

**Types CDG 11 and CDG 16  
Inverse Time Overcurrent and  
Earth Fault Relay**

**ALSTOM**

# Types CDG 11 and CDG 16 Inverse Time Overcurrent and Earth Fault Relay

Relay withdrawn from case



## Application

The type CDG 11 relay is a heavily damped induction disc unit with an inverse definite minimum time/current characteristic. The relay gives selective phase and earth fault overcurrent protection in time graded systems to transformers, ac machines and feeders, etc., and ensures that a minimum number of circuit breakers is tripped to clear a faulted section (see application publication R5087).

## Description

The operating coil is wound to give time/current curves of the same shape on each of seven current taps which are selected by a plug setting bridge. The highest current tap is automatically selected when the plug is removed, so that adjustments can be made on load without open-circuiting the current transformer.

The relay has a high torque movement to ensure consistent timing, even under adverse

conditions, and a low burden and overshoot. Adjustment of the time setting is made by rotating a knurled moulded disc against a graduated time multiplier scale.

To give instantaneous protection under short circuit conditions, a high set overcurrent unit (either CAG 13 or CAG 19) can be fitted in the same case.

The CDG 21 relay is a CDG 11 with an instantaneous unit.

The CDG 31 is a triple pole version of the CDG 11 (with three overcurrent units or two overcurrent units and one earth fault unit in the centre).

The CDG 16 is a variant of the CDG 11 arrangement, incorporating two normally open electrically isolated contacts.

## Technical data

### Starting current

103 - 110% of current setting.

### Closing current

130% of current setting.

### Resetting current

The maximum current up to which the disc will completely reset is 90% of current setting.

### Time settings

0 - 3s at 10 times current setting.

0 - 1.3s at 10 times current setting.

### Resetting time

With the time multiplier set at 1.0 the resetting times of the above are 9s and 4s respectively.

### Overshoot

On removal of a current equal to 20 times current setting the overshoot times of the above are 0.065s and 0.04s respectively.

## Accuracy

- The relay is calibrated at 50Hz or 60Hz and 20°C and falls into error class index E7.5 as given in BS142.

Frequency error: Less than 8% for frequency variation of 2Hz; the time grading of a protective system would be unaffected by this error since all the relays would be similarly affected.

Temperature error: For an overload equal to 10 times the current setting, the percentage timing errors at +45°C and -5°C are respectively:

1.3 second relay -4% and +4%,  
3.0 second relay -3% and +4%

## Auxiliary units and operation indicators

Shunt reinforcing or series seal in auxiliary attracted armature units with a hand reset operation indicator, can be fitted. Relays supplied without an auxiliary unit have a hand reset operation indicator mechanically operated by the disc.

### Standard coil ratings

Voltage operated (shunt) auxiliary units: 30, 110, 125 or 220V dc at a nominal burden of 3W continuously rated.

## Contacts

One or two electrically separate normally-open self or hand reset contacts are fitted which will make and carry 7500VA for 0.5s with maxima of 30A and 660V ac or dc.

Relays supplied without an auxiliary unit have one or two pairs of normally-open self reset contacts which will make and carry 2500VA for 0.5s with maxima of 10A and 660V ac or dc. The two contact relay has a modified disc/contact assembly and is designated CDG 16, CDG 26 or CDG 36.

## Current settings

**Table 1 - Preferred increments**

Setting range (A)	Current settings available						
0.05 - 0.2	0.05	0.06	0.075	0.10	0.12	0.15	0.2
0.1 - 0.4	0.1	0.12	0.15	0.2	0.24	0.3	0.4
0.2 - 0.8	0.2	0.24	0.3	0.4	0.48	0.6	0.8
0.25 - 1	0.25	0.3	0.375	0.5	0.6	0.75	1.0
0.5 - 2	0.5	0.6	0.75	1.0	1.2	1.5	2.0
1 - 4	1.0	1.2	1.5	2.0	2.4	3.0	4.0
1.5 - 6	1.5	1.8	2.25	3.0	3.6	4.5	6.0
2.5 - 10	2.5	3.0	3.75	5.0	6.0	7.5	10.0
4 - 16	4.0	4.8	5.0	8.0	9.6	12.0	16.0

