# Windfreak Technologies SynthNV Pro Programming Interface

The SynthNV Pro responds to commands that come in through its USB port. The USB port, when plugged in and powered will be assigned a COM port by its operating system that will accept serial commands from your code or from a basic terminal emulator. With Linux and Windows 10 the drivers are supplied automatically by the OS. If using older versions of Windows, you will need to install the drivers from the CD or software download.

Communicating with the SynthNV Pro:
First you need to know the COM Port that your computer assigns to your SynthNV Pro. Go to Device Manager and see what has been assigned. In this case we are using COM12. Yours may say Teensy in the description. If you have a few COM ports assigned it is a good idea to plug and unplug the device to know for sure which is which.
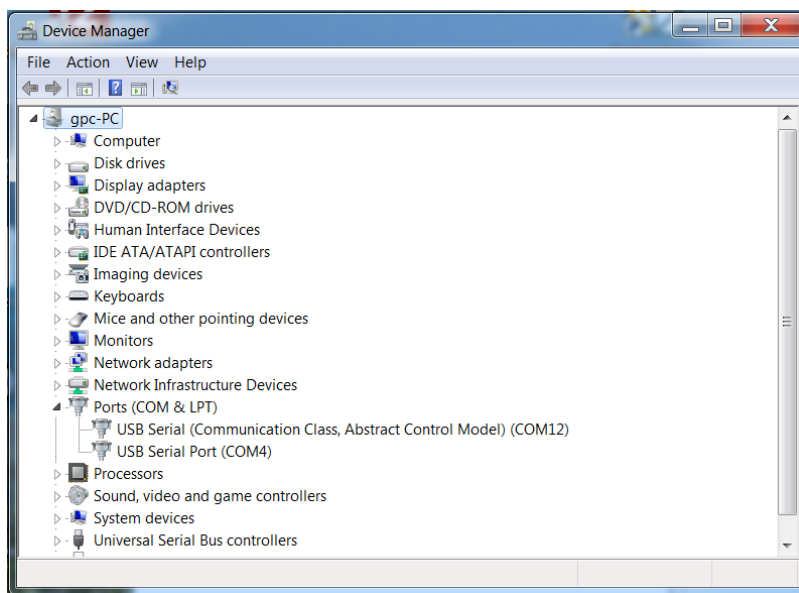
Once you know the SynthNV Pro COM port, communicating with it is as simple as:

1) Open the COM port
2) Send a command character (example "f" without quotes)
3) Send data characters (example "1000.0" without quotes)
4) Close the COM port

If you know the cable will not be unplugged, you could leave the COM Port open.

All the legacy COM port settings such as Data bits, Stop bits, etc. are "don't cares". **It is important to set baud rate to anything but 1200 baud.** All communication will go at full USB speed no matter what these settings are.
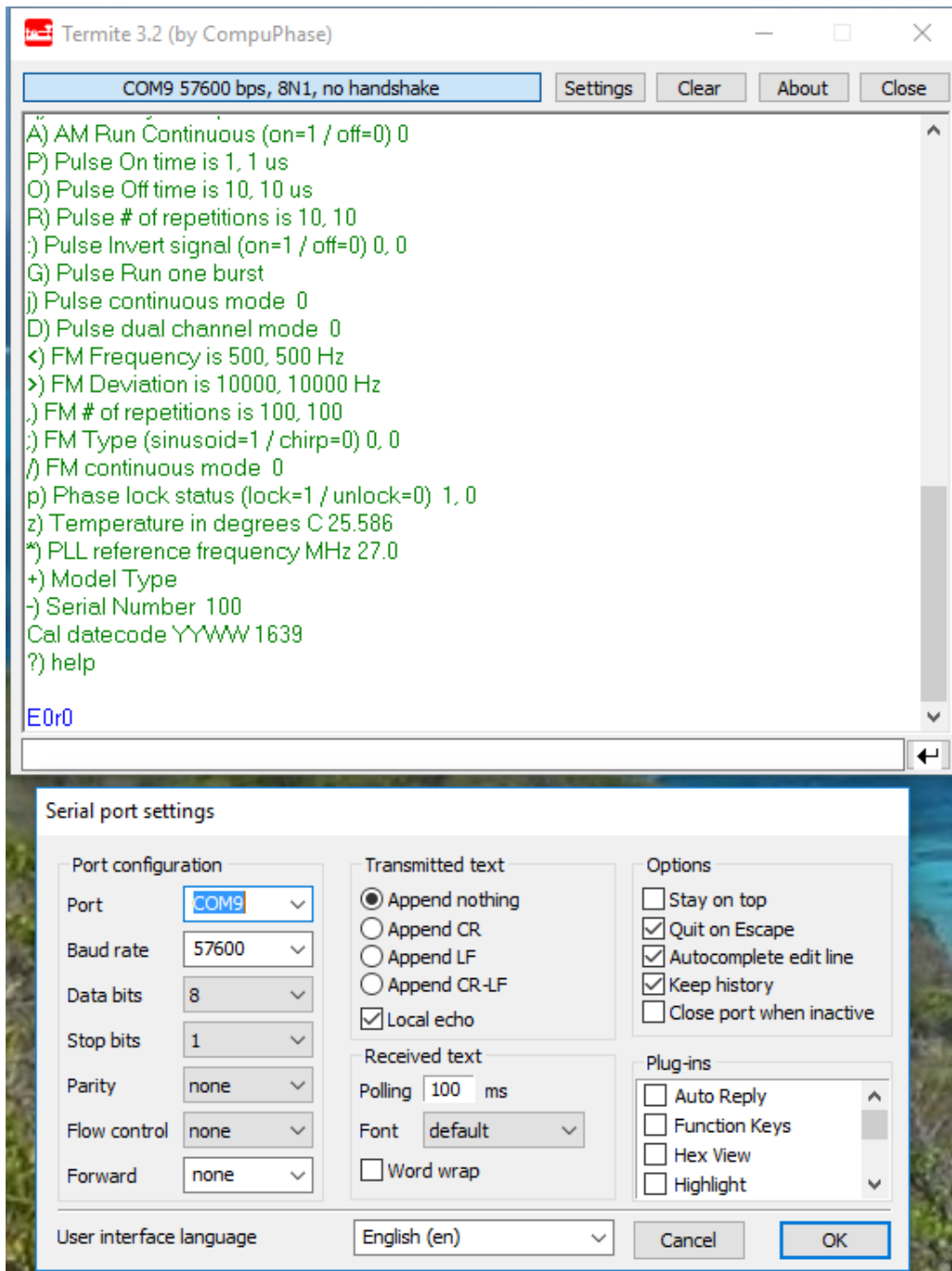
The SynthNV Pro does not accept termination characters such as carriage return or line feed. This was done to make the USB communication scheme as simple and fast as possible. It is possible to string together multiple commands. For example, setting frequency and power to 1000.0MHz and 0.0dBm would be formatted like: "f1000.0W0.0" (without the quotes or any termination characters). Since there are no termination characters it is essential that the command and data are sent as a packet all at once.

