



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



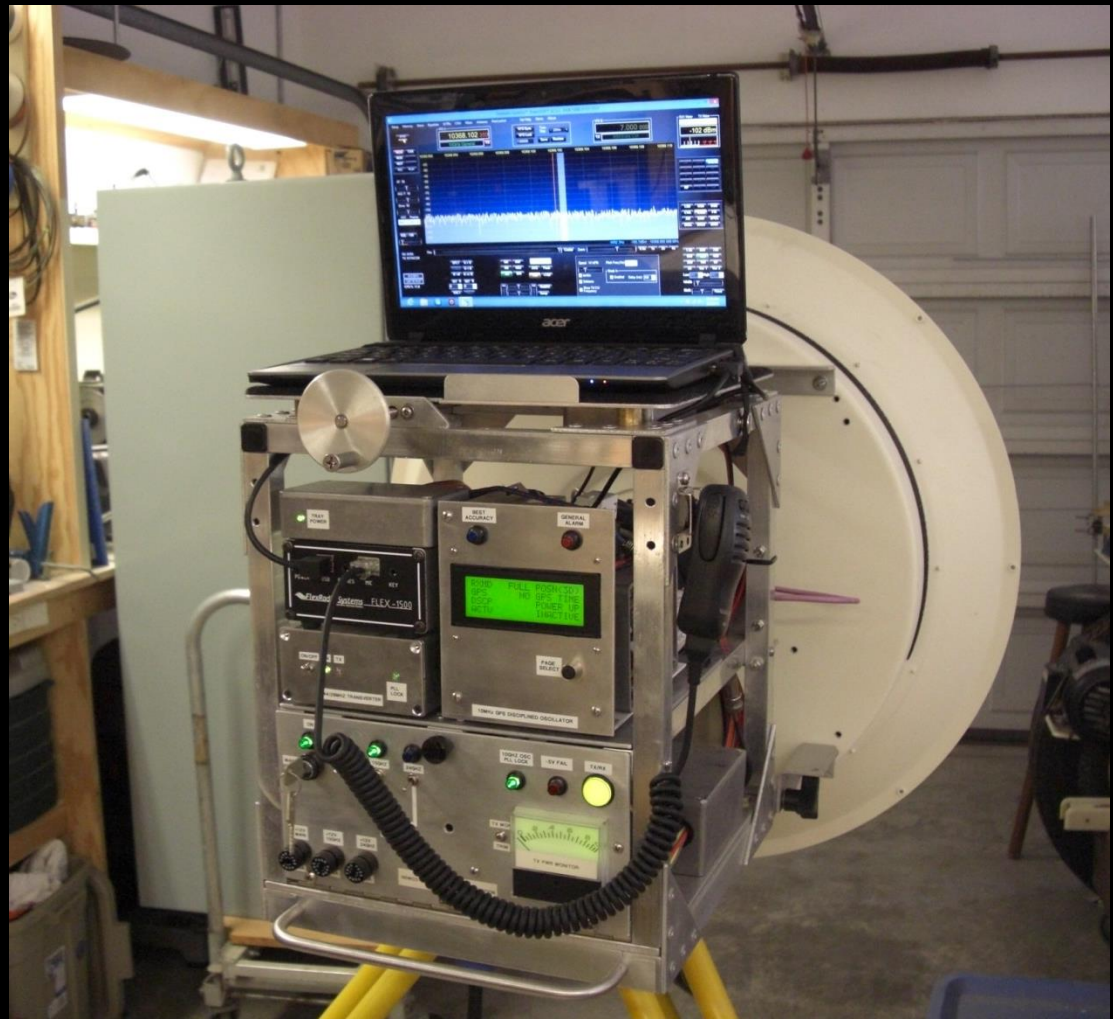
Planned Updates

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

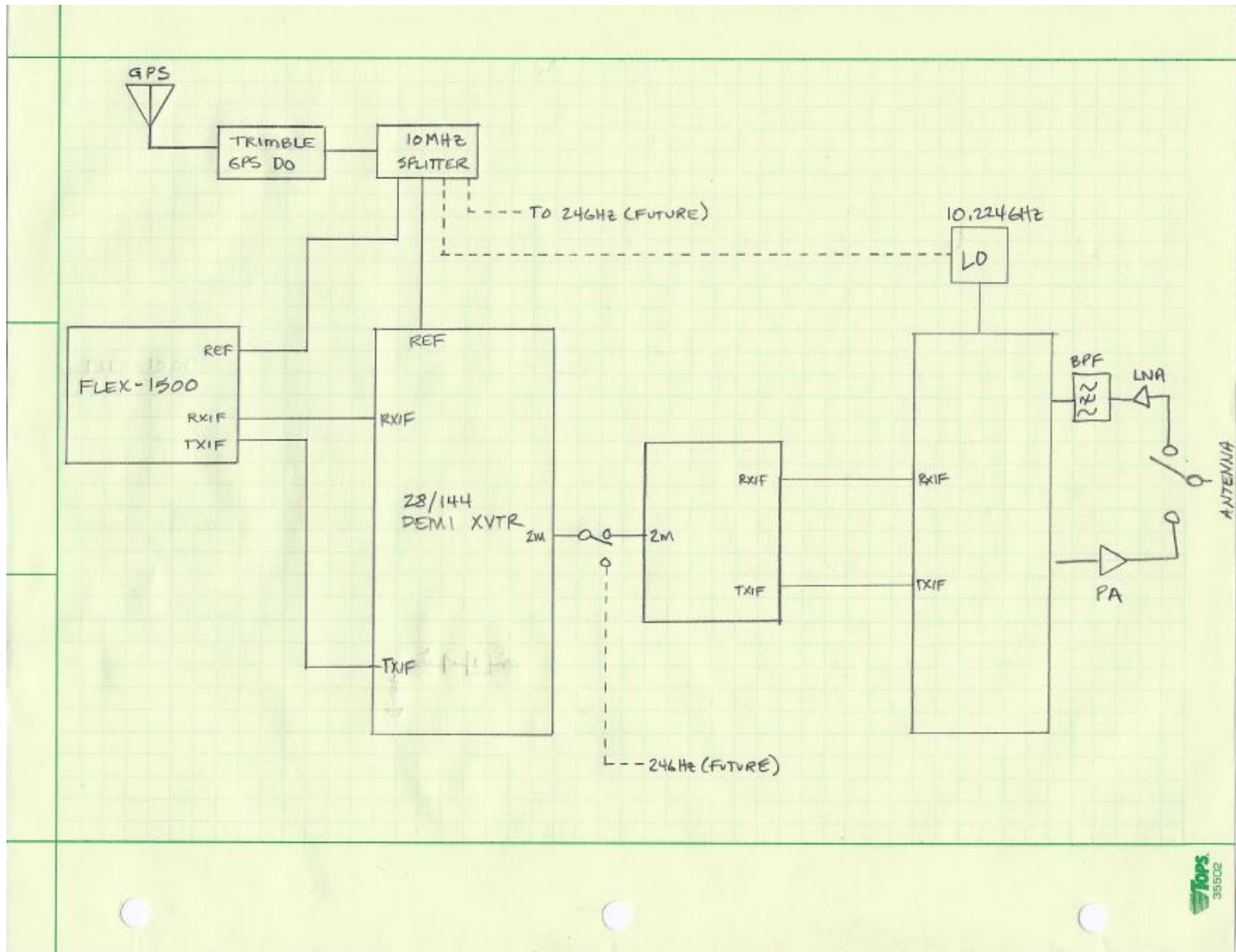


