Mains / Generator Protection Relay  VECFU1 +20/-10% (four wires)
(Vector jump, frequency and voltage control)

Function
The VECFU1 detects a phase jump or an instantaneous phase change on a mains supply line and switches off the output relay if the setpoint (1-20°) is exceeded. An additional quartz-controlled frequency measurement and a convenient (3-phase) voltage measurement is also carried out. One output contact is available for each of these functions.

Application
The Mains/Generator Protection Relay VECFU1 is used in particular in generator systems with synchronous generators for parallel operation with the public network as a so-called vector jump relay for protecting the generator if there are rapid phase jumps or short interruptions. It is also useful for intentional mains interruptions of the interconnected networks with a duration of 200 - 300ms via which 80 - 90% of network disturbances are eliminated.

Reaction of VECFU1 to mains failures
Immediately after a vector jump or mains failure, the generator has to supply the entire network as, if a protective device is not present, the mains has not yet been separated from the generator. The currents from the generator to the mains increase until they reach high values, but they do not lead to short-circuit triggering until after 50 - 200ms. In parallel to this, the generator voltage drops rapidly and the (desirable) emergency power supply connected to the generator is finally switched off via the triggering of the short-circuit relay. The Mains/Generator Protection Relays VECFU1 now detects a phase jump or a mains voltage fail within a time space of 15 – 50ms depending on its development and triggers the opening of the main circuit breaker. Now the running of the generator continues by island mode until the mains voltage is back again and after automatical synchronization the mains circuit breaker closes.

Another type of short interruption can also cause considerable damage to the generator is the short-circuit relay of the generator has not yet triggered after mains failure and the load has caused the generator phase to move so far that asynchronous switching takes place after mains return. The phase change is detected immediately by the vector jump relay VECFU1 and the generator is separated from the mains.

Functional Circuits
- Vector jump function  : 1 potential-free normally open contact, opens when there is a phase jump on conductor L1
- "Ready" function  : Adjustable waiting time until unit goes into readiness
- Test function  : For testing within the system, the test key provides a phase jump of 10° after activation. Triggering then takes place if the phase is set to 8°
- Unter-/overfrequency function  : Window circuit, i.e. the output relay remains attracted between the minimum and maximum setting

The LED is on while the output relay is attracted
- Under-/overvoltage function: 3-phase voltage control (N conductor must be present)
  Minimum setting: If the lowest voltage in each case falls to below the setpoint, the output relays falls off
  Maximum setting: If the highest voltage in each case exceeds the setpoint, the output relay falls off
  The LED is on while the output relay is attracted

**Standard Settings**

The unit is operating when all 4 LEDs are lit up. The settings for frequency and voltage deviations must usually be coordinated with the manufacturer of the generator. Small window settings and phase angles can cause premature unintentional switching off of the system, so that slightly higher values should be set in doubtful cases.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase angle</td>
<td>8°</td>
</tr>
<tr>
<td>Waiting time</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Underfrequency</td>
<td>45Hz (90%)</td>
</tr>
<tr>
<td>Overfrequency</td>
<td>55Hz (110%)</td>
</tr>
<tr>
<td>Undervoltage</td>
<td>215V (93%)</td>
</tr>
<tr>
<td>Overvoltage</td>
<td>247V (107%)</td>
</tr>
</tbody>
</table>

**Technical Data**

- Type: Mains / Generator Protection Relay with frequency and voltage control VECFU1
- Construction: Plastic housing on 35 mm hat rail acc. to DIN EN 50022 bzw. DIN 46277
- Material of housing: Bayblend FR 1439/0240 modified ABS with burning protection UL 94 VO
- Dimensions, Weight: 104x68x110mm (BxHxT), ca. 0.4 kg
- Rated voltage: 231V (L1-N) +20/-10%, Other voltages on request
- Rated frequency: 50 Hz (60 Hz on request)
- Release settings: On front: +20/-10% voltage U, +/-20% frequency F
- Release time VEC: 10 - 50 ms (faster by adjustment to smaller angle, depends also on figure of phase changing)
- Release time F and U: appr. 250 ms (Jump dF=1Hz, dU=10%)
- Repeat accuracy: +/- 0.5% (0 - 60°C)
- Power consumption: 2.5 VA from L1-N
- On period: 100 %
- Contact rating: 5A/250VAC, 5A/30VDC, 0,015 Ohms, 10⁵ switchings
- Isolating voltage: 3000V (Coil-Contact), 1000V (open contact)
- Connecting terminals: Potentialfree, for wire connection up to 2.5 mm²
- Type of protection: Housing IP 40, Terminals IP 20 (or VDE 0106T100/VBG4)
- Ambient temperature: -10 °C bis +55°C, 95% Hum
- Mains isolating: EN 60 742 (Safety transformers)
- General regulations: EN 50 178 (Electrical units in power current installation)
- Radio interference: EN 55 022/B
- EMV: EN 61000 und EN V 50 140
- Installation position: Any
- Maintenance: Maintenancefree

**Circuit Diagram**

Note: Only one phase (L1 in this case) is necessary for detecting and measuring the phase change of the protective unit VECFU1 as the phase changes of the phase L1 also take place in all other phases with the same phase changes (frequency and phase are interconnected in three-conductor power supplies).