APPENDIX B - MOUNT SPECIFIC DATA

For

Patriot 1.2 m Tripod

This appendix describes RC3000 operations unique for the Patriot 1.2m Tripod antenna system. Differences between this version and the operation described in the "baseline" RC3000 manual are noted on a paragraph by paragraph basis.

REVISION HISTORY

10 May 2006, Software Version 1.56

1.1 Manual Organization

This appendix is provided as a supplement to the baseline RC3000 manual. The corresponding paragraphs in the baseline RC3000 manual are referred to when data specific to the Patriot 1.2m Tripod mount are described.

1.2 RC3000 Features

All basic features of the RC3000 are utilized to provide the operations for this mount. Some features have been modified (as described below) to customize operations for a deployable antenna.

Hardware Configuration. A RC3000A version of hardware is utilized for this mount.

Software Configuration. The mount model will be designated as **PA**. Software will be designated as RC3K-PA-xxx.

1.3.2 System Interface Requirements

The PA interface differs from baseline RC3000 interface requirements as follows:

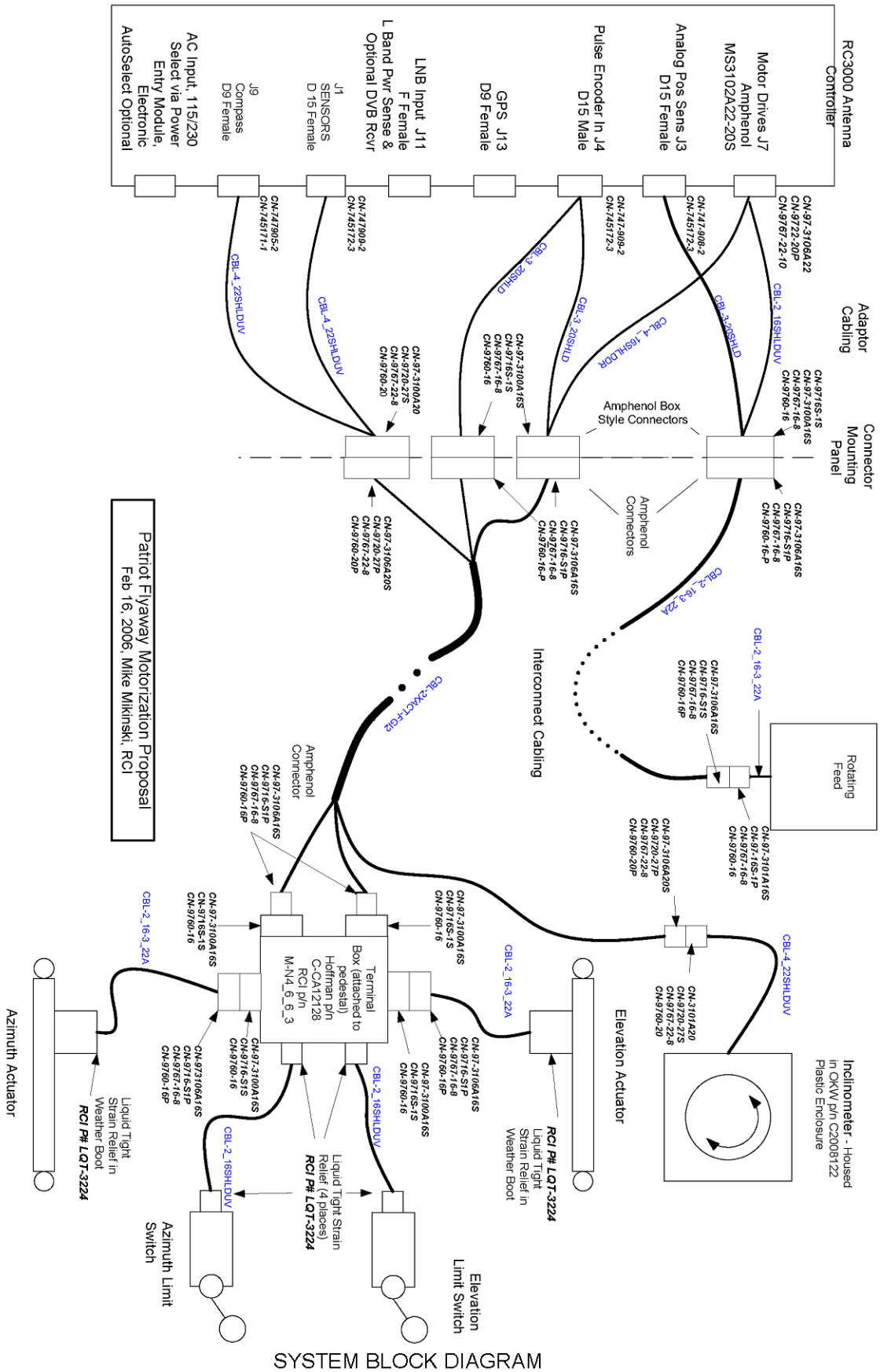
1) No limit switch feedback is provided from the azimuth or elevation axes

2) No angle feedback from the azimuth axis

3) No Polarization axis control

4) No compass present

The following diagram shows the RC3000 connected to the relevant components of the PA mount system.


