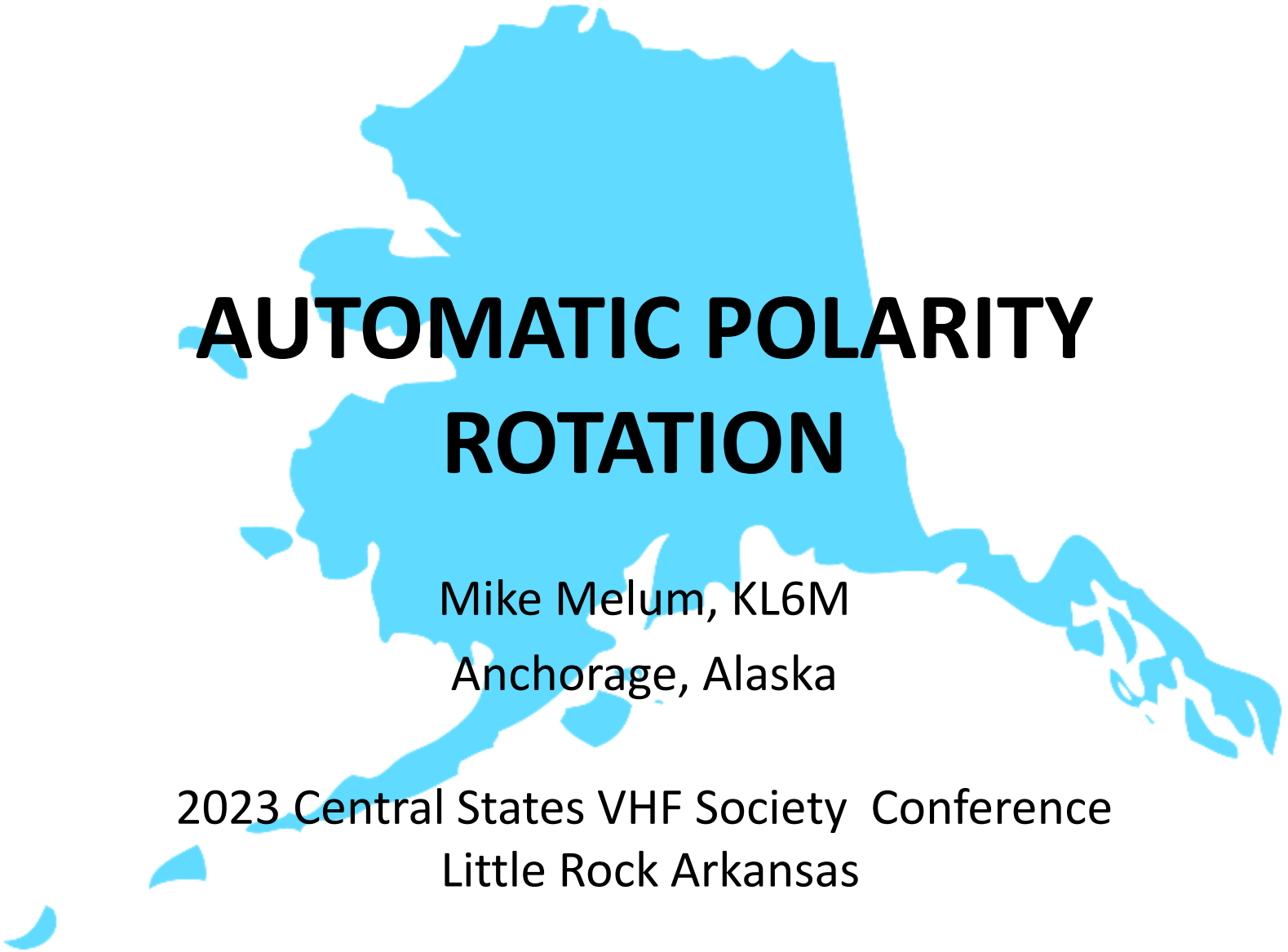


AUTOMATIC POLARITY ROTATION

Mike Melum, KL6M

Anchorage, Alaska

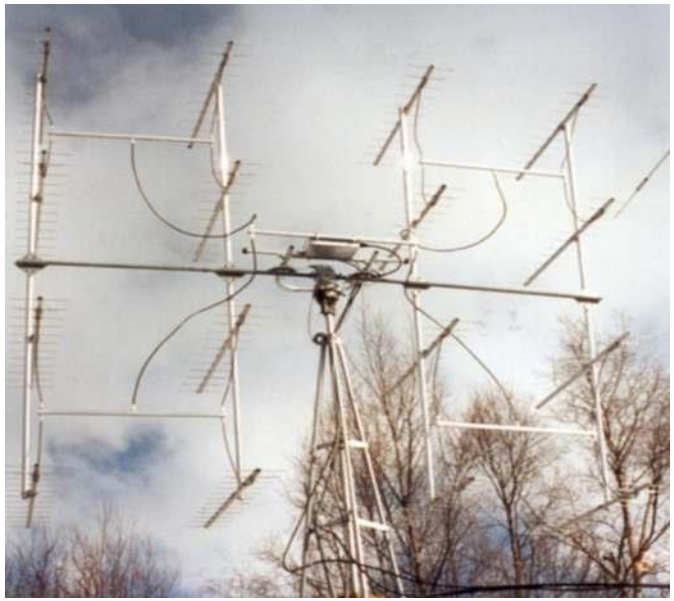
2023 Central States VHF Society Conference
Little Rock Arkansas

Contents

- History
  - Evolution of my EME system
  - Original feed mount with polarity rotator versus current
- Geometric Polarity and Faraday Rotation and Manually Compensating
- Automatic Rotator Design
- Results

