Type CRN-1
Single Phase Reverse Power Relay

Application
The CRN-1 relay detects reverse power flow into ac generators. Its use is recommended in cases where the connected system has sufficient capacity to "motor" the generator upon loss of input to the prime mover (steam turbine, hydraulic turbine, or diesel engine). The protection afforded is primarily for the prime mover, rather than for the generator.

With the CRN-1 relay on the system, steam turbines are protected against overheating should low steam flow occur; and hydraulic turbines are protected against blade cavitation, in case of low water flow.

The CRN-1 also provides three phase protection for reverse magnetization of power transformers when utility tie is interrupted.

The CRN-1 relay operates to initiate an alarm or tripping circuit. In this way, a single phase relay affords three phase protection. It is energized by a single-phase line current and a line-to-line voltage using either wye or delta potential transformers.

Features
Single-phase relay provides three-phase protection from "motoring" of generators, or reverse magnetization of power transformers when utility tie is interrupted.

Trip timing adjustable over a range of 2 to 40 seconds.

Low burden, high efficiency timer unit produces high torque and positive contact action.

Ratings Available
120 or 208 volts line-to-line.
Construction and Operation

The CRN-1 consists of a sensitive directional unit which directionally controls a voltage-operated timing unit. Sensitivity of the directional unit is 0.02 ampere at rated voltage. The timing unit can be adjusted over a 2 to 40 second range.

**Torque**

Maximum torque occurs in the directional unit when operating current leads polarizing voltage by 30°. Using the 30° connection (Figure 4, page 4) maximum torque occurs at 100% power factor on the system.

**Minimum Reverse Power Required to Drive Prime Mover at Synchronous Speed Upon Loss of Input Energy**

<table>
<thead>
<tr>
<th>Machine</th>
<th>Percent of Nameplate Kw Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam Turbine</td>
<td>3</td>
</tr>
<tr>
<td>Hydraulic Turbine</td>
<td>.2-2</td>
</tr>
<tr>
<td>Diesel Engine</td>
<td>25</td>
</tr>
</tbody>
</table>

**Directional Unit (D)**

Product type. Operates as a result of interaction of flux created by operating circuit current and polarizing circuit voltage.

**Stationary Contact**

Made of silver-cadmium oxide. Attached to molded supporting bridge. Electrical connection is through the spiral spring of the moving contact.

**Laminated Electromagnet**

Has two series-connected polarizing coils mounted on alternate sides, and two series-connected operating coils on remaining opposite sides.

**Moving Contact**

Made of silver-cadmium oxide. Includes a contact carrying arm, spiral spring, rotatable shaft, and cylinder assembly.

**Timer Unit (T)**

Induction disc design. "E" unit has high efficiency and low burden, and produces high torque which results in positive contact action. Main coil is connected in series with the directional unit contact, and can only operate when power flow is in "trip" direction, and above the pickup ratings of both the timer and directional units. Timer picks up at 54% of rated voltage and will withstand 110% of rating continuously.

**Time Dial**

Indicates initial position of moving contact of timer unit. Dial is indexed from ½ (minimum time) to 11 (maximum time). See time curves, page 3.

**Timer Moving Contact**

Made of pure silver and connected via spiral spring to spring adjuster assembly.

**Induction Disc**

Spiral shaped to compensate for spring windup throughout moving contact travel. Provides accurate pickup at any disc position.

**Damping Magnet**

High strength Alnico. Dampens the induction disc.

**Indicating Contactor Switch**

Indicates tripping action by appearance of letter "T" in target area.

The main relay contacts will close 30 amperes at 250 volts dc, and the ICS contacts will safely carry this current long enough to trip a circuit breaker.

Front located taps provide connection for either 0.2 (left) or 2.0 (right) ampere dc minimum pickup setting.

When the CRN-1 energizes a WL relay rated 125 or 250 volts dc, the 0.2 tap is recommended. The 2.0 tap is used on 24 or 48 volt dc circuits.
Characteristics

Contact Closing Time
Contact closing time is approximately proportional to time-dial settings and inversely proportional to the applied timer voltage.

