APPENDIX B - MOUNT SPECIFIC DATA
For
VERTEX/RSI 240 MVO

This appendix describes RC3000 operations unique for two versions (potentiometer or resolver-based) of the Vertex/RSI 240 MVO mount.

Revision History. Date: 19 February 2003 - Software Version: 1.40

1.1 Manual Organization

This appendix is provided as a supplement to the baseline RC3000 manual. Differences between this version and the operation described in the baseline RC3000 manual are noted on a paragraph by paragraph basis.

1.2 RC3000 Features

All features described in the baseline manual are supported.

Note that the optional tracking of inclined orbit satellites is only supported for MVO mounts that have resolvers for azimuth and elevation position sensing.

Hardware Configuration. A RC3000E version of hardware is required for this mount. The E model is similar to a RC3000A (low voltage drive) model but the chassis backpanel contains the correct connectors to mate with standard MVO cables.

Software Configuration. Two variations of the MVO mount are supported by software.

Potentiometer-based mounts (R4).

One software version supports MVO mounts that have potentiometers for the azimuth and elevation axes. This version will be designated as R4. Software will be designated as RC3K-R4-xxx

Resolver-based mounts (R5).

The second version supports mounts having resolvers on the azimuth and elevation axes. This version will be designated as R5. Software will be designated as RC3K-R5-xxx.

Many of the unique functions described in this appendix are common to both the R4 and R5 versions. Unique items to R4 or R5 will be noted.

Military configured mounts (LM).

A slight variation of the R5 software is also provided to support military operations. This version is designated as LM. The LM software version is almost identical to the R5 but it disables expert access at power up and only uses one of signal strength input channels. All documentation for the R5 version is applicable to the LM version. The few items unique to the LM version will be noted throughout the remaining text.

1.3.1 Controller Description

RESOLVER BOARD. To support the R5 version, an additional resolver to digital conversion board must be added to the baseline RC3000 hardware. A schematic of this board is shown in section 4.2.

HPA DISABLE. A modified version of the RC3000 ‘s waveguide switch board is used to mechanize a relay for the HPA disable function.

1.3.2 System Interface Requirements

The following unique interface requirements are common to the R4 and R5 versions:

- RC3000 relays normally used for HPA and alarm contact closure are used to energize azimuth and elevation brakes
- The MVO’s CCW polarization limit switch drives the RC3000’s polarization stow limit input
- Feed type is sensed via the RC3000 inputs normally used to sense pulse inputs.

The azimuth potentiometer input is used only for the R4 version.

Additionally the following unique interface requirements exist for the R5 version:

- No azimuth potentiometer exists, a resolver is used for sensing azimuth position and for performing high resolution movements in azimuth.
- A resolver is used for high resolution movements in elevation.

1.3.3 Operational Overview

Operation of the R4 and R5 versions 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. In addtion to azimuth cw and ccw limit switches, azimuth software limits are implemented (R5 only). An elevation UP software limit is also implemented for the R5 version.

Jam and Runaway Sensing. Jammed and runaway sensing is based on resolver counts (R5 only).

2.0 INSTALLATION

2.1.1 RC3000 Antenna Controller

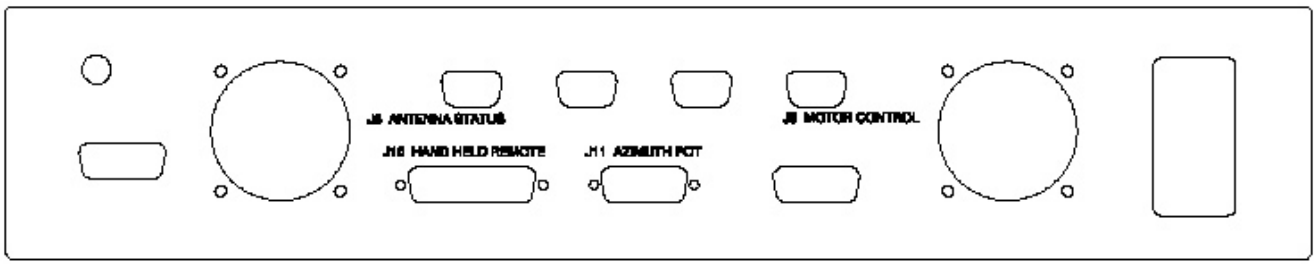
The RC3000E is slightly deeper (19.1” vs. 17.05”) than the baseline RC3000. This additional depth is required to accommodate the backpanel with MVO connectors.

2.1.4 Electronic Clinometer

The inclinometer should be rigged with the backstructure vertical. With the backstructure vertical, the inclinometer should be mounted so that it is 22.7 (35.0 –22.3) degrees from vertical. This orientation will allow linear output from the inclinometer to a RF angle of 90 degrees.

2.2 Electrical Connections.

The RC3000E’s backpanel contains the standard connectors for use with the RSI MVO’s antenna status (J8) and motor control (J9) cabling. The following diagram shows this backpanel.



2.2.1 Power Entry

The RC3000E has the same fuse requirements as the RC3050A model (8 A. for 115, 4 A. for 230).

2.2.2 Motor Drive

2.2.3 Drive Sense

2.2.4 Limit Switches

2.2.7 Accessories

2.2.10 Pulse Sensors

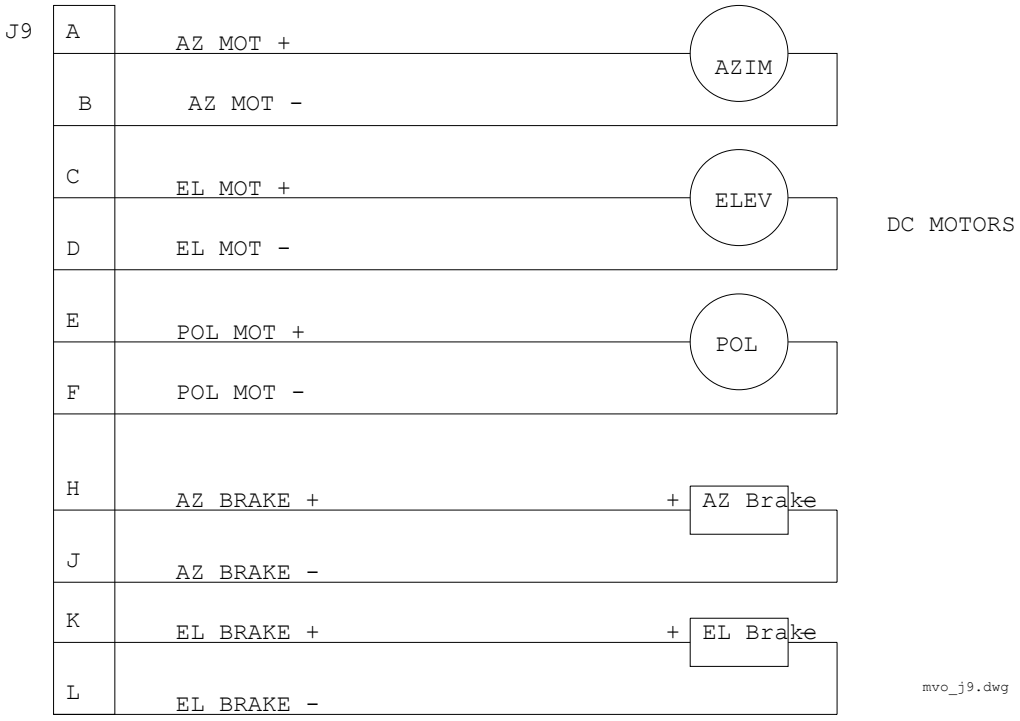
Internal to the RC3000E is cabling that adapts these standard interface connections shown in the baseline manual to the MVO style connectors on the backpanel. Schematics are provided in section 4.2 showing this adaptation.

NOTE: The relays provided via the RC3000’s Accessories connector are used to energize the azimuth and elevation brakes. Also the RC3000’s Pulse Sensor inputs are used for sensing the status of the MVO’s feed type inputs. The mechanization of these inputs is shown in the adapter cable schematic.

The individual MVO connectors are now discussed.

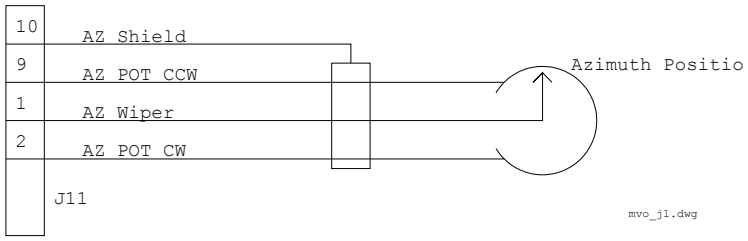
Motor Control.

Azimuth, elevation and polarization drive commands along with azimuth and elevation brake control is provided via J9. J9 is a female 35 pin Amphemnol MS (size 28-15) type connector.



Azimuth Potentiometer (R4 only).

The azimuth potientiometer is interfaced via J11. J11 is a female DB-15 type connector.



NOTE: J11 is used for the azimuth resolver on the R5 version.

