Brad Cobo, N5WCO

10GHz Portable Station
2013 Updates

2001-2012

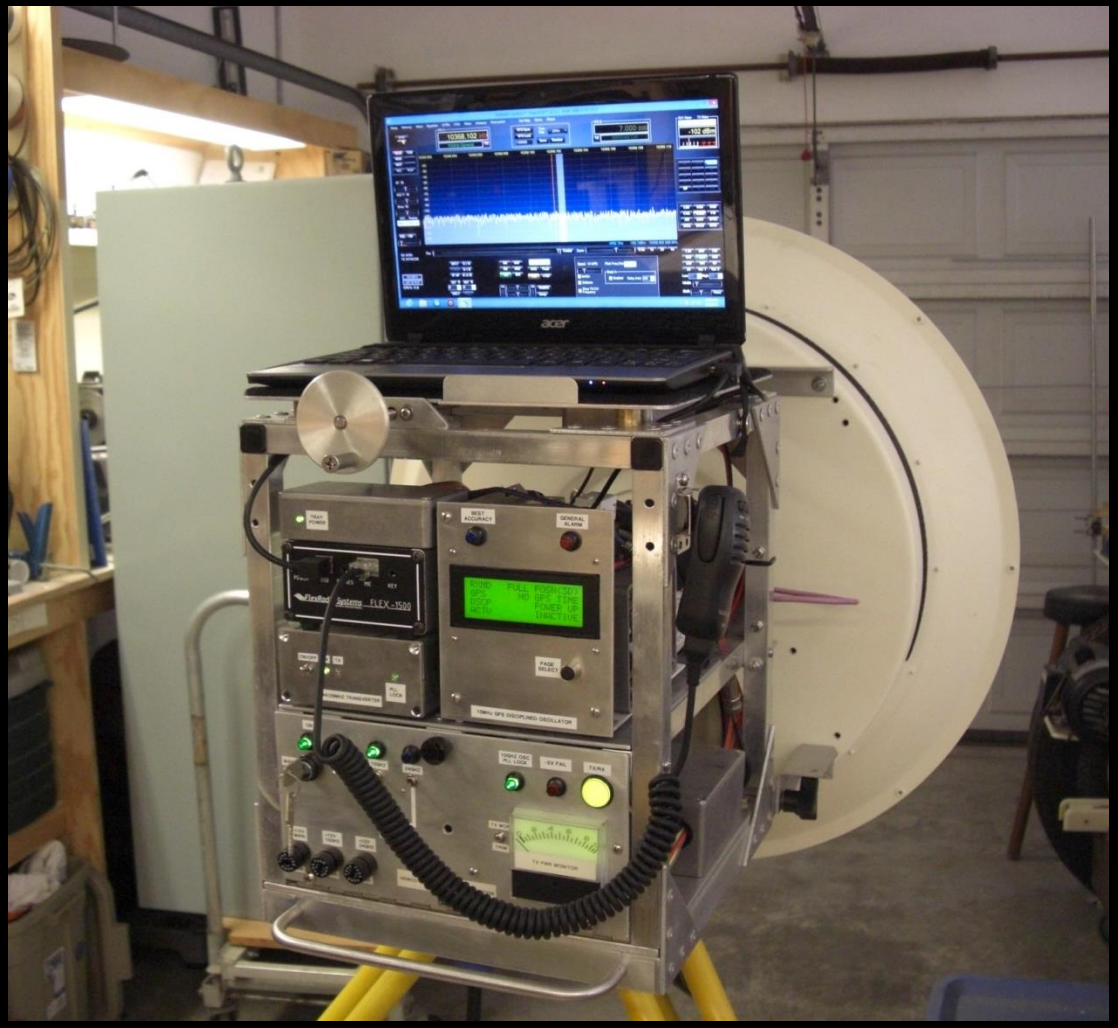
- Based on M/A-Com “White Box”
- ~200mW Barefoot
- Modified Ku Band Satellite LNB
- MFJ 2m IF Radio
- 55VAC Supply

Planned Updates

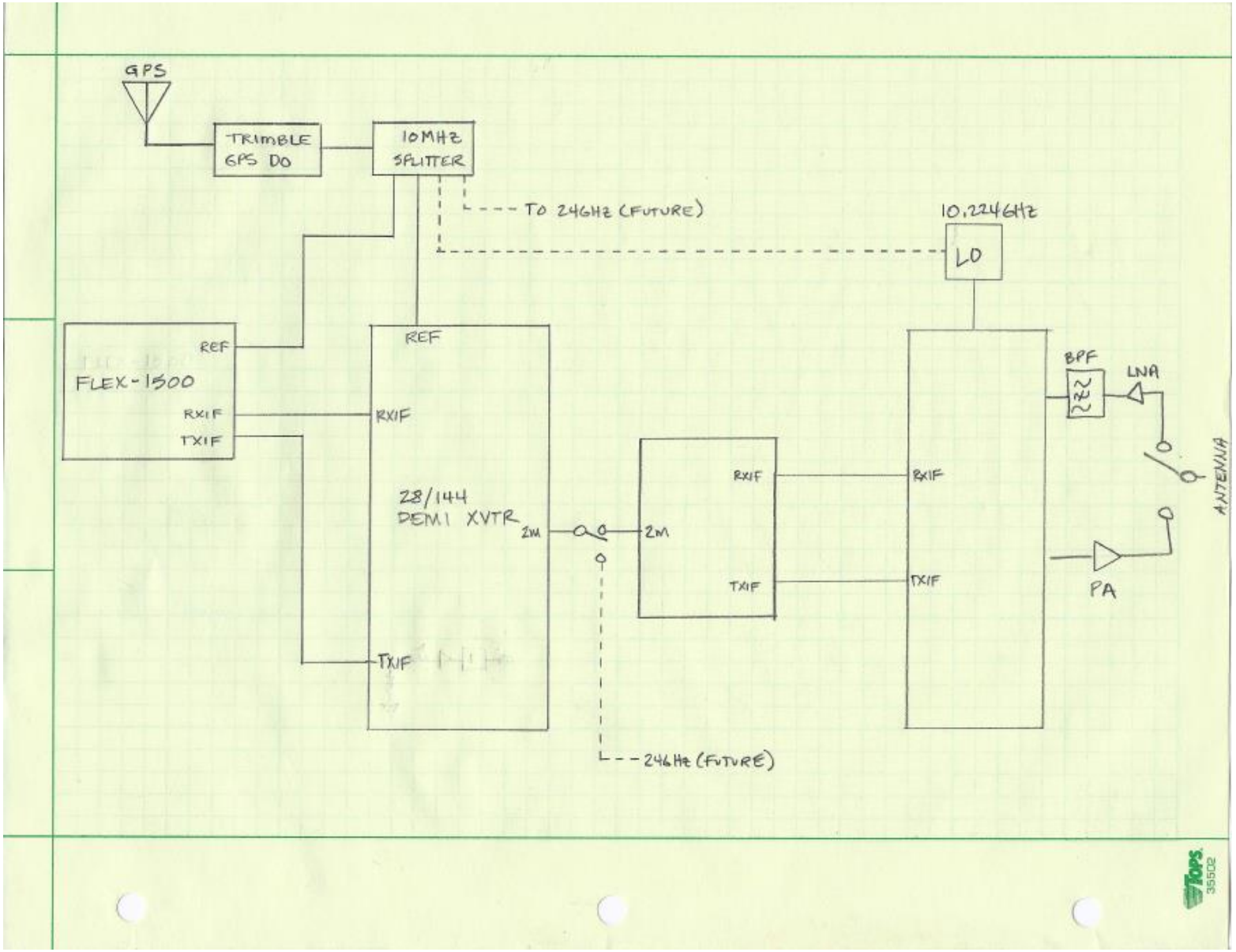
- FLEX-1500 SDR
- GPSDO
- More Power
- LNA
- Consolidate PSU's
- Plan for 24GHz

Aug 2013

- New IF Radio – Flex 1500 SDR
- DEMI 144/28 Transverter
- New 10GHz PA
- New 10GHz LNA
- GPSDO
- New Sequencer
- New Power Supplies
- No 24GHz (Yet!)

