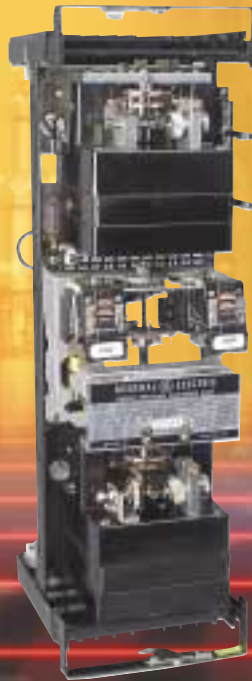


JBC, JBCG & JBCV

Phase & Ground O/C



JBC relay



JBCG relay



JBCV relay

Directional overcurrent protection of feeders and transmission lines.

Features and Benefits

- Mechanical targets
- 3 inverse time/current characteristics
- Drawout case

Applications

- Directional phase fault protection (JBC)
- Directional ground fault protection (JBCG)
- Distinguish phase faults from overloads/power swings (JBCV)

Protection and Control

- Time overcurrent
- Instantaneous overcurrent
- Voltage-restrained phase overcurrent



APPLICATION

The JBC, JBCG and JBCV relays consist of three units, an instantaneous power-directional unit (bottom) of the induction-cup type, a time overcurrent unit (middle) of the induction-disk type, and an instantaneous-overcurrent unit (top) of the induction-cup type. The directional-unit contacts control the operation of both the instantaneous and the time-overcurrent units (directional control). In this application, the instantaneous unit provides high-speed protection for close-in high-current faults.

Phase Faults — JBC

The JBC relays are frequently applied for phase-fault protection of a single line. Typical external connections of current and potential transformers are shown in Figure 1. With this connection, the current (at unity-power-factor load) leads the polarizing potential by 90 degrees. Since the directional unit has a 45 degrees characteristic, its maximum torque will occur when the fault current (balanced 3-phase fault) lags its unity-power-factor position by 45 degrees. Typical internal connections are shown in Figure 2.

Ground Faults — JBCG

The JBCG relay, with both time and instantaneous units directionally controlled, is designed for protection against ground faults and is therefore of lower operating current range. The relays used for such protection usually have a low-range operating coil which is rated either 0.5-4 or 1.5-12 A and 2-16 A is also available.

The directional unit of the JBCG is dual polarized and may be polarized by current alone, voltage alone, or by both simultaneously. This dual polarization is desirable on applications where both current

and potential polarizing sources are available and there is a possibility that one or the other source may be temporarily lost. Typical internal connections are shown in Figure 3.

Phase Faults — JBCV

The JBCV relay is applied for phase-fault protection when it is necessary to distinguish between fault conditions and overload or power swings. The voltage restraint feature of the relay makes this distinction possible.

When the generation at a given station is apt to vary from time to time, it is possible that the maximum load current may exceed the minimum fault current. When this occurs the JBC relay will not distinguish between a heavy load with maximum generation and a fault with minimum generation. This is a typical application for the JBCV relay. When a fault occurs with minimum generation, the restraint torque in the directional unit collapses rapidly as the voltage drops, thus permitting the relay to trip at the low value of fault current. On the other hand, the relay is prevented from tripping on heavy-load currents with maximum generation as the directional unit will not pick up due to the system voltage being maintained. Long or heavily loaded lines, that are operating near the stability limit, are subject to severe power swings. These power swings appear to the relay as traveling faults. Since the voltage is maintained near normal during a power swing, the JBCV relay is less likely to trip than would a relay without voltage restraint.

General

Inverse Time Characteristics are preferred where fault current magnitude depends largely upon system generating capacity at time of fault.

Very-inverse and Extremely-inverse Time Characteristics are preferred where fault current

magnitude is dependent mainly upon location of fault relative to relay and only slightly upon system generation setup. Target seal-in-units are provided for the time and instantaneous overcurrent units and are rated 0.2/2.0 A, or 0.6/2.0 A.

Table 1. Directional Instantaneous Unit Ratings

| Col. Range (A) | Setting | Pick-up Range (A) | 1 Sec Rating (A) | Contin. Current Rating (A) |
|----------------|----------|-------------------|------------------|----------------------------|
| 2-16 | Series | 2-8 | 160 | 5 |
| | Parallel | 4-16 | 320 | 10 |
| 10-80 | Series | 10-40 | 230 | 10 |
| | Parallel | 20-80 | 460 | 20 |

Table 2. Non-Directional Instantaneous Unit Ratings

| Range (A) | Connection and Range (A) | | Contin. Rating (A) | 1 sec Rating (A) |
|-----------|--------------------------|----------|--------------------|------------------|
| 6-150 | Low (Series) | 6-30 ① | 10.2 | 260 |
| | High (Parallel) | 30-150 ① | 19.6 | |

① This range is approximate, which means that 6-30 and 30-150 might actually be 6-28 and 28-150. However, there is at least a 1 A overlap between the maximum "Low" setting and the minimum "High" setting.