Finally, the SynthNV Pro expects case sensitive characters. It is essential that for any data you send to the device you convert any number values to their corresponding characters. In other words, the number 255 has a value that is represented as a single byte value (b11111111), but it will need to be converted to 3 bytes of characters 2,5, and 5. Programming languages such as LabVIEW have a native function to do this shown below:
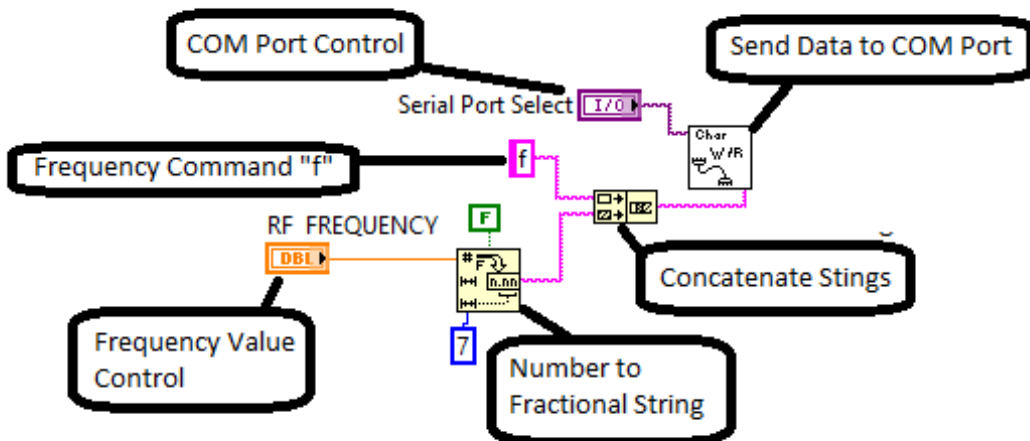
Using a Serial Terminal:

Before beginning your programming project, it might be a good idea to do some communicating with a 3rd party terminal program to understand how some of the commands work. In Windows, Windfreak Tech recommends a free program called Termite from www.compuphase.com. CuteCom is recommended for Linux. Serial USB Terminal is recommended for Android. The following graphic shows the use and setup of Termite. The only thing to set up is under Setting / "Transmitted text". There you will need to set "Append nothing" to transmitted characters. A Cutecom screen capture follows with the circled portion showing how to remove termination characters in that program for Linux.

Termite 3.2 (by CompuPhase) window showing:

COM9 57600 bps, 8N1, no handshake   [Settings] [Clear] [About] [Close]

A) AM Run Continuous (on=1 / off=0) 0
P) Pulse On time is 1, 1 us
O) Pulse Off time is 10, 10 us
R) Pulse # of repetitions is 10, 10
:) Pulse Invert signal (on=1 / off=0) 0, 0
G) Pulse Run one burst
j) Pulse continuous mode 0
D) Pulse dual channel mode 0
<) FM Frequency is 500, 500 Hz
>) FM Deviation is 10000, 10000 Hz
,) FM # of repetitions is 100, 100
:) FM Type (sinusoid=1 / chirp=0) 0, 0
/) FM continuous mode 0
p) Phase lock status (lock=1 / unlock=0) 1, 0
z) Temperature in degrees C 25.586
*) PLL reference frequency MHz 27.0
+) Model Type
-) Serial Number 100
Cal datecode YYWW 1639
?) help

E0r0

Serial port settings

Port configuration
Port   COM9   ∨
Baud rate   57600   ∨
Data bits   8   ∨
Stop bits   1   ∨
Parity   none   ∨
Flow control   none   ∨
Forward   none   ∨

Transmitted text
◉ Append nothing
○ Append CR
○ Append LF
○ Append CR-LF
☑ Local echo

Received text
Polling 100 ms
Font   default   ∨
☐ Word wrap

Options
☐ Stay on top
☑ Quit on Escape
☑ Autocomplete edit line
☑ Keep history
☐ Close port when inactive

Plug-ins
☐ Auto Reply
☐ Function Keys
☐ Hex View
☐ Highlight

User interface language   English (en)   ∨   [Cancel] [OK]

At the bottom of the screen is the command and data entry box. Send a "?" to have the SynthNV Pro respond back with a list of its commands. Try sending a frequency or power command like already mentioned and watch for the change on your spectrum analyzer. Also try sending queries like "f?" to have the SynthNV Pro respond with the status of that command variable. All responses are terminated with a "\n" which is a LF (or New Line) character.

Sessions   Help

Close   Device: /dev/ttyACM0 ▾   Settings

?
f1000.5
f?