1997

1999 - 2000



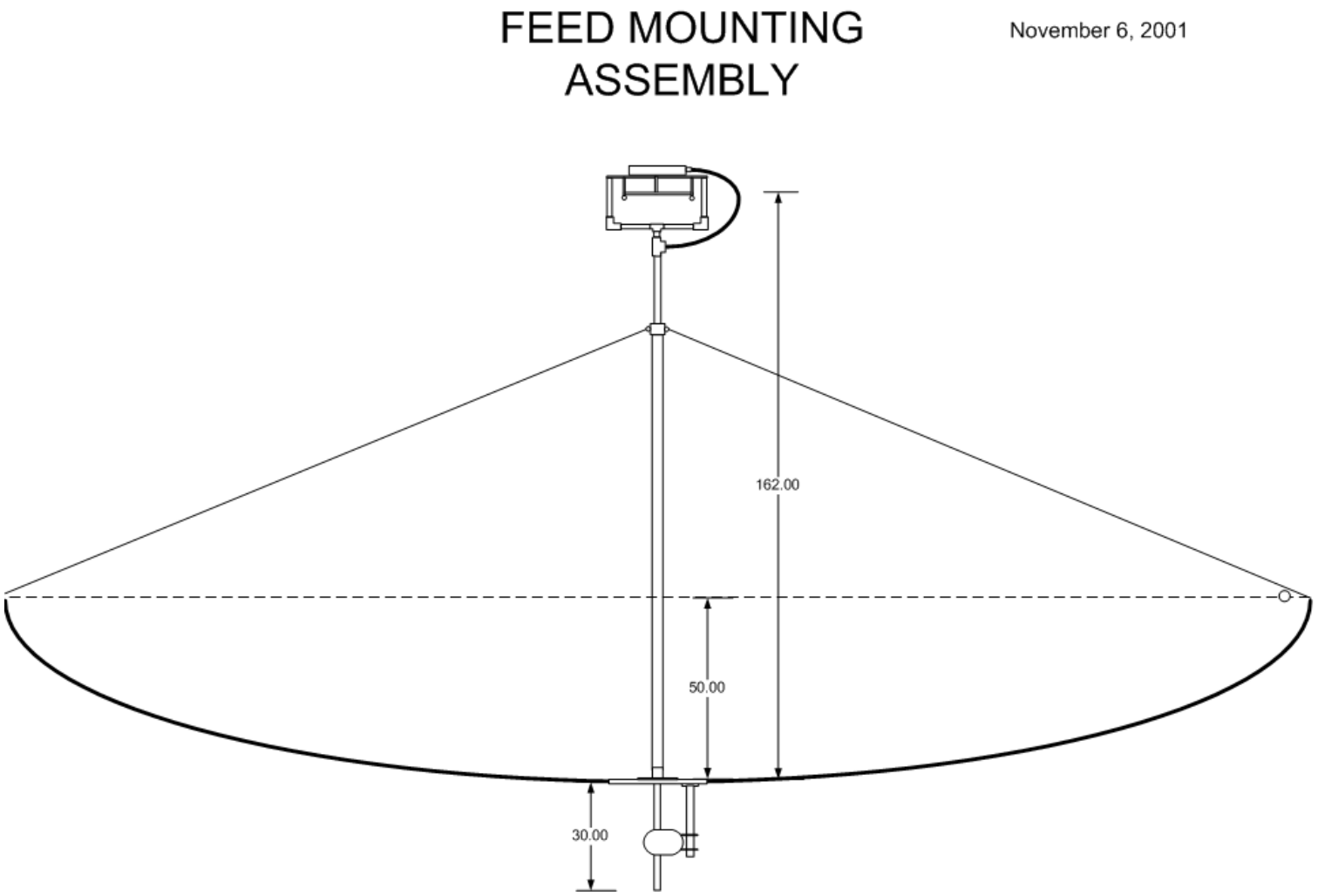
- First EME RX
- Fixed Horizontal 70cm Array
- Lots of Faraday lock-outs and one-ways