CONTACTS

The current-closing rating of the induction unit contacts is 30 A for voltages not exceeding 250 V. Their current-carrying rating is limited by the tap rating of the seal-in unit.

Available Settings

- 0.5-4: 0.5, 0.6, 0.7, 0.8, 1, 1.2, 1.5, 2, 2.5, 3, 4
- 1.5-12: 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 10, 12
- 2-16: 2, 2.5, 3, 4, 5, 6, 7, 8, 10, 12, 16

Connection Diagrams

Fig.1. Typical external connections for three single-phase JBC51 relays for directional phase-fault protection of a single line

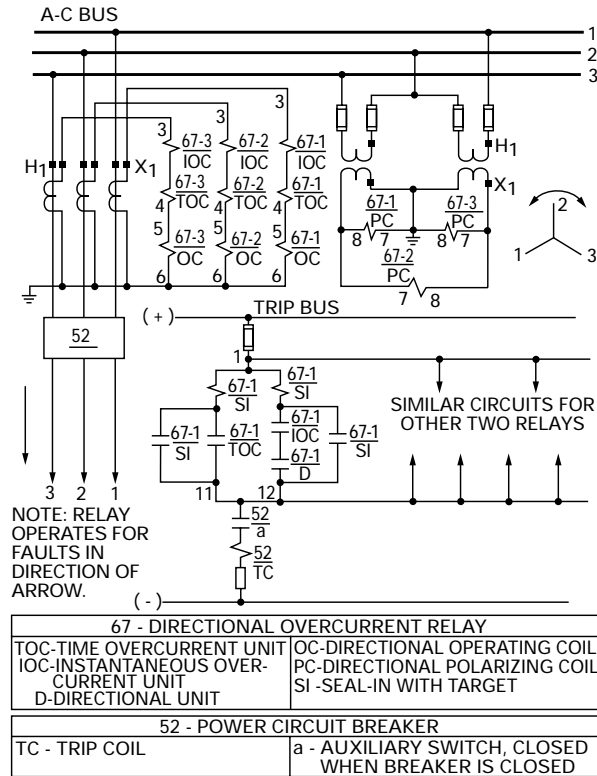
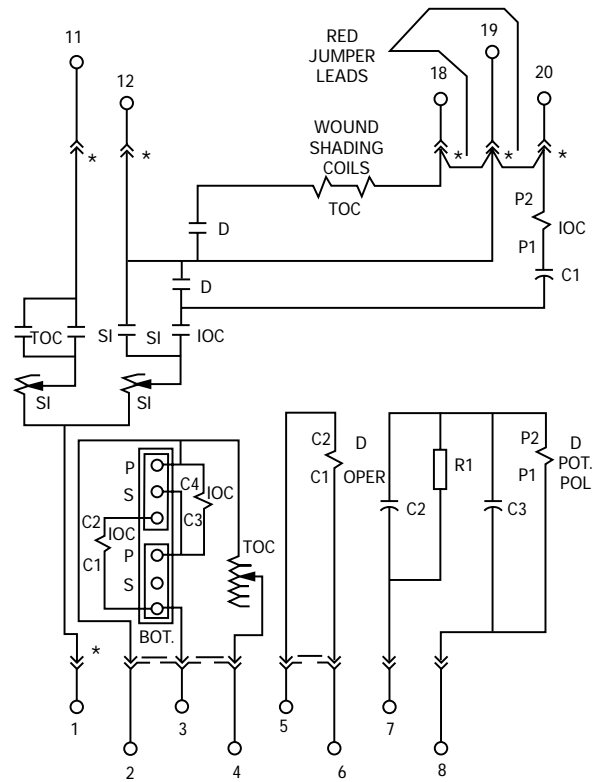


Fig.2. Internal connections for JBC51M and JBC53M relays (0257A6174-0)