Input: [   ] None ▾ Char delay: 0 ms ⬍ Send file... Plain ▾

[09:33:33:206] C) Control Channel (A(0) or B(1)) 0
[09:33:33:206] f) RF Frequency Now (MHz) 1000.00000000, 1000.00000000
[09:33:33:206] W) RF Power (dBm) 0.000, 0.000
[09:33:33:206] V) Amp Calibration success? 1
[09:33:33:206] Z) Temperature Comp (0=none, 1=on set, 2=1sec, 3=10sec) 3, 3
[09:33:33:206] a) VGA DAC Setting (0=min, 4000=max) 798, 843
[09:33:33:206] ~) RF Phase Step (0=minimum, 360.0=maximum) 0.0000, 0.0000
[09:33:33:206] h) RF High(1) or Low(0) Power 1, 1
[09:33:33:206] E) PLL Chip En On(1) or Off(0) 1, 0
[09:33:33:206] U) PLL charge pump current 5, 5
[09:33:33:206] b) REF Doubler On(1) or Off(0) 0, 0
[09:33:33:206] i) Channel spacing (Hz) 100.000, 100.000
[09:33:33:206] x) Reference (external=0, int 27MHz=1, int 10MHz=2) 1
[09:33:33:206] *) PLL reference frequency (MHz) 27.00000000
[09:33:33:206] l) Sweep lower frequency (MHz) 1000.00000000, 1000.00000000
[09:33:33:206] u) Sweep upper frequency (MHz) 5000.00000000, 5000.00000000
[09:33:33:206] s) Sweep step size (MHz/%) 200.00000000, 200.00000000
[09:33:33:206] t) Sweep step time (mS) 1.000, 1.000
[09:33:33:206] [) Sweep amplitude low (dBm) 0.000, 0.000
[09:33:33:206]]) Sweep amplitude high (dBm) 0.000, 0.000
[09:33:33:206] ^) Sweep direction (up=1 / down=0) 1, 1
[09:33:33:206] k) Sweep differential seperation (MHz) 1.00000000
[09:33:33:206] n) Sweep differential: (0=off, 1=ChA-DiffFreq, 2=ChA+DiffFreq) 0
[09:33:33:206] X) Sweep type (lin=0 / tab=1 / %=2) 0, 0
[09:33:33:206] g) Sweep run (on=1 / off=0) 0
[09:33:33:206] c) Sweep set continuous mode 0
[09:33:33:206] w) Enable trigger: (0=software, 1=sweep, 2=step, 3=hold all) 0
[09:33:33:206] F) AM step time (uS) 20
[09:33:33:206] q) AM # of cycle repetitions 65
[09:33:33:206] A) AM Run Continuous (on=1 / off=0) 0
[09:33:33:206] P) Pulse On time (uS) 1, 1
[09:33:33:206] O) Pulse Off time (uS) 10, 10
[09:33:33:206] R) Pulse # of repetitions 10, 10
[09:33:33:206] :) Pulse Invert signal (on=1 / off=0) 0, 0
[09:33:33:206] G) Pulse Run one burst
[09:33:33:206] j) Pulse continuous mode 0
[09:33:33:206] <) FM Frequency (Hz) 1000, 1000
[09:33:33:206] >) FM Deviation (Hz) 100000, 100000
[09:33:33:206] ,) FM # of repetitions 100, 100
[09:33:33:206] ;) FM Type (sinusoid=0 / chirp=1) 0, 0
[09:33:33:206] /) FM continuous mode 0
[09:33:33:206] p) Phase lock status (lock=1 / unlock=0) 1, 0
[09:33:33:206] z) Temperature in degrees C 33.250
[09:33:33:206] v) Show version (0=FW, 1=HW, 2=Model) 3.13, 2.03
[09:33:33:206] +) Model Type
[09:33:33:206] -) Serial Number 595
[09:33:33:206] e) Write all settings to eeprom
[09:33:33:206] ?) help
[09:33:33:206] Cal datecode YYWW 1934
[09:33:33:206] EOM.
[09:34:13:621] 1000.50000000

Clear   ☐ Hex output ☐ Logging to: /home/pi/cutecom.log

Device: /dev/ttyACM0 Connection: 115200 @ 8-N-1

12.5MHz – 6.4GHz Signal Generator plus RF Detector

After sending a "?" command the SynthNV Pro will respond with a list of its commands and settings similar to the following list. Click the links below for quick access to further details on each command.

f) RF Frequency Now (MHz) 1000.00000000
W) RF Power (dBm) 10.300
V) Amp Calibration success? 1
Z) Temperature Comp (0=none, 1=on set, 2=1sec, 3=10sec) 3
w) Read Pwr Detector dBm (burst samples) -49.112
&) RF Detector Mode Inst(0), Av(1), Pk(2) 0
a) VGA DAC Setting (0=min, 4000=max) 2238
~) RF Phase Step (0=minimum, 360.0=maximum) 0.0000
h) RF High(1) or Low(0) Power 1
E) PLL Chip En On(1) or Off(0) 1
U) PLL charge pump current 5
D) REF Doubler On(1) or Off(0) 0
i) Channel spacing (Hz) 10.000
x) Reference (external=0, int 27MHz=1, int 10MHz=2) 1
*) PLL reference frequency (MHz) 27.00000000
l) Sweep lower frequency (MHz) 1000.00000000
u) Sweep upper frequency (MHz) 5000.00000000
s) Sweep step size (MHz/%) 200.00000000
t) Sweep step time (mS) 1.000
[) Sweep amplitude low (dBm) 0.000
]) Sweep amplitude high (dBm) 0.000
^) Sweep direction (up=1 / down=0) 1
X) Sweep type (lin=0 / tab=1 / %=2) 0
r) set reading while sweeping (on=1 / off=0) 0
d) set sweep display (off=0 / freq+amp=1 / only amp=2) 0
m) show maximum then minimum of a sweep (not enabled yet)
g) Sweep run (on=1 / off=0) 0
c) Sweep set continuous mode 0
y) Enable trigger: (0=software, 1=sweep, 2=step, 3=hold all) 0
F) AM step time (uS) 4998
q) AM # of cycle repetitions 65

