

RC3KD TriKit RC3000D to ANDREW Trifold® Interface Kit

Installation Manual



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1.0 RC3KD TriKit Installation

The RC3KD TriKit provides all the hardware necessary to interface a RC3000D mobile antenna controller with an Andrew 3.7/4.5m.Trifold antenna system.

Chapter 1 of this document describes how to install the components of RC3K TriKit onto an Andrew Trifold antenna system. Chapter 2 details calibrating the RC3000D antenna controller with the Trifold system. Chapter 3 provides drawings and schematics associated with the interface kit.

1.1 Mount Requirements

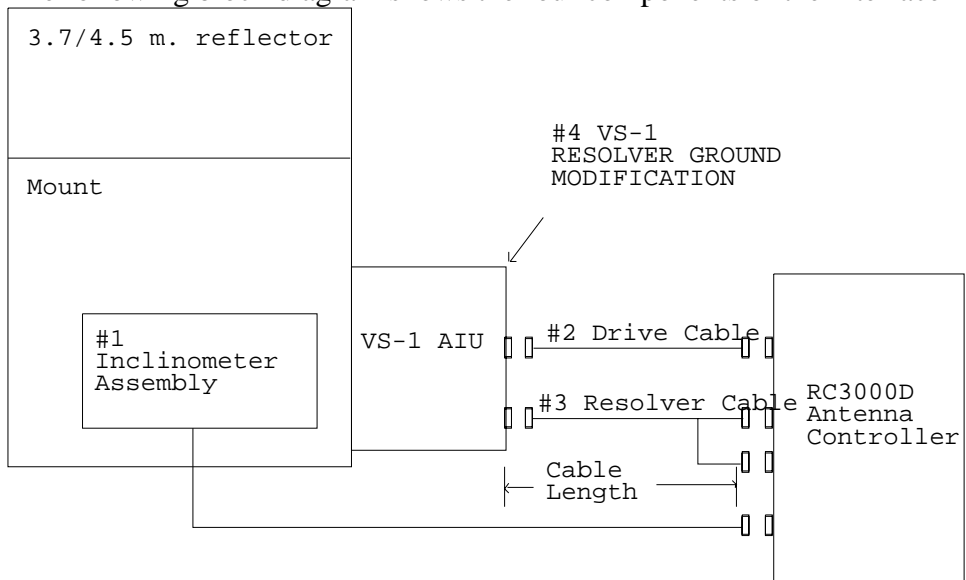
The RC3KD TriKit requires that the following Andrew antenna components are present:

- 1) Andrew positioner (mount) mechanism. Andrew supplies the combined reflector (3.7m. or 4.5m. Trifold) and mount as their model AP (Antenna and Positioner).
- 2) Andrew MKAPVS1 motorization kit. This option provides the azimuth, elevation and polarization motors along with the VS-1 antenna interface unit (AIU) and VS-2 handheld control.
- 3) Andrew REMKAP-VS1-100 2 pole resolver kit. This option provides the azimuth, elevation and polarization resolvers, brackets and cabling to the VS-1 AIU. **Note: Make sure to have the 2 pole vs. 4 pole resolver kit.**

Prior to installation of the kit, manual control of the mount via the Andrew VS-2 local controller should be established to ensure proper operation of the MKAPVS1 motorization kit. This manual assumes that a RC3000D antenna controller is present. The model RC3000D is specifically configured to interface to the Andrew VS-1 AIU.

1.2 Interface Kit Components

The following block diagram shows the four components of the interface kit.



RC3000D to Andrew Trifold Interface Kit - Block Diagram

The following provides a description of the RC3K TriKit components:

#1 Inclinometer Assembly. This assembly contains :

- electronic inclinometer used by the RC3000D for sensing true reflector elevation
- weatherproof housing for the inclinometer (the inclinometer will be mounted inside at the correct orientation)
- plates and bolts to attach the inclinometer housing to the appropriate place on the trifold mount
- cable to connect to the RC3000D

The inclinometer assembly is shown in the following picture attached to a 3"x3" metal tube.



#2 Drive Cable. This cable connects between the VS-1's APC Command connector and the RC3000D's Motor Drive connector.

#3 Resolver Cable. This cable connects between the VS-1's APC Resolver connector and the RC3000D's azimuth/elevation/polarization resolver connectors.

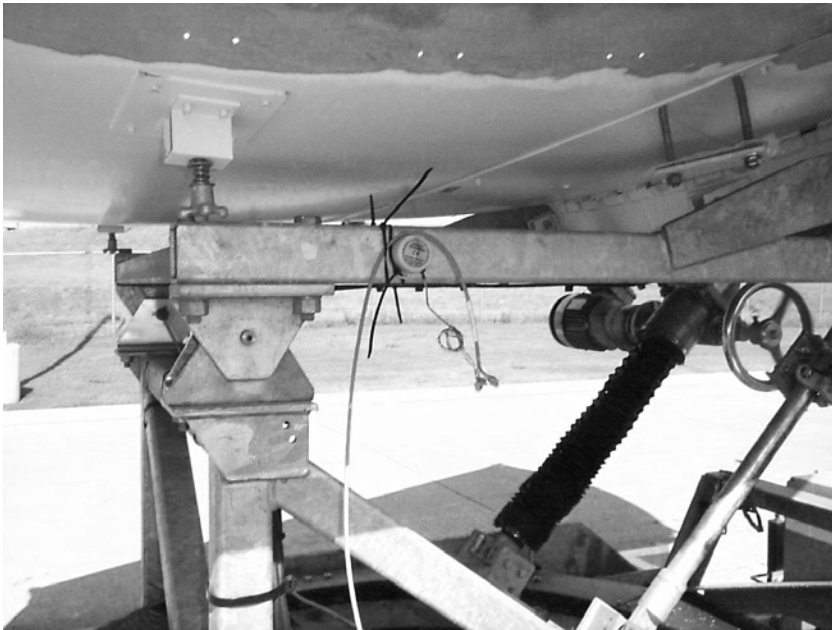
#4 VS-1 Resolver Ground Modification. For VS-1 AIUs manufactured before September 2000, a simple wiring modification must be made inside the VS-1 to minimize the amount of noise generated on the resolver interface to the RC3000D. This modification consists of inserting a pin with a short wire attached (provided) into an empty slot in one of the connectors inside the VS-1. An existing ground wire inside the VS-1 is disconnected from a terminal and connected to the wire attached to the newly inserted pin. This modification (if required) is easily accomplished. The RC3KD TriKit includes a wire with a crimped pin on one end and a heat-shrinkable butt connector on the other. Spare butt connectors are provided.