Aug 2013

- 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!)

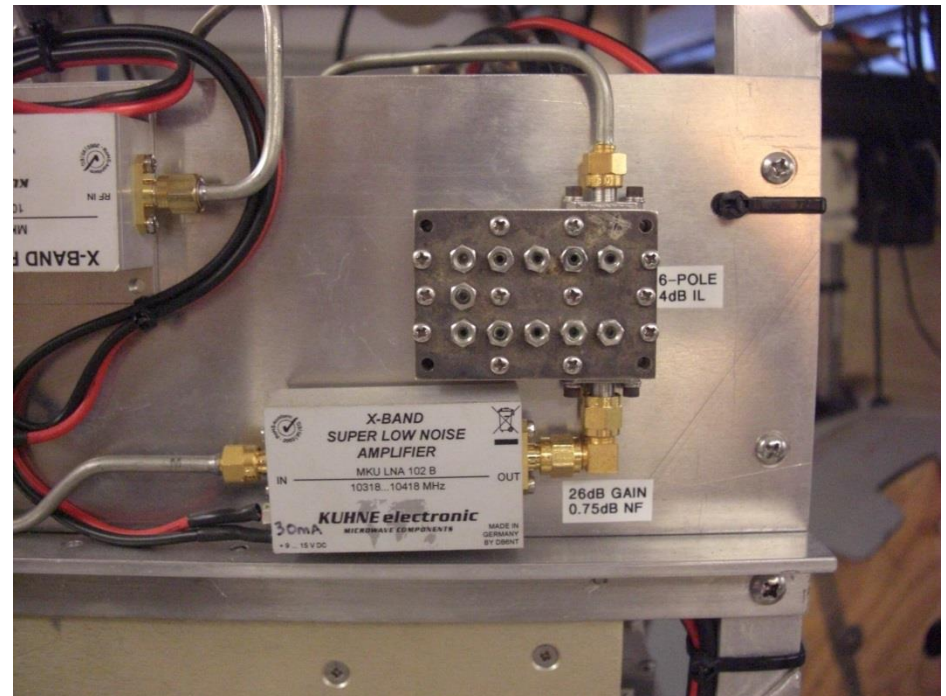
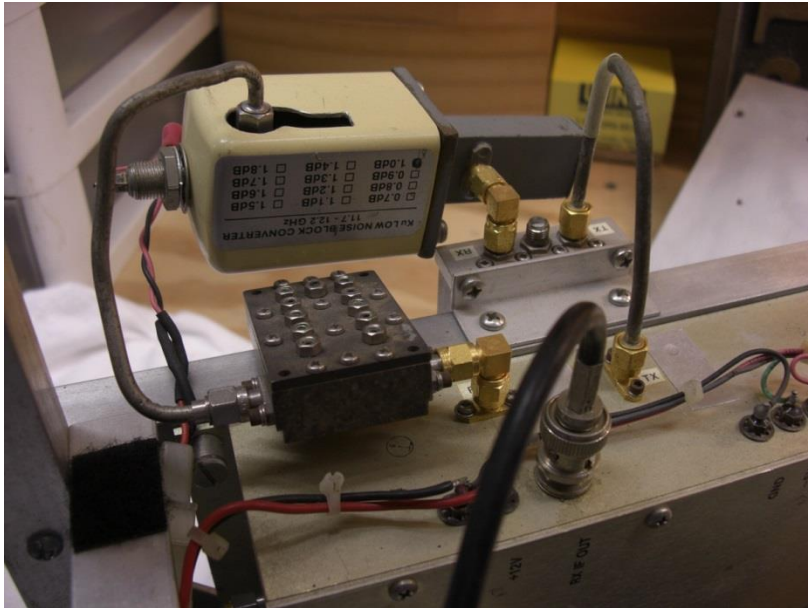
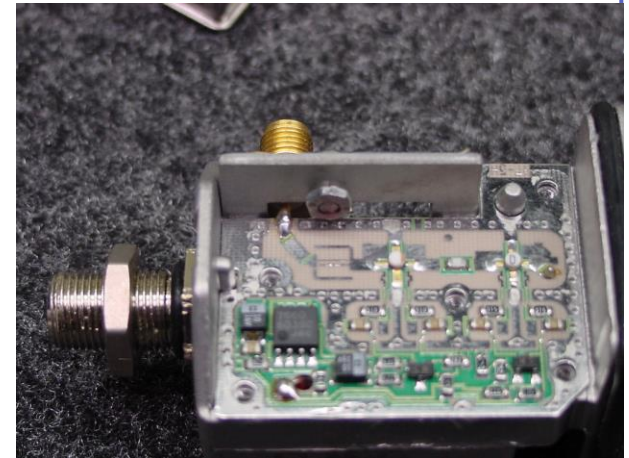