A) AM Run Continuous (on=1 / off=0) 0
P) Pulse On time (uS) 1
O) Pulse Off time (uS) 10
R) Pulse # of repetitions 10
:) Pulse Invert signal (on=1 / off=0) 0
G) Pulse Run one burst
j) Pulse continuous mode 0
<) FM Frequency (Hz) 500
>) FM Deviation (Hz) 10000
,) FM # of repetitions 100
;) FM Type (sinusoid=0 / chirp=1) 0
/) FM continuous mode 0
b) Speaker Feedback Mode 0
p) Phase lock status (lock=1 / unlock=0) 1
z) Temperature in degrees C 27.750
v) Show version (0=firmware, 1=hardware) 2.01
+) Model Type
-) Serial Number 25
e) Write all settings to eeprom
?) help

Command Definitions:

Set Frequency in MHz (Command f):
The SynthNV Pro frequency is settable between 12.5MHz and 6400.0MHz. The setting is always in MHz.
fxxxx.xxxxxxx sets frequency to x MHz in 0.1Hz resolution
f? queries frequency setting in 0.1Hz resolution

Set Power in dBm (Command W):
The SynthNV Pro RF power is settable between -60dBm and +20dBm depending on frequency. With this setting the SynthNV Pro will automatically calibrate itself and set the power as close as it can get to what is requested.
Wxx.xxx sets RF power to x dBm in 0.001dB resolution
W? queries the RF output power setting in 0.001dB resolution

Query for Successful Calibration Completion (Command V):
If the SynthNV Pro can successfully complete its calibration routine upon frequency or amplitude set, it will set a flag of 1 showing the output should be accurate and leveled.
V queries if there was successful calibration. 1=success, 0=failure

Set Temperature Compensation Method (Command Z):
The SynthNV Pro RF power can be stabilized over temperature. "On set" means that it will only be adjusted for when frequency or power is set. The 1 second and 10 second setting will also both be adjusted "on set" as well but also automatically compensate every 1 or 10 seconds respectively. The default setting is to automatically run the routine every 10 seconds. During modulation, the temperature compensation routine is put on hold and resumes once modulation is turned off.
Zx sets the method for temperature compensation (x=0=none, 1=on set, 2=1sec, 3=10sec).
Z? queries the setting for Temperature Compensation

Read Power Detector (Command w):
Measure detected RF power on the RFin connector. The report is in dBm followed by "/nEOM./n" where "/n" is a line feed termination character. Sending "w" or "w0" or "w1" all respond with 1 measurement. If requesting more than 1 measurement, the device measures as fast as it can and each dBm response is followed by "/n" with the end of message designated by "EOM./n" . The RF detector uses the RF generator frequency setting for its calibration frequency. Disable the RF generator ("E0") for maximum dynamic range if not concurrently using the RF generator.
An example response for a "w5" command is as follows:
"-10.176
-10.176
-10.149
-10.176
-10.176
EOM."
wx measures RFin power x times

Set RF Detector Mode (Command &):
The RF power detector can asynchronously measure RF power in 1 of 3 modes:
  0) ("&0") The default measurement mode is instantaneous. This mode sets the log detector to measure with no averaging. Its best for CW signals with similar peak and average power levels. This mode is calibrated.
  1) ("&1") This mode runs the output of the log detector through an RC (series resistor, shunt capacitor) low pass filter to achieve some amount of averaging of the incoming signal. Use this mode for signals with different peak and average powers that vary quickly. The RC time constant (t=R*C) is 5.6mS. This mode is calibrated.
  2) ("&2") This mode runs the output of the log detector through a series diode, shunt capacitor to attempt to capture sporadic peak RF events, possibly in conjunction with using the internal speaker. This mode is experimental and not calibrated due to the diode

voltage drop. There is a bleed-off resistor for the capacitor that has a time constant of 50mS.

&x sets the method for RF detection (x=0=instant, 1=average, 2=peak).
&? queries the setting for RF Detector Mode

Set Raw DAC Value (Command a):
The SynthNV Pro RF power setting can be bypassed and set with a raw VGA DAC value between 0 and 4000. A setting of 0 is minimal and 4000 would be maximum gain. To use this function Temperature Compensation must be turned off with "Z0".
ax sets DAC value for x drive level where x is between 0 and 4000
a? queries the DAC setting

Set Phase Step Value (Command ~):
The SynthNV Pro RF phase can be adjusted. These adjustments are relative adjustments that add the phase amount to the current phase being generated. There is no way (currently) to know the absolute phase setting of the SynthNV Pro without external measurement. Every reboot or frequency change (besides FM) will reset the phase to an arbitrary value.
~xxx.xxx sends a phase increment to the SynthNV Pro in x degrees. (Sending x359.0 will appear to decrement the phase by 1.0 degrees).
~? Has no real meaning.

Set RF Mute (Command h):
The SynthNV Pro output power can be muted without fully powering down the PLL. The amount of muting depends on frequency.
hx sets the muting function where x=1=not muted and x=0=muted
h? queries the setting

Set PLL Power On (Command E):
The SynthNV Pro PLL can be powered down for absolute minimum noise on the output connector. This command enables and disables the PLL and VCO to save energy and can take 20mS to boot up.
Ex sets the enable function where x=1=powered on and x=0=powered off
E? queries the setting

Set PLL Charge Pump Current (Command U):
PLL loop filter bandwidth can be adjusted to a certain degree through the PLL charge pump current setting. This can affect things like lock time, phase noise and FM quantization noise. In general, higher values give higher loop filter bandwidths, but the steps are not monotonic. Higher bandwidths tend to have better phase noise and stepping times, but possibly higher spurs. A setting of zero should be avoided as the charge pump output is tri-stated and the PLL will not phase lock.
Ux sets the the charge pump current where x=1 through 15 is allowed
U? queries the setting