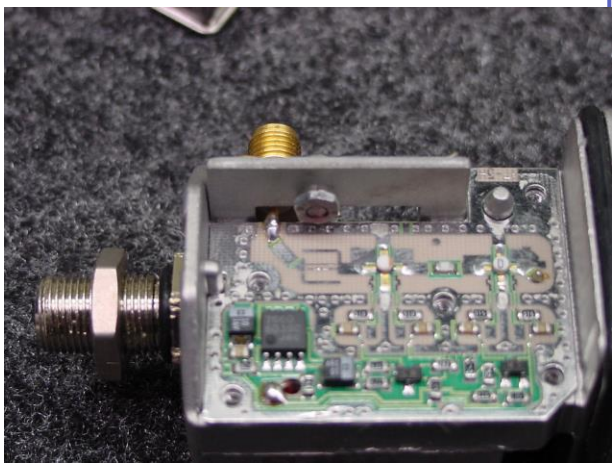


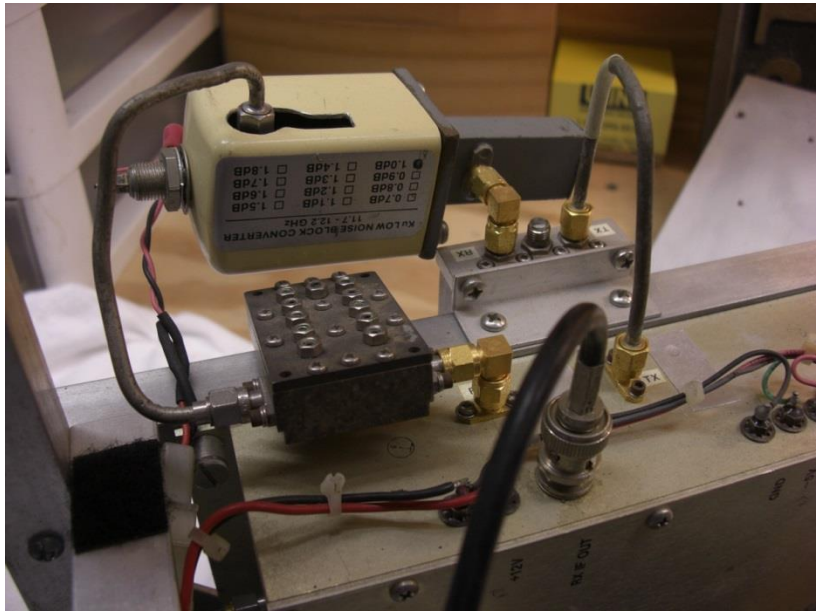
RF Chain

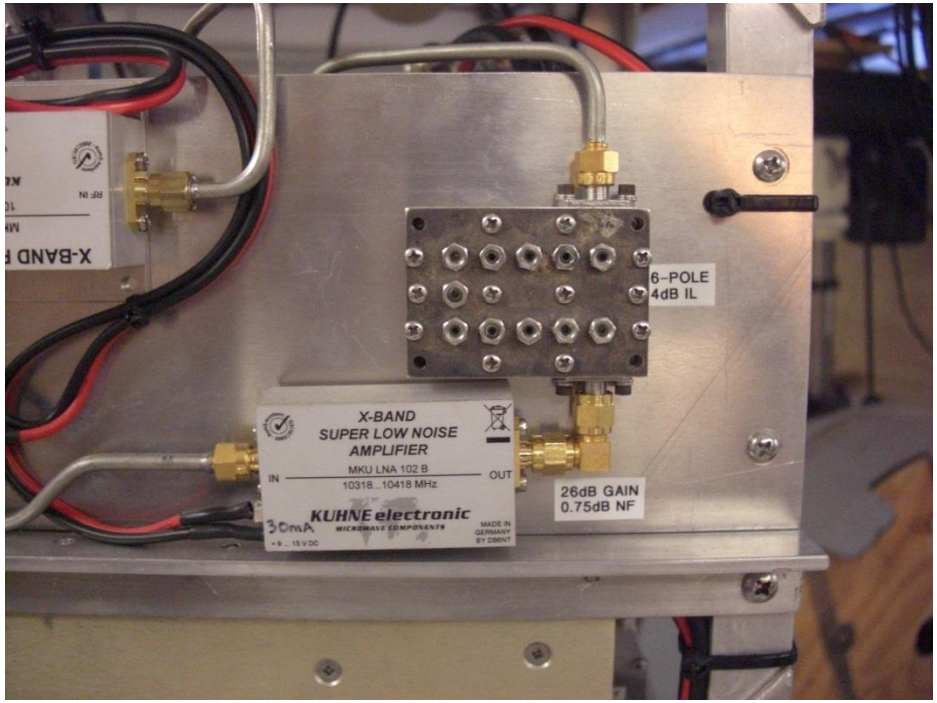

GPS
TRIMBLE GPS DO
10MHz SPLITTER
TO 24GHz (FUTURE)
10.2246GHz
LO
REF
FLEX-1500
RXIF
TXIF
REF
RXIF
28/144 DEMI XVTR
2M
TXIF
246Hz (FUTURE)
RXIF
TXIF
RXIF
TXIF
BPF
LNA
PA
ANTENNA

10GHz LNA Upgrade

- Old Ku Band LNB
  - WG to SMA transition poor
  - Ok NF (~1.0dB)
- Kuhne LNA
  - 0.75dB NF
  - 26dB Gain

