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SUBJECT: Forwards addl response to NRC 900910 request for addl info re emergency power sys enhancement project.

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L-90-349

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Re: Turkey Point Units 3 and 4
Docket No. 50-250 and 50-251
Emergency Power System Enhancement Project

By letter L-88-269, dated June 23, 1988 as supplemented by letter L-89-124, dated April 3, 1989, FPL provided the Emergency Power Systems (EPS) Enhancement Report to the NRC staff. By letter dated September 10, 1990, the NRC requested additional information relating to the design of the electrical load sequences. Enclosed please find the additional information as requested.

Should there be any questions, please contact us.

Very truly yours,

KN HARRIS by DeLPearce

K. N. Harris
Vice President
Turkey Point Plant Nuclear

KNH/GS

enclosure

cc: Stewart D. Ebneter, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant

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RESPONSE TO NRC QUESTIONS
EDG BUS LOAD SEQUENCER

RAI 1

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

Response to RAI 1:

The Bus Load Sequencer, as manufactured by United Controls Incorporated, is based on the Allen-Bradley Mini PLC-2/16 programmable logic controller (PLC). The PLC and I/O ac source is passed through a 120/120V single phase isolation transformer before it is supplied to the processor and I/O cards. Additionally, 125V dc power is used as the circuit voltage for determining field contact status for the 125V dc input modules.

Each I/O card utilizes either a solid state photo-optic device (opto-isolator) or a relay to provide electrical isolation for the processor circuits and components from field applied and/or induced voltage surges and transients.

The manufacturer's test program for the PLC is in accordance with IEEE 472-1974, "IEEE Guide for Surge Withstand (SWC) Tests," and NEMA ICS 1-1983, "General Standards for Industrial Control and Systems," as documented by Allen-Bradley Procedures PC-009 and PC-010. Allen-Bradley procedures provide ac surge testing for the isolation modules which are rated for and applied in both ac and dc applications. Electrical noise tests include subjecting the I/O modules' inputs and outputs and the PLC power connections to 1500 volt transients. Additionally, 3,000 volt surge tests were conducted for the same connections in accordance with IEEE 472.

Schemes for the noise test are included in Attachment 1. The surge test is performed by connecting a surge transient generator, through an isolation network, to the ac power supplied to the test PLC. The waveforms and other characteristics of the transients and surges are in accordance with IEEE 472 and NEMA ICS-1.

RAI 2

Provide 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 to RAI 2:

The sequencer has three (3) safety related inputs: two (2) 120 Vac vital (inverter) feeds, and one (1) 125 Vdc feed. Each input power supply is ungrounded. A fourth non-vital power feed (120 Vac) is also provided for input supply to the 125 Vdc power supply used for sequencer lamp test. Since this is a non-safety related function, this feed is not discussed further. A detailed transient study has not been performed for the ac and dc power supplies at Turkey Point. Testing requirements are specified in accordance with standard industry practice using the following standards as guidance.

a) NEMA standard ICS 1-1983 for noise (for all control and ac lines supplying power to a power supply of a programmable logic controller).

b) ANSI C37.90A-1974/IEEE standard 472-1974 - This standard provides a guide for ac surge withstand capability tests and requires a test wave in the range of 2.5-3.0 kV.

The transient voltages specified in the identified standards, as applied to the PLC during testing, are believed to be conservative compared to the application at Turkey Point based on the following:

a) Surges are applied directly to PLC in test; however, both the isolation transformer and ac/dc power supply provide attenuation to upstream surges.

b) The battery and battery chargers provide significant attenuation of upstream ac transients due to the long time constant as compared to a transient surge duration.

c) Interposing relays between the PLC outputs and the field driven devices provide additional isolation.

RAI 3

Provide 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 to verify that other faults were considered, i.e., open and short circuits.

Response to RAI 3:

In accordance with NEMA, ANSI, and IEEE standards mentioned in RAIs 1 and 2 above, transient voltages have been applied to the output modules to verify PLC resistance to voltage transients for normal throughput and transverse operating modes, as shown in Attachment 1. Open and short circuit faults simulate change of state of contacts which have been demonstrated through testing. Proprietary test data is maintained at the Allen-Bradley facility.

RAI 4

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

Response to RAI 4:

The following acceptance criteria has been submitted by Allen-Bradley as it applies to the PLC:

During the test period, the product or programmable controller system under test shall continuously operate in a normal manner, within its specification, without interruption, failure or damage. In addition to other failure modes, loss or alteration of memory and soft errors shall be considered failures.