Reference Frequency (x2) Doubler (Command D):
The doubler will control whether the phase detector phase comparison frequency runs at the reference frequency or at double the reference frequency. Keep the comparison frequency below 100MHz. Use the doubler and higher comparison frequencies for achieving better phase noise.
Dx turns on and off the reference doubler where x=0 doubler disabled and x=1 is doubler enabled.
D? queries the setting

Channel Spacing (Command i):
Sets the frequency resolution for the RF signal generator between 0.1Hz and 1000Hz. The SynthNV Pro will attempt to achieve mathematically perfect RF frequency settings at the fundamental VCO frequency. The drawback for small settings can be very long phase tuning time, especially at low RF frequencies. Smaller channel spacing will have higher phase and frequency resolutions but slower phase tuning speed. Going below 100MHz carrier with smaller channel spacing than 100Hz may be prohibitively slow and/or erratic and may cause slow USB communication response times.
ix sets the channel spacing x is the frequency in Hz
i? queries the setting

Program all Settings to Nonvolatile Memory (EEPROM) (Command e):
All of the settings currently set in the SynthNV Pro can be programmed to the SynthNV Pro nonvolatile memory for default operation on power up. Verify that the SynthNV Pro is set exactly the way you need it set before sending this command since it will also save a state that may not work. Almost all functions like modulation, sweep etc. are saved. Lookup tables (sweep, FM, AM) may not be saved.
e saves all variables in the SynthNV Pro for power up boot

Set Internal or External Reference (Command x):
The SynthNV Pro has two internal references (10MHz and 27MHz). It also has the ability to use an external reference. If using an external reference, see the "*" PLL Reference Frequency Command.
xy sets the reference where y=0=external, y=1=internal 27MHz, y=2=internal 10MHz
x? queries the setting

Set Reference Frequency in MHz (Command *):
The SynthNV Pro reference frequency is settable between 10.0MHz and 100.0MHz. The setting is always in MHz. Reference frequency is automatically set when one of the internal frequencies is selected with the "x" command.
*xxx.xxx sets frequency to x MHz in 0.001MHz resolution
*? queries reference frequency setting

Set Trigger Connector Functions (Command y):
The SynthNV Pro Trigger input is a multifunction input. It is used for trigger events, but also used for other things like external FM, AM and Pulse modulation inputs. The values are:
    0) No Triggers

1) Trigger full frequency sweep
2) Trigger single frequency step
3) Trigger "stop all" which pauses sequencing through all functions of the SynthNV Pro
4) Trigger digital RF ON/OFF – Could be used for External Pulse Modulation
5) Remove Interrupts (Makes modulation have less jitter – use carefully)
6) Reserved
7) Reserved
8) External AM modulation input (requires AM Internal modulation LUT set to ramp)
9) External FM modulation input (requires FM Internal modulation set to chirp)

wx sets the Trigger connector as described above to x
w? queries the setting

Notes on External Modulations:

External AM Modulation is driven through the Trigger connector and responds to analog voltages between 0 and 2.5V. It responds to setting stored in the AM look up table and cycles through each sample. For best performance set the AM frequency to 1Hz which gives the maximum of 200 samples. Set the wave shape to RAMP and select whether you want the response linear in dB or Volts. 0V input will correspond with the Minimum Power setting and 2.5V will drive to the Peak Power setting with 100 steps in between. Sample rate is roughly 22uS.

External FM Modulation is driven through the Trigger connector and responds to analog voltages between 0 and 2.5V. It responds to setting stored in the FM control tab and cycles through each sample it creates. For best performance set the FM frequency to 1Hz which gives the maximum of 100 samples. Set the wave shape to CHIRP. 0V input will correspond with the (negative) FM Deviation setting and 2.5V will drive to the (positive) Deviation setting with 100 steps in between. Sample rate is roughly 22uS per point.

Software doesn't necessarily have to perform these functions every time. The SynthNV Pro can be programmed for the proper external modulation and the data be saved to nonvolatile EEPROM so that its always there. Use the supplied GUI to do these functions as well as set any other defaults (uses the "e" command).

Sweep Definitions:
Lower Frequency for Linear Sweep (Command l):
Sets the lower frequency for the linear sweep in MHz. This frequency should be lower than the Upper Frequency and kept within 12.5MHz – 6400MHz.
lx sets the lower frequency where x is the frequency in MHz
l? queries the setting

Upper Frequency for Linear Sweep (Command u):
Sets the upper frequency for the linear sweep in MHz. This frequency should be higher than the Lower Frequency and kept within 12.5MHz – 6400MHz.

12.5MHz – 6.4GHz Signal Generator plus RF Detector

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ux sets the upper frequency where x is the frequency in MHz
u? queries the setting

Step Size Frequency for Linear Sweep (Command s):
Sets the step size frequency for the linear sweep in MHz. This frequency should be smaller than the range between Lower and Upper frequencies.
sx sets the step size frequency where x is the frequency in MHz
s? queries the setting

Step Time for Linear Sweep (Command t):
Sets the step time for the linear sweep in mS. Step time should be kept between 0.1mS and 60,000.0 mS.
txxxxx.xxx sets the step size frequency where x is the time in mS.
t? queries the setting

Linear Sweep Power Low (Command [):
Sets the sweep RF power in dBm for the Lower Frequency setting of the sweep. RF Power should be within the range of -50 to +20dBm. This value is used in combination with the Sweep Power High (]) and causes a linear adjustment of power as the sweep occurs. Keep both values the same to have a level sweep.
[xx.xxx sets the lower RF sweep power setting in dBm.
[? queries the setting