Acquired a Dish - Sept 1999

On the moon - Oct. 2000

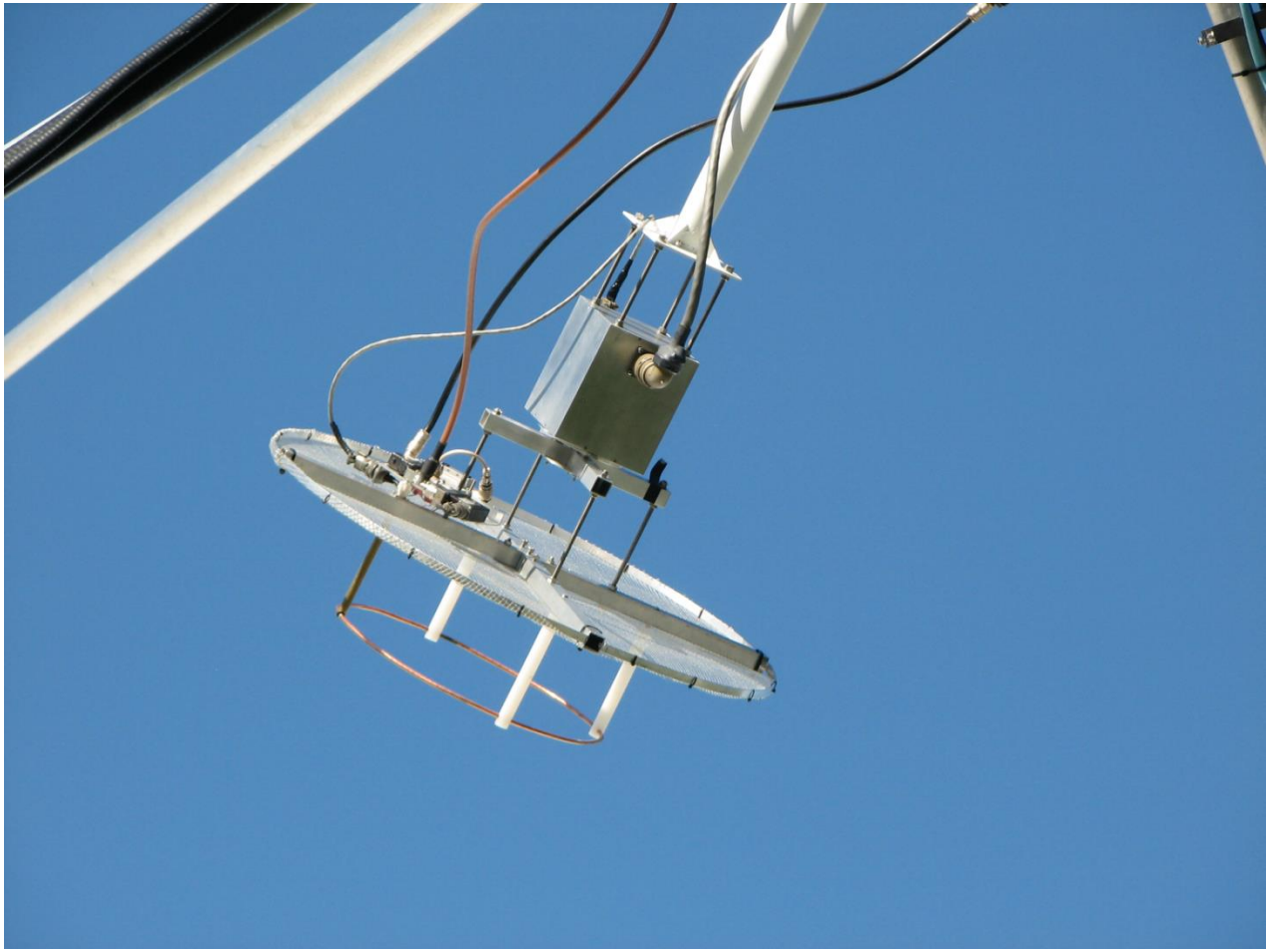
Guyed Center Supported Rotatable Feed

Mounting the Feed

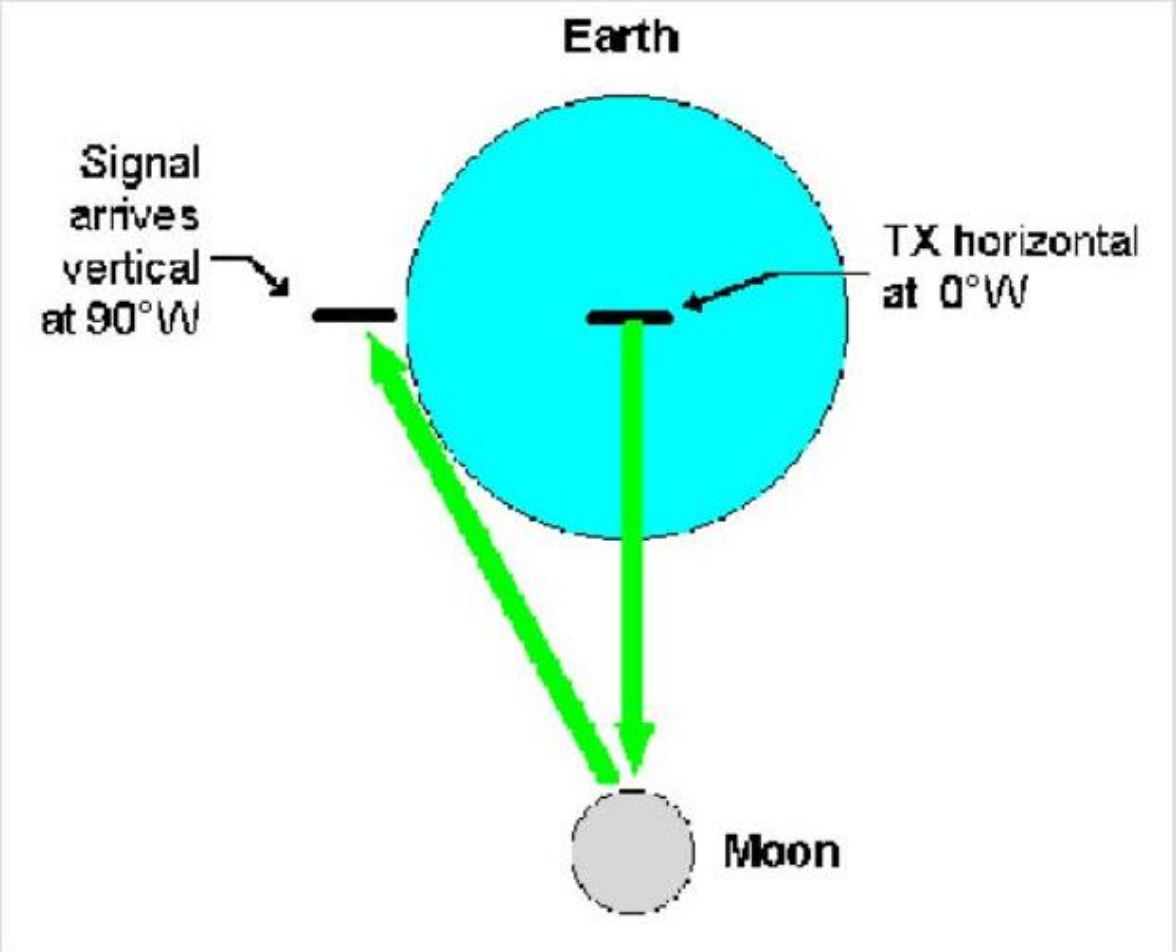


Current Feed System (2003)

