

PWB ARTWORK REVISIONS			
LTR	DESCRIPTION	DATE	APPD.
NC	Changed part # from FCOG12BP to FCOG61BP	11-29-06	fjb
A	Add resistor R32, connect U3 pin 4 to gnd.	01-19-07	srs
B	Add connector J7, J8 and J9, rename components	4-27-07	srs

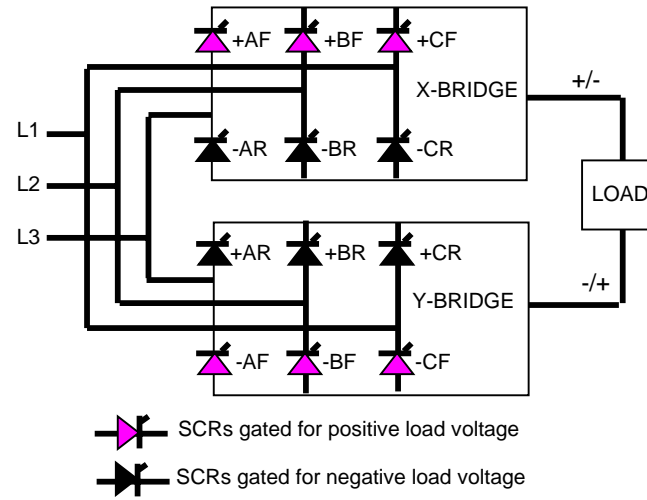
<b>ENERPRO</b>			
CIRCUIT DIAGRAM: BIPOLAR 3-PHASE FIRING BOARD			
dwn: fjb	09-22-06	<b>P.N. FCOG61BP</b>	<b>E1535B</b>
ver: srs	05-01-07	SIZE: A	SHEET 1 OF 2

- |     |      |     |      |     |      |     |       |     |      |     |       |     |      |     |      |     |      |
|-----|------|-----|------|-----|------|-----|-------|-----|------|-----|-------|-----|------|-----|------|-----|------|
| U2  | 2907 | U9  | 4077 | U3  | 1014 | U5  | 34074 | U7  | 1016 | U4  | 34074 | U8  | 293  | U1  | 4053 | U6  | 4053 |
| C1  | 2907 | C9  | 2.2  | C12 | 2.2  | C26 | 2.2   | C10 | 2.2  | C34 | 2.2   | C11 | 2.2  | C2  | .33  | C6  | .33  |
| C14 | .022 | C18 | .022 | C8  | .10  | C29 | 2.2   | C30 | .033 | C33 | .033  | C23 | 100p | C24 | 100p | C25 | 100p |
| C15 | 680p | C17 | 22   | C16 | .022 | C28 | .22   | C31 | .033 | C32 | .033  | C27 | .68  | C7  | .33  | C3  | .33  |
| C13 | 2.2  | C19 | .10  | C20 | 2.2  | C21 | .015  | C22 | .33  | C35 | .10   | C36 | 14V  | C4  | .33  | C5  | .33  |

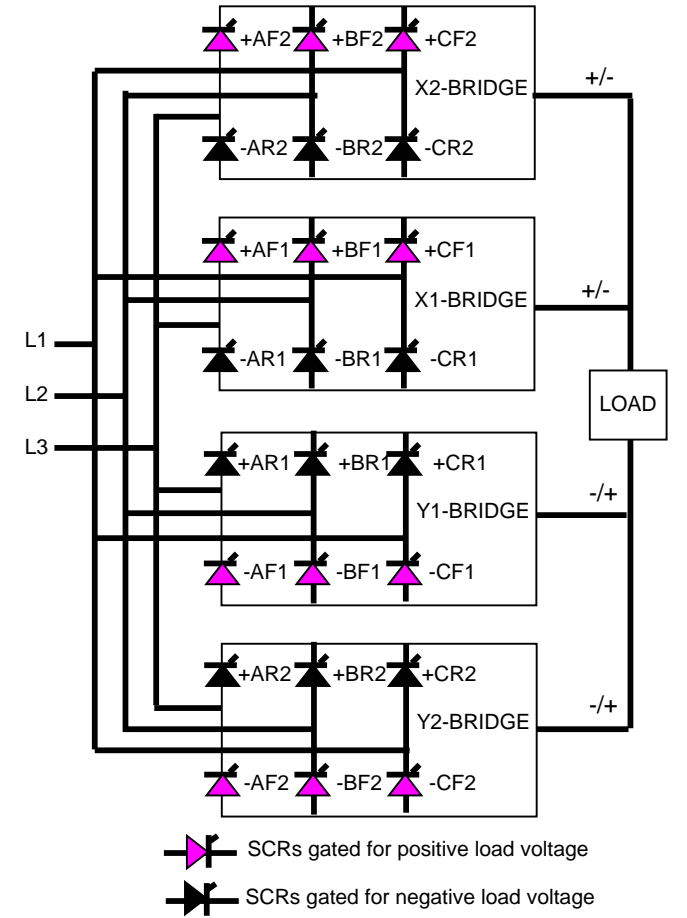
PART	PART NUMBER	STOCK NUMBER
U1,U6	MC4053BC	I14053P
U2	MM2907N-8	I12907N-8
U3	EP1014	I11014S
U4,U5	MC34074BC	I134074P
U7	EP1016	I11016S
U8	LM293N	I1293N
U9	MC4077BC	I14077BC
VR1	LM78L12ACZ (TO-92)	T2VL78L12
Q1-Q13	IRF110	T2IRFD110
Q14	BS170	T2BS170
D1-D8	1N914B	D1N914B
D9	1N4004	D1N4004
D10	1N 5341B 6.2 V	D1N5341B
D11	1N 5351B 14 V	D1N5351B
PD1	550-2204	DIL5502204G
PD2-PD4	550-2404	DIL5502404R
BR1	W02G	D1BRW02G
RN1,RN7	4308R-1-1-153	R1S08NI153
RN2	8R-2-333	R1S08I333
RN3	10R-2-332	R1S10I332
RN4	10R-2-222	R1S10I222
RN5	4308R-1-1-104	R1S08NI104
RN6	6R-2-473	R1S06I473
RN8	8R-2-103	R1S08I103
RN9	6R-2-152	R1S06I152
RN10	6R-2-124	R1S06I124
RN11	6R-2-153	R1S06I153
R1	CW2C 180	R1W03W180
R2 (5)	CW2C 220	R1W03W220
R3-R8	CW2C 150	R1W03W150
R11-R32	RN60 (see table)	