Linear Sweep Power High (Command]):
Sets the sweep RF power in dBm for the Upper Frequency setting of the sweep. RF Power should be within the range of -50 to +20dBm. This value is used in combination with the Sweep Power Low ([) and causes a linear adjustment of power as the sweep occurs. Keep both values the same to have a level sweep.
]xx.xxx sets the upper frequency RF sweep power setting in dBm.
]? queries the setting

Sweep Direction (Command ^):
Sets the sweep direction from upper frequency to lower frequency or vice versa.
^x sets the direction where x=0 is from upper frequency to lower frequency and x=1 is from lower frequency to upper frequency. For tabular sweep x=0 reverses the order of the steps and x=1 is normal increment.
^? queries the setting

Sweep Type (Command X):
Determines whether to do a linear sweep (0), tabular sweep (1) (500 point frequency and power table hopping), or a percentage of frequency sweep (3).
Xy toggles the type of sweep to perform where y=0=linear, y=1=tabular and y=2=percentage
X? queries the setting

Read RFin power while sweeping RFout (Command r):
Sets the SynthNV pro to measure its power detector on RFin after every new frequency is set in the generator - only during an automated sweep. This does not control the display of the data, only the measurement.
rx sets read while sweep, where x=0 is don't read and x=1 is to read.
r? queries the setting

Set Sweep Display style (Command d):
Sets the SynthNV Pro to display the frequency in MHz and/or power in dBm after every new frequency is set in the generator - only during an automated sweep. Every value of the sweep is followed by a "/n" (line feed) termination character and the total sweep is final after an "EOM./n" end of message flag.
A sweep of 6 data points from 1000.0MHz to 2000.0MHz at 200.0MHz steps with a "d1" setting would look similar to:
1000.00000
-9.96
1200.00000
-10.26
1400.00000
-10.38
1600.00000
-10.08
1800.00000
-9.81
2000.00000
-9.84
EOM.
dx sets sweep display style, where x=0 is don't display, x=1 is display frequency and amplitude, and x=2 is display only amplitude.
d? queries the setting
0

Run Sweep (Command g):
Starts a sweep. Once complete the value is automatically returned to 0 unless Sweep Continuous "c" is set to 1. If "c" is set to 1 then the sweep process automatically repeats forever. If Sweep Continuous "c" is set to 0 a g1 will completely restart the sweep no matter where the sweep is at. If "c" is set to 1 a "g0" will pause the sweep and a "g1" will continue the sweep.
gx controls running a single sweep when x=1=start, restart or continue and x=0=pause
g? queries the setting

Sweep Continuously (Command c):
Sets sweep continuously mode. If asserted ("c1") the Run Sweep "g" command will not be reset to 0 after a complete sweep and sweeping or hopping will continue until a "g0" command is sent. Alternatively, a "c0" will terminate the sweep after it is complete.
cx controls running a single sweep when x=0 and continuous, repetitive sweeping when x=1
c? queries the setting

AM Step Time in Microseconds (Command F):
Sets the additive delay on top of the minimum sample rate achieved by the DAC driving the VGA to achieve AM modulation.
*Fx sets the delay where x is in microseconds*
F? queries the setting

Amplitude Modulation Definitions:
AM modulation is achieved through a digital sampled waveform that has to be uploaded to the device and "played" with a certain sample rate. The waveform is always loaded 200 samples long, but any sample with a value of -75.0dBm is not played. So frequency is determined both by the number of samples played in the waveform and the samples per second play rate.
An example of loading a sinusoidal, 10KHz, +10dBm to -30dBm table to the device would be:
F1@0a10.00@1a8.02@2a2.47@3a-5.55@4a-14.45@5a-22.47@6a-28.02@7a-30.00@8a-28.02@9a-22.47@10a-14.45@11a-5.55@12a2.47@13a8.02@14a-75.0@15a-75.0@16a-75.0@17a-75.0@18a-75.0@19a-75.0@20a-75.0@21a-75.0@22a-75.0@23a-75.0@24a-75.0@25a-75.0@26a-75.0@27a-75.0@28a-75.0@29a-75.0@30a-75.0@31a-75.0@32a-75.0@33a-75.0@34a-75.0@35a-75.0@36a-75.0@37a-75.0@38a-75.0@39a-75.0@40a-75.0@41a-75.0@42a-75.0@43a-75.0@44a-75.0@45a-75.0@46a-75.0@47a-75.0@48a-75.0@49a-75.0@50a-75.0@51a-75.0@52a-75.0@53a-75.0@54a-75.0@55a-75.0@56a-75.0@57a-75.0@58a-75.0@59a-75.0@60a-75.0@61a-75.0@62a-75.0@63a-75.0@64a-75.0@65a-75.0@66a-75.0@67a-75.0@68a-75.0@69a-75.0@70a-75.0@71a-75.0@72a-75.0@73a-75.0@74a-75.0@75a-75.0@76a-75.0@77a-75.0@78a-75.0@79a-75.0@80a-75.0@81a-75.0@82a-75.0@83a-75.0@84a-75.0@85a-75.0@86a-75.0@87a-75.0@88a-75.0@89a-75.0@90a-75.0@91a-75.0@92a-75.0@93a-75.0@94a-75.0@95a-75.0@96a-75.0@97a-75.0@98a-75.0@99a-75.0@100a-75.0@101a-75.0@102a-75.0@103a-75.0@104a-75.0@105a-75.0@106a-75.0@107a-75.0@108a-75.0@109a-75.0@110a-75.0@111a-75.0@112a-75.0@113a-75.0@114a-75.0@115a-75.0@116a-75.0@117a-75.0@118a-75.0@119a-75.0@120a-75.0@121a-75.0@122a-75.0@123a-75.0@124a-75.0@125a-75.0@126a-75.0@127a-75.0@128a-75.0@129a-75.0@130a-75.0@131a-75.0@132a-75.0@133a-75.0@134a-75.0@135a-75.0@136a-75.0@137a-75.0@138a-75.0@139a-75.0@140a-75.0@141a-75.0@142a-75.0@143a-75.0@144a-75.0@145a-75.0@146a-75.0@147a-75.0@148a-75.0@149a-75.0@150a-75.0@151a-75.0@152a-75.0@153a-75.0@154a-75.0@155a-75.0@156a-75.0@157a-75.0@158a-75.0@159a-75.0@160a-75.0@161a-75.0@162a-75.0@163a-75.0@164a-75.0@165a-75.0@166a-75.0@167a-75.0@168a-75.0@169a-75.0@170a-75.0@171a-75.0@172a-75.0@173a-75.0@174a-75.0@175a-75.0@176a-75.0@177a-75.0@178a-75.0@179a-75.0@180a-75.0@181a-75.0@182a-75.0@183a-75.0@184a-75.0@185a-75.0@186a-75.0@187a-75.0@188a-75.0@189a-75.0@190a-75.0@191a-75.0@192a-75.0@193a-75.0@194a-75.0@195a-75.0@196a-75.0@197a-75.0@198a-75.0@199a-75.0