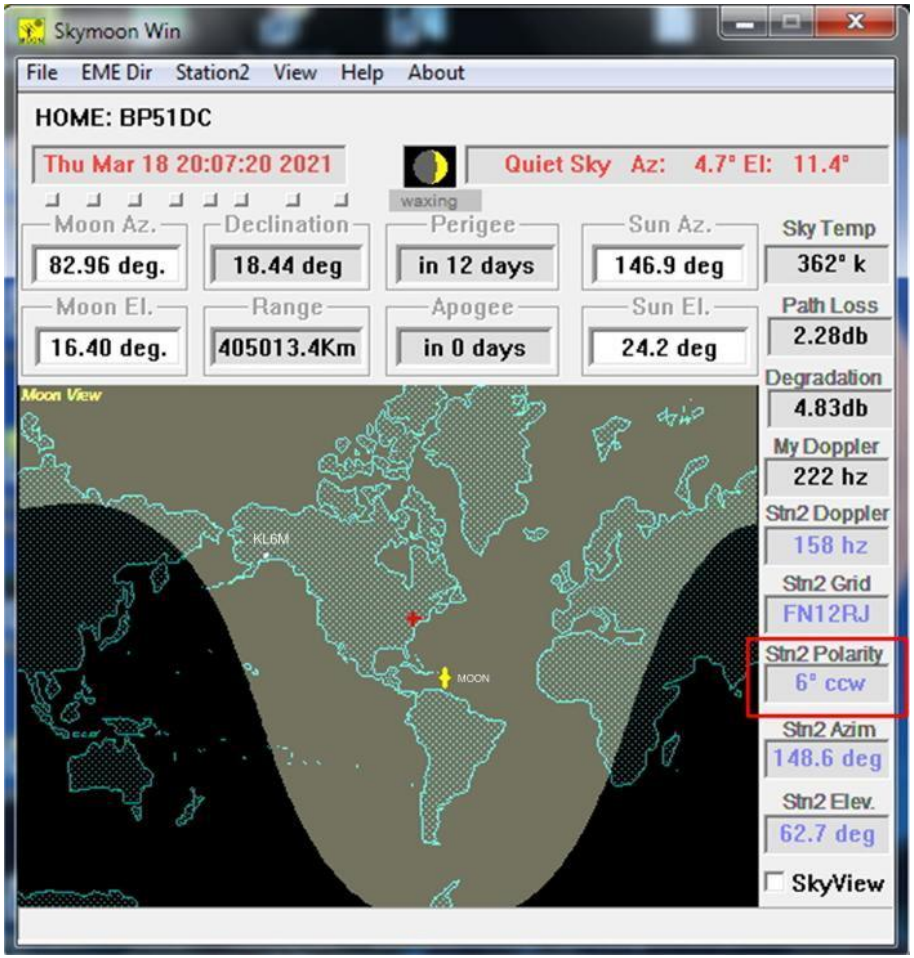
222 Feed with Polarity Rotator



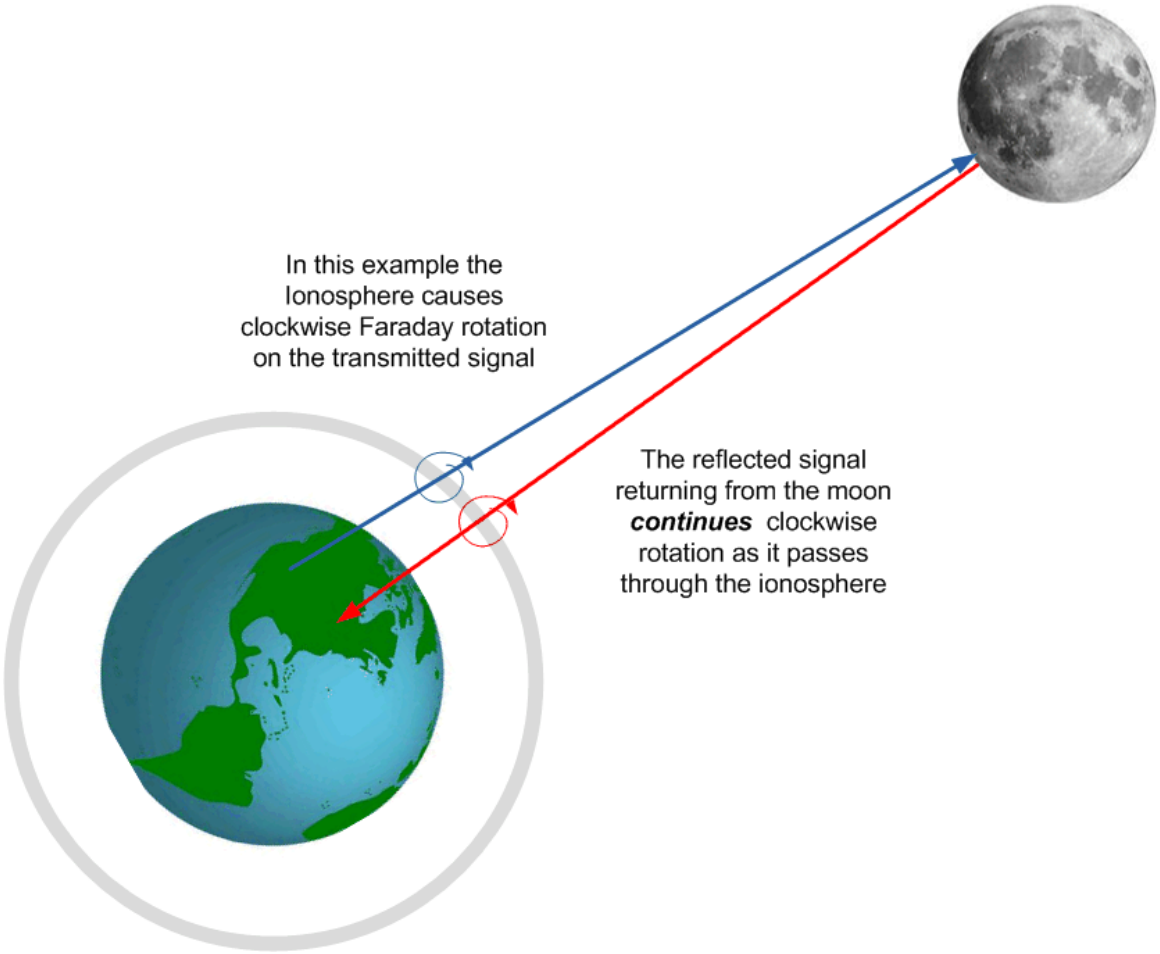
Geometric (Spatial) Polarity



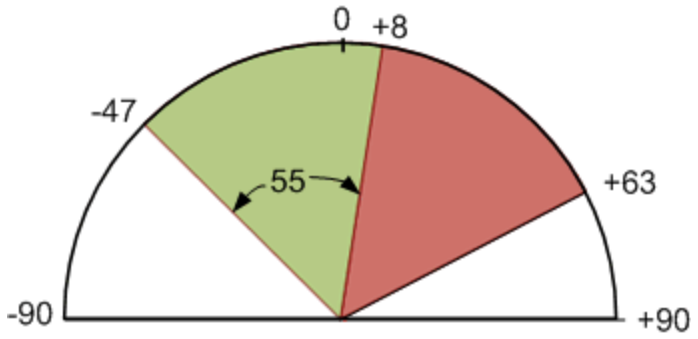
SkyMoon
(by W5UN)



Faraday Rotation

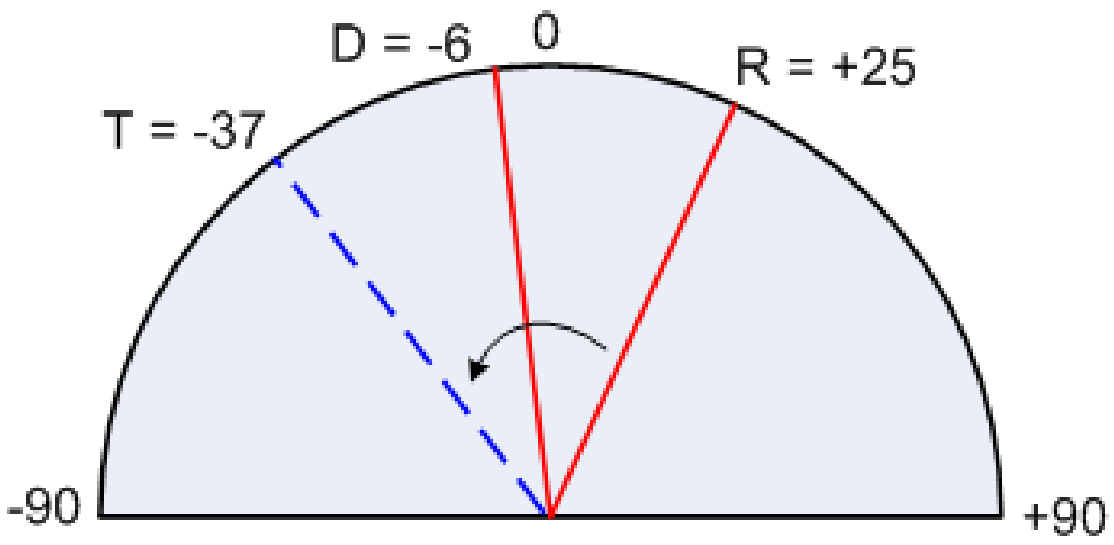


Manually Compensate for Faraday



- Determine Geometric Polarity
  - Sked – Enter Grid
  - CQ (random) – click map
  - Remember that angle
- Sweep for signal & peak
  - Subtract = difference
- Rotate difference past Geo