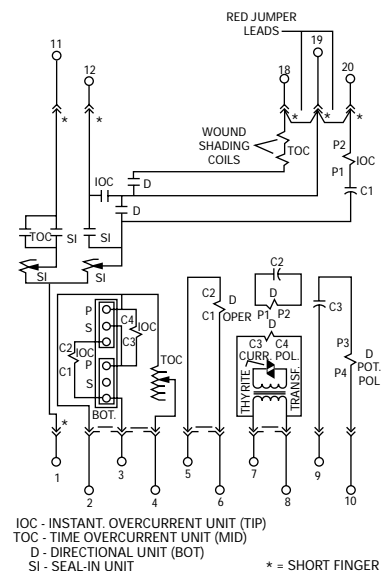
IOC - INSTANT. OVERCURRENT UNIT (TIP)
TOC - TIME OVERCURRENT UNIT (MID)
D - DIRECTIONAL UNIT (BOT)
SI - SEAL-IN UNIT

* = SHORT FINGER

Table 3. Time overcurrent unit taps and ratings

| Tap Range (A) | Characteristics | 1 Sec Rating (A) | Continuous Rating (A) | |
|---------------|------------------------|------------------|-----------------------|-------------|
| | | | Minimum Tap | Maximum Tap |
| 0.5-4 | Inverse (51) | 70 | 1.6 | 5 |
| | Very inverse (53) | 140 | 4 | 13 |
| | Extremely inverse (77) | 125 | 3.5 | 10 |
| 1.5-12 | Very inverse (53) | 260 | 10 | 30.5 |
| | Extremely inverse (77) | 260 | 9.5 | 20 |
| 2-16 | Inverse (51) | 260 | 8 | 20 |

Fig.3. Internal connections for JBCG51M and JBCG53M relays (0257A6195-0)



Selection Guide

Minimum IOC P.U. Greater Than Full Load

| Frequency (Hz) | Time O/C Unit (A) | Dir. Inst. Unit (A) | Non-Dir. Inst. Unit (A) | Tripping Contacts | Model Number | | | Case Size | Approx. Wt. in lbs (kg) | |
|-------------------|-------------------------|---------------------------|----------------------------|----------------------|--------------|----------------------|---------------------------|--------------|----------------------------|------|
| | | | | | Inverse Time | Very Inverse Time | Extremely Inverse Time | | Net | Ship |

JBC, PHASE-TYPE, 120 V, 0.2/2.0 A TARGET AND SEAL-IN UNIT

| | | | | | | | | | | | | |
|----|--------|-------|-------|--------|------------|----------|----------|--------------|--------------|--------------|--|--|
| 60 | 1.5-12 | 10-80 | — | 1 N.O. | ---- | JBC53M1A | JBC77M1A | L2 | 34 (15.4) | 50 (22.7) | | |
| | 2-16 | | — | | JBC51M1A | ---- | ---- | | | | | |
| | 2-16 | 2-16 | 6-150 | | JBC51M2Y1A | ---- | ---- | | 35 (15.9) | 51 (23.1) | | |
| | | 10-80 | | | M1Y1A | ---- | ---- | | | | | |
| 50 | 1.5-12 | 10-80 | — | | ---- | JBC53M2A | JBC77M2A | 34 (15.4) | 50 (22.7) | | | |
| | 2-16 | | — | | JBC51M2A | ---- | ---- | | | | | |
| 60 | 2-16 | 10-80 | — | 2 N.O. | JBC52M1A | ---- | ---- | L2 | 34 (15.4) | 50 (22.7) | | |
| | 1.5-12 | | — | | ---- | JBC54M1A | JBC78M1A | | | | | |
| 50 | 2-16 | 10-80 | — | | JBC52M2A | ---- | ---- | | | | | |
| | 1.5-12 | | — | | ---- | JBC54M2A | JBC78M2A | | | | | |

