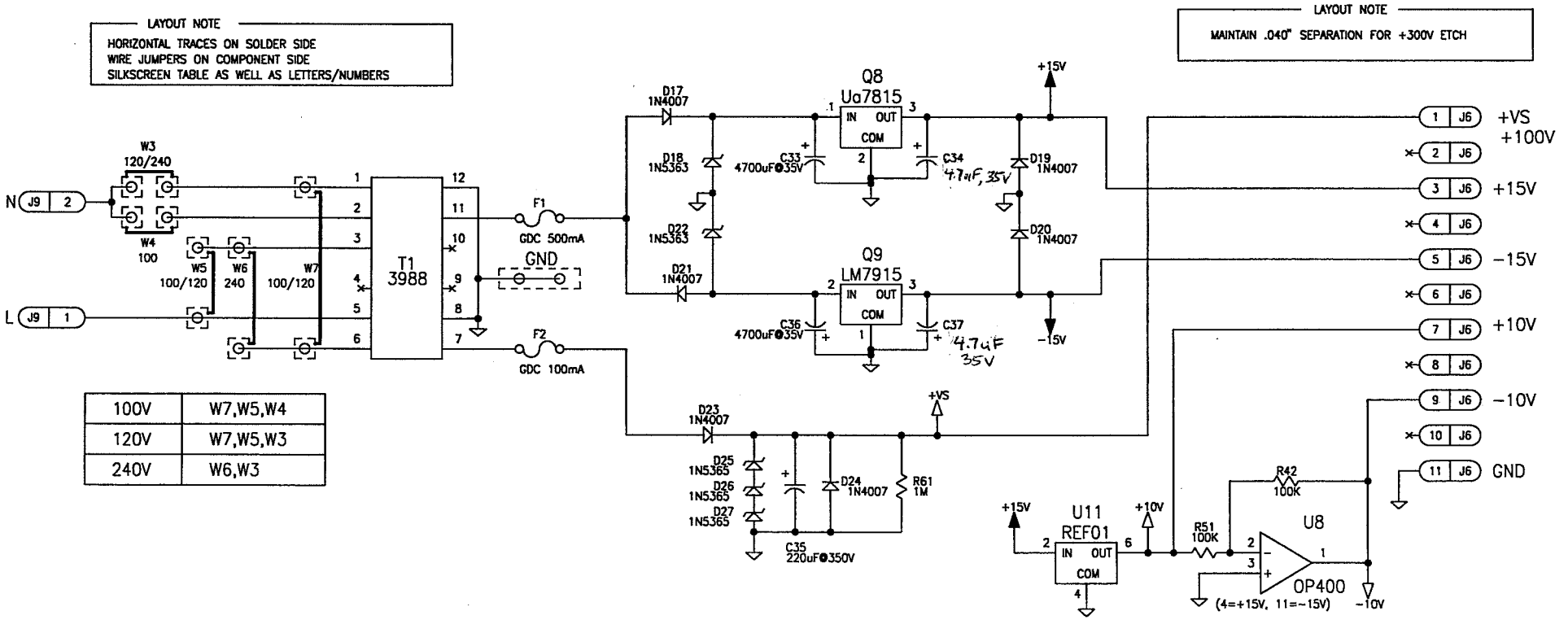
LEED/AES SCHEMATICS / Table of Contents



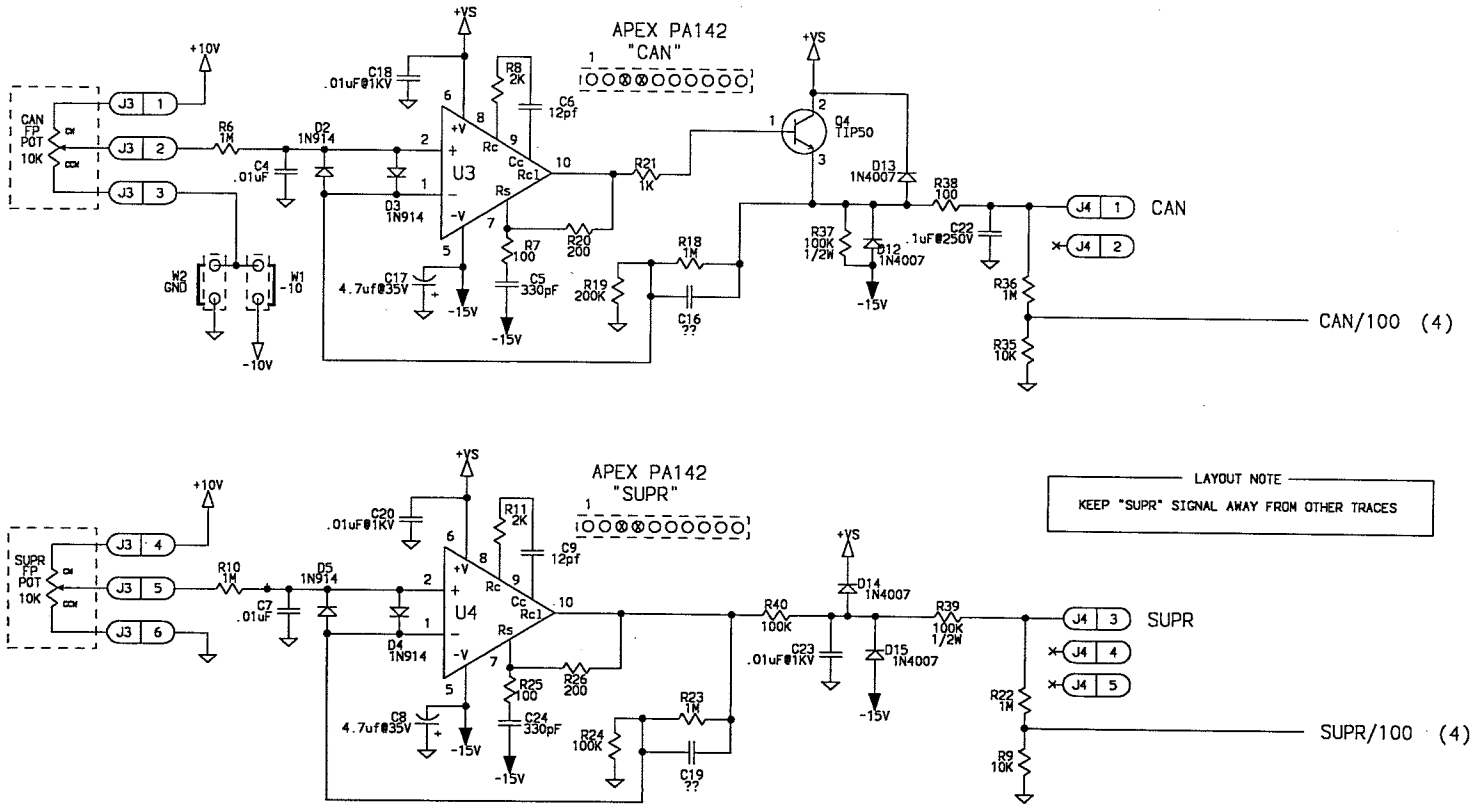
100V	W7,W5,W4
120V	W7,W5,W3
240V	W6,W3

ALL RESISTORS 1/4W MF UNLESS NOTED.
ALL CAPACITORS ARE 50V UNLESS NOTED.

6/1/06 Change C34, C37 to 4.7uF@35V (LD-18)

FILE: LEEDREVA.SCH	LK TECHNOLOGIES
DATE: 8/29/01	3910 W. Roll Ave.
DRAWN BY: CD	Bloomington, IN 47403
APPR BY:	
SHEET: 01 OF 04	LEED Filament Car A

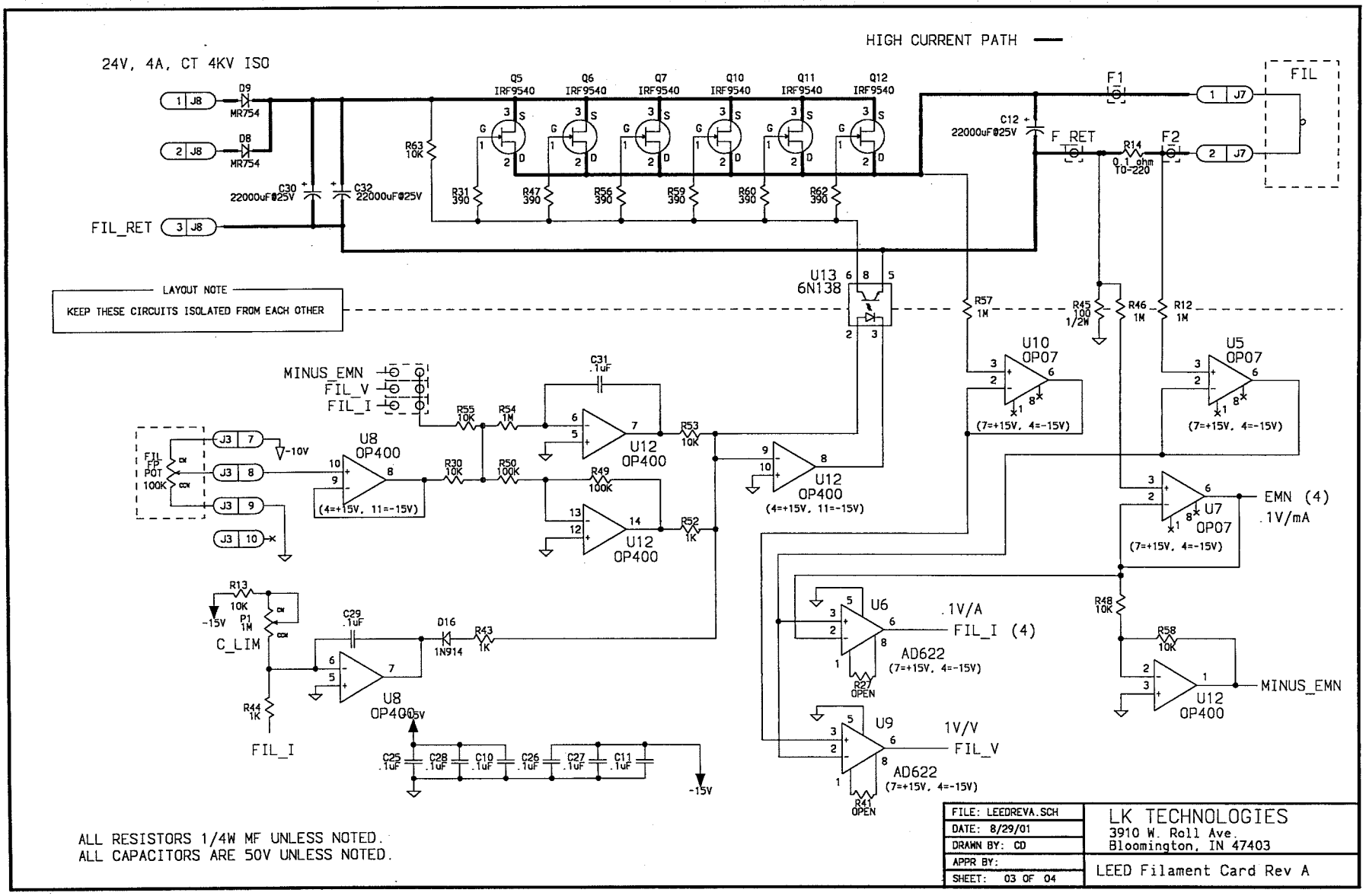
For PA241: omit R7, C5; R25, C24
R20, R26 = 47.5Ω
R8, R11 = 0Ω

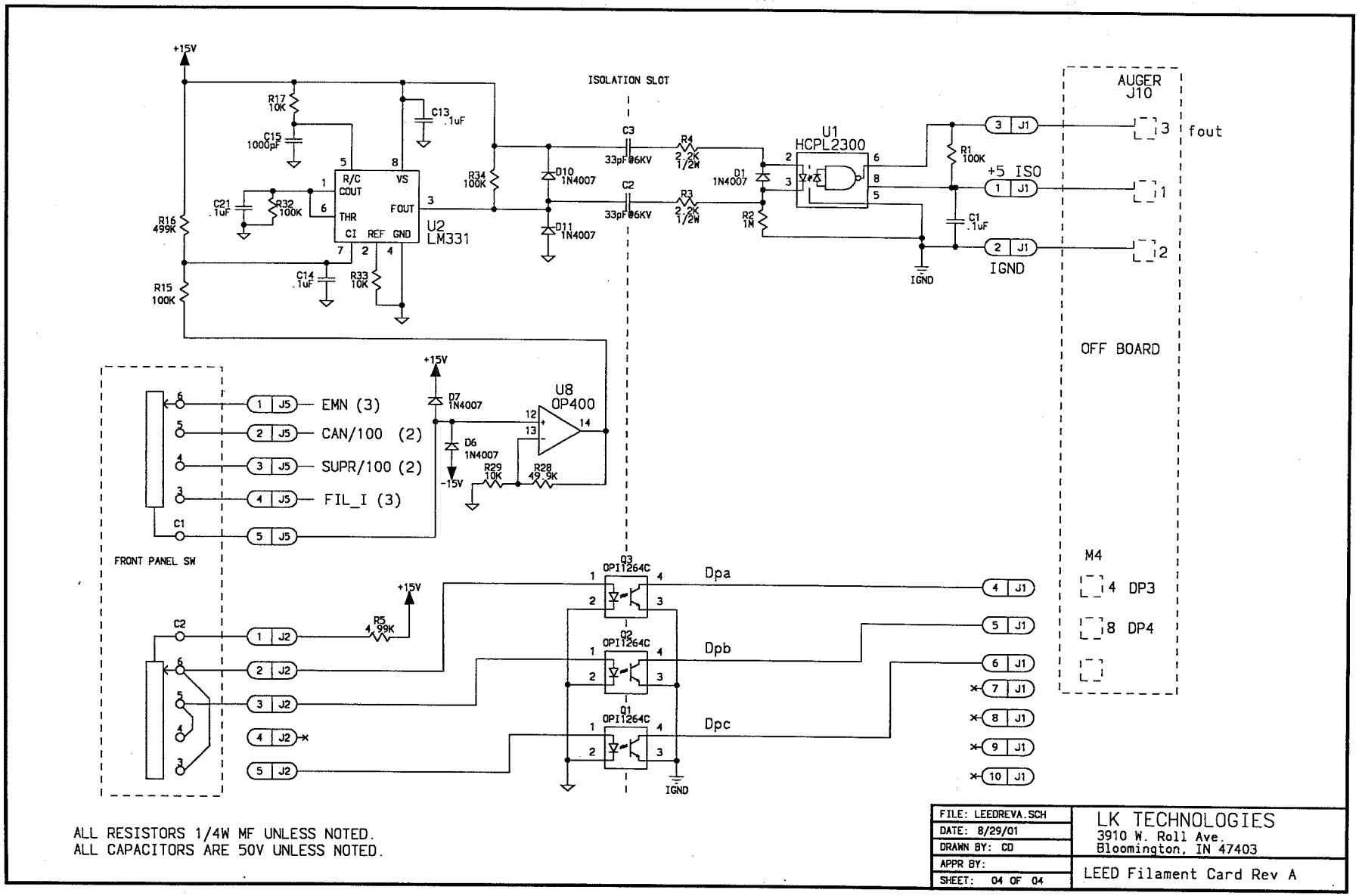


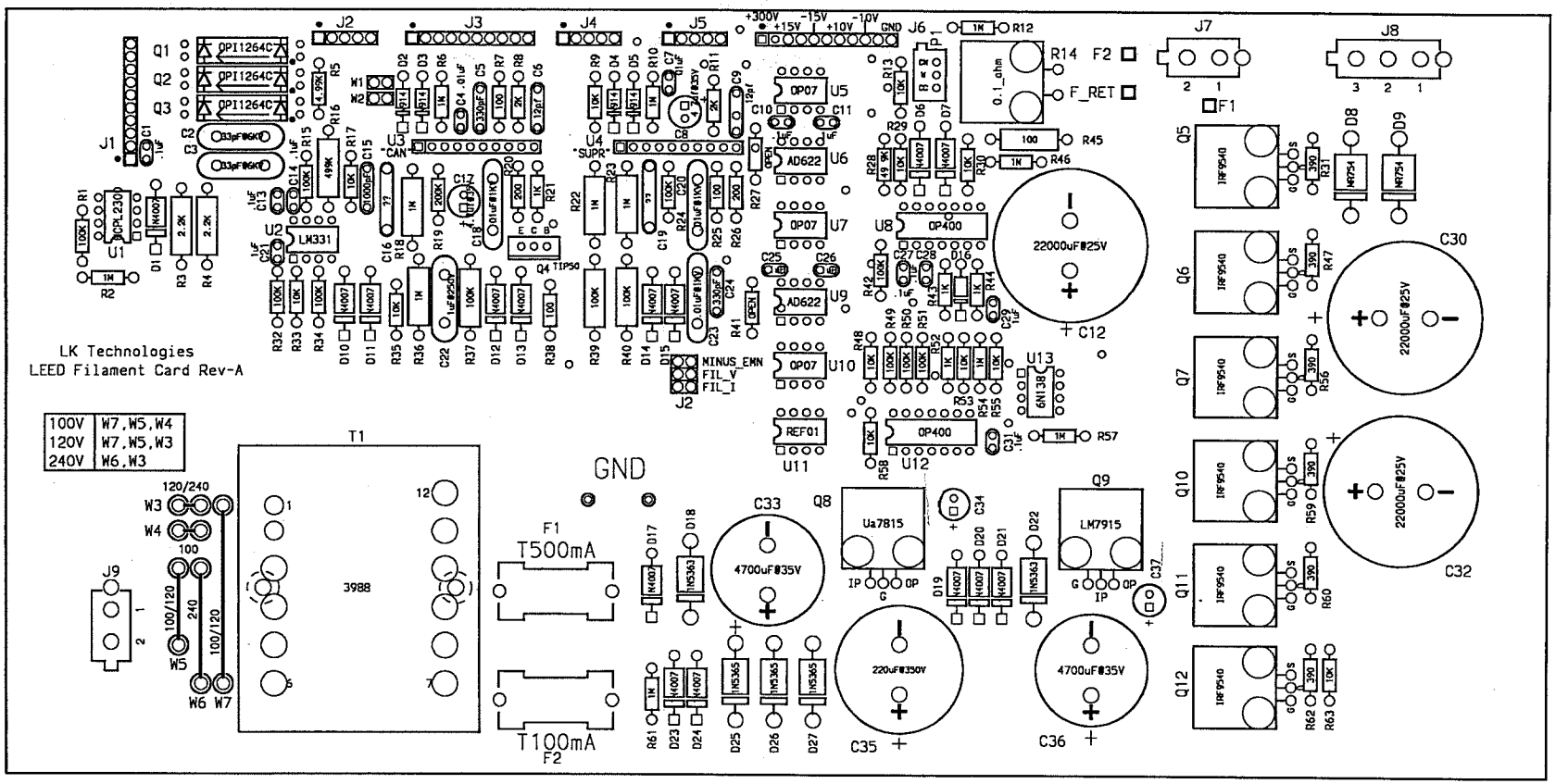
LAYOUT NOTE
KEEP "SUPR" SIGNAL AWAY FROM OTHER TRACES

ALL RESISTORS 1/4W MF UNLESS NOTED.
ALL CAPACITORS ARE 50V UNLESS NOTED.