1.3 TriKit Installation

The following instructions require that the mount be initially placed in a specific position. It will be easiest to obtain this position by leveling the mount's platform as much as possible.

Place the mount in the following position using the VS-2 hand controller:

- 1) position the azimuth axis at its center of travel. This position may be recognized by noting if the mount is symmetrically seated when in the stowed position
- 2) position the polarization axis in its center of travel. This position should place the waveguide(s) in a horizontal or vertical orientation.
- 3) move the elevation axis to the position where the structural member attached to the elevation pivot point is horizontal. This position is shown in the following picture. Use a level to obtain an exact horizontal position of the member.

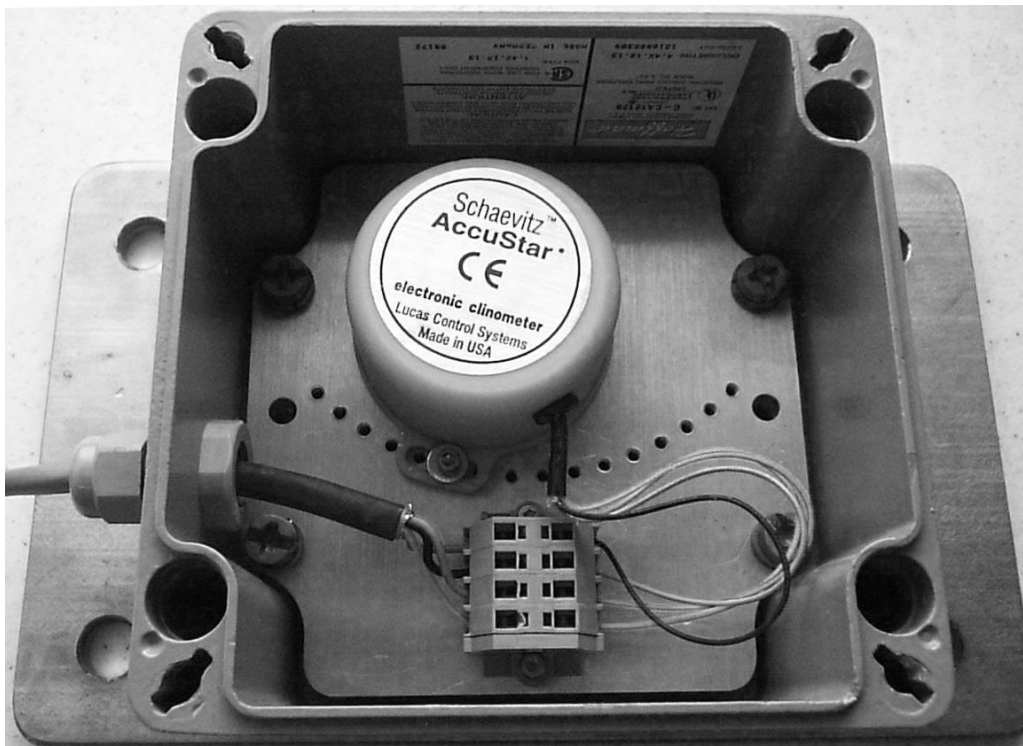


1.3.1 Mounting the Inclinometer Assembly

The inclinometer housing will be clamped to the mount so that it will rotate as the antenna rotates in elevation. The housing should be positioned on the 3 inch x 3 inch member of mount as shown in the picture in section 1.3. *The current picture in 1.3 shows an unhoused inclinometer but it is placed in the general location where the inclinometer assembly should be attached.*

NOTE: Be sure to place the housing with the side marked “UP” facing up. From this position the cable coming from the housing should point toward the elevation pivot point.

The inclinometer will be correctly oriented for the Trifold mount (15 degrees from vertical, shown below) when shipped. There should be no need to adjust the orientation of the inclinometer inside the housing.



Clamp the housing firmly (until the lock washers flatten) using the plates and bolts provided. The nuts may be tightened using 1/2” and 9/16” (or alternately 2 adjustable) wrenches.

The cable from the inclinometer housing should be routed along the mount structure to the area where the VS-1 AIU is attached to the mount. The inclinometer cable is 25 feet longer than the drive and resolver cables. This additional 25 feet should be plenty to safely route and attach the cable along the mount to the VS-1 area. Routing the inclinometer cable to the VS-1 area will allow it to be bundled together with the resolver and drive cables to the RC3000D antenna controller.

WARNING: Near the elevation pivot point, the cable should be provided enough slack to allow the elevation axis to completely rotate without straining the cable. Also confirm that the cable has been routed such that no azimuth movement will pinch the cable.

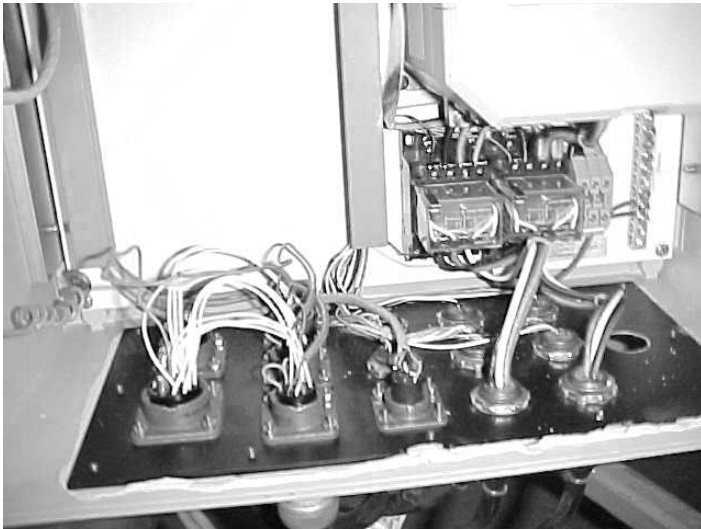
1.3.2 VS-1 Resolver Ground Modification

This modification allows the ground shielding of the azimuth, elevation and polarization resolvers to be passed through to the RC3000D's resolver cable. VS-1 AIUs manufactured after September 2000 will have this wiring incorporated.

WARNING: Be sure that power to the VS-1 AIU is off before proceeding.

