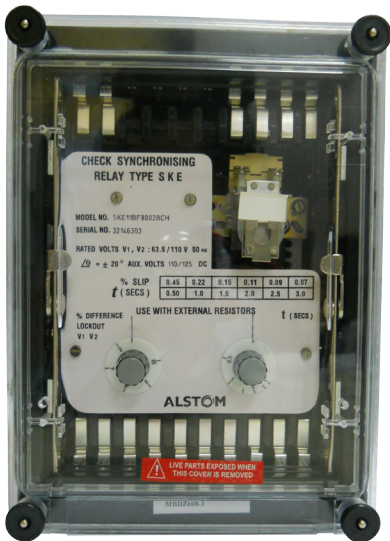


# SKD and SKE

## Check Synchronising Relays



Check synchronising relays are used to prevent interconnection of badly synchronised supplies. Type SKD relays are generally used in auto reclosing sequence of interconnectors along with the auto reclosing relay. Type SKE relays are used to safeguard manual synchronising of generators. The check synchronising relay contacts are normally connected in series with the circuit breaker closing circuit and ensures that the differences in phase, voltage and frequency are within pre-selected limits before switching in an incoming alternator or interconnecting two sections of a power system.

### Features

- Low burden, static design.
- Accurate and reliable.
- Immune to transient and surges; withstands 5 kV impulse voltage test.

### General Description

#### Phase difference measurement

Phase measurement is achieved by algebraically subtracting the two supply voltage waveforms and comparing the resultant modulated beat waveform envelope with a dc reference voltage (See Figure 1).

The dc reference is proportioned to the sum of the peaks of the two supply voltages to provide phase measurement independent of supply voltage variation. Referring to Figure 2, the resulting voltage produced after subtraction is passed via the gate (which is opened when the VTI supply is present) to the phase angle comparator and integrating amplifier.

The signal is compared with the dc reference and produces a smoothed output to the relay drive unit if the signal is less than dc reference. The relay drive circuit prevents chatter of the relay at the just-operate condition.

#### Frequency difference measurement

Frequency difference measurement is achieved by checking that the phase angle traversed in a defined period is less than

a pre-determined value. Referring to the block diagram the output from the phase measurement circuit drives an accurately calibrated timer. The timer operates the relay on completion of its timing cycle, if the output from the phase measurement circuit persists.

The relationship between timer setting and frequency difference is given in Table 1.

#### Voltage difference measurement

Two types of voltage lockout are available. Type SKD compares the amplitude of the two supply voltages, with a stabilised dc reference which is proportioned to the nominal supply voltage. The Voltage lockout circuit inhibits the gate if either voltage is below the preset limit. Type SKE compares the two supply voltages and inhibits the gate if the difference between the supply voltages exceeds the preset limit.

#### Customer Benefits

- Immune to transients.
- Static design and low burden.
- Prevents interconnection of badly synchronized supplies.

## Technical data

### Voltage rating

110 volts/63.5 volts ac, 50 Hz.

### Auxiliary supply

50V, 110V and 220V dc.

For 110V dc and above, external dropping resistors are used.

### Minimum operating voltages Type SKD

Either supply below setting.

### Type SKE

Both supplies at 37%.

### Settings

Phase angle, frequency difference and voltage difference settings as shown in Table 1.

### Operating time

200 m.sec. with timer disconnected.

### Burden

2.5VA at rated voltage on each supply.

### Accuracy

±5% on voltage lockout setting.

