[time-nuts] FE-5680A - pinout, serial commands for 217400-30352-1 model

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I recently bought a pair of FEI FE-5680A Rubidium Frequency Standard units on ebay (best offer of $150 for 2, free shipping from Hong Kong - seller tortlex2). It was relatively cheap (compared to EFRATOM units 10 years ago), compact and modern (programmable DDS), perhaps even useful to replace internal timebase in some test equipment.

The first thing I found out is that it wasn't easy to find *reliable information on them. Many conflicting pinouts, different packaging, connectors all for the same FE-5680A model. One source (a seller on eBay) lists pin 3 as +5V, when in fact that is the lock indication output - I ran the unit like that initially, and it gave 10MHz out for a while (possibly the ACT240 buffer output diodes taking all the current to back feed the power) until the output buffer burned (if you get >100mA on the 5V, this is a good candidate for replacement - it right by the DB-9 connector, accessible by removing 4 bottom screws (the bottom plate only). I replaced it and used pin 4 instead, which is the correct one.

Another difficulty was to get the unit to respond to serial commands, which was ultimately solved after finding the Rosetta stone (a technical manual for the unit in my configuration). This particular model, part number 217400-30352-1 doesn't respond to the trimpot on the side (at least not with any change in frequency) and uses the synthesizer for very fine adjustment of frequency around nominal 10MHz. 32-bit value adjusts in 7E-13 increments (way below the noise floor of the unit stability).

After my little tribulation in getting to this point, I decided to post my verified findings, clearly identifying the model number of the unit, to help others that already have the unit or decide to spring $75 to join this nuthouse... er... community.

1. Manufacturer: FEI
2. Model FE-5680A, part number 217400-30352-1
3. Connector: DB-9M (male) with signals:

        pin 1: +15V input (1.7A max when cold starting, 0.6A typ steady state)
        pin 2: GND (15V return)
        pin 3: LOCKn (low=locked, high=unlocked) ACT240 output
        pin 4: +5V input (80mA typ.)
        pin 5: GND (signal)
        pin 6: 1pps (about 1us positive pulse each second)
        pin 7: 10MHz sinewave (~1Vpp on 50 ohm)
        pin 8: RS-232 RX (receive commands into unit)
        pin 9: RS-232 TX (unit sends responses to pc)

4. Trimpot with external access doesn't seem to do a thing - reportedly C-field on other models.
5. Instead of wide range DDS, this unit seems to only generate 10MHz, which can be fine tuned by programming a 32-bit value through the serial commands. Make it very fine - my units needed about 140000 counts to change 1Hz - that is about 7E-13 relative change per lsb. '
6. Serial commands: I found a manual for a slightly different unit (Googled "FE-5680A manual" and got the top link <http://www.ham-radio.com/wa6vhs/Test%20equipment/FREQUENCY%20STANDARDS/FE-5680A/5680%20TECH%20MANUAL.pdf> http://www.ham-radio.com/wa6vhs/Test%20equipment/FREQUENCY%20STANDARDS/FE-5680A/5680%20TECH%20MANUAL.pdf), which listed three commands. 9600,8,N,1 worked fine.

        All commands have the general format [cmd] [lenght_lsb] [length_msb] [xorchecksum] [data] [data] ... [data] [data xor checksum]

        6.1 READ CURRENT OFFSET: 2D 04 00 29
                                  sample response: 2D 09 00 24 FF FF FE C8 36

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              This command simply returns the current offset value. In this
example it shows offset of FFFFFEC8, which is equivalent to -312 (this unit
had to be slowed down by 2.1E-10 to match my GPS trained reference).

        6.2 SET TEMPORARY OFFSET: 2E 09 00 27 aa bb cc dd cs (aabbccddee is
the 32-bit word to write, cs is the xor of aa,bb,cc,dd)
              no response is given to this command, use 2D command to
verify. Value is lost on power cycle.
              Example command: 2E 09 00 27 FF FF FE C8 36

        6.3 SET PERMANENT OFFSET: 2C 09 00 25 aa bb cc dd cs (same as 2E
command but also writes to EEPROM so survives a power cycle)

    One would use the 2C command during a calibration (EEPROM life is 100k
cycles), and use the 2E command for uses like a GPS-trained reference.


   7. Notes:  Operating the unit without any heatsink gets the external case
to around 58C (keeps your coffee warm), could lead to premature failure as
ICs get even hotter inside. If you just turn it on for a couple hours at a
time, it might be OK, but a large heatsink on the bottom (or a small fan -
some of the slim hard disk coolers might be appropriate in size).
       I set the offset to -4096, 0 and 4096, measured a long average of 10s
gate readings, then fit a curve to it and calculated where it crossed
10.000000000000MHz, then sent the 2C command to burn it. It is easy to go
overboard, as the resolution offered is normally way overkill and beyond
measurement or stability capabilities of most time nuts (except perhaps for
a couple time-nutcases). For instance, after adjusting to 2e-12 error (in
theory, as this gets in the noise of my measurments), I turned the unit
upside down and got a step change of 3.7E-11 for the 2 g change.If you are a
time nutcase (the type that has 3 cesium clocks but still shows up late to
places) tuning it to the last digit, decide where to mount it, first  :-)

Jose Camara
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