To identify if this modification needs to be performed you will have to open up the front panel of the VS-1. Pins G, H and J of connectors J3, J4 and J5 are daisy chained together. If this daisy chain is terminated with a long wire from J5 to the ground terminal on the right side of the VS-1, the modification needs to be performed.

The following pictures show a VS-1 that does not need to be modified. Note that no wire runs from J5 to the ground terminal strip. Instead the wire runs from J5 to pin V of J1.



If needed, the following steps describe how to modify the VS-1 resolver ground scheme:

- 1) Identify the green wire with crimped on connector supplied with the RC3KD TriKit
- 2) Pin V of the VS-1's J1 (APC resolver) connector should be empty. Insert the connector from the supplied wire all the way into pin V.
- 3) Identify the resolver ground wire running from connector J5 to the ground terminal block. Unscrew the wire from the ground terminal block.
- 4) Leave the wire from J5 connected but cut it to a length that will produce a reasonably short connection between J5 and the wire inserted during step 2. Strip the wire so it may be used in the heat-shrinkable butt connector supplied with the RC3KD TriKit.
- 5) Connect the wires from J1 pin V and from the J5 connector by crimping them in the supplied butt connector.
- 6) After verifying that a good crimp connection has been made, apply heat to shrink the butt connector.
- 7) Close the VS-1 cabinet.

1.3.3 Resolver Cable

The 5-headed resolver cable will connect between the three antenna-mounted resolvers with Amphenol 97-series connectors and the RC3000D's Back Panel-mounted J12 (AZ/EL Resolver) and J4 (POL Resolver) connectors. There will be no connection made to the resolver connectors on the VS-1.

1.3.4 Drive Cable

The drive cable will connect between the VS-1's J2 (APC Command) connector and the RC3000D's J7 (Motor Drive) connector.

2.0 RC3000D CALIBRATION

After installing the components of the RC3KD TriKit, the RC3000D controller may now be calibrated to optimize performance with the Trifold mount.

Note that the calibration steps described here parallel the steps contained in section 2 (INSTALLATION) of the RC3000 User's Manual. The steps described here are condensed from that in the User's Manual and are specific to this situation (Trifold mount with RC3KD TriKit). The installer should reference the RC3000's User's Manual and the RC3000D's appendix to the User's Manual for more details of specific calibration steps.

2.1 Equipment Mounting

2.1.1 RC3000D

Place the RC3000D in its rack as described in the User's Manual.

2.1.2 GPS Receiver

Install the GPS receiver anywhere close to the mount as errors in latitude and longitude as large as a 100 meters will not significantly affect the calculated pointing angle to a satellite. The main criteria is that the GPS receiver have an unobstructed view of the sky. If additional cable length is needed to reach the RC3000D, a simple DB-9 to DB-9 extension cable may be used.

2.1.3 Fluxgate Compass

The fluxgate compass should be positioned so that is oriented in a direction parallel to the centerline of azimuth travel (the azimuth 0.0 degree position). If additional cable length is needed to reach the RC3000D, a simple DB-9 to DB-9 extension cable may be used.

2.1.4 Inclinometer

The inclinometer will be correctly oriented in the weatherproof housing when shipped. If the housing was installed correctly in step 1.3.1, the inclinometer will operate in its linear range throughout the range of mount elevation movement.

2.2 Electrical Connections

2.2.1 Power Entry

Make sure the RC3000D is configured for the correct input voltage (115 or 230 VAC).

2.2.2 Motor Drive

The correct motor drive connections will be achieved via the drive cable installed in 1.3.3. The RC3000D will send drive control signals to the VS-1 AIU. Actual drive voltage will be generated by the VS-1.

2.2.3 Drive Sense

The inclinometer cable installed in step 1.3.1 satisfies the connections to J1 of the RC3000D.

Note: There is no azimuth or polarization potentiometers from the Trifold antenna.

2.2.4 Limit Switches

No limit switch signals come from the VS-1 AIU to the RC3000D. The RC3000D has been internally configured to ignore the J3 signals.

NOTE: When the Trifold mount encounters one of its limit switches, motor drive to the appropriate axis is disabled within the VS-1 AIU. The RC3000D allows for setting of “software limits” which are described in the azimuth, elevation and polarization calibration procedures later. The software limits should be set slightly “inside” of the hardware limits. If hardware limits are encountered, the VS-1 will stop physical movement, but the RC3000D will continue to send a drive command until it declares a jammed condition.

2.2.5 Signal Strength

Connections to J2 should be made as described in section 2.2.5 of the User’s Manual.

2.2.6 Navigation Sensors

Connections to the fluxgate compass and the GPS receiver should be made using the supplied cables. As noted in 2.1.2 and 2.1.3, additional length for these connections may be achieved via straight-through DB-9 to DB-9 extension cables.

2.2.7 Accessories

The HPA disable signal may be mechanized as described in 2.2.7 of the User’s Manual.

2.2.8 RF Autopeak

The RF Autopeak signal may be mechanized as described in 2.2.8 of the User’s Manual.

2.2.9 Hand Held Remote

It is assumed that the optional RC3000 Hand Held Remote will not be required since the mount may be moved via the Andrew VS-2 local controller.

2.2.10 Pulse Sensors

There are no pulse sensors from the Trifold mount. The J4 position on the back of the RC3000D is actually used for the polarization resolver DB-15 connector.

2.2.11 PC Remote Control

If the PC remote control option is purchased, J5 would be configured as described in 2.2.11 of the User's Manual.

2.2.12 Waveguide Switch

The waveguide switch option is not available with the RC3000D. The J12 position on the back the RC3000D is actually used for the azimuth and elevation resolvers DB-15 connector.

2.3 Initial Configuration

2.3.1 Initialization

Ensure the RC3000D has been configured for the correct input voltage (115 or 230 VAC).

2.3.2 Elevation Calibration

NOTE: When the trifold mount is moved in the UP direction (RF pointing angle increases), the mount itself looks like it is moving down (towards the stowed position). Keep this in mind to avoid confusion.

Before starting calibration of the elevation axis, make sure that the initial position of the mount referenced in section 1.3 is established. The level of the 3"x3" mount structure should be confirmed before proceeding.

- 1) Go to the VOLTS maintenance screen and record the elevation voltage. This voltage should be around 2.7 +/- 0.2 volts.

Recorded Elevation Reference Voltage _____ V.