FILE: LEEDREVA.SCH	LK TECHNOLOGIES
DATE: 8/29/01	3910 W. Roll Ave.
DRAWN BY: CD	Bloomington, IN 47403
APPR BY:	LEED Filament Card Rev A
SHEET: 02 OF 04	

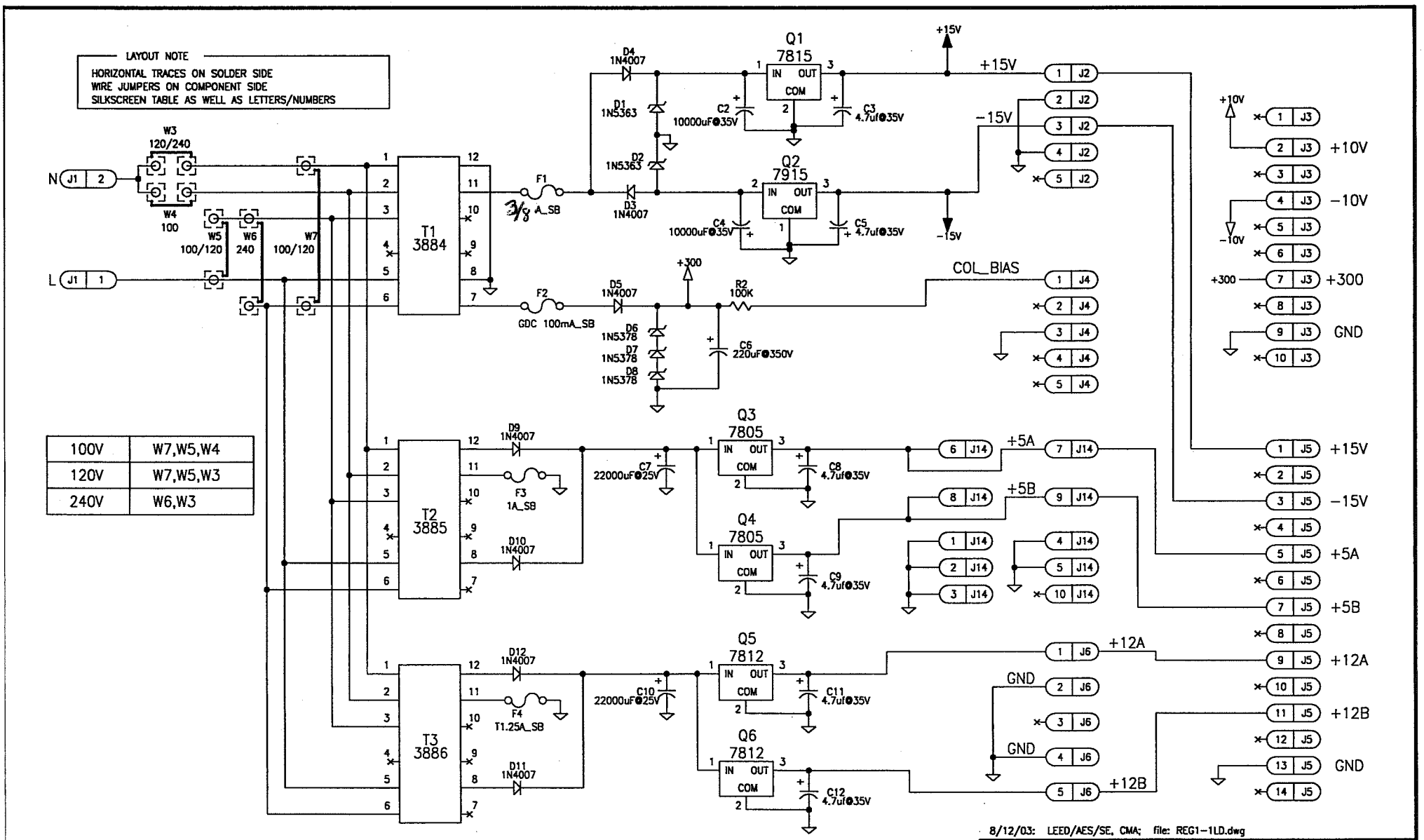

HIGH CURRENT PATH
24V, 4A, CT 4KV ISO
D9 MR754
D8 MR754
C30 22000uF@25V
C32 22000uF@25V
FIL_RET
Q5 IRF9540
Q6 IRF9540
Q7 IRF9540
Q10 IRF9540
Q11 IRF9540
Q12 IRF9540
R63 10K
R31 390
R47 390
R56 390
R59 390
R60 390
R62 390
C12 22000uF@25V
F1
F_RET
R14 0.1 ohm TO-220
F2
FIL
LAYOUT NOTE
KEEP THESE CIRCUITS ISOLATED FROM EACH OTHER
U13 6N138
R57 1M
R45 100 1/2W
R46 1M
R12 1M
U10 OP07
(7=+15V, 4=-15V)
U5 OP07
(7=+15V, 4=-15V)
MINUS_EMN
FIL_V
FIL_I
C31 .1uF
R55 10K
R54 1M
R53 10K
FIL POT 100K
-10V
U8 OP400
(4=+15V, 11=-15V)
R30 10K
R50 100K
R49 100K
R52 1K
U12 OP400
(4=+15V, 11=-15V)
U12 OP400
U7 OP07
(7=+15V, 4=-15V)
EMN (4)
.1V/mA
R13 10K
P1 1M
C_LIM
-15V
C29 .1uF
D16 1N914
R43 1K
R44 1K
FIL_I
U8 OP400
+5V
-15V
C25 .1uF
C28 .1uF
C10 .1uF
C26 .1uF
C27 .1uF
C11 .1uF
U6 AD622
(7=+15V, 4=-15V)
.1V/A
FIL_I (4)
R27 OPEN
U9 AD622
(7=+15V, 4=-15V)
1V/V
FIL_V
R41 OPEN
R48 10K
R58 10K
U12 OP400
MINUS_EMN
ALL RESISTORS 1/4W MF UNLESS NOTED.
ALL CAPACITORS ARE 50V UNLESS NOTED.
FILE: LEEDREVA.SCH
DATE: 8/29/01
DRAWN BY: CD
APPR BY:
SHEET: 03 OF 04
LK TECHNOLOGIES
3910 W. Roll Ave.
Bloomington, IN 47403
LEED Filament Card Rev A


+15V
ISOLATION SLOT
AUGER
J10
OFF BOARD
U2
LM331
U1
HCPL2300
U8
OP400
+5 ISO
IGND
fout
EMN (3)
CAN/100 (2)
SUPR/100 (2)
FIL_I (3)
FRONT PANEL SW
Dpa
Dpb
Dpc
M4
4 DP3
8 DP4
ALL RESISTORS 1/4W MF UNLESS NOTED.
ALL CAPACITORS ARE 50V UNLESS NOTED.
FILE: LEEDREVA.SCH
DATE: 8/29/01
DRAWN BY: CD
APPR BY:
SHEET: 04 OF 04
LK TECHNOLOGIES
3910 W. Roll Ave.
Bloomington, IN 47403
LEED Filament Card Rev A

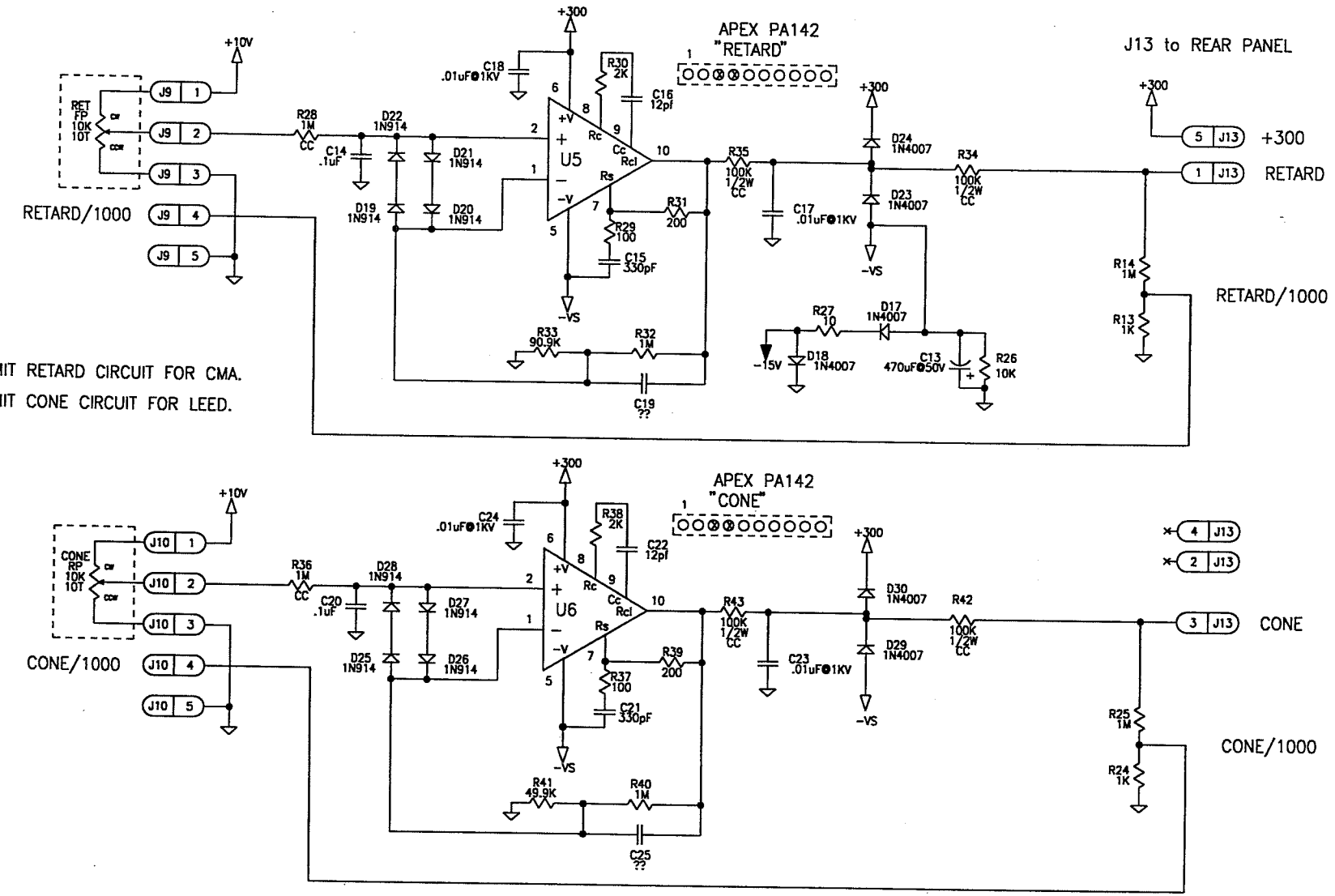


SILKSCREEN

LEED Filament Card Rev A - Assembly			LK TECHNOLOGIES 3910 W. Roll Ave. Bloomington, IN 47403
TOLERANCES 3 PLACE DECIMALS +/- .010 2 PLACE DECIMALS +/-	DRN BY: CD	DATE: 29 AUG 01	
	SCALE: NA	SHEET 1 OF 1	FILE NAME: LEEDREVA.PCB

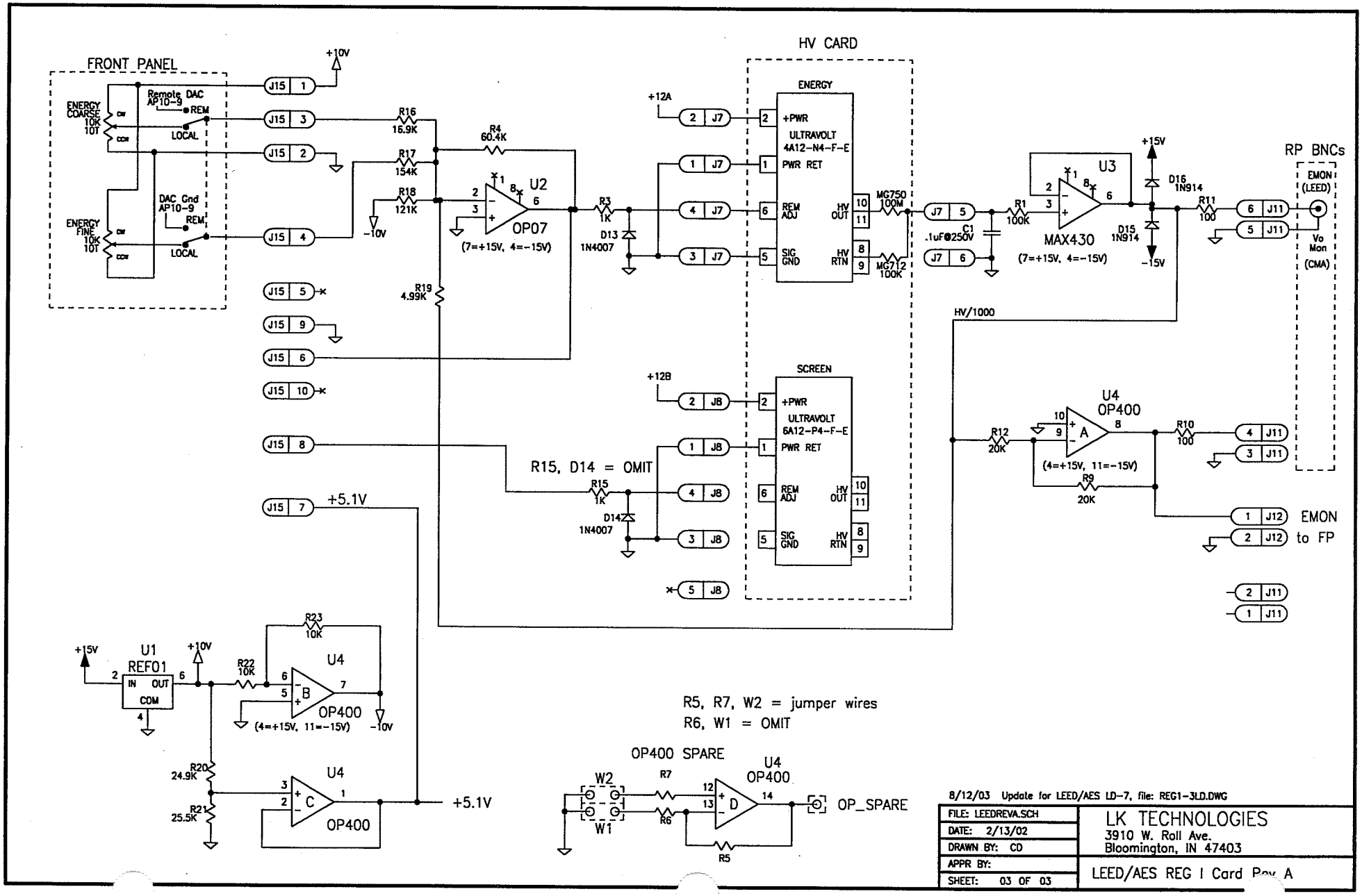

LAYOUT NOTE
HORIZONTAL TRACES ON SOLDER SIDE
WIRE JUMPERS ON COMPONENT SIDE
SILKSCREEN TABLE AS WELL AS LETTERS/NUMBERS
W3 120/240
W4 100
W5 100/120
W6 240
W7 100/120
N J1 2
L J1 1
T1 3884
T2 3885
T3 3886
F1 3/8 A_SB
F2 GDC 100mA_SB
F3 1A_SB
F4 T1.25A_SB
D1 1N5363
D2 1N5363
D3 1N4007
D4 1N4007
D5 1N4007
D6 1N5378
D7 1N5378
D8 1N5378
D9 1N4007
D10 1N4007
D11 1N4007
D12 1N4007
Q1 7815
Q2 7915
Q3 7805
Q4 7805
Q5 7812
Q6 7812
C2 10000uF@35V
C3 4.7uf@35V
C4 10000uF@35V
C5 4.7uf@35V
C6 220uF@350V
C7 22000uF@25V
C8 4.7uf@35V
C9 4.7uf@35V
C10 22000uF@25V
C11 4.7uf@35V
C12 4.7uf@35V
R2 100K
+15V
-15V
+300
COL_BIAS
+5A
+5B
+12A
+12B
GND
+10V
-10V
100V W7,W5,W4
120V W7,W5,W3
240V W6,W3
ALL RESISTORS 1/4W MF UNLESS NOTED.
ALL CAPACITORS ARE 50V UNLESS NOTED.
8/12/03: LEED/AES/SE, CMA; file: REG1-1LD.dwg
FILE: LEEDREVA.SCH
DATE: 2/13/02
DRAWN BY: CD
APPR BY:
SHEET: 01 OF 03
LK TECHNOLOGIES
3910 W. Roll Ave.
Bloomington, IN 47403
LEED REG I Card F

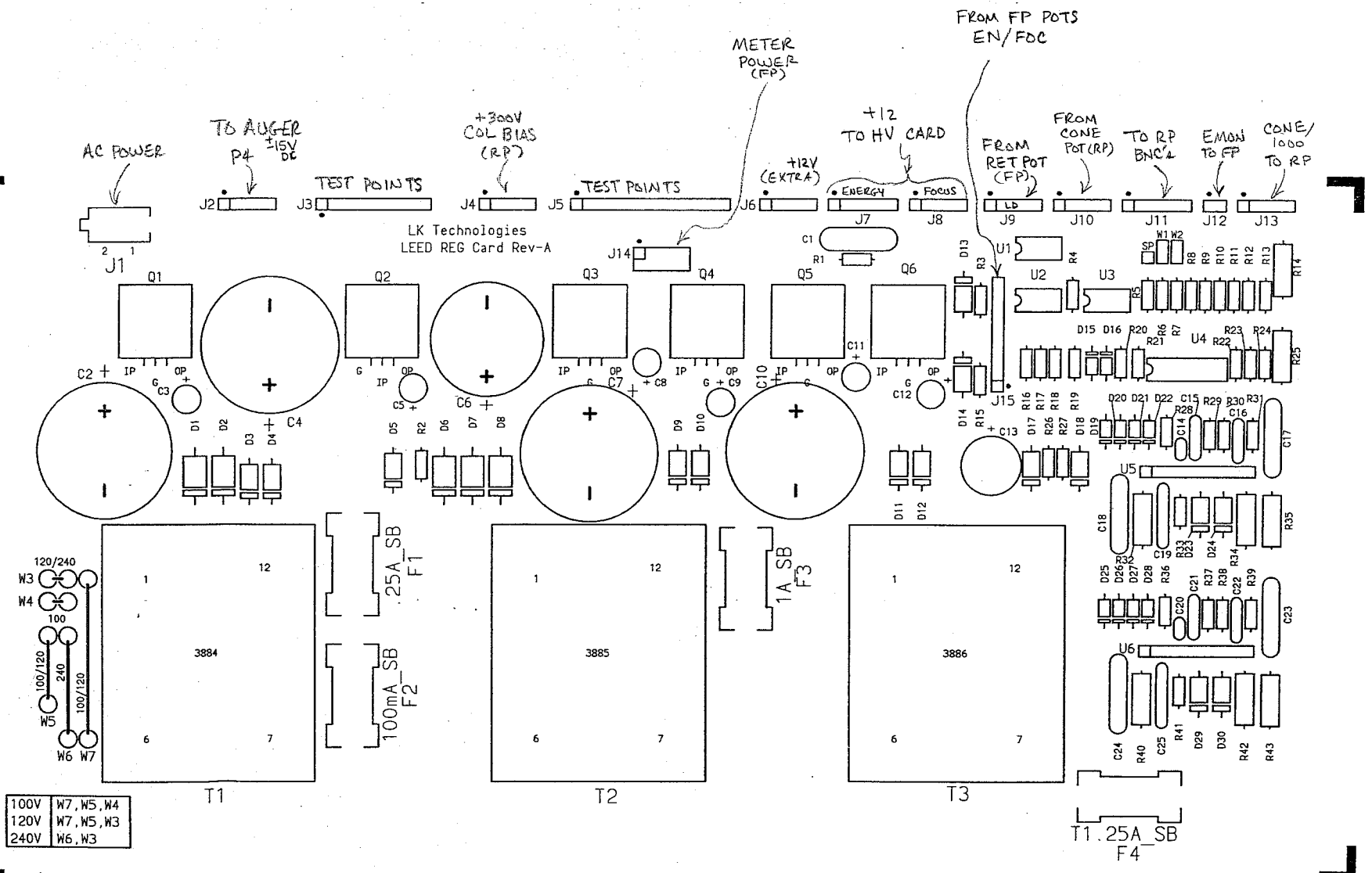
For PA241: omit R29, C15; R37, C21
R30, R38 = 0Ω
R31, R39 = 47.5Ω

