

TECHNICAL REPORT

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LOCATION: Central Laboratories, Chattanooga Power Service Center
 SUBJECT: ISOLATING DEVICES - FAULT TESTS

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INTRODUCTION

The Central Laboratories Services Branch (CLSB) was requested to perform fault tests for the following: Robertshaw isolation amplifier, General Electric transmitter, and International Rectifier/Crydom solid state relay. The purpose was to determine if any credible events occur at the input while inserting various faults to the output. These tests were requested by H. Styles, Office of Engineering, Electrical Engineering Branch, W8A32 C-K.

RESULTS

Regardless of output fault, no electrical event could be observed on the input. It is evident that the devices provide complete isolation between input and output. Oscillograph recordings are bulky and will be transmitted in a package that is separate from this report to the Electrical Engineering Branch.

PROCEDURE

All measurements were performed by instruments that are certified in accordance with the approved laboratory quality assurance program. These instruments have documented traceability to officially recognized standards. Specific tests performed are contained in this report.

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The circuit shown on Figure 1 (attached) was used for testing the Robertshaw Model 572-C2 (S/N 7725015) isolation amplifier and the General Electric Type 550 (Code No. 7421-21G006-001) transmitter. Functional tests were first performed on each device to ensure proper operation and results of these are provided below. A check was made after each fault test to ensure that no damage was incurred and a complete functional test was performed after all faults had been applied as a comparison to the pre-fault test. Isolator output measurements for these tests are in millivolts measured across R1 of the output network and may be converted to milliamps using the measured value of this resistor.

PRE-FAULT FUNCTIONAL TEST RESULTS

<u>Isolator Input</u>	<u>Robertshaw Output</u>	<u>G.E. Output</u>
0% of range 10 mA	109 mV	111 mV
50% of range 30 mA	326 mV	329 mV
100% of range 50 mA	543 mV	547 mV

Input current was provided by a battery-resistor supply to ensure total isolation. On the oscillograph recordings the Robertshaw full-range input appears as a 5 V trace, the resultant voltage drop across the 100 Ω input resistance with 50 mA current flow. The G.E. input appears as approximately 60 mV due to the lower input resistance.

Performance of these two units during fault tests were identical in every respect. The following test results apply to both units.

TEST NO. 1

Instrument output load was removed and reconnected several times and then left open approximately five minutes.

Result: The oscillograph recordings for this test showed no effect on either the supply voltage or signal input line of either the Robertshaw or G.E. unit. Also, no visual effects were seen and a functional check of each unit after this test showed both to be fully operational.

TEST NO. 2

Instrument output short circuit was applied and removed several times and then left shorted approximately five minutes.

Result: The oscillograph recordings for this test showed no effect on the monitored inputs of either the Robertshaw or G.E. unit. Also, no visual effects were observed and a functional check of each unit after this test showed both to be fully operational.

TEST NO. 3

Application of a 120 VAC, 20 amp capacity supply to instrument output.

Result: Inspection of the oscillograph recordings resulting from this test again revealed no effect on the monitored inputs of either the Robertshaw or G.E. unit. No visual effects were seen but the two 5 KΩ

resistors were very warm to the touch. After this test a complete functional test was performed on each unit and the results are shown below.

<u>Isolator Input</u>	<u>Robertshaw Output</u>	<u>G.E. Output</u>
0% of range 10 mA	109 mV	108 mV
50% of range 30 mA	326 mV	324 mV
100% of range 50 mA	543 mV	541 mV

The circuit shown on Figure 2 (attached) was used for testing the International Rectifier/Crydom solid state relay Model No. A1202-1. Prior to fault testing, a functional test of the relay with a suitable load was performed which verified proper operation of the device. This test was repeated after the first fault test. Because of the results of the second fault test, a final functional test was not performed.

TEST NO. 1

With control side of relay de-energized, placing relay output in the open state, a 120 VAC, 20 amp, capacity supply was connected to the relay output and left for approximately one minute.

Result: There was no effect whatsoever observed on either the oscillograph recording or on the relay itself. A functional test after removal of the fault showed the relay was still operational.

TEST NO. 2

With control side of relay energized placing relay output in the closed state, a 120 VAC, 20 amp, capacity supply was connected to the relay output.

