FRS300

Features:

Industry Standard ASIC-Based Design

Half-Controlled Rectifier

Voltage/Current Regulator (Optional)

RC Snubber Circuit (Optional)

Independently Configurable Soft-Start and Soft-Stop

Isolated Gate Drive
Circuitry

Phase Loss and Power-On Reset Protection

Applications:

DC Bus Capacitor Chargers

Battery Chargers

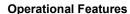
Corrosion-Protecting Semi-converters

ENERPRO®

FRS300 Three-Phase Half-Controlled Rectifier, Regulator, and Snubber Board

Description

The FRS300 provides an economical combination firing, regulator, and snubber board solution for three-phase half-controlled rectifiers. The compact circuit board replaces the individual boards that usually provide these functions. The FRS300 board may be supplied with or without current or voltage regulation, or with or without snubber RC components as long as the maximum SCR dV/dt rating is not exceeded.



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 delay angle command signal (SIG HI).

Regulator Circuit: The board typically operates in voltage or current regulation mode, depending upon which error signal is larger. This allows a seamless transition from voltage to current regulation or vice-versa.

Snubber Circuit: The snubber section consists of three RC circuits connected to the SCR anodes and cathodes.



High Current Picket Fence Gate Drive: The transformer-isolated gate drive circuits provide a hard firing initial 13 V open circuit/1.3 A short circuit firing pulse followed by sustaining "back porch" pulses at 6 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 based on the Ainsworth three-phase PLL circuit and implemented with a proprietary ASIC. This circuit adjusts the gate delay firing angle in negative proportion to the SIG HI command. Gate drive phase balance is typically less than ±1°.

Control Power Options: The FRS300 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.



Product Datasheet			
Maximum Ratings			
AC mains voltage	630 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	20 mA (Note 1)		
5 V reference output current	5 mA (Note 1)		
Auxiliary control power available from 24 Vac and 30 V outputs	10 W		
Delay angle range	13° ≤ α ≤ 168°		
Characteristic	es		
Delay angle command signal (SIG HI)	0-5, 0.85-5.85, 0-10, 1-2 V 4-20 mA Or as specified		
Delay angle reference phase shift	-30° (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)		
Delay angle variance	$\Delta(\alpha)/\Delta(f) = 1.5^{\circ}/Hz$		
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		
Gate pulse width, 50 Hz	24-29 μs		
Gate pulse width, 60 Hz	20-24 μs		
Initial gate pulse open circuit voltage	13 V (Note 1)		
Sustaining gate pulse open circuit voltage	6.0 V (Note 1)		
Initial gate drive short circuit current	1.3 A (Note 1 and 2)		
Sustaining gate drive short circuit current	0.6 A (Note 1 and 2		
Short-circuit gate drive current rise time	0.9 A/μs (Note 1 and 2)		
Board dimensions	165 x 152 x 34 mm (L x W x D)		
Minimum creepage distance to ac mains	8 mm		
Conformal Coating	per MIL-1-46058, Type UR		
NOTES			

Ordering Guide				
Parameter		Description	Code	
Snubber	1	Omit		
Circuit	2	Install		
	1	Open Loop		
	2	Voltage Regulation with		
Regulation		Current Limit		
	3	Voltage Regulation Only		
	4	Current Limit Only		
J1 & J2	0	Horizontal		
Header Type	1	Vertical		
CT Ratio	XX	(Note 1)		
	1	0 - 5 V		
Command	2	0 - 10 V		
Signal	3	4 - 20 mA		
	4	Other (Specify)		
SCR Mains Voltage	хх	Specify (Note 2)		
	50	50 Hz		
Mains	60	60 Hz		
Frequency		50 or 60 Hz		
	XX	Specify (Note 3)		
Rectifier	1	None		
Filter	2	Capacitor		
, ,,,,,,	3	Inductor		

Notes

- 1.0 A maximum CT current
- Specify as mains voltage divided by 10 Example: 480 V / 10 = 48
- 3 Specify as mains frequency divided by 10

Example: 400 Hz / 10 = 40

Enerpro, Inc.

99 Aero Camino Goleta, CA 93117 (USA)

Tel: (805) 683-2114 (877) 648-2114

Fax: (805) 964-0798

info@enerpro-inc.com www.enerpro-inc.com

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