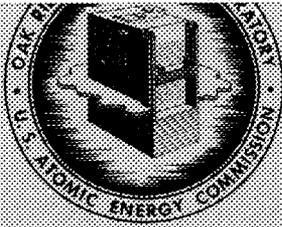




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## NUCLEAR INSTRUMENT MODULE MAINTENANCE MANUAL

## PART 23

## RELAY SAFETY ELEMENT, ORNL MODEL Q-2623

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## ABSTRACT

The circuit, application, maintenance procedures, and acceptance tests for a Relay Safety Element are described. The circuit, which forms part of a relay coincidence network, is constructed in a "2-unit" module of the ORNL Modular Reactor Instrumentation series Q-2600, and is intended for use in safety systems of reactors employing this series of instruments.

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## 1. DESCRIPTION

### 1.1 General

The Relay Safety Element is a logic element intended for use in the safety system of nuclear reactors. The circuit has a single input which is "normal" (115 v ac) or "trip" (0 v). The output is a family of relay contacts which are intended to combine with other relay safety element outputs to form coincidence relay matrices.

### 1.2 Construction

The Relay Safety Element is constructed in a single module 2.83 in. wide, 4.72 in. high, and 11.90 in. deep. It is a standard "2-unit" plug-in module of the ORNL Modular Reactor Instrumentation series depicted on ORNL drawings Q-2600-1 through Q-2600-5.

### 1.3 Application

The Relay Safety Element is used in reactor safety systems to combine the several information signals of a safety channel into a single action output where it is desired to cause safety action when any one or more of the several signals is in the "abnormal," or "trip" condition. In general, the input is 115 v ac for a "normal" condition and 0 v when "tripped." A typical application would be for the information signals to be applied to Fast Trip Comparators, ORNL model Q-2609 (or equivalent), whose output in the normal condition is a closed relay contact. The input to the Relay Safety Element (115 v ac) passes through these contacts and is interrupted any time a comparator is in the "abnormal" state.

The output of the Relay Safety Element is contacts from four relays. One relay provides contacts (SPDT) for annunciators and control actions as required. Each of the other relays furnish two normally open contacts for use in a two out of three safety matrix.

### 1.4 Specifications

- |                      |  |
|----------------------|--|
| 1. Number of inputs: | any number of relay contacts may be placed in series with the input.                                     |
| 2. Logic level:      | normal, 115 v ac; abnormal, 0 v.   |
| 3. Action:           | when input is 115 v ac, the output is "normal" (closed relay contacts for matrix application).           |
| 4. Maximum load:     | relay contacts rated noninductive 15 amp at 29 v dc or 115 v ac; inductive 6 amp at 29 v dc or 115 v ac. |

- |                               |                                     |
|-------------------------------|-------------------------------------|
| 5. Power required:            | less than 250 ma at 115 v ac.       |
| 6. Response time:             | 35 msec total time to change state. |
| 7. Ambient temperature range: | 0 to 55°C.                          |

### 1.5 Applicable Drawings

The following list gives the drawing numbers (ORNL Instrumentation and Controls Division drawing numbers) and subtitles for the Relay Safety Element:

- |             |                   |
|-------------|-------------------|
| 1. Q-2623-1 | Circuit.          |
| 2. Q-2623-2 | Details.          |
| 3. Q-2623-3 | Metalphoto Panel. |
| 4. Q-2623-5 | Assembly.         |
| 5. Q-2623-6 | Parts List.       |

The following list gives the drawing numbers and subtitles for the Plug-In Chassis System:

- |             |           |
|-------------|-----------|
| 1. Q-2600-1 | Assembly. |
| 2. Q-2600-2 | Details.  |
| 3. Q-2600-3 | Details.  |
| 4. Q-2600-4 | Details.  |
| 5. Q-2600-5 | Details.  |

## 2. CIRCUIT DESCRIPTION

The Relay Safety Element consists of five relays with their coils in parallel, as shown in Fig.1. The Relays are energized whenever 115 v ac is applied to the input (pin A) if the "Test" pushbutton S1 is closed (normal) and if the "Reset" pushbutton S2 is closed. When the relays have picked up, contact K4-1 seals around the "Reset" pushbutton. At all times 115 v ac should be applied to pin D, lighting the "Power" lamp on the front panel. Whenever the relays are energized, there is no potential difference across the "Trip" lamp. If, however, the 115 v ac is removed from the input, the "Trip" lamp is lighted from the 115 v ac applied to pin M. The "Hold" lamp is lighted any time the relays are energized.

