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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
SUPPLEMENTAL PLANT-SPECIFIC AMSAC INFORMATION

REFERENCE: CP&L Letter NLS-87-219 from Mr. S. R. Zimmerman (CP&L) to NRC, H. B. Robinson Plant-Specific AMSAC Submittal, dated October 30, 1987

Gentlemen:

As discussed in our conference call of December 15, 1987, Carolina Power & Light Company (CP&L) hereby submits the requested supplemental information relative to implementation of the AMSAC system at the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBR2). The attachment to this submittal provides a restatement of each specific information request followed by the CP&L response. In addition, some minor changes to the original submittal are required as a result of subsequent evolutions of the system towards final design. These changes are also included in the attachment.

Carolina Power & Light Company would like to express appreciation of the timely review provided for our original submittal and requests similarly expeditious review of these remaining items to avoid any potential schedule impact. Installation of the AMSAC equipment is planned for the next refueling outage, currently scheduled for late summer 1988.

If you have any questions concerning this matter. Please contact Mr. Robert W. Prunty at (919) 836-7318.

Yours very truly,

L. I. Loflin
Manager
Nuclear Licensing Section

MDM/lah (5389MDM)

Attachment

cc: Dr. J. Nelson Grace
Mr. R. Lo
Mr. L. Garner (NRC-HBR)

A001

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ATTACHMENT 1

The information provided below supplements CP&L's October 30, 1987 plant-specific AMSAC submittal for the H. B. Robinson plant. The NRC's additional information requests have been restated and numbered to correspond to the item numbers in the original response which they supplement. However, the first two information requests refer to NRC requests concerning the general description of the AMSAC system.

GENERAL DESCRIPTION:

Verify that HBR2 AMSAC design will be in accordance with Revision 1 of WCAP 10858P-A.

RESPONSE: As conveyed verbally during the conference call, HBR2 AMSAC design is in accordance with Revision 1 of the WCAP. Specifically, the HBR2 AMSAC system will incorporate a timer which will provide a 25 second delay in the AMSAC signal to actuate the various AMSAC mitigating actions. This delay will help ensure that the Reactor Protection System has had adequate time to actuate its mitigating actions. Thus, AMSAC will not preempt the normal plant safety system actuation. This delay is short enough to ensure that the AMSAC system will provide its actuation signal in time to establish auxiliary feedwater flow within 90 seconds following receipt of low-low water level signal in two out of three steam generators as specified in the WCAP. This delay also satisfies the criteria that turbine trip is accomplished within 30 seconds of that same coincident, two out of three, low-low steam generator level signals.

The AMSAC system also incorporates a timer which will delay by 360 seconds the disarming of AMSAC which would otherwise occur following a reduction of power below the 40 percent arming criteria. This is in accordance with the provision of the WCAP to avoid disarming AMSAC before it can perform its function in the event a turbine trip occurs.

GENERAL DESCRIPTION:

Provide a simplified Logic Diagram.

RESPONSE: The CP&L AMSAC system utilizes the capabilities of a pair of redundant microprocessors in a moderately sophisticated scheme in order to enhance system operability and reliability. As a result, the system does not lend itself to the type of simplified logic diagrams typically depicted in the AMSAC WCAPs. However, in order to facilitate the staff's review, a simplified Functional Diagram (Figure 1) has been attached to provide an overall view of the AMSAC system from its interface with the existing plant input signal to its interface with the output actuation circuitry. To maintain the simplicity of the diagram, the more relevant functions of the microprocessors have been depicted as subprograms, the outputs of which feed the overall program logic. The detailed operations of these subprograms have been provided on separate figures (Figures 2 and 3). Although all of the functions and capabilities of the system are not depicted by the diagram, CP&L believes that the attached figures provide the level of detail required for the NRC to perform its review.

The information concerning testing capabilities (Section 12) provides a discussion of the system capabilities which will help explain the Functional Diagram.

ITEM 3: SAFETY-RELATED INTERFACE

Specify the safety criteria referred to in response to Item 3 of the plant-specific information request. Reference to FSAR section is acceptable.

RESPONSE: The Reactor Trip System safety criteria are defined in Section 7.2 of the HBR2 FSAR. Carolina Power & Light Company's implementation of the prescribed AMSAC functions has focused upon ensuring that the hardware installed will not create potential mechanisms for this new equipment to degrade the reliability of the RPS. Particular attention has been paid to AMSAC input and output isolation and physical separation to avoid possible perturbations of the existing plant systems from AMSAC system malfunctions. The potential operational impact of AMSAC is currently being reviewed for potential impact upon the FSAR accident analysis. No problems are anticipated. The normal plant modification process, including the formal safety review, will ensure the fact that the RPS safety criteria are maintained.

ITEM 4: QA PROGRAM

The NRC requests more specific descriptions of CP&L's QA Program for AMSAC and how it compares to the guidance provided by Generic Letter 85-06.