- 2) Go to the Elevation Calibration screen (UM 3.3.1.2.2) and enter the recorded voltage as the REF_V value. This establishes the reference voltage for the inclinometer. After entering the reference voltage, go to the MANUAL mode screen and verify that an elevation of 60.0 is shown.
- 3) Go back to the VOLTS maintenance screen and observe the value of the elevation resolver angle. The resolver angle should be about 180.0 degrees (center of resolver movement) to ensure that the elevation resolver will not "wrap around" when the elevation axis approaches its end of travel.

If the elevation resolver angle (observed from the VOLTS screen) is not approximately 180.0, the resolver should be rotated until this is achieved.

Recorded Elevation Resolver Angle _____ Degrees

- 4) Go to the Elevation Calibration screen. Enter the required offset to make the resolver-based elevation angle equal 60.0.

Example: If the recorded elevation resolver angle is 181.4, enter an elevation offset of -121.4 (60 - 181.4).

- 5) From the MANUAL mode screen, move the elevation axis down. The indicated angle should decrease. Press the SCROLL UP key to show elevation resolver counts. Again move the elevation axis down and verify that the resolver count decreases.
- 6) Move the elevation axis down until it reaches its limit of motion. Motion should stop via the VS-1.

Move the elevation slightly up from the limit. Record the elevation resolver count and enter as the down_limit on the ELEVATION PULSE DRIVE configuration screen. This count will trigger the RC3000D's DOWN limit indication.

- 7) Move the elevation axis up until the angled piece of the structure almost touches the pivoting stops (shown below). Don't drive the elevation axis all the way onto the pivoting stops. From this position, when the elevation stow clamps are engaged they should pull the structure onto the pivoting stops and provide effective clamping action.

Record the elevation resolver count and enter as the up_limit on the ELEVATION PULSE DRIVE configuration screen. This count will trigger the RC3000D's STOW limit indication. This is the position the mount will stop at when the RC3000D STOW operation is performed.



8) Return the elevation axis to the reference position. Perform the Elevation Scale Factor Calibration step described in section 2.3.2 of the User's Manual to characterize the output signal of the inclinometer.

2.3.3 Azimuth Calibration

Before starting calibration of the azimuth axis, make sure that the initial position of the mount referenced in section 1.3 is established. The azimuth center position may be determined by verifying that the structure sits symmetrically on the pivoting elevation stops.

- 1) Go to the VOLTS maintenance screen and observe the value of the azimuth resolver angle. The resolver angle should be about 180.0 degrees (center of resolver movement) to ensure that the azimuth resolver will not "wrap around" when the azimuth axis approaches its end of travel.

If the azimuth resolver angle (observed from the VOLTS screen) is not approximately 180.0, the resolver should be rotated until this is achieved.

Recorded Azimuth Resolver Angle _____ Degrees

- 2) Go to the Azimuth Calibration screen. Enter the required offset to make the resolver-based azimuth angle equal 0.0.

Example: If the recorded azimuth resolver angle is 181.4, enter an elevation offset of -181.4 (0.0 - 181.4).

Verify that the azimuth angle displayed in the MANUAL mode is 0.0.

NOTE: When doing a STOW operation, the RC3000D will require the azimuth axis to at an angle of 0.0 +/- 1.0 degrees before allowing the elevation axis to go the stow position.

- 3) From the MANUAL mode, drive the azimuth axis clockwise. The indicated angle should increase.

Drive the azimuth axis until it reaches its clockwise limit. Drive the azimuth axis slightly counter-clockwise and stop. Note the azimuth resolver count.

Recorded Azimuth Clockwise Limit Resolver Count _____

- 4) Enter the clockwise limit resolver count as the cw_pulse_limit in the AZIMUTH PULSE DRIVE configuration screen. This value will trigger the RC3000D’s CW limit indication.
- 5) From the MANUAL mode, drive the azimuth axis counter-clockwise. The indicated angle should decrease.

Drive the azimuth axis until it reaches its counter-clockwise limit. Drive the azimuth axis slightly clockwise and stop. Note the azimuth resolver count.

Recorded Azimuth Counter-Clockwise Limit Resolver Count _____

- 6) Enter the counter-clockwise limit resolver count as the ccw_pulse_limit in the AZIMUTH PULSE DRIVE configuration screen. This value will trigger the RC3000D’s CCW limit indication.

2.3.4 Polarization Calibration

Before starting calibration of the polarization axis, make sure that the initial position of the mount referenced in section 1.3 is established. The polarization center position may be determined by verifying that the waveguides are oriented with the local horizontal and vertical.

- 1) Go to the VOLTS maintenance screen and observe the value of the polarization resolver angle. The resolver angle should be about 180.0 degrees (center of resolver movement) to ensure that the polarization resolver will not “wrap around” when the polarization axis approaches its end of travel.

If the polarization resolver angle (observed from the VOLTS screen) is not approximately 180.0, the resolver should be rotated until this is achieved.

Recorded Polarization Resolver Angle _____ **Degrees**

- 2) Go to the Polarization Calibration screen. Enter the required offset to make the resolver-based polarization angle equal 0.0.

Example: If the recorded polarization resolver angle is 181.4, enter an polarization offset of -181.4 (0.0 - 181.4).

Verify that the polarization angle displayed in the MANUAL mode is 0.0.

- 3) From the MANUAL mode, drive the polarization axis clockwise. The indicated angle should increase.

Drive the polarization axis until it reaches its clockwise limit. Drive the polarization axis slightly counter-clockwise and stop. Note the polarization resolver angle.

Recorded Polarization Clockwise Limit Resolver Angle _____

- 4) Enter the clockwise limit resolver angle as the cw_limit in the POLARIZATION CALIBRATION configuration screen. This value will trigger the RC3000D’s CW limit indication.

- 5) From the MANUAL mode, drive the polarization axis counter-clockwise. The indicated angle should decrease.

Drive the polarization axis until it reaches its counter-clockwise limit. Drive the polarization axis slightly clockwise and stop. Note the polarization resolver angle.

Recorded Polarization Counter-Clockwise Limit Resolver Angle _____

- 6) Enter the counter-clockwise limit resolver angle as the `ccw_limit` in the POLARIZATION CALIBRATION configuration screen. This value will trigger the RC3000D's CCW limit indication.

2.3.5 Fast/Slow Motor Speed

The RC3000D only sends a Fast/Slow command to the VS-1 AIU. The actual setting of the Fast/Slow speeds is accomplished at the VS-1 AIU.

