Description and Application

The type SBF-1 relay is a solid state relay with contact output utilizing a new concept for breaker failure protection. This new approach uses the pickup characteristic of the overcurrent unit rather than the reset characteristic as the significant ingredient for such protection.

The relay is applicable with any of the bus/breaker schemes in general use.

Provision is included in the relay for "re-tripping" the breaker without time delay. This may avoid clearing a bus during incorrect maintenance procedure or due to the failure of a trip contact to close.

The new approach of the SBF-1 has many advantages over the traditional ones:

(1) The device 50 will not operate before the 62BF is timed out, therefore, it will never operate when clearing normally and device 50 reset time is not a consideration.

Block Diagram of the SBF-1 Relay

Detection of a fault by a protective relay provides an input (by the 62X, 62Y, or BFI contacts) to the SBF-1 relay to start the adjustable pickup timer. Until timing is completed, the overcurrent units are restrained from operation. If current is still flowing following completion of the timing, the overcurrent unit operates and trips.
(2) It permits shorter margin and shorter overall clearing times, and will give a net saving of 1-2 cycles over the traditional approach.

(a) Traditional scheme

Total clearing time = protective relay + (breaker interrupting time x 2) + max. 50 reset time + margin + 86BF ....... (A)

(b) New scheme

Total clearing time = protective relay + (breaker interrupting time x 2) + margin + 86BF ....... (B)

Equ. (A) - (B) (Saving in clearing time) = max. 50 reset time .... (C).

Equ. (C) shows that the saving in total clearing time equals the device 50 max. reset time. The maximum reset time is one cycle for the SBFU relay and is 2 cycles for the KC-4 relay.

(3) The overall clearing time for the new scheme varies with fault current level. The higher the fault current, the faster the breaker failure clearing time. This is consistent with the requirements of system stability.

The pickup time of the overcurrent units in the SBF-1 relay is 3-8 millisecond for fault current level from 2-20 times its tap setting.

(4) The overcurrent unit will never operate when clearing normally so it can be set lower than load current, if necessary. This avoids delayed tripping associated with low current until other breakers clear.

**Operation**

The operation of the SBF-1 is somewhat different than the conventional breaker failure relay. It may be summarized by saying that the breaker failure relay timer is started by only the BFI (62X) input rather than the BFI and the overcurrent fault detector. The breaker failure timer controls the fault detector so that after it times out, the overcurrent signal (if present) is connected to the level detector. This arrangement keeps the overcurrent input transformer load at a low level. Fast reset of the secondary voltage of 3 ms. or less, even at very high multiples of pickup current is permitted. By use of an additional timer (called the control timer) the breaker failure timer is reset after it times out, as well as the X seal-in relay.
Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcurrent unit range</td>
<td>0.5 to 13.5 amperes</td>
</tr>
<tr>
<td>Continuous Rating</td>
<td>10 Amperes (250 amperes for 1 sec.)</td>
</tr>
<tr>
<td>Pickup time of o/c units</td>
<td>3 (min.) to 8 (max.) ms. for current level of 2X to 20X of setting.</td>
</tr>
<tr>
<td>Breaker failure timer</td>
<td>18 to 175 ms. continuously adjustable</td>
</tr>
<tr>
<td>Control timer</td>
<td>150 to 250 ms. continuously adjustable</td>
</tr>
<tr>
<td>Battery drain (125 Vdc)</td>
<td>standby 0 timing 95 mA, tripping 130 mA.</td>
</tr>
<tr>
<td>Output</td>
<td>4 (N.O.) AR contact outputs, with 2 ICS, one telephone relay contact can replace an AR contact for retrig function.</td>
</tr>
<tr>
<td>Seal-in</td>
<td>Telephone relay contact seal-in for (1) BFI contact bounce, (2) Close-in 3-phase fault when memory action of the distance relay is decayed.</td>
</tr>
<tr>
<td>Voltage level detector</td>
<td>To restrain the relay from operating if dc supply voltage is below 60% of its rated value.</td>
</tr>
<tr>
<td>dc input operate range</td>
<td>80 to 110% of rated. Max. Continuous input 110% of rated.</td>
</tr>
<tr>
<td>Operate temperature range</td>
<td>-20° to +55°C</td>
</tr>
</tbody>
</table>

Simplified Internal Schematic

![Simplified Internal Schematic](image)

**Notes:**

To obtain AR contact output move yellow lead from terminal 11 to terminal 12.

