Features:

Industry Standard ASIC-Based Design

Fully Connectorized

Virtually eliminates 5th and 7th harmonics

Balance circuit minimizes DC ripple voltage and supply current imbalance

Independently Configurable Soft-Start and Soft-Stop

Phase Loss and Power-On Reset Protection

Applications:

12-Pulse Converters or Controllers

UPS Systems

FCOG1200 Standard Twelve-Pulse SCR Firing Board

Description

The FCOG1200 board provides a six-phase firing circuit with equidistant 30-degree gating and excellent bandwidth. Twelve isolated gate outputs provide hard-firing pulses for parallel or series connected 12-pulse converters or ac controllers. The twelve gate outputs are spaced at 30-degree intervals as required to eliminate the 5th and 7th harmonics of the ac input current.

Operational Features

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.

Power-On Reset: A special circuit prevents unintentional SCR gating upon board power-up.

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 Balance Circuit: The FCOG1200 provides three methods of trimming the nominal 30-degree group delay angle to optimize the rectifier performance: on-board (manual), on-board (auto), and external (auto). The 30-degree delay angle trim balances parallel bridge currents, ensuring full utilization of phase shift transformer secondary windings. Mains current harmonics and DC ripple voltage are also minimized.

High Current Picket Fence Gate Drive: The twelve transformer-isolated and 30-degree spaced 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.

Analog Delay Determinator Circuit: Enerpro's gate delay determinator circuit is a six phase phase-locked loop consisting of a summing junction, low-pass filter, voltage controlled oscillator implemented with two proprietary ASIC devices. The VCO frequency is locked to the power line frequency. The DC delay angle command signal (SIG HI) varies the delay angle.

Control Power Options: The FCOG1200 is powered from an external 30 VDC or 24 Vac source.

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.*

ENERPRO®

Product Datasheet

Maximum Ratings

AC mains voltage	600 Vac
Pulse transformer hipot	3500 Vac (60 seconds)
Operating temperature range	-5 C to 85 C
Board ac supply voltage	28 Vac (24 Vac nominal)
12 V regulator output current	5 mA
5 V reference output current	5 mA
Auxiliary control power available from 24 Vac and 30 V outputs	10 W
Delay angle range	$10° \leq \alpha \leq 170°$

Characteristics

Delay angle command signal (SIG HI)	0-5, 0.85-5.85, 0-10, 1-2 V 4-20 mA Or as specified
Control signal isolation from ground	Galvanic isolation provided by pulse transformers and control power transformer
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 167 Hz
Gate drive phase balance	±1° (max)
Delay angle variance	$\Delta(\alpha)/\Delta(f) = 0.2°/Hz$
Lock acquisition time	30 ms (typ)
Soft-start/stop time	0.05 - 20.0 s, independently configurable
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. Select via JU1 & JU2.
Gate pulse burst frequency	384 times line frequency
Gate pulse width, 50 Hz	20-22 μs
Gate pulse width, 60 Hz	24-26 μs
Initial gate pulse open circuit voltage	15 V (Note 1)
Sustaining gate pulse open circuit voltage	7.0 V (Note 1)
Peak gate drive short circuit current	1.5 A (Notes 1, 2)
Sustaining gate drive short circuit current	0.5 A (Notes 1, 2)
Short-circuit gate drive current rise time	1.0 A/μs (Notes 1, 2)
Board dimensions	194 x 191 x 34 mm (L x W x D)
Minimum creepage distance to ac mains	13 mm
Conformal Coating	per MIL-1-46058, Type UR

NOTES
1 Assumes nominal 30 V control power is applied to board
2 Assumes a purely resistive gate load of 1.0 Ω

Ordering Guide

Parameter		Description	Code
SCR Circuit Arrangement	01	AC Controller	
	02	DC Converter	
Mains Frequency	50	50 Hz	
	60	60 Hz	
	5/6	50 or 60 Hz	
	XX	Specify (Note 1)	
Command Signal	1	0 - 5 V	
	2	0.85 - 5.85 V	
	3	0 - 10 V	
	4	1 - 2 V	
	5	4 - 20 mA	
	6	Other (Specify)	
SCR Mains Voltage	XX	Specify (Note 2)	
Phase References	1	On-board	
	2	External	
Balance Circuit Type	01	Manual Balance	
	02	On-Board Auto-Balance	
	03	External Auto-Balance	

NOTES
1   Specify code as frequency divided by 10
    Example: 400 Hz / 10 = 40
2   Specify as mains voltage divided by 10
    Example: 480 V /10 = 48