RF Chain



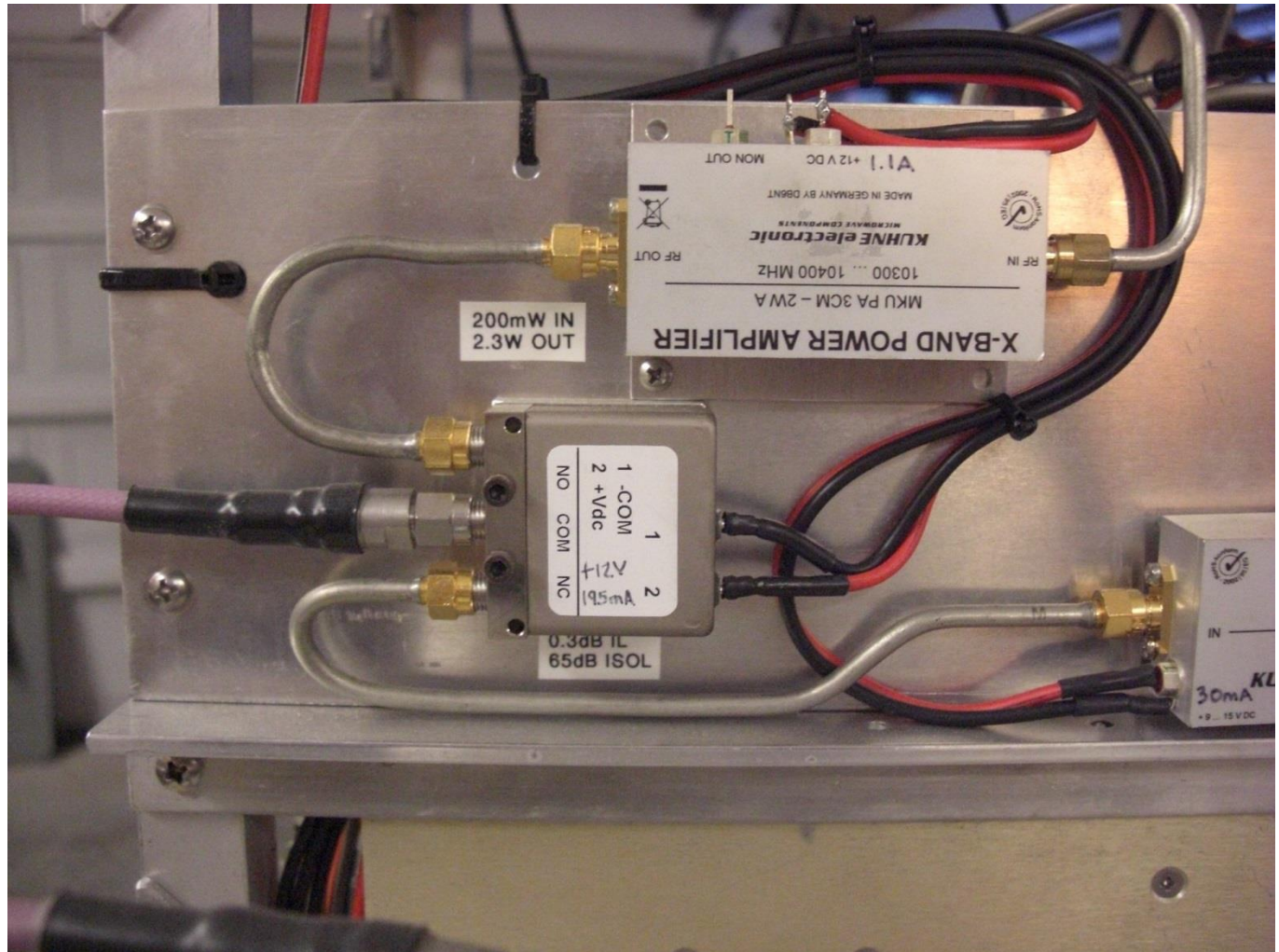
10GHz LNA Upgrade

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