RC3000 Antenna Controller
Motor Drives J7 Amphenol MS3102A22-20S
Analog Pos Sens J3 D15 Female
Pulse Encoder In J4 D15 Male
GPS J13 D9 Female
LNB Input J11 F Female
L Band Pwr Sense & Optional DVB Rcvr
J1 SENSORS D 15 Female
J9 Compass D9 Female
AC Input, 115/230 Select via Power Entry Module, Electronic AutoSelect Optional
Adaptor Cabling
Connector Mounting Panel
Amphenol Box Style Connectors
Amphenol Connectors
Interconnect Cabling
Rotating Feed
Inclinometer - Housed in OKW p/n C2008122 Plastic Enclosure
Elevation Actuator
Azimuth Actuator
Terminal Box (attached to pedestal) Hoffman p/n C-CA12128 RCI p/n M-N4_6_6_3
Amphenol Connector
Liquid Tight Strain Relief in Weather Boot
RCI P# LQT-3224
Liquid Tight Strain Relief (4 places)
Azimuth Limit Switch
Elevation Limit Switch
Patriot Flyaway Motorization Proposal
Feb 16, 2006, Mike Mikinski, RCI
SYSTEM BLOCK DIAGRAM

1.3.3 Operational Overview

The baseline RC3000 modes are modified to accommodate the operational scenario for the PA mount. The following provides an overview of the intended operational sequence. Detailed description of the each mode will be provided in section 3.

POWER UP. After the RC3000 is powered up, the controller enters MENU mode. The MENU selections for the PA mount are shown below:

```
1-CALCULATE 2-SETUP  3-LOCATE
MENU
4-SEARCH    5-STORE
8-PACK      9-POSITION
UTC
<0-9>SELECT <MODE>MANUAL
14:37:23
```

CALCULATE. This mode provides pointing data to the selected satellite as an aid in initially positioning the mount.

```
POS:   39°01N  94°49W
CALCULATE
SAT:TELSTAR 4   89.0W          MAG:
167.2
                                EL:
44.4
<1>SELECT NEW SAT      H:  82.9 V:  -
7.1
```

CALCULATE mode determines the magnetic heading and elevation (RF look angle) required given the current latitude and longitude of the mount. Latitude and longitude may be obtained dynamically via the GPS receiver or entered manually via the POSITION mode. CALCULATE mode also determines nominal horizontal and vertical (H/V) polarization angles as an aid in orienting the polarization axis.

The CALCULATE mode may be skipped if other data (operational orders, other software programs, etc.) are available to indicate which direction the mount should be positioned in order to find the required satellite.

SETUP. After attaching the actuators on the mount, the SETUP mode automatically moves the azimuth and elevation axes in order to synchronize the pulse counters on both axes.

LOCATE. LOCATE mode calculates a pointing solution to the required satellite. The selected satellite is shown along with the pointing solution required for the current latitude and longitude and heading of the mount. The user may select another satellite either manually or from a list. Upon selection of another satellite, a new pointing solution will be automatically calculated.

After the pointing solution is calculated, the user may initiate an automatic movement to that approximate position.

```
POS:   39°01N  94°49W 138.4
LOCATE
SAT:TELSTAR 4   89.0W          MAG:
170.8
                                EL: 44.4
<1>SELECT NEW SAT         READY TO
LOCATE
```

MANUAL. After performing a LOCATE operation, the controller transitions to MANUAL mode. In MANUAL mode the mount may be manually jogged in azimuth and elevation in order to peak up on the satellite. The relative signal strength indication (SS2:) will provide an aid in positioning the mount on the satellite.

At this time the user should make a positive identification of the satellite.

```
AZIM: 11025( 12.8) SS2: 50
MANUAL
ELEV:  44.5( 44.4) SAT:telstar 4
                   SPD:FAST
UTC
<0-9>JOG ANTENNA   <MODE>MENU
14:39:01
```

SEARCH. As an aid in finding an inclined orbit satellite, SEARCH mode may be used to perform an expanding spiral search pattern.

```
AZIM:10456
SEARCH
ELEV:17429

SPIRAL SEARCH(CCW 12)
<STOP>HALT
```

STORE. After verifying the antenna is precisely on the intended satellite, the user may STORE the mount's azimuth and elevation angles for subsequent RECALLs.

If the satellite has been defined as having an inclined orbit, the TRACK mode will be automatically entered.

```
AZIM: 15.9      750  SS2:735( X)
TRACK
ELEV:  42.0     750  SAT:BRASIL A1
                     STEP:PEAKING
SIG
JOGGING ANTENNA TO FIND MAXIMUM SIGNAL
```

PACK. When it is time to disassemble the mount, the STOW mode automatically retracts the actuators to their storage position.