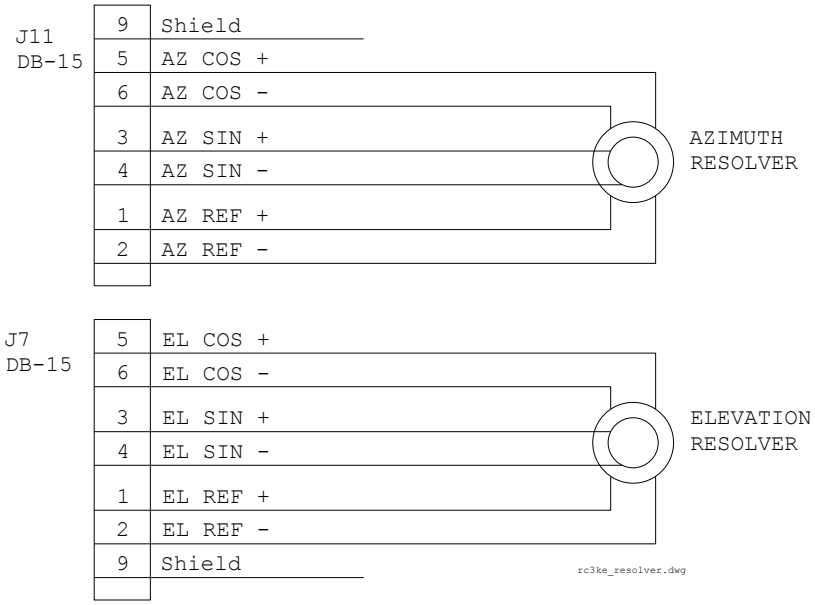
Antenna Status.

Limit switch status, feed type status, polarization and elevation position is provided via the J8 connector. J8 is a female 37 pin Amphemnol MS (size 28-21) type connector.

Pinouts for the J8 connectors are shown on the following page.

2.2.12 Resolver inputs (R5 only)

J11 and J7 are used for the azimuth and elevation resolver interfaces.



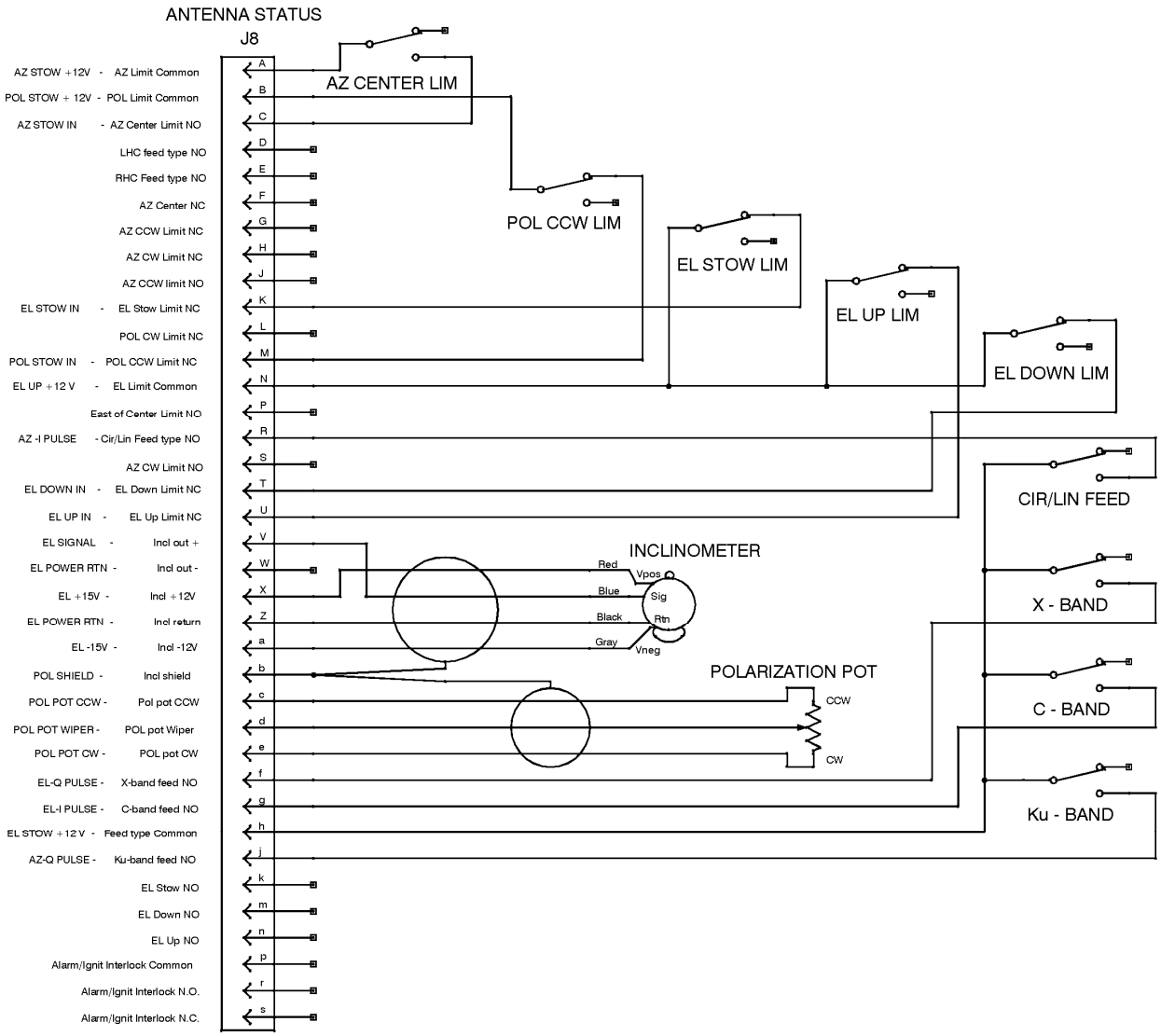
2.2.5 Signal Strength

NOTE: The gain and offset potentiometers associated with the signal strength connector are recessed from the backpanel on the RC3000E model. The lid of the RC3000 will have to be removed in order to calibrate these pots. This connector is designated J2 on the 3000E backpanel.

2.2.6 Navigation Sensors

On “baseline” RC3000’s the J9 connector is a 37 pin connector. An adapter “dongle” is supplied that adapts the DB-37 to two DB-9 connectors.

The RC3000E model supplies the two DB-9 connectors (J4-GPS, J5-Fluxgate) directly on the backpanel. Pinouts for these DB-9s are as shown in the baseline manual.


ANTENNA STATUS
J8
AZ STOW +12V - AZ Limit Common
POL STOW + 12V - POL Limit Common
AZ STOW IN - AZ Center Limit NO
LHC feed type NO
RHC Feed type NO
AZ Center NC
AZ CCW Limit NC
AZ CW Limit NC
AZ CCW limit NO
EL STOW IN - EL Stow Limit NC
POL CW Limit NC
POL STOW IN - POL CCW Limit NC
EL UP +12 V - EL Limit Common
East of Center Limit NO
AZ -I PULSE - Cir/Lin Feed type NO
AZ CW Limit NO
EL DOWN IN - EL Down Limit NC
EL UP IN - EL Up Limit NC
EL SIGNAL - Incl out +
EL POWER RTN - Incl out -
EL +15V - Incl +12V
EL POWER RTN - Incl return
EL -15V - Incl -12V
POL SHIELD - Incl shield
POL POT CCW - Pol pot CCW
POL POT WIPER - POL pot Wiper
POL POT CW - POL pot CW
EL-Q PULSE - X-band feed NO
EL-I PULSE - C-band feed NO
EL STOW +12 V - Feed type Common
AZ-Q PULSE - Ku-band feed NO
EL Stow NO
EL Down NO
EL Up NO
Alarm/Ignit Interlock Common
Alarm/Ignit Interlock N.O.
Alarm/Ignit Interlock N.C.
A
B
C
D
E
F
G
H
J
K
L
M
N
P
R
S
T
U
V
W
X
Z
a
b
c
d
e
f
g
h
j
k
m
n
p
r
s
AZ CENTER LIM
POL CCW LIM
EL STOW LIM
EL UP LIM
EL DOWN LIM
CIR/LIN FEED
X - BAND
C - BAND
Ku - BAND
INCLINOMETER
Red
Blue
Black
Gray
Vpos
Sig
Rtn
Vneg
POLARIZATION POT
CCW
CW

2.2.9 Hand Held Remote

NOTE: When the handheld remote control is placed in “MANUAL”, the RC3000 energizes (releases) the azimuth and elevation brakes until the HHR is placed back in the “COMPUTER” position.

2.2.8 RF Autopeak Designated as J1 for RC3000E.

2.2.11 PC Remote Control Designated as J3 for RC3000E.

These connectors are provided on the backpanel of the RC3000E. Their function is as described in the baseline manual.

2.3 Initial Configuration

2.3.1 Software Initialization

Reset Defaults. The table at the end of the document supplies the default configuration item values for the R4 and R5 versions.

NOTE: All configuration item values should be examined to determine if they are appropriate for your specific installation.

2.3.2 Elevation Calibration

Both the R4 and R5 versions utilize an inclinometer on the elevation axis. Elevation calibration will be as described in the baseline manual.

Elevation Reference Position. Both the inclinometer and elevation resolver (R5 only) should be calibrated while the backstructure is vertical (i.e. the elevation reference position).

With the inclinometer oriented as described in 2.1.4 the elevation reference voltage should be approximately 1.45 volts.

Resolver Calibration (R5 only).

R5 also mechanizes a resolver on the elevation axis. The following modified steps are required for elevation calibration.

Sensor Polarity. The inclinometer should increase in voltage when going up, elevation resolver count (R5 only) should also increase.

Rotate the elevation resolver until a raw resolver angle of approximately 122.3 degrees in seen in the MAINTENANCE-VOLTS screen. Lock the elevation resolver in place and observe the raw resolver angle. Subtract 22.3 from this observed angle and enter it as the elevation resolver offset (see 3.3.1.2.2).

2.3.3 Azimuth Calibration.

R4 Version - The only position sensor on the azimuth axis is a potentiometer. Azimuth calibration will be as described in the baseline manual.

R5 Version - The only position sensor on the azimuth axis is the resolver. The following modified steps are required for azimuth calibration.

