FCOVF6100 Features:
- Industry Standard
- ASIC-Based Design
- Variable frequency range of operation: 30-140 Hz (nominal) (others available)
- Fully Connectorized
- Independently Configurable
- Soft-Start and Soft-Stop
- Isolated Gate Drive Circuitry
- Phase Loss Protection

Applications:
- Generator Exciters
- Battery Chargers
- Wind Turbine Controllers
- DC Drives

FCOVF6100 Variable Frequency Three-Phase Six SCR Firing Board

Description
The FCOVF6100 variable frequency firing board provides the functionality of the industry-standard FCOG6100 firing board for applications with variable-frequency AC mains. An onboard frequency compensation scheme makes the firing circuit less sensitive to line frequency variations while an isolated DC-DC converter provides enhanced control power flexibility. The FCOVF6100 is offered in a standard 30-140 Hz frequency of operation range and customer-specific ranges to 600 Hz.

Operational Features

Frequency Insensitivity: A frequency-to-voltage converter acts in concert with the delay angle determinator circuit to reduce delay angle variance over the operating frequency range. This scheme limits delay angle variance to approximately 3° over a frequency range of 30 to 120 Hz.

Analog Delay Angle Command Signal (SIG HI): Users may choose a variety of DC control signal ranges including 0-5 V, 0-10 V, 4-20 mA, or custom ranges.

Soft-Start and Soft-Stop: Upon soft-start, SCR firing is enabled and the delay angle command ramps from the maximum value to the setpoint value determined by the SIG HI command signal. Upon soft-stop, the delay angle ramps from the setpoint value to the maximum value after which SCR firing is inhibited.

Phase Loss Inhibit: A phase loss circuit instantly inhibits SCR firing if a loss of one or more phases or gross phase imbalance is sensed on the AC line. Firing will soft-start when such a fault is cleared.

Instant Enable and Inhibit: A contact closure (relay, switch, transistor) instantly enables or inhibits SCR firing at the delay angle commanded by the SIG HI delay angle command signal.

Phase Sequence Insensitivity: SCR gating is unaffected by mains voltage phase sequence.

High Current Picket Fence Gate Drive: The transformer-isolated gate drive circuits provide a hard firing initial 15 V open circuit/1.8 A short circuit firing pulse followed by sustaining "back porch" pulses at 7 V open circuit/0.5 A short circuit. The gate pulse burst frequency is 384 times the mains voltage frequency.

Flexible Control Power Options:
The FCOVF6100 board is typically configured to accept 24 or 48 VDC control power. In this configuration, an onboard 20 W DC-DC converter rated for 1600 V isolation (with a voltage limiting Zener preregulator) creates the necessary 30 VDC and 15 VDC rail voltages on the firing board. The customer may alternatively supply 30 and 15 VDC rails directly.

Board Construction: All circuit boards are assembled at the Enerpro plant in Goleta, California and are manufactured by a UL-approved fabricator from 2.4 mm thick FR4 fire resistant fiberglass epoxy laminate. All boards are conformal coated (MIL-1-46058, Type UR).

Enerpro applications engineers are available by e-mail or fax for applications assistance.

Power Electronics Control Specialists – www.enerpro-inc.com
**Product Datasheet**

### Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC mains voltage</td>
<td>600 Vac</td>
</tr>
<tr>
<td>Pulse transformer hipot</td>
<td>3500 Vac (60 seconds)</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-5 C to 85 C</td>
</tr>
<tr>
<td>Board supply voltage without DC-DC converter</td>
<td>30 and 15 VDC supplies ± 5% max</td>
</tr>
<tr>
<td>Board supply input range with DC-DC converter, 24 VDC nominal input</td>
<td>18 - 36 VDC</td>
</tr>
<tr>
<td>Board supply input range with DC-DC converter, 48 VDC nominal input</td>
<td>36 - 75 VDC</td>
</tr>
<tr>
<td>Board ac supply voltage</td>
<td>28 Vac (24 Vac nominal)</td>
</tr>
<tr>
<td>12 V regulator output current</td>
<td>20 mA (Note 1)</td>
</tr>
<tr>
<td>5 V reference output current</td>
<td>5 mA (Note 1)</td>
</tr>
<tr>
<td>Auxiliary control power available from 30 V output</td>
<td>10 W (DC-DC)</td>
</tr>
<tr>
<td>Delay angle range</td>
<td>(10^\circ \leq \alpha \leq 170^\circ)</td>
</tr>
</tbody>
</table>