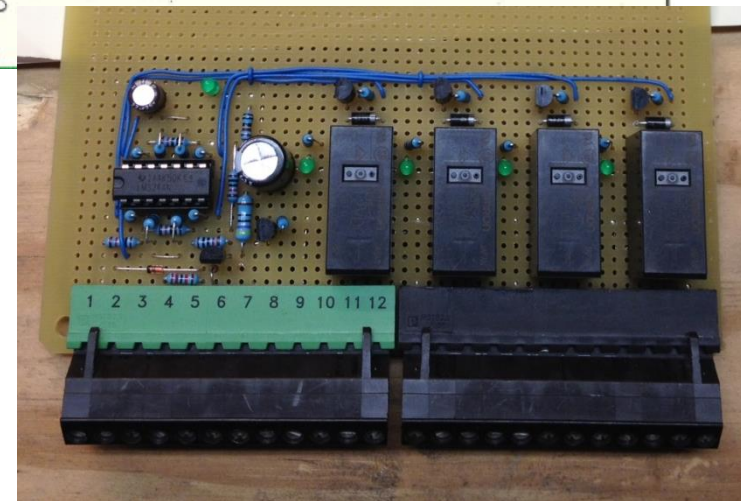
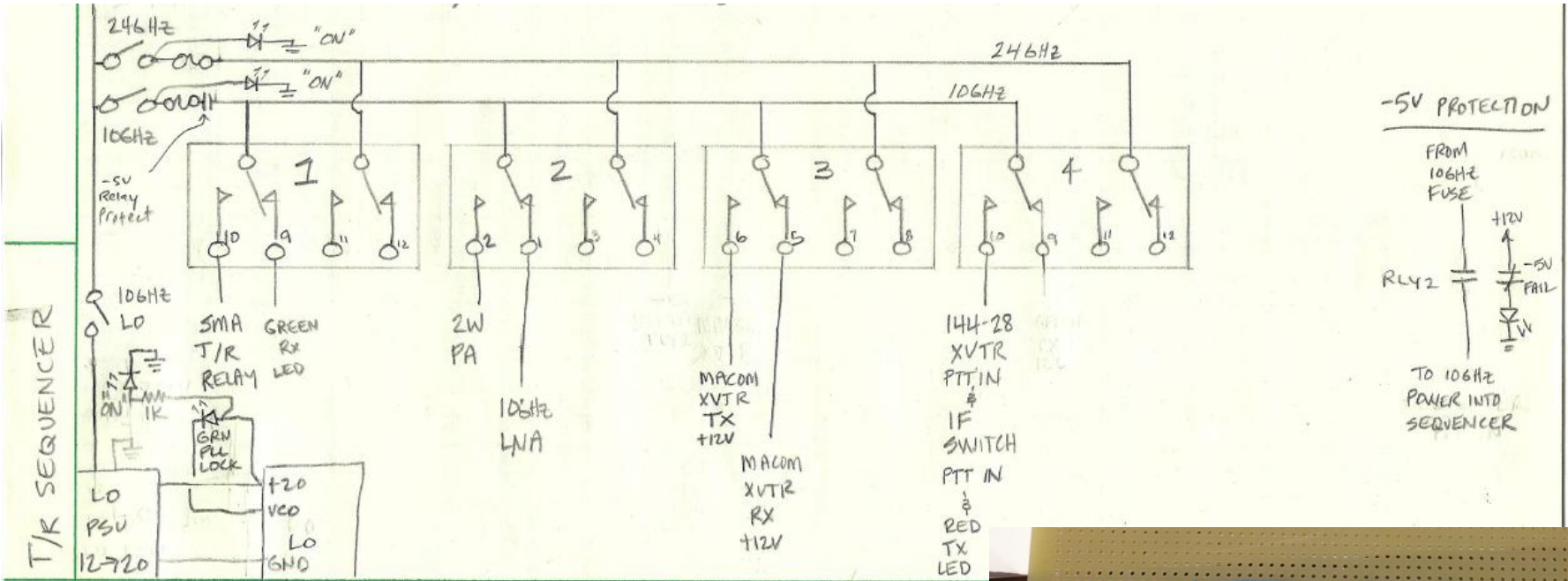
10GHz PA Upgrade

