Watch Dog Serial Interface Guide

03/20/2019
Firmware versions v1.3.5 and up

1. Summary

Every aspect of the Watch Dog tuner board is accessible via its USB serial interface. Connection to the serial interface is made via the USB connector on the main board. The interface is optimized for both human operation (UI) and machine/programmatic control (API).

2. Connection settings

Serial connection settings are 115200 8N1

3. Commands

The serial interface commands all take the form of a single word command and an optional argument. Responses to commands are almost entirely given in plain text output; a few commands can make use of Pipe-Delimited Values to ease configuration and accessing the Watch Dog's real-time meters (see *VALS* and *RT* commands below).
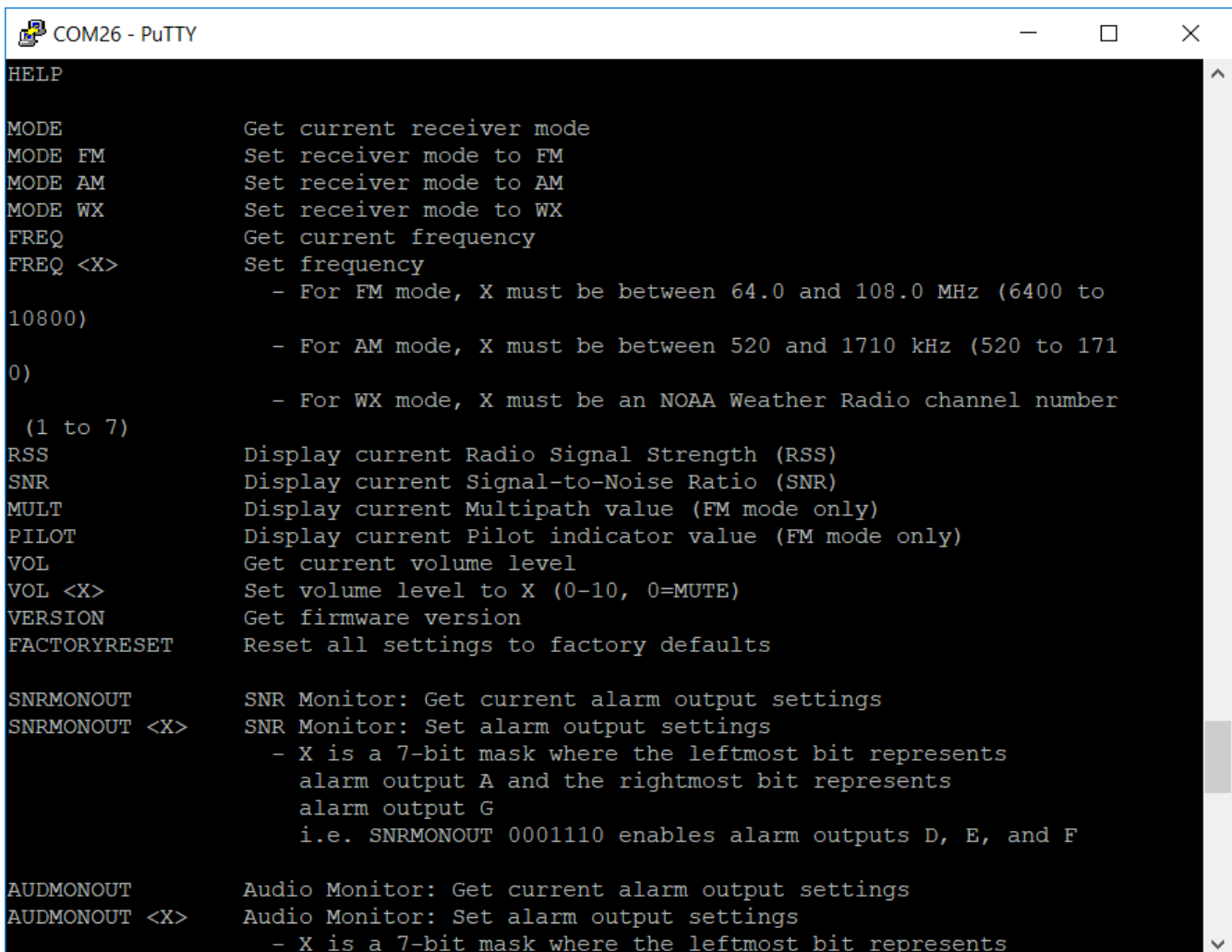
3.1 A few example commands