LAT/LON. This mode is provided to allow the user to manually enter the mount's latitude and longitude for use by the CALCULATE mode.

1.3.7 Drive System

Position Sensing and Limits. No azimuth or elevation limit switches are interfaced to the RC3000, azimuth and elevation software limits are implemented.

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

2.0 INSTALLATION

2.1 Equipment Mounting

As shown in the system diagram in 1.3.2, the inclinometer is mounted in a waterproof box. This box is mounted on the antenna's structure in a level position when the antenna's elevation RF look angle is 22.3 degrees.

2.2 Electrical Connections

Electrical connections between the RC3000 and the PA mount are made via an RC3000 adapter cable and an interconnect cable assembly. The RC3000 adapter cable connects to the standard backplane connectors described in the baseline manual.

Schematics for the adaptor cable and the interconnect cable are shown in section 4.2.

The following subparagraphs describe any unique items with respect to the PA system.

2.2.2 Motor Drive. No polarization axis drive.

2.2.3 Drive Sense. Only the elevation inclinometer interface is supported. The azimuth and polarization inputs are jumpered within the RC3000 so that azimuth or polarization limit conditions are not generated.

2.2.4 Limit Switches. The limit switch inputs are internally jumpered within the RC3000 since no limit switches on the mount are supplied to the controller.

2.2.5 Signal Strength. AGC channel 2 is to be wired to the Tracking Receiver as shown in this section of the baseline manual.

2.2.6 Navigation Sensors. The GPS receiver is wired as shown in the baseline manual.

2.2.7 Accessories. Outputs from this connector are available as described in the baseline manual.

2.2.8 RF Autopeak. This input is available but it is intended that only use the signal strength indication from the tracking receiver via AGC channel 2.

2.2.9 Hand Held Remote. This option is available.

2.2.11 PC Remote Control. The remote control interface is wired as shown in the baseline manual.

2.2.12 Waveguide Switch. The optional waveguide switch module is not provided.

2.3 Initial Configuration, 2.4 Final Calibration

2.3 Initial Calibration

2.3.1 Initialization

After the antenna has been assembled, mount the Inclinometer box to the antenna back structure. It should be mounted such that the antenna boresight elevation-angle is at 22.3 degrees when the top of the inclinometer box is level.

Mount the linear actuators on the antenna. Connect the RC3000 controller to the antenna using the adapter and interconnect cable sets.

Perform the SETUP function to synchronize the azimuth and elevation pulse counts and to move the mount into a good position to do azimuth and elevation calibration.

2.3.2 Elevation Calibration

The first elevation calibration step should be performed from the 22.3 degree look angle position. From Manual Mode, jog the antenna until the face of the reflector is plumb.

Elevation Reference Voltage. Go to the Maintenance – Voltages Screen, read off and note the indicated elevation reference voltage. Then go to the Config Mode Elevation Calibration Screen. Enter the previously measured reference voltage at the REF_V prompt. (refer to step 3a in baseline manual)

Elevation Scale Factor. Characterize the elevation inclinometer scale factor as described in step 4 of the baseline manual.

Elevation DOWN limit. Confirm the elevation DOWN limit happens before the elevation actuator encounters the down limit switch. If not, note the elevation pulse count (from the MANUAL mode) and enter this as the DOWN limit in the ELEVATION PULSE DRIVE configuration screen. An elevation pulse count less than this value will thereafter generate an elevation DOWN limit.

2.3.3 Azimuth Calibration

Azimuth CCW limit. Confirm the azimuth CCW limit happens before the azimuth actuator encounters the CCW limit switch. If not, note the azimuth pulse count (from the MANUAL mode) and enter this as the CCW limit in the AZIMUTH PULSE DRIVE configuration screen. An azimuth pulse count less than this value will thereafter generate an azimuth CCW limit.

2.4.2 Azimuth and Elevation Alignment

As described in the baseline manual, perform a LOCATE to several known satellites. If necessary, adjust the elevation offset configuration item.

Operational Setup

Perform a SETUP function each time the mount is reassembled.

3.0 Detailed Operation

3.1.1 Modes

While the basic functionality of the RC3000 is as described in the baseline manual, several modes are customized and several modes are unique for operation with the PA version mount.

3.2.1 Manual Mode

```
AZIM: 11010(157.6) SS2:579
MANUAL
ELEV: -67.5( 42.4) SAT:telstar 402
                   SPD:FAST
UTC
<0-9>JOG ANTENNA   <MODE>MENU
14:25:47
```

AZIM: 11010

Since no angle feedback exists on the azimuth axis, only the azimuth pulse count can be displayed.