**Table 2 - Standard increments**

Setting range (A)	Current settings available						
0.05 - 0.2	0.05	0.075	0.1	0.125	0.15	0.175	0.2
0.1 - 0.4	0.1	0.15	0.2	0.25	0.30	0.35	0.4
0.2 - 0.8	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.25 - 1	0.25	0.375	0.5	0.625	0.75	0.875	1.0
0.5 - 2	0.5	0.75	1.0	1.25	1.5	1.75	2.0
1 - 4	1.0	1.5	2.0	2.5	3.0	3.5	4.0
2.5 - 10	2.5	3.75	5.0	6.25	7.5	8.75	10.0

## Thermal rating

Continuous current rating							
Tap	1	2	3	4	5	6	7
Multiples of tap setting current	4.5	3.7	3.2	2.7	2.6	2.4	2.2
Short time current rating	The relay will withstand 20 x the maximum tap setting for 3s.						

## Current operated (series) auxiliary units

Minimum operating current in A (two taps)	0.5 second current rating in A	Coil resistance in ohms
0.1 and 0.3	18 and 22	9.2 and 2.1
0.2 and 2.0	22 and 92	6.0 and 0.125
0.6 and 2.4	92 and 188	0.29 and 0.031

Other coil ratings can be supplied for both types of auxiliary unit.

## Burdens

Standard (3VA nominal) - 2.5VA at current setting on lowest tap 3.5VA at current setting on highest tap	Alternative with lower operating torque (CDG 11, 21 & 31 only) (1VA nominal) - 1VA at current setting on lowest tap 1.9VA at current setting on highest tap
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Typical burden

CDG 11 1VA 50Hz 2.5 - 10A

For 60Hz relays increase burden by 20%

**Table 3**

	VA burden Multiples of plug setting			
Tap setting value	1.0	3.0	10.0	20.0
2.5	1.0	5.5	34	130
3.75	1.1	6.8	44	168
5.0	1.1	7.8	60	220
6.25	1.4	9.8	78	297
7.5	1.5	11.0	92	360
8.75	1.7	12.7	107	413
10.0	1.9	14.4	120	460

Typical burden

CDG 11 3VA 50Hz 2.5 - 10A

For 60Hz relays increase burden by 20%

**Table 4**

	VA burden Multiples of plug setting			
Tap setting value	1.0	3.0	10.0	20.0
2.5	2.5	15	97	312
3.75	2.7	15	119	422
5.0	2.9	17	131	500
6.25	2.9	19	164	625
7.5	3.1	20	174	675
8.75	3.1	23	206	827
10.0	3.4	24	250	1,000

**Table 5**

	Setting range (A) - Standard increments						
	0.05-0.2	0.1-0.4	0.2-0.8	0.25-1	0.5-2	1-4	2.5-10
K (50Hz)	2,500	625	156	100	25	6.3	1.0
K (60Hz)	2,750	687	171	110	28	6.8	1.1

**Table 6**

	Setting range (A) - Preferred increments								
	0.05-0.2	0.1-0.4	0.2-0.8	0.25-1	0.5-2	1-4	1.5-6	2.5-10	4-16
K (50Hz)	2,500	625	156	100	25	6.3	2.8	1.0	0.39
K (60Hz)	2,750	687	171	110	28	6.8	3.1	1.1	0.45

## Impedance characteristics

The impedance of a relay may be calculated by using Table 5 or Table 6 in conjunction with the relevant impedance current curve, see Figure 3 or 4.