RESPONSE: A. Nonsafety Related

QA guidance for nonsafety-related AMSAC equipment has been provided by the NRC through Generic Letter 85-06. CP&L has reviewed the Generic Letter and has determined that the requirements for radioactive waste management systems provided in Section 19 of the CP&L Corporate Quality Assurance Program (CQAP) meet or exceed the guidance provided in Generic Letter 85-06 with the exception of Sections IX and XVIII.

Existing engineering and plant modification control procedures provide for controls over Special Processes (Section IX).

In order to ensure that the guidance concerning Audits (Section XVIII) is met, plant modifications that involve AMSAC will be included in the population of modifications from which QA audit samples are selected. This measure will be taken in addition to the normal reviews by line management provided for in procedures for engineering and plant modifications.

Therefore, activities to date (related to design and procurement of nonsafety-related AMSAC equipment) have been controlled in accordance with Section 19 of the CQAP as supplemented above.

These activities have been primarily performed at the Corporate General Office. During preparation of the plant modification package, it was determined that control of quality assurance for site activities related to AMSAC would be more appropriately implemented via existing site procedures for nonsafety-related equipment. Therefore, CP&L's plant site activities will be controlled by plant procedural requirements for nonsafety-related equipment. These site procedures meet or exceed the guidance for quality assurance provided in Generic Letter 85-06 with the exception of Section XVIII. Here again, the program will be supplemented as described above to ensure that appropriate G.L. 85-06 Section XVIII guidance concerning audits is incorporated. This does not represent a reduction in CP&L's implementation of the guidance presented in Generic Letter 85-06, only a change in how CP&L is implementing that guidance.

Record keeping for design control and modification of existing plant systems will comply with the requirements of 10CFR50.59.

B. Safety Related

Activities related to the design, procurement, installation, and testing of equipment which interfaces directly with existing safety-related systems will comply with the requirements of Section 1 through 17 of the CQAP and the applicable procedures in Section 3.0 (Engineering Procedures) and 4.0 (Procurement of Engineering Items) of the Nuclear Engineering Department Procedures Manual. Reference 10CFR50, Appendix B.

AMSAC is not required to be safety related nor to meet IEEE-279. However, the implementation will incorporate good engineering practices and will be such that the existing protection system continues to meet applicable safety-related criteria. Devices isolating AMSAC from the Reactor Protection System will meet the isolation device requirements of IEEE 279-1971.

ITEM 7: **MEANS FOR BYPASSING**

Bypass Switch Location

RESPONSE: As identified during the course of the subject conference call, a bypass switch will not be provided at the local AMSAC panel as shown in Figure B of the original submittal. This switch is provided in the Control Room only.

ITEM 9: **ELECTRICAL INDEPENDENCE FROM EXISTING REACTOR PROTECTION SYSTEM**

The staff requested that CP&L provide the Appendix A test data for the output isolation relays.

RESPONSE: Carolina Power & Light has selected the Struthers and Dunn Model 219XBX234 relay for output isolation. It is CP&L's understanding that this relay module had been accepted by the NRC for this application at other facilities and that selection of this module would resolve any NRC concerns that a qualified isolation device would be used. It is not used in the RPS system, thereby ensuring the required diversity for protection against common mode failures in both AMSAC and RPS. To the extent applicable for relay type devices, the Appendix A information for this unit is provided in Attachment 2 to show that this unit is used in a configuration enveloped by its testing.

ITEM 10: **PHYSICAL SEPARATION FROM EXISTING REACTOR PROTECTION SYSTEM**

State the physical separation criteria for the RPS system (FSAR section reference is adequate).

RESPONSE: AMSAC will be physically separated from existing Reactor Protection System hardware. Cable routing will maintain separation from existing Reactor Protection System cable. The AMSAC controller will be located in a separate cabinet where there will be no interaction with existing Reactor Protection System equipment. Nonsafety AMSAC equipment will be isolated from existing Reactor Protection System as inputs and outputs.

The physical separation criteria for the Reactor Protection System at H. B. Robinson is stated in Section 7.2 of the Updated FSAR. Specific sections pertaining to the AMSAC installation are 7.2.1.1.5; 7.2.1.1.6; 7.2.1.2; and 7.2.1.3.

ITEM 12: **TESTABILITY AT POWER**

Provide more specific information concerning the AMSAC system's periodic testing capabilities and requirements. Specifically describe the test program including test descriptions, frequencies, and identification of controlling documents. Demonstrate that end-to-end testing of the entire system will be accomplished at least every refueling outage.

RESPONSE: Some of the testing methodology described in the original October 30, 1987 submittal have changed as a result of subsequent evolutions and refinements of the system design. To avoid confusion as to the capabilities of the existing design, the following is a comprehensive, revised discussion of the system's testing capabilities which supersedes the description provided in the previous submittal. The attached AMSAC Functional Diagram will be used to help demonstrate which portions of the system are being tested by each test described.