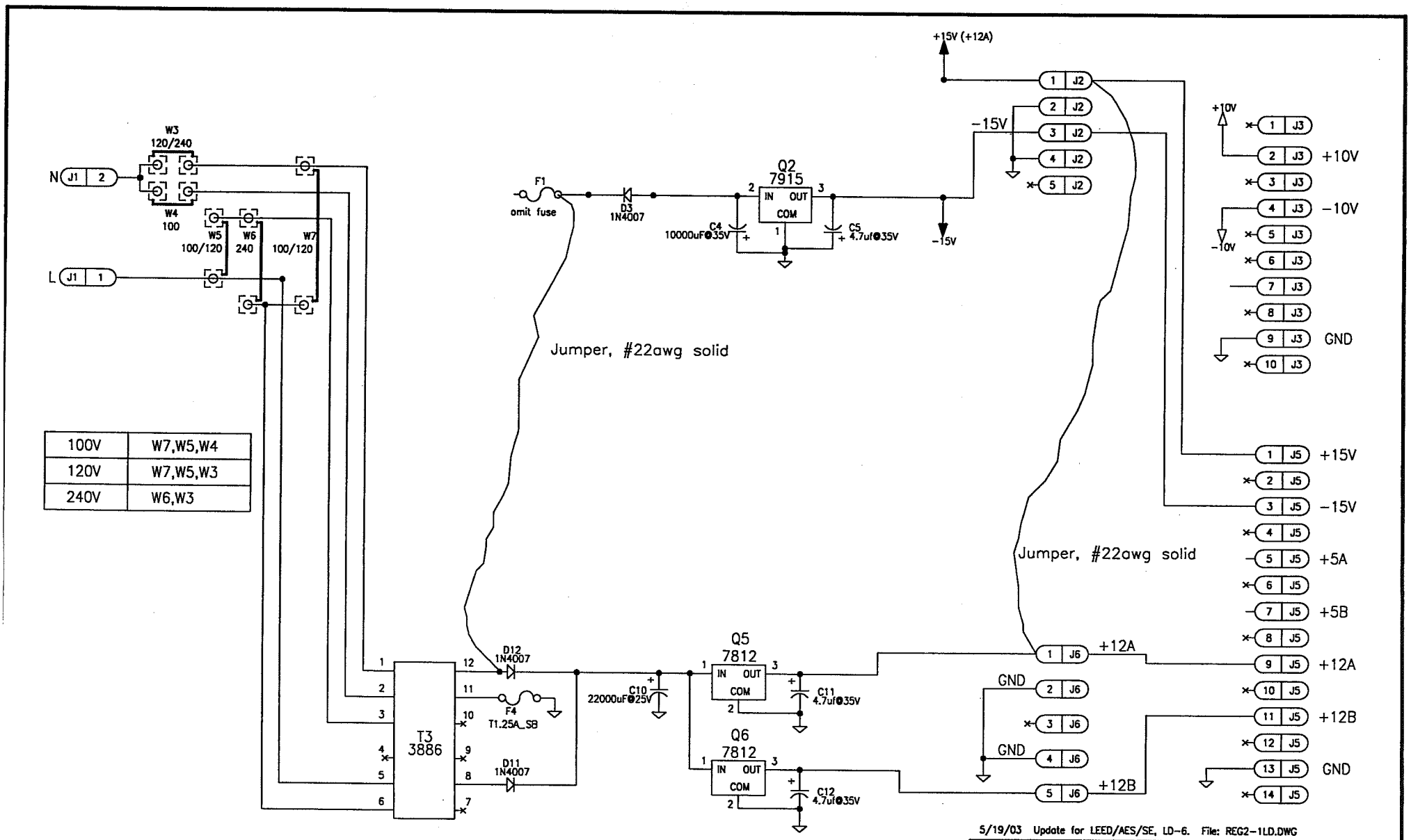


8/12/03: LEED/AES/SE, CMA; file: REG1-2LD.DWG

FILE: LEEDREVA.SCH	LK TECHNOLOGIES
DATE: 2/13/02	3910 W. Roll Ave.
DRAWN BY: CD	Bloomington, IN 47403
APPR BY:	
SHEET: 02 OF 03	LEED REG I Card Rev A


FRONT PANEL
ENERGY COARSE 10K 10T
Remote DAC AP10-9
REM
LOCAL
ENERGY FINE 10K 10T
DAC Gnd AP10-9
+10V
-10V
J15 1
J15 3
J15 2
J15 4
J15 5
J15 9
J15 6
J15 10
J15 8
J15 7
R16 16.9K
R17 154K
R18 121K
R19 4.99K
R4 60.4K
U2
OP07
(7=+15V, 4=-15V)
R3 1K
D13 1N4007
HV CARD
ENERGY
+12A
+PWR
ULTRAVOLT 4A12-N4-F-E
PWR RET
REM ADJ
SIG GND
HV OUT
HV RTN
MG750 100M
MG712 100K
J7 5
J7 6
C1 .1uF@250V
R1 100K
U3
MAX430
(7=+15V, 4=-15V)
+15V
-15V
D16 1N914
D15 1N914
R11 100
RP BNCs
EMON (LEED)
Vo Mon (CMA)
J11 6
J11 5
HV/1000
SCREEN
+12B
ULTRAVOLT 6A12-P4-F-E
R15, D14 = OMIT
R15 1K
D14 1N4007
J8 2
J8 1
J8 4
J8 3
J8 5
U4 OP400
R12 20K
R10 100
R9 20K
(4=+15V, 11=-15V)
J11 4
J11 3
J12 1
J12 2
EMON to FP
J11 2
J11 1
U1 REF01
IN OUT COM
R22 10K
R23 10K
U4 OP400
(4=+15V, 11=-15V)
R20 24.9K
R21 25.5K
+5.1V
R5, R7, W2 = jumper wires
R6, W1 = OMIT
OP400 SPARE
W2
W1
R7
R6
R5
OP_SPARE
8/12/03 Update for LEED/AES LD-7, file: REG1-3LD.DWG
FILE: LEEDREVA.SCH
DATE: 2/13/02
DRAWN BY: CD
APPR BY:
SHEET: 03 OF 03
LK TECHNOLOGIES
3910 W. Roll Ave.
Bloomington, IN 47403
LEED/AES REG I Card Rev A


AC POWER
J1
TO AUGER P4 ±15V DC
J2
TEST POINTS
J3
+300V COL BIAS (RP)
J4
J5
TEST POINTS
METER POWER (FP)
J14
+12V (EXTRA)
J6
+12 TO HV CARD
ENERGY
FOCUS
J7
J8
FROM FP POTS EN/FOC
FROM RET POT (FP)
LD
J9
FROM CONE POT (RP)
J10
TO RP BNC's
J11
EMON TO FP
J12
CONE/1000 TO RP
J13
LK Technologies
LEED REG Card Rev-A
Q1
Q2
Q3
Q4
Q5
Q6
U1
U2
U3
U4
U5
U6
J15
IP
OP
G
120/240
W3
W4
100
100/120
240
100/120
W5
W6
W7
3884
3885
3886
1
12
6
7
.25A_SB F1
100mA_SB F2
1A_SB F3
T1.25A_SB F4
T1
T2
T3
100V W7,W5,W4
120V W7,W5,W3
240V W6,W3
LK TECHNOLOGIES
LEED REG Card Rev-A
SILKSCREEN
12.000"
1/20/02
JAN 28 2002

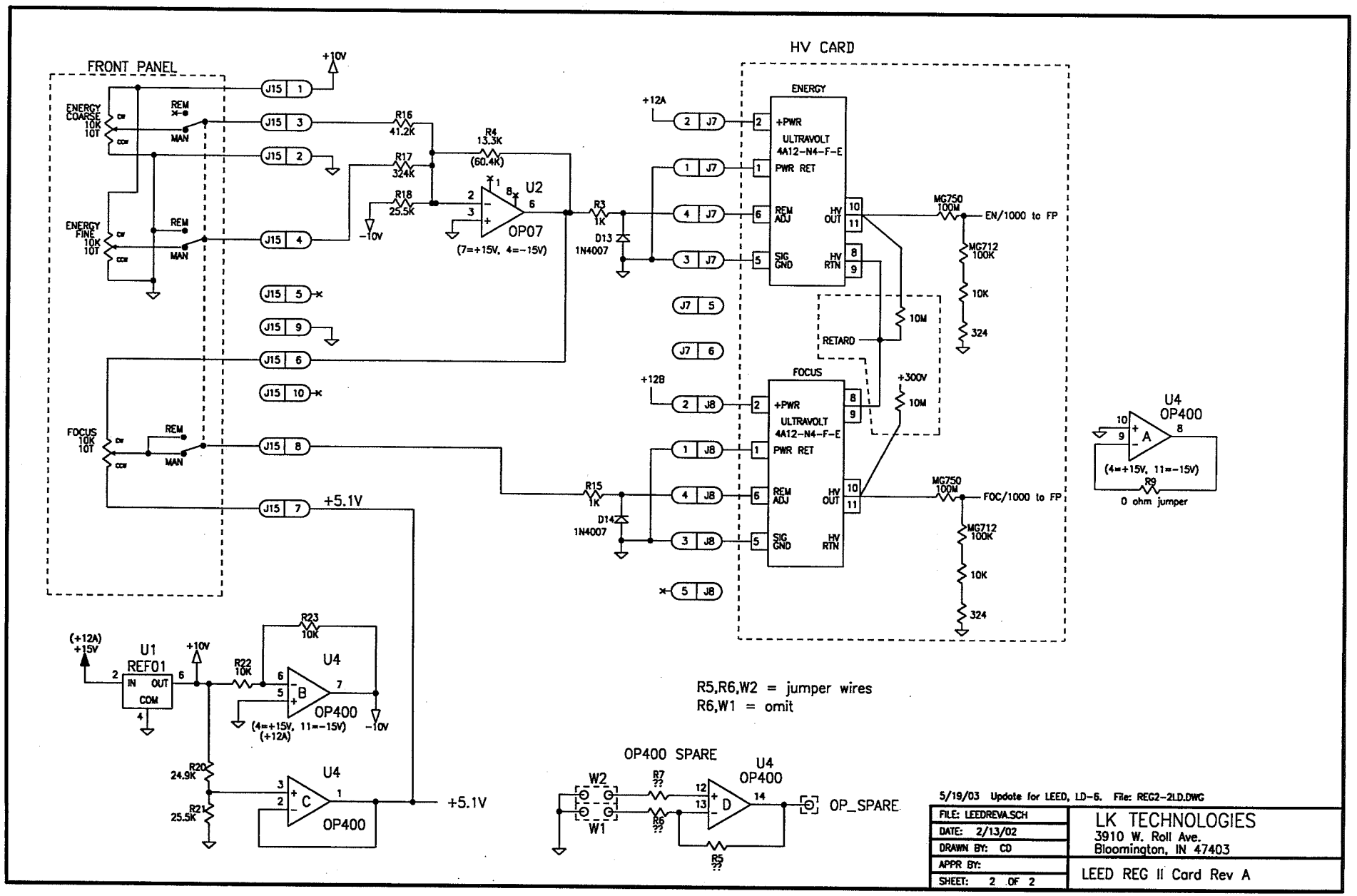


100V	W7,W5,W4
120V	W7,W5,W3
240V	W6,W3

ALL RESISTORS 1/4W MF UNLESS NOTED.
ALL CAPACITORS ARE 50V UNLESS NOTED.

5/19/03 Update for LEED/AES/SE, LD-6. File: REG2-1LD.DWG

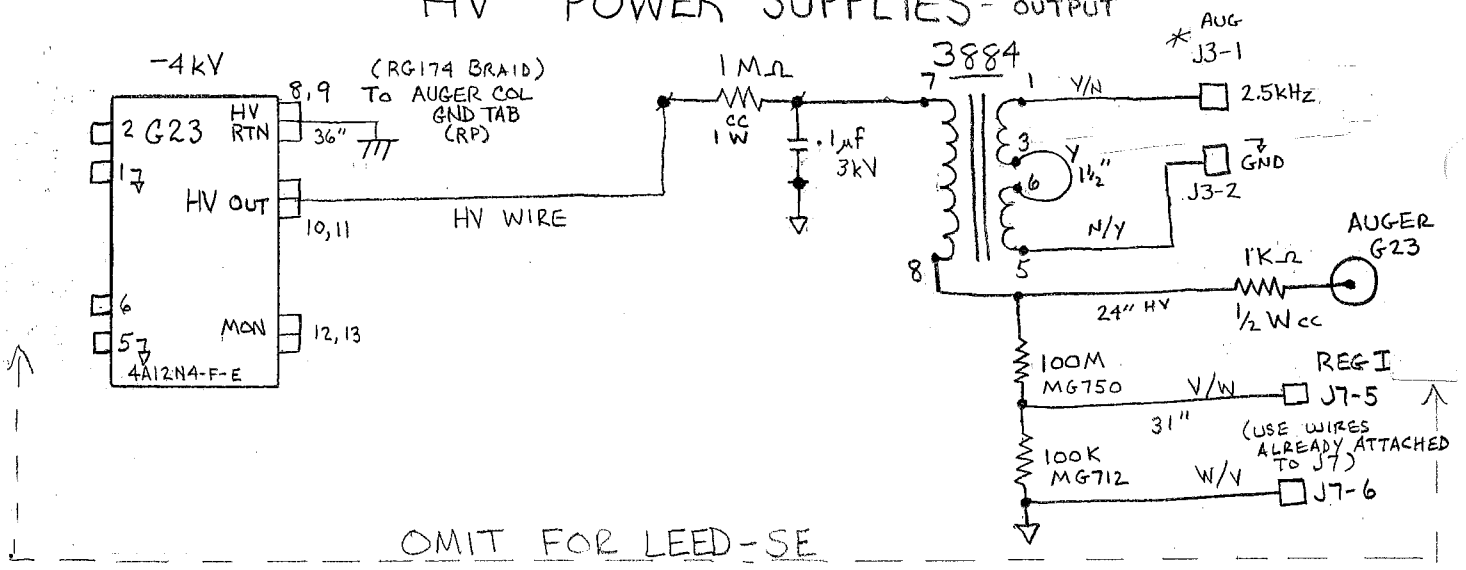
FILE: LEEDREVA.SCH	LK TECHNOLOGIES
DATE: 2/13/02	3910 W. Roll Ave.
DRAWN BY: CD	Bloomington, IN 47403
APPR BY:	
SHEET: 1 OF 2	LEED REG II Card



5/19/03 Update for LEED, LD-6. File: REG2-2LD.DWG

FILE: LEEDREVA.SCH	LK TECHNOLOGIES
DATE: 2/13/02	3910 W. Roll Ave.
DRAWN BY: CD	Bloomington, IN 47403
APPR BY:	
SHEET: 2 OF 2	LEED REG II Card Rev A

