Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

February 4, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: LaSalle County Station Units 1 and 2
Response to NRC Request for Additional Information on SPDS Electric and Electronic Isolation
NRC Docket Nos. 50-373 and 50-374

References (a): D. M. Crutchfield letter to D. L. Farrar dated June 22, 1984.

(b): J. G. Marshall letter to H. R. Denton dated August 30, 1984.

Dear Mr. Denton:

The following information is provided in response to questions raised during a telecon of November 7, 1984 with Dr. A. Bournia, et. al., of your staff. This response consists of two attachments. They consist of a letter from G. R. Crane of our Station Nuclear Engineering Department to D. L. Farrar dated February 1, 1985, and its attachment, a letter from R. Schiavoni of Sargent and Lundy to G. R. Crane dated January 31, 1985.

One signed original and fifteen copies of this letter and its attachments are provided for NRC use.

Should you have additional questions or concerns relating to this information, please contact this office.

Very truly yours,

J. G. Marshall

J. G. Marshall
Nuclear Licensing Administrator

lm

cc: Dr. A. Bournia - via Federal Express
Resident Inspector - LSCS
G. J. Diederich

Attachments

A001
1/1

February 1, 1985

Subject: LaSalle County Station, Units 1 & 2
Electric and Electronic Isolation of SPDS

Mr. D.L. Farrar:

Following the NLA response of August 30, 1984 to NRR on the SPDS design for CECo Stations, Mr. Bournia asked for additional LaSalle information by telecon of November 7, 1984. The requested information is attached in the form of a letter from S&L's, R. Schiavoni to G.R. Crane dated January 31, 1985. The statements refer to the LaSalle SPDS which is essentially twice removed from the safety channels of the plant: once, by signal isolators between the safety circuits and the process computer, and secondly by the process computer which inputs to the CRT displays that constitute the SPDS. The thrust of the question is the electrical and electronic isolation of SPDS. The functional tests employed for the qualification of the CM-249 isolator are described. A statement of the acceptance criteria is made in terms of total isolation function. Because the input impedance of the operational amplifier (Validyne CM249) is so large, the potential for short circuiting the entire isolator is trivial based upon the overvoltages possibly available to the op-amp. The functional tests and the dielectric strength test demonstrated this characteristic via a maximum credible fault test at 2000 Volts (DC) for one minute.

Propagation of a fault from the SPDS backward through the process computer and the isolators to the safety circuits is not credible; it is impossible. Typical failure of an op-amp isolator opens the circuit to deprive the process computer of the input parameter. The process computer buffering action protects SPDS against an external fault across the op-amp isolator.

The op-amp isolators for SPDS were qualified to NUREG 0588 Category II standards which is the licensing basis for originally installed equipment at LaSalle. 10CFR50.49k insures that requirements-racheting was not the intent of the rule on environment qualification. The license basis was specifically amplified via FSAR responses Q.031.137(6), 031.128, 031.69, 031.146, 040.75, and 040.99.

The Validyne CM 249 isolators are to be included as a generic item on the LaSalle Q-List similar to other generic switches, lights, terminals, etc. that are part of local electrical panels which were qualified as a unit for LaSalle.

George R. Crane

GRC/ji
4991L
Attachment
cc: J.S. Abel
R.F. Janecek
B.K. Wong
J. Marshall
R.M. Schiavoni (S&L)
J.B. Gouvas (S&L)
W. Huntington (LSCS)

SARGENT & LUNDY
ENGINEERS
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CHICAGO, ILLINOIS 60603
(312) 269-2000
TWX 910-221-2807

SCE-2178
January 31, 1985
Project No. 7043-63

Commonwealth Edison Company
La Salle County Station - Units 1 & 2

SPDS Electric and Electronic Isolation
WIN #0270

Reference: CECo letter dated November 26, 1984 from Mr. G. R. Crane to Mr. D. C. Haan (S&L)

Mr. G. R. Crane
Commonwealth Edison Company
P. O. Box 767
Chicago, Illinois 60609

Dear Mr. Crane:

This letter provides additional information to confirm that the SPDS is electrically and electronically isolated from sensors and equipment in safety systems.

General Description - SPDS

The La Salle SPDS is a CRT display system driven from the process computer which is a non-safety-related, electronically isolated plant component. Electrical inputs from safety-related equipment for the Process/SPDS computer are routed to Validyne CM249 Remote Carrier Modulator/Isolation devices. Figure 1 is a block diagram for the SPDS. The Validyne CM249 Remote Carrier Modulator provides suitable isolation from electrical or electronic interference with equipment and sensors that are in use for safety systems.

General Description - CM249

The CM249 is designed as a remote carrier modulator accessory for use with the MC1 and MC170 Validyne Modular transducer control systems. It provides input-to-output isolation and signal modulation for standard signal presentation to carrier demodulator plug-in modules.

