APPENDIX B - MOUNT SPECIFIC DATA
For
RF Scientific 4.5/3.8m.

Date: 29 October 2010
Software: 1.60

This appendix describes RC3000 operations unique for the RF Scientific mounts equipped with an Antenna Interface Unit (AIU). Differences between this version and the operation described in the "baseline" RC3000 manual are noted on a paragraph by paragraph basis.

Manual Organization

This appendix is provided as a supplement to the baseline RC3000 manual.

RC3000 Features – Configuration

A RC3000G version of hardware is required for this mount. The mount model will be designated as N5 (4.5m) or F2 (3.8m).

Software will be designated as RC3K-N5/F2-xxx

Mount Model

DESIGNATION	MODEL
F2	3.8 m
N5	4.5 m

1.3.1 Controller Description

The model RC3000D differs from a baseline RC3000 in the following ways:

RESOLVER BOARD. A resolver to digital conversion board has been added to the baseline RC3000 hardware.

AIU COMMAND BOARD. In place of a DC Motor Control module, a AIU command board is used to generate drive signals to the AIU. A schematic of this board is shown in section 4.2.

1.3.2 System Interface Requirements

The interface requirements for this mount are very similar to the "standard" RC3000 interface described in the baseline manual. The main difference are:

- instead of generating drive voltage from the controller, the RC3000D generates drive commands to the AIU. The AIU will then generate the actual drive voltage to the mount.

- limit switch inputs from the mount are interpreted by the AIU. The RC3000G allows for the setting of "software limits".

- azimuth and elevation resolver position feedback is passed through the AIU to the RC3000G

1.3.3 Operational Overview

The operation of the N5/F2 version is almost identical to that described in the baseline manual. Differences will be noted in the appropriate paragraphs.

1.3.7 Drive System

Position Sensing and Limits. Azimuth and elevation software limits are implemented.

Jam and Runaway Sensing. Jammed and runaway sensing is based on resolver counts.

2.1.4 Inclinometer Orientation

For the N5 mount , the inclinometer should be 15 degrees clockwise beyond vertical when the reflector is at the 60.0 degree look (RF) angle position.

2.2 Electrical Connections

2.2.1 Power Entry

The RC3000G uses a 1 Amp fast-blow fuse. Note: this smaller value fuse may be used since the RC3000G does not generate the actual drive voltage.

2.2.2 Motor Drive

J7 generates drive signals to the AIU per the following table.

J7 PIN	VS-1 Drive Signal
A	AZ – EAST
B	AZ – WEST
C	AZ – FAST
D	AZ – SLOW
E	EL – DOWN
F	EL –UP
G	EL – FAST
H	EL – SLOW
J	POL – CCW
K	POL – CW
L	AZ + EAST
M	POL + CW

2.2.4 Limit Switches

No azimuth or elevation limit switch indications come to the RC3000G from the mount. All limit switch inputs are hardwired inside the RC3000G.

2.3.2 Elevation Calibration

Sensor Polarity. The inclinometer should increase in voltage when going up, elevation resolver count should also increase.

Elevation Reference Position. Both the inclinometer and elevation resolver should be calibrated while the reflector is at the 60.0 degree RF look angle (i.e. the elevation reference position).

With the inclinometer oriented as described in 2.1.4 the elevation reference voltage should be approximately 2.70 volts.

Rotate the elevation resolver until a raw resolver angle of approximately 180.0 degrees in seen in the MAINTENANCE-VOLTS screen. Lock the elevation resolver in place and observe the raw resolver angle. Subtract 60.0 from this observed angle and enter it as the elevation resolver offset (see 3.3.1.2.2).

2.3.3 Azimuth Calibration.

The only position sensor on the azimuth axis is the resolver.

Sensor Polarity. Azimuth resolver "counts" should increase as the mount rotates clockwise. If it does not, the polarity may be changed by setting the azimuth resolver reverse flag.

Azimuth Reference Position. - Position the mount at the azimuth stow position as exactly as possible. Loosen and adjust the azimuth resolver to be as close to 180 degrees (seen at a/d volts screen 3.3.2.1) as possible. The azimuth resolver offset will be 0.0 – "raw resolver angle".

Azimuth Limits. This version of the RC3000 implements "software" limits. The azimuth CW and CCW pulse limits (3.3.1.3.3) should be set to values that reflect the azimuth resolver count values near the end of azimuth travel. When the RC3000 senses that the azimuth axis has reached these values, it will generate a "software" limit condition even though the actual hardware limit has not been reached. If the user does not want to use the "software limit" feature, set these configuration items to values outside the range of normal azimuth travel.

3.3.1.3.2 Azimuth Pot Drive

Since no potentiometer exists on the azimuth axis, these items actually are used to tune azimuth movements based on angles derived from the resolver feedback.

3.3.1.3.3 Azimuth Pulse Drive
3.3.1.3.6 Elevation Pulse Drive

The items on the Pulse Drive screens are actually used to tune drive movements based on resolver "counts". The resolver counts are used in the same fashion as pulse counts are used for making precise movements (during tracking, recall) of the mount.

NOTE: the azimuth and elevation pulses_per_radian values are set to 10,431. This is the number of resolver counts per radian.
360 degrees / 65536 total counts = 0.005493164 degrees/count or 182.044 counts/degree.
182.044 counts/degree * 57.29 degrees/radian = 10431 counts/radian

3.3.1.3.4 Azimuth Drive Monitoring
3.3.1.3.7 Elevation Drive Monitoring
The items on the Drive Monitoring screens are actually used to tune drive movements based on resolver "counts". The resolver counts are used in the same fashion as pulse counts are used for making precise movements of the mount.

3.3.1.2 Reset Defaults

The following table supplies the default configuration item values for this model of mount. Only the values for F2 that are different from N5 are shown.

Space has also been provided to record installation specific changes to the configuration items. Note: recording of installation specific changes to defaults may prove valuable when trying to restore system configuration.