Example:

To calculate the impedance, at 10 times setting, of a 3VA rated CDG 11 relay, setting range 1-4A 50Hz with preferred taps, and set to 2A, i.e. 50%:

Refer to curves, Figure 4, i.e. for 3VA, and select the 50% curve from which the value at 10 times setting is 0.052.

Referring now to Table 6, for preferred taps 1-4A range, select the multiplying factor K for 50Hz, which gives:

$$6.3 \times 0.052 = 0.325 \text{ ohms.}$$

## AC trip circuit

Where an external tripping supply is not available, a relay can be supplied which trips the circuit breaker directly using current from the line current transformer.

Under fault conditions, the tertiary winding on the relay current coil develops an ac voltage. This is rectified to energise the auxiliary tripping relay, causing current to flow through the trip coil of the circuit breaker. See Figure 5. The contacts are rated for series trip coil currents up to 150A at 150V.

## Earthing arrangements

Although not included in the diagram, it is assumed that secondary CT and/or VT circuits will be earthed as necessary in compliance with standard safety requirements and determined by the switchgear contractor user. If in doubt, please consult ALSTOM T & D Protection & Control for advice.

## Insulation

The relay will withstand 2.0 kV rms 50Hz for 1 minute between all live parts and earth and between all circuits not intended to be connected together. It will also withstand 1 kV rms 50Hz for 1 minute across open contacts.

## Technical data for CAG 13

### Current rating

1A or 5A.

### Settings

500 – 2000% }  
400 – 1600% } at rated current –  
200 – 800% } continuously  
100 – 400% } adjustable

### Resetting current

The relay will reset at approximately 15% of current setting.

### Operating time

Approximately 10 milli seconds at 5 times current setting.

### Burdens

1.4 VA at lowest current setting  
to

18 VA at highest current setting.

VA burdens given above are applicable to all setting ranges.

### Thermal rating

The relay will withstand 1.5 times the minimum current setting continuously and 12 times the maximum current setting for 3 seconds.

### Accuracy

The relay conforms to error class index E 10.0 as per B.S.142:1966.

### Operation indicator

The relay is fitted with an operation indicator which is hand reset by means of a push-rod protruding through the relay case.

### Contacts

2 make self reset.

## Technical data for CAG 19

### Current rating

1A or 5A.

### Settings

500 - 2000% }  
400 - 1600% } at rated current –  
200 - 800% } continuously  
100 - 400% } adjustable

### Resetting current

Not less than 80% of current setting.

### Operating time

Less than 30 milli seconds at 5 times setting current.

### Resetting time

Within 30 milli seconds when resetting to no current.

### Transient overreach

Less than 1% for system angles upto 88° on all settings.

### Burden

1.0 VA on lowest setting }  
3.0 VA on highest setting } at  
setting  
current

### Thermal rating

Continuous : Maximum setting current

Short time : 20 x max. setting current for  
3 seconds

### Accuracy

Error class index : E 5 as per BS.142:1966

### Contacts

2 make self reset.