Burden Data (60 Hertz)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Coil</th>
<th>Burden At:</th>
<th>Volt-Amperes</th>
<th>Power Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directional</td>
<td>Voltage</td>
<td>Rated Voltage</td>
<td>3.5</td>
<td>60°</td>
</tr>
<tr>
<td></td>
<td>Current</td>
<td>5 Amperes</td>
<td>5.5</td>
<td>47°</td>
</tr>
<tr>
<td>Timer</td>
<td>Voltage</td>
<td>Rated Voltage</td>
<td>6.5</td>
<td>73°</td>
</tr>
</tbody>
</table>

1 Degrees current lags voltage.

Directional Unit Sensitivity

<table>
<thead>
<tr>
<th>Rating: Volts</th>
<th>Minimum Pickup Values:</th>
<th>Phase Angle Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 or 208</td>
<td>Volt</td>
<td>Ampere</td>
</tr>
<tr>
<td></td>
<td>Rated</td>
<td>.020</td>
</tr>
<tr>
<td></td>
<td>Rated</td>
<td>.023</td>
</tr>
</tbody>
</table>

2 Energization quantities are input quantities at the relay terminals.
3 Maximum torque angle.

ICS Unit

<table>
<thead>
<tr>
<th>Tap in Amps:</th>
<th>Ohms:</th>
<th>Ampere Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dc</td>
<td>Continuous</td>
</tr>
<tr>
<td>0.2</td>
<td>6.4</td>
<td>0.4</td>
</tr>
<tr>
<td>2.0</td>
<td>0.15</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Time Curves

CRN-1 120-Volt Relay
(Proportional Values Apply for 208-Volt Type)

Internal Wiring

Spst-cc (Dash Line, dpst-cc), FT-21Case

Indicating Contactor Switch
Timer Unit
Directional Unit
Chassis Operated Shorting Switch
Flexitest Switch
Current Test Jack
Case Terminals

Fig. 3

Spst-cc 184A404, Dpst-cc 184A405

July, 1991
External Wiring Diagrams
For Reverse Power Protection

Shipping Weights and Carton Dimensions

<table>
<thead>
<tr>
<th>Flexist Case Type</th>
<th>Weight Net</th>
<th>Weight Shipping</th>
<th>Domestic Shipping Carton Dimensions: Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT-21</td>
<td>12</td>
<td>16</td>
<td>9 x 12 x 13</td>
</tr>
</tbody>
</table>

Further Information
List Prices: PL 41-020
Technical Data: TD 41-025
Instructions: IL 41-251.2
Flexist Case Dimensions: DB 41-075
Renewal Parts: RPD 41-922
Other Protective Relays:
Application Selector Guide, 41-016

Device Numbers
32 - Reverse Power Relay, CRN-1
32D - CRN-1 Directional Unit
32T - CRN-1 Timer Unit
52 - Power Circuit Breaker
52TC - Breaker Trip Coil
52a - Breaker Auxiliary Contact
ICS - Indicating Contactor Switch

To Prevent Reverse Magnetization When Utility Tie is Removed From the Local System

Device Numbers
32 - Reverse Power Relay, CRN-1
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ICS - Indicating Contactor Switch

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July, 1991
Reversing Power  

Device Number: 32

<table>
<thead>
<tr>
<th>Type and Time Curve</th>
<th>Contacts</th>
<th>Volts Line-to-Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRN-1</td>
<td>Spst-cc</td>
<td>0.2/2.0 amps dc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>208</td>
</tr>
<tr>
<td>Inverse</td>
<td>Dpst-cc</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>208</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relay Data</th>
<th>Internal Schematic</th>
<th>Style Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>184A404</td>
<td>290B038A09</td>
</tr>
<tr>
<td></td>
<td>208</td>
<td>290B038A11</td>
</tr>
<tr>
<td></td>
<td>208</td>
<td>290B038A10</td>
</tr>
<tr>
<td></td>
<td>208</td>
<td>290B038A12</td>
</tr>
</tbody>
</table>

- Denotes item available from stock.
- 50-Hertz relays and auxiliaries can be supplied at same price. Order “Similar to Style Number ………. except 50 Hertz.”

ICS: Indicating Contact Switch (dc current operated) having sealed 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 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.