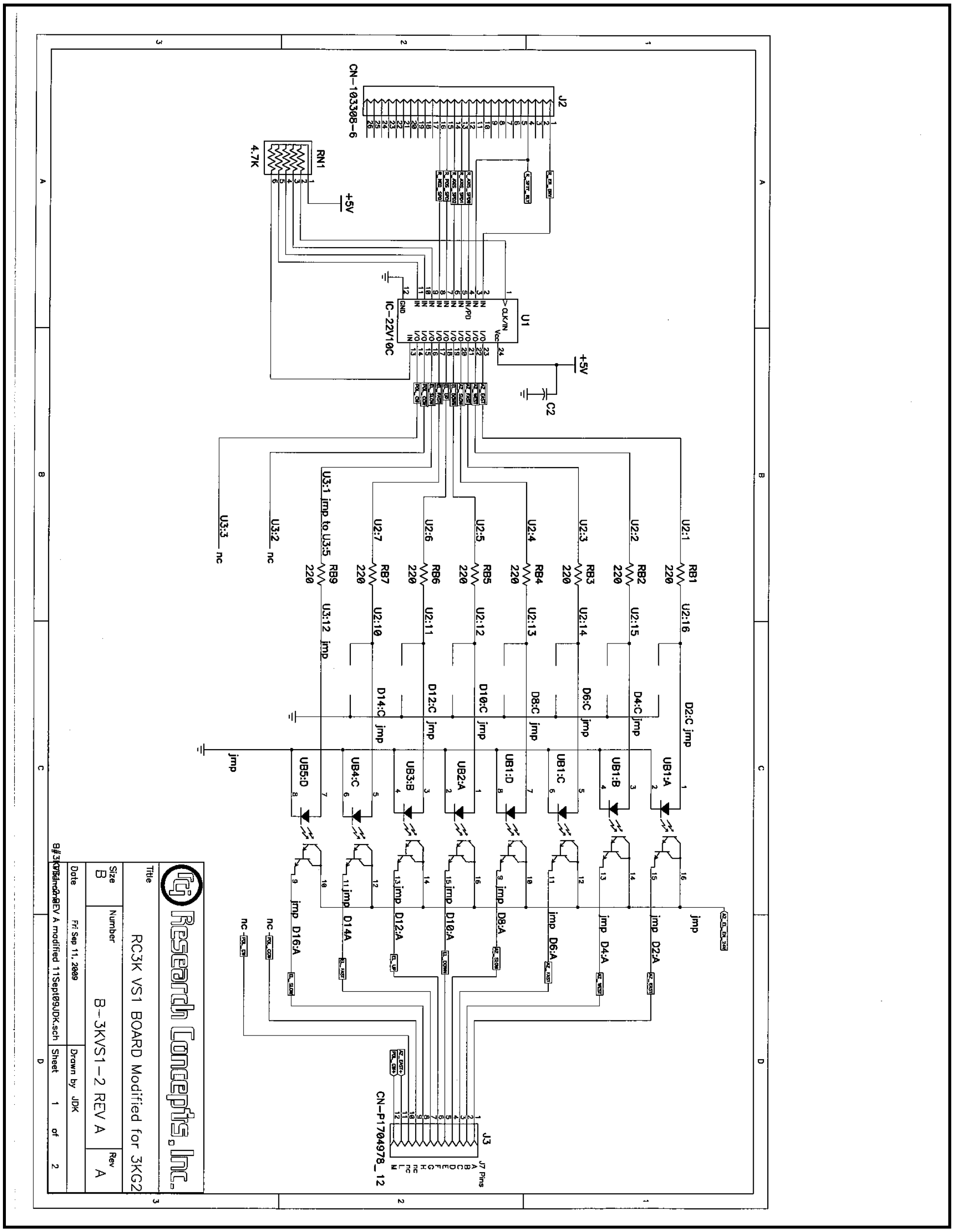
CONFIGURATION ITEM	N5	F2						INSTALL VALUE
SYSTEM DEFINITION								
GPS_present	1							
Compass_present	1							
Mode	2							
antenna_size_cm	450	380						
Waveguide_Switch_Present	0							
AZIMUTH CALIBRATION								
Azim_offset	0.0							
ccw_azim_limit	165							
Cw_azim_limit	165							
Resolver Offset	-180.0							
Resolver Direction	0							
ELEVATION CALIBRATION								
Zero Voltage	2.70							
Elev_offset	0.0							
Up_elev_limit	90							
Down_elev_limit	0							
Elevation_Scale_Factor	50.00							
Resolver Offset	-120.0							
Resolver Direction	0							
Elevation_look_configuration	1							
POLARIZATION CAL								
Resolver Offset	2.50							
Reference Voltage	0							
Polarization_Offset	0.0							
CW Polarization Limit	90.0							
CCW Polarization Limit	90.0							
Polarization_type	2							
H/V_Reference	1							
Default Horizontal Position	-45.0							
Default Vertical Position	45.0							
Pol_Automove_Enable	1							
SIGNAL PARAMETERS								
Channel 1 Polarity	1							
Channel 1 Threshold	100							
Channel 1 Delay	0.1							
Channel 1 Lock Type	0							
Channel 2 Polarity	1							
Channel 2 Threshold	100							
Channel 2 Delay	0.1							
Channel 2 Lock Type	0							
AUTOPEAK								
Autopeak Enabled	0							
Signal Source	1							
RF Band	1							
Spiral Search AZ Limit	3							
Spiral Search EL Limit	3							
Spiral Signal Threshold	200							
Scan Range Limit	8							
Scan Signal Threshold	200							