## 3. OPERATING INSTRUCTIONS

### 3.1 Installation

The Relay Safety Element is a module of the ORNL Modular Reactor Instrumentation series. Like the other modules in this series, it has standard connectors and dimensions and has a pin- and hole-code on the rear plate so that the module will not be inserted in a wrong location in a

drawer. The module is installed by placing it in its proper location, inserting the module firmly and tightening the thumb screw. The module may be plugged in with power on without damage.

### 3.2 Operating Controls

The only controls on the module are two pushbuttons on the front panel. The "Test" pushbutton, when depressed, causes the relays to drop out, or "trip." The "Reset" pushbutton is required to be momentarily depressed when "untripping," or energizing the relays.

### 3.3 Connections

All connections are made through the rear connector P21 when the module is inserted.

## 4. MAINTENANCE INSTRUCTIONS

### 4.1 General

This module is designed to operate continuously with a minimum of maintenance and no adjustments. Should a failure occur, any part listed in the Replaceable Parts List, Sect. 5, may be replaced.

### 4.2 Periodic Maintenance

The Relay Safety Element will be tested routinely as a part of the overall safety tests, and must function if all other tests of the system are to be successful. No specific maintenance procedures other than this testing are indicated.

## 5. REPLACEABLE PARTS LIST

A description and an ORNL Stores number for all replaceable parts are given in Table 1.