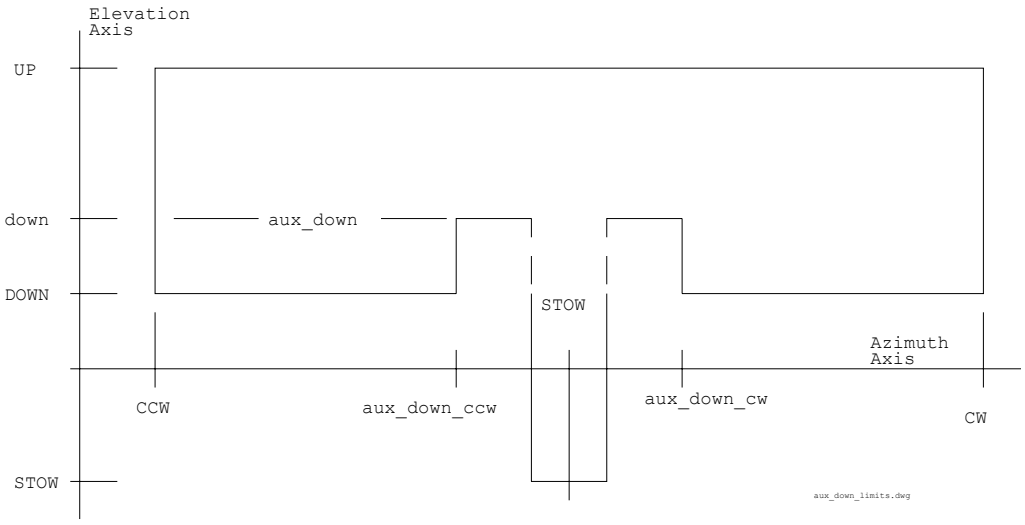
Sensor Polarity. Azimuth resolver “counts” should increase as the mount rotates clockwise. If it does not, the polarity may be changed by setting the azimuth resolver reverse flag.

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. In addition to using CW and CCW limit switch inputs, 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.

Auxiliary Down Region Calibration (R5 only).

The R5 version implements an “auxiliary down region” that allows the mount to achieve lower elevation look angles (in some areas of travel) than is normally permitted. Compare the following drawing to the drawing in section 1.3.7 of the baseline manual. The auxiliary down region prevents the mount’s feed boom from contacting the top of the vehicle when the azimuth position is near the center of travel. This auxiliary region is defined by software values as discussed in section 3.3.1.3.14.



When outside of the auxiliary region, the down limit is defined by the hardware elevation down limit switch. The auxiliary down region allows the hardware limit switch to be set lower than normal.

To define the auxiliary down region, move the antenna clockwise and counterclockwise to azimuth positions where the boom can safely move below obstructions on the top of the vehicle. Note the azimuth resolver count at these positions. These counts will define the aux_down_ccw and aux_down_cw values.

Also note the elevation resolver count that the boom needs to stay above to ensure that the top of the vehicle will not be contacted. This count will define the aux_down value.

Having recorded the aux_down_ccw, aux_down_cw and aux_down resolver counts, go to the AUX_DOWN configuration screen (3.3.1.3.14) and enter the values.

When elevation movement is restricted by the auxiliary down software values, the elevation limit field in the MANUAL mode will display “down” vs. “DOWN” which is displayed when the hardware limit is encountered.

NOTE: If one does not care to implement an auxiliary down region, set the aux_down value to a count that is below the hardware down limit position. This will effectively keep the “down” limit indication from happening.

2.3.4 Polarization Calibration.

Separate reference voltages are maintained for the three linear feed types. At power up the linear feed type is sensed and the reference voltage stored for that feed type is used. Therefore the reference voltage for each linear feed type used should be separately set.

3.2.1 Manual Mode.

If the feed type input has sensed that a circular polarized feed is installed, no POL field will be displayed since the RC3000 assumes that there is no need for polarization feedback from a circular polarized system.

R5 only - The azimuth angle is generated as a function of the azimuth resolver feedback. Elevation angle represents true mount elevation based on feedback from the inclinometer. The scroll up key will switch the display between azimuth and elevation angles to resolver “counts”.

R5 only - When elevation is below the DOWN limit, the displayed elevation angle will be derived from the elevation resolver.

R5 only - When the auxiliary down region is active the limit display will indicate “down” vs. “DOWN”.

3.2.2.2 Stow

As part of the STOW sequence the polarization axis will be driven to the polarization CCW limit when a linear feed is attached. If the polarization axis is not at the CCW limit, elevation movement below the DOWN limit will not be allowed.

3.2.2.8 Settings (LM only)

The only setting available to be changed is the state of the expert access permission flag. Note that for the LQ version, expert access will always be initialized to the OFF state at power up.

```
1-EXPERT ACCESS:OFF          SETTINGS


<1>CHANGE SETTING
```

When the “1” key is pressed the user is prompted to provide the expert access code (see appendix A) to toggle the value between “OFF” and “ON”.

```
1-EXPERT ACCESS:12345        SETTINGS


<5 DIGIT CODE>TOGGLE OFF/ON
```

If a drive error (such as jam or runaway) occurs, the error may be reset from the SETTINGS screen as described in the baseline manual.

3.3.1.2.2 Elevation Calibration (R5 only)

In addition to the normal inclinometer calibration items, two elevation resolver calibration items are included.

```
REF_V:1.69 OFF:  0.0        CONFIG-ELEV
 DOWN:  0   UP: 90.0   SF:50.00
 LOOK:1    RES: 0.0   REV:0
SET REFERENCE VOLTAGE <0.50 - 3.50>
```

RES: ELEV RESOLVER OFFSET<+/-300.00 DEGREES>

The elev_resolver_offset configuration item defines the offset to be applied to the angle read directly from the elevation resolver for the purpose of displaying elevation angle. Example: If when at the elevation reference (stow) position the raw elevation resolver angle reads 122.3, a elev_resolver_offset of -100.0 will result in a resolver based elevation angle of 22.3.

NOTE: the resolver-based angle is displayed in MANUAL mode when the elevation DOWN limit is active.

REV: ELEV RESOLVER<0-NORMAL 1-REVERSED>

The elev_resolver_reversed configuration item defines whether the polarity of the elevation resolver matches that of the RC3000 resolver circuitry. If the raw elevation resolver angle decreases as the mount moves up, the elev_resolver_reversed item must be described as reversed.

3.3.1.2.3 Azimuth Calibration (R5 only).

In addition to the normal azimuth calibration items, two azimuth resolver calibration items are included. No azimuth reference_voltage item is displayed since no azimuth potentiometer is present.

```
          OFF: 0.0          CONFIG-AZIM
  CCW:180   CW:180
  RES: 0.0 REV:0
SET REFERENCE VOLTAGE <2.00 - 3.00>
```

RES: AZIM RESOLVER OFFSET<+/-300.00 DEGREES>

The azim_resolver_offset configuration item defines the offset to be applied to the angle read directly from the azimuth resolver for the purpose of displaying azimuth angle. Example: If when at the azimuth stow position the raw azimuth resolver angle reads 181.3, a azim_resolver_offset of –181.3 will result in a resolver based azimuth angle of 0.0.

REV: ELEV RESOLVER<0-NORMAL 1-REVERSED>

The elev_resolver_reversed configuration item defines whether the polarity of the elevation resolver matches that of the RC3000 resolver circuitry. If the raw elevation resolver angle decreases as the mount moves up, the elev_resolver_reversed item must be described as reversed.

3.3.1.3.2 Azimuth Pot Drive (R5 only)

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 (R5 only).

3.3.1.3.6 Elevation Pulse Drive (R5 only)

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.

3.3.1.3.14 Auxiliary Down Region (R5 only)

The AUX DOWN configuration screen allows the values for aux_down_ccw, aux_down_cw and aux_down as discussed in section 2.3.3 to be entered.

```
 CCW:32768                CONFIG-AUX DOWN
  CW:32768
DOWN:  100
AUX CCW RESOLVER COUNT <100 - 65535>
```

3.3.2.1 Analog to Digital Voltages

R5 only - In addition to the normal voltages displayed this screen also shows "raw resolver" angles and counts.

```
AZ: 1.114   181.30 33004    AD VOLTAGES
EL: 1.143 1 122.30 22264   22.3     L1:0
POL:2.237                          L2:1
SIG: 3.756(1) <1>RF <2>SS1 <3>SS2 <4>GND
```

The azimuth and elevation resolver angles and counts displayed are read directly from the resolvers without being biased by offset terms. NOTE: The displayed values will reflect if the azimuth or elevation resolver polarity has been reversed.

As an aid in calibrating the elevation resolver, the angle resulting from applying offset and reverse factors is also displayed.

3.3.2.5 Limits Maintenance

```
AZIM CW:0  CCW:1  STOW:0          LIMITS
ELEV UP:1   DN:1  STOW:1  f:1 E:1 ACTIVE
 POL CW:0  CCW:1  STOW:1  j:0 R:0  REM:1
<BKSP>MAKE LIMITS INACTIVE    <MODE>EXIT
```

REM:1

In addition to the normal limit switch state information, this screen also shows the state of the handheld remote/computer switch. The REM field will be 1 if the handheld remote is attached and the remote/computer switch is at remote. If the switch is at computer or if the handheld remote is not attached, the REM field will indicate 0.

f:1 E:1

j:0 R:0

The state of the feed type inputs is also shown. The letters f, j, E and R correspond to corresponding pin in the connector. A 1 indicates that a switch closure is sensed at the pin. Note that E actually represents a logical OR'ing of pins E and D. The following table shows how the feed input combinations are interpretted.