AMSAC will undergo end-to-end testing and calibration on a once per refueling outage basis. Although the program has not been finalized, it is anticipated that AMSAC testing/calibration will be performed in three overlapping major segments: plant variable sensor input loops; the AMSAC processors through output isolation relays; and the final actuation circuit test. Regardless of the manner in which AMSAC testing is ultimately segmented, it will be conducted in accordance with plant procedures in a manner that provides effective end-to-end testing of the AMSAC capability. The following discussion describes the currently envisioned periodic manual testing program.

- INPUT INSTRUMENT LOOP VERIFICATION AND CALIBRATION

  The existing steam generator level and turbine pressure input instrumentation loops are presently calibrated once a refueling outage as a part of the existing Reactor Protection System (RPS). The plant procedures governing those calibrations will be modified to test the additional isolator and current-to-voltage conversion in each loop that feeds the AMSAC system. These procedures will test and calibrate the AMSAC input signals from the sensors through the isolators to the test terminal strips in the AMSAC cabinet.

- PROCESSOR TEST AND CALIBRATION

  The AMSAC cabinet is equipped with a special test/terminal strip which enables the technician to break the connection from any input signal to either processor by simply opening a knife blade type contact across the input and output lugs of the terminal strip. A simulated input signal can then be injected into either processor by plugging a 0-5 VDC signal generator into the signal injection port on the output lug of the terminal strip. The terminal strip is accessible from the front of the AMSAC cabinet so that the technician can readily view the information displayed on the panel.

  Using this capability to simulate inputs and the various information displayed on the AMSAC panel, a functional test and calibration of the AMSAC processor can be performed. The processor's comparators which identify the "tripped" condition and perform the "spread checks" for each of the AMSAC signal inputs can be calibrated. The setpoints can be verified or adjusted by observing the input value which activates the corresponding lamps on the cabinet display. By injecting various combinations of signals into each processor, the program logic can be verified and the capability of each processor to independently trip the final output isolation relay can be verified. During the course of this testing and calibration, proper functioning of the AMSAC panel and Control Room displays can be verified. At the conclusion of the tests, the continuity across the closed knife contacts on the terminal strip will be verified for each input to the processor under test. These tests will be performed once every refueling outage and will be controlled in accordance with plant procedures.

  This processor test and calibration will cover the AMSAC circuitry from the test/terminal strip up to its interface with the existing turbine trip and auxiliary feedwater (AFW) actuation circuits. This testing will verify that the AMSAC signal at that interface is capable of initiating the required actuation function.

- FINAL ACTUATION CIRCUIT TEST

  The turbine trip and AFW actuation circuits are tested independently of AMSAC by the existing test program on at least a once per refueling outage basis. The plant procedures governing these tests will be amended as necessary to include the additional

AMSAC actuation circuit. The combination of the previously discussed input instrument loop calibration, the processor testing, and this final actuation circuit testing will provide effective end-to-end testing of the AMSAC capability.

In addition to the manual periodic test/calibration described above, the following sections describe the automatic checks performed by each processor.

- CONTINUOUS SELF-DIAGNOSTICS (AUTOMATIC)

  Each programmable controller will perform self-diagnostics to ensure proper operation. Immediately upon power-up, it will perform a cyclic redundancy check on the read only memory (EPROM) containing the microprogram which directs the programmable controller operation. The self-diagnostics will test the random access memory (RAM) to ensure it can be written to, and read from, and verify proper operation of the arithmetic and logic functions.

  A parity check on the program memory is performed each time an instruction is executed. This involves encoding a specific "parity bit" tracer at predetermined locations in the program data in memory. The controller verifies the authenticity of the command by verifying the existence and location of the parity bit. A watchdog timer will check that each scan is executed normally. These checks will ensure that the hardware functions properly and the software is not corrupted. Processor failures identified will be indicated by activation of the "Trouble Lamp" in the control room and on the local AMSAC panel.

- SENSOR INPUT QUALITY CHECKS (AUTOMATIC)

  The AMSAC controller program will perform a "spread check" on AMSAC input signals every scan cycle and light the "AMSAC Trouble" lamp on the RTGB in the Control Room and on the local AMSAC panel if a large difference exists among the signal inputs from the steam generators or the turbine. The plant personnel will then use the AMSAC panels diagnostic features to investigate the nature of the problem. The spread checks test each signal for most failure modes, however, slight instrument drift cannot be detected. These will be adjusted by the refueling outage calibrations. Figure 4 shows the controls and displays currently planned for this local AMSAC panel. The final design may be subject to change.

  Status lights for the steam generator level and power level inputs to each controller unit will indicate which of the inputs was exhibiting the excessive "spread" which initiated the "AMSAC Trouble" lamp in the Control Room. Diagnostic capabilities at the AMSAC panel, in conjunction with existing control room instrumentation, will enable plant personnel to establish the probable source of the problem that actuated the trouble light.

