Check Synchronising Relay

Type CSQ-2

- Multifunction precision LED synchronoscope
- Easy push-button programming of all setpoints
- Very high user safety
- High immunity to harmonic distortion
- Dead-bus functionality
- Version for marine applications

Application
The CSQ-2 is a microprocessor based synchronising unit. It can be used in any kind of installation where manual or semi-automatic synchronising is required.

Versions
Two versions optimized for land or marine applications exist.

Measuring principle
The unit measures the busbar (U_{BUSBAR}) and generator (U_{GEN}) voltages and frequencies and compares these, plus compares the phase angle relationship.

Settings
The unit is equipped with several user settings, hidden under the front foil. This placement gives a high degree of user safety because no hazardous voltages are present, i.e. the unit can be programmed while running without the risk of electric shock or damage to installations.

Phase window, \( \Delta \phi \):
Here the phase window for synchronisation is chosen. It can be set both symmetrically and asymmetrically.

Voltage difference, \( \Delta U \):
Here the allowed voltage difference between U_{GEN} and U_{BUSBAR} is set. It can be set both symmetrically and asymmetrically. Measurement is done relatively to U_{BUSBAR}

Length of SYNC pulse, T_{R}:
Determines the length of the SYNC pulse (SYNC relay activating time) This value must be matched to the time characteristic of the circuit breaker.

SYNC relay delay, T_{D}:
Determines the time U_{GEN} and U_{BUSBAR} has to be within the phase window before the SYNC relay is activated. This parameter can only be adjusted when T_{R} = \infty is selected.

Dead-bus function/offset voltage, T_{D}:
The allowed noise level voltage on U_{BUSBAR} can be set to determine dead-bus mode. It is measured relatively to U_{GEN}.

Factory settings:
All the above mentioned settings are pre-set from the factory. At any time these factory defaults can be re-stored.

Sealing of settings:
If necessary the settings can be sealed when the wanted functionality is obtained. This is very easy because of the placement under the front foil/cover.

Operation:
The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation pr. second equals 1Hz difference.

The position of the lit red LED indicates the phase difference between U_{GEN} and U_{BUSBAR}. The circle represents a degreescale from 0-360 degree with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between U_{GEN} and U_{BUSBAR} is higher than 3Hz, the rotation of the LED circle stops. If it stops with a lit red LED at “TOO SLOW”, the frequency of the U_{GEN} is lower than U_{BUSBAR}. If it stops with a lit red LED at “TOO FAST”, the frequency of the U_{GEN} is higher than U_{BUSBAR}.

When the phase angle between U_{GEN} and U_{BUSBAR} is within the preset \( \Delta \phi \) window, then the yellow LED “\( \Delta \phi \) OK” will be lit.

If the voltage difference between U_{GEN} and U_{BUSBAR} is outside the preset \( \Delta U \) range, one of the two red LEDs will be lit and the SYNC relay cannot be activated. If the voltage on U_{GEN} is higher than U_{BUSBAR} LED “U_{GEN} TOO HIGH” will be lit. If the voltage on U_{GEN} is lower than U_{BUSBAR} LED “U_{GEN} TOO LOW” will be lit.

If both the “U_{GEN} TOO LOW” and “U_{GEN} TOO HIGH” LEDs are lit simultaneously, it indicates an overvoltage error at the input.

Normal synchronising:
The unit automatically calculates the synchronising parameters to check if there is the required space for the synchronising signal inside the preset phase window. These calculations compare the frequency difference with T_{R} and the size of the phase window. When T_{R} is set to \infty, T_{D} can be set by the user and is included in the calculations.

If the \( \Delta \phi \) window is set symmetrically, both under-frequency synchronising and over-frequency synchronising is possible.

Under- or over-frequency synchronising:
When the \( \Delta \phi \) window is set asymmetrically, the following functionality is possible:

- If the \( \Delta \phi \) window is set asymmetrically with a lower positive than negative \( \Delta \phi \) value, only synchronising with the generator input at higher frequency than the bus-bar input is possible (positive slip frequency).
- If the \( \Delta \phi \) window is set asymmetrically with a higher positive than negative \( \Delta \phi \) value, only synchronising with the generator input at lower frequency than the bus-bar input is possible (negative slip frequency).