2.3.6 Pulse Sensor Checkout

No pulse sensors are used on the Trifold mount. The RC3000D's software uses resolver counts instead of pulse counts to perform several functions (such as inclined orbit tracking) that require very precise (high resolution) movements of the antenna.

Analogous steps to the ones described in 2.3.6 of the User's Manual have already been performed in the azimuth, elevation and polarization calibration steps above.

2.3.7 Drive System Checkout

Perform the checkout as described in the User's Manual.

2.3.8 Navigation Sensor Communication

Perform the checkout as described in the User's Manual.

2.4 Final Calibration

All steps in 2.4 may be performed as described in the User's Manual with the exception of 2.4.4 (Pulse Scale Factors). The calculation described in **2.4.4 is not required to be performed** since the correct value for the resolver interface (10,431 counts per radian) is included as the default value.

2.5 Operational Presets

Perform as described in the User's Manual.

2.6 Miscellaneous Adjustments

Perform as described in the User's Manual.

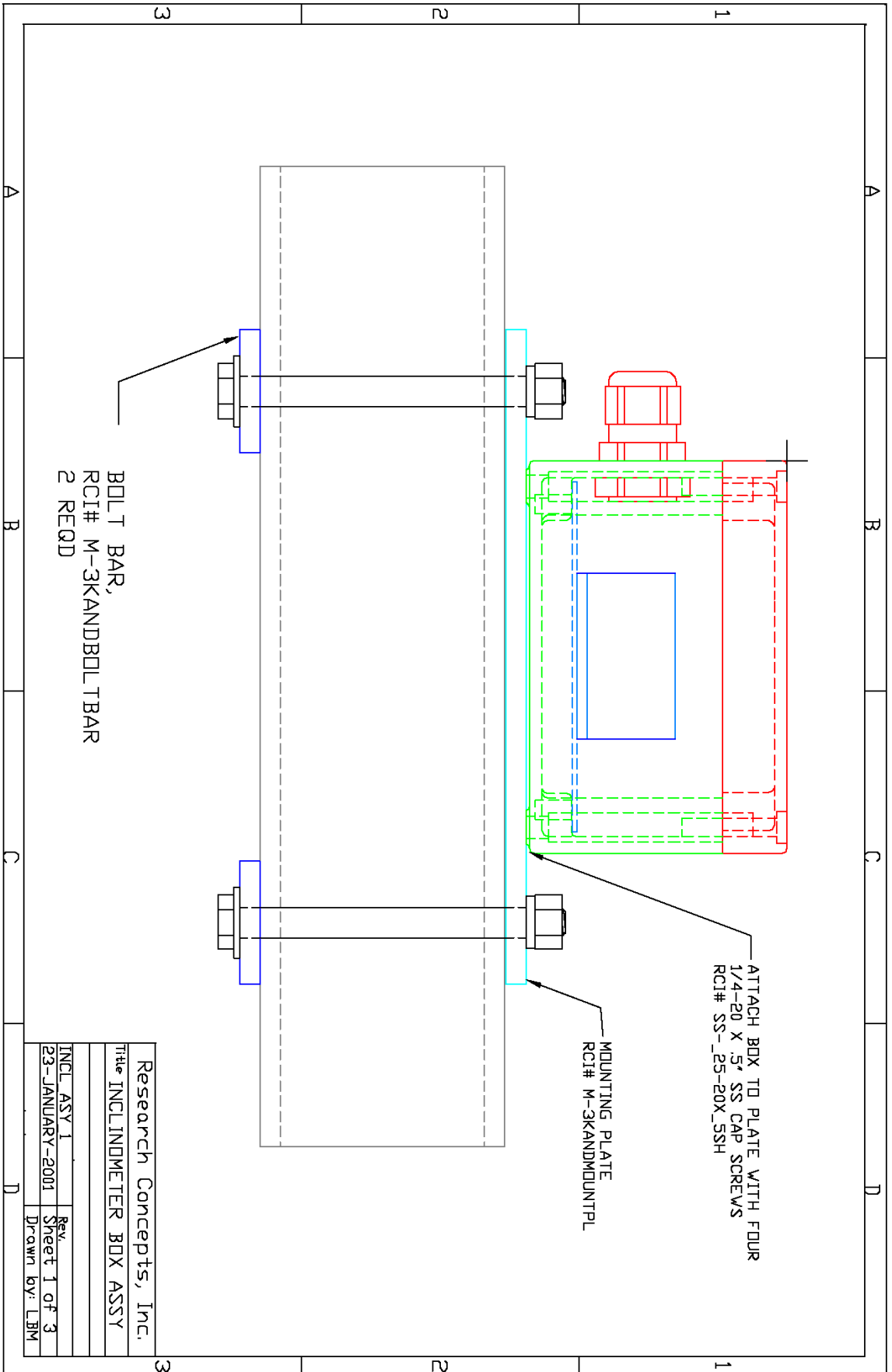
3.0 DRAWINGS & SCHEMATICS

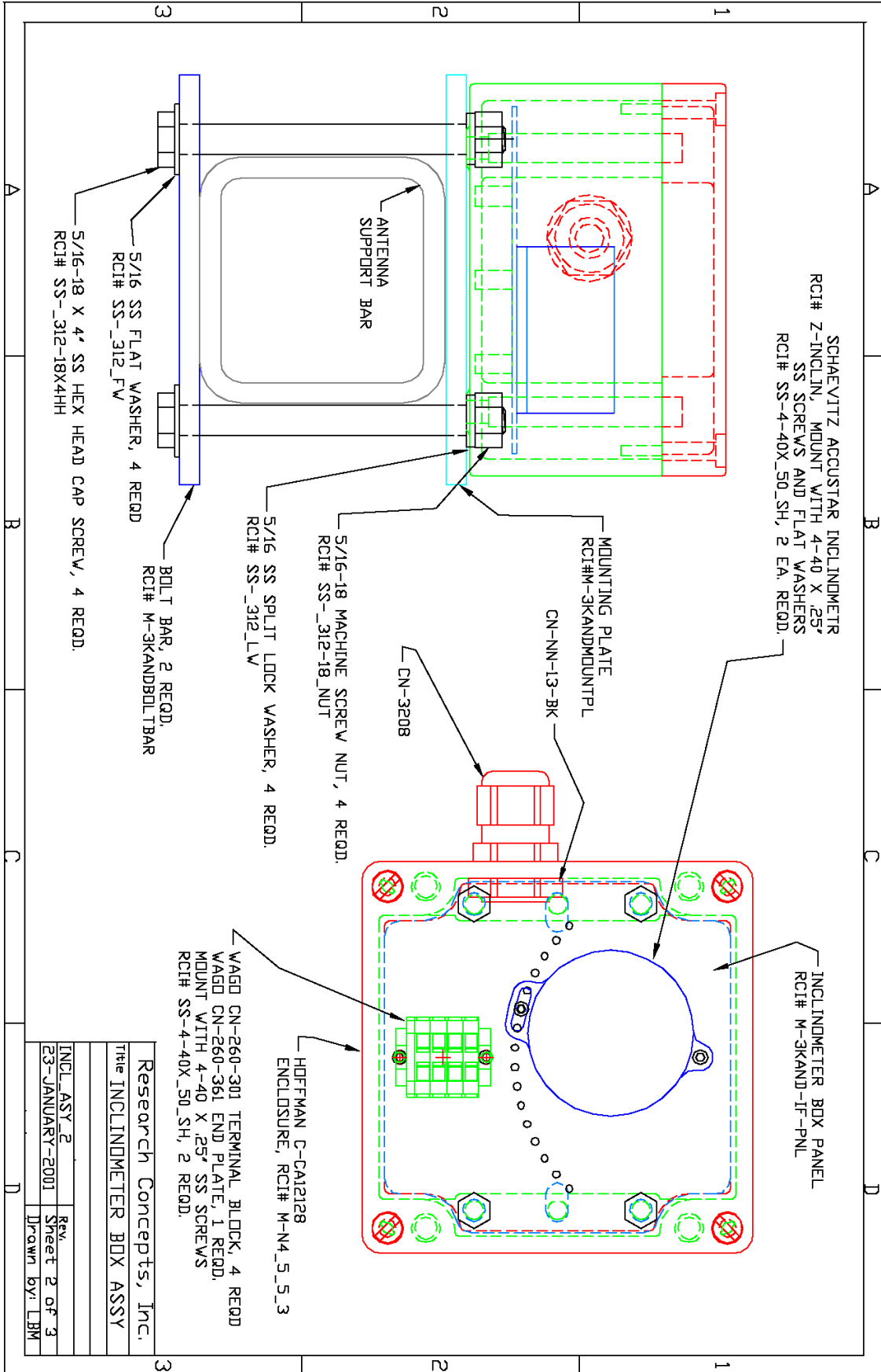
Inclinometer Box Assembly

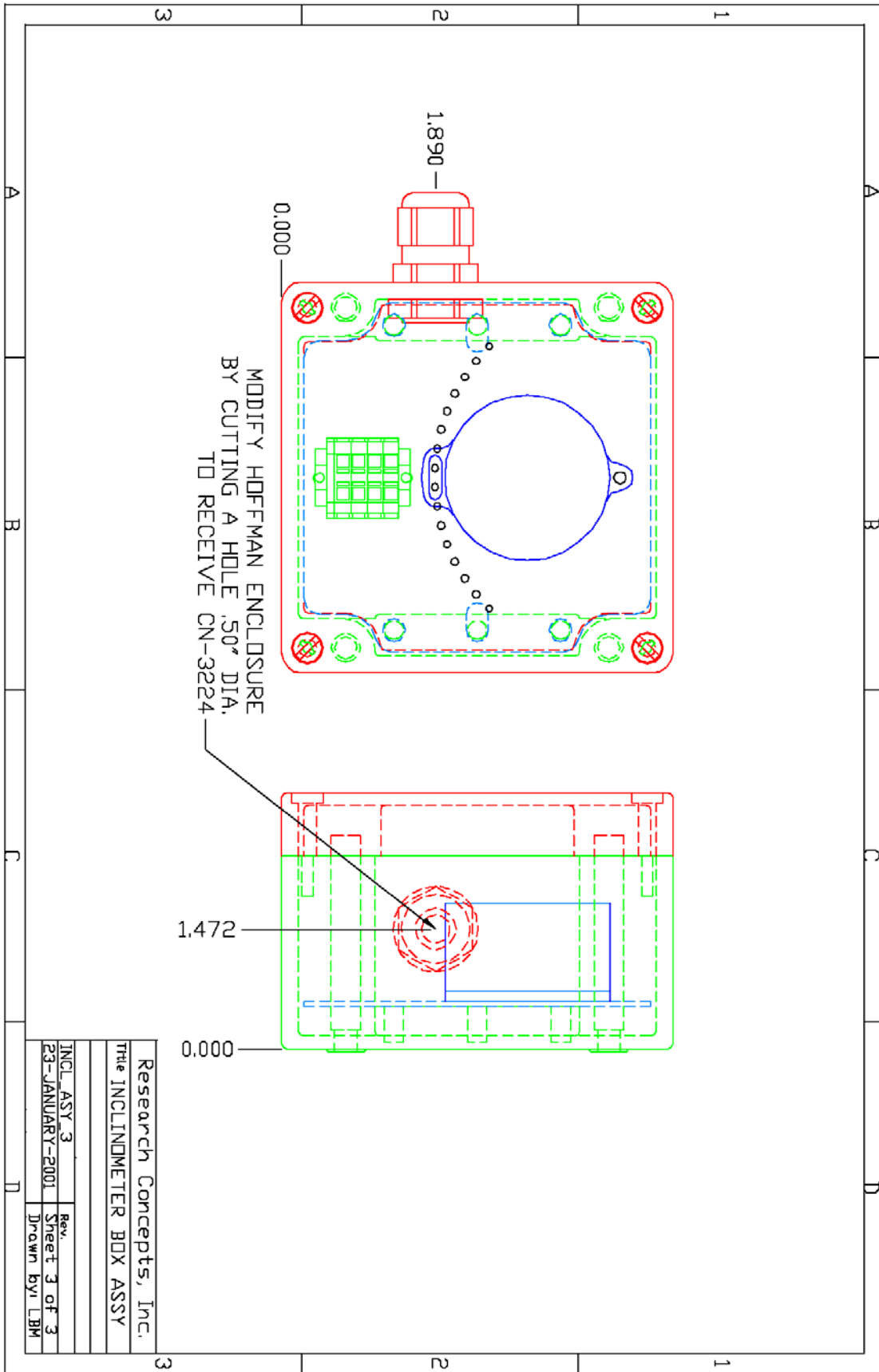
Inclinometer Cable

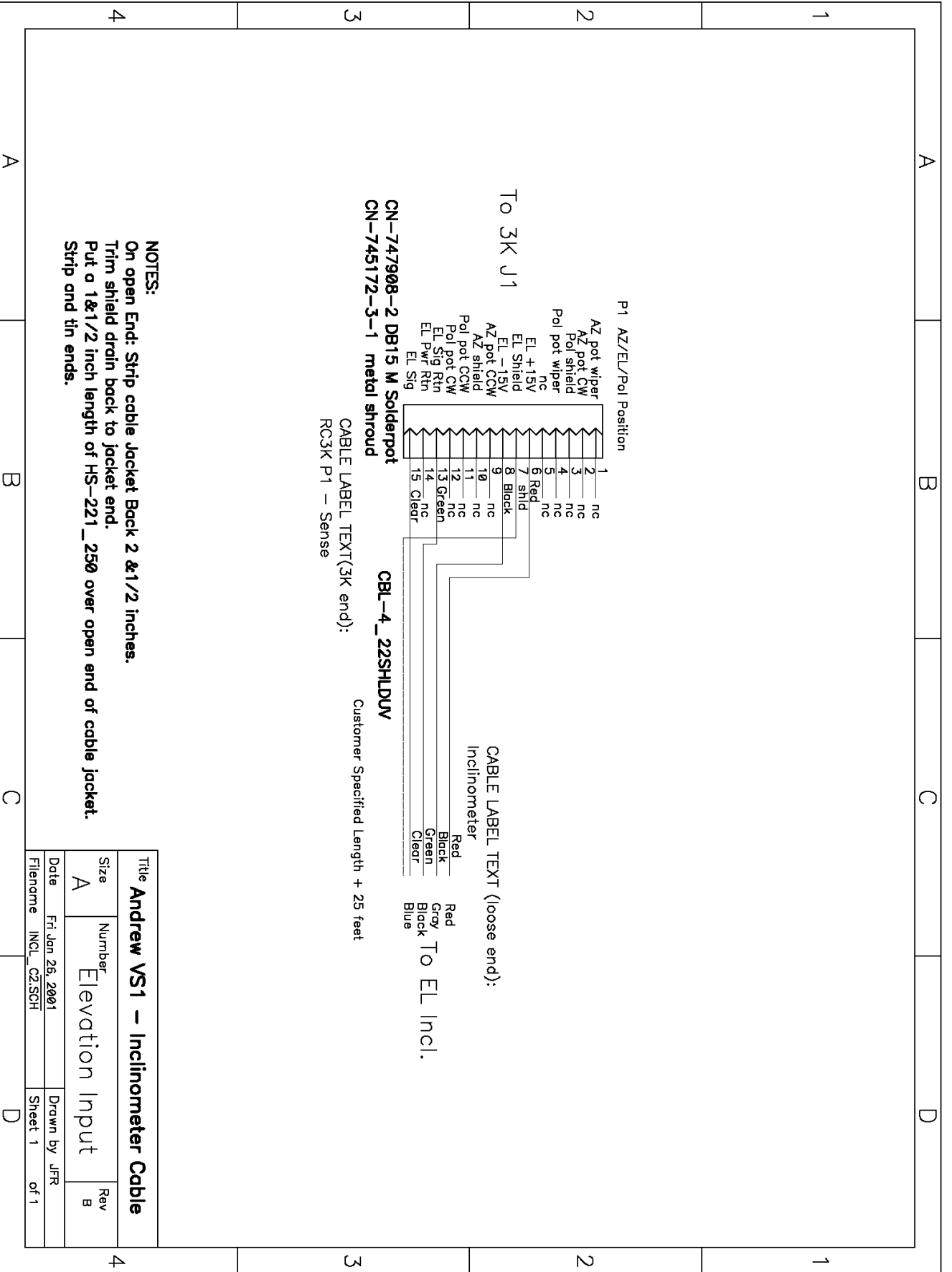
Resolver cable

Drive cable

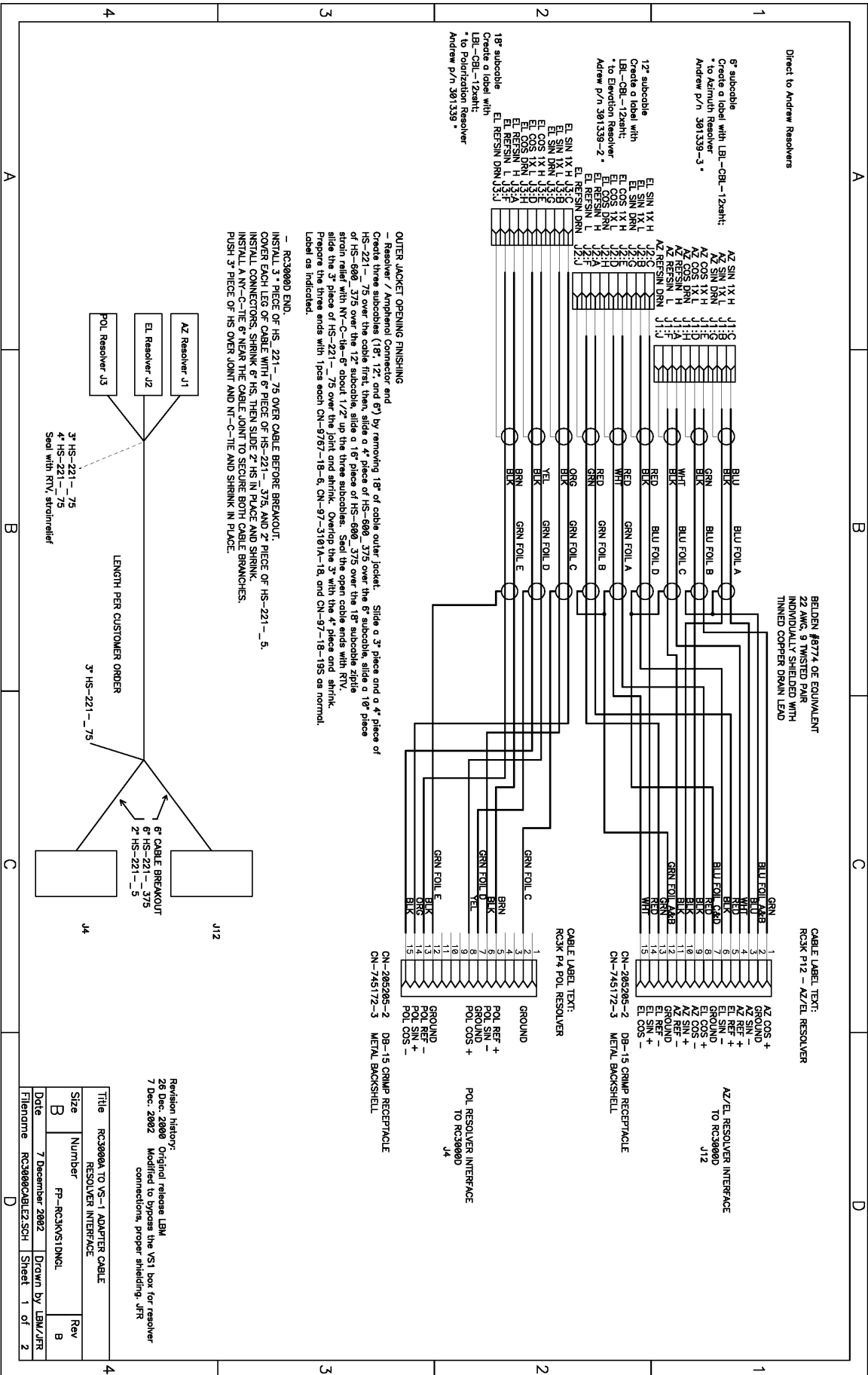


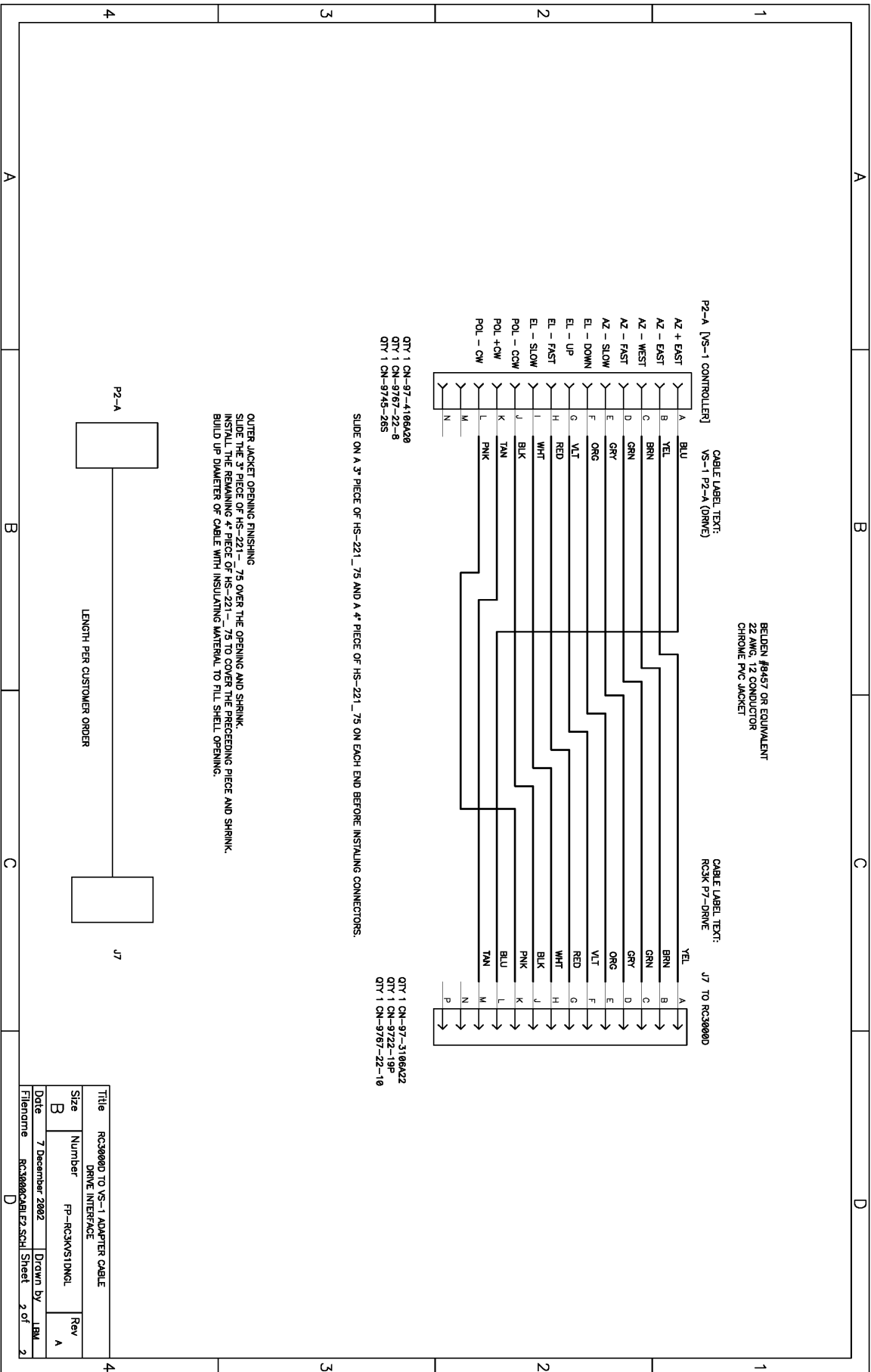






Title Andrew VS1 - Inclinator Cable			
Size	Number	Rev	
A	Elevation Input	B	
Date	Fri Jan 26 2001	Drawn by	JFR
Filename	INCL_C2.SCH	Sheet	1 of 1





RC3KD TriKit DATA SHEET

Customer _____

PO# _____

Cable Length _____

INCLINOMETER ASSEMBLY

Inclinometer S/N _____

Scale Factor _____

Date Assembled _____

Initials _____

Date Tested _____

Initials _____

RESOLVER CABLE

Date Assembled _____

Initials _____

Date Tested _____

Initials _____

DRIVE CABLE

Date Assembled _____

Initials _____

Date Tested _____

Initials _____

VS-1 MODIFICATION

Date Assembled _____

Initials _____

Date Tested _____

Initials _____

Date Assembled _____

Initials _____