Calculated Approach to Compensate for Faraday

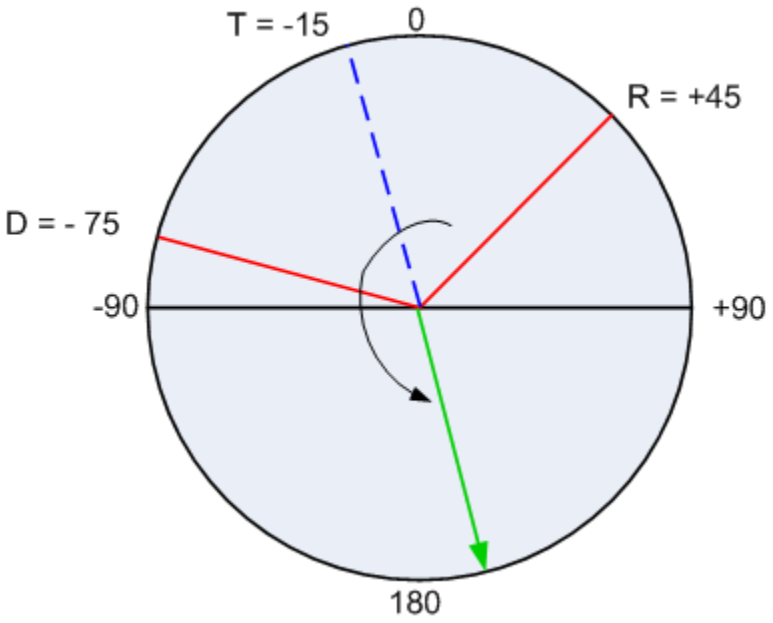


T = Tx polarity
D = Geometric
R = Best signal

T = 2D - R

T = 2 x -6 – 25
T = - 12 – 25
T = - 37

Another Example



T = Tx polarity
D = Geometric
R = Best signal

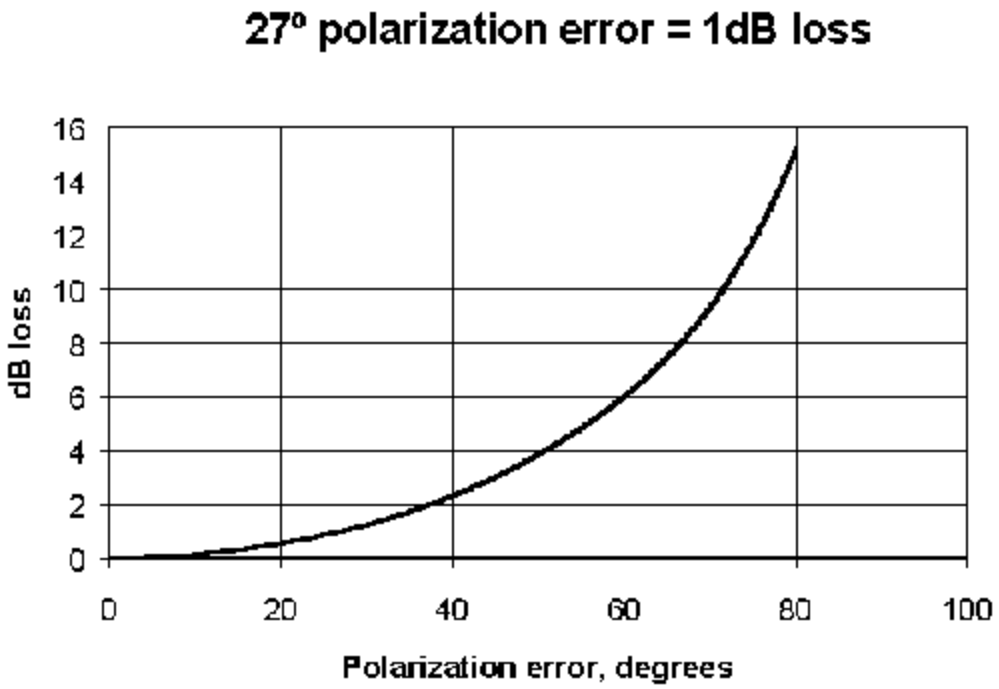
T = 2D - R

T = 2 x -75 – 45
T = - 195

IF T > 90 THEN T - 180
IF T < -90 THEN T + 180

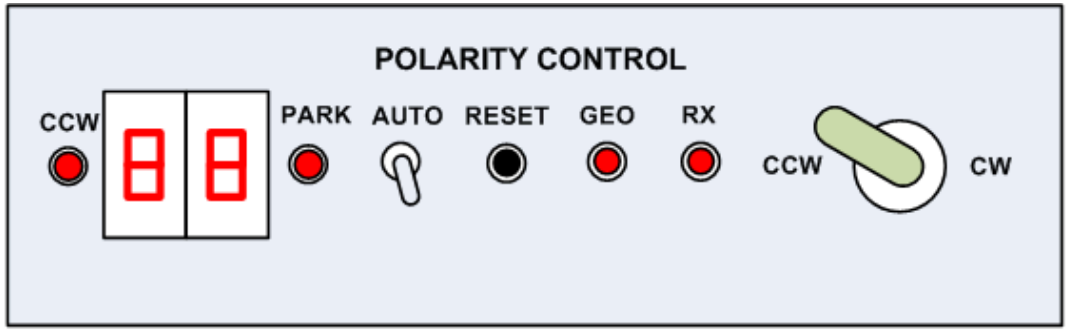
T = -195 + 180
T = -15

Why Do All This ?



To keep the signal losses below 1dB, the polarization error must be less than about ±(20-30)°. The good news is that the signal loss within the ±20° region is very small.