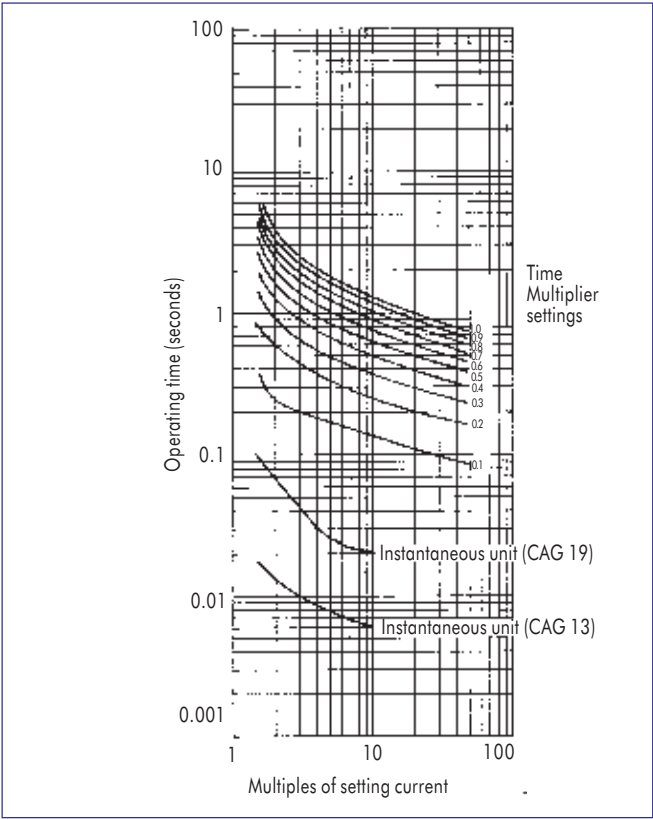


Figure 1:  
Time-current characteristic, inverse time relay CDG 11, 1.3s

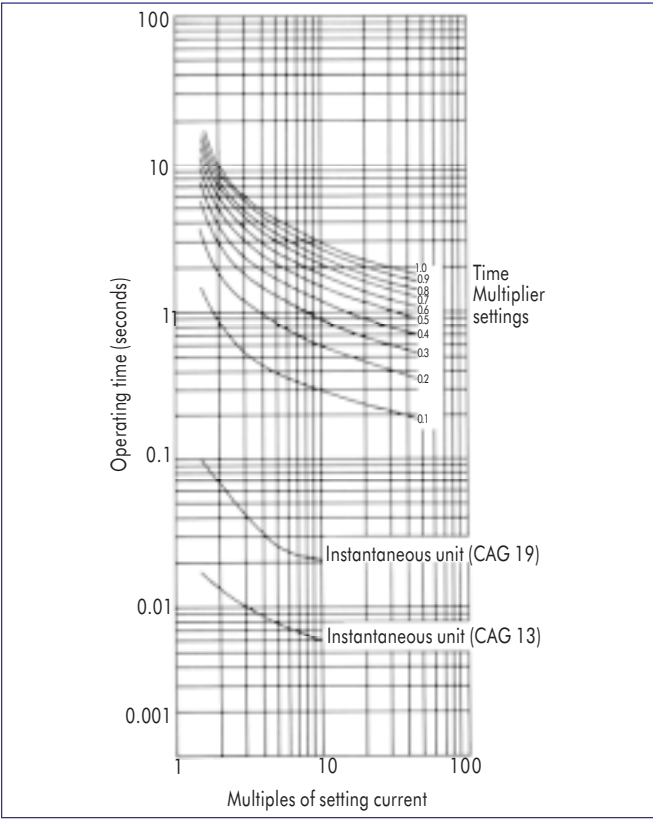


Figure 2:  
Time-current characteristic, inverse time relay CDG 11, 3s