Pin f	Pin j	Pin E	Pin R	Sensed Feed Type
0	0	0	1	C-Band Linear
0	0	1	0	C-Band Circular
0	1	0	0	X-Band Circular

0	1	0	1	Ku-Band Linear
1	1	0	0	Ka-Band Circular
1	1	0	1	Ka-Band Linear
All other combinations				INVALID FEED TYPE

3.3.1.2 Reset Defaults

The following table supplies the default configuration item values for this mount. 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	R4	R5	LM unique				INSTALL VALUE
SYSTEM DEFINITION							
Antenna_size_cm	240	240					
GPS	1	1					
COMP	1	1	2				
MODE	2	2					
WAVE	0	0					
ELEVATION CALIBRATION							
Zero Voltage	0.81	0.81					
Elev_offset	0.0	0.0					
Up_elev_limit	90	90					
Down_elev_limit	10	10					
Elevation_Scale_Factor	50.00	50.00					
Elevation_look_configuration	1	1					
Res	N/A	0.00					
Rev	N/A	0					
AZIMUTH CALIBRATION							
Reference_voltage	2.50	N/A					
Azim_Scale_Factor	56.25	N/A					
Azim_offset	0.0	0.0					
ccw_azim_limit	135	135					
Cw_azim_limit	135	135					
Res	N/A	0.00					
Rev	N/A	1					
POLARIZATION CAL							
Zero Voltage	2.50	2.50					
Polarization_Offset	0.0	0.0					
CW Polarization Limit	90.0	90.0					
CCW Polarization Limit	90.0	90.0					
Pol_Scale_Factor	40.90	40.90					
Polarization_type	2	2					
H/V_Reference	0	0					
Default Horizontal Position	-45.0	-45.0					
Default Vertical Position	45.0	45.0					
Pol_Automove_Enable	1	1					
SIGNAL PARAMETERS							
RF_Lock	0	0					
RF_Time	0.1	0.1					
Channel 1 Polarity	1	1					
Channel 1 Threshold	100	100					
Channel 1 Delay	0.1	0.1					
Channel 1 Lock Type	0	0					
Channel 2 Polarity	1	1					
Channel 2 Threshold	100	100					
Channel 2 Delay	0.1	0.1					
Channel 2 Lock Type	0	0					

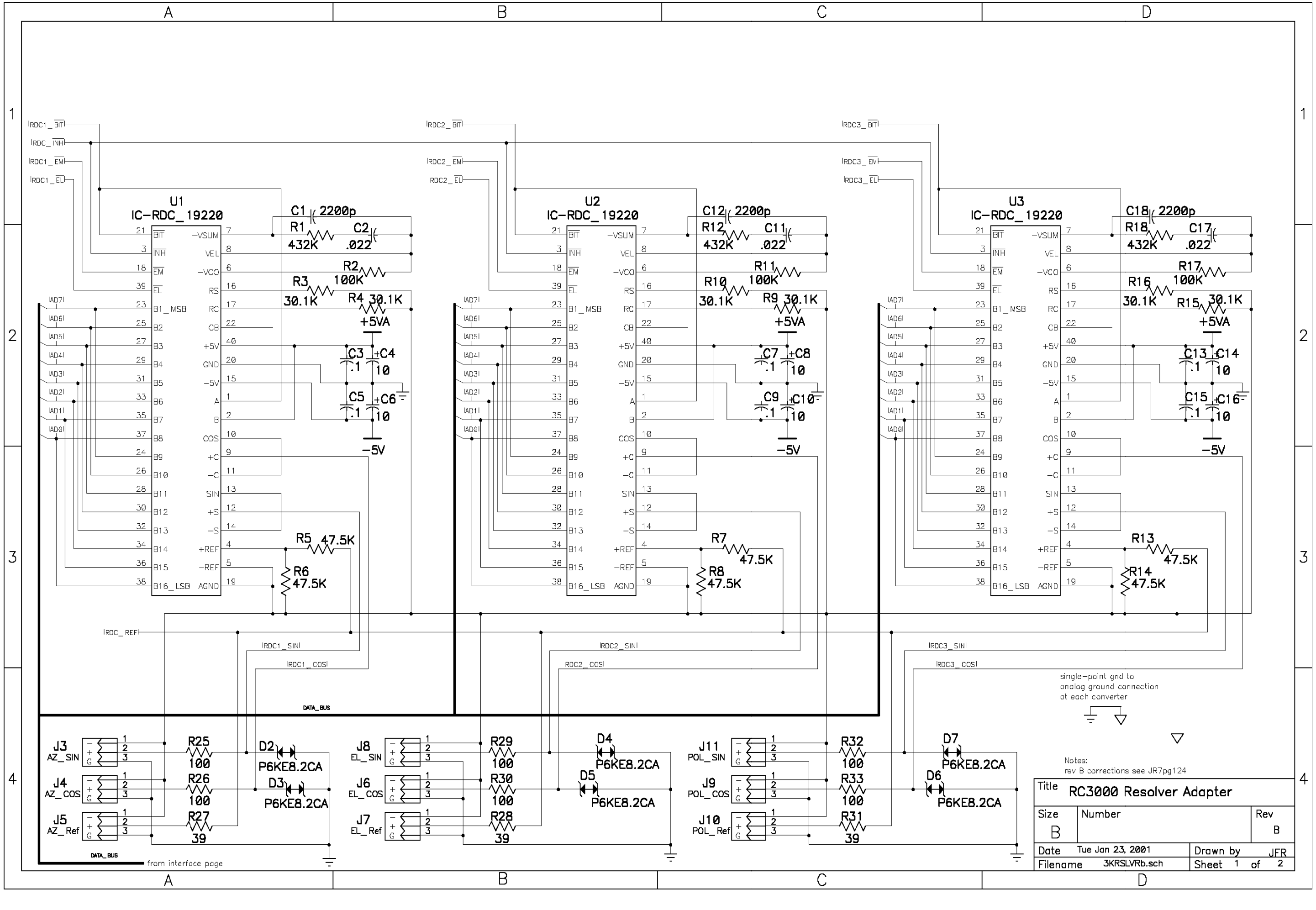
CONFIGURATION ITEM	R4	R5	LM unique					INSTALL VALUE
AUTOPEAK								
Autopeak Enabled	0	0						
Signal Source	1	1	3					
RF Band	1	1						
Spiral Search AZ Limit	5	5						
Spiral Search EL Limit	5	5						
Spiral Signal Threshold	200	200						
Scan Range Limit	4	4						
Scan Signal Threshold	200	200						
AZIMUTH POT DRIVE								
Fast/Slow Threshold	2.5	2.5						
Maximum Position Error	0.20	0.20						
Coast Threshold	0.1	0.1						
Maximum Retry Count	3	3						
AZIMUTH PULSE DRIVE								
Pulse Scale Factor	N/A	10431						
CW Pulse Limit	N/A	65000						
CCW Pulse Limit	N/A	1000						
Fast/Slow Threshold	N/A	100						
Maximum Position Error	N/A	2						
Coast Threshold	N/A	3						
Maximum Retry Count	N/A	2						
AZIM DRIVE MONITORING								
Jam Slop	1	1						
Runaway Slop	200	200						
Fast Deadband	1000	1000						
Slow Deadband	500	500						
ELEV POT DRIVE								
Fast/Slow Threshold	3.0	1.0						
Maximum Position Error	0.2	0.2						
Coast Threshold	0.4	0.4						
Maximum Retry Count	3	3						
ELEV PULSE DRIVE								
Pulse Scale Factor	N/A	10431						
UP Pulse Limit	N/A	65000						
Down Pulse Limit	N/A	1000						
Fast/Slow Threshold	N/A	100						
Maximum Position Error	N/A	2						
Coast Threshold	N/A	3						
Maximum Retry Count	N/A	2						
ELEV DRIVE MONITORING								
Jam Slop	1	1						
Runaway Slop	200	200						
Fast Deadband	1000	1000						
Slow Deadband	500	500						