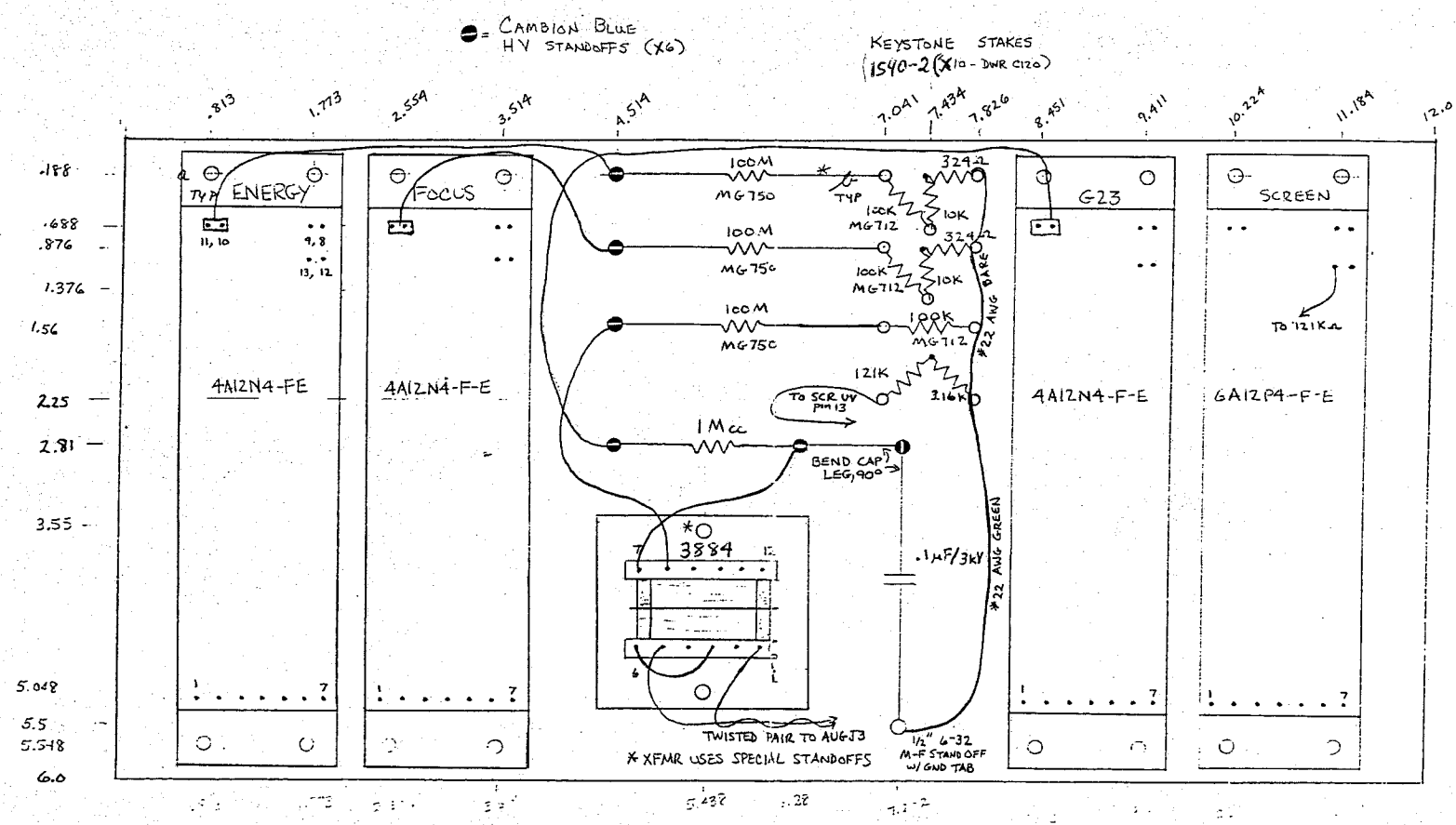
HV POWER SUPPLIES - OUTPUT



LEED
ULTRAVOLT
OUTPUT CONNECTIONS

12-12-00
UPDATED 6-28-01

1/2

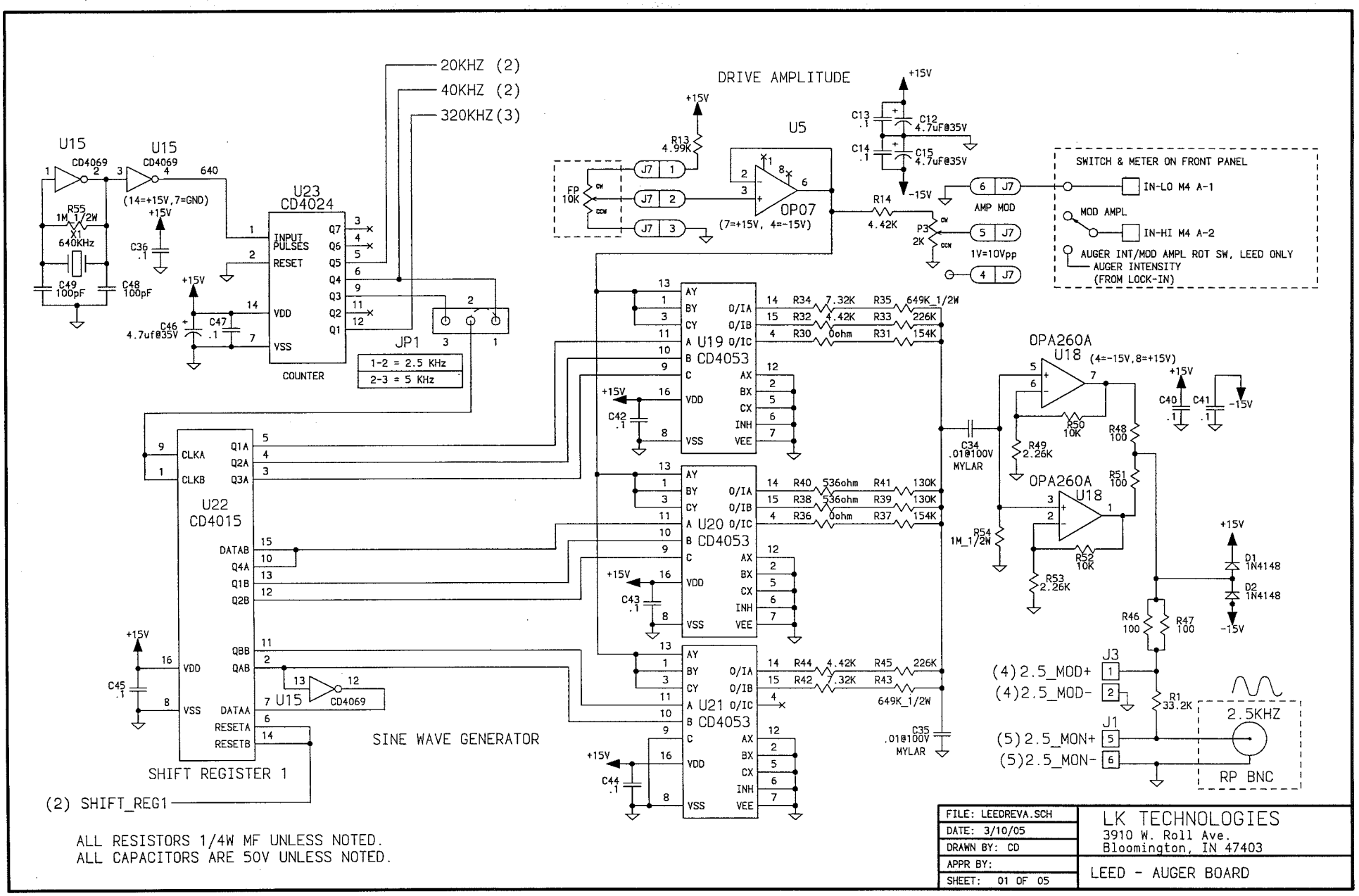


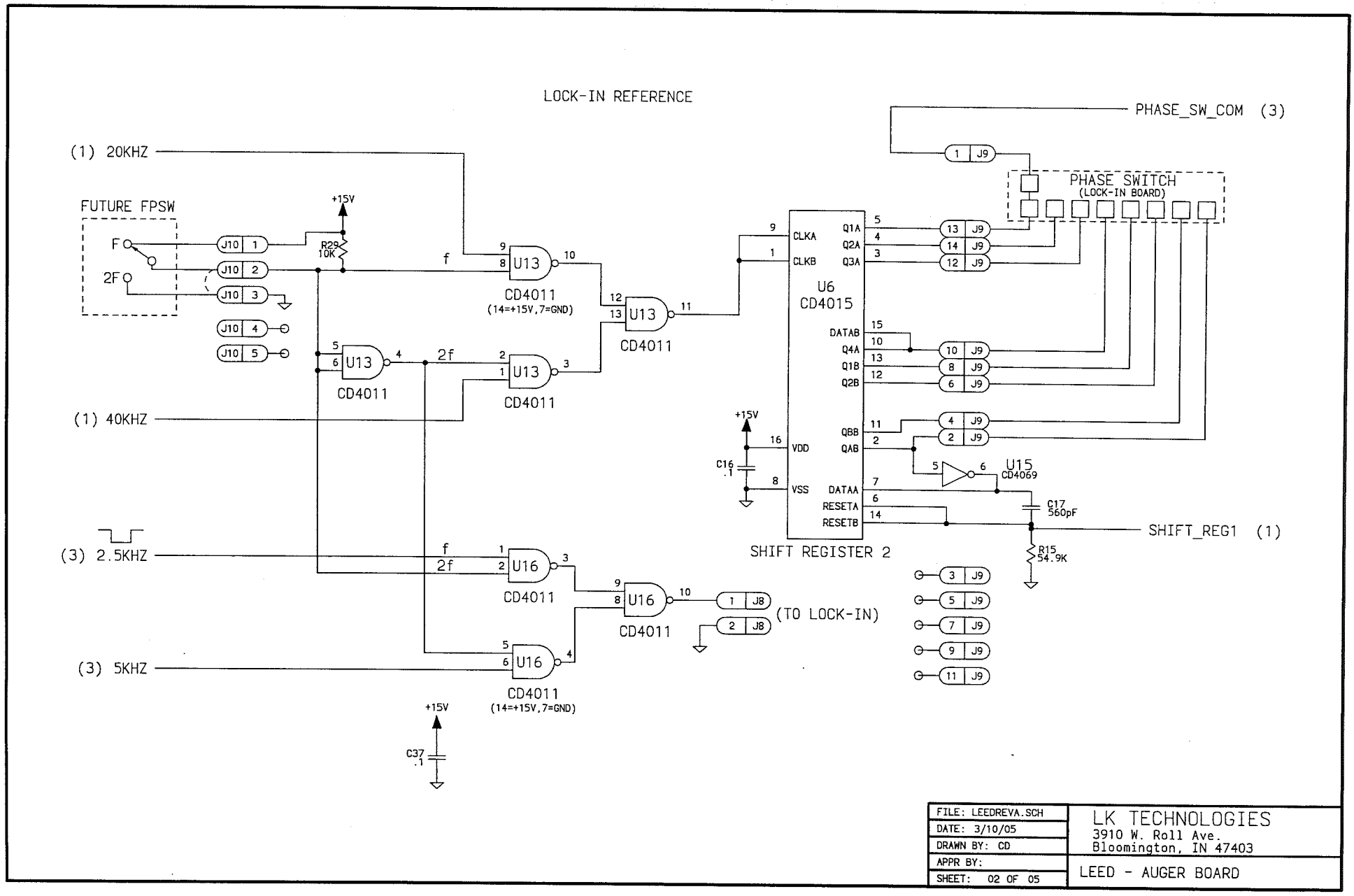
HOLE SIZES:
ALL HOLES = #26 UNLESS OTHERWISE NOTED
⊥ = #41 (10 PLCS.)

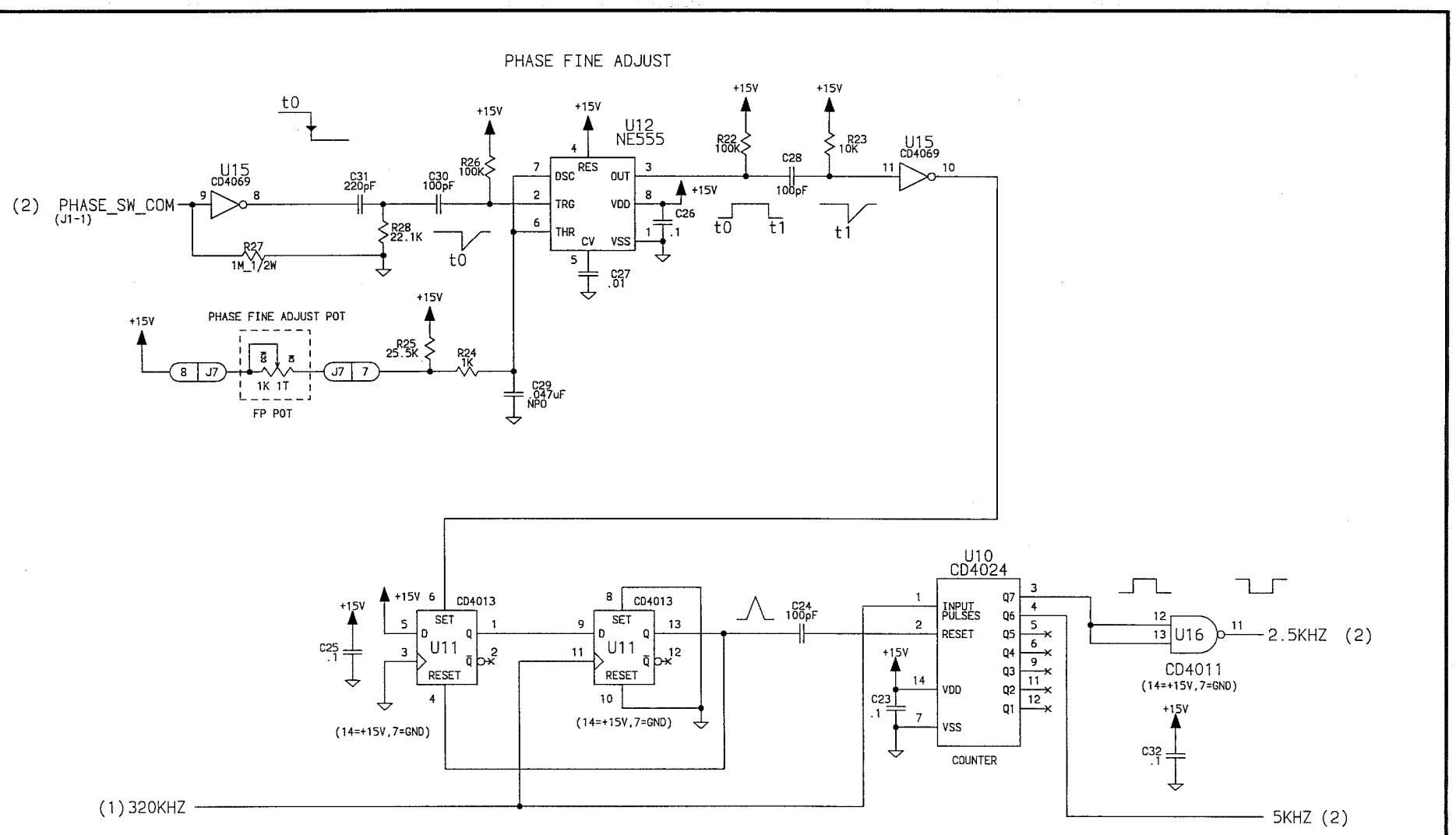
NOTE: HOLES [illegible]

LEED HV BOARD
MATL: 6X12 G-10 (1/16" THICKNESS)
QTY: 1 PER UNIT
6-29-99 RAW
2-13-02 CMA-2, LD-6
8-14-03 LD-9, CMA-4

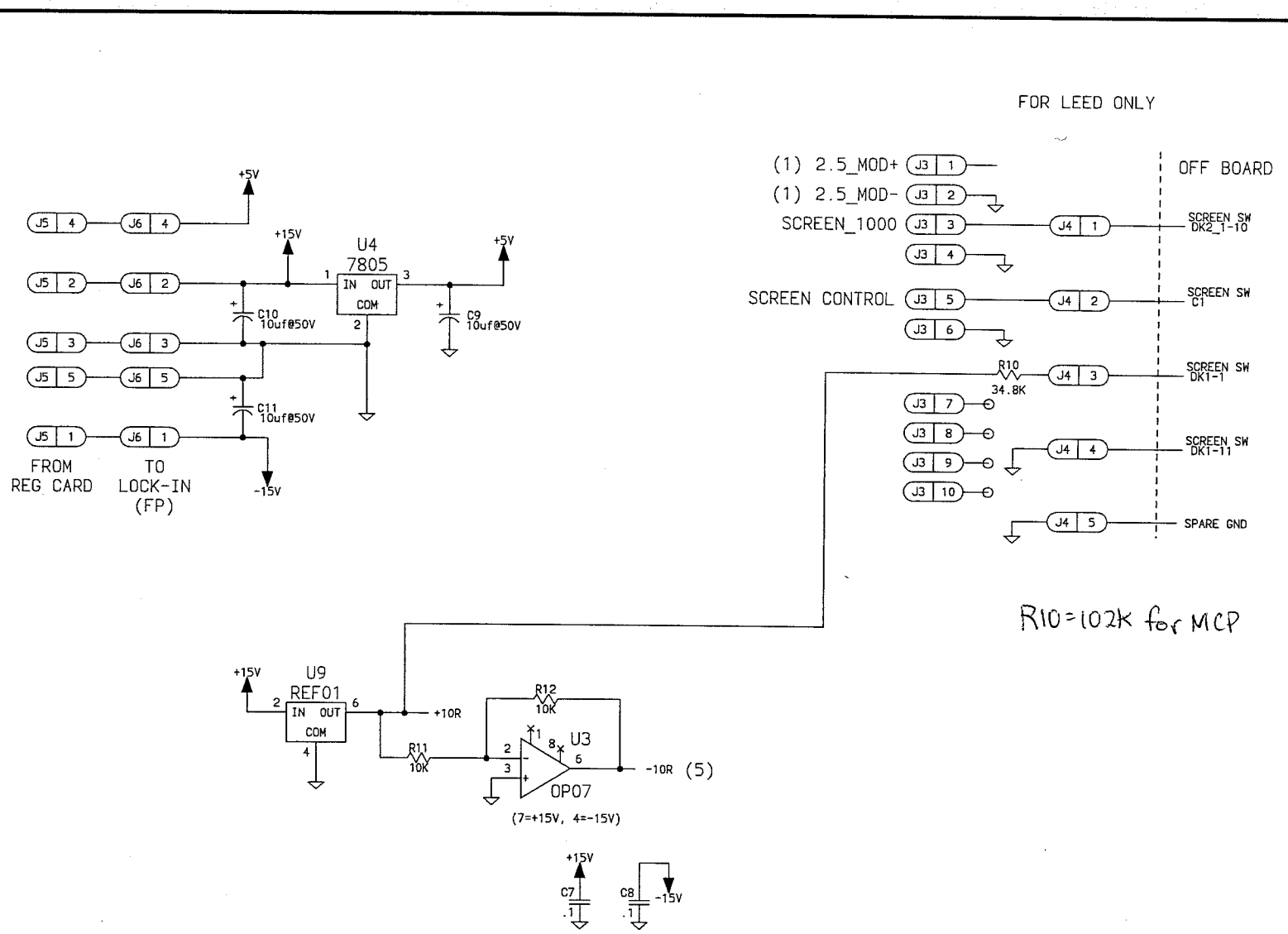
CONSTRUCTION ORG


20KHZ (2)
40KHZ (2)
320KHZ(3)
DRIVE AMPLITUDE
U15
CD4069
(14=+15V,7=GND)
640
R55
1M 1/2W
X1
640KHz
C49
100pF
C48
100pF
C36
.1
U23
CD4024
INPUT PULSES
RESET
VDD
VSS
Q7
Q6
Q5
Q4
Q3
Q2
Q1
COUNTER
C46
4.7uf@35V
C47
.1
JP1
1-2 = 2.5 KHz
2-3 = 5 KHz
U5
OP07
(7=+15V, 4=-15V)
R13
4.99K
FP
10K
R14
4.42K
P3
2K
1V=10Vpp
AMP MOD
C13
.1
C12
4.7uF@35V
C14
.1
C15
4.7uF@35V
SWITCH & METER ON FRONT PANEL
IN-LO M4 A-1
MOD AMPL
IN-HI M4 A-2
AUGER INT/MOD AMPL ROT SW, LEED ONLY
AUGER INTENSITY
(FROM LOCK-IN)
U19 CD4053
U20 CD4053
U21 CD4053
R34
7.32K
R35
649K_1/2W
R32
4.42K
R33
226K
R30
0ohm
R31
154K
R40
536ohm
R41
130K
R38
536ohm
R39
130K
R36
0ohm
R37
154K
R44
4.42K
R45
226K
R42
.32K
R43
649K_1/2W
C42
.1
C43
.1
C44
.1
C34
.01@100V
MYLAR
C35
.01@100V
MYLAR
OPA260A
U18
(4=-15V,8=+15V)
R50
10K
R48
100
R49
2.26K
R51
100
R54
1M_1/2W
R52
10K
R53
2.26K
C40
.1
C41
.1
D1
1N4148
D2
1N4148
R46
100
R47
100
J3
(4)2.5_MOD+
(4)2.5_MOD-
J1
(5)2.5_MON+
(5)2.5_MON-
R1
33.2K
2.5KHZ
RP BNC
U22
CD4015
CLKA
CLKB
Q1A
Q2A
Q3A
DATAB
Q4A
Q1B
Q2B
QBB
QAB
DATAA
RESETA
RESETB
U15
CD4069
C45
.1
SHIFT REGISTER 1
(2) SHIFT_REG1
SINE WAVE GENERATOR
ALL RESISTORS 1/4W MF UNLESS NOTED.
ALL CAPACITORS ARE 50V UNLESS NOTED.
FILE: LEEDREVA.SCH
DATE: 3/10/05
DRAWN BY: CD
APPR BY:
SHEET: 01 OF 05
LK TECHNOLOGIES
3910 W. Roll Ave.
Bloomington, IN 47403
LEED - AUGER BOARD

