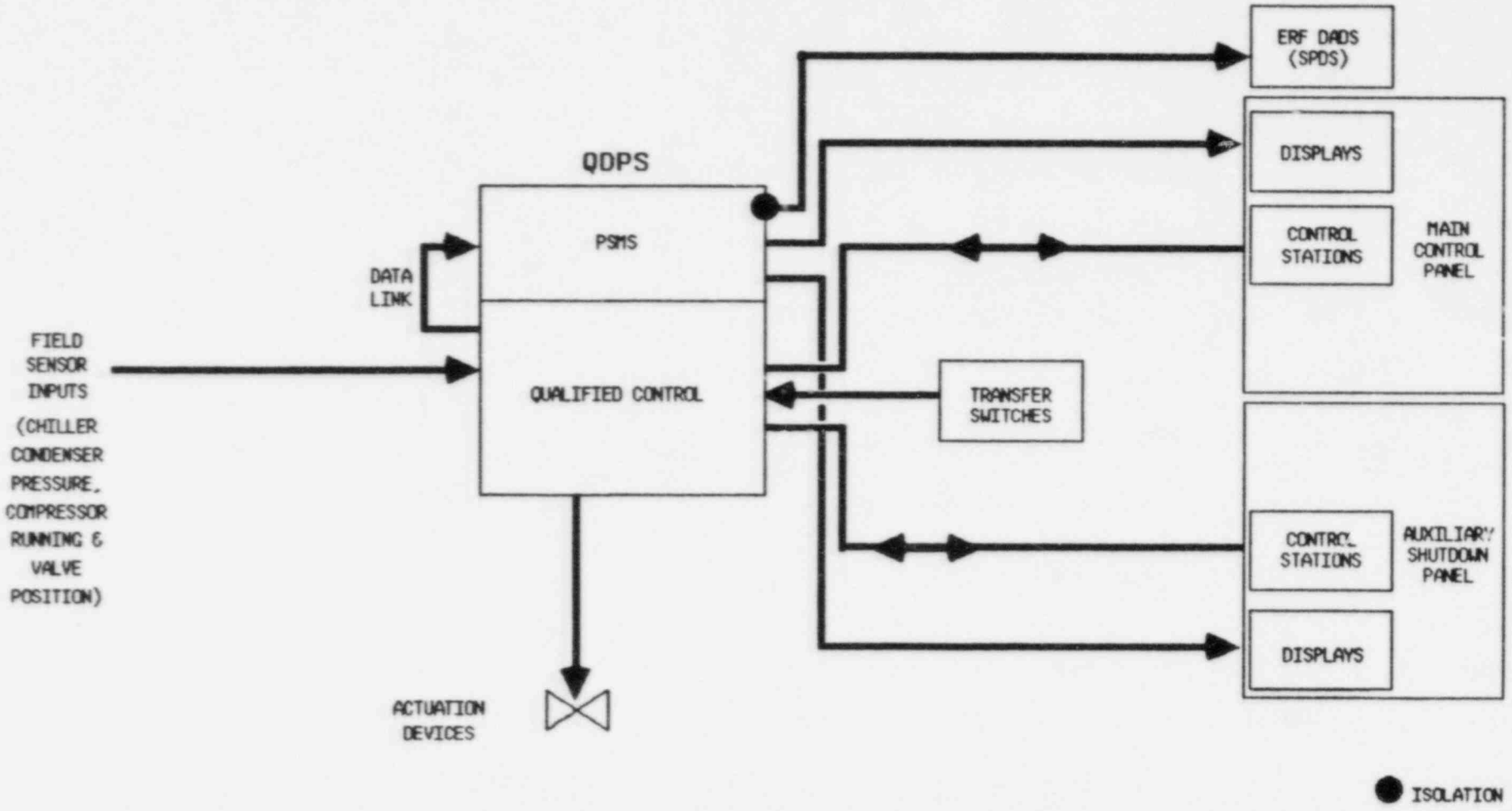

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FIGURE D-4

NARROW RANGE STEAM GENERATOR LEVEL CHANNEL

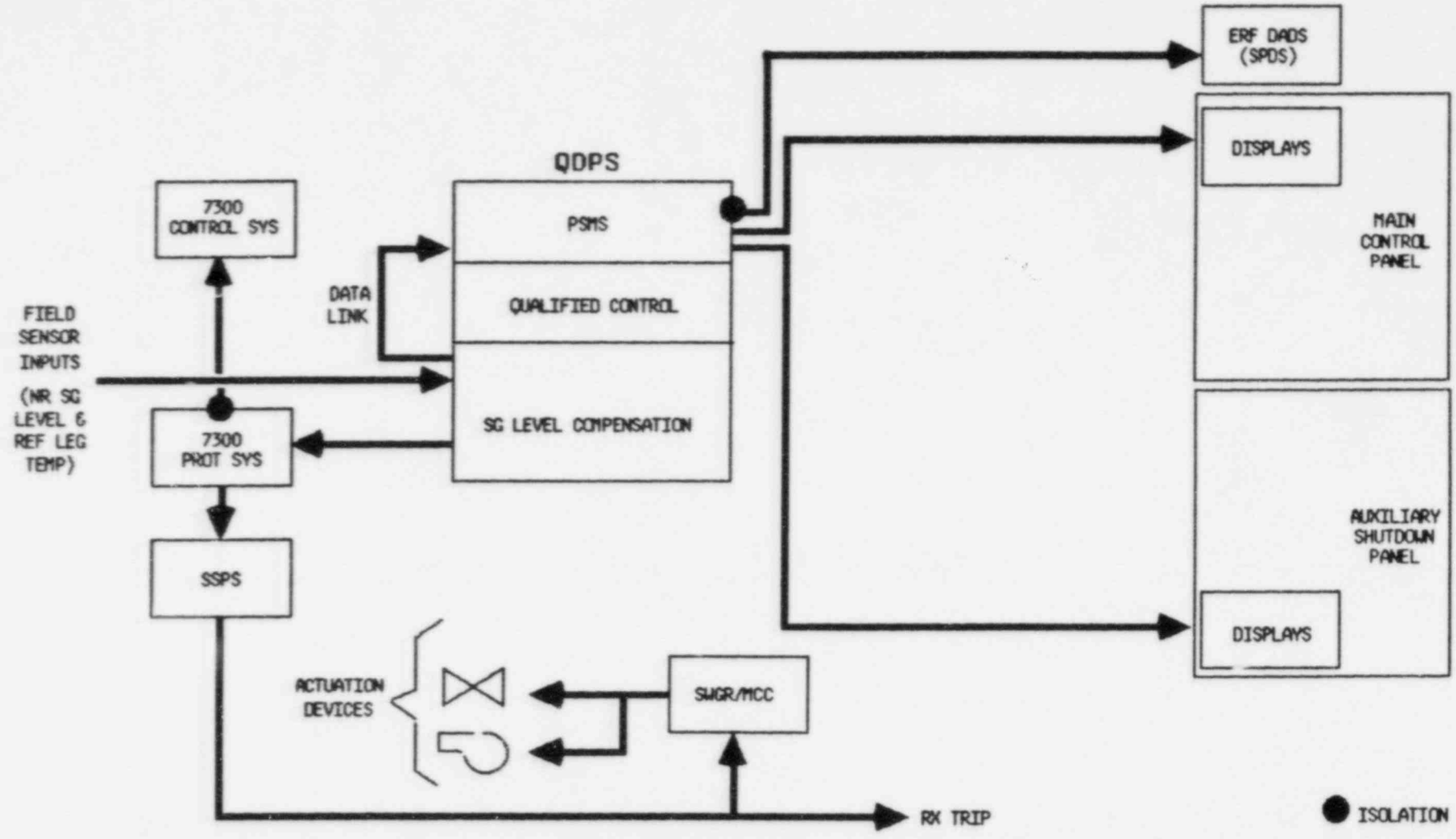