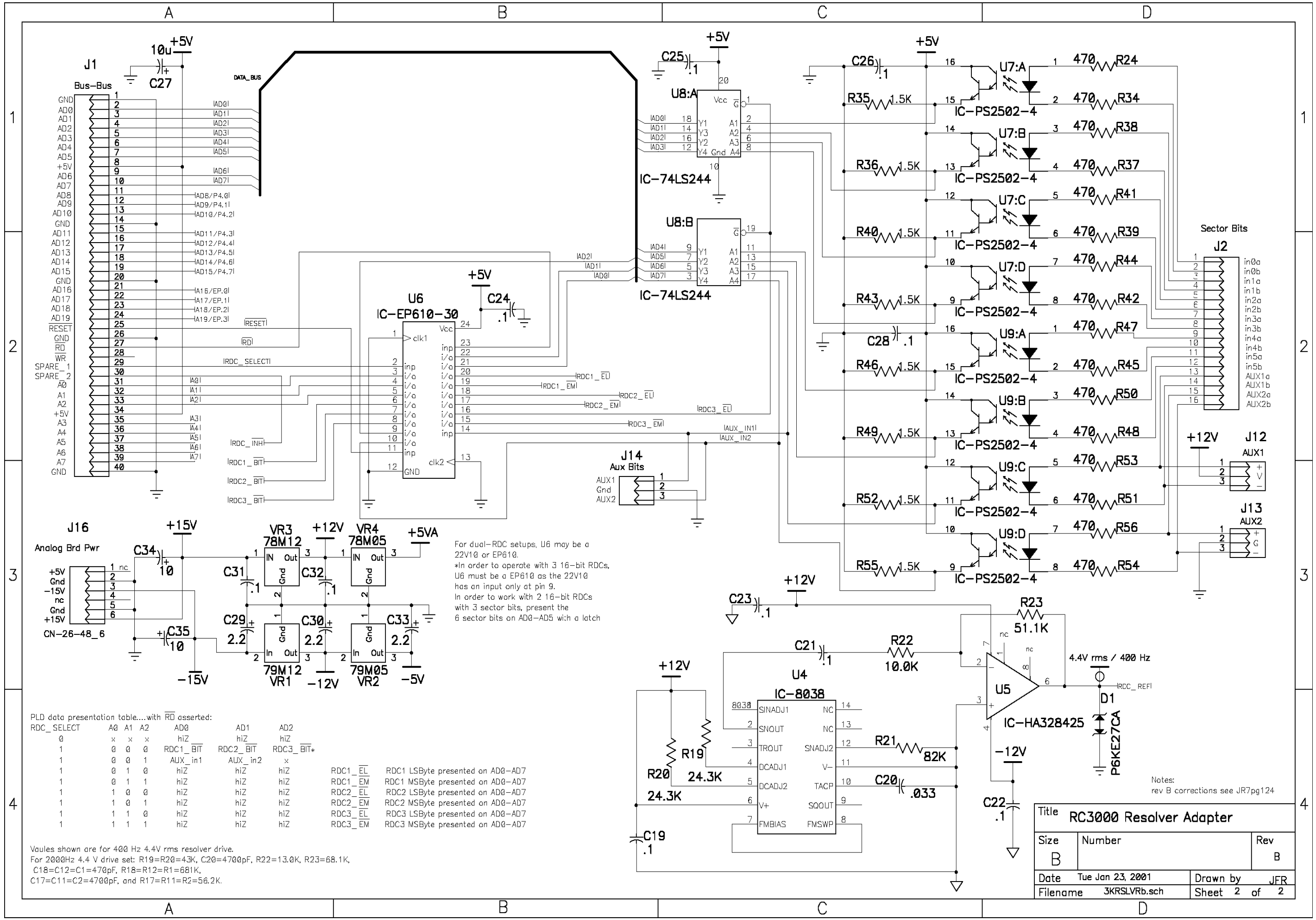
CONFIGURATION ITEM	**R4**	**R5**	**LM unique**					**INSTALL VALUE**
POL POT DRIVE								
Fast/Slow Threshold	2.0	2.0						
Maximum Position Error	0.5	0.5						
Coast Threshold	0.3	0.3						
Maximum Retry Count	3	3						
POL DRIVE MONITORING								
Jam Slop	1	1						
Runaway Slop	200	200						
Fast Deadband	1000	1000						
Slow Deadband	500	500						
TRACK								
Search Enable	N/A	0						
Max Track Error	N/A	3						
Search Width	N/A	4						
Peakup Holdoff Time	N/A	120						
Track Signal Source	N/A	SS1	SS2					
Signal Sample Time	N/A	2						
REMOTE CONTROL								
Remote Enabled	1	1						
Bus Address	50	50						
Baud Rate	6	6						
Jog	20	20						
STOW / DEPLOY								
AZ STOW	0.0	0.0						
EL STOW	-67.5	-67.5						
PL STOW	-95.0	-95.0						
AZ DEPLOY	0.0	0.0						
EL DEPLOY	22.3	22.3						
PL DEPLOY	0.0	0.0						
PL ENABLED	1	1						
AUXILIARY DOWN								
AUX DOWN CCW	N/A	32768						
AUX DOWN CW	N/A	32768						
AUX DOWN	N/A	100						

4.2 Schematics

- Resolver board

- Backpanel Interconnects


A
B
C
D
1
2
3
4
IRDC1_BIT
IRDC_INH
IRDC1_EM
IRDC1_EL
U1
IC-RDC_19220
C1 2200p
R1 432K
C2 .022
R2 100K
R3 30.1K
R4 30.1K
+5VA
C3 .1
C4 10
C5 .1
C6 10
-5V
R5 47.5K
R6 47.5K
IAD7I
IAD6I
IAD5I
IAD4I
IAD3I
IAD2I
IAD1I
IAD0I
BIT
INH
EM
EL
B1_MSB
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15
B16_LSB
-VSUM
VEL
-VCO
RS
RC
CB
+5V
GND
-5V
A
B
COS
+C
-C
SIN
+S
-S
+REF
-REF
AGND
IRDC2_BIT
IRDC2_EM
IRDC2_EL
U2
IC-RDC_19220
C12 2200p
R12 432K
C11 .022
R11 100K
R10 30.1K
R9 30.1K
+5VA
C7 .1
C8 10
C9 .1
C10 10
-5V
R7 47.5K
R8 47.5K
IRDC3_BIT
IRDC3_EM
IRDC3_EL
U3
IC-RDC_19220
C18 2200p
R18 432K
C17 .022
R17 100K
R16 30.1K
R15 30.1K
+5VA
C13 .1
C14 10
C15 .1
C16 10
-5V
R13 47.5K
R14 47.5K
IRDC_REFI
IRDC1_SINI
IRDC1_COSI
IRDC2_SINI
RDC2_COSI
IRDC3_SINI
IRDC3_COSI
DATA_BUS
J3 AZ_SIN
J4 AZ_COS
J5 AZ_Ref
R25 100
R26 100
R27 39
D2 P6KE8.2CA
D3 P6KE8.2CA
J8 EL_SIN
J6 EL_COS
J7 EL_Ref
R29 100
R30 100
R28 39
D4 P6KE8.2CA
D5 P6KE8.2CA
J11 POL_SIN
J9 POL_COS
J10 POL_Ref
R32 100
R33 100
R31 39
D7 P6KE8.2CA
D6 P6KE8.2CA
DATA_BUS
from interface page
single-point gnd to
analog ground connection
at each converter
Notes:
rev B corrections see JR7pg124
Title RC3000 Resolver Adapter
Size B
Number
Rev B
Date Tue Jan 23, 2001
Drawn by JFR
Filename 3KRSLVRb.sch
Sheet 1 of 2



For dual-RDC setups, U6 may be a 22V10 or EP610.
*In order to operate with 3 16-bit RDCs, U6 must be a EP610 as the 22V10 has an input only at pin 9.
In order to work with 2 16-bit RDCs with 3 sector bits, present the 6 sector bits on AD0-AD5 with a latch

PLD data presentation table....with $\overline{RD}$ asserted:

RDC_SELECT	A0	A1	A2	AD0	AD1	AD2		
0	x	x	x	hiZ	hiZ	hiZ		
1	0	0	0	RDC1_$\overline{BIT}$	RDC2_$\overline{BIT}$	RDC3_$\overline{BIT}$*		
1	0	0	1	AUX_in1	AUX_in2	x		
1	0	1	0	hiZ	hiZ	hiZ	RDC1_$\overline{EL}$	RDC1 LSByte presented on AD0-AD7
1	0	1	1	hiZ	hiZ	hiZ	RDC1_$\overline{EM}$	RDC1 MSByte presented on AD0-AD7
1	1	0	0	hiZ	hiZ	hiZ	RDC2_$\overline{EL}$	RDC2 LSByte presented on AD0-AD7
1	1	0	1	hiZ	hiZ	hiZ	RDC2_$\overline{EM}$	RDC2 MSByte presented on AD0-AD7
1	1	1	0	hiZ	hiZ	hiZ	RDC3_$\overline{EL}$	RDC3 LSByte presented on AD0-AD7
1	1	1	1	hiZ	hiZ	hiZ	RDC3_$\overline{EM}$	RDC3 MSByte presented on AD0-AD7

Vaules shown are for 400 Hz 4.4V rms resolver drive.
For 2000Hz 4.4 V drive set: R19=R20=43K, C20=4700pF, R22=13.0K, R23=68.1K, C18=C12=C1=470pF, R18=R12=R1=681K, C17=C11=C2=4700pF, and R17=R11=R2=56.2K.

Notes:
rev B corrections see JR7pg124

Title	RC3000 Resolver Adapter	
Size B	Number	Rev B
Date Tue Jan 23, 2001		Drawn by JFR
Filename 3KRSLVRb.sch		Sheet 2 of 2

W–22AWG (10") Color as required

P3 Limit Switches

To 8097BAN3 J3

Pol Stow in	1	ORG
Pol Stow +12V	2	WHT
nc	3	
Limit Switch Shields	4	
EL Dwn +12V from EL Stow in	5	
EL Dwn in	6	RED/BLK
AZ Stow in	7	RED
nc	8	
AZ Stow +12V	9	BLK
EL Up +12V	10	BLU
EL Stow +12V	11	WHT/ORG
nc	12	
EL Stow in	13	GRN
EL Up in	14	GRN/BLK
	15	

CN–747908–2

attach to PCB mounted DB–15F with 2pcs. each CN–206514–1 and CN–206942–1 post and clip kits.

P4 Pulse Sensors

To 3K50FEAT J5

AZ–I Rtn	1	
AZ–I Pulse	2	WHT/BLK
AZ–Q Rtn	3	
AZ–Q Pulse	4	WHT/GRAY
EL–Q Pulse	5	WHT/YELLOW
EL–Q Rtn	6	
EL–I Pulse	7	WHT/PURPLE
EL–I Rtn	8	
AZ Shield	9	
AZ–I Pwr	10	
AZ–Q Pwr	11	
Alarm in	12	
EL–Q Pwr	13	
EL–I Pwr	14	
EL Shield	15	

CN–747909–2

attach to PCB mounted DB–15M with 2pcs. each CN–206514–1 and CN–206942–1 post and clip kits.

P1 AZ/EL/Pol Position

To 8097BAN3 J1

AZ pot wiper	1	GRAY\BLK
AZ pot CW	2	YELLOW\BLK
Pol shield	3	WHT/GRN
Pol pot wiper	4	YELLOW
nc	5	
EL +15V	6	BLU/BLK
EL Shield	7	
EL –15V	8	GRAY
AZ pot CCW	9	WHT\BRN
AZ shield	10	PURPLE\BLK
Pol pot CCW	11	WHT/BLU
Pol pot CW	12	PURPLE
EL Sig Rtn	13	
EL Pwr Rtn	14	BROWN
EL Sig	15	ORG/BLK

CN–747908–2

attach to PCB mounted DB–15F with 2pcs. each CN–206514–1 and CN–206942–1 post and clip kits.