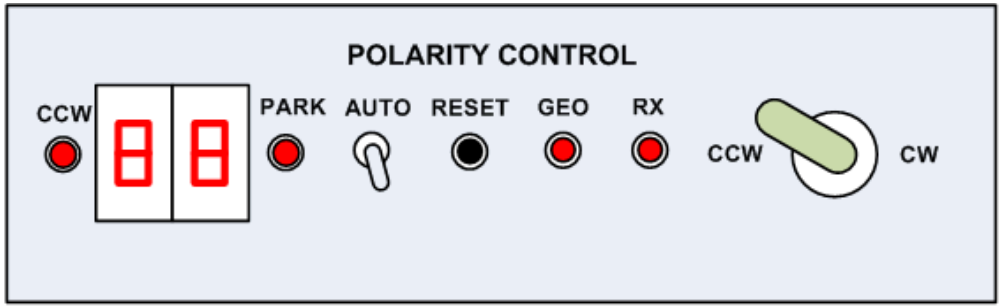
Automatic Polarity Rotation



FEATURES

1 Polarity display (2 digits + sign LED (CCW)) +/-99 DEGREES
2 0 degree LED (PARK)
3 Automatic TX positioning triggered by T/R signal (AUTO)
4 Reset (power off-on)
5 Geometric position memory (GEO)
6 Received polarity memory (RX)
7 Manual polarity control via M-O-M Toggle switch
8 Automatic park (Hold RX and GEO for 1/2 second)

Operating Procedure



OPERATING PROCEDURE

1. First look up the geometric or spatial offset and rotate the feed to that setting and store that angle. (Press Geo)

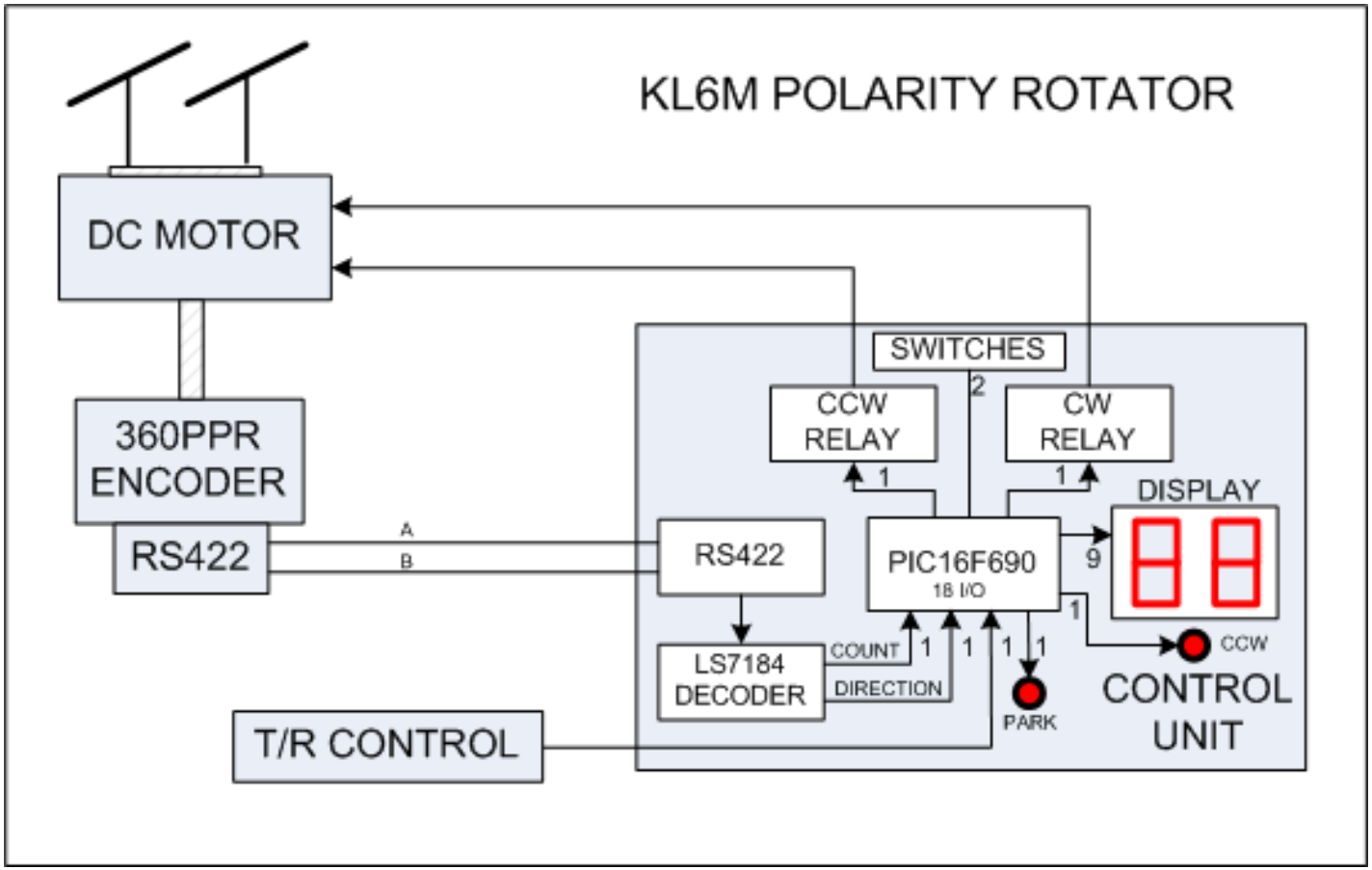
2. Then rotate to best signal and store that angle. (Press RX)

