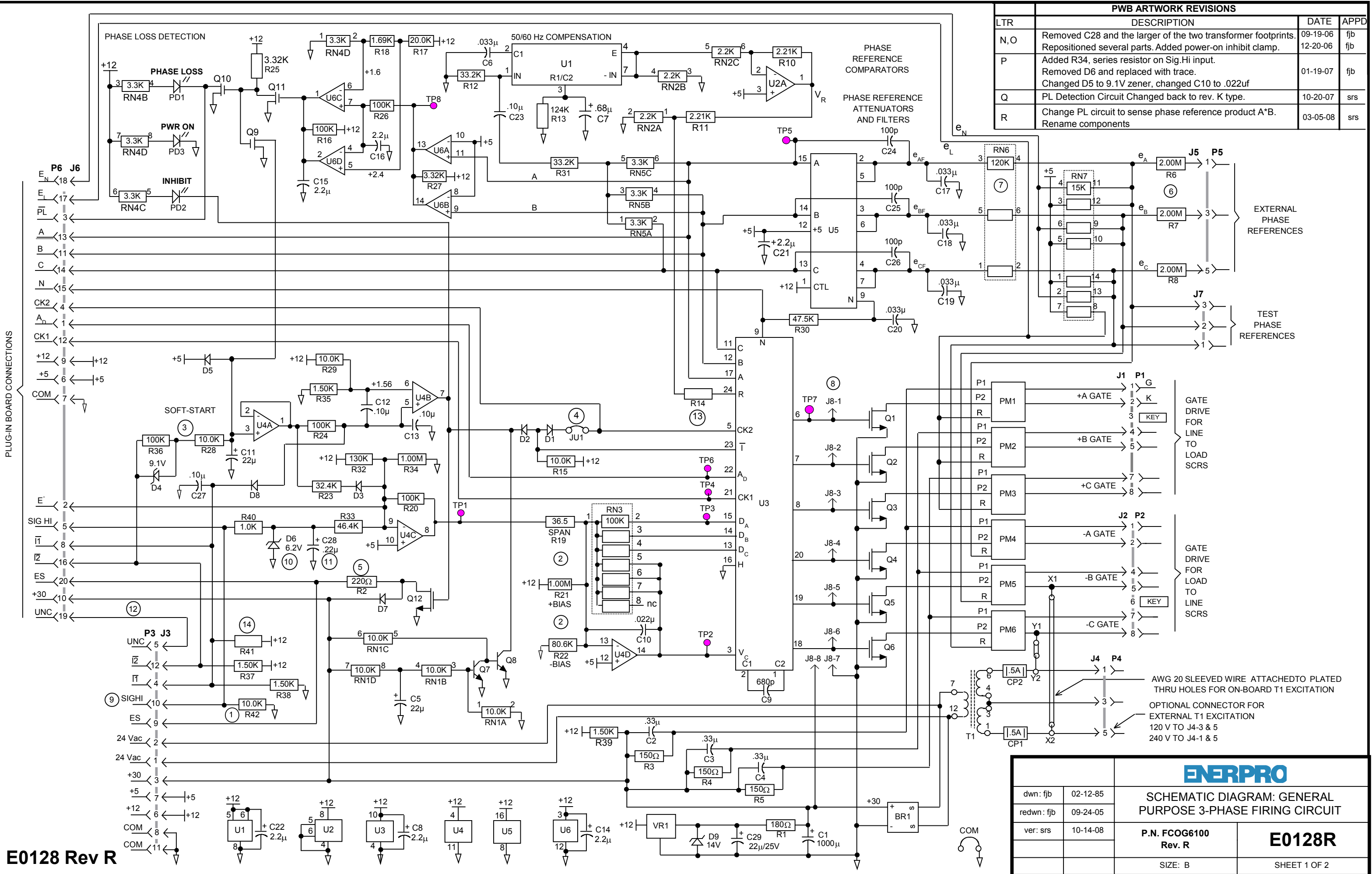


PWB ARTWORK REVISIONS			
LTR	DESCRIPTION	DATE	APPD
N,O	Removed C28 and the larger of the two transformer footprints. Repositioned several parts. Added power-on inhibit clamp.	09-19-06	fjb
P	Added R34, series resistor on Sig.Hi input. Removed D6 and replaced with trace. Changed D5 to 9.1V zener, changed C10 to .022uf	01-19-07	fjb
Q	PL Detection Circuit Changed back to rev. K type.	10-20-07	srs
R	Change PL circuit to sense phase reference product A*B. Rename components	03-05-08	srs