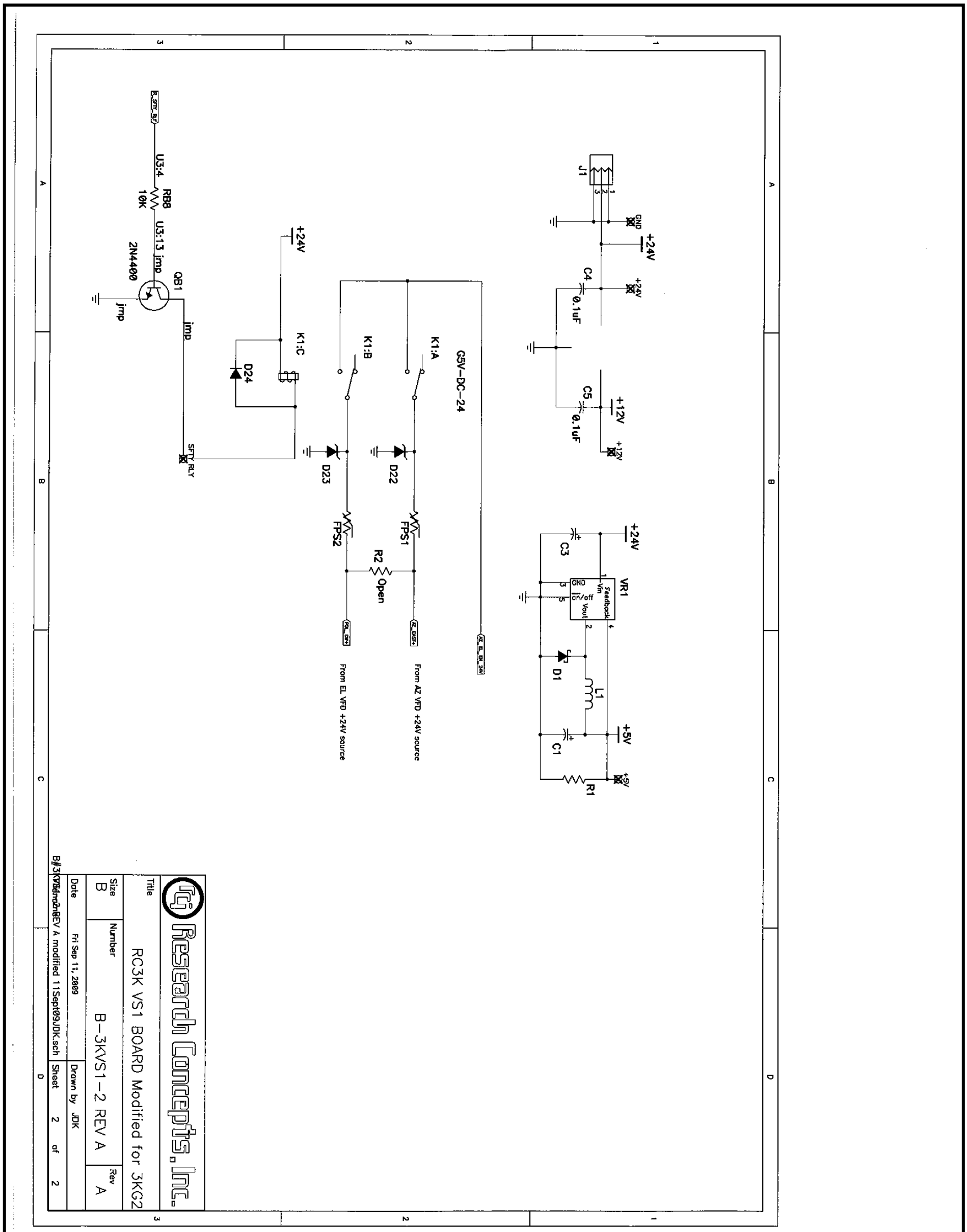
CONFIGURATION ITEM	N5	F2						INSTALL VALUE
AZIMUTH POT DRIVE								
Fast/Slow Threshold	0.3							
Maximum Position Error	0.1							
Coast Threshold	0.1							
Maximum Retry Count	3							
AZIMUTH PULSE DRIVE								
Pulse Scale Factor	10431							
CW Pulse Limit	63000							
CCW Pulse Limit	2000							
Fast/Slow Threshold	50							
Maximum Position Error	0							
Coast Threshold	3							
Maximum Retry Count	3							
AZIM DRIVE MONITORING								
Jam Slop	1							
Runaway Slop	200							
Fast Deadband	1000							
Slow Deadband	500							
ELEV POT DRIVE								
Fast/Slow Threshold	0.8							
Maximum Position Error	0.2							
Coast Threshold	0.4							
Maximum Retry Count	3							
ELEV PULSE DRIVE								
Pulse Scale Factor	10431							
UP Pulse Limit	39000							
Down Pulse Limit	21000							
Fast/Slow Threshold	100							
Maximum Position Error	0							
Coast Threshold	3							
Maximum Retry Count	3							
ELEV DRIVE MONITORING								
Jam Slop	1							
Runaway Slop	200							
Fast Deadband	1000							
Slow Deadband	500							
POL POT DRIVE								
Fast/Slow Threshold	2.0							
Maximum Position Error	0.5							
Coast Threshold	0.3							
Maximum Retry Count	3							
POL DRIVE MONITORING								
Jam Slop	1							
Runaway Slop	200							
Fast Deadband	1000							
Slow Deadband	500							

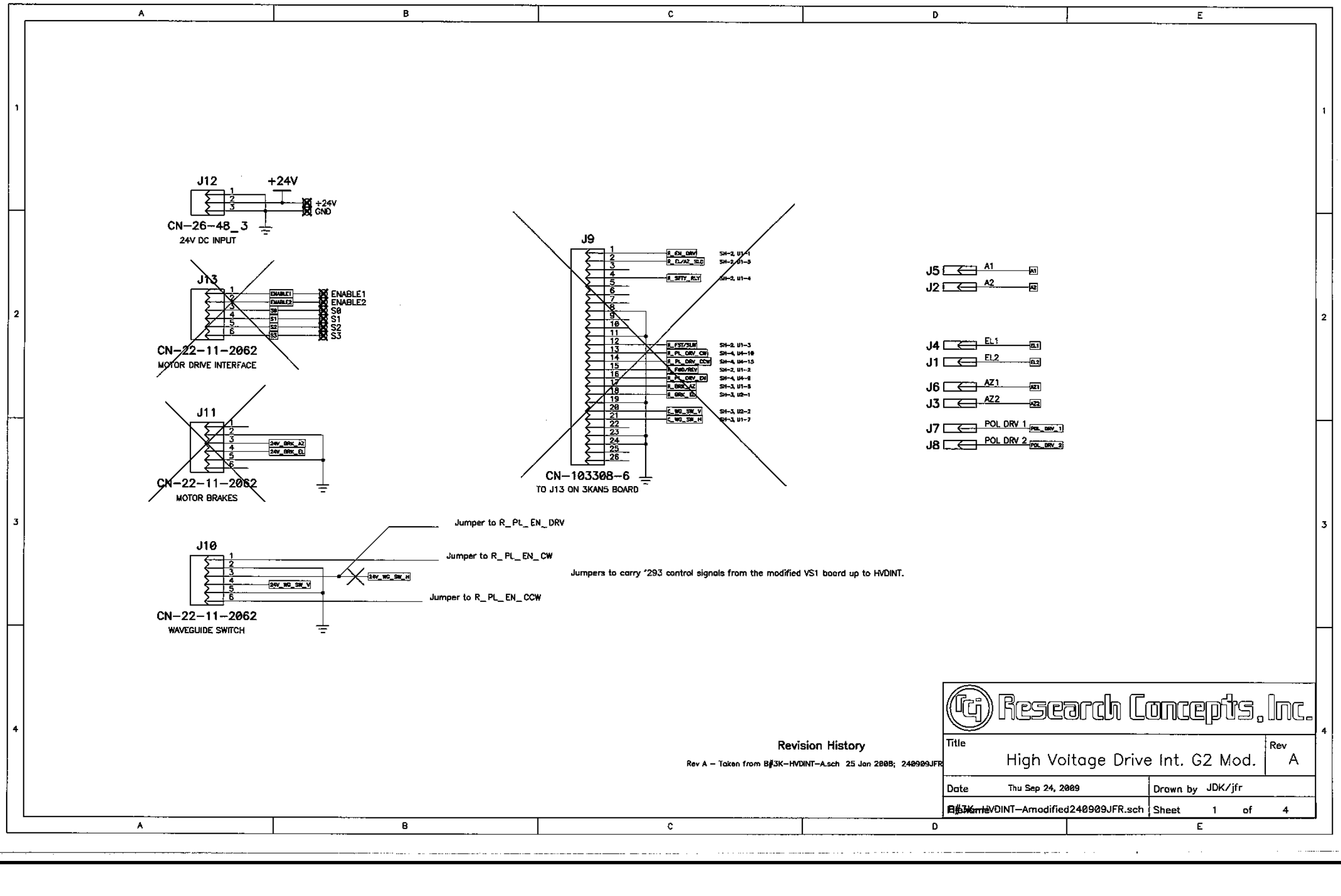
CONFIGURATION ITEM	N5	F2						INSTALL VALUE
TRACK								
Search Enable	0							
Max Track Error	3							
Search Width	4							
Peakup Holdoff Time	120							
Track Signal Source	2							
Signal Sample Time	2							
REMOTE CONTROL								
Remote Enabled	1							
Bus Address	50							
Baud Rate	6							
STOW / DEPLOY								
AZ STOW	0.0							
EL STOW	95.0							
PL STOW	0.0							
AZ DEPLOY	0.0							
EL DEPLOY	60.0							
PL DEPLOY	0.0							
PL ENABLED	2							