RAI 5

Provide a discussion of protective devices or other means provided to prevent lightning strikes or switching surges from propagating to the solid state programmable logic load sequencers and causing a common mode failure of the load sequencers.

Response to RAI 5:

With regard to common mode failures affecting both the "A" and "B" sequencers of a unit, the following is noted:

a. The sequencers have their power circuits routed in dedicated raceway separate from that of the other sequencers.

b. Each sequencer obtains ac power from an inverter which is powered from a dc source which is of the same train as the sequencer.

c. Each sequencer obtains dc power from a dc source which is of the same train as the sequencer.

d. Batteries, chargers, and inverters are all located indoors, and are therefore immune from direct equipment lightning strikes.

Items a-d above preclude common mode failures of a unit's A and B sequencers due to unexpected switching surges or lightning strikes which propagate through one train's source.

Typical lightning strikes will either be associated with direct strikes to structures or to transmission lines. Since strikes to structures will be diverted directly to the ground grid by the plant grounding and lightning protection system, typical lightning transients will not affect the sequencer circuitry. Transmission line strikes (surges) will be significantly attenuated by the cabling and power transformers. In addition, the station battery and battery chargers, due to their large time constant compared to the short duration of the lightning strike on the system, will also provide significant attenuation.

Since the inverter is powered from the dc system, its input will not be affected by typical transmission line strikes for the reasons noted above.

Switching surges upstream of the battery chargers will be attenuated by the battery and chargers for the reasons noted above. Switching surges on the ac and dc systems are expected to be enveloped by the IEEE 472 surge testing discussed in RAI-2 and as such, will not cause a failure of the PLCs.

REFERENCES

1. NRC letter to FPL dated September 10, 1990, Request For Additional Information.

2. ANSI C37.90A-1974/IEEE 472-1974, "IEEE Guide for Surge Withstand (SWC) Tests."

3. NEMA ICS 1-1983, "General Standards for Industrial Control and Systems."

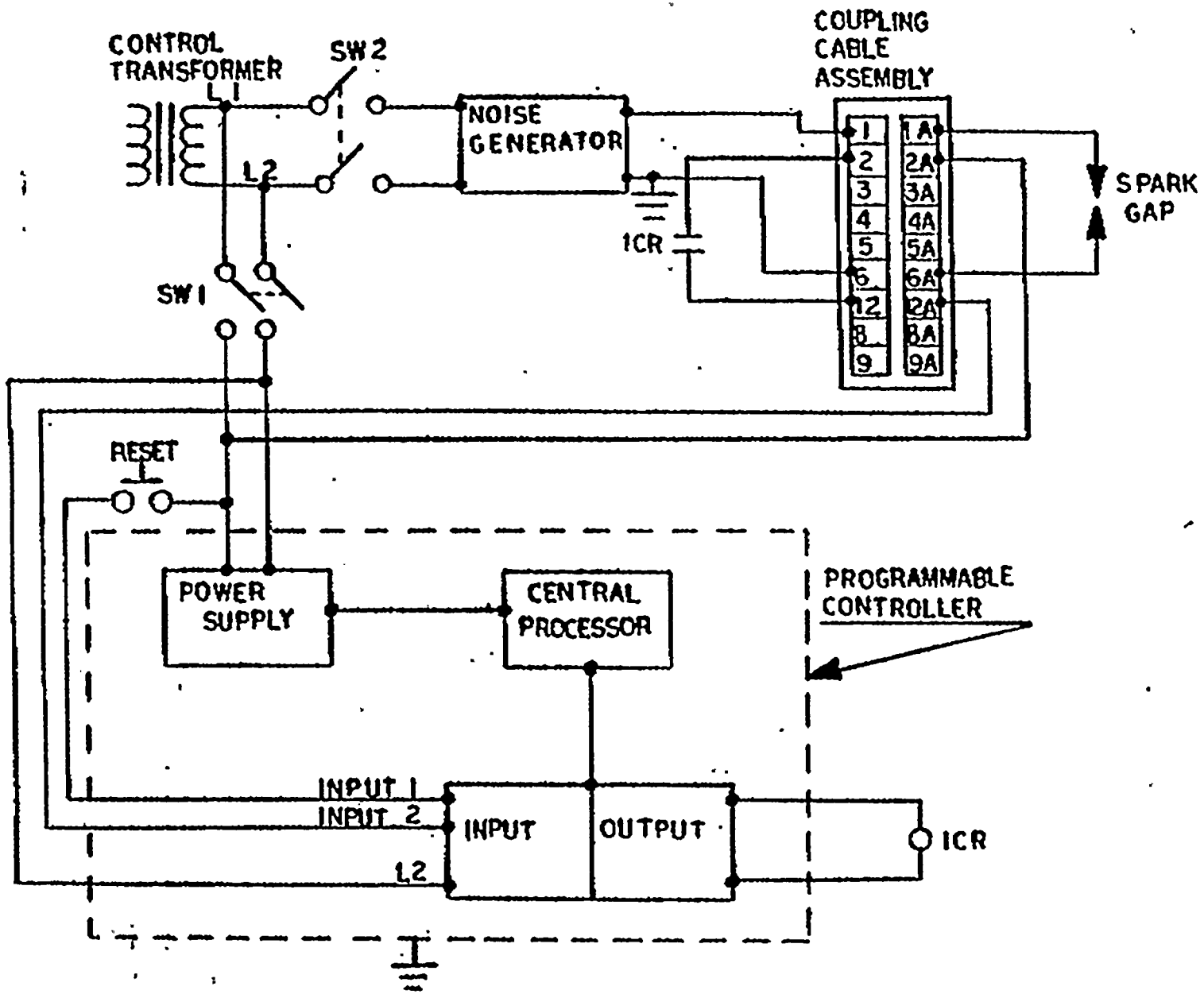
4. Allen-Bradley Procedures PC-009 and PC-010.