- Kuhne PA
 - 200mW in / 2.3W out



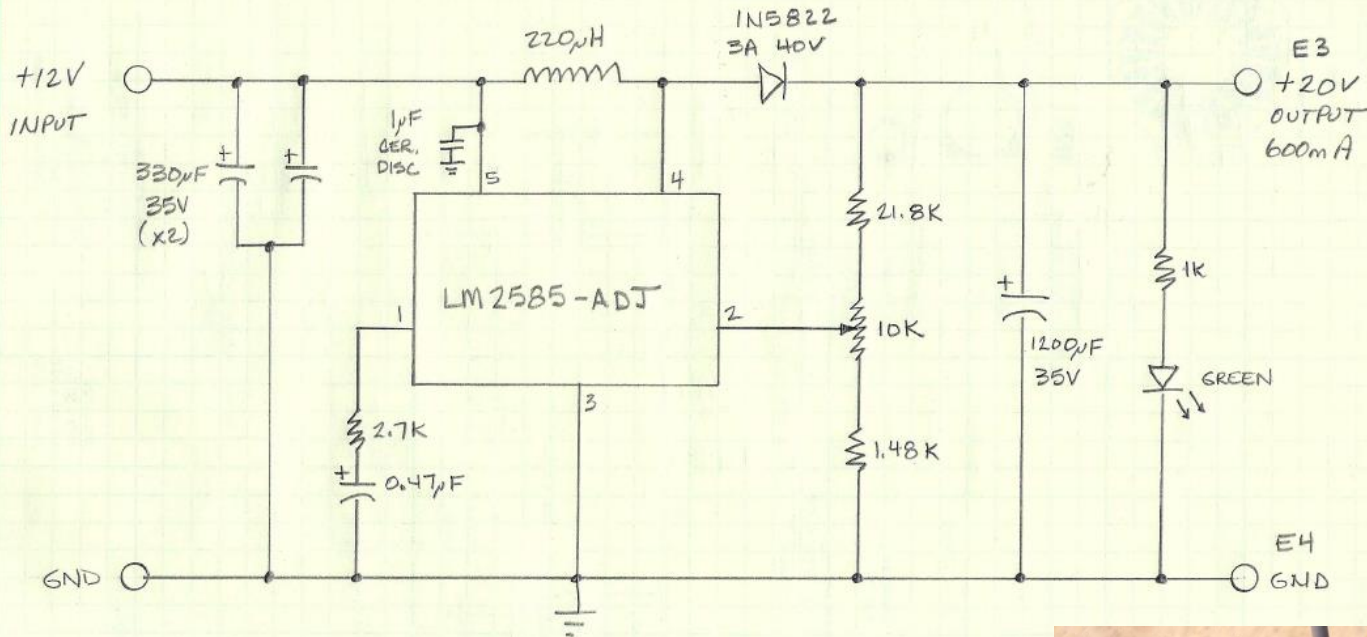
Sequencer

W5LUA Design



New 10GHz OCXO Power Supply

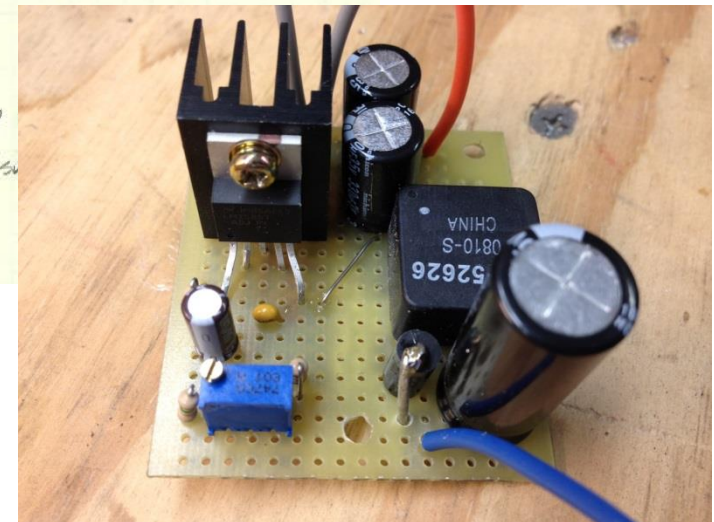
3/15/13 B. CoBo



Notes:

Between +12 & pin 5 of LM2585, replace short with 4.7K resistor & 0.1µF cap
Datasheet recommends this Filter for +12V input that is switched by contacts (su

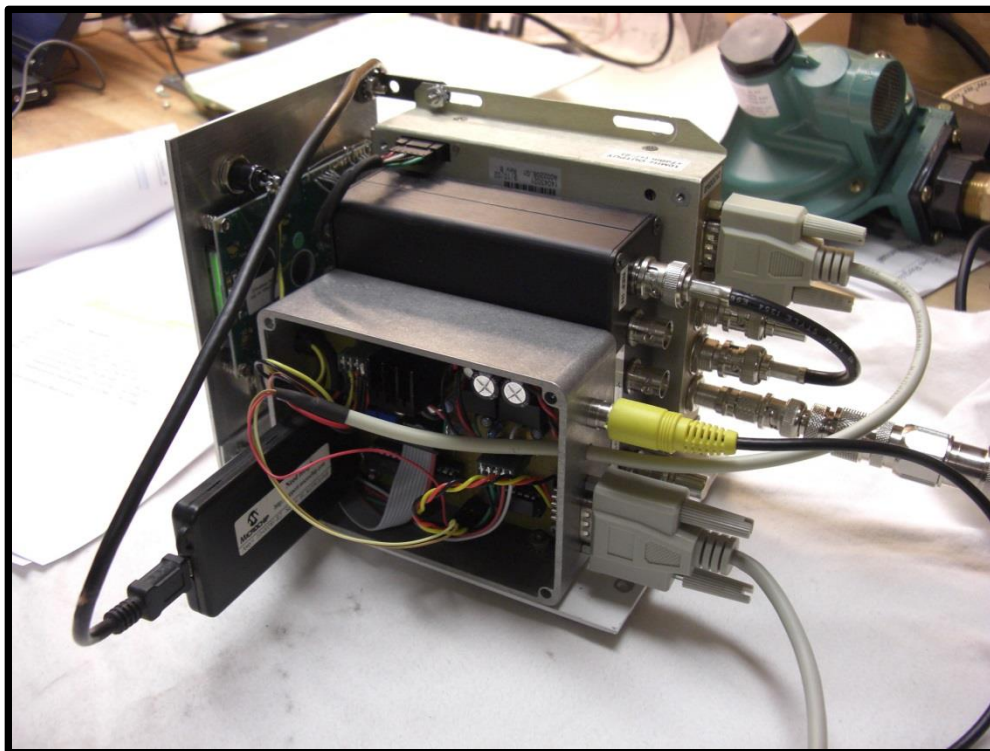
10GHz OCXO Pwr. supply



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 μ C parses data / drives LCD / monitors voltages / temp
 - PSU
 - 10MHz Reference Amp/Splitter