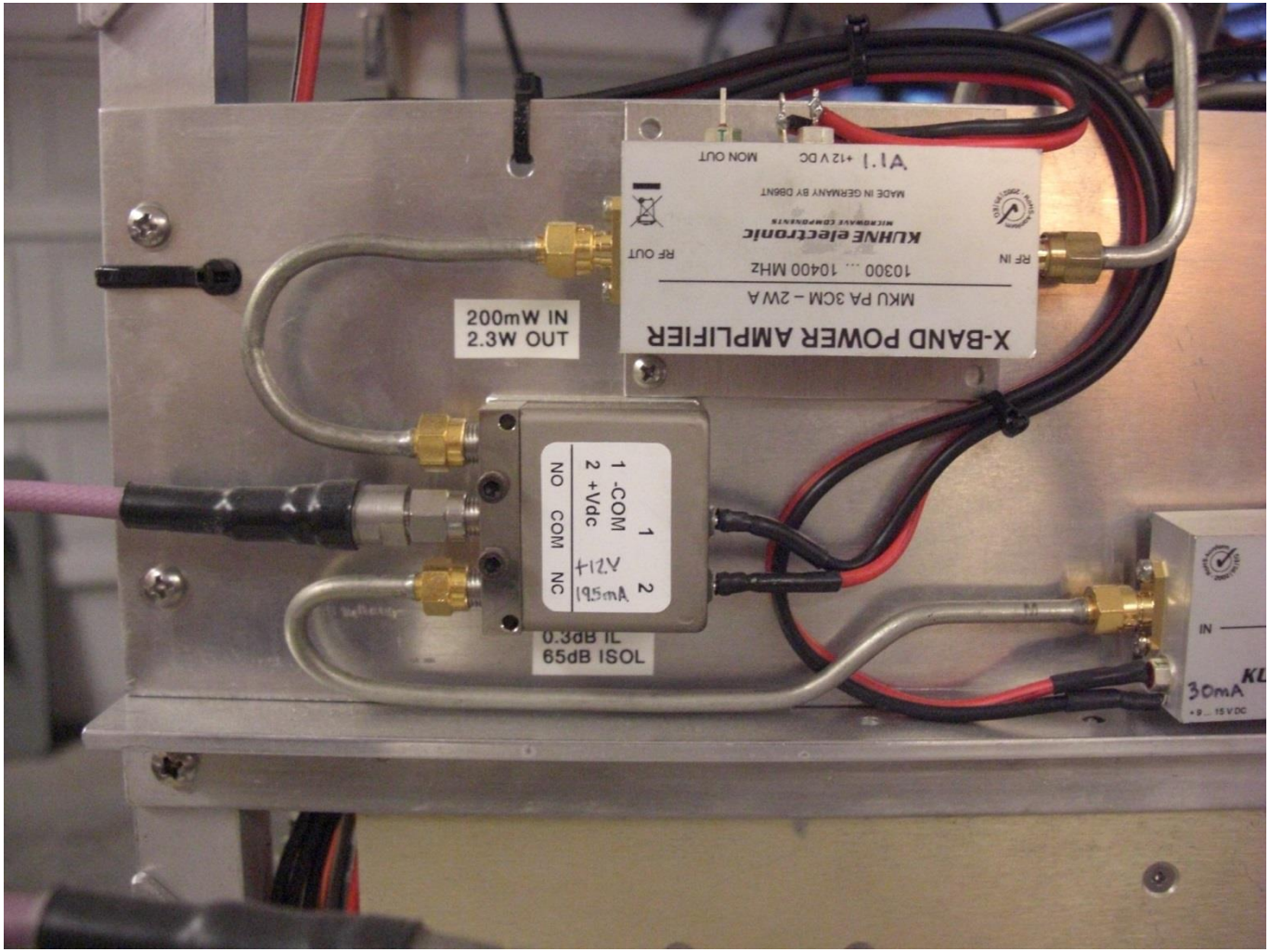






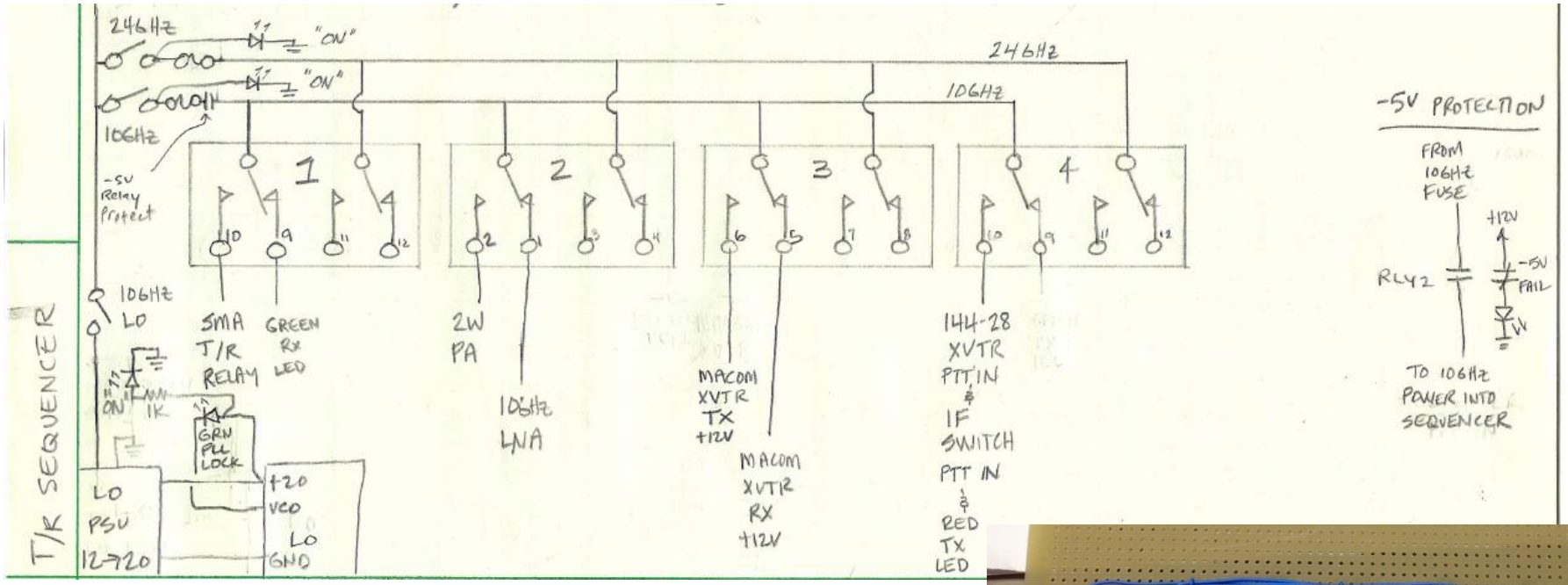
10GHz PA Upgrade

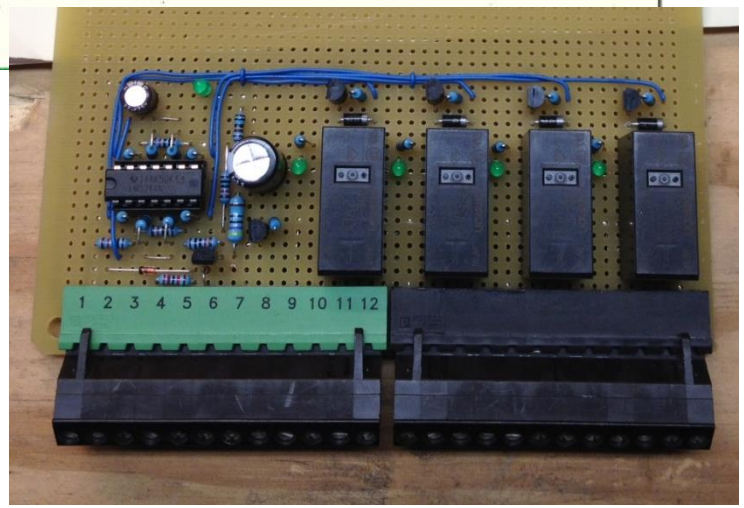
- Kuhne PA
  - 200mW in / 2.3W out



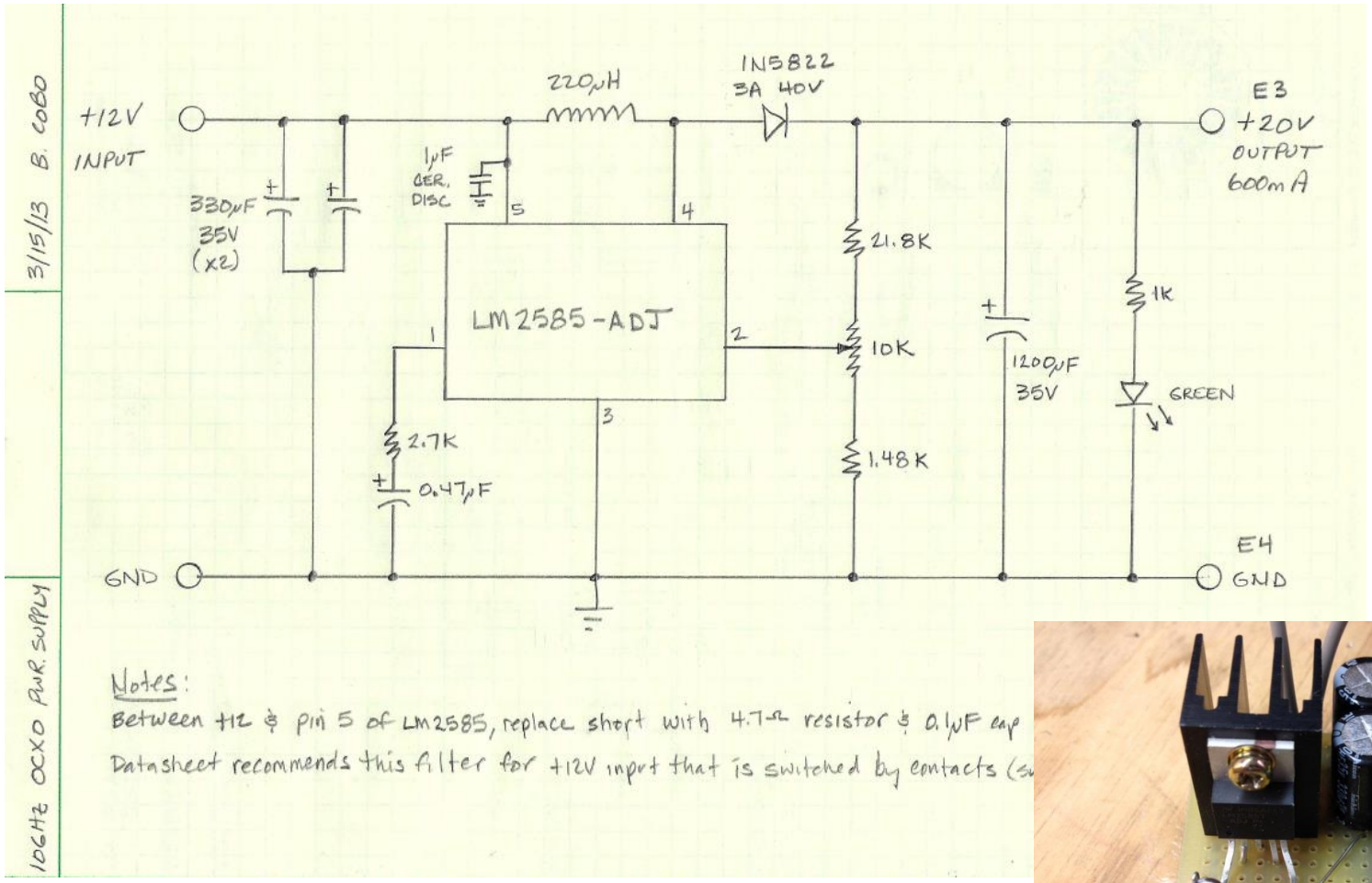
Sequencer