3.2.2 Menu Mode

MENU mode provides a customized selection of functions. As described in the baseline manual, pressing the Mode key will move to MANUAL mode.

```
1-CALCULATE 2-SETUP  3-LOCATE
MENU
4-SEARCH    5-STORE  6-RECALL 7-DELETE
8-PACK      9-POSITION
UTC
<0-9>SELECT <MODE>MANUAL
14:37:23
```

The following subparagraphs describe how the various modes are customized for the operation of the Vertex SK mount.

3.2.2.1 SETUP

The SETUP mode will move the azimuth and elevation actuators to their retracted position in order to synchronize pulse counts. Azimuth will then be moved to approximately the center of travel and elevation will move to approximately the face vertical position.

3.2.2.2 PACK

The PACK mode's target positions will be set to angles beyond the elevation UP and azimuth CW limits. The intent is to move the actuators to their fully retracted position for shipping.

In order to allow the azimuth and elevation axes to move beyond their operational limits, STOW will inactivate the software limits during its sequence of movements. The "LIMITS INACTIVE" alarm may be visible during this time. This will allow both actuators to jam into their fully retracted positions.

3.2.2.3 LOCATE

Two versions of the LOCATE mode described in the baseline manual are provided for the VK mount. Unique characteristics of CALCULATE and LOCATE modes are described next.

Calculate

CALCULATE mode determines a pointing solution (magnetic heading and elevation look angle) to the selected satellite given the present latitude and longitude.

```
POS:   39°01N  94°49W
CALCULATE
SAT:TELSTAR 4   89.0W          MAG:
167.2
                                EL:
44.4
<1>SELECT NEW SAT      H:  82.9 V:  -
7.1
```

If the GPS receiver is connected to the RC3000, CALCULATE mode will automatically acquire latitude and longitude from it. The user may also manually insert a latitude and longitude via the LAT/LON mode described later.

CALCULATE mode will determine the magnetic variation for the given latitude, longitude and date. The azimuth part of the pointing solution will be displayed as a magnetic heading (MAG:) since CALCULATE is intended to be used as an aid in initially positioning the mount.

Even though no polarization movement is provided, CALCULATE does display nominal horizontal (H) and vertical (V) polarization angles. Section 1.3.8 of baseline manual should be reviewed for definition of the sign convention for polarization used by the RC3000.

LOCATE

LOCATE mode operates in the basic sequence described in the baseline manual. Since no compass is available for a heading reference and since no azimuth angle sensor is available, LOCATE will first go to the calculated elevation position and then perform a flat spiral using most of the available azimuth range of motion.

SEARCH

SEARCH mode is provided as an automatic way to search for an inclined orbit satellite. SEARCH mode functions as described in section 3.2.2.4 “Spiral Search Autopeak” of the baseline manual. SEARCH mode will begin the spiral search from the current location of the mount.

3.2.2.4 STORE

3.2.2.5 RECALL

3.2.2.6 DELETE

STORE, RECALL and DELETE modes function as described in the baseline manual.

3.2.2.7 LAT/LON

The LAT/LON mode may be used to supply latitude and longitude to the CALCULATE mode in case the GPS receiver is not connected or malfunctioning.

3.2.2.8 SETTINGS

No SETTINGS mode is applicable to the operation of the PA mount.

NOTE: in case of an azimuth of elevation jammed condition, the axis may be reset via the DRIVE RESET mode described in section 3.3.2.2 of the baseline manual.

3.2.2.9 TRACK

3.2.2.10 REMOTE

TRACK and REMOTE modes perform as described in the baseline manual.

3.3 Programming Group

All programming group modes described in the baseline manual are provided.