Trimble TBoltMon.exe Utility

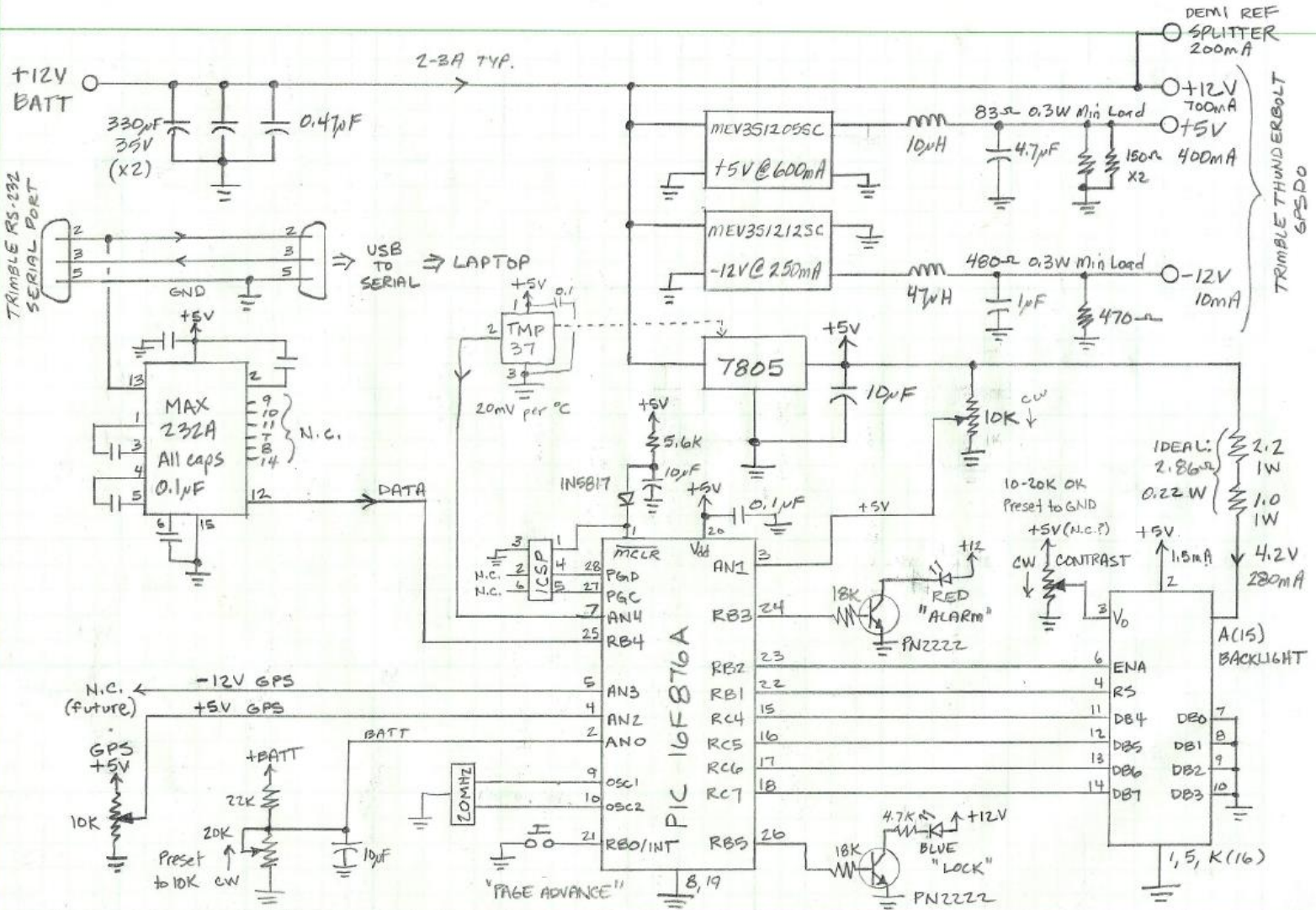
The screenshot displays the Trimble TBoltMon.exe utility interface, which is divided into several functional sections:

- Control Setup Window Help:** The top menu bar.
- Time:** Displays the current time (07:07:44), date (May 4, 2013), week (1738), and TOW (544064).
- Position:** Shows latitude (32.58874 degrees), longitude (-96.98470 degrees), and altitude (223.0 meters).
- Timing Outputs:** Displays PPS (1.30 ns GPS) and 10 MHz (0.00 ppb).
- Critical Alarms:** A list of system health indicators, including RDM Checksum, RAM Check, Power Supply, FPGA Check, and Oscillator Control Voltage.
- Minor Alarms:** A list of operational warnings, including Oscillator Control Voltage, Antenna Open, Antenna Short, Satellite Tracking, Oscillator Disciplining, Self-Survey Activity, Stored Position, Leap Second Pending, Test Mode, Position Questionable, EEPROM Invalid, and Almanac.
- Signal Levels:** A table showing signal strength for SV and AMU across various channels.
- Disciplining Status:** Displays Mode (Normal), DAC Voltage (0.213776), Activity (Phase Locking), DAC Value (0x85790), Holdover (0 sec), and Temp (30.7 deg C).
- Raw Packet Monitor:** A window showing real-time data packets received and transmitted over COM4. It includes a 'Resume' button and checkboxes for 'Tx Packets', 'Rx Packets', 'Display IDs Only', 'Main Packets', '8F-AE Cust', and '8F-AF Internal'.

Channel	SV	AMU
1	12	20.0
2	4	3.0
3	29	12.8
4	10	8.6
5	5	23.6
6	25	14.6
7	2	23.8
8	0	0.0
9		
10		
11		
12		
13		
14		
15		
16		
Tx All		