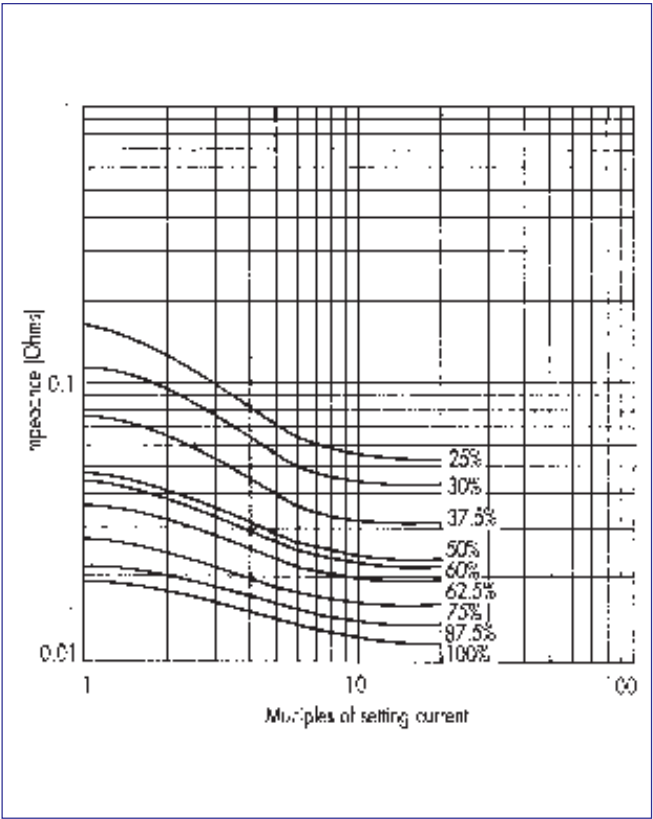


Figure 3:  
CDG 11 impedance  
characteristic 1VA 50Hz.

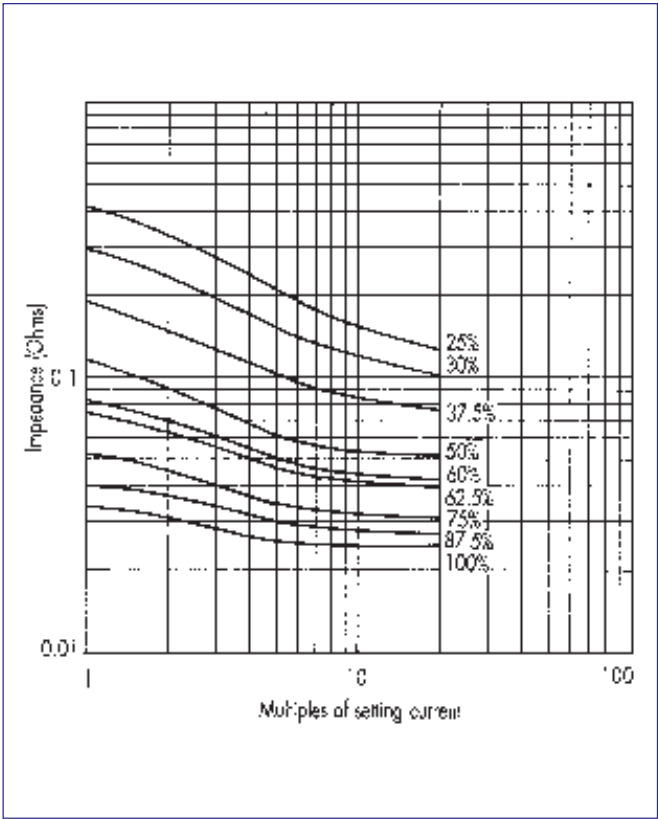


Figure 4:  
CDG 11 impedance  
characteristic 3VA 50Hz.