3.3.1.2 Reset Defaults

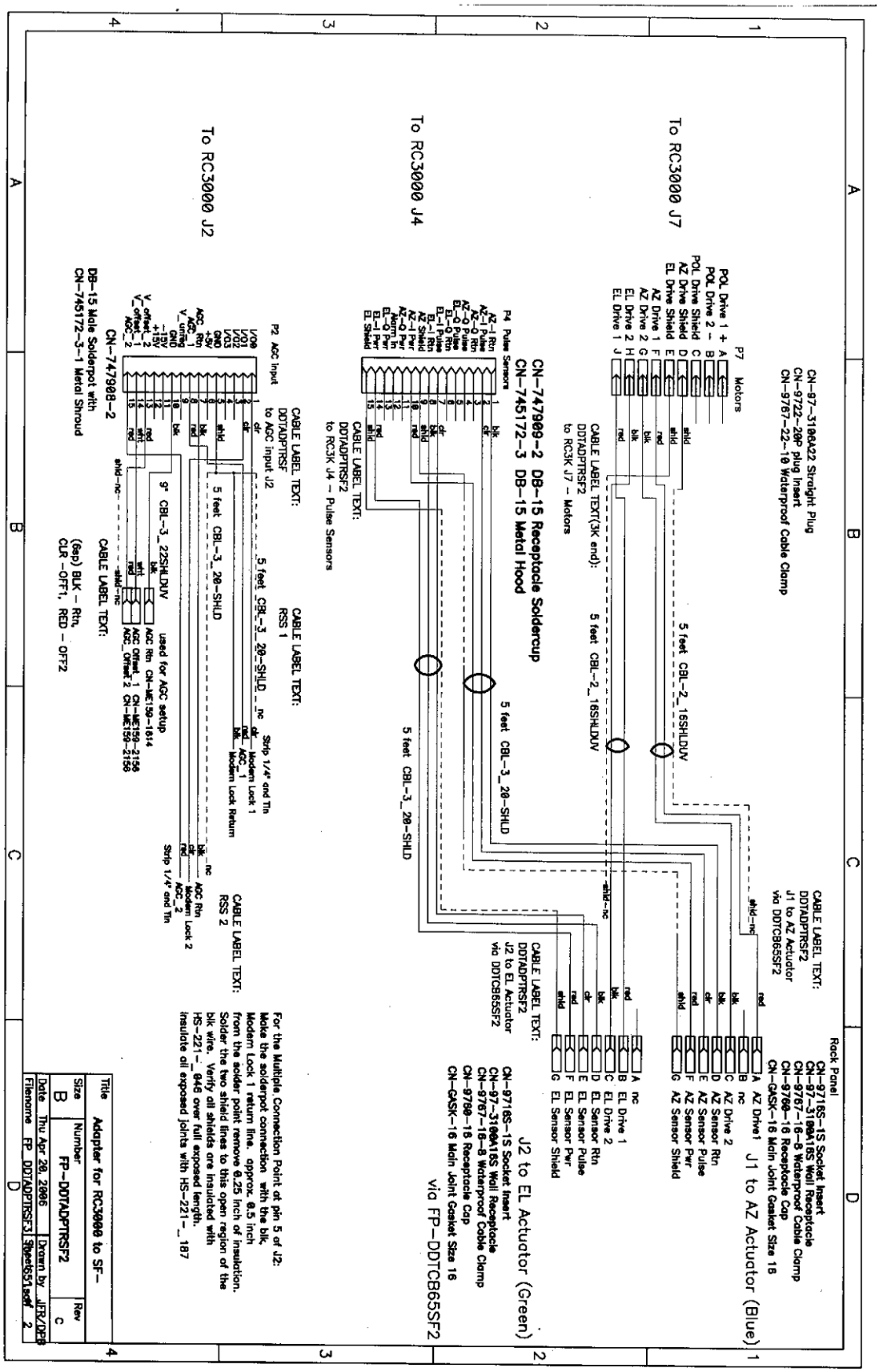
The following table supplies the default configuration item values for this mount. Space has also been provided to record installation specific changes to the configuration items. Note: recording of installation specific changes to defaults may prove valuable when trying to restore system configuration.

CONFIGURATION ITEM	PA	COMMENTS	INSTALL VALUE
SYSTEM DEFINITION			
GPS_present	1		
Compass_present	2		
Initial_mode	2		
antenna_size_cm	244		
Waveguide_present	0		
ELEVATION CALIBRATION			
Zero Voltage	3.00	Set during calibration	
Elev_offset	0.0		
Up_elev_limit	90		
Down_elev_limit	0		
Elevation_Scale_Factor	50.00	Set during calibration	
Elevation_look_configuration	1		
AZIMUTH CALIBRATION			
Azim_offset	0.0		
ccw_azim_limit	0		
Cw_azim_limit	360		
POLARIZATION CALIBRATION			
Zero Voltage	2.50		
Polarization_Offset	0.0		
CW Polarization Limit	90.0		
CCW Polarization Limit	90.0		
Pol_Scale_Factor	37.50		
Polarization_type	1	1=Circular=> No Pol Axis	
H/V_Reference	1		
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	2	Enabled with peak	
Signal Source	3	3=SS2	
RF Band	4	X band	
Spiral Search AZ Limit	5		
Spiral Search EL Limit	5		
Spiral Signal Threshold	200		
Scan Range Limit	8		
Scan Signal Threshold	200		