The CM249 is designed for remote location. It is capable of isolation of common-mode voltages as high as 2000V peak. The CM249 modulates signals and transmits these signals down long lines to be demodulated by a Validyne Carrier Demodulator such as a CD19, CD183, etc. Electrical Specifications for the CM249 are given in Figure 2.

Figure 3 is a block diagram of the CM249 remote carrier modulator/isolator. The input is configured with an integrated circuit voltage amplifier, with a two megohm input impedance. The output impedance is 10 ohms, which virtually eliminates cable loading effects. All high voltage is removed from interconnecting cables for greater safety.

The CM249 has two modes of operation: +5V differential input mode and switch closure mode. The +5V differential input mode is used in connection with voltage input and current loop input sensing as shown in Figures 4A and 4B. In the switch closure mode an internal voltage supply (4.4Vdc bias voltage in series with a one megohm resistor, available at input terminal 1) provides excitation to enable contact closure status sensing. This mode is illustrated in Figures 4C and 4D.

Qualification Testing - CM249

As noted in FSAR Question 31.137, qualification of CM249 prototype units was completed in February 1979. The report covering this qualification is Wyle Laboratories Test Report No. 58390, dated April 25, 1979. To address the areas of NRC concern excerpts from this report on the functional testing performed are appropriate.

Functional Tests

a. Measurements of dc differential input impedance without device connection to a demodulator and without excitation, were conducted.

b. The same as above was conducted except with an ac (5V peak, 60Hz) input signal.

c. The same as a, above, was conducted except with a Validyne CD19 demodulator connected.

d. Same as c, above, was conducted except with the output pins (2 and 3) not connected.

e. The same as c, above, was conducted except with the output pins (2 and 3) shorted.

f. The same as c, above, was conducted except with output pins (2 and 3) connected to the case.

g. The same as c, above was conducted except with the excitation conditions listed as follows:

1. 110% voltage level, nominal frequency
2. 90% voltage, nominal frequency
3. Nominal voltage, 105% frequency
4. Nominal voltage, 95% frequency

Note that for these tests, the CD19 output is meaningless.

h. The dc common mode input impedance was measured with 500Vdc between each input pin and output pin 3.

i. The switch closure mode of operation was verified by measuring the CD19 output voltage (10 volts full scale with the specimen inputs 1 and 2 connected (should be 40% of full scale) and then with input pins, 1, 2, and 3 connected (should be 0% of full scale).

j. The output/input noise ratio was determined for frequencies of 60 to 20K Hz (in one octave steps); i.e., the voltage appearing across a 50 ohm source impedance simulation was measured for 0.2 amp currents through output pins 1 and 3.

k. The same as j, above, was conducted except through output pins 2 and 3.

l. 2000Vdc output to input isolation tests were conducted by applying 2000Vdc between the following pins:

1. Between 2 and 3 inputs (bussed) and 2 and 3 outputs (bussed)

2. Between 2 and 3 inputs (bussed) to the chassis

3. Between 2 and 3 outputs (bussed) to the chassis

Tests a through l were performed prior to and after seismic testing. Functional tests c, d, e, and f were performed continuously. The input impedance signals were continuously recorded on an oscillograph. Tests j and k were also performed at resonance frequencies and at 70 Hz in each axis.

During fragility tests the differential input impedance was continuously monitored and tests c, d, e, f, and i were conducted after each 2g sweep.

In addition, prior to and after the accelerated aging (terminal strips), functional tests of the following description were performed on the terminal strips.

m. Dielectric Strength. The terminal strip was subjected to a "hi-pot" test of 2200 volts applied for one minute each between each terminal (eight) and ground, and between each terminal and an adjacent terminal.

n. Insulation Resistance. The terminal strip was subjected to 500Vdc for one minute between terminations and between the terminals and ground. The terminal strip insulation resistance was greater than 2×10^{12} ohms before and after aging.

o. A selected cable/connector joint was subjected to a cable pull test of a force magnitude of 1.0 pound. The strip was bolted in place during this test.

Based on the La Salle computer input isolation application of the CM249 isolation/modulator, the pass/fail acceptance criteria is the device must remain structurally intact and the device input impedance shall perform to manufacturer's specifications (greater than two megohms).

Conclusion

The maximum credible fault used for device qualification, 2000Vdc, envelopes all possible faults in terms of potential voltage and current exposures. This voltage was applied between the input and output of the device, as well as, between the input and chassis, and the outputs and chassis.The Validyne CM249 isolation devices comply with the environmental qualifications (10 CFR 50.49) and the seismic qualifications which were the basis for plant licensing.Therefore, electrical interference from the SPDS is isolated from La Salle safety systems.