(L), (R), (LC) & (RC) denote left hand, right hand, left center & right center positions.

**25W Resistors**

<table>
<thead>
<tr>
<th>Volts DC</th>
<th>RA</th>
<th>RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>9000</td>
<td>2000</td>
</tr>
<tr>
<td>125</td>
<td>31500</td>
<td>10000</td>
</tr>
<tr>
<td>250</td>
<td>71000</td>
<td>25000</td>
</tr>
</tbody>
</table>

**Further Information**

List Prices: PL 41-020
Technical Data: TD 41-026
Instructions: IL 41-776.5
Flexiteet Case Dimensions: DB 41-076
Other Protective Relays:
Application Selector Guide, TD 41-016

July, 1991
Figure 2. DC External Connection for Type SBF-1 Breaker Failure Relay

DEV | Description
---|---
52  | Circuit Breaker
62  | SBF-1 Breaker Failure Relay
62S, 62Y | Breaker Failure Initiate Contacts
86BF | Breaker Failure Lockout Relay
86TI | Transformer Lockout Relay

Typical 86BF and/or Relay Aux Functions

1. Trip Breakers connected to same bus section.
2. Block all automatic reclosing.
4. Key transfer trip transmitters to trip remote breakers and block reclosing.
5. Stop “Blocking” carrier.

*SPP surge protection capacitor to be used when surge voltage may exceed 2500 volts peak.
†When surge voltage may exceed 2500 volts peak use shielded control cable & ground both ends per switchyard runs where surge voltage may exceed 2500 volts peak.

Figure 3. AC External Connection for Type SBF-1 Breaker Failure Relay

DEV | Description
---|---
52  | Circuit Breaker
62  | SBF-1 Breaker Failure Relay
## Type SBF-1

### Breaker Failure Relay

**Breaker Failure Relay, Solid State, Contact Output**  
(Device Number: 50/62 BF)

<table>
<thead>
<tr>
<th>Type</th>
<th>Current Range</th>
<th>BFI Timer</th>
<th>Control Timer</th>
<th>No. of Overcurrent Units</th>
<th>Control Voltage</th>
<th>Indicating Contactor Switch Voltage</th>
<th>Tripping Voltage</th>
<th>Internal Schematic</th>
<th>Style Number</th>
<th>Case Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SBF-1</strong></td>
<td>0.5-13.5A</td>
<td>25-175 ms</td>
<td>150-250 ms</td>
<td>3</td>
<td>48 Vdc</td>
<td>125 Vdc</td>
<td>48/125/250</td>
<td>77SB13</td>
<td>1529F93A01</td>
<td>FT-32</td>
</tr>
<tr>
<td>(utilizes AR Relay Output)</td>
<td>50-500 ms</td>
<td>150-600 ms</td>
<td>3</td>
<td>48 Vdc</td>
<td>125 Vdc</td>
<td>250 Vdc</td>
<td>1489B31</td>
<td>1529F93A08</td>
<td>1529F93A09</td>
<td>1529F93A10</td>
</tr>
<tr>
<td></td>
<td>25-175 ms</td>
<td>150-250 ms</td>
<td>3</td>
<td>48 Vdc</td>
<td>125 Vdc</td>
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</tr>
</tbody>
</table>

® Denotes item available from stock.

ICS: Indicating Contactor Switch (dc current operated) having seal-in contacts and indicating target which are actuated when the ICS coil is energized at or above pickup current setting. Suitable for dc control voltages up to and including 250 volts dc. Two current ranges are available:

1. 0.2/2.0 amps dc, with tapped coil.
2. 1.0 amp dc, without taps.

Rating of ICS unit used in specific types of relays is shown in price tables. All other ratings must be negotiated.

When ac current is necessary in a control trip circuit, the ICS unit can be replaced by an ACS unit.

The ACS unit may be supplied in place of an ICS unit at no additional cost. Specify system voltage rating on order.