Trimble GPSDO PSU/Interface/LCD

BREAD COBO SPRING 2013



GPS DISCIPLINED
10MHz REF OSC

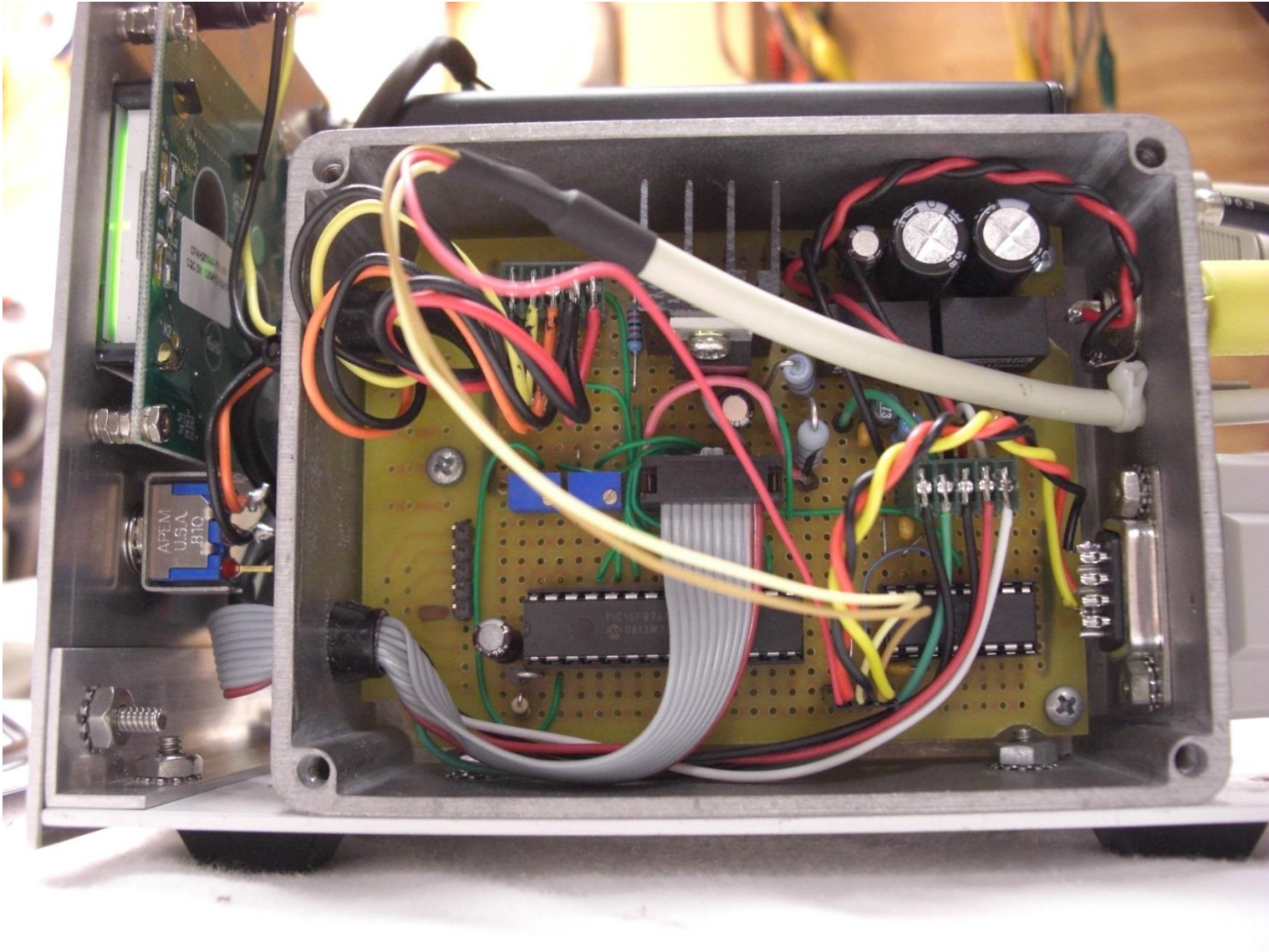
43-999 300 SHEETS RECYCLED WHITE PAPER
43-998 100 SHEETS RECYCLED WHITE PAPER
43-997 100 SHEETS RECYCLED WHITE PAPER
43-996 100 SHEETS RECYCLED WHITE PAPER
43-995 100 SHEETS RECYCLED WHITE PAPER
43-994 100 SHEETS RECYCLED WHITE PAPER
43-993 100 SHEETS RECYCLED WHITE PAPER
43-992 100 SHEETS RECYCLED WHITE PAPER
43-991 100 SHEETS RECYCLED WHITE PAPER
43-990 100 SHEETS RECYCLED WHITE PAPER



RC2 PIN12 = HPWM OUT

RC0, 1, 3 = UNUSED

Hardware



Trimble TSIP Serial Data

each digit is 4bits / 2digits = 1byte

Transmit COM 4 Packet ID: 24 Data Length: 0

Transmit COM 4 Packet ID: 27 Data Length: 0

Receive COM 4 Packet ID: 8F-AC Data Length: 68

AC 04 01 01 00 00 00 00 00 08 78 01 06 00 00 00 00 00 00 00 00 00 00 08 00 00 00 00 00 41 F6 E9 B8 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

ALT (m) PPS offset clock offset DAC Value DAC Voltage TEMP °C LAT (radians) LON
AB 00 00 08 0B 04 00 00 00 0C 13 22 00 16 08 07 CF

Full post 30
Power up survey Progress %
Holdover Duration secs
critical alarms
Minor Alarms
GPS Decoding Sts
Disciplining Activity
01 = don't have GPS Time

08 78 = 100001111000

no stored posn, not disciplining, not tracking satls
survey in progress, Almanac not complete

Transmit COM 4 Packet ID: 24 Data Length: 0

Transmit COM 4 Packet ID: 27 Data Length: 0

Receive COM 4 Packet ID: 8F-AB Data Length: 17

AC 04 01 01 00 00 00 00 00 08 78 01 06 00 00 00 00 00 00 00 00 08 00 00 00 00 00 41 F6 EE F5 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

AB 00 00 08 0C 04 00 00 00 0C 14 22 00 16 08 07 CF

Time of week (sec), Week #, UTC offset (sec), Sec min, hours, month, Year (1999), Timing Flag