For reference here is the LabVIEW code used to generate a table:
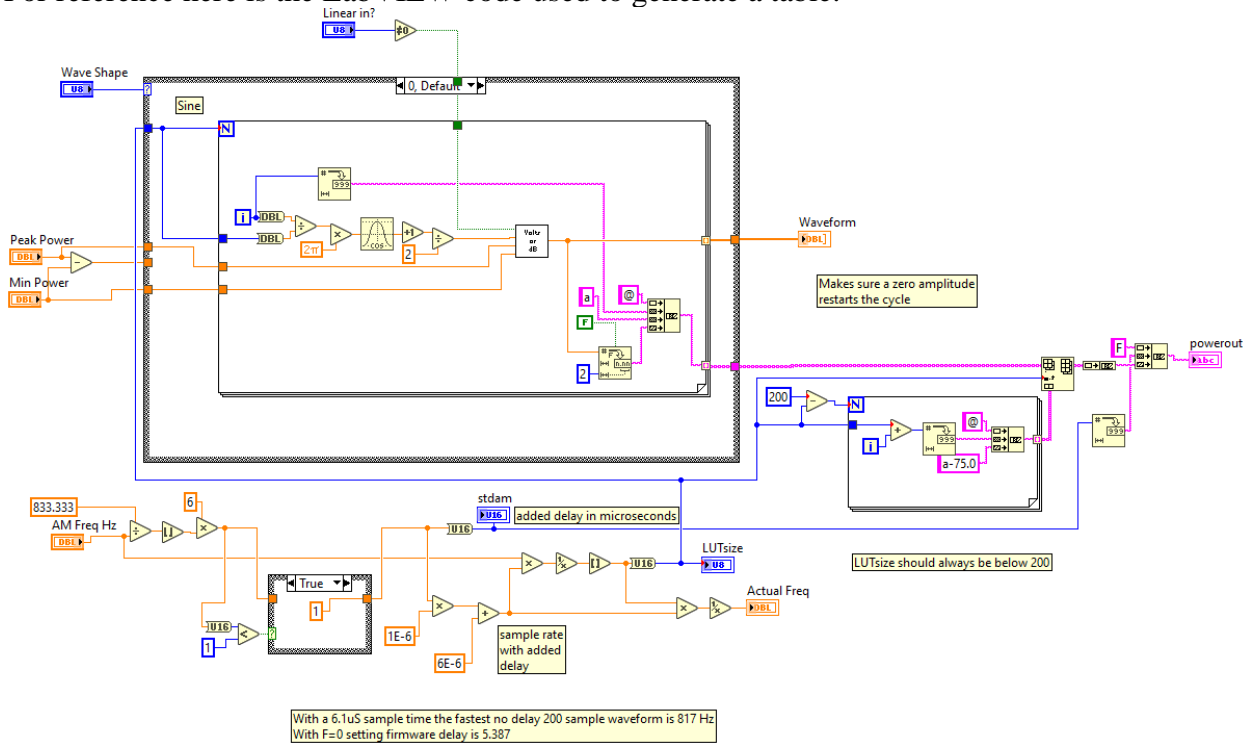
How the delay is calculated in the Windfreak SynthNV Pro GUI:
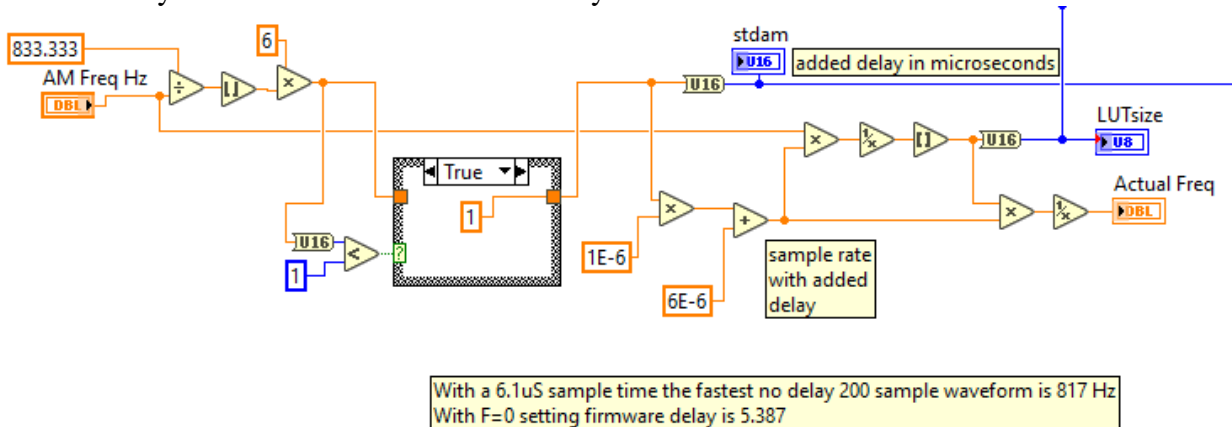
Read back the AM sample table by sending "@?". Each sample is followed by a "/n" termination character and the table is complete when "EOM./n" is received.