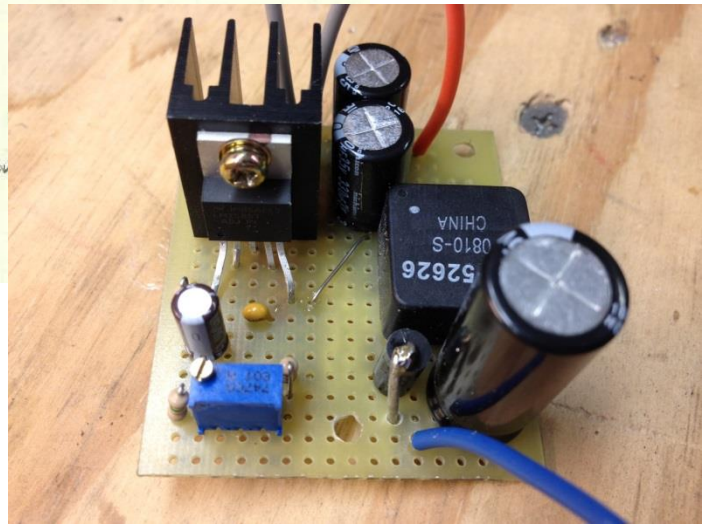
- W5LUA Design





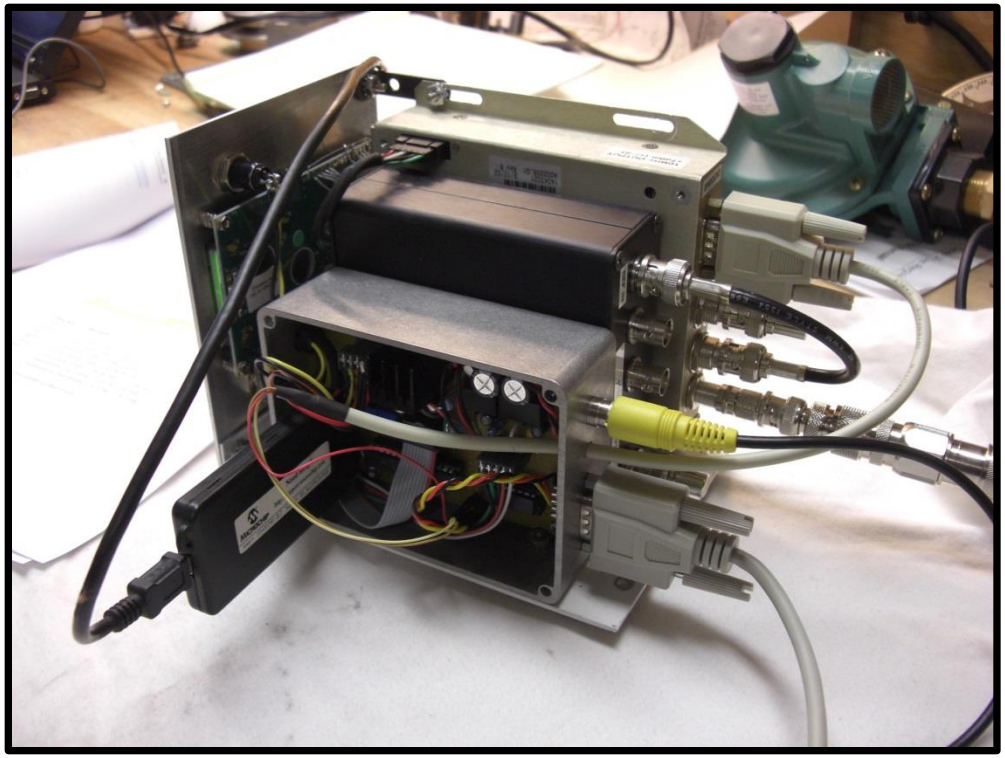
New 10GHz OCXO Power Supply



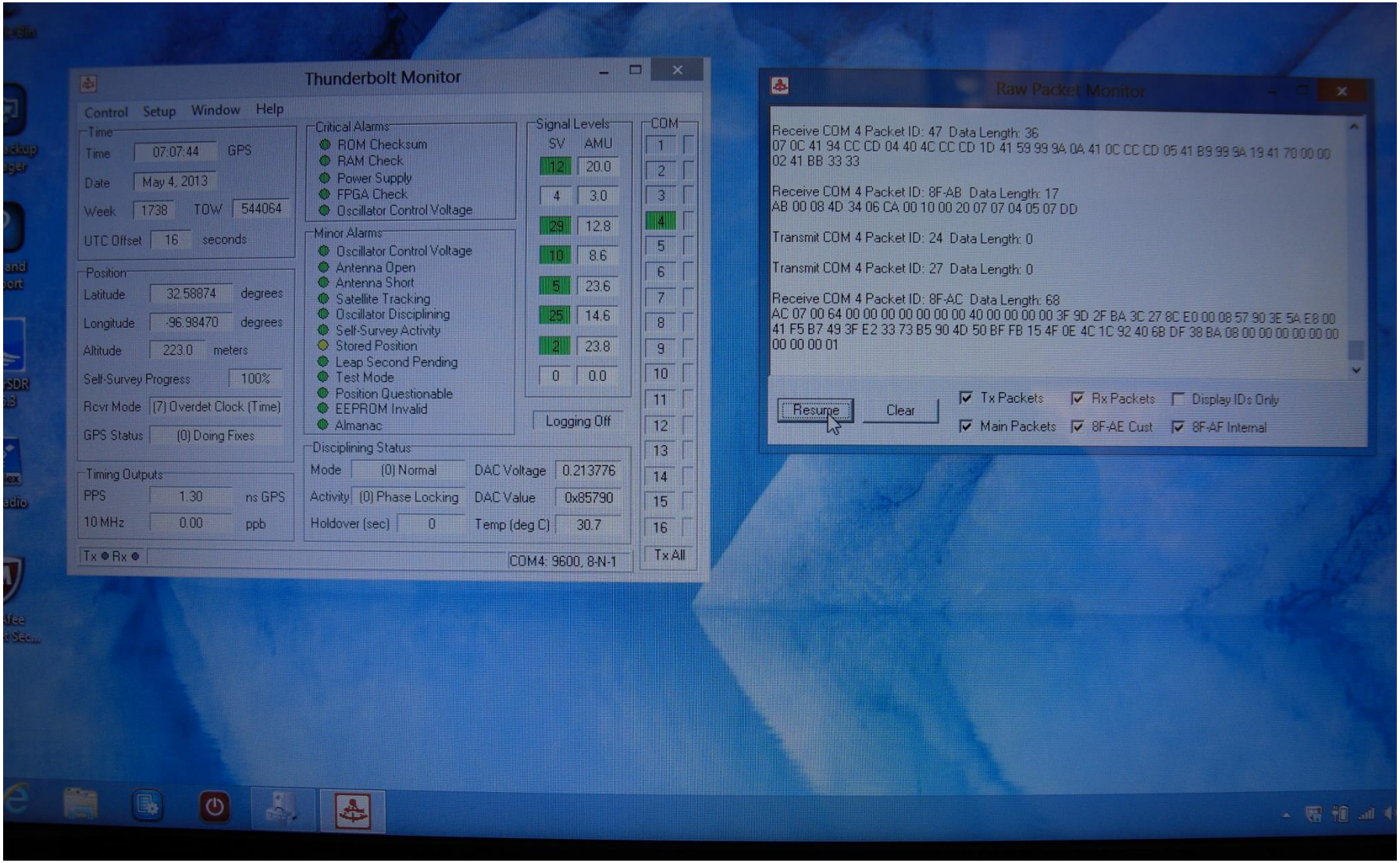


Trimble GPSDO Overview

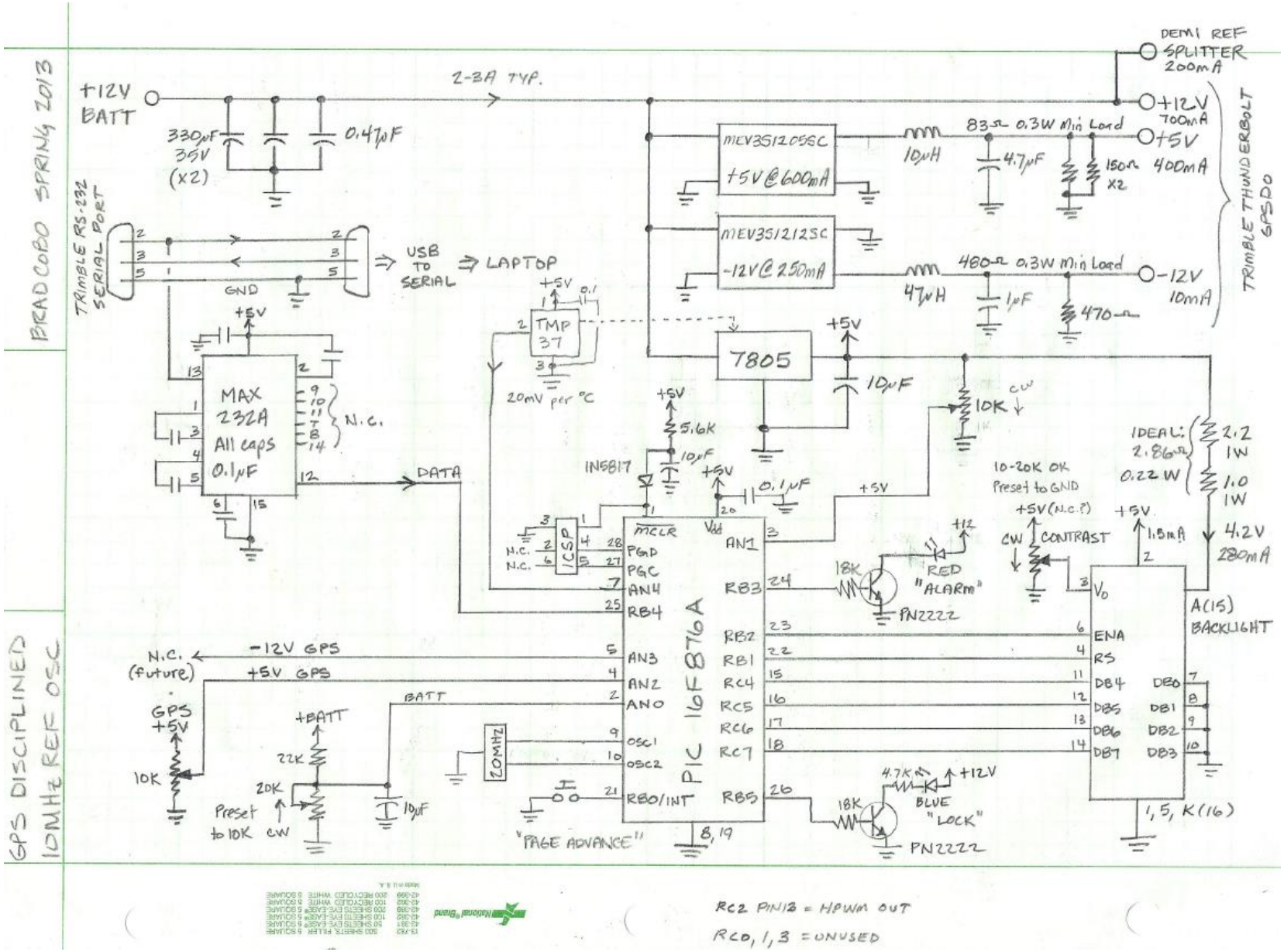
- Trimble Thunderbolt GPSDO
  - Cell site surplus (3G -> 4G upgrade?)
  - Outputs NMEA0183 or TSIP serial data
  - Nice software utility (free)
  - Microchip PIC 16F876A µC parses data / drives LCD / monitors voltages / temp
  - PSU
  - 10MHz Reference Amp/Splitter