These status lamps will also indicate any inputs which are in a "tripped" status for having exceeded their setpoint values. A separate "variable tripped" lamp indication will allow plant personnel to distinguish indication of an input exceeding its setpoint from that of the input exhibiting an excessive spread from the other corresponding inputs.

o PROCESSOR VOTING RELAY TEST (AUTOMATIC)

To enhance reliability and testability, each AMSAC controller unit will drive three relays wired in a configuration shown in the attached Figure 5. Continuity is required across these contacts in order to supply power to the isolation relays which initiate mitigating actions. One of the relays from each controller unit (labeled A3 and B3) will be normally closed during operation and opened only when the associated controller unit is isolated in a test mode. The other two relays from each unit are redundant modules which are normally open and close only upon an AMSAC actuation signal from the associated controller. This configuration of redundant output relays from independent controller units contributes significantly to the reliability of the system. These relays are automatically tested every 14 days by the Output Relay Test Subprogram. Auxiliary circuits enable each processor to open or close its associated relays while maintaining a nontripped configuration. The processor is then capable of testing relay operation by generating a test signal which is passed through the relay contracts. Proper contact position is verified by receipt of the signal at the contact output. The test signal connections and relay sequencing logic are configured to ensure that each output relay (e.g., A1 to A3 and B1 to B3) is unambiguously tested to open and close on the appropriate command.