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FIGURE E-1

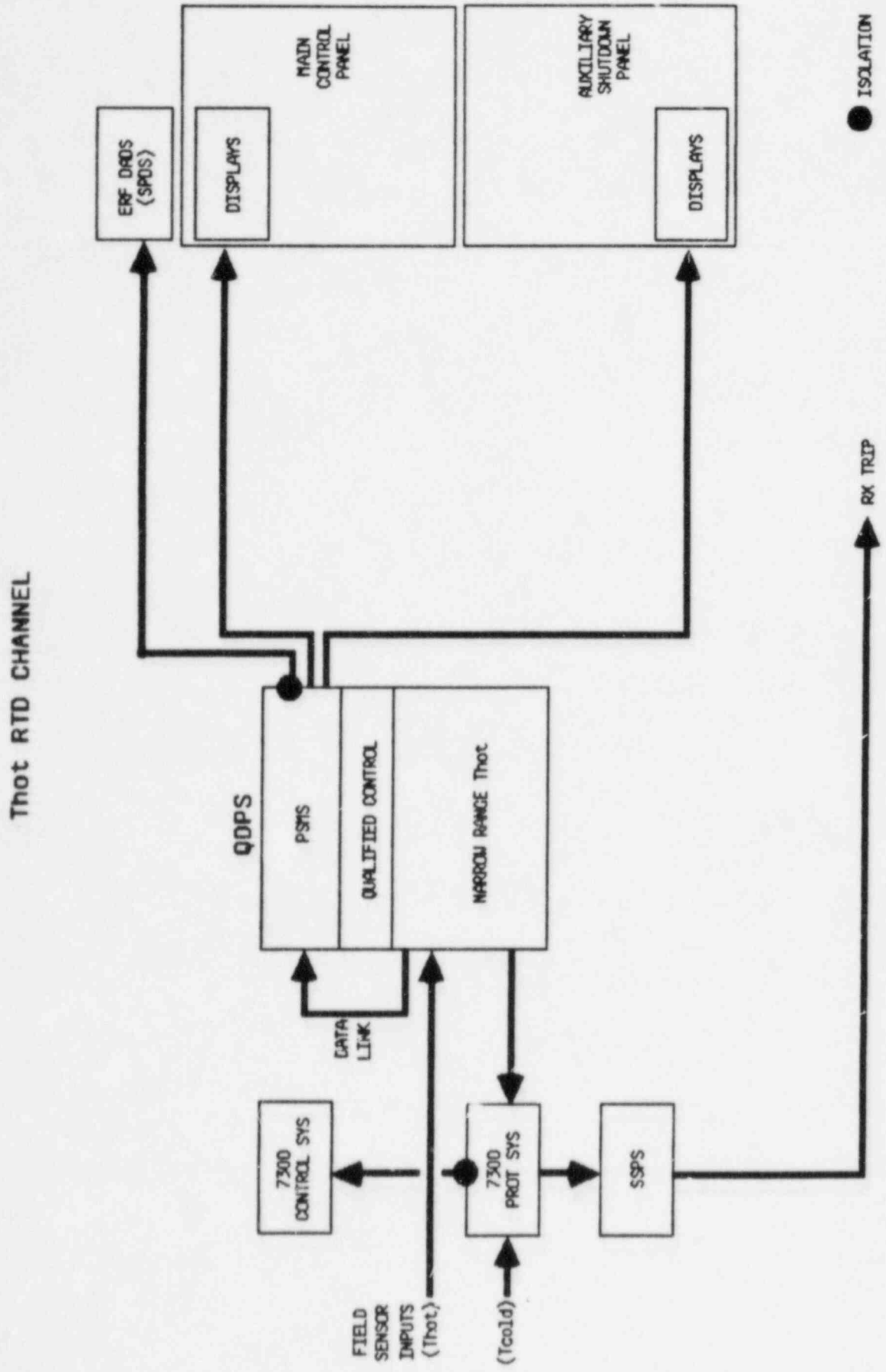
Thot RTD CHANNEL
ERF DMDS (SPDS)
MAIN CONTROL PANEL
DISPLAYS
AUXILIARY SHUTDOWN PANEL
DISPLAYS
ISOLATION
QDPS
PSMS
QUALIFIED CONTROL
NARROW RANGE Thot
DATA LINK
RX TRIP
7300 CONTROL SYS
7300 PROT SYS
SSPS
FIELD SENSOR INPUTS (Thot)
(Tcold)
1 - U13