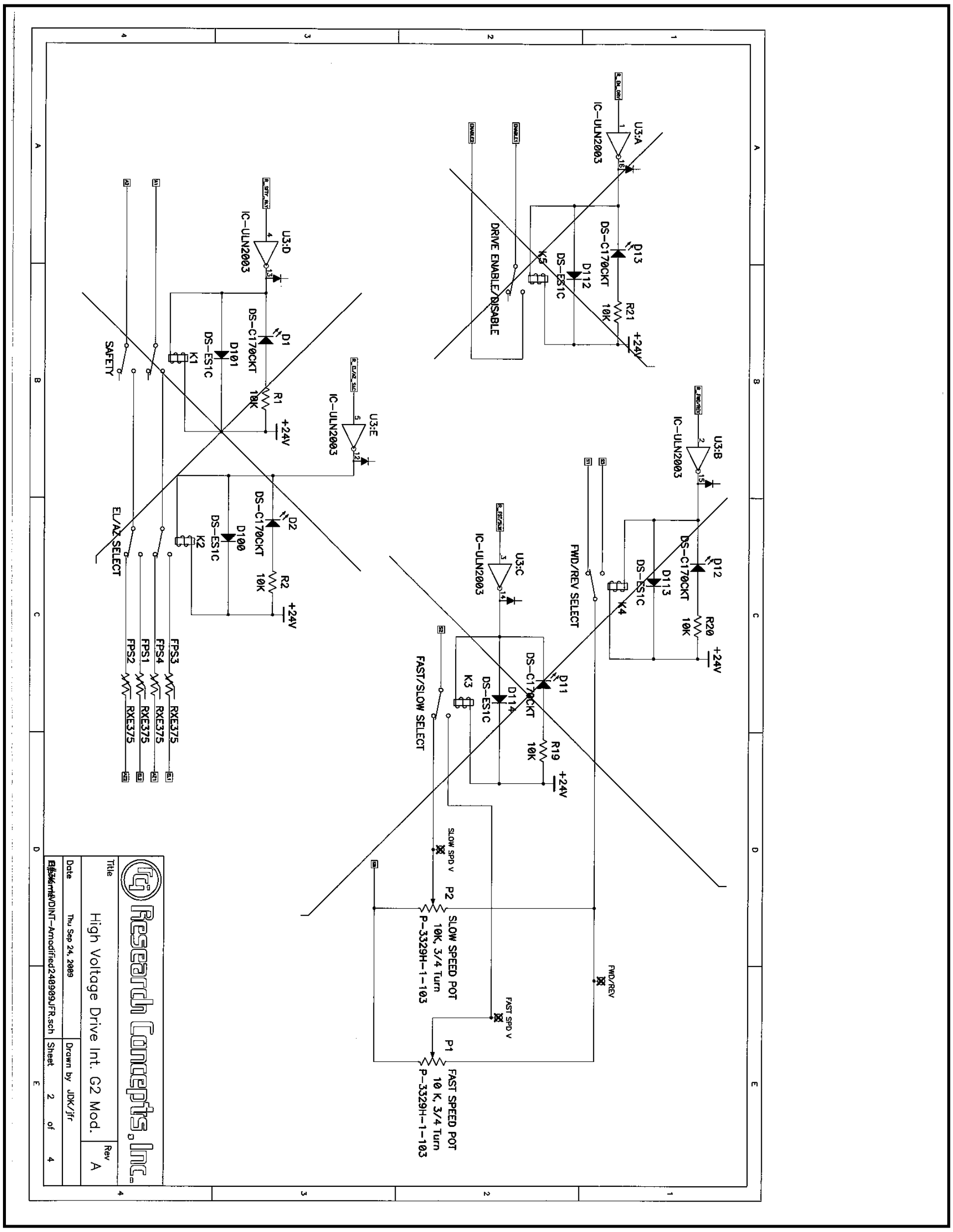
4.2 schematics

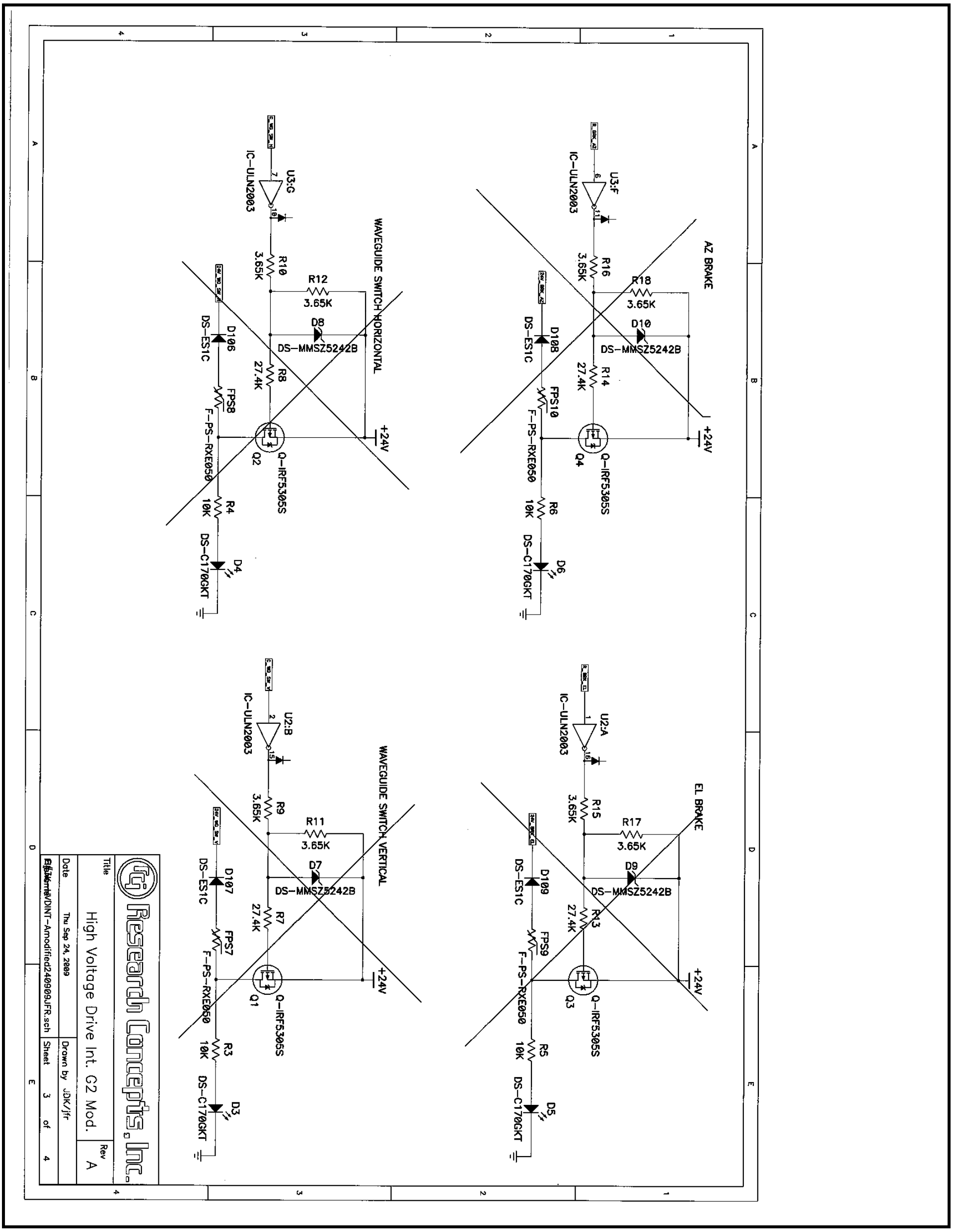
AIU card

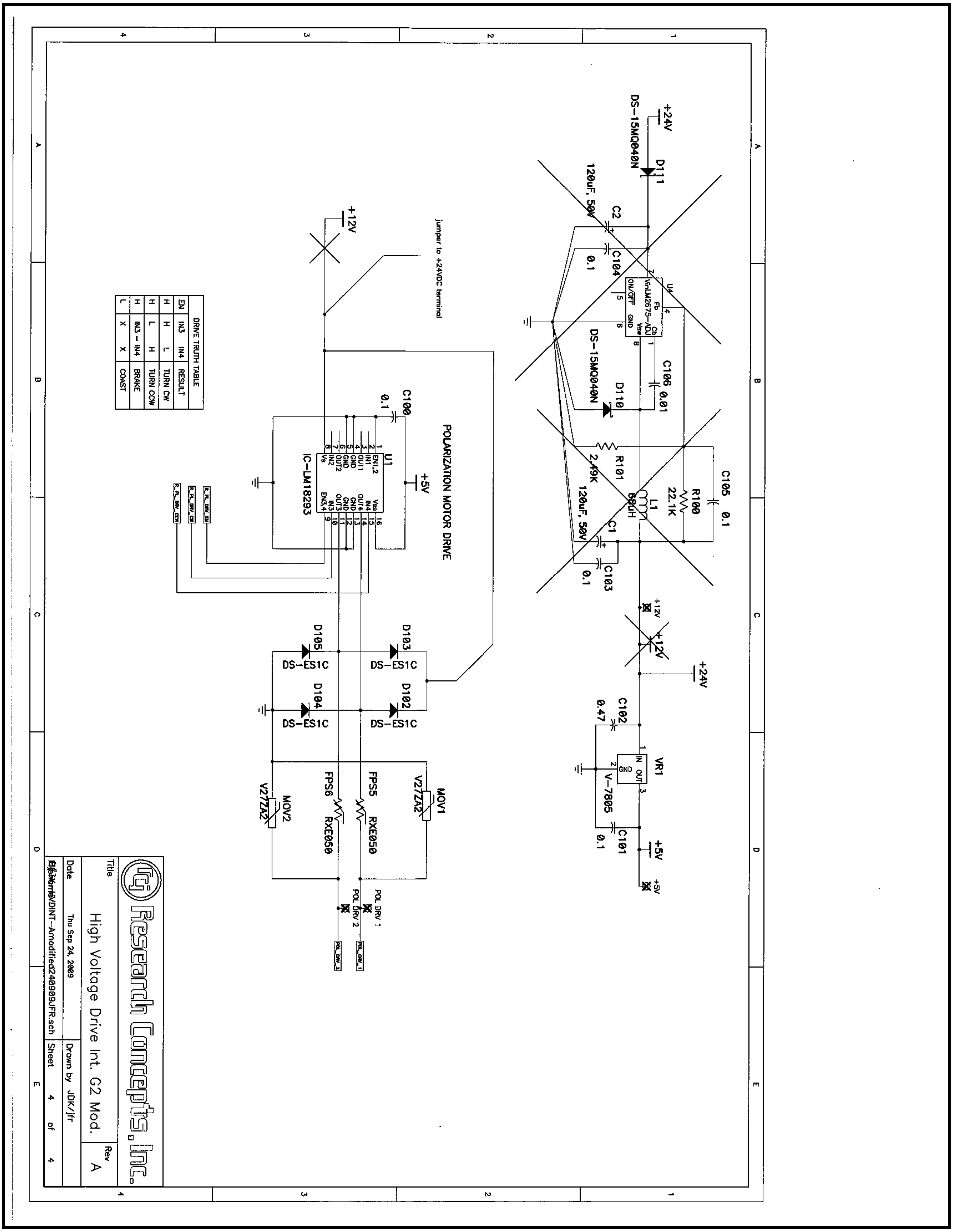

CN-103308-6
J2
RN1
4.7K
+5V
U1
IC-22V10C
C2
U2:1 RB1 220 U2:16 D2:C jmp UB1:A
U2:2 RB2 220 U2:15 D4:C jmp UB1:B
U2:3 RB3 220 U2:14 D6:C jmp UB1:C
U2:4 RB4 220 U2:13 D8:C jmp UB1:D
U2:5 RB5 220 U2:12 D10:C jmp UB2:A
U2:6 RB6 220 U2:11 D12:C jmp UB3:B
U2:7 RB7 220 U2:10 D14:C jmp UB4:C