Dead-bus function:
When activated, the dead-bus function enables the SYNC relay to be activated, when no busbar voltage is present (i.e. during a power failure). When the generator voltage is within 80% of nominal level and the busbar voltage is under the preset busbar-offset level, the SYNC relay will be activated, regardless of all other parameters. Therefore, be careful when using this feature!
Type CSQ-2

Technical specifications

Accuracy: ±2 electrical degrees
Resolution: 10 electrical degrees
Max. freq. difference: No limit
Frequency range: 40...70Hz (supply)
SYNC output: 1 SPST-NO-contact
Relay contact ratings:
AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC
Life mechanical: 2 x 10^7
Life electrical: 1 x 10^6 (nominal value)
Optocoupler output: (Only on marine version)
System status off = failure
2 wires AWG 20 (red/black)
30 mm length
Max. 40V, 10mA
Temperature: -25...70°C (operating)
Temperature drift: Set points:
Max. ±0.2% of full scale per 10°C
Shock test: 15g – 6 times – 3 directions
50g/6ms
22g/20ms
Galvanic separation: Between inputs and output:
2200V - 50Hz - 1 min
Input range (U_N):
100...127V AC (115V AC) ±20%
220...240V AC (230V AC) ±20%
380...415V AC (400V AC) ±20%
440...450V AC (450V AC) ±20%
(Above 450V AC: +10% only)
Busbar input: Load: 2kΩ/V
Generator input: (Max. 3.5VA at nominal voltage)
Supply for the unit
Max. input voltage: 1.2 x U_N, continuously
2 x U_N, for 10 sec.
Climate: HSE, to DIN 40040
EMC: To EN 50081-1/2, EN 50082-1/2,
SS4361503 (PL4) and IEC 255-3
Safety: To EN 61010-1. Installation cat. III,
300V. Pollution degree 2
Connections:
Max. 2.5 mm² (single-stranded)
Max. 1.5 mm² (multi-stranded)
Materials:
All plastic parts are self-extinguishing to UL94 (V0)
Protection:
Front: IP52. Terminals: IP20,
to IEC 529 and EN 60529
Type approval:
For current approvals see www.deif.com or contact DEIF A/S

Settings

<table>
<thead>
<tr>
<th>Setting of</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆ϕ</td>
<td>±5...20° in 1° step or ±10...40° in 2° step</td>
</tr>
<tr>
<td>∆U</td>
<td>±1...10% in 1% step</td>
</tr>
<tr>
<td>Tr</td>
<td>0...1 sec. in 0.1 sec. step or ≥</td>
</tr>
<tr>
<td>Td</td>
<td>SYN C relay delay 0...1 sec. in 0.1 sec. step</td>
</tr>
<tr>
<td>UOFFSET</td>
<td>Dead-bus offset voltage Off or 4 levels of noise suppression</td>
</tr>
</tbody>
</table>

Indication

<table>
<thead>
<tr>
<th>LEDs</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYNC</td>
<td>Green, when the SYNC relay is activated</td>
</tr>
<tr>
<td>∆ϕ OK</td>
<td>Yellow, when inside the phase window</td>
</tr>
<tr>
<td>TOO FAST</td>
<td>Red LED stopped. Frequency difference too high. GEN too high</td>
</tr>
<tr>
<td>TOO SLOW</td>
<td>Red LED stopped. Frequency difference too high. GEN too low</td>
</tr>
<tr>
<td>UG TOO LOW</td>
<td>Red, when outside the ∆U level</td>
</tr>
<tr>
<td>UG TOO HIGH</td>
<td>Red, when outside the ∆U level</td>
</tr>
<tr>
<td>UG TOO LOW</td>
<td>When both are red simultaneously, there is an overvoltage error on the input</td>
</tr>
</tbody>
</table>

Once the relay has been mounted and adjusted, the front cover may be sealed, preventing unwanted change of the setting.

For more information about the product a User’s manual (Item: 4189340218) is available on www.deif.com.

Connections

<table>
<thead>
<tr>
<th>BUSBAR</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSQ</td>
<td>1</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

Weight: Approx 0.35 kg

Order specifications

<table>
<thead>
<tr>
<th>Type - Input voltage - Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
</tr>
<tr>
<td>CSQ-2 230V AC Land</td>
</tr>
<tr>
<td>CSQ-2 230V AC Marine</td>
</tr>
</tbody>
</table>

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

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