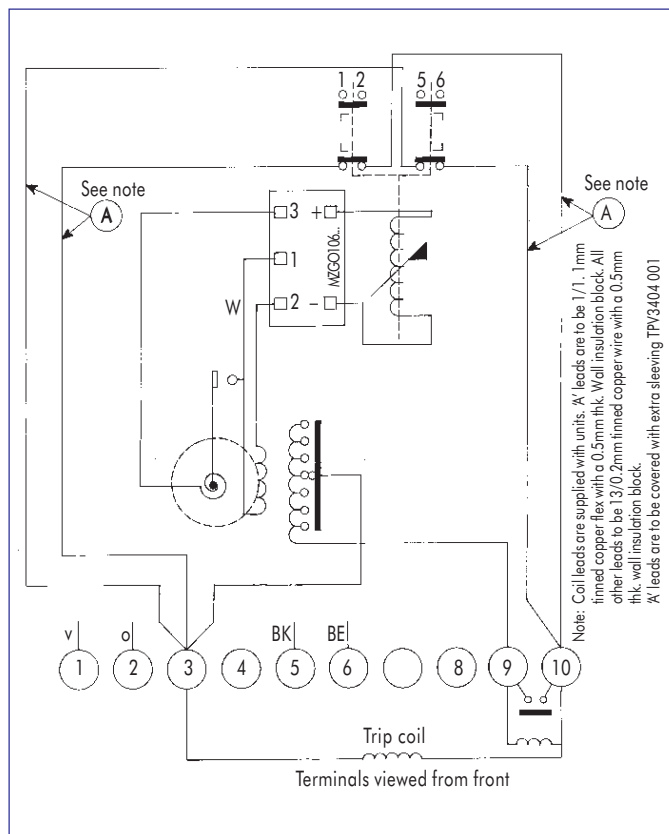


Figure 5:  
Connection diagram for ac series  
tripping, hand-reset

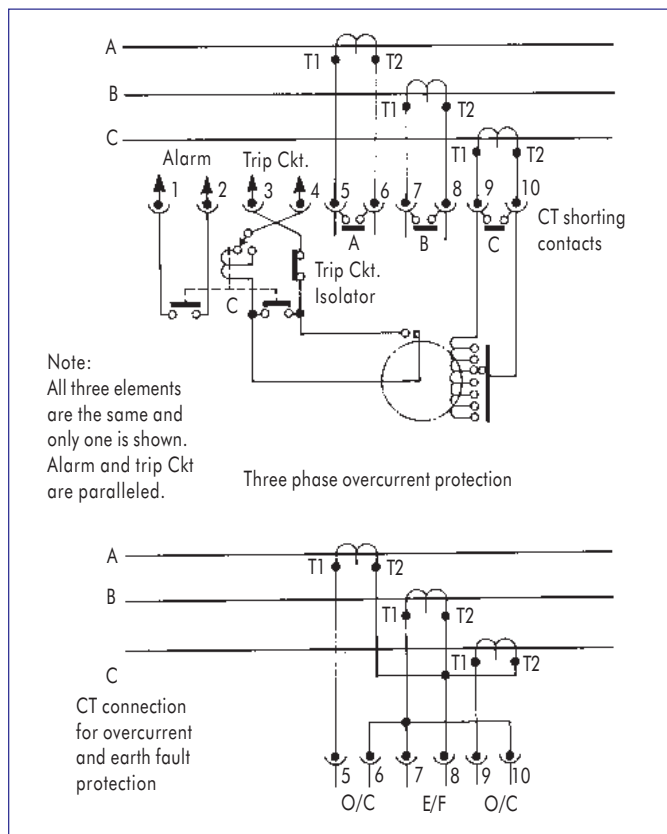


Figure 6:  
Typical application and internal circuit  
diagram of Type CDG 31 relay  
with series seal in