U3:12 jmp RB9 220 U3:1 jmp to U3:5
U3:2 nc
U3:3 nc
jmp
jmp D2:A
jmp D4:A
jmp D6:A
jmp D8:A
jmp D10:A
jmp D12:A
jmp D14A
jmp D16:A
nc
J3
CN-P1704978_12
J7 Pins
Research Concepts, Inc.
Title
RC3K VS1 BOARD Modified for 3KG2
Size B
Number B-3KVS1-2 REV A
Rev A
Date Fri Sep 11, 2009
Drawn by JDK
Sheet 1 of 2
B#3KVS1-2REV A modified 11Sept09JDK.sch

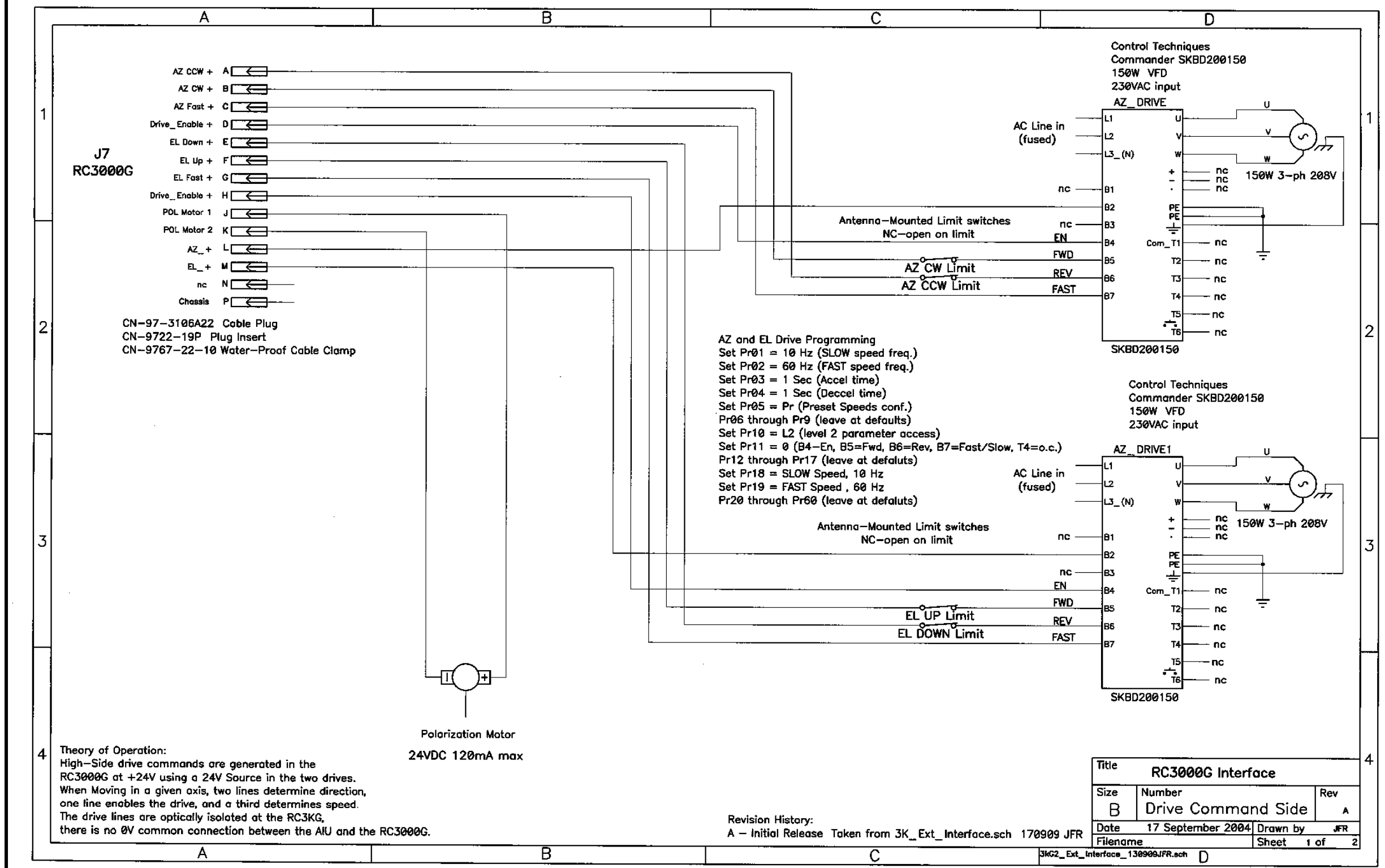

J1
GND
+24V
C4
0.1uF
+12V
C5
0.1uF
+12V
+24V
C3
VR1
Feedback
Vin
GND
on/off
Vout
D1
L1
C1
+5V
R1
+5V
U3:4
RB8
10K
U3:13 jmp
2N4400
QB1
jmp
jmp
SFTY RLY
+24V
G5V-DC-24
K1:A
K1:B
K1:C
D24
D22
D23
FPS1
FPS2
R2
Open
From AZ VFD +24V source
From EL VFD +24V source
Research Concepts, Inc.
Title
RC3K VS1 BOARD Modified for 3KG2
Size
B
Number
B-3KVS1-2 REV A
Rev
A
Date
Fri Sep 11, 2009
Drawn by
JDK
Sheet
2
of
2
B# 3KVS1-2 REV A modified 11Sept09JDK.sch