### Characteristics

- Delay angle command signal (SIG HI): 0-5, 0.85-5.85, 0-10, 1-2 V<br>4-20 mA<br>Or as specified
- Delay angle reference phase shift: -60° (or application-specific)
- Control signal isolation from ground: 653 kΩ
- Gate delay steady-state transfer function: Delay angle inversely proportional to delay angle command SIG HI
- Gate delay dynamic transfer function bandwidth: -3 dB at 119 Hz, phase shift -45° at 68 Hz
- Gate drive phase balance: ±1° (max)
- Lock acquisition time: 30 ms (typ)
- Soft-start/stop time: 0.05 - 20.0 s, independently configurable
- Phase rotation effect: None
- Phase loss inhibit: Automatic
- Power-on inhibit: Automatic
- Instant/soft inhibit/enable inputs: Dry contact
- SCR gate pulse waveform: 120° burst or 2-30° bursts, 30° spaced
- Gate pulse burst frequency: 384 times line frequency
- Initial gate pulse open circuit voltage: 15 V (Note 1)
- Sustaining gate pulse open circuit voltage: 7.0 V (Note 1)
- Initial gate drive short circuit current: 2.0 A (Note 1 and 2)
- Sustaining gate drive short circuit current: 0.5 A (Note 1 and 2)
- Short-circuit gate drive current rise time: 1.0 A/μs (Note 1 and 2)
- Board dimensions: 191 x 152 x 35 mm (L x W x D)
- Minimum creepage distance to ac mains With onboard phase references: 13 mm<br>With phase references entering on J6: 10 mm
- Conformal Coating: per MIL-1-46058, Type UR

### Notes

1. Assumes nominal 30 V control power
2. Assumes a purely resistive gate load of 1.0 Ω

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**Ordering Guide**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR Circuit Type</td>
<td>01 Controller&lt;br&gt;02 Converter</td>
<td></td>
</tr>
<tr>
<td>Parallel SCR s</td>
<td>0 No&lt;br&gt;1 Yes (Note 1)</td>
<td></td>
</tr>
<tr>
<td>Mains Frequency</td>
<td>01 30 - 140 Hz&lt;br&gt;02 Other, Specify (Note 2)</td>
<td></td>
</tr>
<tr>
<td>Command Signal</td>
<td>1 0 - 5 V&lt;br&gt;2 0.85 - 5.85 V&lt;br&gt;3 0 - 10 V&lt;br&gt;4 1 - 2 V&lt;br&gt;5 4 - 20 mA&lt;br&gt;6 Other - Specify</td>
<td></td>
</tr>
<tr>
<td>Used with Regulator Board</td>
<td>0 No&lt;br&gt;1 Horizontal Header&lt;br&gt;2 Vertical Header</td>
<td></td>
</tr>
<tr>
<td>SCR Mains Voltage</td>
<td>XX Specify (Note 3)</td>
<td></td>
</tr>
<tr>
<td>Control Power</td>
<td>0 Omit DC/DC Converter-Specify (Note 4)&lt;br&gt;1 With 24 Volt DC/DC Converter&lt;br&gt;2 With 48 Volt DC/DC Converter</td>
<td></td>
</tr>
<tr>
<td>Phase References</td>
<td>1 On-board&lt;br&gt;2 External (Note 5)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**

1. Auxiliary firing board required for parallel SCRs
2. Specify desired mains frequency range. Specify code as mains voltage divided by 10. Example: 480 V / 10 = 48
3. Customer must supply regulated 30 and 15 VDC for control power.
4. Connect ac mains via J6 to provide phase references.

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