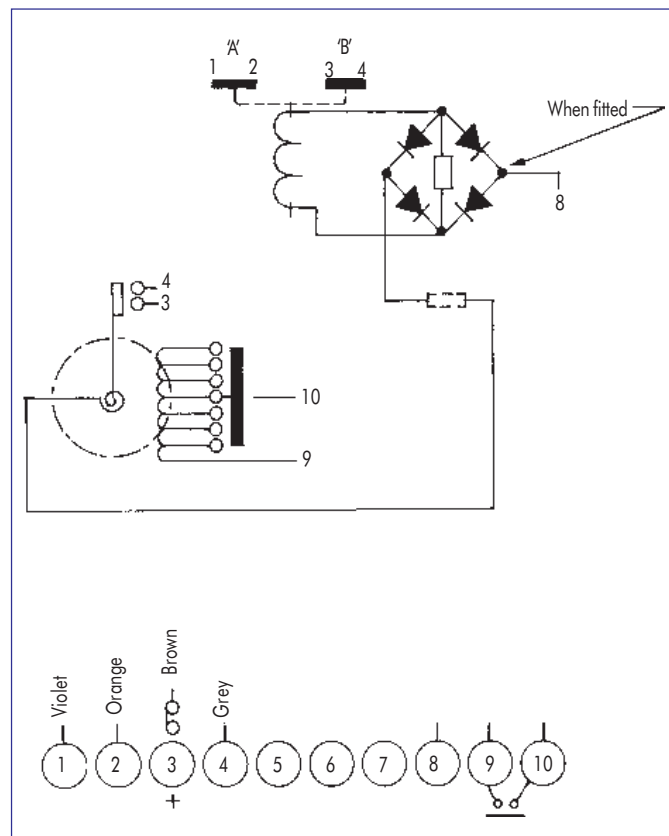


Figure 7:  
Connection diagram for  
CDG 11 relay.

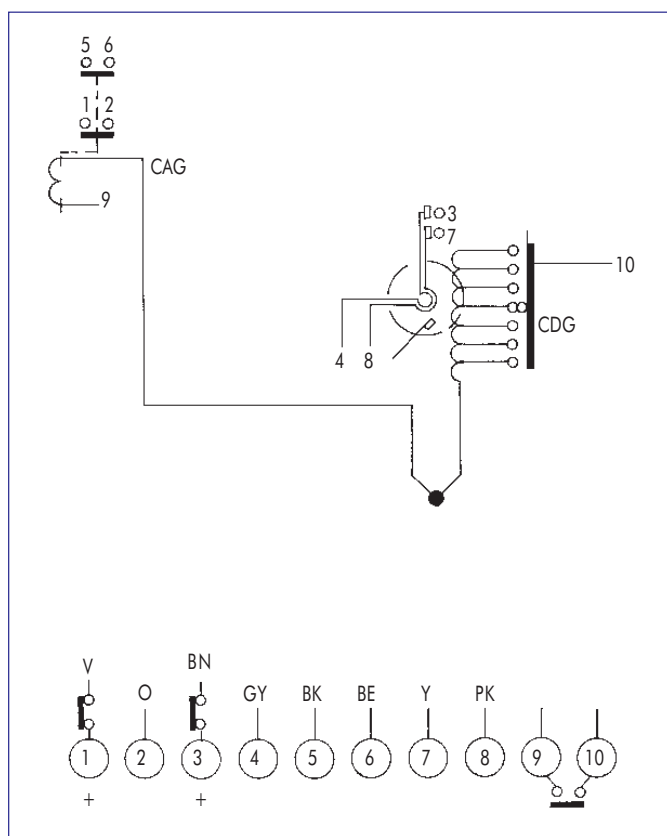


Figure 8:  
Connection diagram for CDG 26 relay.

## Dimensions and weights

Relay	Case	Maximum overall dimensions		
		Height mm	Width mm	Depth* mm
CDG 11 CDG 21	1D	237	173	218
CDG 21 (double pole)	2D (vert)	425	174	218
CDG 31	3D (vert)	527	174	218
	3D (horiz)	238	458	218
* Add 7 mm. for maximum length of M5 terminal screws.				

## Cases

Relays are supplied in drawout cases designed for either flush or projection mounting. Case wrappers are manufactured from hot dipped galvanised steel with a black pvc outer coating/powder coating. Relays comply with 56 day humidity requirements as specified in IEC 68, climatic category 20/50/56.

Dimensioned drawings of case outlines, panel cut-outs and mounting details are available on request.

## Information required with order

1. Relay type
2. Current setting range
3. Preferred or standard increments
4. Current transformer secondary rating
5. Characteristic (time setting at 10 times  $I_s$ )
6. Burden (1VA or 3VA)
7. Trip circuit (series seal in, shunt reinforcing or ac)
8. Trip circuit current (series seal in)
9. Trip circuit voltage (shunt reinforcing)
10. Operation indicator inscription if required
11. Auxiliary contacts (hand or self reset)
12. Details of instantaneous unit (CAG) if required
13. Case mounting







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