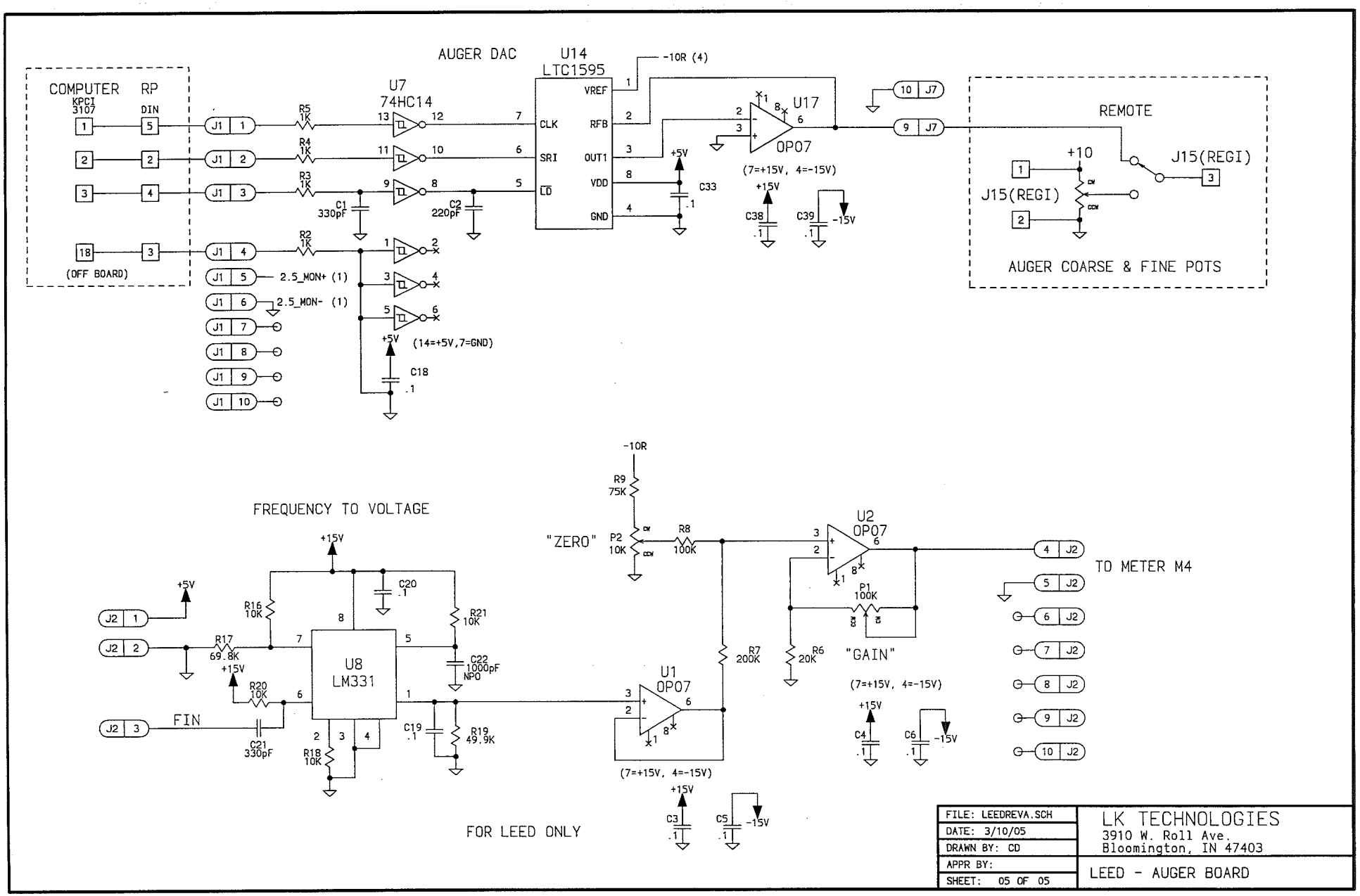

LOCK-IN REFERENCE
(1) 20KHZ
(1) 40KHZ
(3) 2.5KHZ
(3) 5KHZ
FUTURE FPSW
F
2F
J10 1
J10 2
J10 3
J10 4
J10 5
+15V
R29
10K
f
2f
U13
CD4011
(14=+15V,7=GND)
U16
U6
CD4015
CLKA
CLKB
Q1A
Q2A
Q3A
DATAB
Q4A
Q1B
Q2B
QBB
QAB
VDD
VSS
DATAA
RESETA
RESETB
SHIFT REGISTER 2
C16
.1
U15
CD4069
C17
560pF
R15
54.9K
SHIFT_REG1 (1)
PHASE_SW_COM (3)
PHASE SWITCH
(LOCK-IN BOARD)
J9
J8
(TO LOCK-IN)
C37
.1
FILE: LEEDREVA.SCH
DATE: 3/10/05
DRAWN BY: CD
APPR BY:
SHEET: 02 OF 05
LK TECHNOLOGIES
3910 W. Roll Ave.
Bloomington, IN 47403
LEED - AUGER BOARD



FILE: LEEDREVA.SCH	LK TECHNOLOGIES 3910 W. Roll Ave. Bloomington, IN 47403
DATE: 3/10/05	
DRAWN BY: CD	
APPR BY:	
SHEET: 03 OF 05	LEED - AUGER BOARD



FILE: LEEDREVA.SCH	LK TECHNOLOGIES 3910 W. Roll Ave. Bloomington, IN 47403
DATE: 3/10/05	
DRAWN BY: CD	
APPR BY:	
SHEET: 04 OF 05	LEED - AUGER BOARD


AUGER DAC
U14
LTC1595
-10R (4)
COMPUTER
KPCI
3107
RP
DIN
U7
74HC14
R5 1K
R4 1K
R3 1K
R2 1K
C1 330pF
C2 220pF
VREF
CLK
RFB
SRI
OUT1
LD
VDD
GND
C33 .1
U17
OP07
(7=+15V, 4=-15V)
C38 .1
C39 .1
-15V
+15V
+5V
10 J7
9 J7
REMOTE
+10
J15(REGI)
J15(REGI)
AUGER COARSE & FINE POTS
(OFF BOARD)
2.5_MON+ (1)
2.5_MON- (1)
(14=+5V,7=GND)
C18 .1
FREQUENCY TO VOLTAGE
"ZERO"
-10R
R9 75K
P2 10K
R8 100K
U2
OP07
P1 100K
"GAIN"
R6 20K
R7 200K
TO METER M4
R16 10K
R17 69.8K
R20 10K
R18 10K
R21 10K
C20 .1
C22 1000pF NPO
C19 .1
R19 49.9K
U8
LM331
FIN
C21 330pF
U1
OP07
(7=+15V, 4=-15V)
C3 .1
C5 .1
C4 .1
C6 .1
FOR LEED ONLY
FILE: LEEDREVA.SCH
DATE: 3/10/05
DRAWN BY: CD
APPR BY:
SHEET: 05 OF 05
LK TECHNOLOGIES
3910 W. Roll Ave.
Bloomington, IN 47403
LEED - AUGER BOARD

AUGER CONNECTOR PIN ASSIGNMENTS 12-26-00

J9
- 1 PHASE SW COM
- 2 PHASE SETTINGS
- 4
- 6
- 8
- 10
- 12
- 13
- 14

J7
- 1 +15 TO FP-POT CW AMP MOD
- 2 POT WIPER
- 3 AMPL MOD CCW ↴ (K/V)
- 4 V/K HEAT SHRINKED TO K/V M4A-2 "IN-HI" (CMA ONLY)
- 5 AMP MOD ROT SW (LEED ONLY) M4A-1 "IN-LO" (CMA ONLY)
- 6 AMP MOD ROT SW ↴ (LEED ONLY)
- 7 PHASE FINE ADJ CW
- 8 PHASE FINE ADJ +15
- 9 AUGER DAC OUT
- 10 AUG DAC GND

J3
- 1 2.5 kHz before R_Z
- 2 ↴
- 3 SCR ÷ 1000
- 4 ↴
- 5 SCR CTL
- 6 ↴
- 7
- 8
- 9
- 10

FROM REF. I. TO LOCK IN
J5/6 -1 −15
- 2 +15
- 3 ↴
- 4 +5
- 5 ↴

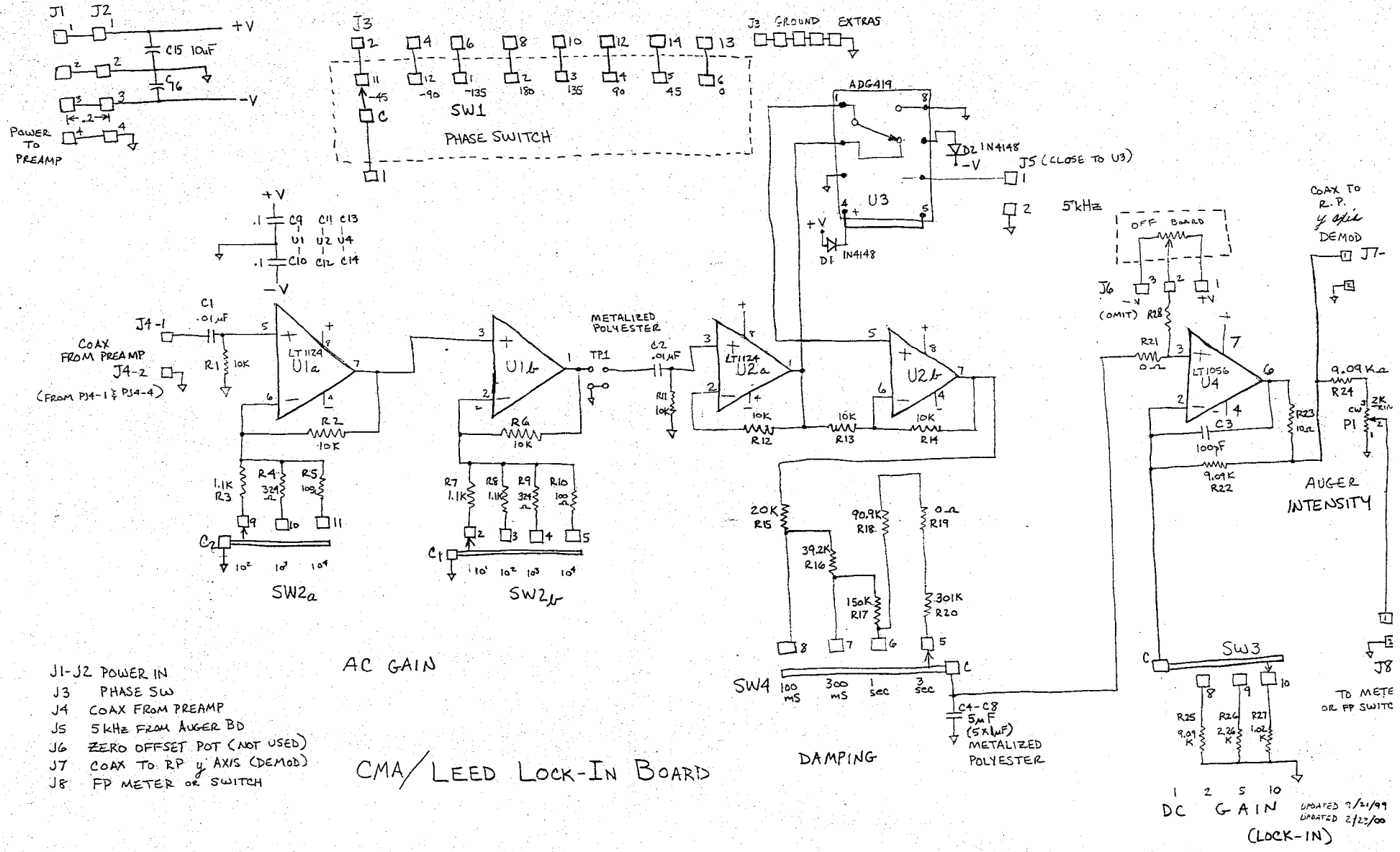
J1
- 1 CLK
- 2 DATA
- 3 LOAD
- 4 GND
- 5 2.5 kHz
- 6 ↴
- 7
- 8
- 9
- 10

J4

	CMA	LEED ONLY
1		SCR ÷ 1000
2		SCR CTL
3	0	R_f +10R
4	P	SCR SW ↴, DKI-11
5	EN	OPEN

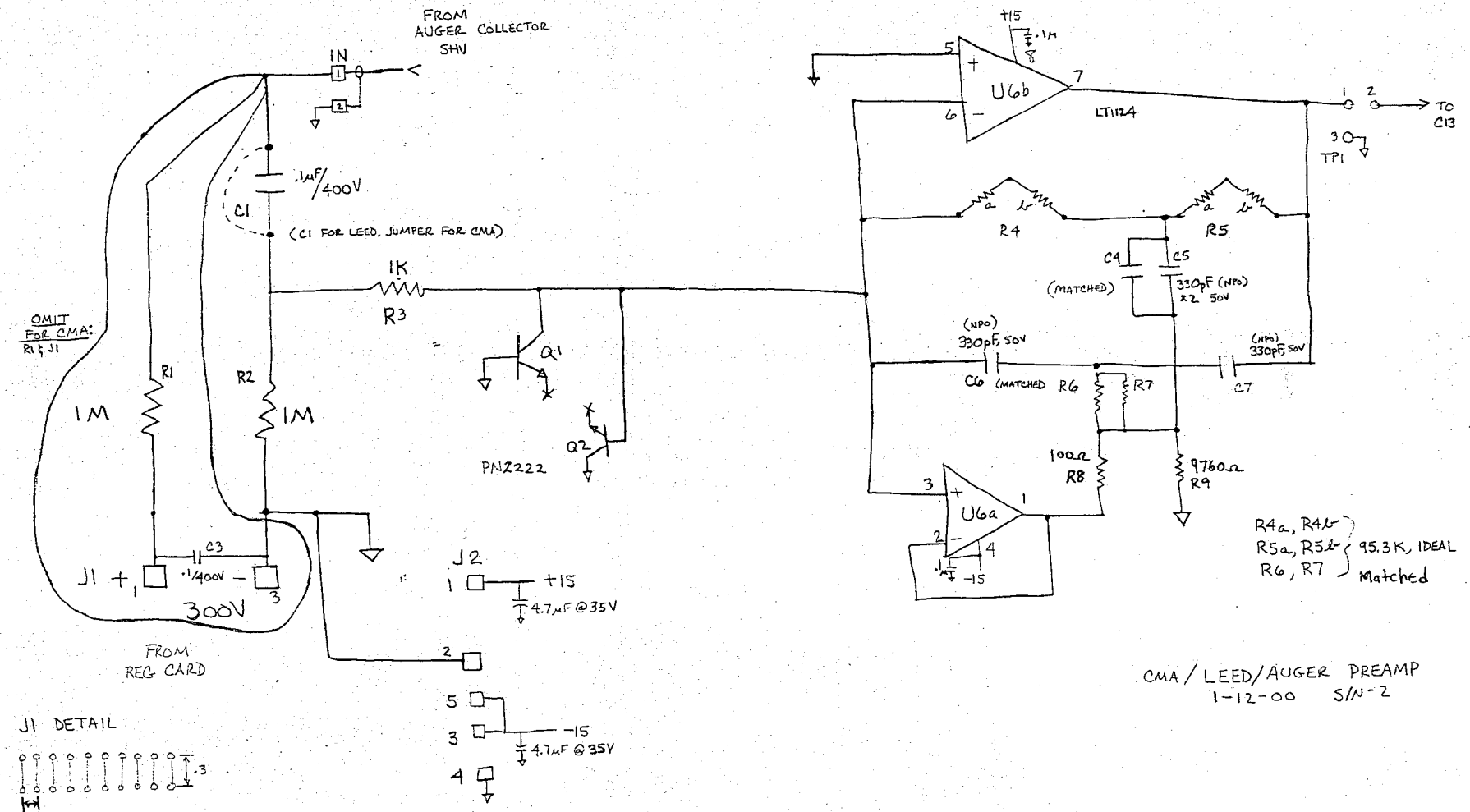
J8
- 1 LOCK-IN } 5 kHz
- 2 ↴ " " }

J2 LEED ONLY
- 1 +5
- 2 ↴
- 3 f IN (C291)
- 4 M4 IN (V_{OUT})
- 5 M4 SIG ↴
- 6 ↴ (for f)
- 7
- 8
- 9
- 10

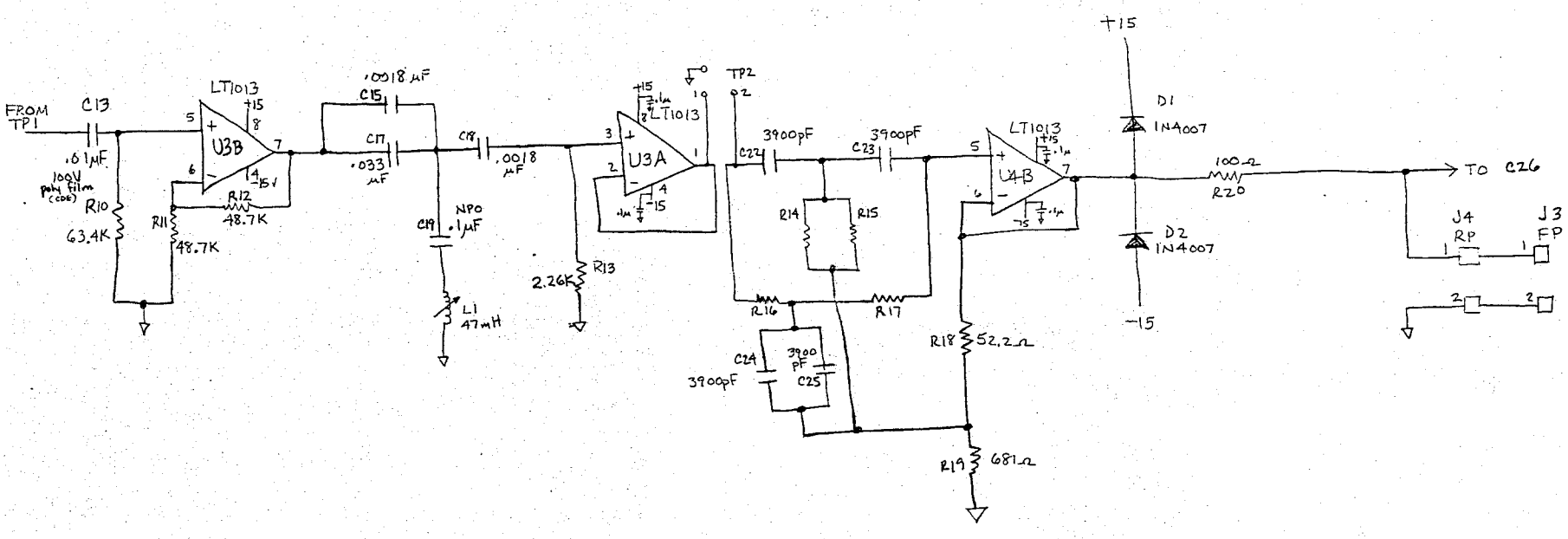


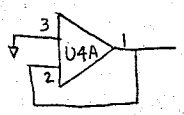
J1-J2 POWER IN
J3 PHASE SW
J4 COAX FROM PREAMP
J5 5kHz FROM AUGER BD
J6 ZERO OFFSET POT (NOT USED)
J7 COAX TO RP y AXIS (DEMOD)
J8 FP METER OR SWITCH

CMA/LEED LOCK-IN BOARD



CMA / LEED / AUGER PREAMP
1-12-00 S/N-2





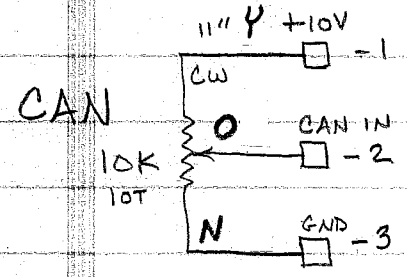
R14, R15, R16, R17 = 15.8K, MATCHED
C22, C23, C24, C25 = 3900 pF, MATCHED

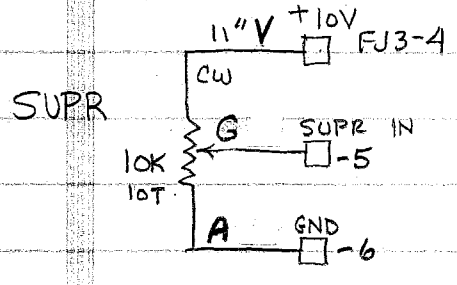
CMA/LEED/AUGER PREAMP
1-12-00 S/N-2

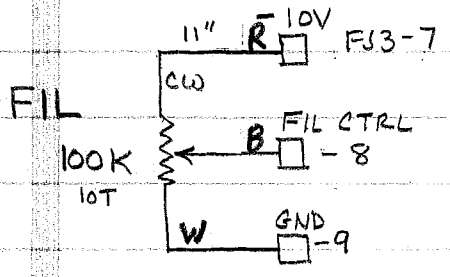
FIL BD - To - FP WIRING

9/01
LD-5

FJ3 -







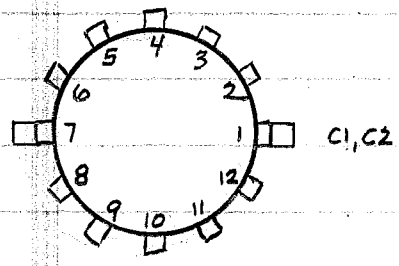
N/C ☐ FJ3-10

ALL WIRES = ROWE WHT HV WIRE

FJ3 = 10-pin MOD IV (FP-to-FIL BD)

FJ2, FJ5 = 5-pin MOD IV (FP-to-FIL BD)

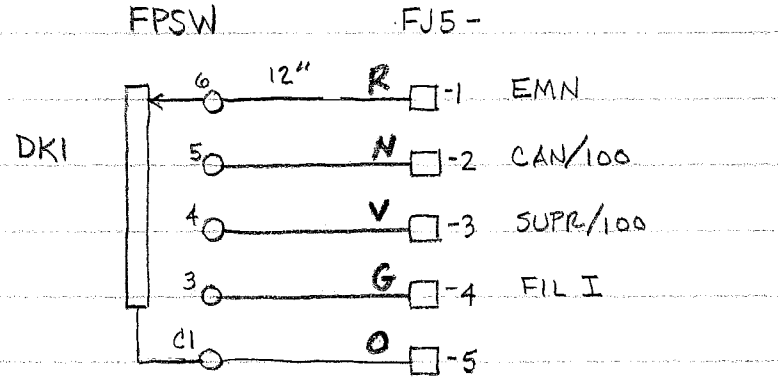
FPSW = 44D30-02-2-AJN

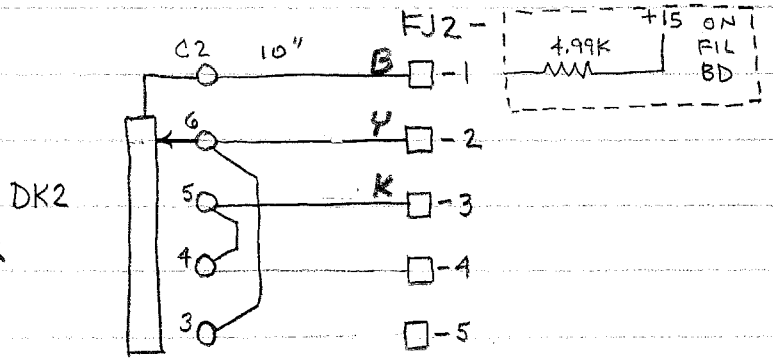


Deck 1 is outer deck

Rear View of Can Rotary Switch

Fasten to front panel in this orientation.