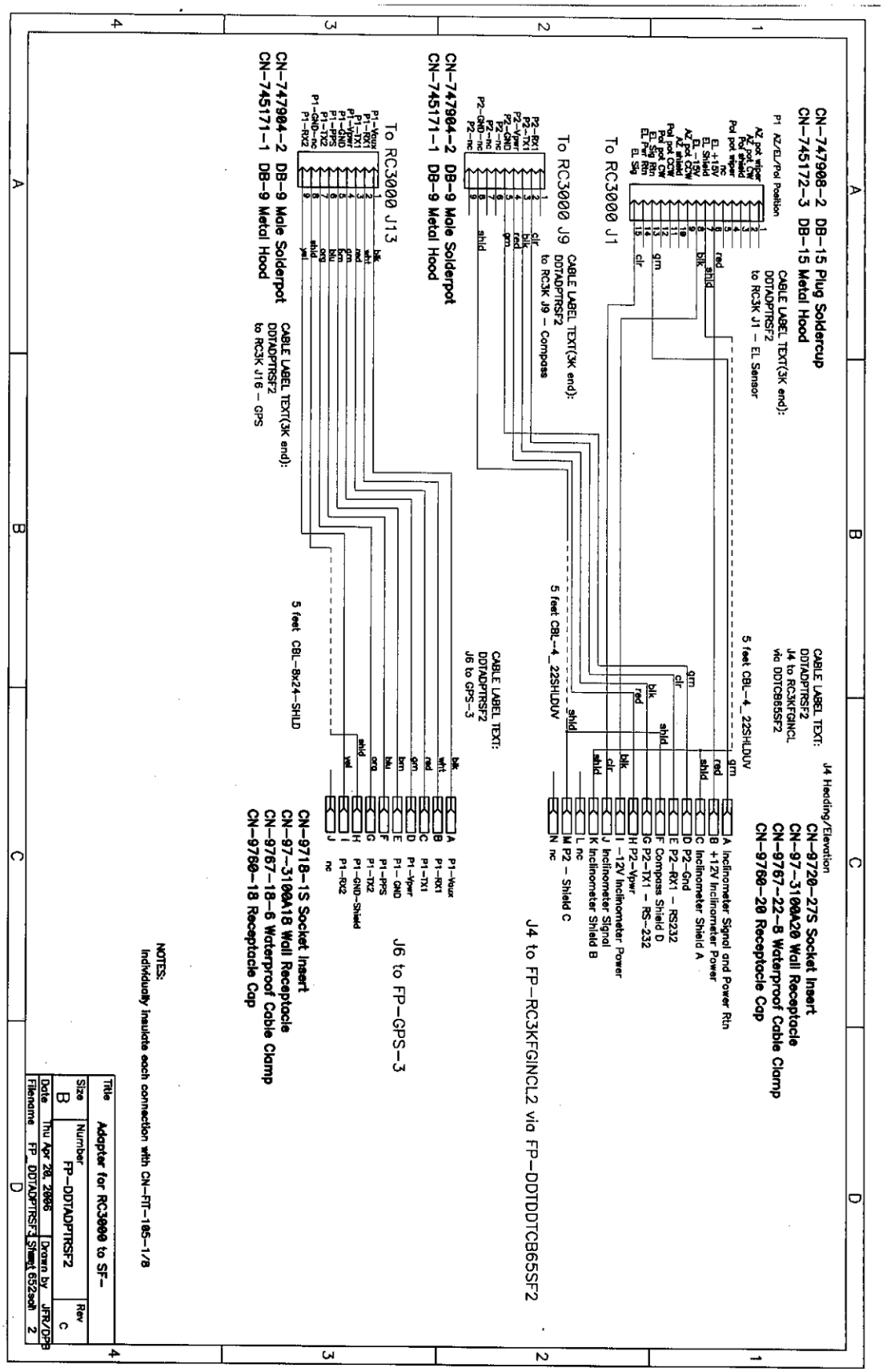
CONFIGURATION ITEM	PA	COMMENTS	INSTALL VALUE
AZIMUTH POT DRIVE			
Fast/Slow Threshold	1.0		
Maximum Position Error	0.1		
Coast Threshold	0.0		
Maximum Retry Count	3		
AZIMUTH PULSE DRIVE			
Pulse Scale Factor	802		
CW Pulse Limit	11200	Confirm during calibration	
CCW Pulse Limit	10010	Confirm during calibration	
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	1.0		
Maximum Position Error	0.1		
Coast Threshold	0.2		
Maximum Retry Count	3		
ELEV PULSE DRIVE			
Pulse Scale Factor	688		
UP Pulse Limit	19990	Confirm during calibration	
Down Pulse Limit	15600	Confirm during calibration	
Fast/Slow Threshold	50		
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	PA	COMMENTS	INSTALL VALUE
TRACK			
Search Enable	0		
Max Track Error	3		
Search Width	4		
Peakup Holdoff Time	120		
Track Signal Source	3	3=SS2	
Signal Sample Time	2		
REMOTE CONTROL			
Remote Enabled	1		
Bus Address	50		
Baud Rate	6		
Jog	20		
STOW / DEPLOY			
AZ STOW	-21.0		
EL STOW	91.0		
PL STOW	0.0		
AZ DEPLOY	0.0		
EL DEPLOY	20.0		
PL DEPLOY	0.0		
PL ENABLED	1		
SHAKE			