CN–97–3102A28 / CN–9728–21S

A	AZ Limit Common	BLK
B	POL Limit Common	WHT
C	AZ Center Limit NO	RED
D	LHC C–band feed type NO	WHT/GRAY
E	RHC C–band feed type NO	
F	AZ Center NC	
G	AZ CCW Limit NC	
H	AZ CW Limit NC	
J	AZ CCW limit NO	GRN
K	EL Stow Limit NC	
L	POL CW Limit NC	ORG
M	POL CCW Limit NC	BLU
N	EL Limit Common	
P	East of Center Limit NO	WHT/BLK
R	Ka, Ku, or C–band Lin feed type NO	
S	AZ CW Limit NO	RED/BLK
T	EL Down Limit NC	GRN/BLK
U	EL Up Limit NC	ORG/BLK
V	Incl out +	
W	Incl out –	BLU/BLK
X	Incl +12V	BROWN
Z	Incl return	GRAY
a	Incl –12V	WHT/GRN
b	Incl shield	WHT/BLU
c	Pol pot CCW	YELLOW
d	POL pot Wiper	PURPLE
e	POL pot CW	WHT/YELLOW
f	Ka–band feed NO	
g	feed type ?	WHT/ORG
h	Feed type Common	WHT/PURPLE
j	C–band feed type NO	
k	EL Stow NO	
m	EL Down NO	
n	EL Up NO	
p	Alarm/Ignit Interlock Common	
r	Alarm/Ignit Interlock N.O.	
s	Alarm/Ignit Interlock N.C.	

J8
ANTENNA STATUS
when used without the resolver option.

NOTES:
Pol Stow is located at POL CCW and is valid only when using a Ku–band linear feed.

J11
AZ POT CONNECTOR
J11A
AZ POT CONNECTOR

GRAY\BLK	1	AZ pot wiper
YELLOW\BLK	2	AZ pot CW
WHT\BRN	3	AZ pot CCW
	4	
	5	
	6	
	7	
	8	
PURPLE\BLK	9	AZ shield
	10	
	11	
	12	
	13	
	14	
	15	

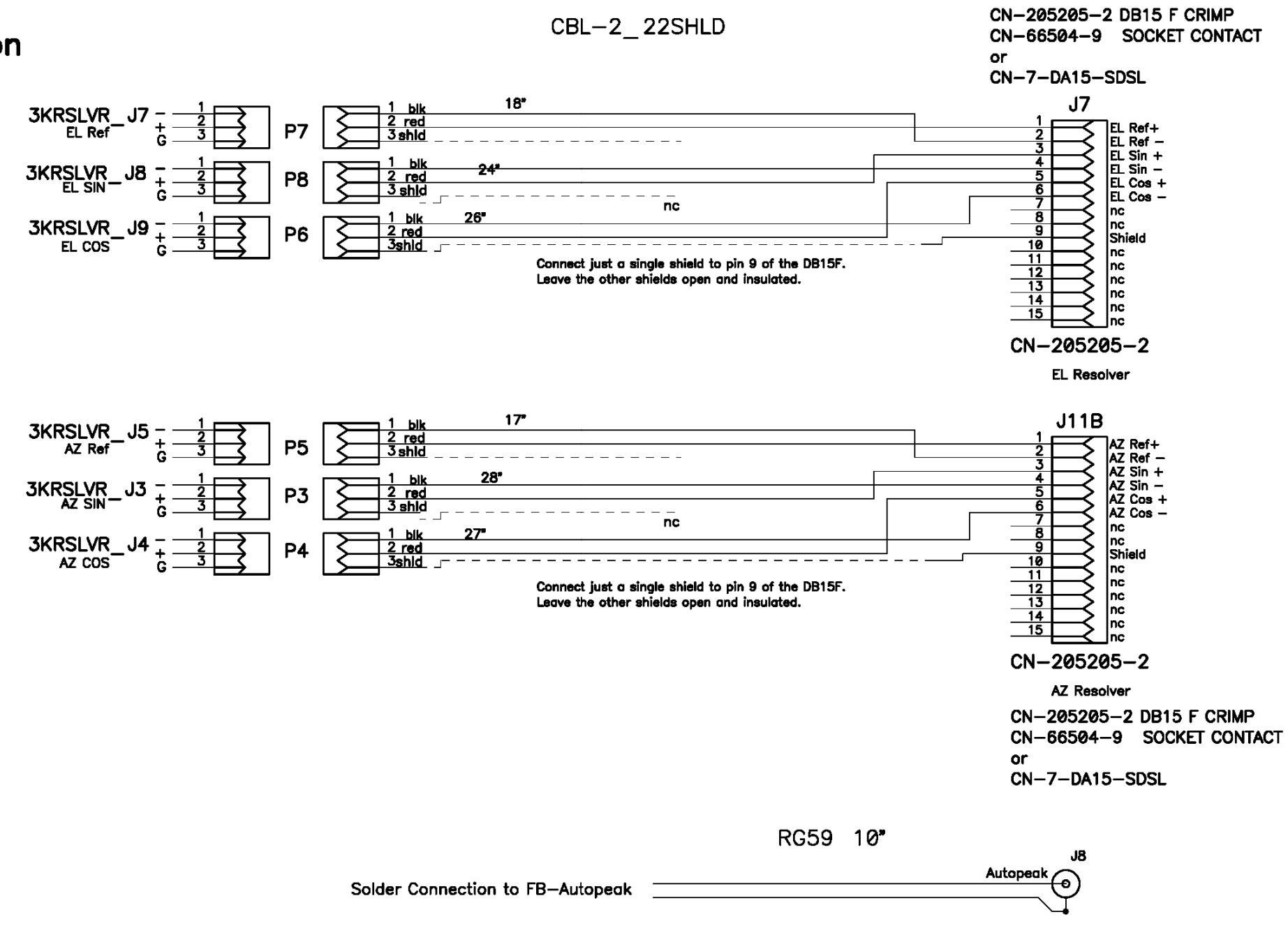
CN–7–DA15–SDSL

Notes:
J11 is used for the AZ potentiometer for the low–cost version and for the AZ Resolver when the RC3KRSLVR option is installed.

Revision history:
A – original
B – changed the AZ pot wiring so that VertexRSI can use the same cable for the AZ resolver and the AZ pot.
This change will commence after s/n 413, they will change the AZ pot and motor wiring but not feed type in s/n 373 to the B revision. Changed the motor polarity for AZ and EL to jive with what they have.
Added shield connection to J7 and J11B, swapped the org/grn and blu/red wires on J5 pins 4 and 5 to match the RJS software. Rerouted blu/red (J5:4) to D+E pins for new feed arrangement.
Relabled J8 pins D,E,R,f,g, and j to conform to new std.
C – added the R–100 resistors to achieve the AZ limit switch to AZ pot input conversion.
D – added back panel J6, HPA disable connections to FC–3KF–WG–DRV3. and corrected wire colors on J8 resolver – sheet 6. changed some wire colors to match production's choices.
E – Wire colors and part numbers modified 9 Aug 2002, TKB.
F – removed jumper between P3:5 and P3:11, should've never been there.

Title	RC3000E Back Panel Interconnects		
Size	Number		Rev
B	FB–3K50E–ASC		F
Date	23 Sept. 2002	Drawn by	JFR
Filename	CN–RC3KE_BP_intrcnF.sch	Sheet 1	of 6

Connectors on 3KRSLVR2



Notes:
J7 and J11B are used only when the controller is order with the RC3KRSLVR option. Without resolvers, the controller uses J11A and J7 is blank.

See Sheet 1 for revision history

Title: RC3000E Back Panel Interconnects		
Size: B	Number:	Rev: F
Date: 23 Sept. 2002		Drawn by: JFR
Filename: CN–RC3KE_BP_intrcnF.sch		Sheet 2 of 6

RIBBON 8

To 3KFEAT J8

3JFEAT1_J8
Nav-Pak

Port 1: Battery Backup, 1PPS input, RX1, TX2, TX1, Gnd, Vpwr, RX2, Gnd
Port 2: Gnd, nc, Vpwr, Gnd, TX1, nc, RX1, nc, Battery Backup
Port 3: Battery Backup, nc, nc, TX2, nc, Gnd, Vpwr, RX2, Gnd
Port 4: Gnd, RX2, Vpwr, Gnd, nc, TX2, nc, nc, Battery Backup, TTL input (spare)

pins 1–18 as labeled; pins 19–40 = nc

CN–89140

GPS
1 P1–Vaux
2 P1–RX1
3 P1–TX1
4 P1–Vpwr
5 P1– GND
6 P1–PPS
7 P1–TX2
8 P1–GND–Shield
9 P1–RX2
J4
CN–747052–4
CN–747275–4 SRC

to GPS Receiver FP–GPS–2

Flux Gate Compass
9 P2–GND–Shield
8
7
6
5 P2–GND
4 P2–Vpwr
3 P2–TX1
2 P2–RX1
1
J5
CN–747052–4
CN–747275–4 SRC

to Fluxgate Compass RC3KFG1

These are the connections made by an 18–conductor ribbon cable.
9 inches CBL–RBBN–4050, trim back conductors #19 – 40.
connected at J9 pin 1 of the 3KFEAT–1B, CN–89140.
Split the ribbon in two with conductors 1 – 9 installed at
back panel J4 (conductor 1 to pin 1) CN–747052–4,
and conductors 10 – 18 installed at back panel J5,
CN–747052–4 (conductor 18 to pin 1).