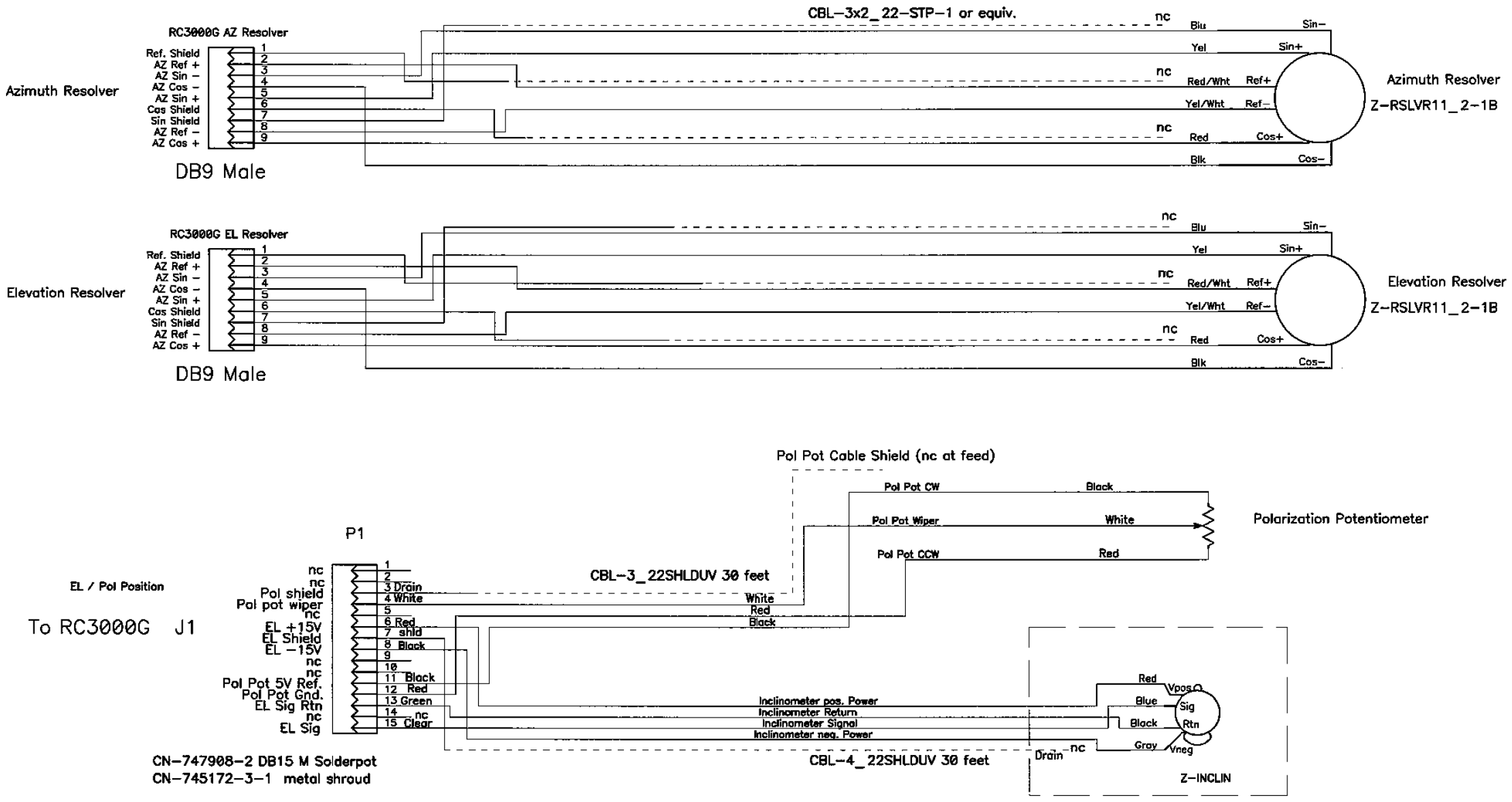

J12
+24V
1
2
3
+24V
GND
CN-26-48_3
24V DC INPUT
J13
ENABLE1
ENABLE2
S0
S1
S2
S3
CN-22-11-2062
MOTOR DRIVE INTERFACE
J11
CN-22-11-2062
MOTOR BRAKES
J9
CN-103308-6
TO J13 ON 3KANS BOARD
J5 A1
J2 A2
J4 EL1
J1 EL2
J6 AZ1
J3 AZ2
J7 POL DRV 1
J8 POL DRV 2
J10
Jumper to R_PL_EN_DRV
Jumper to R_PL_EN_CW
Jumper to R_PL_EN_CCW
CN-22-11-2062
WAVEGUIDE SWITCH
Jumpers to carry '293 control signals from the modified VS1 board up to HVDINT.
Revision History
Rev A – Taken from B/3K-HVDINT-A.sch 25 Jan 2008; 240909JFR
Research Concepts, Inc.
Title
High Voltage Drive Int. G2 Mod.
Rev
A
Date
Thu Sep 24, 2009
Drawn by
JDK/jfr
File
3K-HVDINT-Amodified240909JFR.sch
Sheet
1
of
4


U3:A
IC-ULN2003
D13
DS-C170CKT
D112
DS-ES1C
K5
R21
10K
+24V
DRIVE ENABLE/DISABLE
U3:B
IC-ULN2003
D12
DS-C170CKT
D113
DS-ES1C
K4
R20
10K
+24V
FWD/REV SELECT
U3:C
IC-ULN2003
D11
DS-C170CKT
D114
DS-ES1C
K3
R19
10K
+24V
FAST/SLOW SELECT
U3:D
IC-ULN2003
D1
DS-C170CKT
D101
DS-ES1C
K1
R1
10K
+24V
SAFETY
U3:E
IC-ULN2003
D2
DS-C170CKT
D100
DS-ES1C
K2
R2
10K
+24V
EL/AZ SELECT
FPS3
FPS4
FPS1
FPS2
RXE375
SLOW SPD V
P2
SLOW SPEED POT
10K, 3/4 Turn
P-3329H-1-103
FAST SPD V
P1
FAST SPEED POT
10 K, 3/4 Turn
P-3329H-1-103
FWD/REV
Research Concepts, Inc.
Title
High Voltage Drive Int. G2 Mod.
Rev
A
Date
Thu Sep 24, 2009
Drawn by
JDK/jfr
Sheet
2
of
4


AZ BRAKE
EL BRAKE
WAVEGUIDE SWITCH HORIZONTAL
WAVEGUIDE SWITCH VERTICAL
IC-ULN2003
U3:F
U3:G
U2:A
U2:B
R16
R10
R15
R9
3.65K
R18
R12
R17
R11
D10
D8
D9
D7
DS-MMSZ5242B
R14
R8
R13
R7
27.4K
FPS10
FPS8
FPS9
FPS7
F-PS-RXE050
Q4
Q2
Q3
Q1
Q-IRF5305S
R6
R4
R5
R3
10K
D6
D4
D5
D3
DS-C170GKT
D10B
D10C
D10D
D10A
DS-ES1C
+24V
Research Concepts, Inc.
High Voltage Drive Int. G2 Mod.
Rev A
Thu Sep 24, 2009
Drawn by JDK/jfr
Sheet 3 of 4