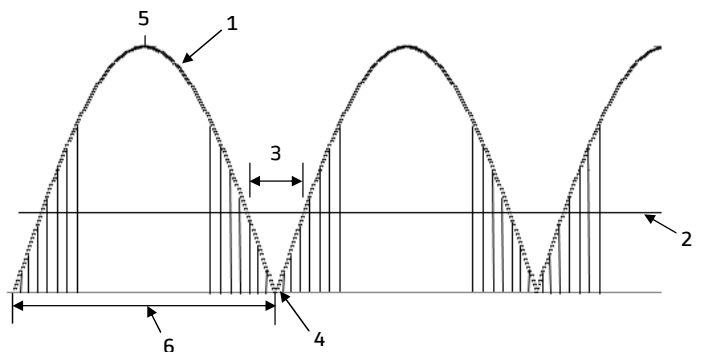
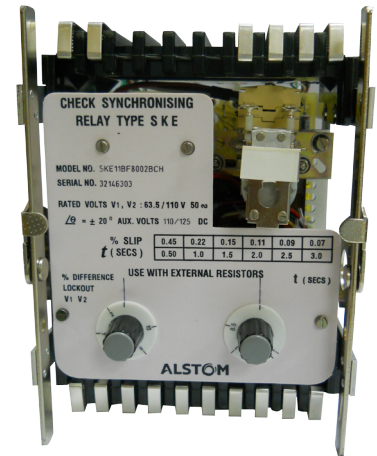
### Thermal rating

### AC supply voltage

115% of rating.

### DC supply

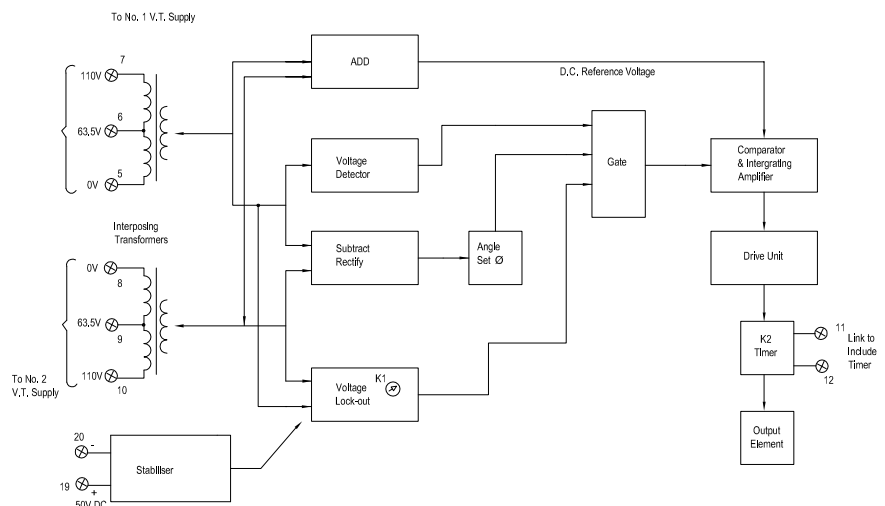
120% of rating.



1. Rectified Envelope (by subtraction of running and incoming voltages)
2. D.C. reference level
3. Angle over which synchronising can occur
4. In-phase condition
5. 180° out of phase
6. Time to cover one slip cycle (360°)

Figure 1: Static check synchroniser rectified beat waveform showing dc reference level