E0128 Rev R

dwn: fjb	02-12-85		SCHMATIC DIAGRAM: GENERAL PURPOSE 3-PHASE FIRING CIRCUIT
redwn: fjb	09-24-05		
ver: srs	10-14-08		
		P.N. FCOG6100 Rev. R	E0128R
		SIZE: B	SHEET 1 OF 2

PART	PART NUMBER	STOCK NUMBER
U1	MM2907N-8	I12907N-8
U2	MC34072BC	I134072P
U3	EP1014	I11014D
U4	MC34074BC	I134074P
U5	EP1016	I11016
U6	LM239N	I1239N
VR1	LM78L12CZL	T2VL78L12
Q1-Q6	IRF110	T2IRFD110
Q7-Q8	2N2222	T2N2222A
Q9-Q11	BS170	T2BS170P
Q12	IRF110	T2IRFD110
D1-D3	1N914B	D1N914B
D4	1N5239 9.1 V	D1N5239
D5	1N914B	D1N914B
D6 (10)	1N5341B 6.2 V	D1N5341B
D7	1N4004	D1N4004
D8	1N914B	D1N914B
D9	1N 5351B 14 V	D1N5351B
PD1-PD2	550-2404	D1L5502404R
PD3	550-2204	D1L5502204G
BR1	W02G	D1BRW02M
RN1	8R-2-103	R1S08I103
RN2	6R-2-222	R1S06I222
RN3	4308R-1-1-104	R1S08NI104
RN4	8R-2-332	R1S08I332
RN5	6R-2-332	R1S06I332
RN6 (7)	6R-2-124 6R-2-333	R1S06I124 R1S06I333
RN7	4114RLF1-153	R1D14I153
R1	CW2C 180Ω	R1W03W180
R2 (5)	CW2C 220Ω	R1W03W220
R3-R5	CW2C 150Ω	R1W03W150
R6-R8 (6)	RN65 2.00M	RN65D2004F
R10-R42	RN60 (see table)	

RN60 RESISTORS (KΩ)			
R10	2.21	R27	3.32
R11	2.21	R28 (3)	10.0
R12	33.2	R29	10.0
R13	124	R30	47.5
R14 (13)	Select	R31	33.2
R15	10.0	R32 (9)	130
R16	100.0	R33 (9)	46.4
R17	20	R34 (9)	1000
R18	1.69	R35	1.50
R19 (2)	36.5	R36 (3)	100.0
R20 (9)	100.0	R37	1.50
R21 (2)	1000	R38	1.50
R22 (2)	80.6	R39	1.50
R23 (9)	32.4	R40	1.0
R24	100.0	R41	SELECT
R25	3.32	R42 (1)(9)	10.0
R26	100.0		

PART	PART NUMBER	STOCK NUMBER
C1	ECEA1HV102S	C1EL063102
C2	MKS4 .33u	C1FL063334
C3	MKS4 .33u	C1FL063334
C4	MKS4 .33u	C1FL063334
C5	ECS-F1CE35226	C1TN035226
C6	MKS4 .033u +/-1% absolute	C1FL250333
C7	ECS-F1CE16225	C1TN035684
C8	ECS-F1CE16225	C1TN016225
C9	FKS 680p +/-1%	C1FL160681
C10	MKS3 .022u	C1FL100223
C11	ECS-F1CE16226	C1TN016226
C12	MKS4 .10u	C1FL100104
C13	MKS02 .10u	C1FL063104
C14-C16	ECS-F1CE16225	C1TN016225
C17-C20	MKS4 .033u +/-1%	C1FL063333
C21 & C22	ECS-F1CE16225	C1TN016225
C23	MKS3 .10u	C1FL100104
C24-C26	FKS3 100p	C1FL160101
C27	MKSO2 .10u	C1FL063104
C28 (11)	ECS-F1CE035226	C1TN035226
C29	ECS-F1CE16226	C1TN016226
PM1-PM6	EP1024	TIPW1024
CP1-CP2	PC1-2	F1PCB2
J1-J2/P1-P2	640584-2/ 640582-1	C2MNL RPH08 C2MNLPLG08
J3/P3	340433-1/ 1-480708-0	C2MNL VPH12 C2MNLPLG12
J4/P4	1-350945/ 350809-1	C2MNL VPH05 C2MNLPLG05
J5/P5 (6)	640900/350809-1	C2MNL RPH05 C2MNLPLG05
J6/P6	103311-5/ 499568-4	C2BRKVPJ40
J7/P7	640454-3/640440-3	C2MTAVPH03
J8 (8)	640456-8	C2MTAVPH08
JU1 (4)	65474-001	C3MSCJ03
TP1-8	TP104-01-02	T3TP104
T1	EP10XXB	TIPW10XXB
COM RING		W1JCOMM