FIGURE E-2

TYPICAL REACTOR TRIP/ESF ACTUATION CHANNEL

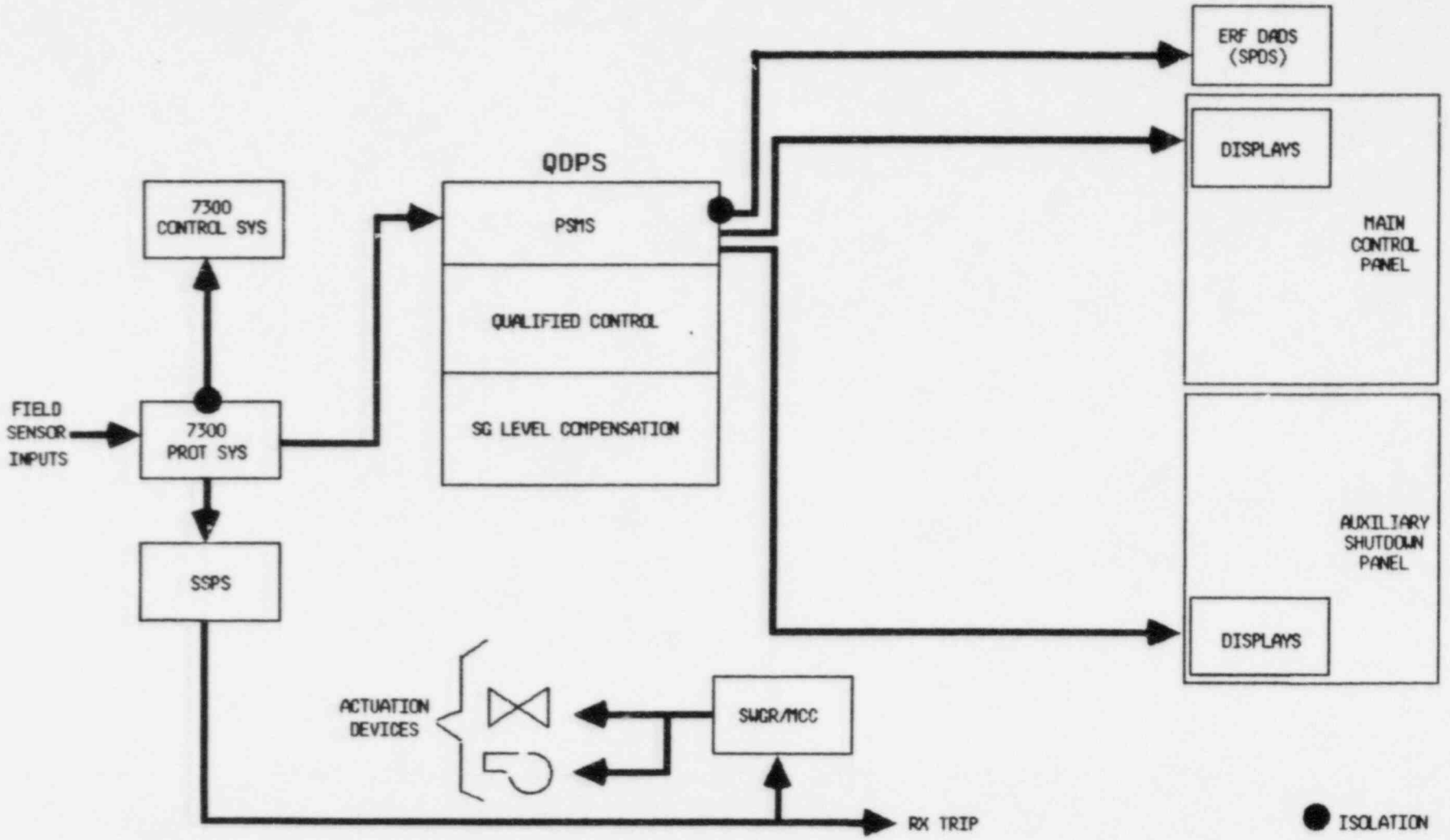

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FIGURE E-3