If you have any question or comments, please contact me at your convenience.

Yours very truly,

R. M. SCHIAVONI

R. M. Schiavoni
Senior Electrical
Project Engineer

RMS/GJH:smq
In duplicate
Attachments
Copies:
R. F. Janecek
D. C. Haan
B. L. Pandit
J. Sinnappan

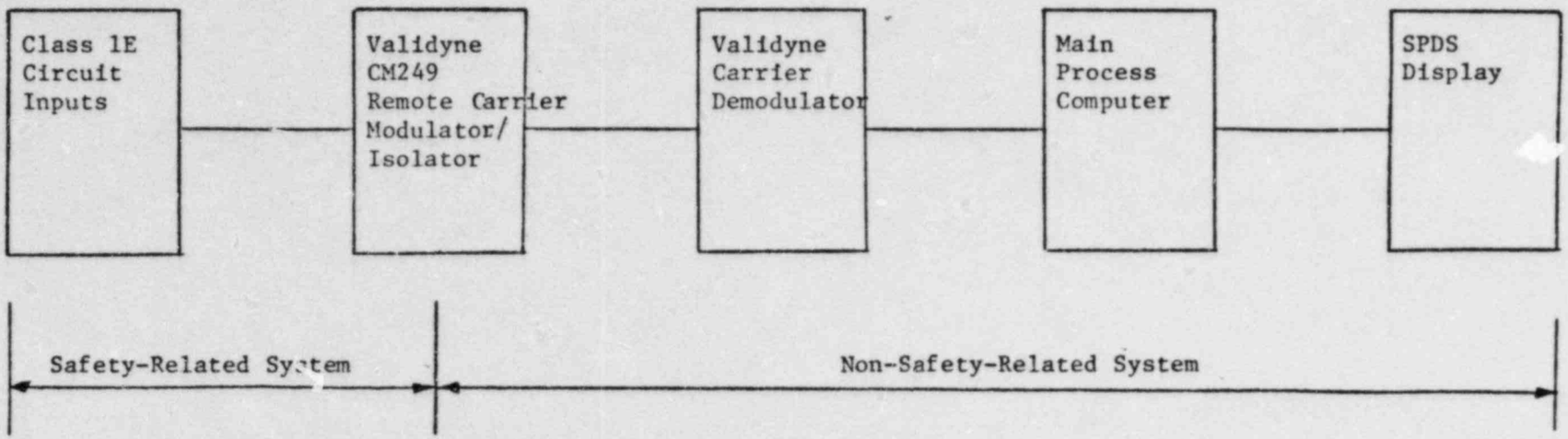


Figure 1 SPDS Block Diagram

SECTION II

2.0 SPECIFICATIONS

2.1 Electrical Specifications

Input:	0 to ±5V
Input Impedance:	2 megohms, operating or non-operating
Input Bias Current:	2 nanoamps
Input/Output Transfer Ratio:	5 volts input produce 35mV/V output, nominal
Power Required: (supplied by Carrier Demodulator)	5V rms; 3kHz at 15 ma max.
Input/Output Dielectric Strength:	2000 Vdc, 220 VAC, 50-60 Hz
Insulation Resistance:	10^{10} ohms
Input/Output Capacitance:	Less than 40pf
Operating Temperature:	0°F to 180°F
Environmental Pressure:	1 PSI above atmospheric
Humidity:	90%, non-condensing, to meet input-to-output insulation resistance
Radiation:	4.5×10^{4} RADS, integrated dose