NO.	NOTES	DESCRIPTION
1	For current signal input, select R42 to give SIG HI = +5.0 V with maximum signal current.	
2	Select R19 for desired PLL delay angle span, where $\alpha_{SPAN} = \alpha_{MAX} - \alpha_{MIN}$ Select R21 and R22 for desired PLL delay angle bias, where $\alpha_{BIAS} = 90 - (\alpha_{MAX} + \alpha_{MIN})/2$.	
3	Select R36 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. (Optional)	
6	For off-board phase references, install J5 and R6-R8 in place of T1.	
7	For converter gating with 30 deg. phase shifted references, install RN6=120K (.033 μF for C17, C18 & C19) For controller gating with 0 deg. phase shifted references, install RN6=33K (.033 μF for C17, C18 & C19)	
8	For gating paralleled SCRs, connect FCOAUX60 auxiliary firing board via cable to J8.	
9	Refer to buffer amplifier resistance table for SIG HI range other than 0 to 5 V.	
10	Make D6 a 11V Zener if the SIG HI range is 0-10V (D1N5348).	
11	Select C28 capacitance in conjunction with SIG HI source resistance to reduce the firing circuit bandwidth. (Optional).	
12	Jumper J6-9 to J6-19 to connect +12 to J3-5. (Optional)	
13	Select R14 resistance to make Vc = 5.00 +/- .05 V at TP2 with F = 60 Hz.	
14	Optional 1.5K pullup resistor R41, connect T1 to COM for instant inhibit.	

SIG HI Range	Resistances in KΩ					
	(9) R20	R23	R32	R33	R34	R42
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 (10)	100	32.4	OMIT	90.9	750	10.0
0 / 2 V	274	32.4	78.7	47.5	1000	10.0
4 / 20 mA	100	32.4	130	47.5	1000	.249

CHANGE RECORD

Date	PCB Rev.	by	Notes
09-19-06	PCB Rev.: N	by: drs	Removed C28 and the larger of the two transformer footprints. Repositioned several parts.
			1. Provide more space for components.
12-19-06	PCB Rev.: 0	by: drs	1. Add power-on inhibit clamp circuit: RN8, Q9, Q10, C28 and D6. 2. Move C13 from U4-6 to U4-5.
			1. Prevent false gate enable when control power is applied. 2. Increase power-on inhibit comparator noise immunity.
01-05-07	PCB Rev.: P	by: fjb	1. Replace D6 with 0 ohm RN60 resistor. 2. Replace D5 with a 9.1 V zener. 3. Change C10 from .10 u to .022 u. 4. Added R34 on Sig. Hi input
			1. Prevent gate inhibit at reduced board supply voltage. 2. Reduce soft-start enable delay time to Rev. K enable delay time. 3. Ensure phase loss inhibit when SCR circuit is disconnected from 3-phase supply. 4. Limit current through D11 and allow lowpass filter with C26
03-05-08	PCB Rev.: R	by: srs	1. Change PL detection circuit: A*B PL circuit: - Re-introduce window comparator: R17, R18 & RN4D. - Add R26 & C16 - Add R16 & C15 - Add Q11, Q10 & R25 - Remove RN3, D3, U6A. 2. Change R10 & R11. 3. Change R13 & C7. 4. Rename components.
			1. Improve PL detection circuit (frequency independent). - Ensure a true phase loss condition is detected, make PL detection independent of SIG HI. - Provide filtering time constant to prevent PL detection during transients or glitches in the AC Mains. - Stretch circuit to eliminate undesired blinking of PL LED. - Provide correct logic and voltage to drive Q9. - Eliminate SIG HI from PL detection circuit. 2. Change gain of F/V converter to a unity gain. 3. Change R/C input ratio to ensure proper operation of PL and firing board at frequencies 45-65Hz. 4. Comply with Enerpro's PCB component layout.

		ENERPRO	
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		SIZE: B	SHEET 2 OF 2