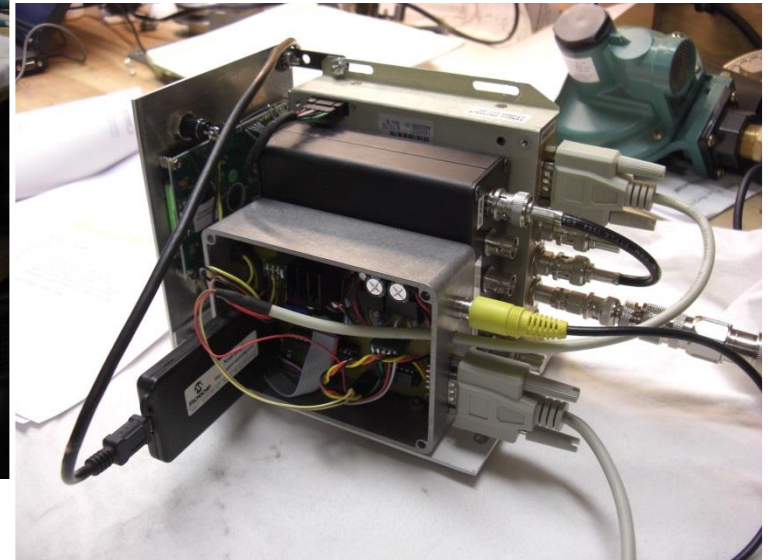
0C = 01100 = GPS time, GPS PPS, time is not set, no UTC info, time from GPS

byte
10 8F AB 16 bytes, 1003
10 8F AC, 67 bytes, 1003

32 x 1500

PIC Programming

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



PIC Program

The screenshot displays the MicroCode Studio - PICBASIC PRO interface. The main window shows a PIC program for a GPS display. The program includes LCD output, pauses, and logic to handle page changes and GPS data. A PICkit 2 Microcontroller Programmer window is open, showing a successful write operation to a PIC16F876A device. The programmer window displays the device configuration, a green success message, and memory verification data.

```
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 $fe, 1 'i clears the LCD
139 TEST1 = 0
140 gps_ok = 1 'turn on gps_ok LED
141 gps_update:
142 'Example NMEA Message:
143 '$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\$, HEX4 CRITALM, HEX4 MINALM, HEX2 GPSSTS, HEX2 DISPA
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 ' ENDF
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	Configuration Word	0x3F7E
User ID's	0x7F7F7F7F	OscCAL	
Checksum	0x0E7F	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

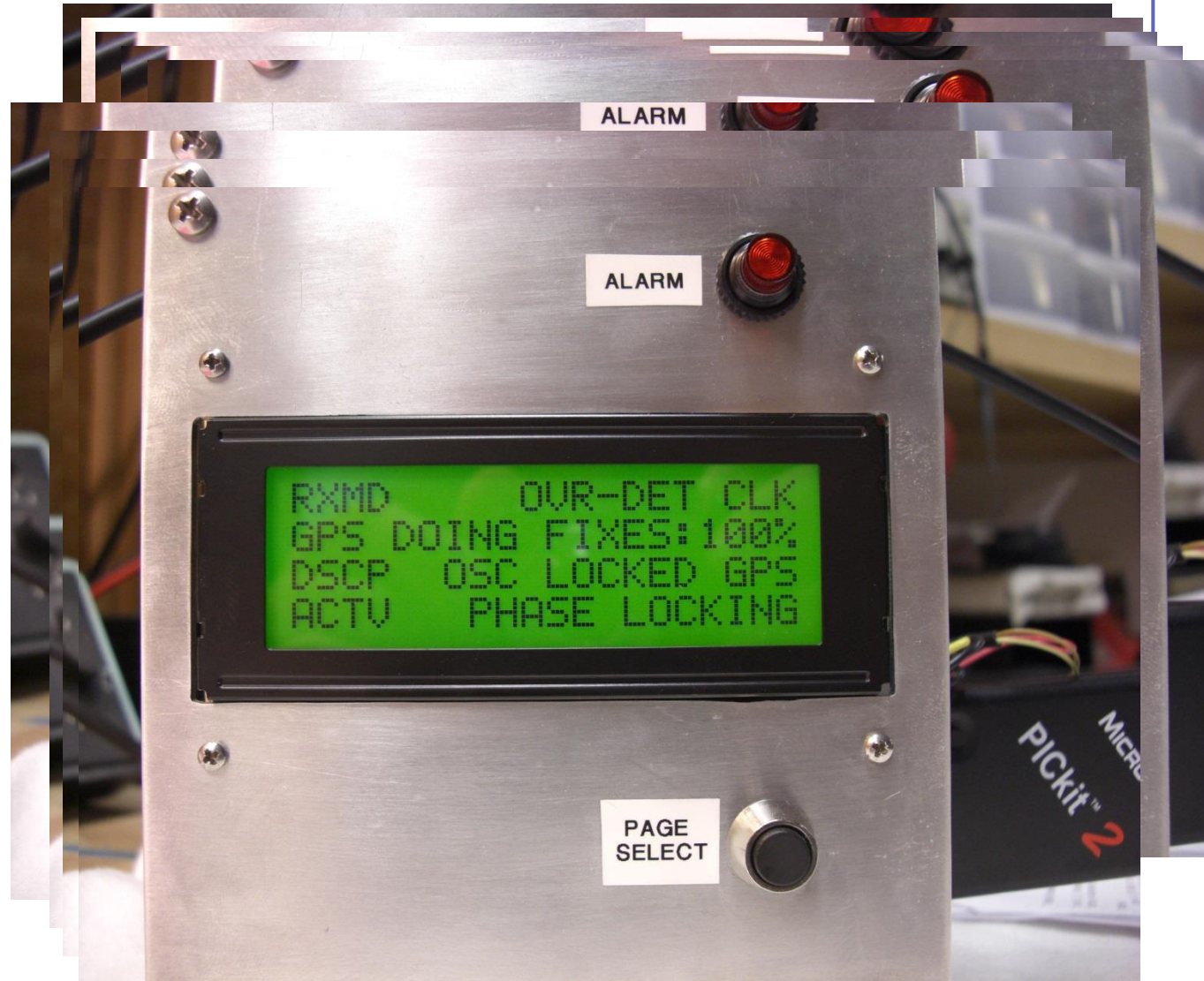
MICROCHIP

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