PART	PART NUMBER	STOCK NUMBER
C1	ECEA1HV102S	C1EL063102
C2-C7	C1FL063334	MKS4-LF
C8,C19,C35	MSS02 .10u	C1FL063104
C9-C13	ECS-F1CE16225	C1TN016225
C14,C16	MKS4 .022u	C1FL100223
C15	FKP3 680p	C1FL160681
C17	ECS-F1CE16226	C1TN016226
C20,26,29,34	ECS-F1CE16225	C1TN016225
C21	MKS02 .015u	C1FL063153
C22,C36-37	ECS-F1CE35226	C1TN035226
C23-C25	FKP3 100p	C1FL160101
C27	MKS4 .68u	C1FL063684
C28	ECS-F1CE35224	C1TN035224
C30	MKS4 .033u	C1FL063333
C31-C33	MKS4 .033u +/-1%	C1FL063333
PM1-PM12	EP1024	TIPW10241
J1-J4(vert)	641828-2	C2MNLVPH08
J1-J4(horiz)	640584-2	C2MNLRPH08
J5	350713-2	C2MNLVPH12
J6	640454-3	C2MTAVPH03
P1-P4	64582-1	C2MNLPLG08
P5	350735-1	C2MNLPLG12
P6	640440-3	C2MTAPLG03
TP1-TP8	TP-104-01-02	T3TP104
COM1-COM2	M1034	W1JCOMM

NO.	DESCRIPTION
1	For current signal input, select R30 to give SIG HI = +5.0 V with maximum signal current.
2	Select R21 for desired PLL delay angle span, where $SPAN = \frac{MAX - MIN}{MAX + MIN} / 2$ . Select R22 and R23 for desired PLL delay angle bias, where $BIAS = \frac{MAX + MIN}{2}$ .
3	Select R27 for desired soft-start time. Select R28 for desired soft-stop time.
4	For 120 deg. burst gating, remove JU1; otherwise gating is 2-30 deg. burst mode.
5	Select R2 resistance to provide desired status relay or lamp voltage.
6	Refer to buffer amplifier resistance table for SIG HI range other than 0 to 5 V.
7	Select C28 capacitance in conjunction with SIG HI source resistance to reduce the firing circuit bandwidth.
8	Select R12 resistance to make $V_c = 5.00 \pm .05$ V at TP2 with $F = 60$ Hz.



REVERSING RECTIFIER CONNECTIONS FOR ONE SCR IN A DUAL MODULE CONDUCTING AT A TIME



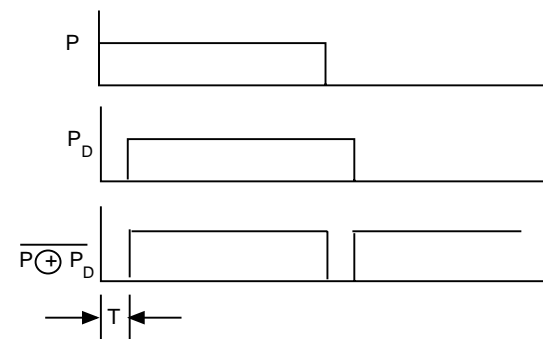
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**RN60 RESISTORS (K )**

R11	200	R22 (2)	1000
R12 (8)	select	R23 (2)	80.6
R13	32.4	R24	130
R14	33.2	R25	46.4
R15	20.0	R26	100
R16	1.5	R27 (3)	100
R17 (3)	100	R28	10.0
R18	1000	R29	200
R19	47.5	R30	10.0
R20	10	R31	1.5
R21 (2)	36.5	R32	1.0

**BUFFER AMPLIFIER RESISTANCE TABLE**

SIG HI Range	Resistances in K					
	R26	R13	R24	R25	R18	R30
0 / 5 V (default)	100	32.4	130	46.4	1000	10.0
.85 / 5.85 V	100	32.4	196	46.4	1000	10.0
0 / 10 V	100	32.4	1000	90.9	374	10.0
0 / 2 V	274	32.4	78.7	46.4	1000	10.0
4 / 20 mA	100	32.4	130	46.4	1000	.249



$$P \oplus P_D = X * Y + X * Y$$

$$T = -RC * \ln(6/12) = .693$$

$$RC = 200 * .68 = 136 \text{ ms}$$

$$T = 66 * .693 = 94 \text{ ms}$$

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ver: srs	05-01-07	SIZE: A	SHEET 2 OF 2