HBR AMSAC FUNCTIONAL DIAGRAM

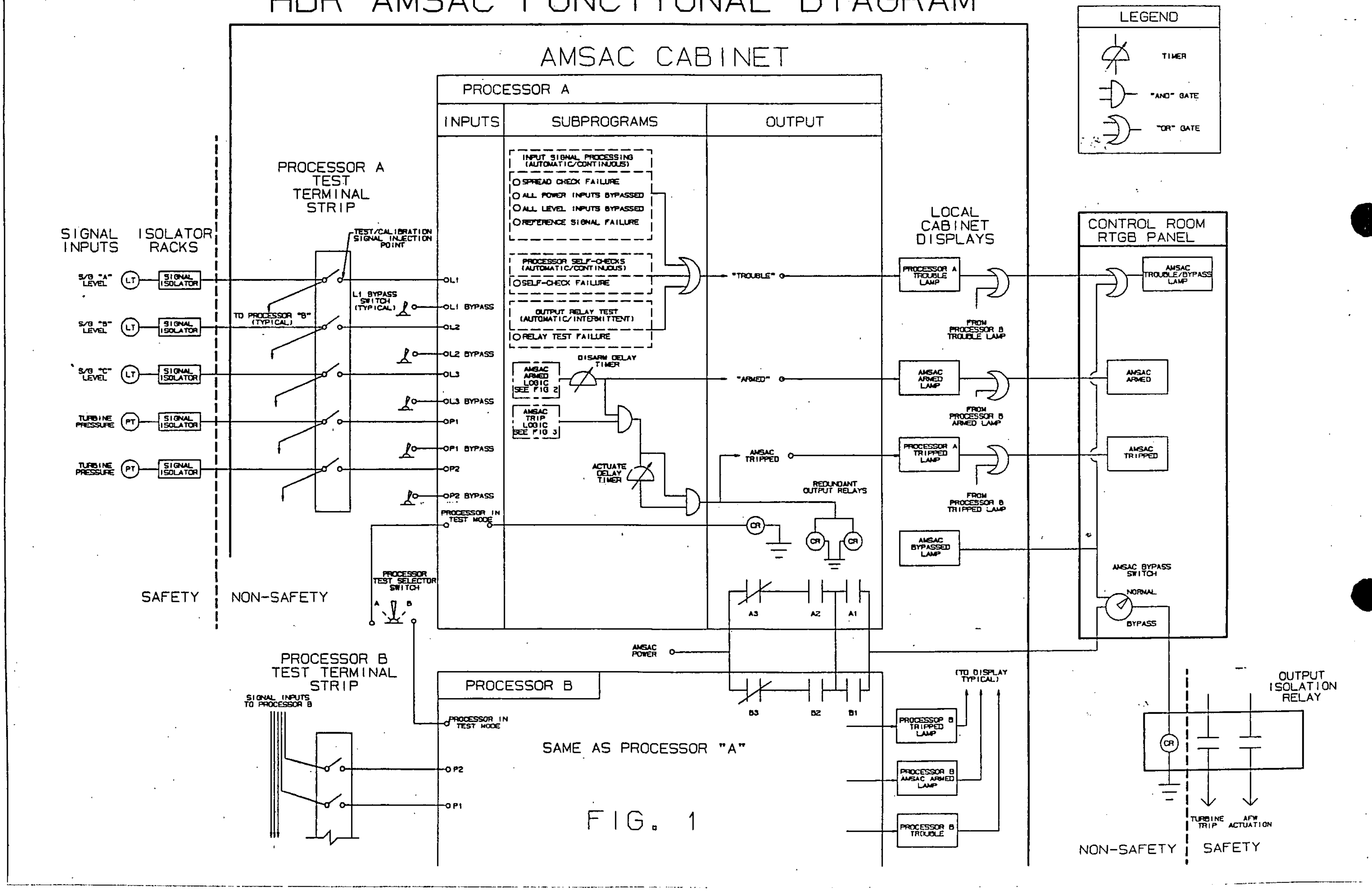
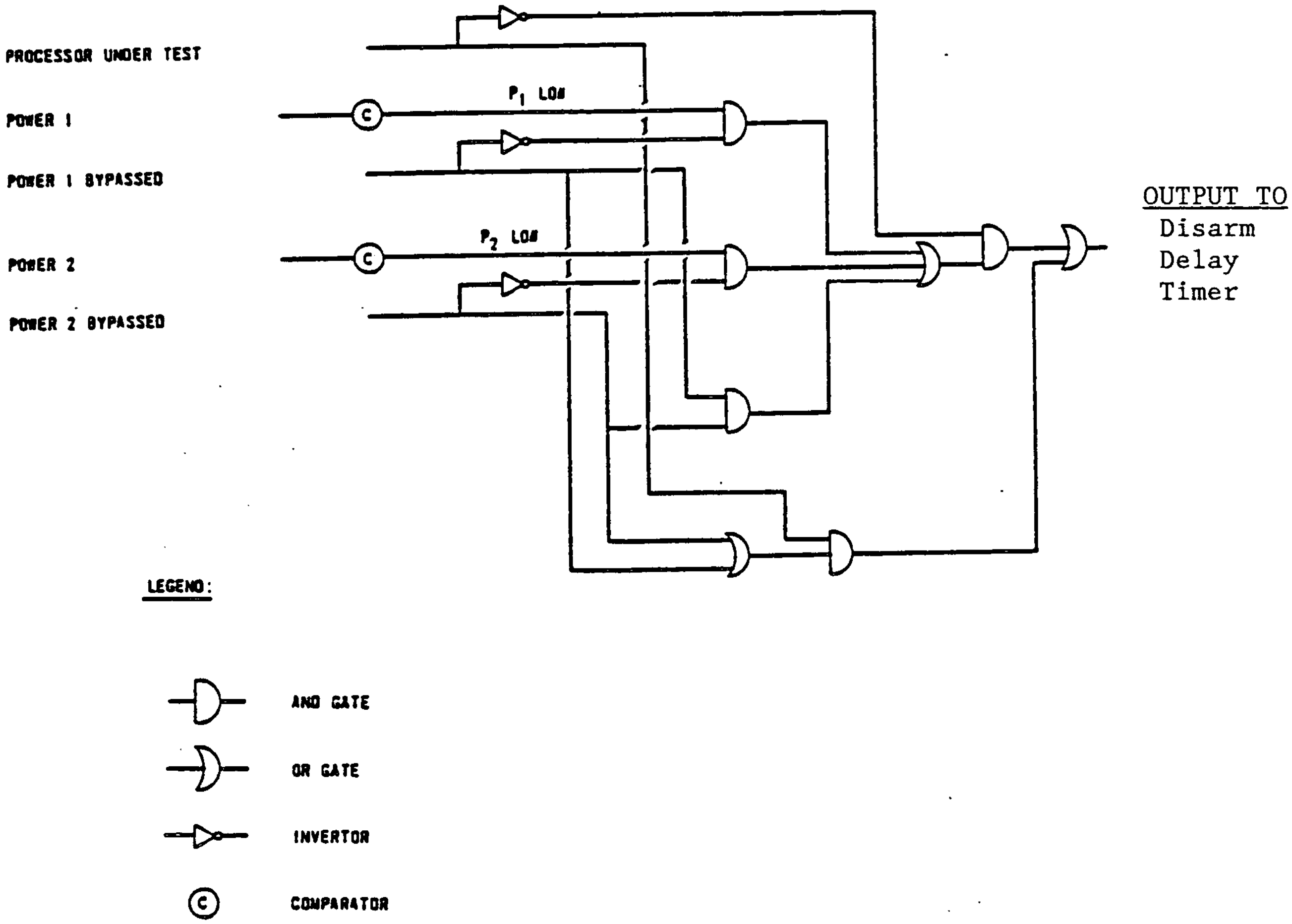