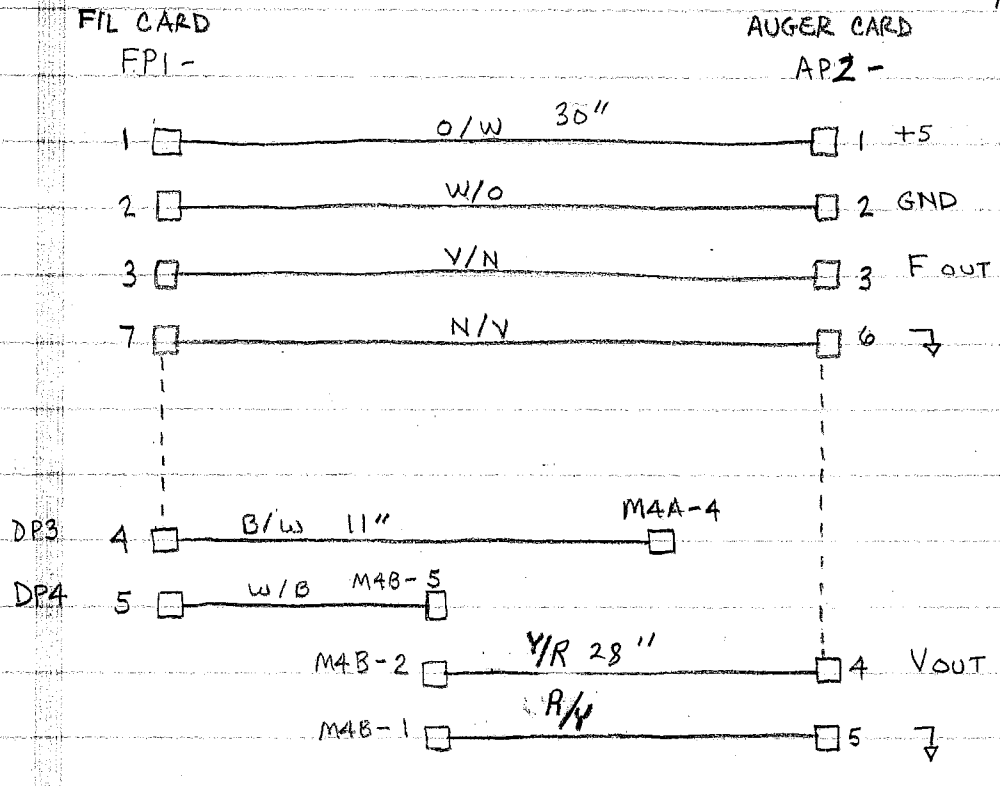
LEED5 9-14-01
LD-6 2-8-02

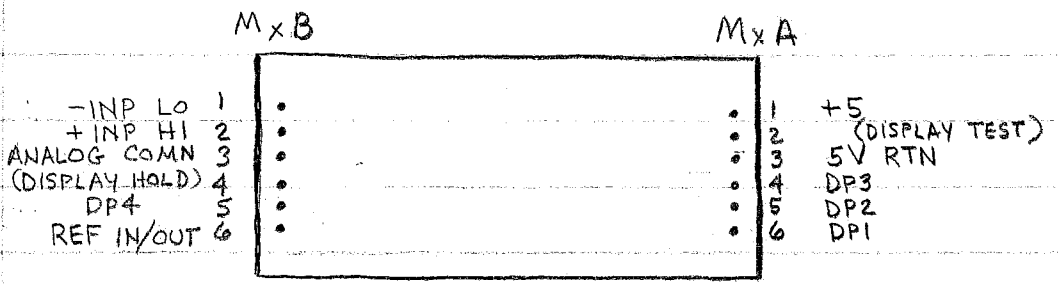
LEED FP WIRING

FP1, AP2 = 10 pin MODIV

M4A, M4B = 6 pin MODIV

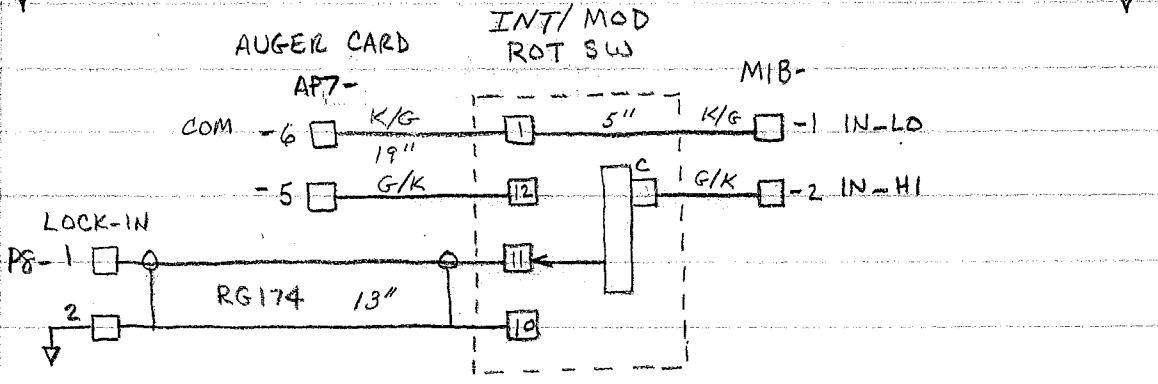
LP8 = 2 pin MODIV





FRONT PANEL METER
(REAR VIEW)

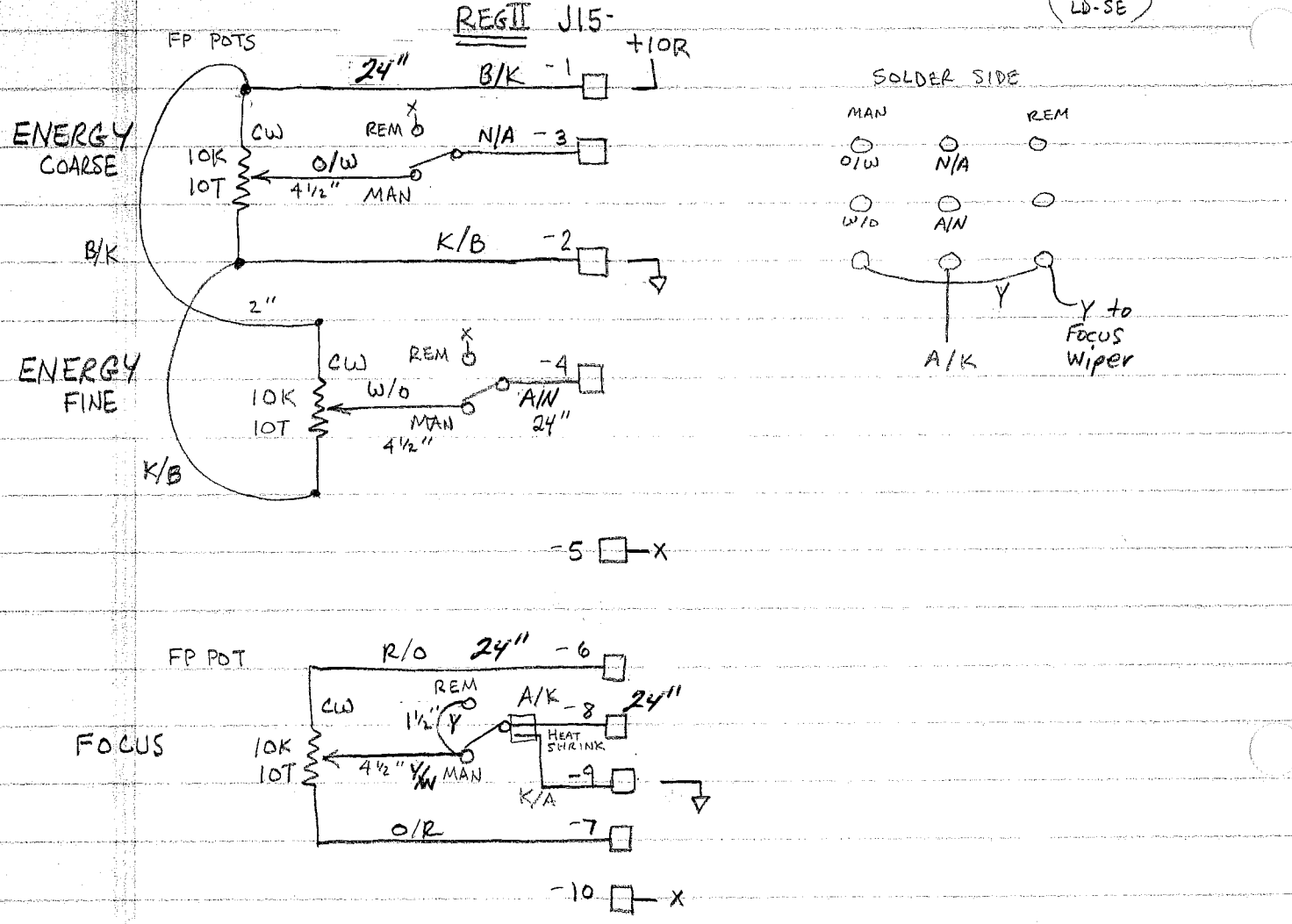
OMIT FOR LD-SE

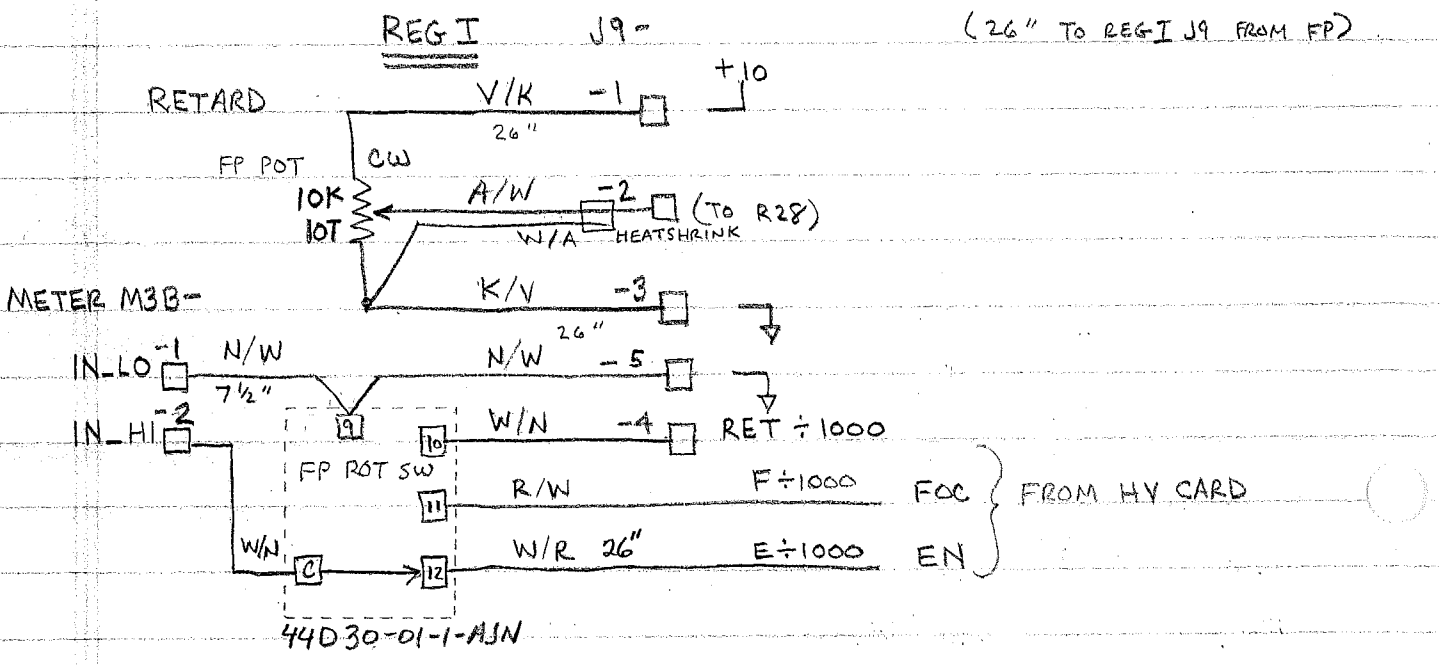


9/02

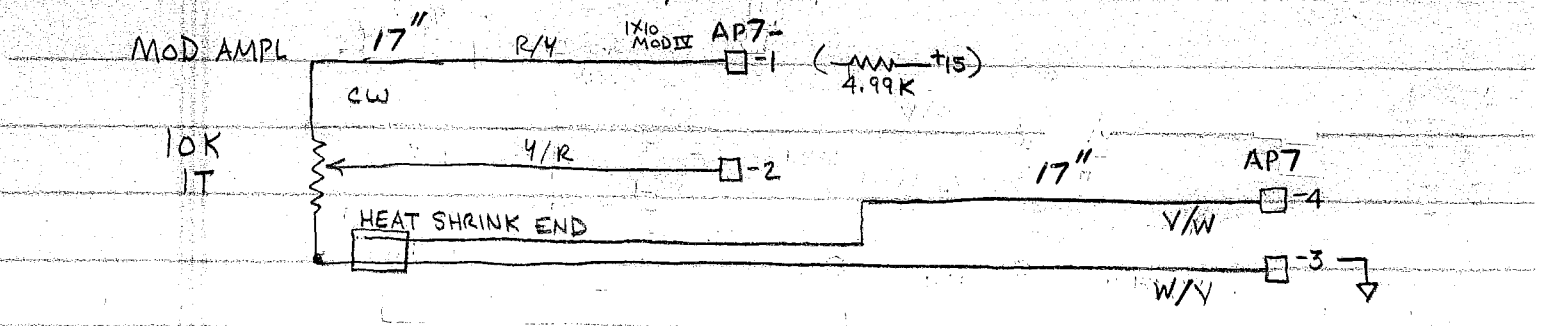
ENERGY, FOCUS, RETARD FP POT WIRING

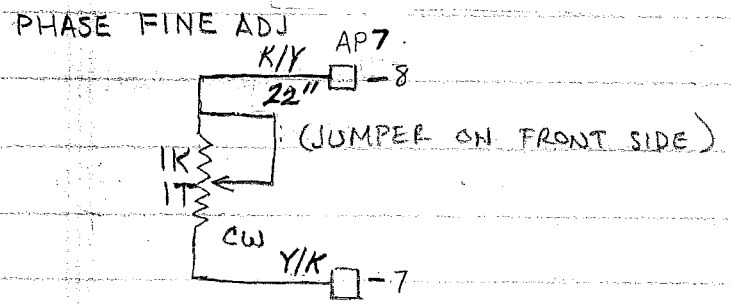
(LD-6 LD-SE)