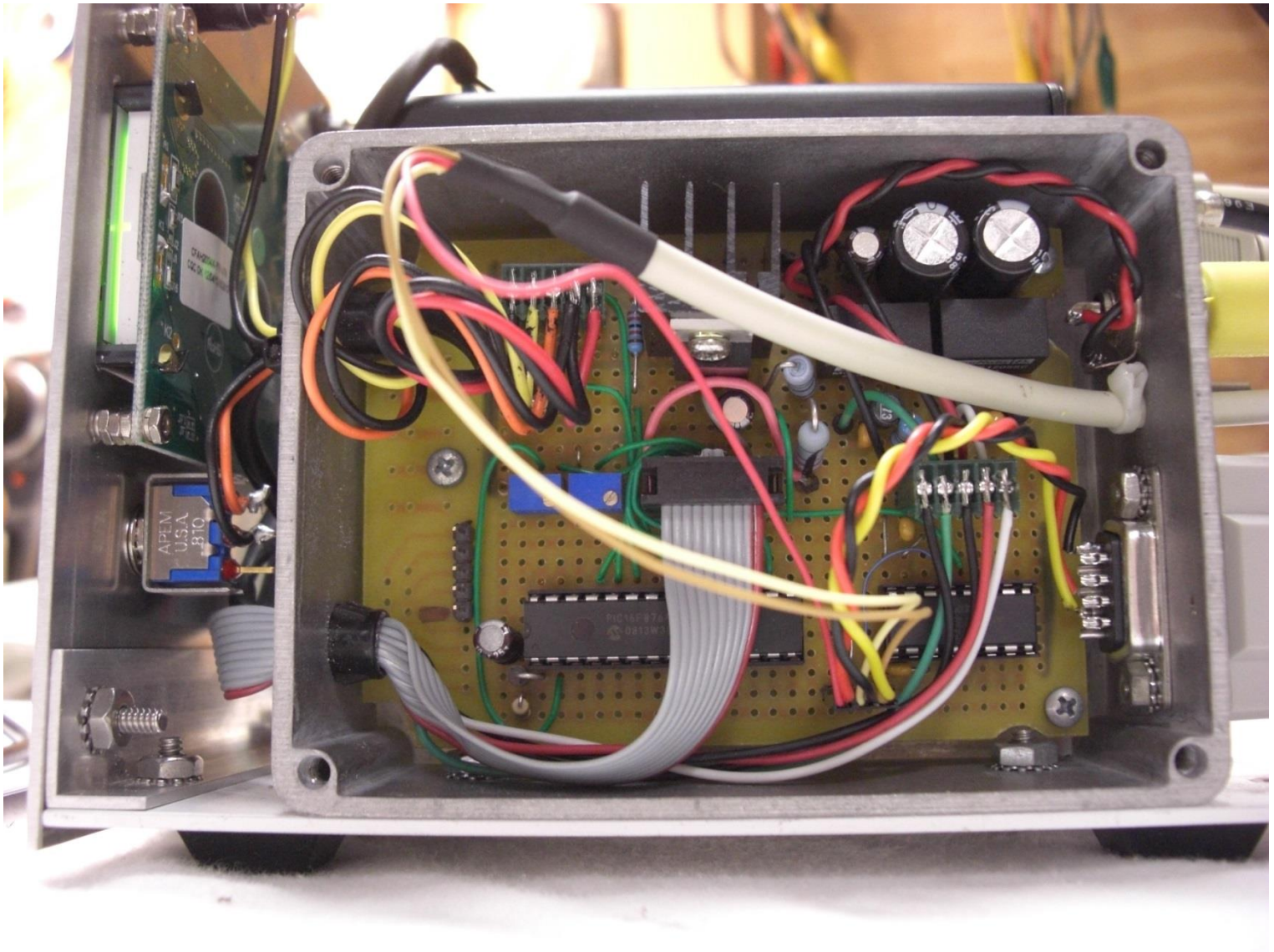
Trimble TBoltMon.exe Utility



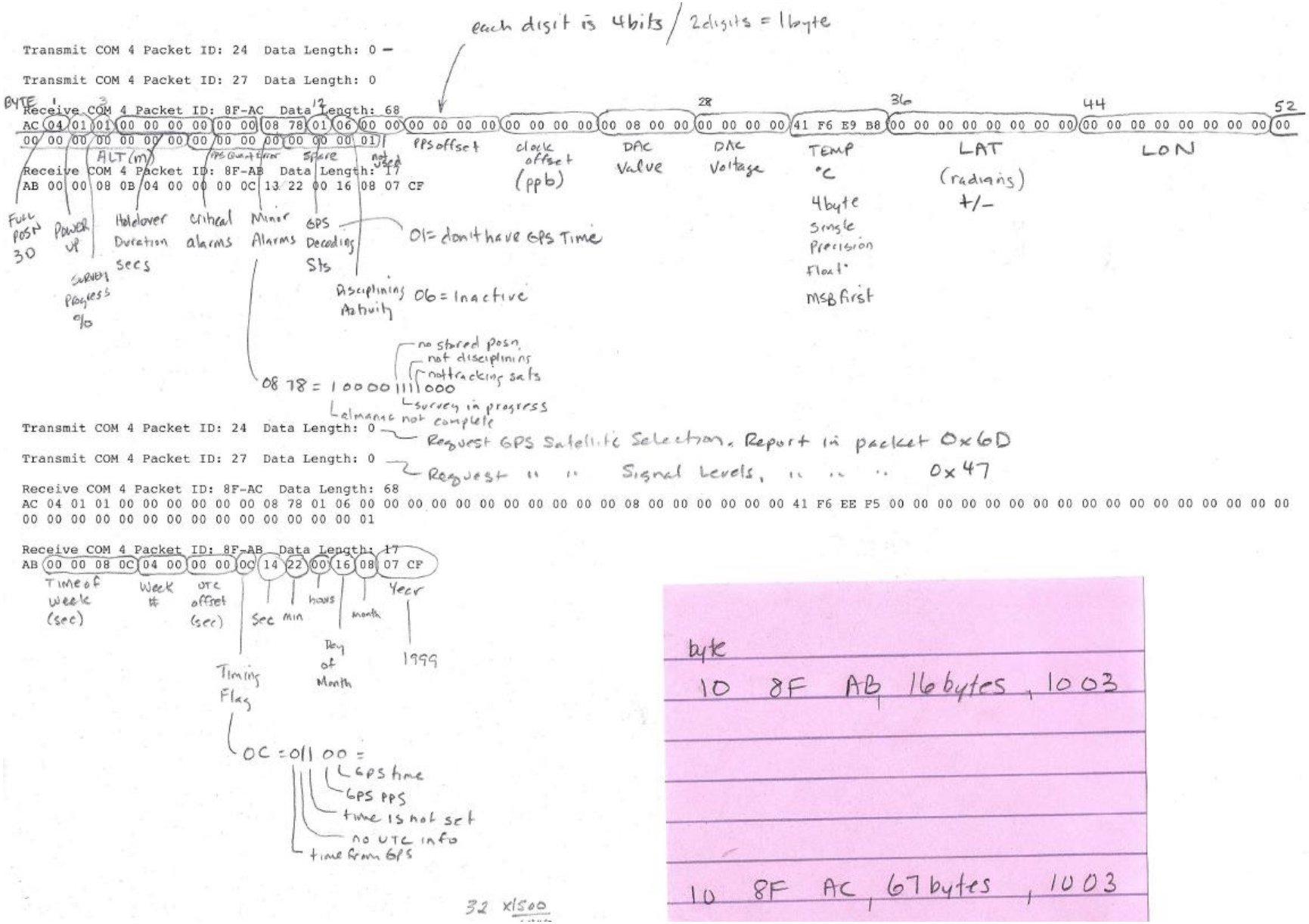
Trimble GPSDO PSU/Interface/LCD



Hardware

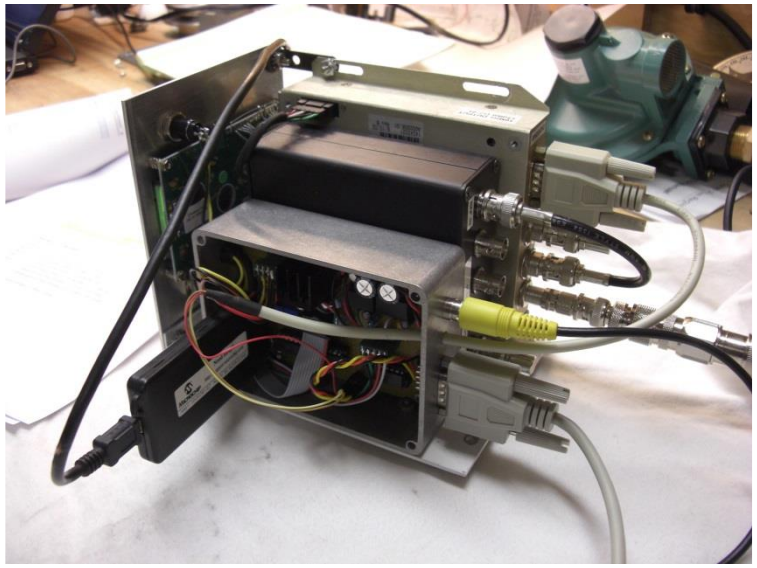


Trimble TSIP Serial Data

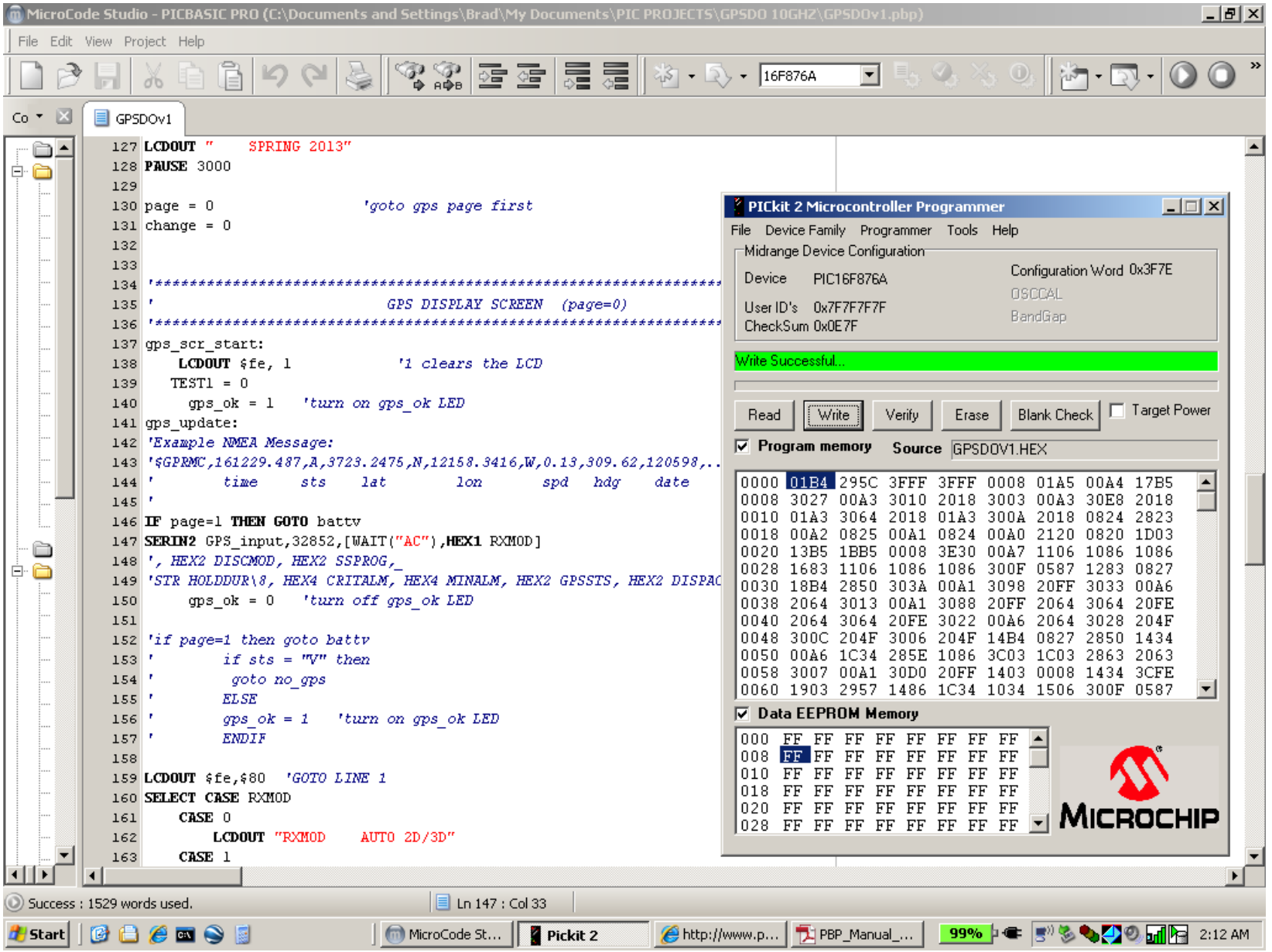


PIC Programming

- Microchip PICKit II USB Programmer
- Laptop running Melabs PICBASIC Pro

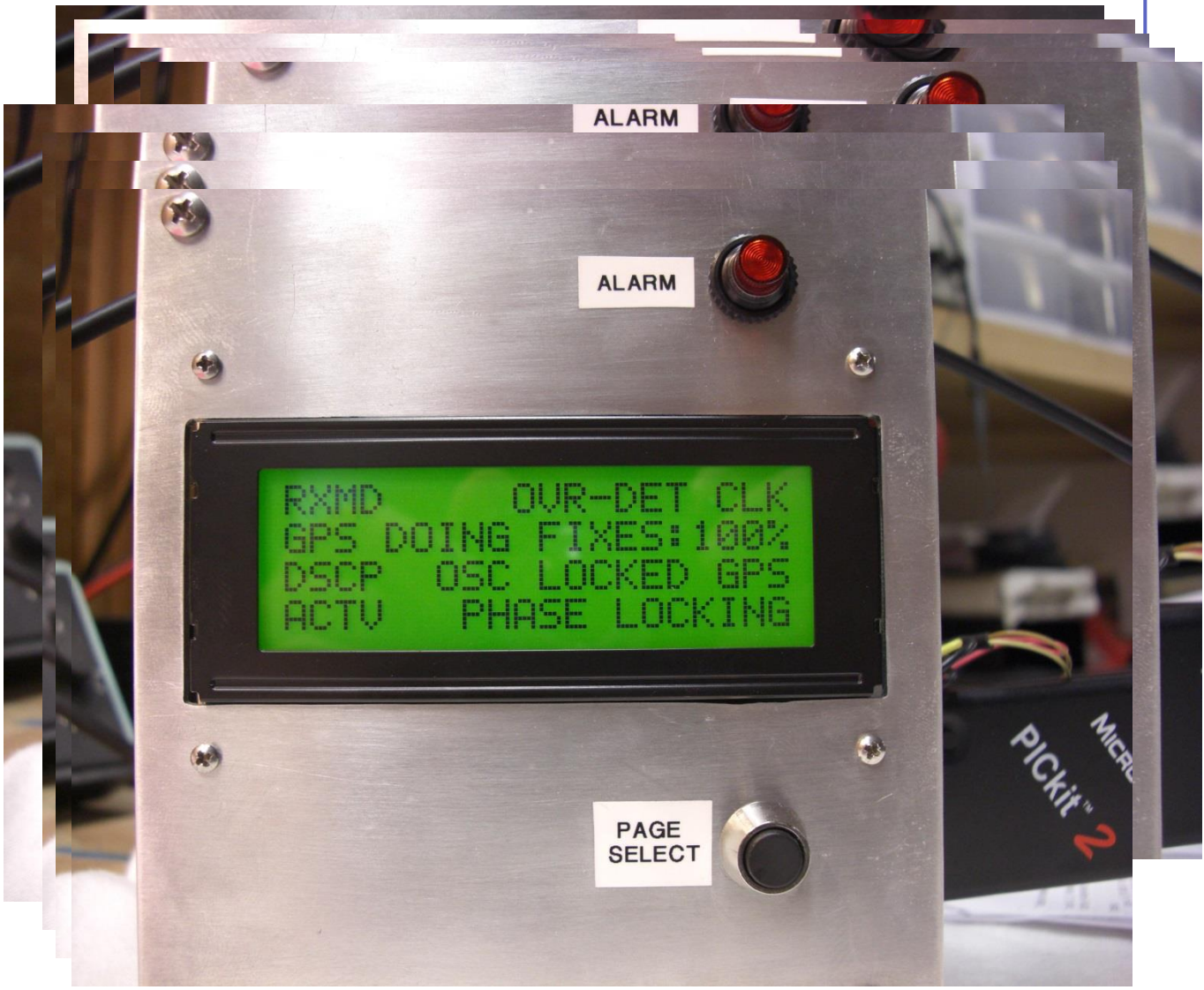


PIC Program


MicroCode Studio - PICBASIC PRO (C:\Documents and Settings\Brad\My Documents\PIC PROJECTS\GPSDO 10GHZ\GPSDOv1.pbp)
File Edit View Project Help
16F876A
GPSDOv1
127 LCDOUT " SPRING 2013"
128 PAUSE 3000
129
130 page = 0 'goto gps page first
131 change = 0
132
133
134 '***
135 ' GPS DISPLAY SCREEN (page=0)
136 '***
137 gps_scr_start:
138 LCDOUT $fe, 1 'l clears the LCD
139 TEST1 = 0
140 gps_ok = 1 'turn on gps_ok LED
141 gps_update:
142 'Example NMEA Message:
143 '$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598,..
144 ' time sts lat lon spd hdg date
145 '
146 IF page=1 THEN GOTO battv