2.2 Mechanical Specifications (See Outline Drawing CM249)

Figure 2 - CM249 SPECIFICATIONS

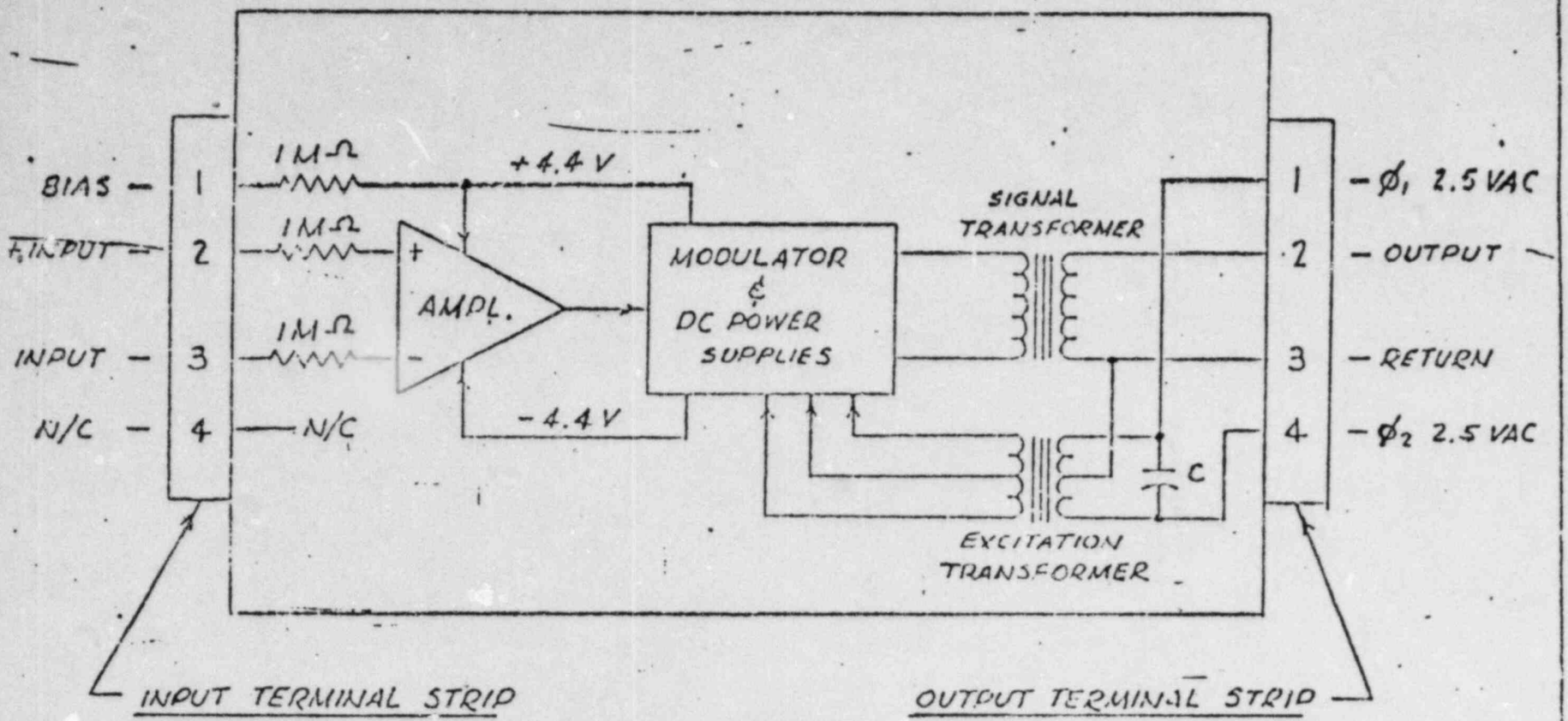


FIGURE 3 - BLOCK DIAGRAM, CM249

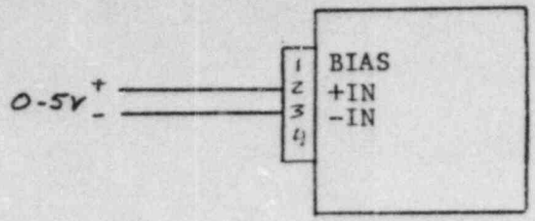


Figure 4A - Voltage Input

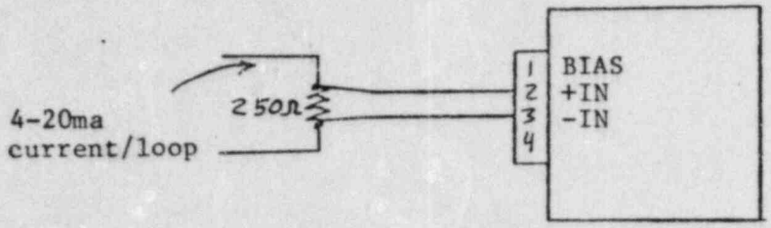
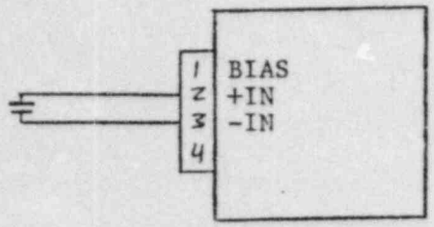
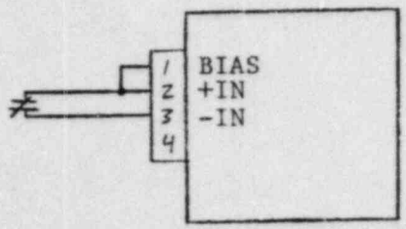


Figure 4B - Current Loop Input



SWITCH	OUTPUT
OPEN	NO
CLOSED	YES

Figure 4C - Contact Closure Input



SWITCH	OUTPUT
OPEN	YES
CLOSED	NO

Figure 4D - Contact Opening Input

Figure 4 CM249 Input Modes