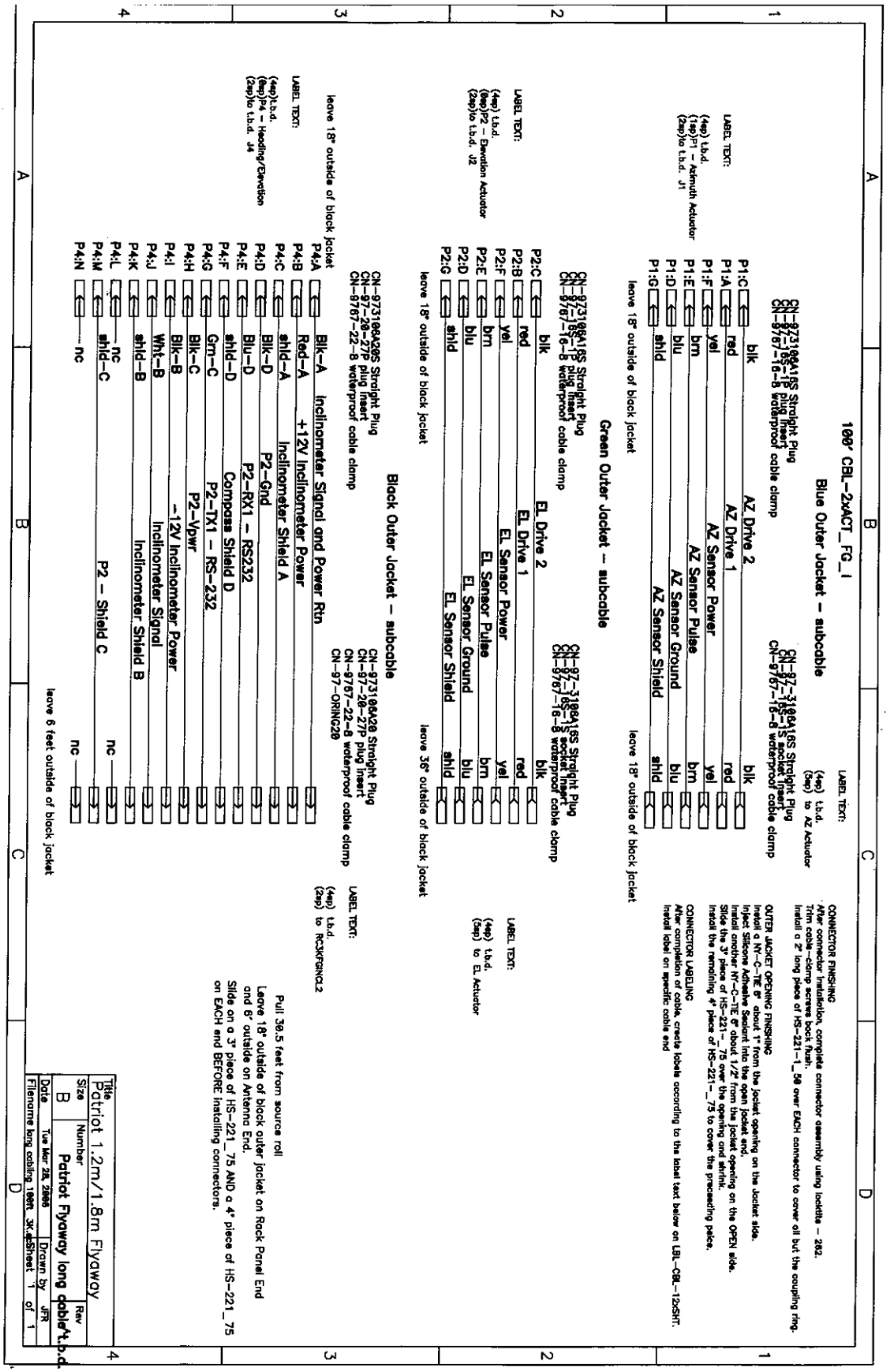
4.2 Schematics



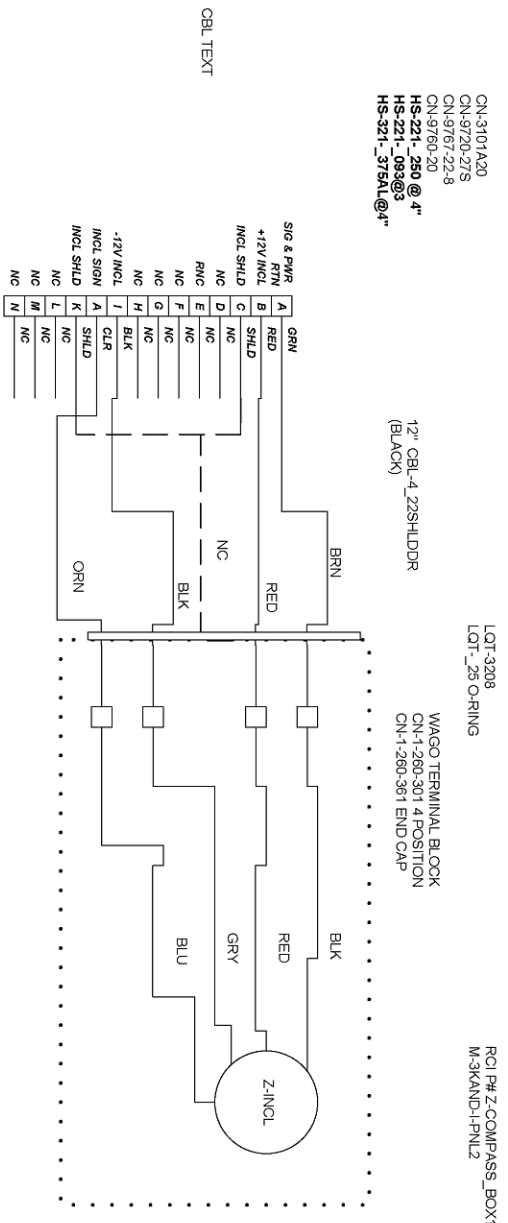
ADAPTER CABLE 1



ADAPTER CABLE 2

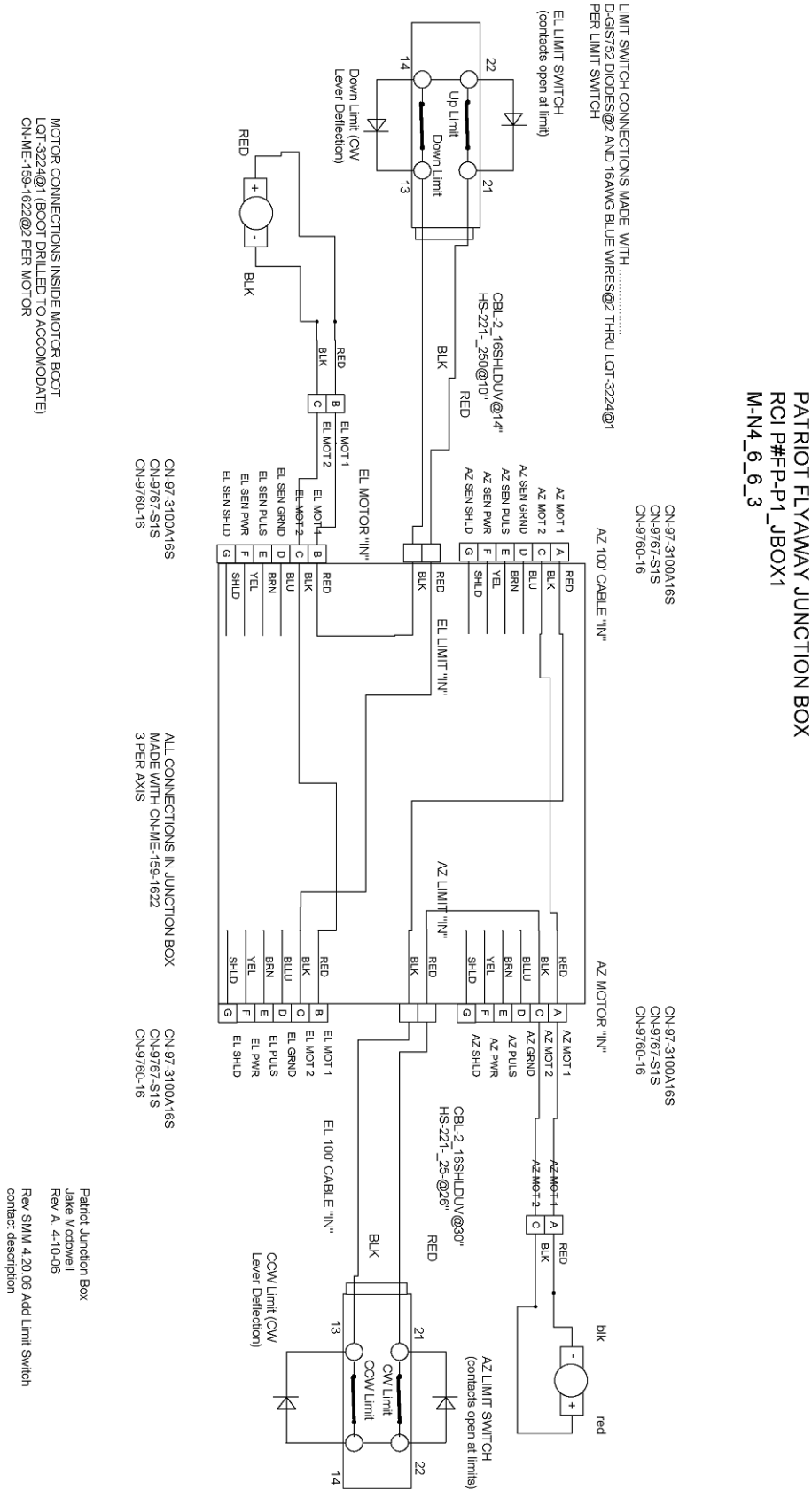


INTERCONNECT CABLE



Patriot Inclinometer Box
Jake Mcdowell
Rev A. changed cable type (weather resistant)
PANEL NEEDS TO BE CHANGED TO REFLECT
15 DEGREE OFFSET

INCLINOMETR BOX WIRING



JUNCTION BOX WIRING