ATTACHMENT 1

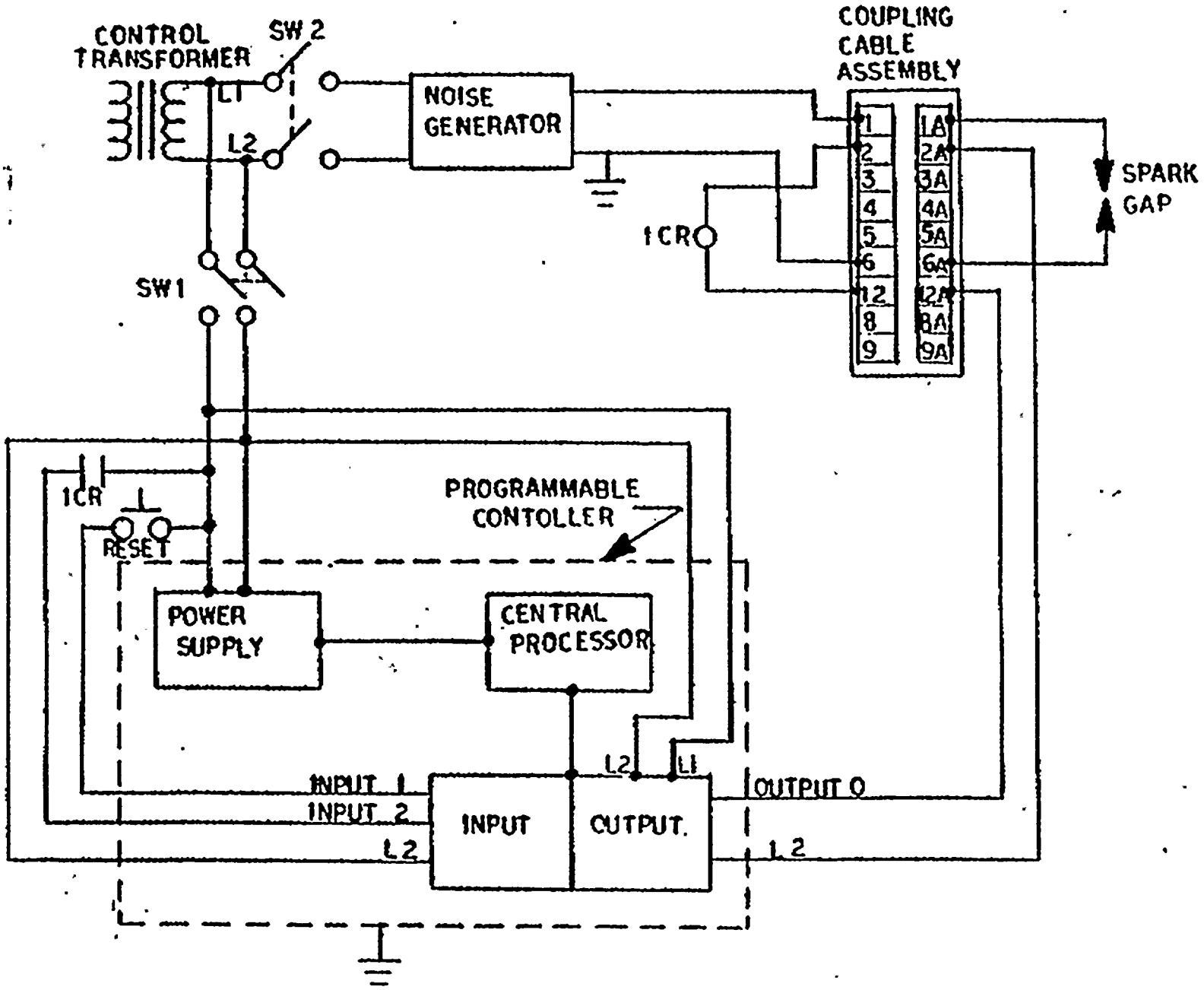
Notes:

1. Figures 1 through 3, attached, provide the actual test schematic as performed by Allen-Bradley for signal noise on PLC input modules, output modules, and power supplies. The test transients applied meet the transient requirements specified in NEMA ICS-1.

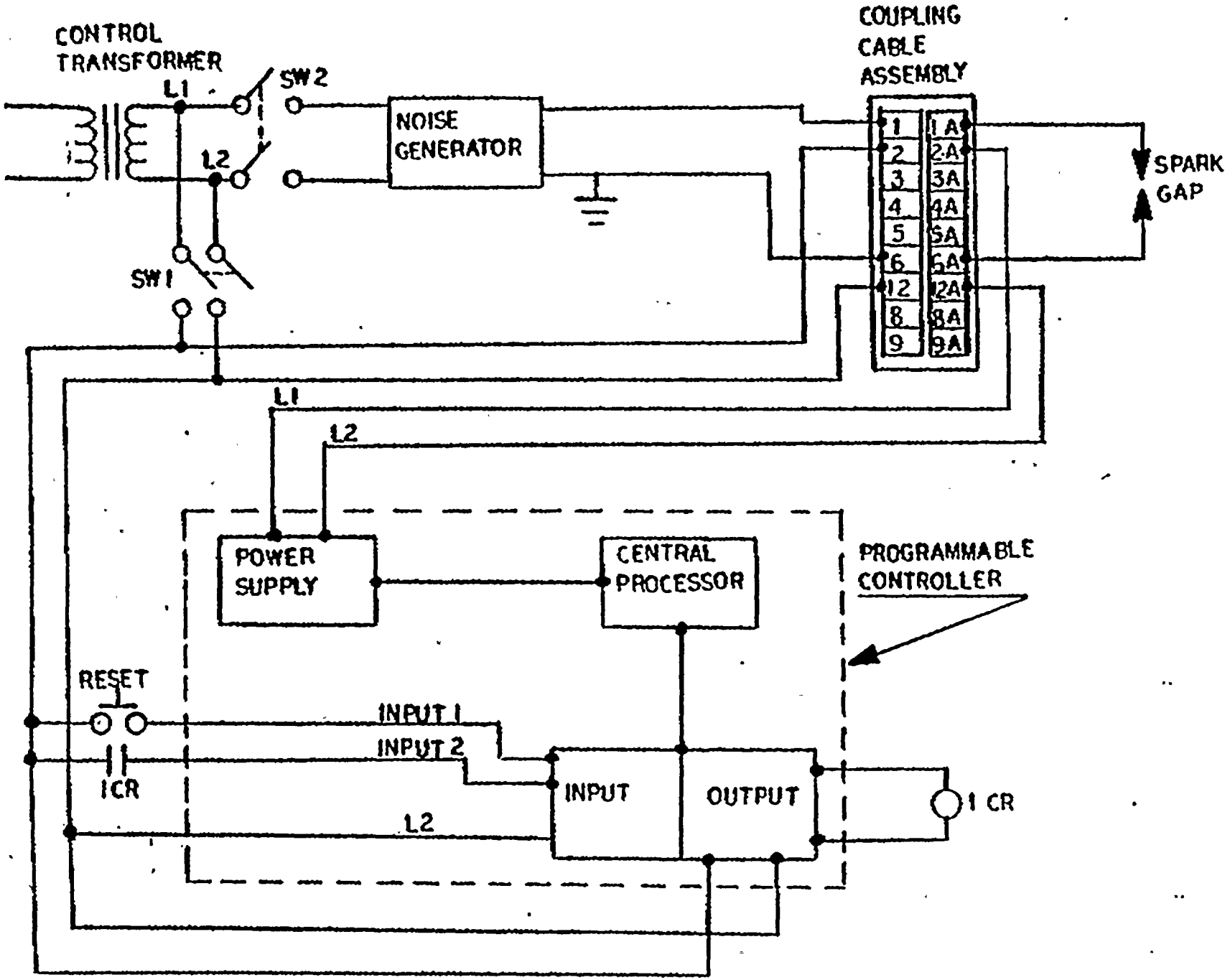
2. Figure 4 shows the model test schematic as contained in IEEE 472/ANSI C37.90a.