3KFEAT1_J10
1 from $\overline{TXD}$ of 3K → to $\overline{RXD}$ of PC
2
3
4
5 from RXD of 3K → toTXD of PC
6
7 from $\overline{TXD}$ of 3K → to $\overline{RXD}$ of PC
8 from$\overline{RXD}$ of 3K → to $\overline{TXD}$ of PC
9
10
RS–422

To 3KFEAT J10 or J11

3KFEAT_J11
1
2
3 TXD of 3K → to RXD (DB–9 pin2) of PC
4
5 RXD of 3K → to TXD (DB–9 pin3) of PC
6
7
8
9 Gnd of 3K → to Gnd (DB–9 pin5) of PC
10
RS–232

J1
1
2
3
4
5
6
7
8
9
10 nc
CN–111810–1
RS–422 / RS–232

10–Conductor Ribbon Cable
14 inches of CBL–RBBN–1050.
Install a CN–111810–1 with CN–111564–5 SRC
with Ribbon Cond.#1 on Pin 1.
trim back conductor #10.
Install CN–747052–4 on the other end with Ribbon
Cond.#1 on pin 1.

to RS–422 or RS–232
Serial Port

J3
RS–422 pinout
1
2
3 (3) to TXD of PC
4 (4) to RXD of PC
5
6 (6) to $\overline{RXD}$ of PC
7
8
9 (9) to $\overline{TXD}$ of PC
PCRC

RS–232 pinout
(2) to RXD (DB–9 pin2) of PC
(3) to TXD (DB–9 pin3) of PC
(5) to Gnd (DB–9 pin5) of PC

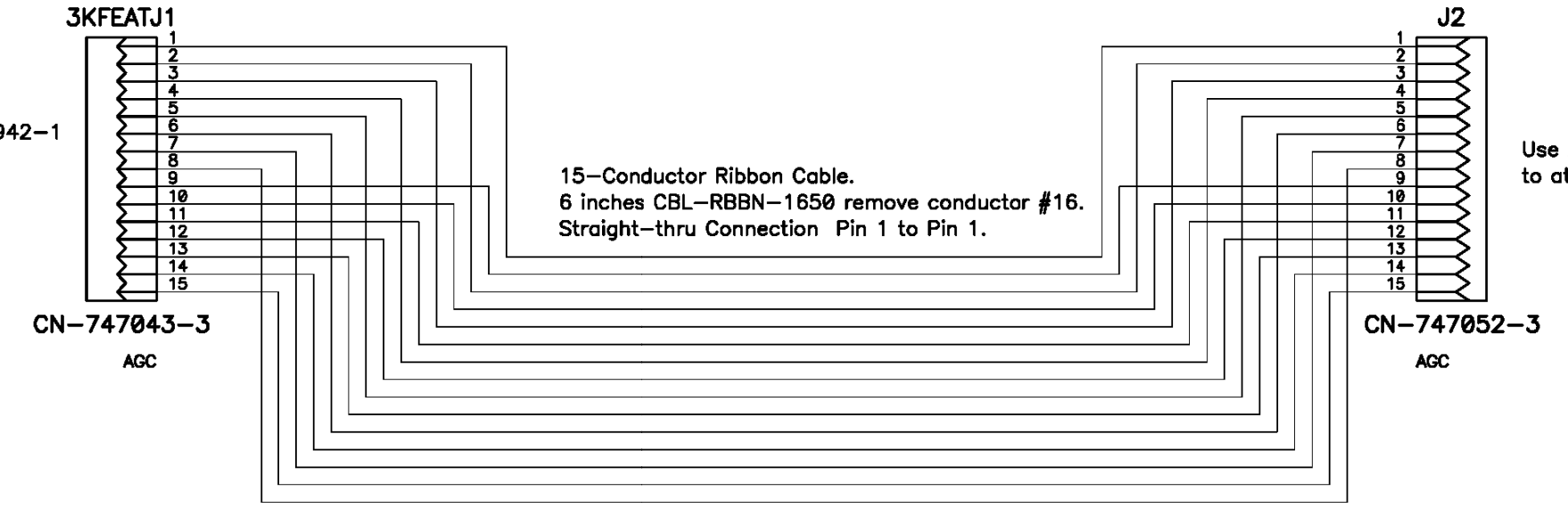
CN–747052–4
CN–747275–4 SRC

See Sheet 1 for revision history

Title: RC3000E Back Panel Interconnects		
Size: B	Number:	Rev: F
Date: 23 Sept. 2002	Drawn by: JFR	
Filename: CN–RC3KE_BP_intrcnF.sch	Sheet 3 of 6	

RIBBON 10

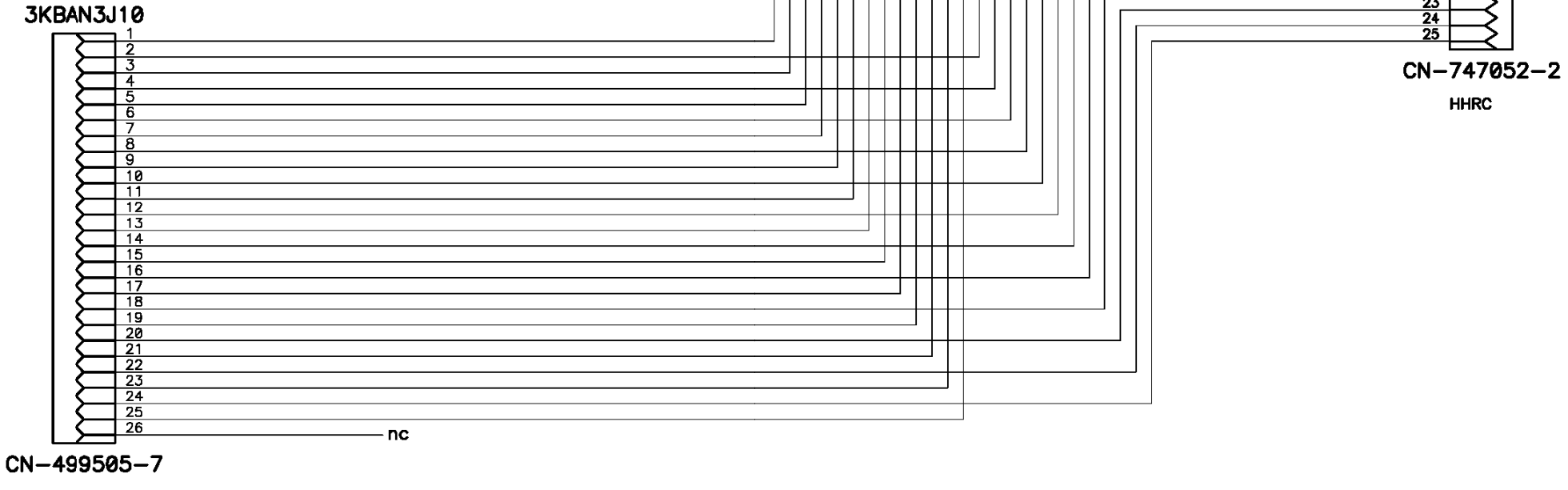
attach to PCB mounted DB-15F with
2pcs. each CN-206514-1 and CN-206942-1
post and clip kits.



Use 2 pcs. HD-205817-3
to attach at back panel

RIBBON 1

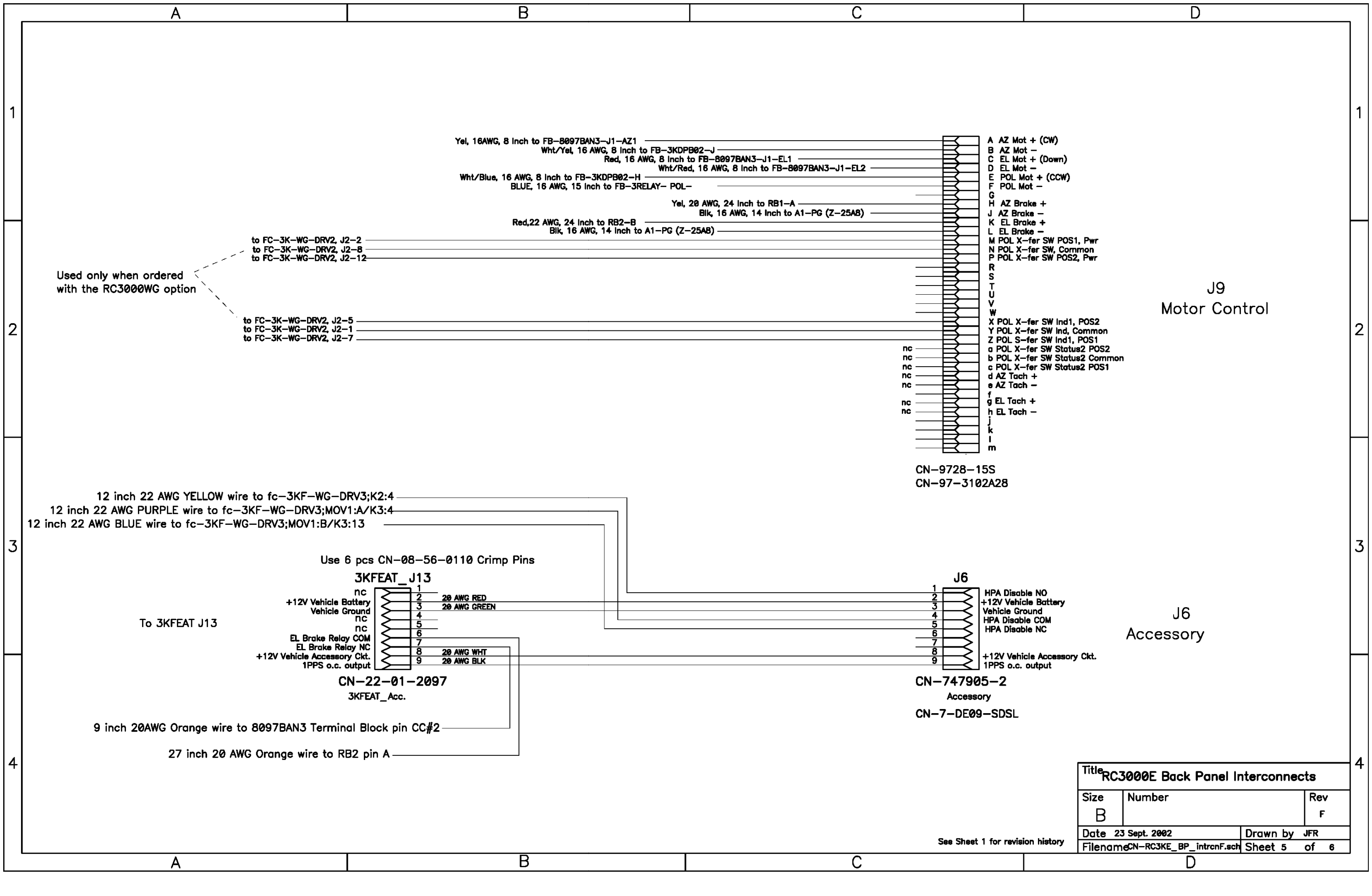
26-Conductor Ribbon Cable
8 1/2 inches of CBL-RBBN-2650.
Install a CN-499505-7 with CN-3448-89129 SRC
with Ribbon Cond.#1 on Pin 1.
trim back conductor #26.
Install CN-747052-2 on the other end with Ribbon
Cond.#1 on pin 1.



