Overvoltage Protection

Washington State University
Hands-On Relay School
Relay Benefits

- Simple setup
- Easy test and replace, draw-out case
- Test in case and on bench
- Long history (25 yrs)
Figure 1-2, Style Number Identification Chart

NOTES
- All relays are supplied in an S1 case size.
- If target is B, output must be E or F.
- If option 2 is A or B, option 3 must be 0, 1, 2, or 3.
If option 1 is 0, option 3 must be 0, 1, 2, or 5.
If option 3 is 0, 4, or 6, option 1 must be 1, 2, 3, or 4.
If sensing input range is 2, timing must be A1, E1, or E2.

Output
- 27 or 59
- E) NO relay
- G) NC relay
- 27/59
- Under
- Over
- F) NO relay
- H) NC relay
- J) NO relay
- K) NC relay

Timing
- 27 or 59
- A1) Instantaneous
- C1) Short inverse
- C2) Medium inverse
- C3) Long inverse
- E1) Definite

Power Supply
- J) 125 Vdc/120 Vac
- K) 48 Vdc
- L) 24 Vdc
- Y) 48/125 Vdc
- Z) 250 Vdc/240 Vac

Option 2
- N) None
- A) Power supply status output
- B) Power supply status output and push-to-energize outputs
- S) Push-to-energize outputs

Option 4
- P) Semi-flush mounting
- P) Projection mounting

Option 3
- 27 or 59
- 0) None
- 1) NO relay
- 2) NC relay
- 3) NO relay
- 4) NC relay
- 5) SPDT relay
- 6) SPDT relay

Option 1
- 27 or 59
- 0) None
- 1) Instantaneous function
- 2) Instantaneous under function
- 3) Instantaneous over function
- 4) Instantaneous under and over function

Option 1
- 27 or 59
- 0) None
- 1) NO relay
- 2) NC relay
- 3) NO relay
- 4) NC relay

Option 2
- N) None
- A) Power supply status output
- B) Power supply status output and push-to-energize outputs
- S) Push-to-energize outputs

Option 4
- P) Semi-flush mounting
- P) Projection mounting

Figure 1-2, Style Number Identification Chart
Voltage-Sensing Ratings

Maximum Continuous Voltage
- 360 V (120-V model)
- 480 V (240-V model)

Burden: < 1 VA

Frequency: 40–70 Hz

V Pickup Accuracy: ±2% or ±0.5 volts (whichever is greater)

 Dropout: ±2% of pickup
Resistive Ratings

- 120 Vac: Make, break, and carry 7 Aac continuous
- 250 Vdc: Make and carry 30 Adc for 0.2 s, carry 7 Adc continuous, and break 0.3 Adc
- 500 Vdc: Make and carry 15 Adc for 0.2 s, carry 7 Adc continuous, and break 0.3 Adc

Inductive Ratings

- 120 Vac, 125 Vdc, 250 Vdc: Break 0.3 A (L/R = 0.04)
  (L/R of 0.04 is about 15.1 X/R at 60-Hz inductive)
Two Types of Targets

Internally operated or current operated targets

Internally operated—electronically latching
- Manual-reset targets indicate that a setpoint contact has energized.
- Select internally operated targets if the relay has normally closed output contacts.

Current-operated
- Require a minimum trip circuit current of 200 mA
  - Continuous rating of 3 amperes
  - Two-minute rating of 7 amperes
  - One-second rating of 30 amperes
Power Supply Options

Wide-range, isolated, low-burden, switching
Input power (source voltage) is NOT polarity sensitive

<table>
<thead>
<tr>
<th>Type</th>
<th>Input Voltage Nominal</th>
<th>Range</th>
<th>Burden (Nominal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K (midrange)</td>
<td>48 Vdc</td>
<td>24 to 150 Vdc</td>
<td>3.8 W</td>
</tr>
<tr>
<td>J (midrange)</td>
<td>125 Vdc</td>
<td>25 to 150 Vdc</td>
<td>4.0 W</td>
</tr>
<tr>
<td></td>
<td>120 Vac</td>
<td>90 to 132 Vac</td>
<td>17.1 VA</td>
</tr>
<tr>
<td>L (low range)</td>
<td>24 Vdc</td>
<td>12 to 32 Vdc*</td>
<td>3.9 W</td>
</tr>
<tr>
<td>Y (midrange)</td>
<td>48 Vdc</td>
<td>24 to 150 Vdc</td>
<td>3.8 W</td>
</tr>
<tr>
<td></td>
<td>125 Vdc</td>
<td>25 to 150 Vdc</td>
<td>4.0 W</td>
</tr>
<tr>
<td>Z (high range)</td>
<td>250 Vdc</td>
<td>68 to 280 Vdc</td>
<td>4.1 W</td>
</tr>
<tr>
<td></td>
<td>240 Vac</td>
<td>90 to 270 Vac</td>
<td>28.4 VA</td>
</tr>
</tbody>
</table>

*Type L begins operation at 14 Vdc; Once operating, voltage can be reduced to 12 Vdc
Time Range and Accuracy

Instantaneous
• Less than 50 ms
• ±5% of the setting or ±50 ms, whichever is greater

Definite
• 0.1 to 9.9 seconds in 0.1-second increments
• ±5% of the setting or ±50 ms, whichever is greater

Inverse
• 01 to 99 time dial in 01 increments varies curve
• 00 designates instantaneous
• ±5% of the setting or ±50 ms, whichever is greater
Inverse-Time Style
(3 curves available)

Figure 3-5. Overvoltage, Short Inverse Timing Characteristic Curve
Front-Panel Controls

Figure 2-1. Location of Controls and Indicators
Front-Panel Controls

Figure 2-1. Location of Controls and Indicators
Figure 3-1. Function Block Diagram

226 Hz
Internal Logic

Figure 3-1: Function Block Diagram

226 Hz
Figure 3-1: Function Block Diagram

226 Hz
226 Hz
Figure 3-1: Function Block Diagram

226 Hz
226 Hz
- NC contacts open to trip
- Contacts closed if relay is de-energized
- Also closed when the paddle is pulled
Figure 4-16. Typical AC Connections
DC Connections
BE1-27 and BE1-59

Figure 4-17. Typical DC Connections
Required Test Equipment

Minimum test equipment required for relay testing and adjustment is listed below. Refer to Figure 5-1 for the test setup.

NOTE
Commercially available frequency relay test sets with frequency and time generating accuracies exceeding those of the relay and including electronic switching, may be used.

- Appropriate ac or dc power source for relay operation.
- Appropriate ac source for frequency sensing. (A source with frequency stability of 0.00002 Hz must exhibit phase noise of less than 90 db for accurate measurement. The accuracy and stability of this source is necessary as the relay precisely measures the period between positive going zero-crossings of the applied waveform and responds instantaneously to the sensed condition.)
- Hardware (battery and lamp, multimeter, etc.) or method of determining that the output contacts close.
Test Connections

Operating Power

AC Source

BE1-27, 59, 27/59

D2816-15

Basler Electric

BE1-27/59
### Table 5-2. Output Terminals

<table>
<thead>
<tr>
<th>Pickup Function</th>
<th>Relay Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27</td>
</tr>
<tr>
<td>Timed Undervoltage</td>
<td>1-10</td>
</tr>
<tr>
<td>Instantaneous Undervoltage</td>
<td>2-10</td>
</tr>
<tr>
<td>Timed Overvoltage</td>
<td>—</td>
</tr>
<tr>
<td>Instantaneous Overvoltage</td>
<td>—</td>
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Questions?