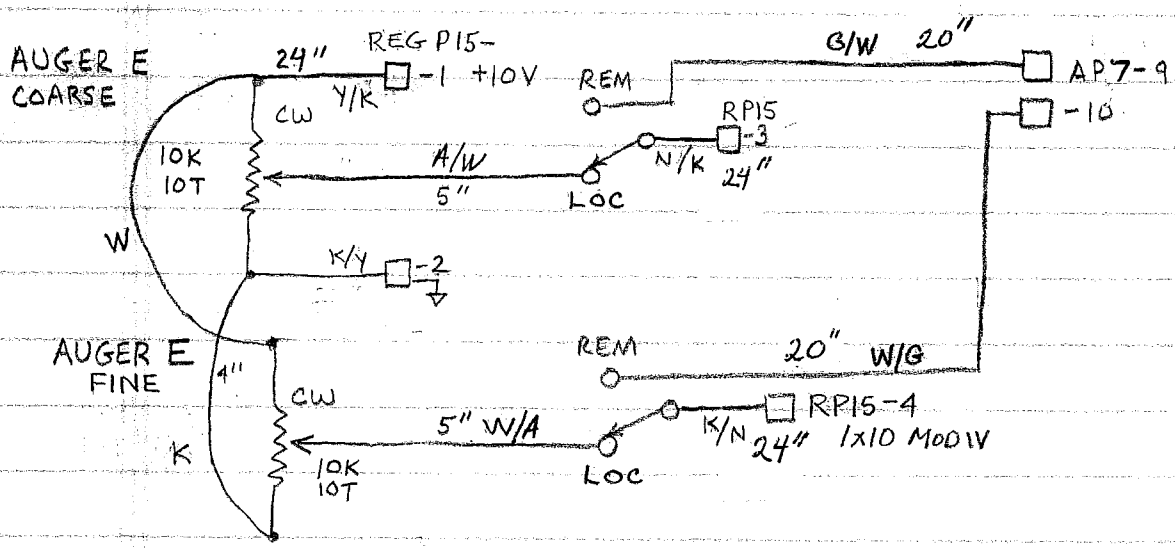


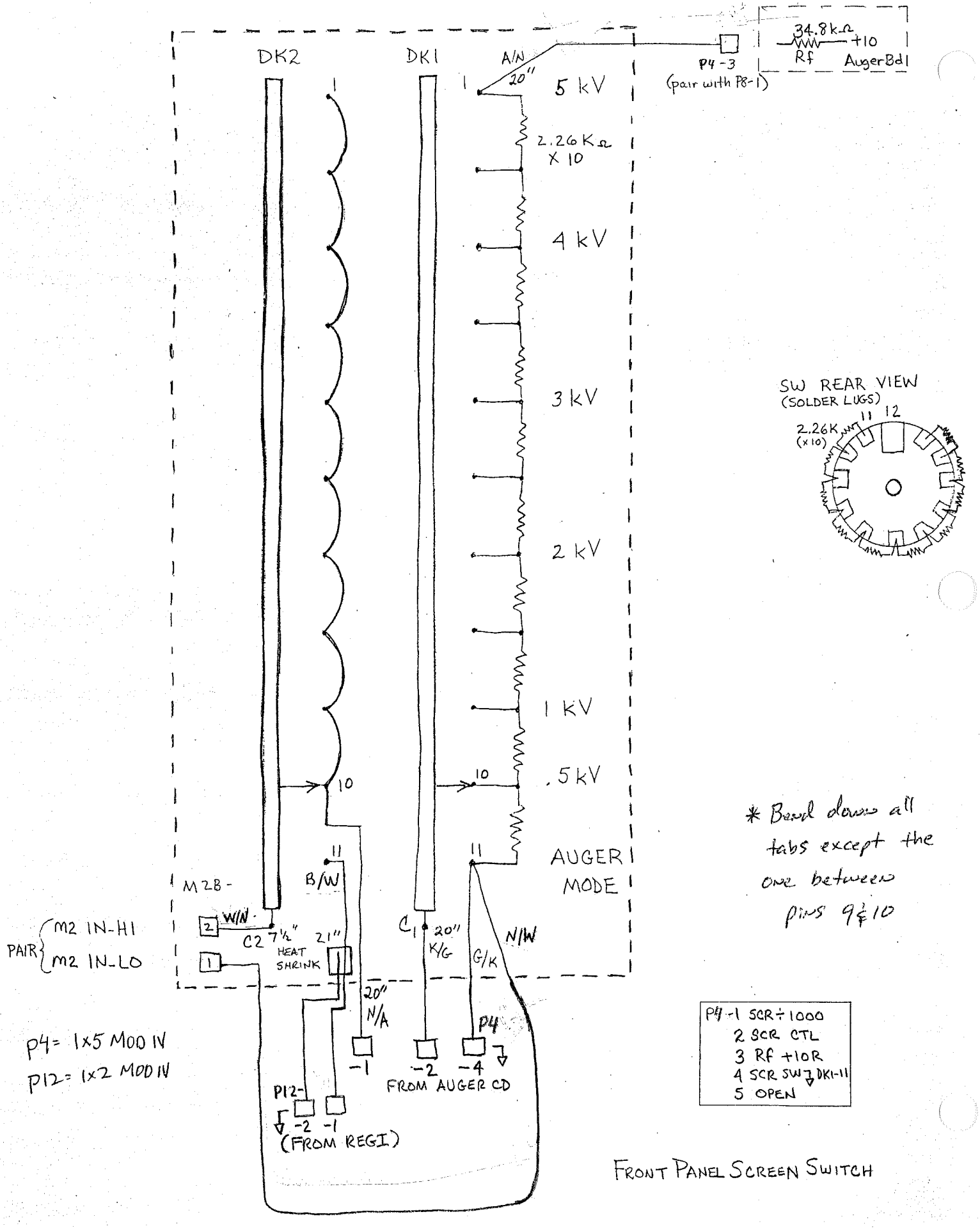


LEED/CMA FP WIRING








DK2
DK1
A/N
20"
5 kV
2.26 KΩ
X 10
4 kV
3 kV
2 kV
1 kV
.5 kV
AUGER
MODE
P4-3
(pair with P8-1)
34.8 kΩ
+10
Rf
AugerBd1
SW REAR VIEW
(SOLDER LUGS)
2.26K
(x10)
11
12
M2B-
W/N
B/W
C2
7½"
HEAT
SHRINK
21"
C1
20"
K/G
G/K
N/W
20"
N/A
PAIR
m2 IN-HI
m2 IN-LO
P4
-1
-2
-4
FROM AUGER CD
P12-
-2
-1
(FROM REGI)
P4 -1 SCR÷1000
2 SCR CTL
3 Rf +10R
4 SCR SW
5 OPEN
P4= 1x5 MOD IN
P12= 1x2 MOD IN
* Bend down all tabs except the one between pins 9 & 10
FRONT PANEL SCREEN SWITCH

DESIGN

Cut Belden 8340 35" to Start

11/5/99 LD-2
9/10/01 LD

BELDEN 8340 #24 awg
1 X 5 MOD IV – MOD IV

X5 10D IV

Auger P5 — REG P2 — 29"

-15	1	O/W	3	
+15	2	R/N	1	
GND	3	W/O	2	
+5	4			
GND	5	N/R	4	
			X 5	

Auger P6 — 23" — Lock-IN P1

-15	1	W/N	3	
+15	2	B/W	1	
GND	3	W/B	2	
+5	4			
GND	5	N/W	4	

1 X 5 MOD IV (X2)

LockIN P2 — 35" — Preamp P2

+15	1	R/O	1	
GND	2	O/R	2	
-15	3	W/A	3	
GND	4	A/W	4	

1 X 5 MOD IV (X 2)

LEED ONLY

REG1 P4 — NQP 26 awg 44" — Preamp P1

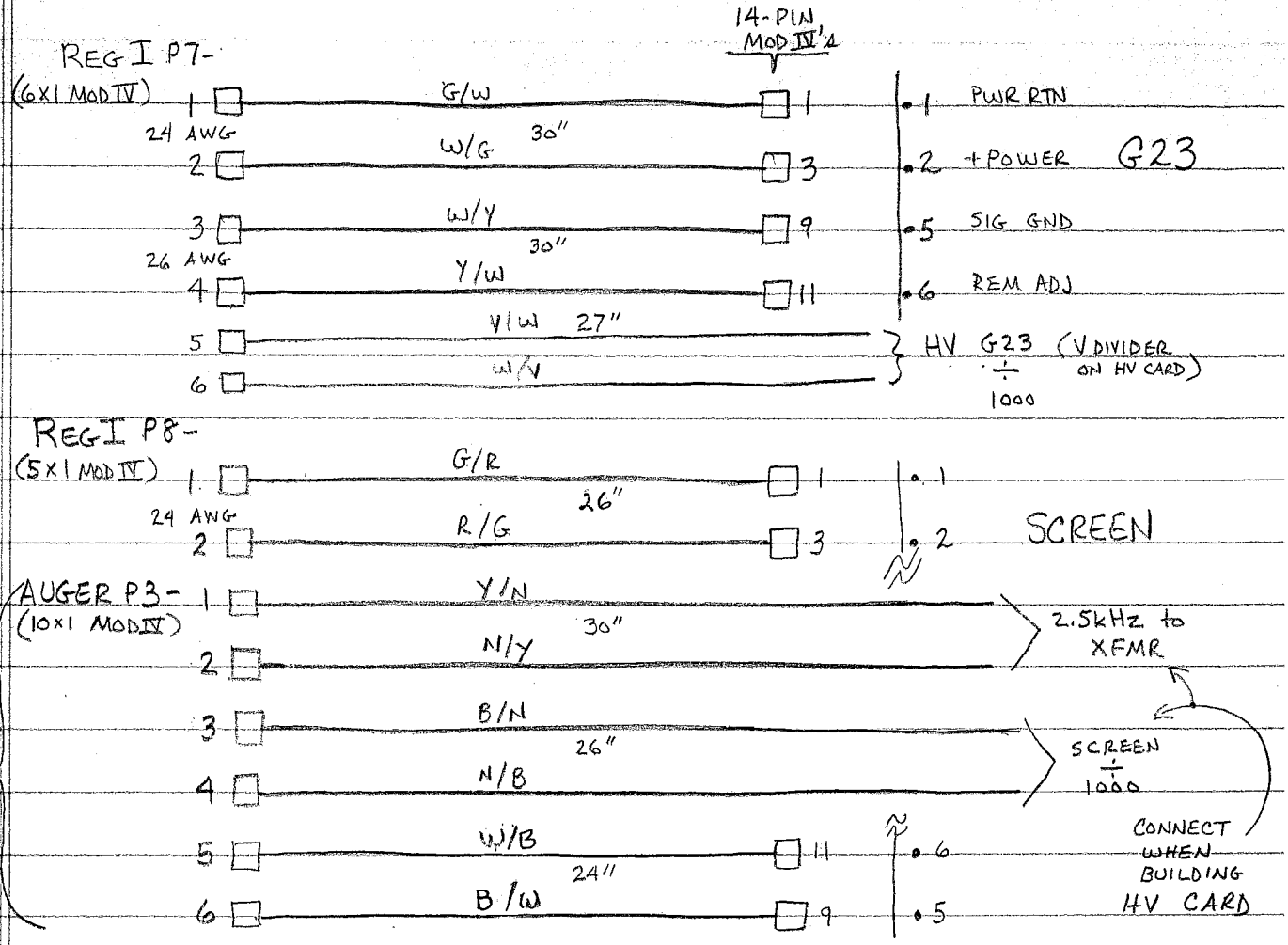
+300	1	R/N	1	
GND	3	N/R	3	

1 X 3 MOD IV

5 X 1

9/03

HIGH VOLTAGE CARD INPUT WIRING HARNESS



Start with 48" NQP cable

8/02

LEED METER POWER

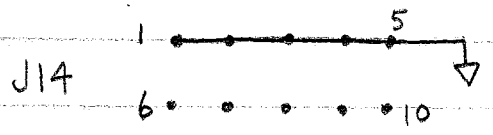
(FOR LD-SE)

4 TWISTED PAIRS - 26 AWG

REG I J14 - OMIT FOR LEED-SE

1X6 MOD IV

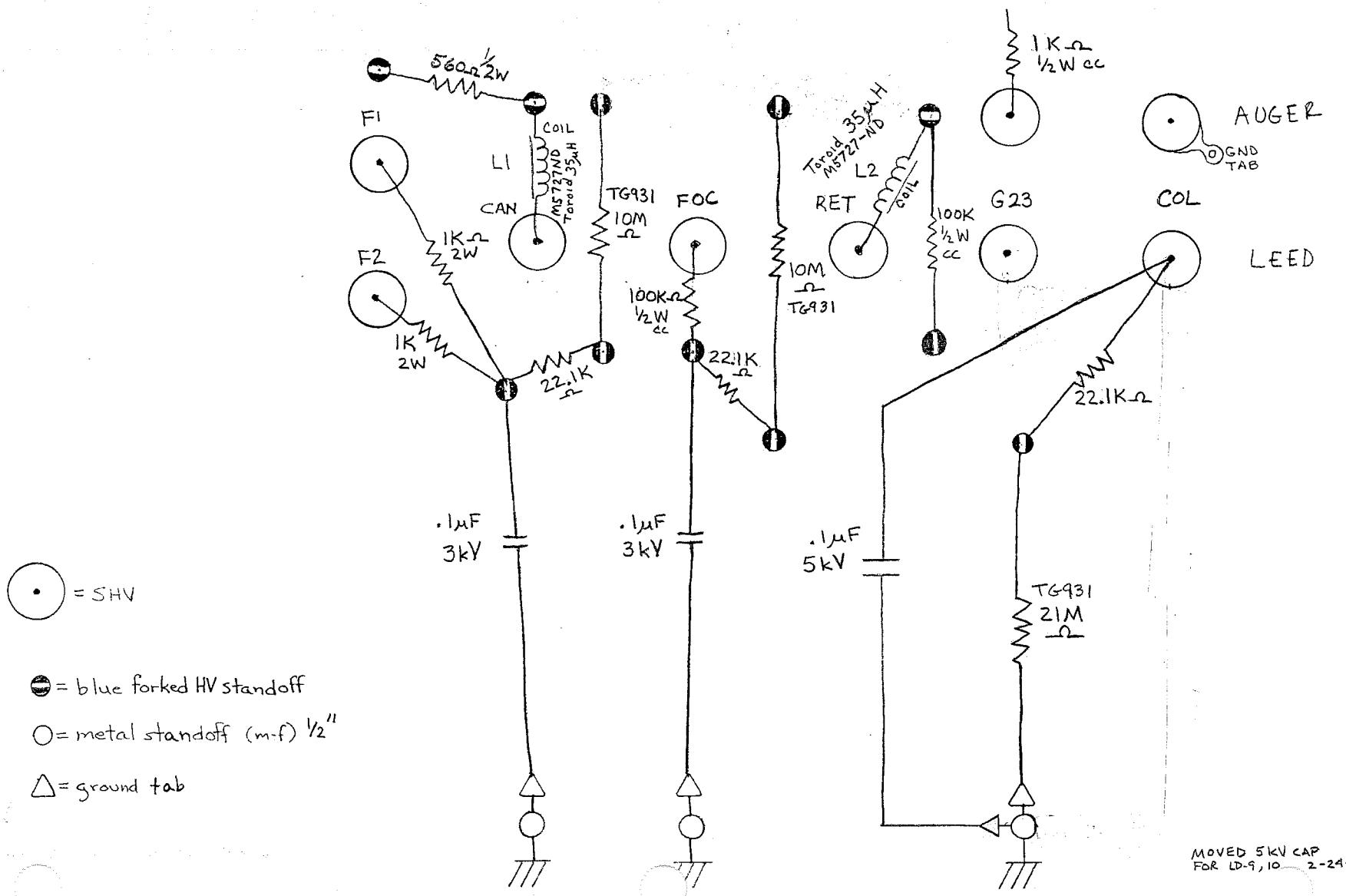
+5V	6	R/G		M1A-1	AUGER INT	
+5A COM	1	G/R 27"		M1A-3	1	
				M1A-4		
+5V	7	O/K		M2A-1	SCREEN	
+5A COM	2	K/O 25 1/2"		M2A-3	1	
				M2A-5		
+5V	8	R/K		M3A-1	EN/FOC/RET	
+5B COM	3	K/R 25 1/2"		M3A-3	1	
+5V	9	O/N		M4A-1	FIL/SUP/CAN/EMN	
+5B COM	4	N/O 27"		M4A-3	1	