AM Number of Samples to Play in a Burst (Command q):
Sets the number of samples to play in one burst. Usually this is the number of total samples in a cycle or multiples thereof. Used when mixed with other functions like stepping. It's possible to sweep and for every step in the sweep generate a given number of AM cycles.
qx sets the number x of samples to play
q? queries the setting

AM Run Continuously (Command A):
Turns continuous AM modulation on or off.
Ax turns AM on or off with x=1=on and x=0=off
A? queries the setting

Program a Spot in the AM Lookup Table in dBm (Command @):
Programming the AM lookup table requires programming memory locations of 0-199 with an amplitude value in dBm. The command is a series of two commands.
@xay sets value in AM LUT where x=memory value between 0 and 199, and y= value in dBm
@xa? Queries value at memory location x

Pulse Modulation Commands:

Pulse On Time (Command P):
Sets the Pulse Modulation On time in microseconds. Range is 1uS to 10,000,000 uS (10 seconds).
Px sets the on time x of the RF pulse in microseconds
P? queries the setting

Pulse Off Time (Command O):
Sets the Pulse Modulation Off time in microseconds. Range is 2uS to 10,000,000 uS (10 seconds).
Ox sets the off time x of the RF pulse in microseconds
O? queries the setting

Pulse Number of Repetitions in a Burst (Command R):
Sets the Pulse Modulation number of repetitions in a burst. Range is 1 to 65500. Burst size is used when mixed with other functions like stepping. It's possible to sweep and for every step in the sweep generate the given number of Pulse On/Off cycles in the burst.
Rx sets the CW off time x of the RF pulse in microseconds
R? queries the setting

Pulse Invert Signal (Command :):
Inverts the Pulse polarity.
This feature is needed if other modulations are required inside the pulse. With a setting of 0 the SynthNV Pro firmware will turn on the RF, delay for the on time, turn off the RF, delay for the off time, (multiply by the burst number) and then go service other routines like USB communication and other modulations. After setting the Invert Pulse to 1, the order is reversed so that the RF is left on during the servicing of those routines. For example, this allows you to do an FM chirp during the pulse on time. When Invert Pulse is ON, the On Time and Off Time get reversed. Finally, since the PAM feature could be used on power amplifiers where the average power is much less than the CW power, RF power is left off after the burst is finished when Invert Pulse is set to 0. This helps protect power amplifiers. Send "h1" (RF Mute OFF) to re-assert CW power.
:x sets the CW off time x of the RF pulse in microseconds
:? queries the setting

12.5MHz –6.4GHz Signal Generator plus RF Detector

Run One Pulse Burst (Command G):
Starts one cycle of a pulse burst.
G starts a burst

Run Pulse Modulation Continuously (Command j):
Starts continuous pulse amplitude modulation.
jx starts continuous pulse modulation where x=1 starts the modulation and x=0 stops the modulation
j? queries the setting

Frequency Modulation Commands:
FM Frequency (Command <):
Sets FM modulation frequency.
<x Sets FM modulation frequency where x is frequency in Hz and the range is 1Hz – 5000Hz
<? queries the setting

FM Deviation (Command >):
Sets FM deviation frequency.
>x Sets FM modulation deviation where x is frequency in +/- Hz. The range minimum is 1 Hz and range maximum is specified by band for the table below.
>? queries the setting

Widest FM Deviation +/-
12.5-25.0MHz = 62.5KHz
-50.0MHz   = 125KHz
-100.0MHz   = 250KHz
-200.0MHz   = 500KHz
-400.0MHz   = 1MHz
-800MHz   = 2MHz
-1600MHz   = 4MHz
-3200MHz   = 8MHz
-6400MHz   = 16MHz
(at room temperature)

FM Number of Samples in Burst (Command ,):
Sets the number of FM samples to play in one burst. Usually this is the number of total samples in a cycle or multiples thereof. Used when mixed with other functions like stepping. It's possible to sweep and for every step in the sweep generate a given number of FM cycles.
,x Sets FM modulation number of samples in a burst
,? queries the setting

FM Modulation Type (Command ,):
Sets the FM modulation type to either sinusoid or chirp (ramp).
;x Sets FM modulation shape for x=0=chirp and x=1=sinusoid
;? queries the setting

Run FM Continuous Modulation (Command /):
Starts continuous frequency amplitude modulation.
/x starts continuous frequency modulation where x=1 starts the modulation and x=0 stops the modulation
/? queries the setting

Speaker Feedback Mode (Command b):
Enables speaker feedback based on the amount of RF power detected by RFin. This feature is experimental and should not be used with sweeps or other modulation. It may also cause large sideband noise on the carrier of the RF signal generator. Higher amplitude RF detected result in higher frequency audio tones from the speaker similar to a Geiger counter. Useable range is subject to change but in the range of -40dBm to +15dBm.
bx sets speaker feedback where x=1 starts the audio and x=0 stops the audio
b? queries the setting

Query for PLL Phase Lock Status (Command p):
Checks if PLL is phase locked.
p Queries PLL to see if its locked and returns a 0=unlocked or a 1=locked

Query for Internal Temperature (Command z):
Checks the temperature of the SynthNV Pro.
z Queries temperature and returns the value in degrees C.

Show Version (Command v):
Shows the version of firmware and hardware used in the SynthNV Pro.
vx shows version where x=0 shows firmware version and x=1 shows hardware version

Show Model type (Command +):
Shows the version of firmware and hardware used in the SynthNV Pro. Example: "WFT SynthNVP 55"
+ shows model type and serial number

Show Serial Number (Command -):
Shows the unique serial number used in the SynthNV Pro. It's the same number as shown on the sticker on the bottom of the device.
- shows serial number