147 SERIN2 GPS_input,32852,[WAIT("AC"),HEX1 RXMOD]
148 ', HEX2 DISCMOD, HEX2 SSPROG,_
149 'STR HOLDDUR\8, HEX4 CRITALM, HEX4 MINALM, HEX2 GPSSTS, HEX2 DISPAC
150 gps_ok = 0 'turn off gps_ok LED
151
152 'if page=1 then goto battv
153 ' if sts = "V" then
154 ' goto no_gps
155 ' ELSE
156 ' gps_ok = 1 'turn on gps_ok LED
157 ' ENDIF
158
159 LCDOUT $fe,$80 'GOTO LINE 1
160 SELECT CASE RXMOD
161 CASE 0
162 LCDOUT "RXMOD AUTO 2D/3D"
163 CASE 1
PICkit 2 Microcontroller Programmer
File Device Family Programmer Tools Help
Midrange Device Configuration
Device PIC16F876A
User ID's 0x7F7F7F7F
CheckSum 0x0E7F
Configuration Word 0x3F7E
OSCCAL
BandGap
Write Successful...
Read Write Verify Erase Blank Check Target Power
Program memory Source GPSDOV1.HEX
0000 01B4 295C 3FFF 3FFF 0008 01A5 00A4 17B5
0008 3027 00A3 3010 2018 3003 00A3 30E8 2018
0010 01A3 3064 2018 01A3 300A 2018 0824 2823
0018 00A2 0825 00A1 0824 00A0 2120 0820 1D03
0020 13B5 1BB5 0008 3E30 00A7 1106 1086 1086
0028 1683 1106 1086 1086 300F 0587 1283 0827
0030 18B4 2850 303A 00A1 3098 20FF 3033 00A6