3. Then the processor will compute the best angle to TX.

4. The processor will sense when I switch from R to T and rotate automatically to the calculated transmit polarity.

5. When I go back to R it will return to that stored receive polarity.

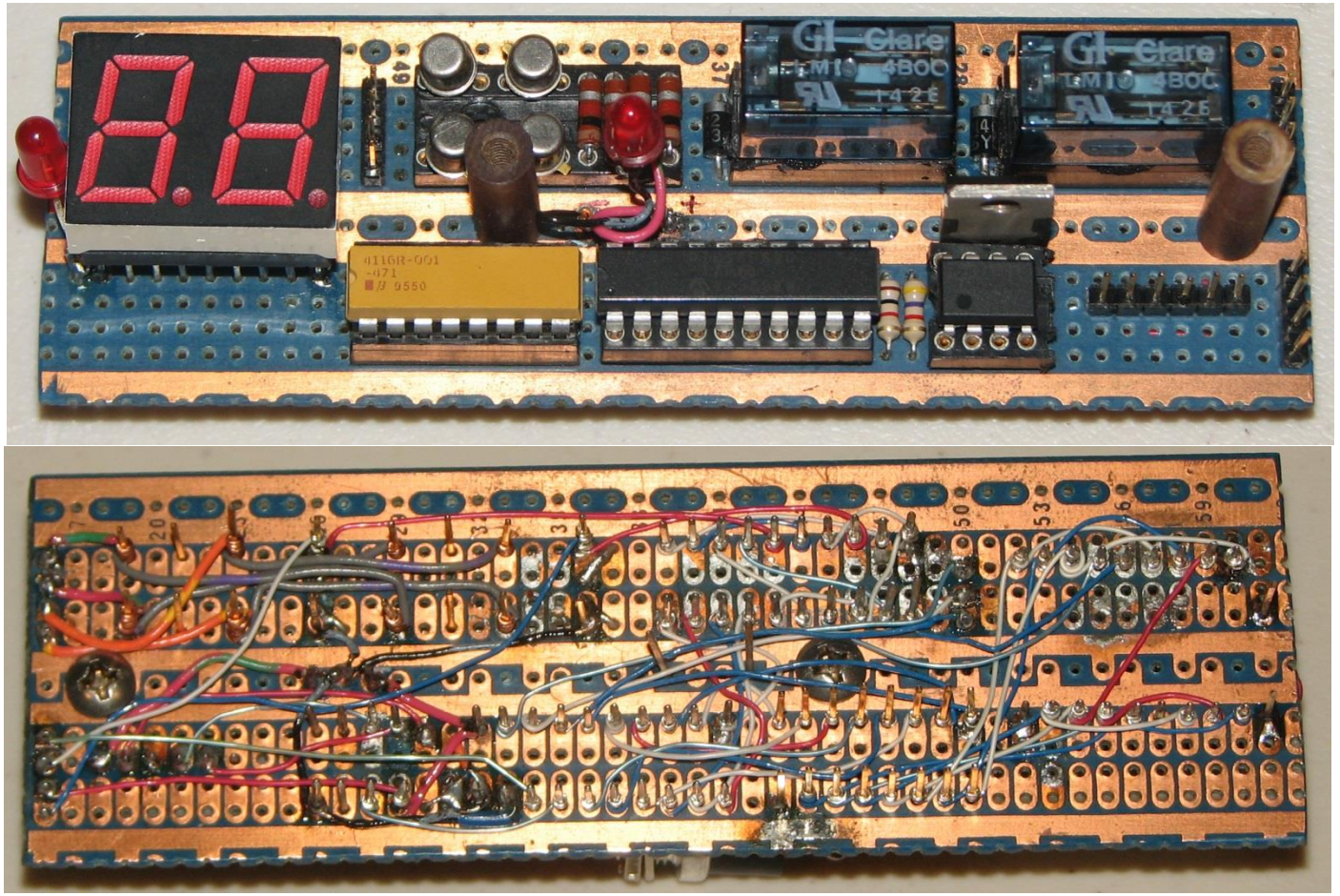
System Block Diagram



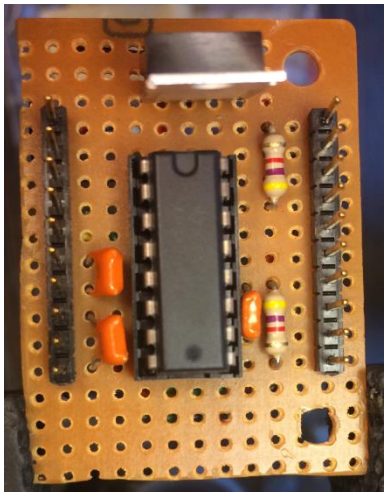
Gear Motor

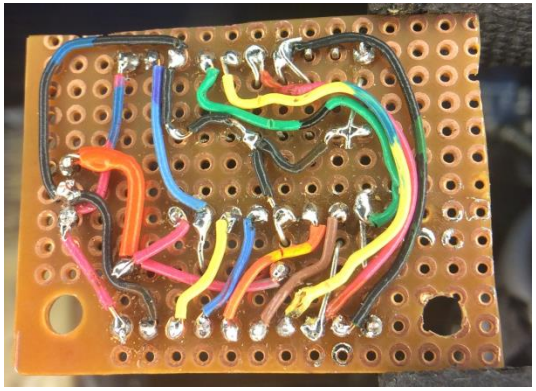
6 volt to 12v dc motor

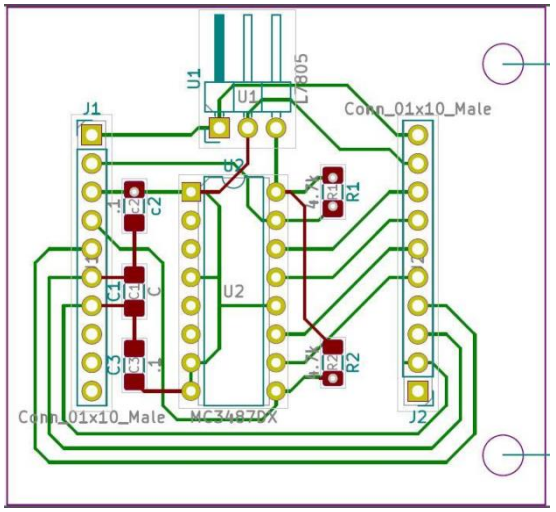
Prototype



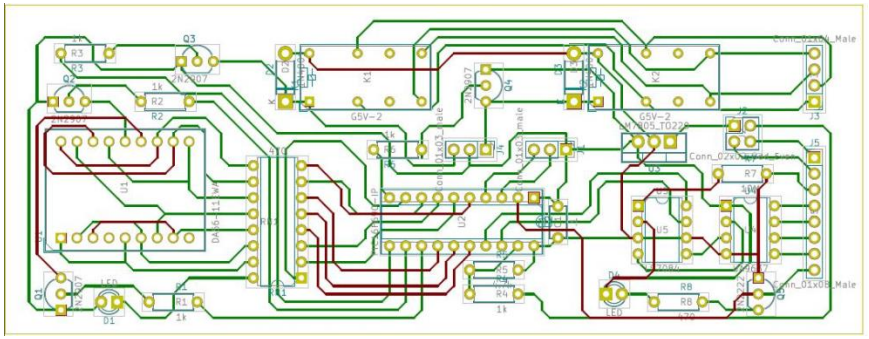
Rotor Interface