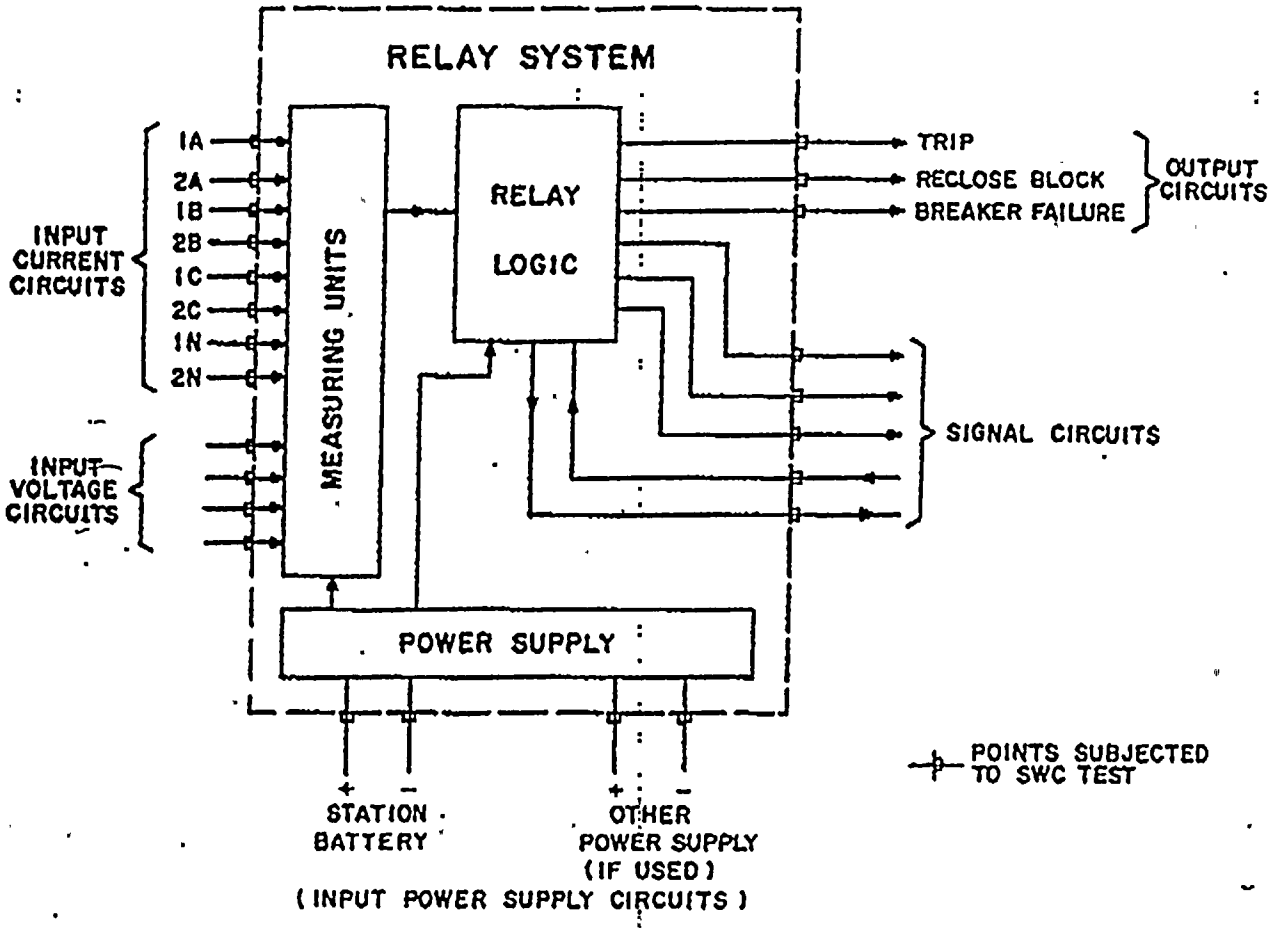
INPUT MODULE
TEST SETUP
FIGURE 1.



OUTPUT MODULE
TEST SETUP
FIGURE 2.



POWER SUPPLY
TEST SETUP
FIGURE 3



General Makeup of a Relay System without Communications Interface Showing Points to Be Subjected to the SWC Test

FIGURE 4