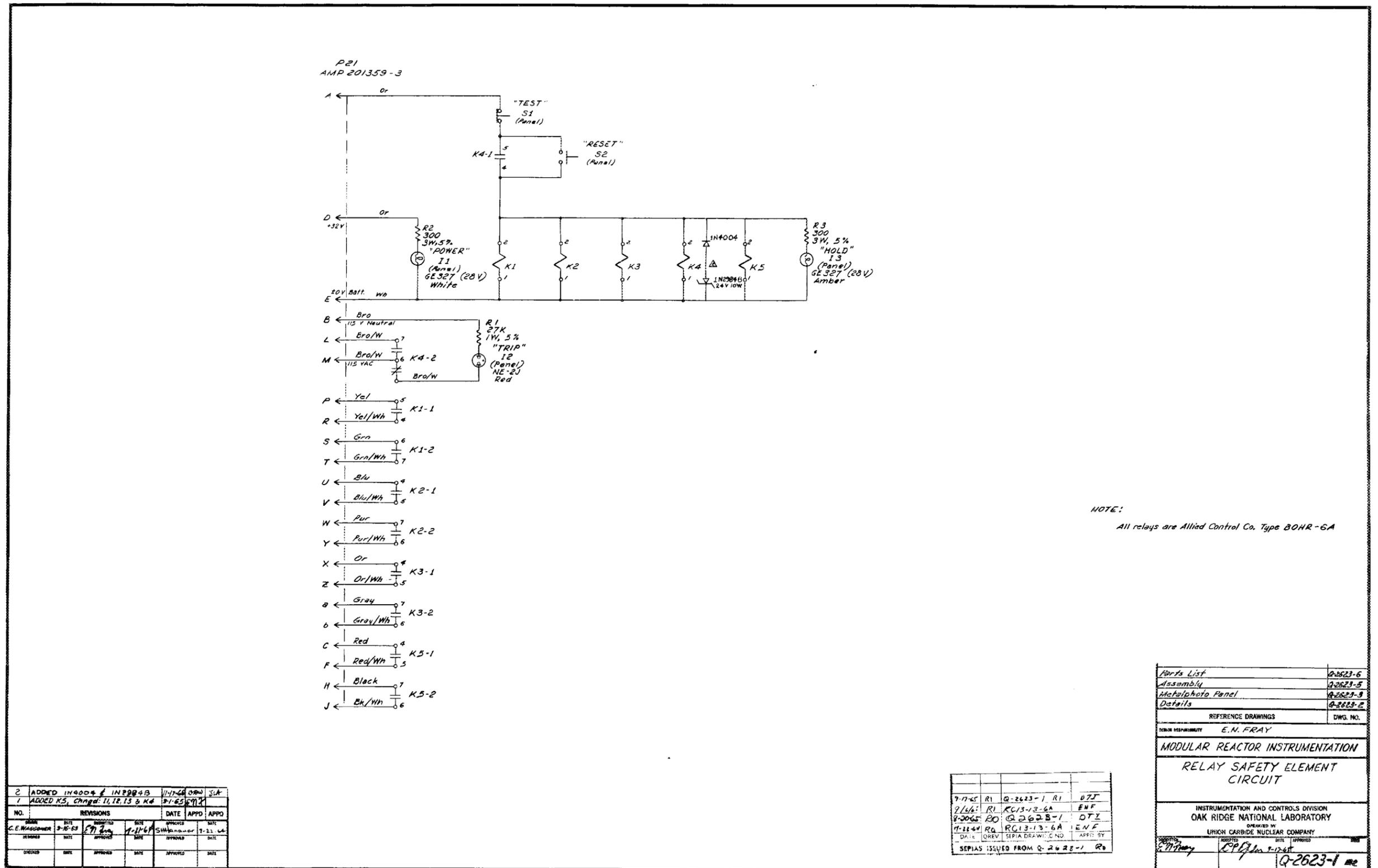


Fig. 1. Relay Safety Element Circuit.

Table 1. Replaceable Parts List

<u>Part No.</u>	<u>ORNL Stores No.</u>	<u>Description</u>
R1, R2, R3		Resistor, 27 kilohms, $\pm 5\%$ , 1 w, A-B.
I1, I2, I3	06-918-1525	Assembly, pilot light, C/W NE-2J lamp, Dialco No. 145-3836-997.
I1	06-918-2171	Cap, lens holder, for use with T-2 bulbs, translucent white, Dialco No. 145-995.
I2	06-918-2169	Cap, lens holder, for use with T-2 bulb, red, Dialco No. 145-991.
I3	06-918-2170	Cap, lens holder, for use with T-2 bulb, amber, Dialco No. 145-993.
S1, S2	06-972-0300	Switch, micro, pushbutton, dpdt, Micro-switch catalog No. 2PB11-T2.
K1, K2, K3, K4	06-942-3121	Relay, dpdt, 115 v, 15-amp contacts, 115 v ac coil, Allied Control No. BOHR-6A-115.

## 6. ACCEPTANCE TEST

### 6.1 Test Equipment

The following test equipment is required:

1. One power supply, 32 v dc, 250 ma.
2. One oscilloscope.
3. A Triplet meter, model 630, or equal.

### 6.2 Test Procedures

1. Connect the line side of 115 v ac to pins A and M, with the neutral connected to pins E and B. The "power" front-panel lamp should be lit at all times when +32 v is applied to pin D. Check for proper operation by depressing the "Reset" pushbutton, which should cause all the relays to pick up, energizing the "hold" lamp and de-energizing the "trip" lamp. The relays may be dropped out by depressing the "trip" pushbutton. Check the aspect of relay contacts with an ohmmeter when the module is both tripped and untripped.

2. Connect relay contacts K1-1, K1-2, K2-1, K2-2, K3-1, and K3-2 in series. Connect a 250-ohm, 5-w resistor to one end of the series string and to ground. Apply +32 v dc to the other end. Connect the oscilloscope input across the resistor and measure the time required for the relays to drop out.

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