JBCG, GROUND-TYPE, 120 V, 0.2/2.0 A TARGET AND SEAL-IN UNIT

| | | | | | | | | | | |
|----|--------|---------------|--------|--------|----------------------|----------------------|------------------|----|--------------|--------------|
| 60 | 0.5-4 | 2-16 10-80 | — — | 1 N.O. | JBCG51M1A M2A | JBCG53M1A M2A | JBCG77M1A M2A | L2 | 35 (15.9) | 51 (23.1) |
| | 1.5-12 | 2-16 10-80 | — — | | ---- | M5A M6A | M5A M6A | | | |
| | 2-16 | 2-16 10-80 | — — | | M5A M6A | ---- | ---- | | | |
| | 0.5-4 | 2-16 10-80 | 6-150 | 1 N.O. | JBCG51M1Y1A M2Y1A | JBCG53M1Y1A M2Y1A | ---- | | 36 (16.3) | 52 (23.6) |
| | 1.5-12 | 2-16 10-80 | | | ---- | M3Y1A M4Y1A | ---- | | | |
| | 2-16 | 10-80 | | | M3Y1A | ---- | ---- | | | |
| 50 | 0.5-4 | 2-16 10-80 | — — | 1 N.O. | JBCG51M3A M4A | JBCG53M3A M4A | JBCG77M3A M4A | L2 | 35 (15.9) | 51 (23.1) |
| | 1.5-12 | 2-16 10-80 | — — | | ---- | M7A M8A | M7A M8A | | | |
| | 2-16 | 2-16 10-80 | — — | | M7A M8A | ---- | ---- | | | |
| | 2-16 | 10-80 | — | | M8A | ---- | ---- | | | |
| 60 | 0.5-4 | 2-16 10-80 | — — | 2 N.O. | JBCG52M1A M2A | JBCG54M1A M2A | JBCG78M1A M2A | L2 | 35 (15.9) | 51 (23.1) |
| | 1.5-12 | 2-16 10-80 | — — | | ---- | M5A M6A | M5A M6A | | | |
| | 2-16 | 2-16 10-80 | — — | | M5A M6A | ---- | ---- | | | |
| | 2-16 | 10-80 | — | | M6A | ---- | ---- | | | |
| 50 | 0.5-4 | 2-16 10-80 | — — | 2 N.O. | JBCG52M3A M4A | JBCG54M3A M4A | JBCG78M3A M4A | L2 | 35 (15.9) | 51 (23.1) |
| | 1.5-12 | 2-16 10-80 | — — | | ---- | M7A M8A | M7A M8A | | | |
| | 2-16 | 2-16 10-80 | — — | | M7A M8A | ---- | ---- | | | |
| | 2-16 | 10-80 | — | | M8A | ---- | ---- | | | |

| Frequency (Hz) | Time O/C Unit (A) | Dir. Inst. Unit (A) | Non-Dir. Inst. Unit (A) | Tripping Contacts | Model Number | | | Case Size | Approx. Wt. in lbs (kg) | |
|---|-------------------------|---------------------------|----------------------------|----------------------|--------------|----------------------|---------------------------|--------------|----------------------------|--------------|
| | | | | | Inverse Time | Very Inverse Time | Extremely Inverse Time | | Net | Ship |
| | | | | | | | | | | |
| JBCG, GROUND-TYPE, 120 V, 0.6/2.0 A TARGET AND SEAL-IN UNIT | | | | | | | | | | |
| 60 | 0.5-4 | 2-16 | — | 1 N.O. | ---- | JBCG53M9A | ---- | L2 | 34 (15.4) | 50 (22.7) |
| | | 10-80 | — | | ---- | M10A | ---- | | | |
| | 1.5-12 | 2-16 | — | | ---- | M13A | ---- | | | |
| | | 10-80 | — | | ---- | M14A | ---- | | | |
| | 0.5-4 | 2-16 | 6-150 | | ---- | JBCG53M5Y1A | ---- | | | |
| | | 10-80 | — | | ---- | M6Y1A | ---- | | | |
| 1.5-12 | 2-16 | 2-50 | ---- | JBCG53M9Y1A | ---- | | | | | |
| | 10-80 | — | ---- | M10Y1A | ---- | | | | | |
| | 2-16 | 6-150 | ---- | M7Y1A | ---- | | | | | |
| | 10-80 | — | ---- | M8Y1A | ---- | | | | | |
| 50 | 0.5-4 | 2-16 | — | 1 N.O. | ---- | JBCG53M11A | ---- | L2 | 34 (15.4) | 50 (22.7) |
| | | 10-80 | — | | ---- | M12A | ---- | | | |
| | 1.5-12 | 2-16 | — | | ---- | M15A | ---- | | | |
| | | 10-80 | — | | ---- | M16A | ---- | | | |