Figure 2: Composite block diagram



**Table 1:**  
**Check synchroniser types and settings**

| Relay                               | Phase angle difference setting | Frequency difference setting |                     | Frequency percentage difference 50 Hz | Voltage setting   |
|-------------------------------------|--------------------------------|------------------------------|---------------------|---------------------------------------|---|
|                                     |                                | Phase angle                  | Time setting (secs) |                                       |   |
| SKD auto reclose check synchroniser | Preset at 35°<br>+0% -5%       | 35°                          | 2                   | 0.19                                  | Lockout continuously variable. 80-90% nominal voltage.  |
|                                     |                                | 35°                          | 3                   | 0.13                                  |   |
|                                     |                                | 35°                          | 4                   | 0.09                                  |   |
|                                     |                                | 35°                          | 5                   | 0.08                                  |   |
|                                     |                                | 35°                          | 6                   | 0.06                                  |   |
|                                     |                                | 35°                          | 10                  | 0.04                                  |   |
| SKE generator check synchroniser    | Preset at 20°<br>+0% -5%       | 20°                          | 0.5                 | 0.45                                  | Difference continuously variable. Voltage difference calibrated. At 2%,4%,6%,8% & 10% nominal voltage |
|                                     |                                | 20°                          | 1.0                 | 0.22                                  |   |
|                                     |                                | 20°                          | 1.5                 | 0.15                                  |   |
|                                     |                                | 20°                          | 2.0                 | 0.11                                  |   |
|                                     |                                | 20°                          | 2.5                 | 0.09                                  |   |
|                                     |                                | 20°                          | 3.0                 | 0.07                                  |   |
|                                     | Preset at 20°<br>+0% -5%       | 10°                          | 0.25                | 0.45                                  |   |
|                                     |                                | 10°                          | 0.5                 | 0.22                                  |   |
|                                     |                                | 10°                          | 0.75                | 0.15                                  |   |
|                                     |                                | 10°                          | 1.0                 | 0.11                                  |   |
|                                     |                                | 10°                          | 1.25                | 0.09                                  |   |
|                                     |                                | 10°                          | 1.5                 | 0.07                                  |   |

### Contacts

Two normally open contacts, or one make and one break.

### Contact rating

Make and carry 7500VA for 3 seconds with maximum of 30A and 660 volts.

### Insulation

The relay meets requirements of IS 3231-1965/IEC 255-5 Series C-2 kV for 1 minute.

### Impulse voltage

The relay complies with the requirements of IS 8686-1977/IEC 255-4 Appendix E to class III.

### High frequency interference

The relay complies with IS 8686-1977/IEC 255-22-1 Appendix C to class III.

### Case

1D drawout cases suitable for flush/projection mounting.

### Information required with order

- Relay type
- Voltage rating
- Auxiliary supply voltage
- Type of mounting

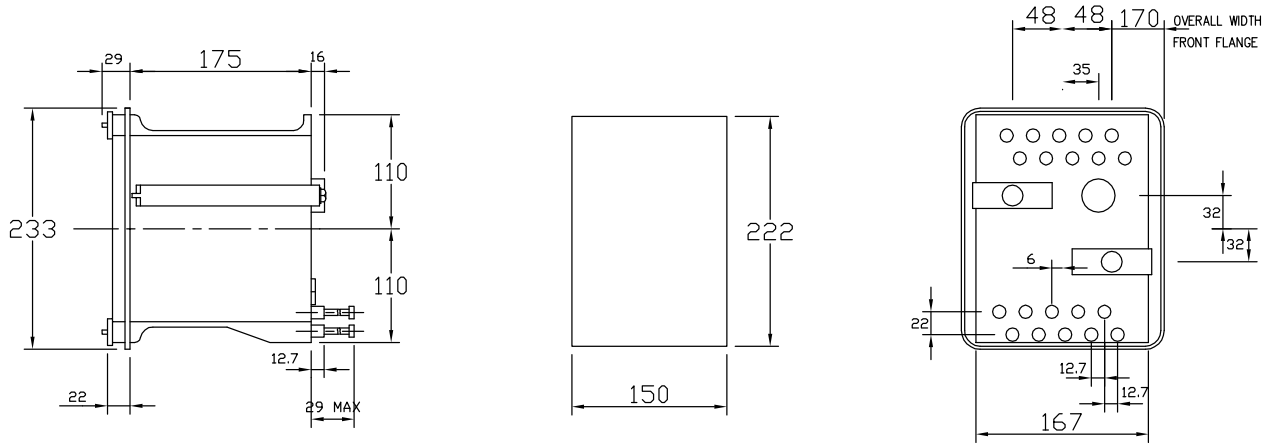


Figure 3 : Case and panel cut-out dimensions for case 1D ( All dimensions in mm)

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