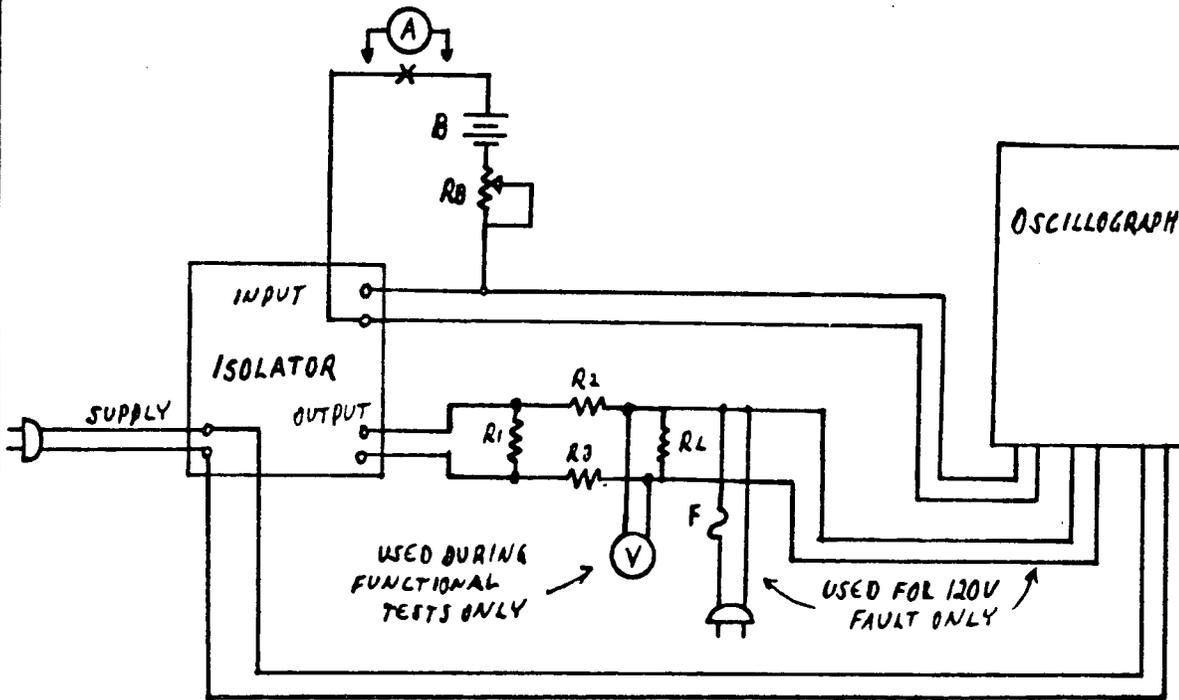
Result: Examination of the oscillograph recording shows that the input side of the relay was unaffected by the fault. Approximately 130 ms (or 8 cycles) after fault application, the fault voltage can be seen to have been pulled down slightly and this re-occurs to a greater extent approximately 730 ms after fault application. This appears to be the point in time when the relay cracked open emitting a popping sound and a small amount of smoke. No further action was observed after this point, and at the end of approximately three minutes the fault was removed. Visual inspection of the relay reveals an open crack in the case material and a blackened area on the mounting surface adjacent to the crack opening. It should be noted that this physical damage is on the input side of the relay but isolation was still maintained.

GAE:VEK:KM
Attachments

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FIGURE 1



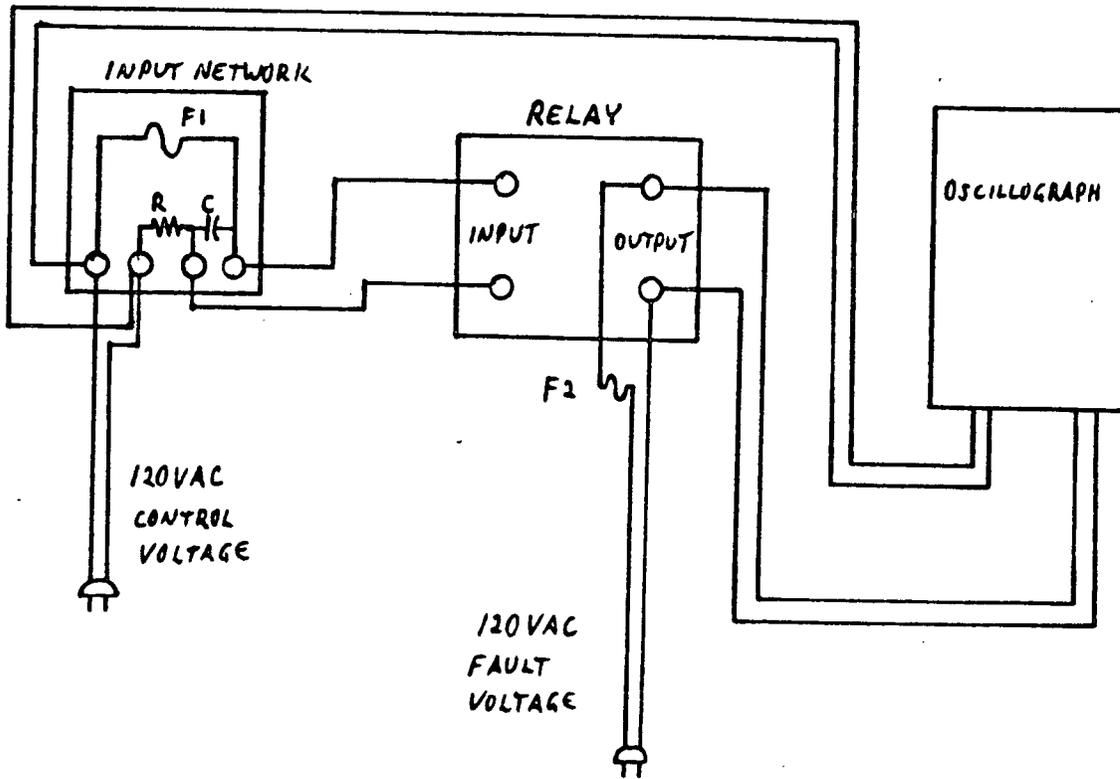
- R1 - 10Ω ¼ W. CARBON COMP. RESISTOR, MEASURED VALUE - 10.99Ω
- R2 - 5KΩ ¼ W. 1% TOL. METAL FILM
- R3 - SAME AS R2
- RL - 1MΩ 1%
- RB - 5KΩ W.W. POT
- B - 12V. 1.2AH NICAD BATTERY
- A - FLUKE 8600 DMM US-TVA 497534
- V - FLUKE 8600 DMM US-TVA 497517
- OSCILLOGRAPH SOLTEC 5M28 US-TVA 512797
- F - 20AMP FUSE

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FIGURE 2



INPUT NETWORK SUPPLIED WITH RELAY

F1 - 1/16 AMP

R - 680Ω 1/2 W. 5% CARBON COMPOSITION

C - .02μfd. 1KV CERAMIC DISC

F2 - 20AMP FUSE

OSCILLOGRAPH SOLTEC 5M28 US-TVA 512797