0038 2064 3013 00A1 3088 20FF 2064 3064 20FE
0040 2064 3064 20FE 3022 00A6 2064 3028 204F
0048 300C 204F 3006 204F 14B4 0827 2850 1434
0050 00A6 1C34 285E 1086 3C03 1C03 2863 2063
0058 3007 00A1 30D0 20FF 1403 0008 1434 3CFE
0060 1903 2957 1486 1C34 1034 1506 300F 0587
Data EEPROM Memory
000 FF FF FF FF FF FF FF FF
008 FF FF FF FF FF FF FF FF
010 FF FF FF FF FF FF FF FF
018 FF FF FF FF FF FF FF FF
020 FF FF FF FF FF FF FF FF
028 FF FF FF FF FF FF FF FF
MICROCHIP
Success : 1529 words used.
Ln 147 : Col 33
Start
MicroCode St...
Pickit 2
http://www.p...
PBP_Manual_...
99%
2:12 AM

GPDO Startup Sequence

1. Osc Warmup
2. Almanac
3. Posn Fix (self-survey)
4. OSC Phase Lock



Work In Progress

- “Bad Data”
- LAT/LON Display
- Grid Square Display
- Time (Local and UTC)
- Freq Error @ 10GHz

Work In Progress

Operating

- 4/20/13 First Run
  - EM10no to W5LUA EM13qc 37.4 miles
  - EM10no to WA5YWC EM13ob 32.0 miles
  - Good Signal Reports
- 2013 10GHz & Above Weekends 8-17/18, 9-21/22
  - ???

73’s de N5WCO