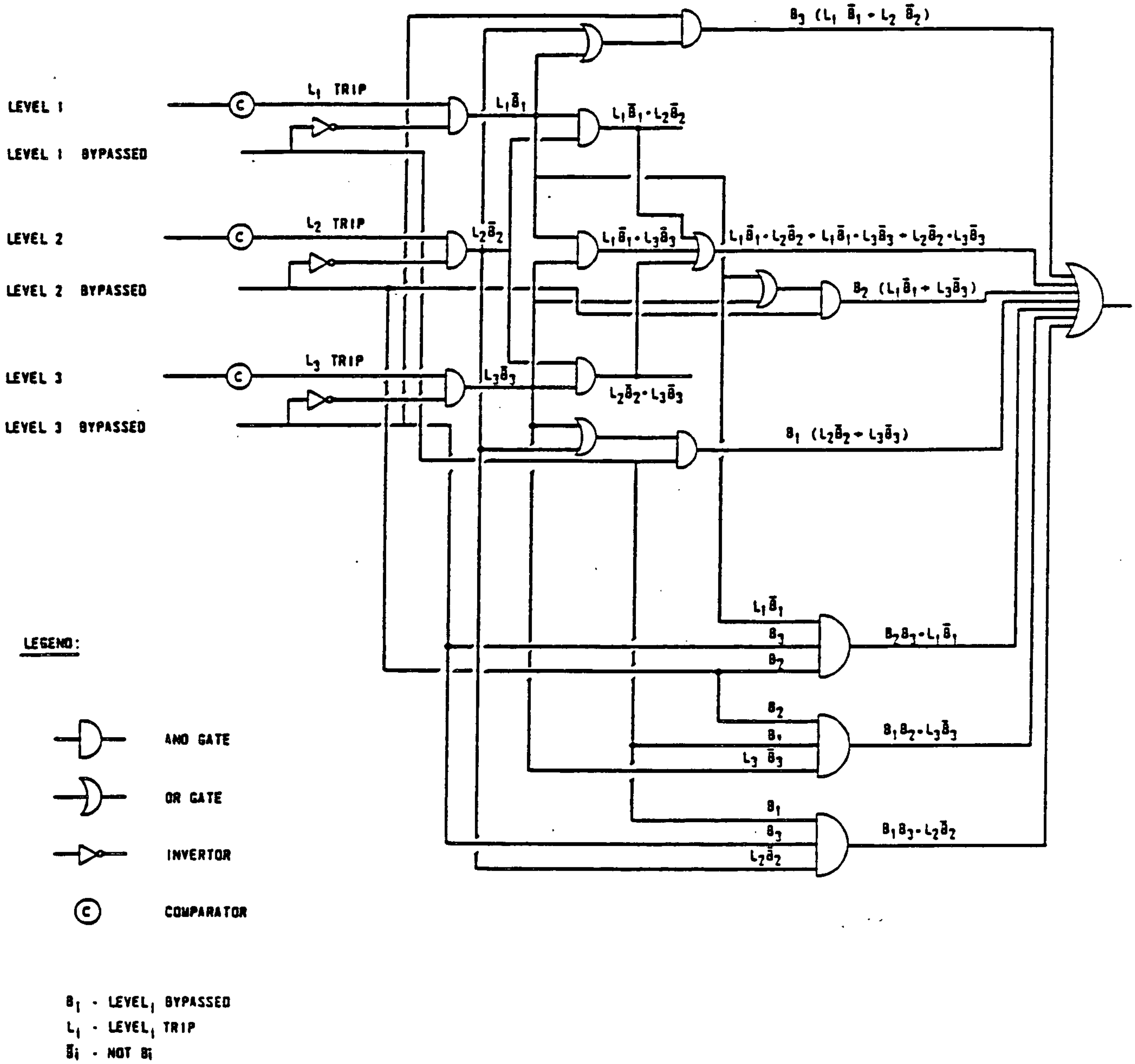
FIG. 1



AMSAC FUNCTIONAL LOGIC DIAGRAMS

AMSAC ARMED LOGIC

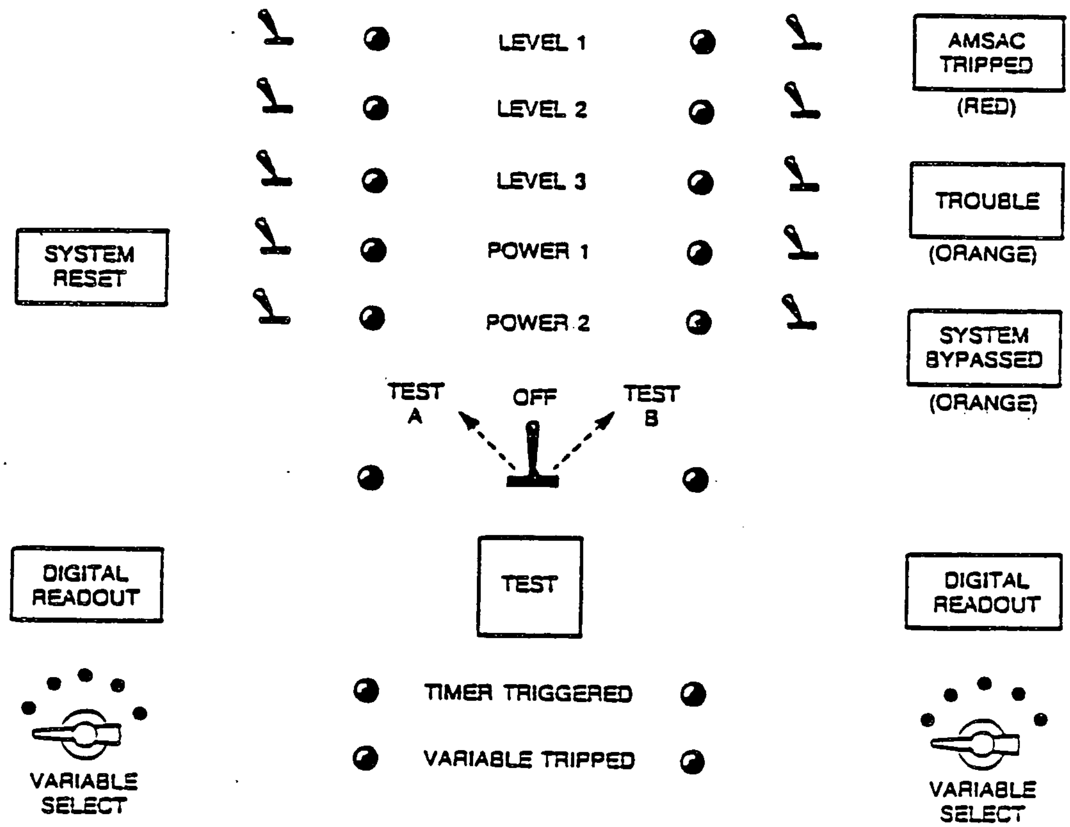
FIGURE 2