Selection Guide

Phase-type Voltage Restrained

| Freq. (Hz) | Time O/C Unit (A) | Dir. Inst. Unit (A) | Non-Dir. Inst. Unit (A) | Dir. P.U. (A) at Rated Volts | Tripping Contacts | Model Number | | | Case Size | Approx. Wt. in lbs (kg) | | | | | | |
|--|-------------------------|---------------------------|-------------------------------|---------------------------------------|----------------------|--------------|----------------------|---------------------------|--------------|----------------------------|--------------|-----------|-----------|----|--------------|--------------|
| | | | | | | Inverse Time | Very Inverse Time | Extremely Inverse Time | | Net | Ship | | | | | |
| | | | | | | | | | | | | | | | | |
| JBCV, PHASE-TYPE, (Dir. Unit with Voltage Restraint), 120 V, 0.2/2.0 TARGET AND SEAL-IN UNIT | | | | | | | | | | | | | | | | |
| 60 | 1.5-12 | 2-16 | — | 9 | 1 N.O. | ---- | JBCV53M1A | JBCV77M1A | L2 | 35 (15.9) | 51 (23.1) | | | | | |
| | 1.5-12 | 10-80 | — | | | ---- | M2A | M2A | | | | | | | | |
| | 2-16 | 2-16 | — | | | JBCV51M1A | ---- | ---- | | | | | | | | |
| | 2-16 | 10-80 | — | | | M3A | ---- | ---- | | | | | | | | |
| 50 | 2-16 | 2-16 | — | 9 | 2 N.O. | JBCV51M2A | ---- | ---- | L2 | 36 (16.3) | 52 (23.6) | | | | | |
| | 2-16 | 10-80 | — | | | M4A | ---- | ---- | | | | | | | | |
| 60 | 1.5-12 | 2-16 | 6-150 | | | ---- | JBCV531Y1A | ---- | | | | | | | | |
| 60 | 1.5-12 | 2-16 | — | | | 9 | 2 N.O. | ---- | | | | JBCV54M1A | JBCV78M1A | L2 | 35 (15.9) | 51 (23.1) |
| | 1.5-12 | 10-80 | — | | | | | ---- | | | | M2A | M2A | | | |
| | 2-16 | 2-16 | — | | | | | JBCV52M1A | | | | ---- | ---- | | | |
| | 2-16 | 10-80 | — | | | | | M3A | | | | ---- | ---- | | | |
| 50 | 2-16 | 2-16 | — | 9 | 2 N.O. | JBCV52M2A | ---- | ---- | L2 | 35 (15.9) | 51 (23.1) | | | | | |
| | 2-16 | 10-80 | — | | | M4A | ---- | ---- | | | | | | | | |

Minimum IOC P.U. Less Than Full Load

| Frequency (Hz) | Time O/C Unit (A) | Dir. Inst. Unit (A) | DC Aux. (V) | Tripping Contacts | Model Number | | | Case Size | Approx. Wt. in lbs (kg) | | |
|---|-------------------------|---------------------------|----------------|----------------------|--------------|----------------------|---------------------------|--------------|----------------------------|--------------|----------|
| | | | | | Inverse Time | Very Inverse Time | Extremely Inverse Time | | Net | Ship | |
| | | | | | | | | | | | |
| JBC, PHASE-TYPE, 120 V, 0.2/2.0 A TARGET AND SEAL-IN UNIT | | | | | | | | | | | |
| 60 | 1.5-12 | 2-16 | 125 | 1 N.O. | ---- | JBC53P1A | JBC77P1A | L2 | 34 (15.4) | 50 (22.7) | |
| | 2-16 | | | | JBC51P1A | ---- | ---- | | | | |
| 50 | 1.5-12 | 2-16 | | | 2 N.O. | ---- | JBC53P2A | | | | JBC77P2A |
| | 2-16 | | | | | JBC51P2A | ---- | | | | ---- |
| 60 | 2-16 | 2-16 | | JBC52P1A | | ---- | ---- | | | | |
| 50 | 2-16 | 2-16 | | JBC52P2A | | ---- | ---- | | | | |

JBCG61 & JBCG63

Application

These ground directional over-current relays are primarily for use in the transferred tripping schemes for highspeed protection of transmission lines. The basic schemes are:

1. Direct underreaching
2. Permissive underreaching
3. Permissive overreaching

The JBCG61 and the JBCG63 relays are similar respectively to the JBCG51 and the JBCG53 relays. However, the JBCG61 and the JBCG63 relays differ in the arrangement of the seal-in unit contacts and in the location of the directional unit contacts. Both contacts of the seal-in unit are connected to separate relay terminals, and the directional unit is arranged so that it can be used independently.

Selection Guide

120 V, 60 Hz (Continuous) 0.6/2.0 A Target and Seal-in Unit

| Time O/C Unit (A) | Dir. Inst. Unit (A) | Tripping Contacts | Model Number | | Case Size | Approx. Wt. in lbs (kg) | |
|----------------------|------------------------|----------------------|--------------|-------------------|-----------|-------------------------|--------------|
| | | | Inverse Time | Very Inverse Time | | Net | Ship |
| 0.5-4 | 2-16 | 1 N.O. | JBCG61M1A | JBCG63M1A | L2 | 35 (15.9) | 52 (23.4) |
| 0.5-4 | 10-80 | | M2A | M2A | | | |
| 1.5-12 | 2-16 | | ---- | M3A | | | |
| 1.5-12 | 10-80 | | ---- | M4A | | | |
| 2-16 | 2-16 | | M3A | ---- | | | |
| 2-16 | 10-80 | | M4A | ---- | | | |