Use 2 pcs. HD-205817-3
to attach at back panel

See Sheet 1 for revision history

Title: RC3000E Back Panel Interconnects		
Size: B	Number:	Rev: F
Date: 23 Sept. 2002		Drawn by: JFR
Filename: CN-RC3KE_BP_intrcnF.sch		Sheet 4 of 6


Yel, 16AWG, 8 Inch to FB-8097BAN3-J1-AZ1
Wht/Yel, 16 AWG, 8 Inch to FB-3KDPB02-J
Red, 16 AWG, 8 Inch to FB-8097BAN3-J1-EL1
Wht/Red, 16 AWG, 8 Inch to FB-8097BAN3-J1-EL2
Wht/Blue, 16 AWG, 8 Inch to FB-3KDPB02-H
BLUE, 16 AWG, 15 Inch to FB-3RELAY- POL-
Yel, 20 AWG, 24 Inch to RB1-A
Blk, 16 AWG, 14 Inch to A1-PG (Z-25A8)
Red,22 AWG, 24 Inch to RB2-B
Blk, 16 AWG, 14 Inch to A1-PG (Z-25A8)
to FC-3K-WG-DRV2, J2-2
to FC-3K-WG-DRV2, J2-8
to FC-3K-WG-DRV2, J2-12
Used only when ordered with the RC3000WG option
to FC-3K-WG-DRV2, J2-5
to FC-3K-WG-DRV2, J2-1
to FC-3K-WG-DRV2, J2-7
A AZ Mot + (CW)
B AZ Mot -
C EL Mot + (Down)
D EL Mot -
E POL Mot + (CCW)
F POL Mot -
G
H AZ Brake +
J AZ Brake -
K EL Brake +
L EL Brake -
M POL X-fer SW POS1, Pwr
N POL X-fer SW, Common
P POL X-fer SW POS2, Pwr
R
S
T
U
V
W
X POL X-fer SW Ind1, POS2
Y POL X-fer SW Ind, Common
Z POL S-fer SW Ind1, POS1
a POL X-fer SW Status2 POS2
b POL X-fer SW Status2 Common
c POL X-fer SW Status2 POS1
d AZ Tach +
e AZ Tach -
f
g EL Tach +
h EL Tach -
j
k
l
m
nc
J9
Motor Control
CN-9728-15S
CN-97-3102A28
12 inch 22 AWG YELLOW wire to fc-3KF-WG-DRV3;K2:4
12 inch 22 AWG PURPLE wire to fc-3KF-WG-DRV3;MOV1:A/K3:4
12 inch 22 AWG BLUE wire to fc-3KF-WG-DRV3;MOV1:B/K3:13
Use 6 pcs CN-08-56-0110 Crimp Pins
3KFEAT_J13
nc 1
+12V Vehicle Battery 2 20 AWG RED
Vehicle Ground 3 20 AWG GREEN
nc 4
nc 5
EL Brake Relay COM 6
EL Brake Relay NC 7
+12V Vehicle Accessory Ckt. 8 20 AWG WHT
1PPS o.c. output 9 20 AWG BLK
To 3KFEAT J13
CN-22-01-2097
3KFEAT_Acc.
9 inch 20AWG Orange wire to 8097BAN3 Terminal Block pin CC#2
27 inch 20 AWG Orange wire to RB2 pin A
J6
1
2 HPA Disable NO
3 +12V Vehicle Battery
4 Vehicle Ground
5 HPA Disable COM
6 HPA Disable NC
7
8
9 +12V Vehicle Accessory Ckt.
1PPS o.c. output
J6
Accessory
CN-747905-2
Accessory
CN-7-DE09-SDSL
See Sheet 1 for revision history
Title RC3000E Back Panel Interconnects
Size B
Number
Rev F
Date 23 Sept. 2002
Drawn by JFR
Filename CN-RC3KE_BP_intrcnF.sch
Sheet 5 of 6

W-22AWG (10°) Color as required

CN-97-3102-A28
CN-9728-21S

To 8097BAN3 J3

P3 Limit Switches

Pol Stow in	1	ORG
Pol Stow +12V	2	WHT
nc	3	
Limit Switch Shields	4	
EL Dwn +12V from EL Stow in	5	
EL Dwn in	6	RED/BLK
AZ Stow in	7	RED
nc	8	
AZ Stow +12V	9	
EL Up +12V	10	BLU
EL Stow +12V	11	WHT/ORG (h)
nc	12	
EL Stow in	13	GRN
EL Up in	14	GRN/BLK
	15	

CN-747908-2

attach to PCB mounted DB-15M with
2pcs. each CN-206514-1 and CN-206942-1
post and clip kits.

To 3K50FEAT J5

P4 Pulse Sensors

AZ-I Rtn	1	
AZ-I Pulse	2	WHT/BLK (R)
AZ-Q Rtn	3	
AZ-Q Pulse	4	WHT/GRAY (E+D)
EL-Q Pulse	5	WHT/YELLOW (f)
EL-Q Rtn	6	
EL-I Pulse	7	WHT/PURPLE (j)
EL-I Rtn	8	
AZ Shield	9	
AZ-I Pwr	10	
AZ-Q Pwr	11	
Alarm in	12	
EL-Q Pwr	13	
EL-I Pwr	14	
EL Shield	15	

CN-747909-2

attach to PCB mounted DB-15F with
2pcs. each CN-206514-1 and CN-206942-1
post and clip kits.

To 8097BAN3 J1
when used with
the resolver option
RC3000RSLVR

P1 AZ/EL/Pol Position

AZ pot wiper	1	BLK
AZ pot CW	2	YELLOW/BLK
Pol shield	3	WHT/GRN
Pol pot wiper	4	YELLOW
nc	5	
EL +15V	6	BLU/BLK
EL Shield	7	
EL -15V	8	GRAY
AZ pot CCW	9	WHT/BROWN
AZ shield	10	
Pol pot CCW	11	WHT/BLU
Pol pot CW	12	PURPLE
EL Sig Rtn	13	
EL Pwr Rtn	14	BROWN
EL Sig	15	ORG/BLK

CN-747908-2

attach to PCB mounted DB-15F with
2pcs. each CN-206514-1 and CN-206942-1
post and clip kits.

BLK	A	AZ Limit Common
WHT	B	POL Limit Common
RED	C	AZ Center Limit NO
	D	LHC C-band feed type NO
WHT/GRAY	E	RHC C-band feed type NO
	F	AZ Center NC
WHT/BROWN R2 100	G	AZ CCW Limit NC
YELLOW/BLK	H	AZ CW Limit NC
R1 100	J	AZ CCW limit NO
GRN	K	EL Stow Limit NC
	L	POL CW Limit NC
ORG	M	POL CCW Limit NC
BLU	N	EL Limit Common
	P	East of Center Limit NO
WHT/BLK	R	Ka, Ku, or C-band Lin feed type NO
	S	AZ CW Limit NO
RED/BLK	T	EL Down Limit NC
GRN/BLK	U	EL Up Limit NC
ORG/BLK	V	Incl out +
	W	Incl out -
BLU/BLK	X	Incl +12V
BROWN	Z	Incl return
GRAY	a	Incl -12V
WHT/GRN	b	Incl shield
WHT/BLU	c	Pol pot CCW
YELLOW	d	POL pot Wiper
PURPLE	e	POL pot CW
WHT/YELLOW	f	Ka-band feed NO
	g	feed type ?
WHT/ORG	h	Feed type Common
WHT/PURPLE	j	C-band feed type NO
	k	EL Stow NO
	m	EL Down NO
	n	EL Up NO
	p	Alarm/Ignit Interlock Common
	r	Alarm/Ignit Interlock N.O.
	s	Alarm/Ignit Interlock N.C.

J8
ANTENNA STATUS
when used with the
resolver option:
RC3000RSLVR

NOTES:
Pol Stow is located at POL CCW and is valid only when using an LP feed.

Use this sheet rather than sheet 1 with the RC3000 is ordered with the RC3000RSLVR option.

Notes:
J11 is used for the AZ potentiometer for the low-cost version and for the AZ Resolver when the RC3KRSLVR option is installed.

See Sheet 1 for revision history

Title	RC3000E Back Panel Interconnects		
Size	Number		Rev
B	FB-3K50E-ASC		F
Date	23 Sept. 2002	Drawn by	JFR
Filename	CN-RC3KE_BP_intrcnF.sch	Sheet	6 of 6