AMSAC FUNCTIONAL LOGIC DIAGRAMS

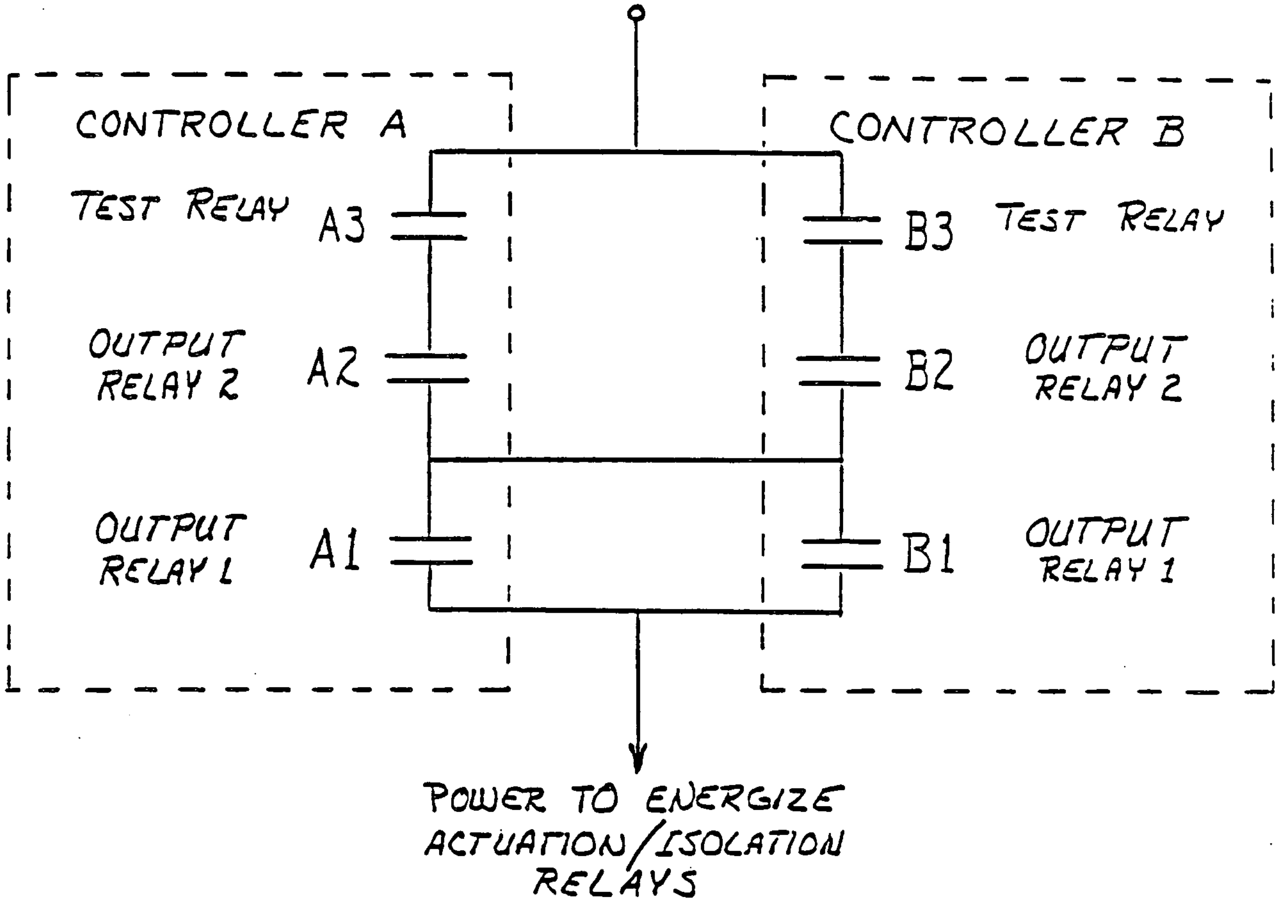
TRIP CONDITION LOGIC

FIGURE 3



AMSAC LOCAL PANEL

FIGURE 4



Notes:

1) All contacts open when de-energized.