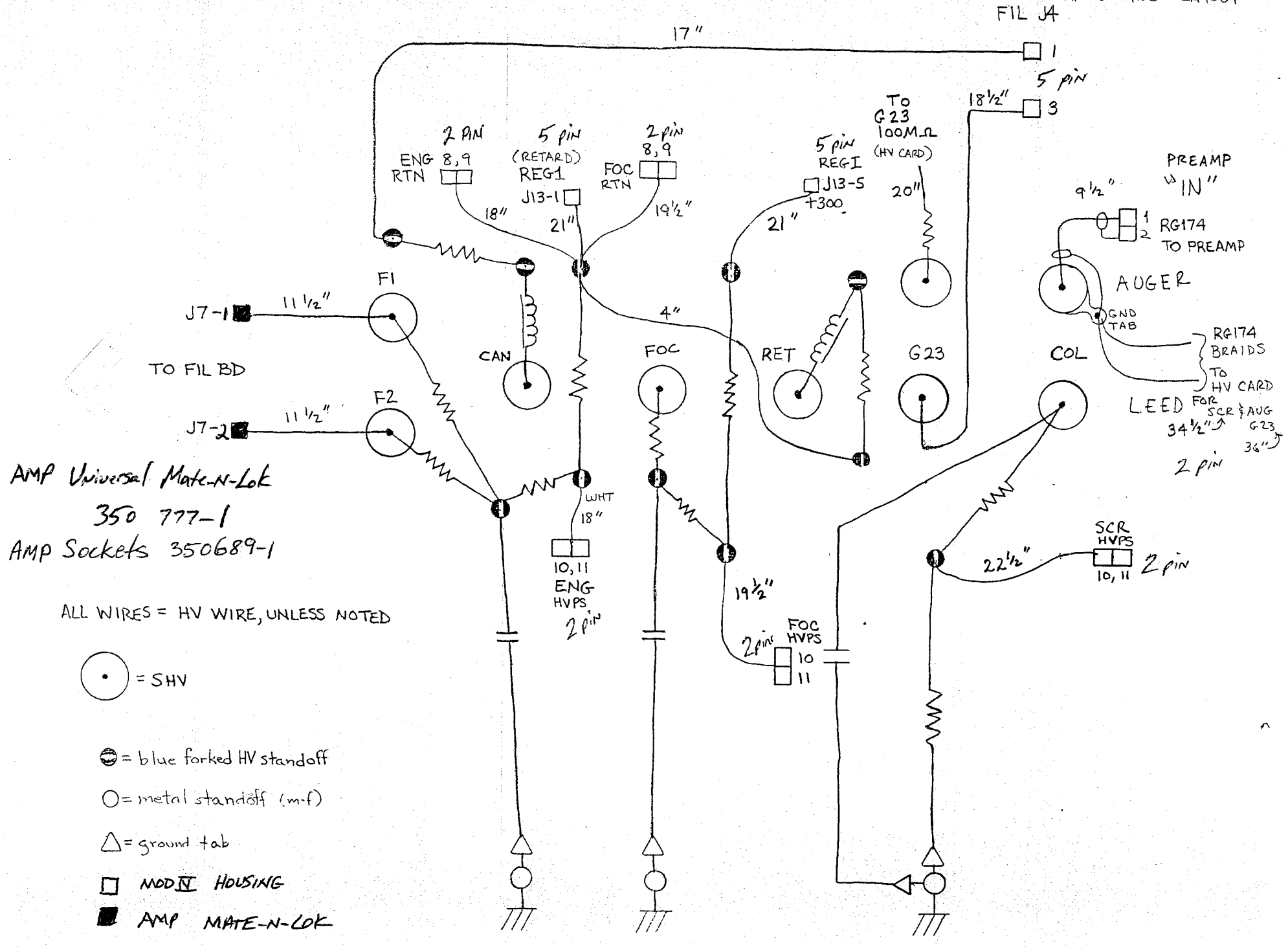
VIEW FROM INSERTION SIDE

5 X 2 MOD IV

RP COMPONENT LAYOUT

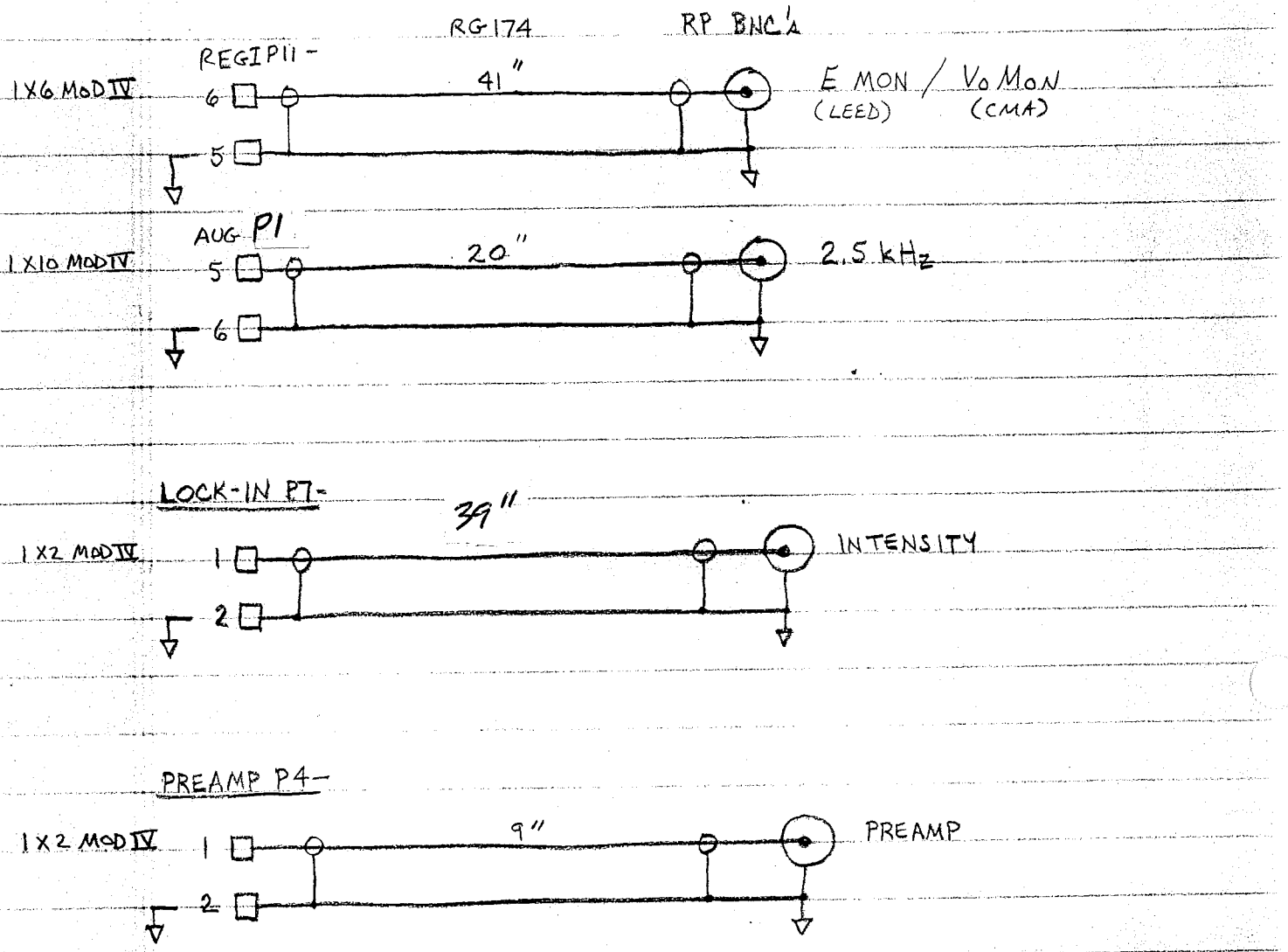


RP WIRING LAYOUT

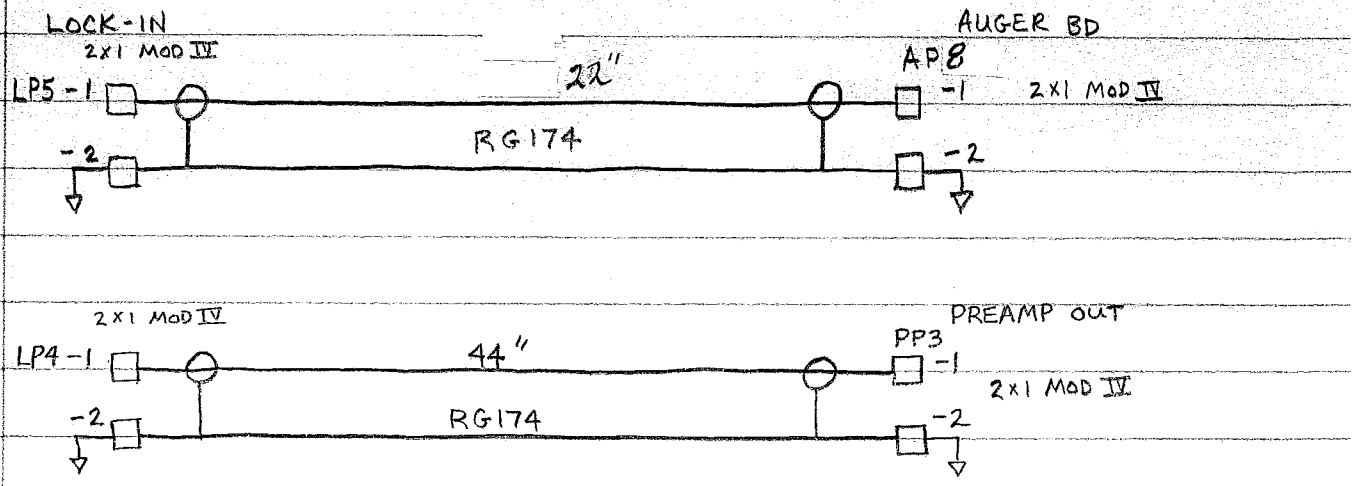


LEED / CMA RP BNC CONNECTIONS

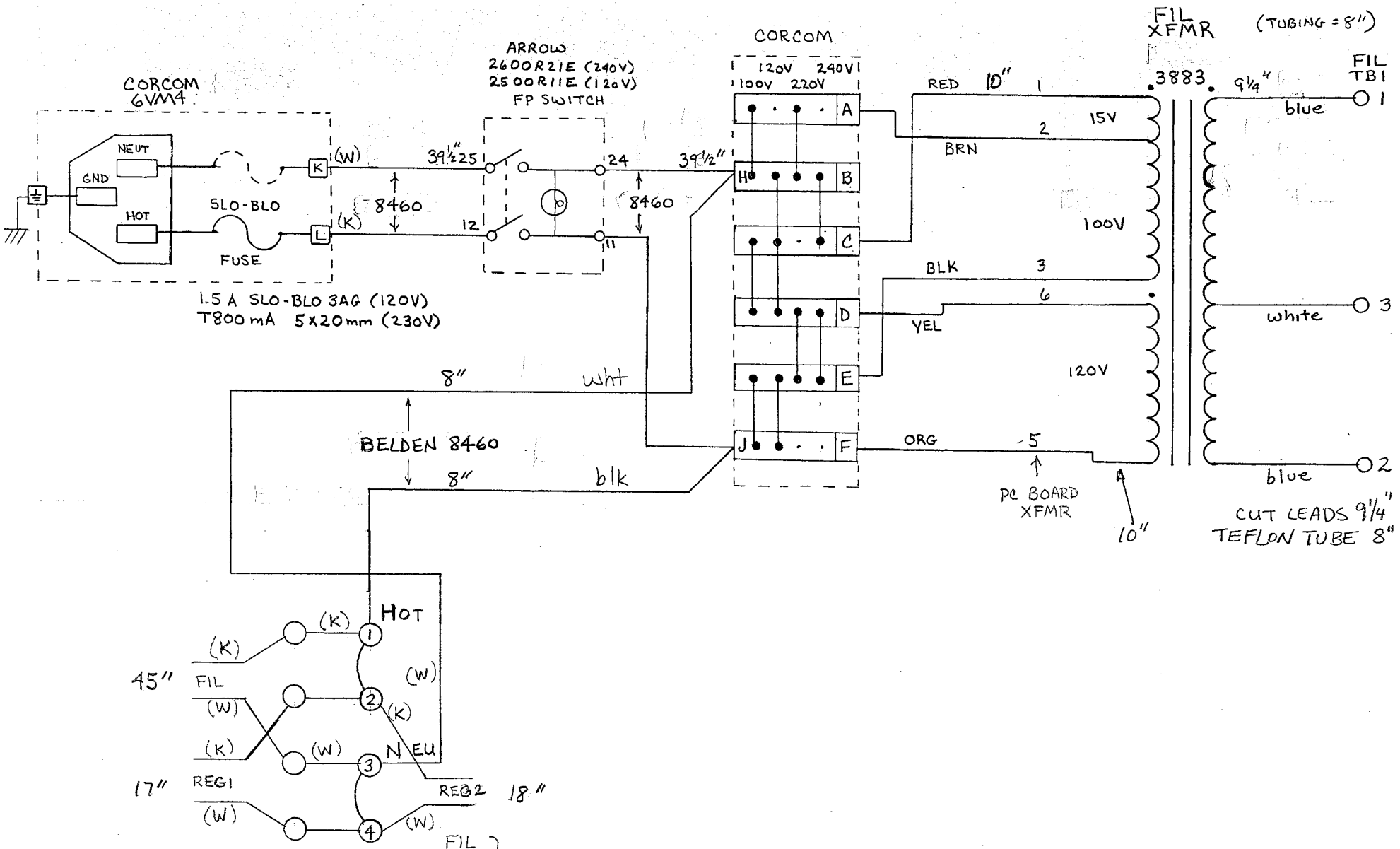
1-4-01



LEED/CMA CoAX CABLES



CMA-2, LD-6 2/02
REDRAWN 8/03



1-20-00 LD-2

7-00 LD-4 TECHMAR

8-02 LD-5F

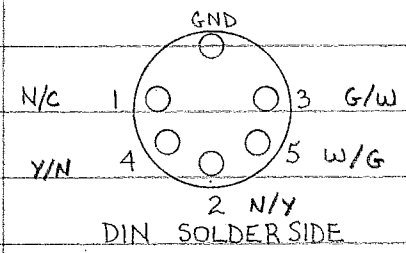
LEED POWER ENTRY

DP-DIN - TO - AUGER J1

9-12-00

INTERNAL COMPUTER SIGNAL WIRING

RP DIN		AUGER J1 (10-PIN MOD IV)
5	W/G 18"	1 CLK
2	N/Y 18"	2 DATA
4	Y/N	3 LD-L
3	G/W	4 GND



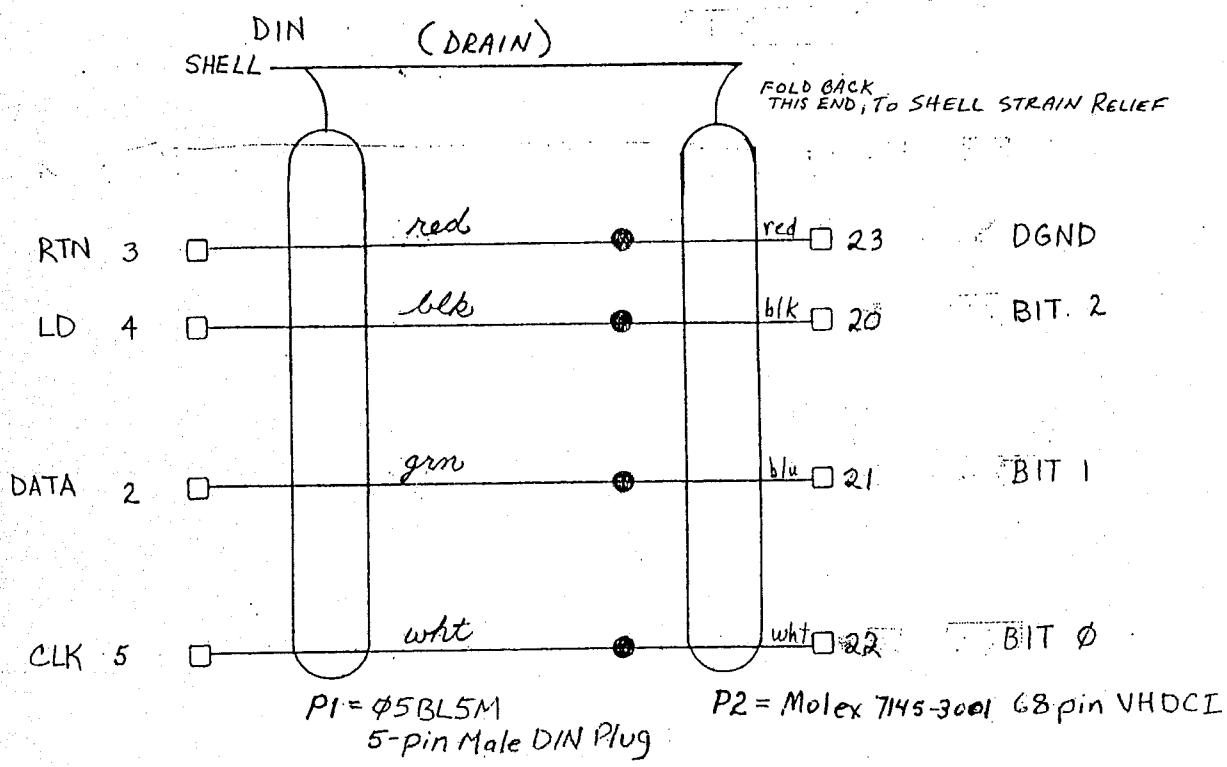
DIN SOLDER SIDE

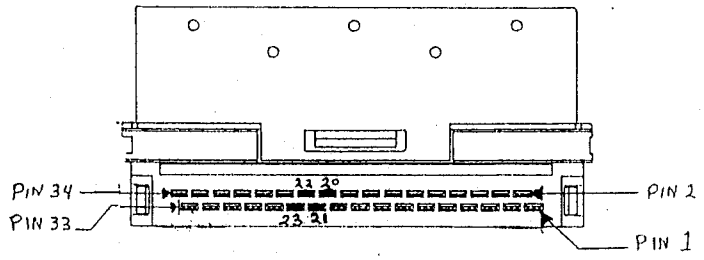
CMA/LEED COMPUTER CABLE

12-2-99 S/N-2
2-8-08 -11

Cabling: 15' Belden 9534 OR Equivalent

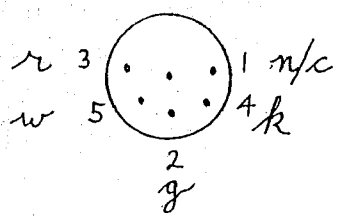
● = splice to #30awg ww wire
to: KCPI-3116





VHDCI 68 PIN LAYOUT

Molex # 71425-3001

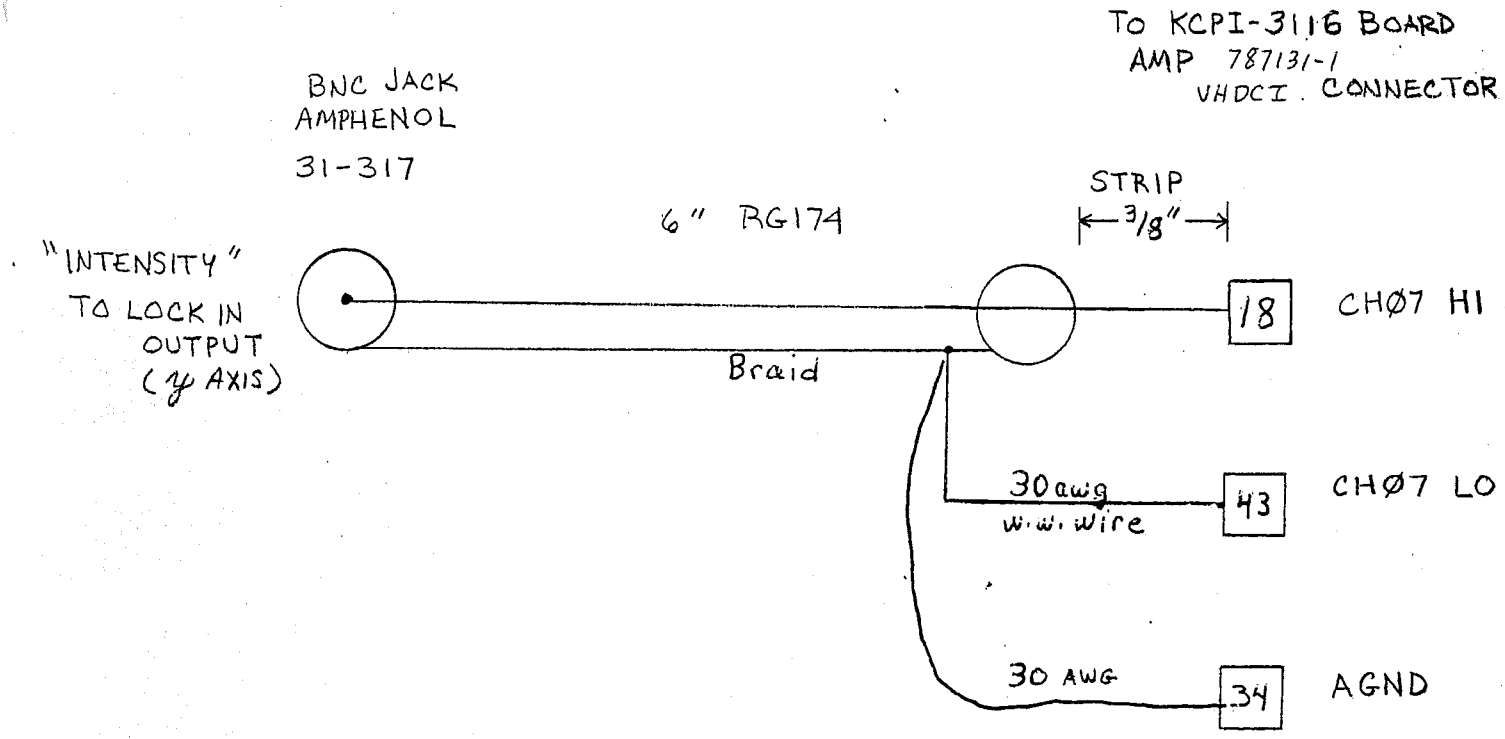


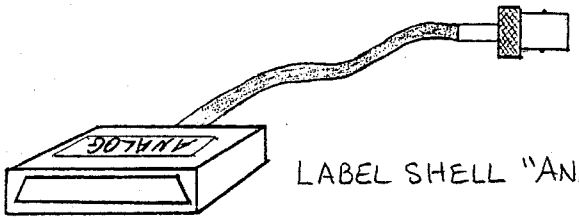
DIN Solder Side

DRAWN BMR 1-13-94
REVISED SAW 12-16-94
REV II SAW 9-12-96
REV III SAW 2-2-98 ELS3-15, ELS5-1
REV IV SAW 1-25-00 LD-2
REV V SAW 8-11-03 LD7-8

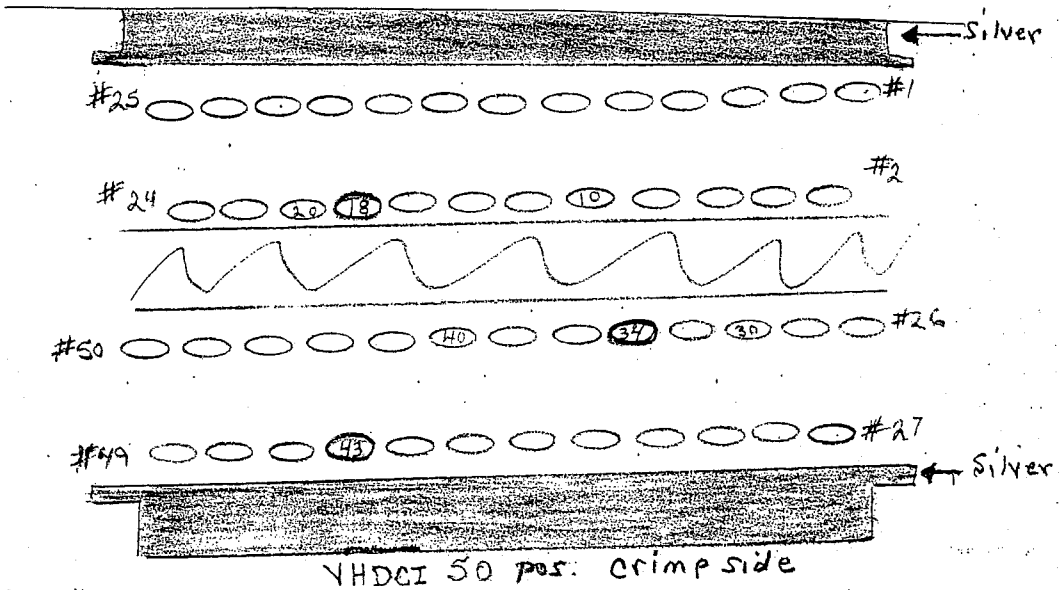
LEED/CMA ANALOG INPUT CABLE

2-8-08 CMA-11, LD-22





LABEL SHELL "ANALOG"



VHDCI 50 pos. crimp side