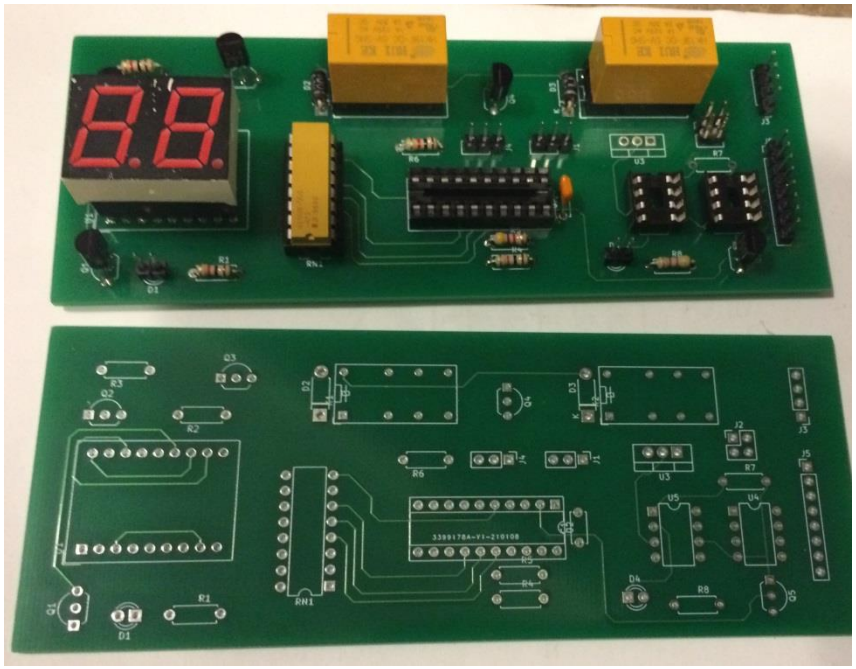




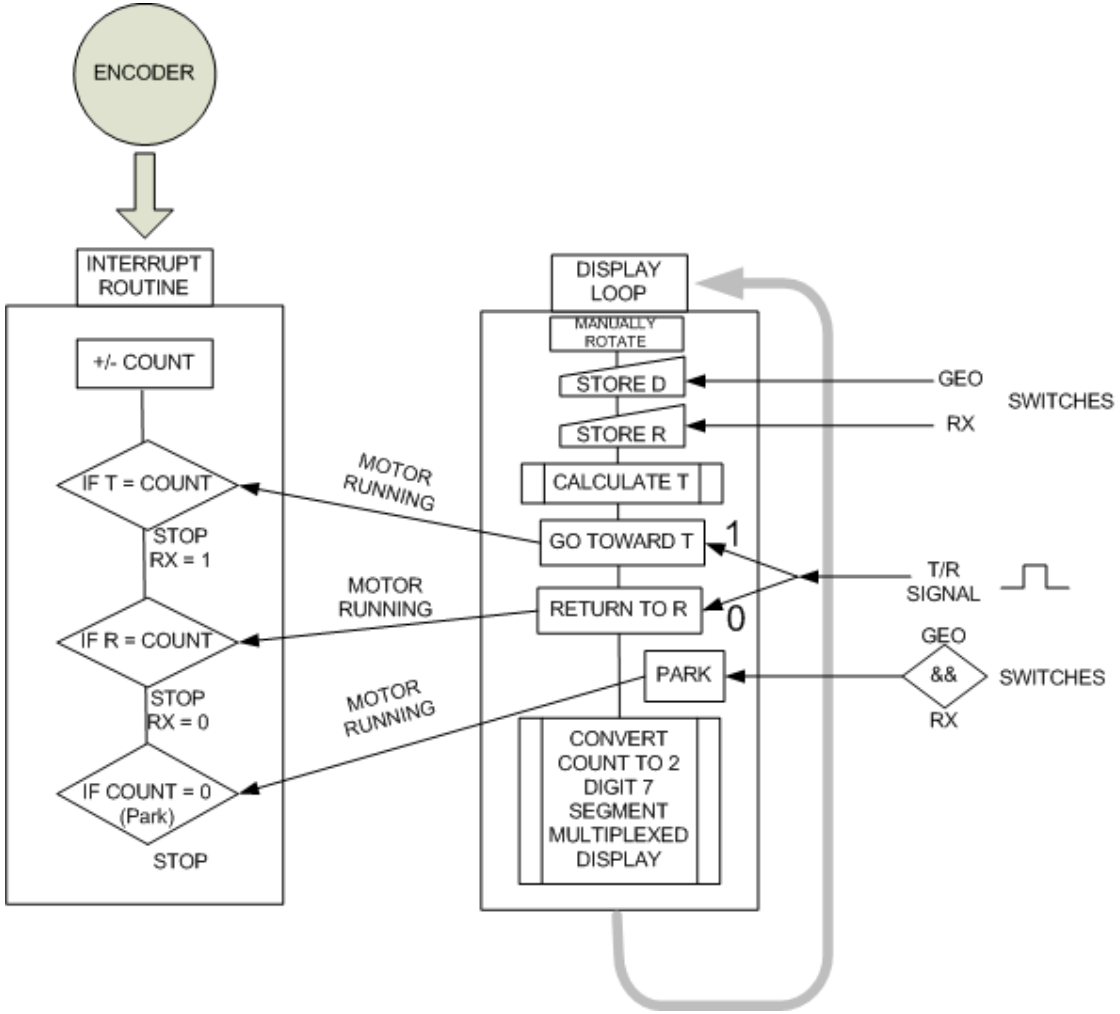


Printed Circuit Board

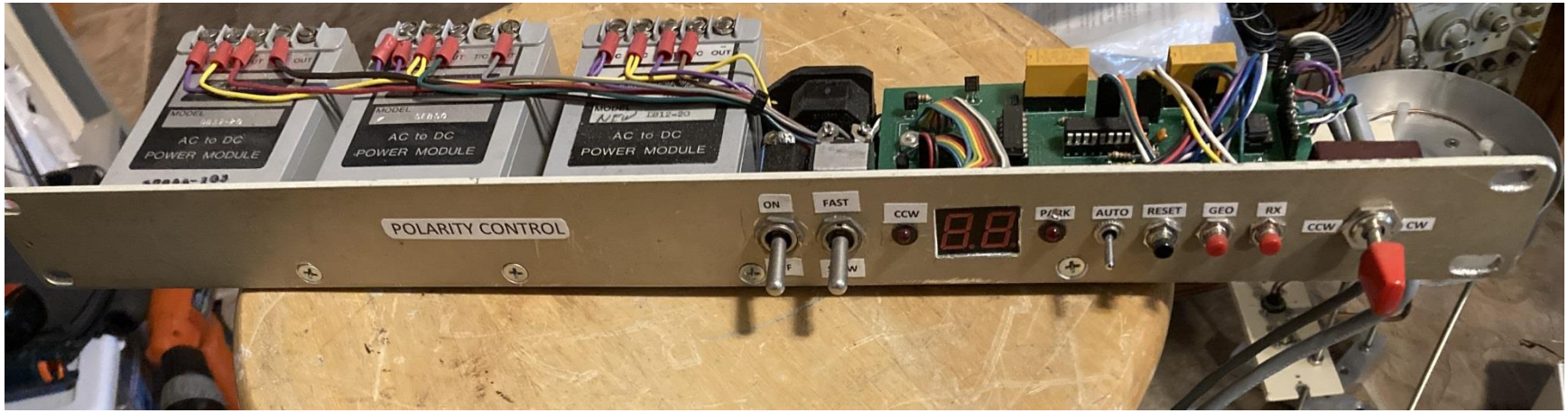




Overall Flow Diagram



Rack Mounted Control Panel



Results

- Generally effective, not perfect.
- Noise issues due to 150 ft. Cable?
  - Adding caps and ferrites
- Cross over encoder Z pulse resets counter
- Motor slow down and stopping
  - Probably due to voltage drop
  - Doubling up conductors
- VERY CLOSE !!

This presentation, paper, and details at https://kl6m.com/polarity