2) Contacts labeled A are driven by Processor A; those labeled B are driven by Processor B. Either processor is capable of independently generating the AMSAC initiating signal.

3) Contacts A3 and B3 are held closed when the AMSAC is running. A3 opens when Processor A is under test; Contact B3 opens when B is under test.

4) Contacts numbered 1 and 2 are from redundant output modules on each controller. Both close upon a signal from the controller to initiate AMSAC mitigating action.

ARRANGEMENT OF SIGNAL OUTPUT RELAYS

FIGURE 5

ATTACHMENT 2

Struthers-Dunn Model 219XBX234 relays will be used as ATWS output isolation devices. These relays were supplied as safety-related Class 1E isolation devices. The response to the Appendix A information request is provided below. The test data discussed in this attachment refers to tests previously performed to qualify this device for other Class 1E applications at the Shearon Harris Nuclear Power Plant.

Information Request A

For the type of device used to accomplish electrical isolation, describe the specific testing performed to demonstrate that the device is acceptable for its application(s). This description should include elementary diagrams when necessary to indicate the test configuration and how the maximum credible faults were applied to the devices.

Response

New and thermally aged Struthers-Dunn test relays were subjected to a hypot test between the coil and contacts of 4400 VRMS for one minute. A hypot test between coil and frame of 4400 VRMS for one minute was also conducted. The results of this testing concluded the relays performed their required isolation function and withstood the 4000 VRMS isolation test.

Information Request B

Data to verify that the maximum credible faults applied during the test were the maximum voltage/current to which the device could be exposed, and define how the maximum voltage/current was determined.

Response

The power supplies used for the Struthers-Dunn isolation relays will be nominal 120 VAC, with the relays enclosed in a protected dedicated enclosure and cabling protected by conduits with only nominal 120 VAC available. Carolina Power & Light Company has examined this configuration and use of the Struthers-Dunn isolation relays and has determined that the maximum credible fault that these relays may be subjected to is 120 VAC. The Struthers-Dunn isolation relays are designed to operate at 120 VAC. This is also the maximum potential supplied to the isolation cabinets in which the relays are installed. In view of the 4000 VRMS isolation design, the isolation relays are adequate for this application.

Information Request C

Data to verify that the maximum credible fault was applied to the output of the device in the transverse mode (between signal and return) and other faults were considered (i.e., open and short circuits).

Response

The maximum credible fault is the 120 VAC operating voltage of the relays (coil and contacts). The 4000 VRMS isolation test between relay coil, contacts, and frame verifies that these relays provide effective isolation at the safety-nonsafety boundary at the maximum credible fault conditions. Due to the design of the isolation device, i.e., a relay and not an electronic isolator, open or short circuits on either safety or nonsafety sides of the isolator would have no effect on the safety-nonsafety boundary isolation. Therefore, CP&L concludes that the isolation relay will limit a failure or malfunction to the side of the relay where the failure occurs.

Information Request D

Define the pass/fail acceptance criteria for each type of device.

Response

Isolation relays type tested must withstand 4000 VRMS hypot testing for 1 minute.

Information Request E

Provide a commitment that the isolation devices comply with the environmental qualifications (10CFR50.49) and with the seismic qualifications which were the basis for plant licensing.

Response

The Struthers-Dunn isolation relays will be installed in a mild environment. Even so, these relays were thermally aged and seismically tested and determined to meet the H. B. Robinson Plant EQ and seismic requirements.

Information Request F

Provide a description of the measures taken to protect the safety systems from electrical interference (i.e., Electrostatic Coupling, EMI, Common Mode, and Cross Talk) that may be generated by the ATWS circuits.

Response

These relays interface with and transfer on-off control signals in relay logic, no low-level electronic instrumentation signals. Therefore, AMSAC generated interference with the actuation circuits is not considered creditable. AMSAC cable routing will provide appropriate separation from safety-related instrument lines to protect against AMSAC generated interference.

Information Request G

Provide information to verify that the Class 1E isolator is powered from a Class 1E source.

Response

The output isolation relays at the H. B. Robinson plant will be powered from the AMSAC battery-backed nonsafety-related power. The failure of AMSAC power would disable the AMSAC output isolation relay, however, it would not have any effect on the isolation of AMSAC from the existing safety-related circuitry.