+24V
D111
DS-15MQ040N
C2
120uF, 50V
C104
0.1
U4
LM2675-ADJ
Vin
ON/OFF
Fb
GND
Cb
Vsw
DS-15MQ040N
D110
C106
0.01
C105
0.1
R100
22.1K
R101
2.49K
L1
68uH
C1
120uF, 50V
C103
0.1
+12V
+24V
C102
0.47
VR1
IN
OUT
GND
V-7805
C101
0.1
+5V
jumper to +24VDC terminal
POLARIZATION MOTOR DRIVE
C100
0.1
U1
IC-LM18293
EN1,2
IN1
OUT1
GND
OUT2
IN2
Vs
Vss
IN4
OUT4
OUT3
IN3
EN3,4
R_PL_DRV_EN
R_PL_DRV_CW
R_PL_DRV_CCW
DRIVE TRUTH TABLE
EN IN3 IN4 RESULT
H H L TURN CW
H L H TURN CCW
H IN3 = IN4 BRAKE
L X X COAST
D103
DS-ES1C
D105
DS-ES1C
D102
DS-ES1C
D104
DS-ES1C
MOV1
V27ZA2
FPS5
RXE050
FPS6
RXE050
MOV2
V27ZA2
POL DRV 1
POL DRV 2
POL_DRV_1
POL_DRV_2
Research Concepts, Inc.
Title
High Voltage Drive Int. G2 Mod.
Rev
A
Date
Thu Sep 24, 2009
Drawn by JDK/jfr
Sheet 4 of 4


A
B
C
D
J7
RC3000G
AZ CCW + A
AZ CW + B
AZ Fast + C
Drive_Enable + D
EL Down + E
EL Up + F
EL Fast + G
Drive_Enable + H
POL Motor 1 J
POL Motor 2 K
AZ_+ L
EL_+ M
nc N
Chassis P
CN-97-3106A22 Cable Plug
CN-9722-19P Plug Insert
CN-9767-22-10 Water-Proof Cable Clamp
Polarization Motor
24VDC 120mA max
Control Techniques
Commander SKBD200150
150W VFD
230VAC input
AZ_DRIVE
AC Line in
(fused)
L1
L2
L3_(N)
nc B1
B2
nc B3
EN B4
FWD B5
REV B6
FAST B7
U
V
W
PE
PE
Com_T1
T2
T3
T4
T5
T6
nc
150W 3-ph 208V
SKBD200150
Antenna-Mounted Limit switches
NC-open on limit
AZ CW Limit
AZ CCW Limit
AZ and EL Drive Programming
Set Pr01 = 10 Hz (SLOW speed freq.)
Set Pr02 = 60 Hz (FAST speed freq.)
Set Pr03 = 1 Sec (Accel time)
Set Pr04 = 1 Sec (Deccel time)
Set Pr05 = Pr (Preset Speeds conf.)
Pr06 through Pr9 (leave at defaults)
Set Pr10 = L2 (level 2 parameter access)
Set Pr11 = 0 (B4-En, B5=Fwd, B6=Rev, B7=Fast/Slow, T4=o.c.)
Pr12 through Pr17 (leave at defaluts)
Set Pr18 = SLOW Speed, 10 Hz
Set Pr19 = FAST Speed , 60 Hz
Pr20 through Pr60 (leave at defaluts)
Control Techniques
Commander SKBD200150
150W VFD
230VAC input
AZ_DRIVE1
EL UP Limit
EL DOWN Limit
Theory of Operation:
High-Side drive commands are generated in the
RC3000G at +24V using a 24V Source in the two drives.
When Moving in a given axis, two lines determine direction,
one line enables the drive, and a third determines speed.
The drive lines are optically isolated at the RC3KG,
there is no 0V common connection between the AIU and the RC3000G.
Revision History:
A - Initial Release Taken from 3K_Ext_Interface.sch 170909 JFR
Title
RC3000G Interface
Size
B
Number
Drive Command Side
Rev
A
Date
17 September 2004
Drawn by
JFR
Filename
3kG2_Ext_Interface_130909JFR.sch
Sheet
1 of 2


A
B
C
D
CBL–3x2_22–STP–1 or equiv.
RC3000G AZ Resolver
Azimuth Resolver
Ref. Shield 1
AZ Ref + 2
AZ Sin – 3
AZ Cos – 4
AZ Sin + 5
Cos Shield 6
Sin Shield 7
AZ Ref – 8
AZ Cos + 9
DB9 Male
nc
Blu
Yel
Red/Wht
Yel/Wht
Red
Blk
Sin–
Sin+
Ref+
Ref–
Cos+
Cos–
Azimuth Resolver
Z–RSLVR11_2–1B
RC3000G EL Resolver
Elevation Resolver
Ref. Shield 1
AZ Ref + 2
AZ Sin – 3
AZ Cos – 4
AZ Sin + 5
Cos Shield 6
Sin Shield 7
AZ Ref – 8
AZ Cos + 9
DB9 Male
Elevation Resolver
Z–RSLVR11_2–1B
Pol Pot Cable Shield (nc at feed)
Pol Pot CW
Pol Pot Wiper
Pol Pot CCW
Black
White
Red
Polarization Potentiometer
P1
EL / Pol Position
To RC3000G J1
nc 1
nc 2
Pol shield 3 Drain
Pol pot wiper 4 White
nc 5
EL +15V 6 Red
EL Shield 7 shld
EL –15V 8 Black
nc 9
nc 10
Pol Pot 5V Ref. 11 Black
Pol Pot Gnd. 12 Red
EL Sig Rtn 13 Green
nc 14 nc
EL Sig 15 Clear
CBL–3_22SHLDUV 30 feet
White
Red
Black
Inclinometer pos. Power
Inclinometer Return
Inclinometer Signal
Inclinometer neg. Power
Drain
nc
Red
Blue
Black
Gray
Vpos
Sig
Rtn
Vneg
CBL–4_22SHLDUV 30 feet
Z–INCLIN
CN–747908–2 DB15 M Solderpot
CN–745172–3–1 metal shroud
Title RC3000G Interface
Size B
Number Position Sense
Rev A
Date Thu Sep 17, 2009
Drawn by JFR
Filename
Sheet 2 of 2