RSS to query the current Received Signal Strength measurement
MODE FM to change the tuner mode to FM

3.2 HELP command

A full listing of available commands, plus documentation for each command, is available via the serial interface's built-in *HELP* command (see screenshot below).

3.3 Automation-specific commands: *VALS* and *RT*

Two commands are made available specifically for machine control and do not show up in the contents of the *HELP* command.

3.3.1 *VALS* command without arguments (get current settings)

The *VALS* command, when used without an argument, returns a Pipe-Delimited Values string containing a large number of current tuner board parameter values (tuner mode, frequency, volume level, alarm settings, etc).

(See further below for usage of the *VALS* command with an argument.)

Example VALS output:
1.3.5|1.4.0|FM|8910|0|5|1000|15|15|1000|1000000|0100000|0010000|0000000|0000000|0000000|5|1000|1000|50|75|1|0

The fields available in the VALS output are as follows:

1. Firmware version
2. Minimum compatible RFE Watch Dog Dashboard version (see below)
3. Tuner mode (FM, AM, or WX)
4. Tuner frequency (or NOAA channel number)
5. Volume level (0-10, 0=muted)
6. SNR Monitor minimum SNR level
7. SNR Monitor timeout (milliseconds)
8. Audio Monitor timeout (seconds)
9. Audio Monitor audio / noise floor
10. RDS Monitor timeout (milliseconds)
11. SNR Monitor alarm output mask (see below)
12. Audio Monitor alarm output mask (see below)
13. RDS Monitor alarm output mask (see below)
14. RSS Monitor alarm output mask (see below)
15. Pilot Monitor alarm output mask (see below)
16. NOAA 1,050 Hz Monitor alarm output mask (see below)
17. RSS Monitor minimum RSS level
18. RSS Monitor timeout (milliseconds)
19. Pilot Monitor timeout (milliseconds)
20. NOAA 1,050 Hz Monitor minimum duration (this field may change in an upcoming firmware version)
21. FM De-emphasis Time Constant (DTC)
22. Stereo/mono audio output
23. Alarm output latch time (seconds)

3.3.2 Alarm output masks

The Watch Dog uses six 7-bit masks to configure how each Monitor (RSS Monitor, SNR Monitor, Audio Monitor, etc) should be tied into the 3 on-board through-hole LEDs (A, B, and C) and/or the 4 GPO pins (D, E, F, and G).

Each mask tells the Watch Dog where to send its respective Monitor's alarm output, if anywhere, whenever it is triggered.

Each Monitor can be tied to as many or as few of the LEDs or GPO pins as desired. Monitors can also be assigned to multiple LEDs and/or GPO pins.

Essentially, the six 7-bit masks make a matrix as follows:

Alarm assignments

	LED			Contact		
	A	B	C	D	E	F	G
SNR Monitor	☐	☐	☐	☐	☐	☐	☐
Audio Monitor	☐	☐	☐	☐	☐	☐	☐
RDS Monitor	☐	☐	☐	☐	☐	☐	☐
RSS Monitor	☐	☐	☐	☐	☐	☐	☐
Pilot Monitor	☐	☐	☐	☐	☐	☐	☐
NOAA Monitor	☐	☐	☐	☐	☐	☐	☐

Each monitor's bit mask contains the following bits, from MSB to LSB:

Bit 6: Enable alarm output A (LED)
Bit 5: Enable alarm output B (LED)
Bit 4: Enable alarm output C (LED)
Bit 3: Enable alarm output D (GPO)
Bit 2: Enable alarm output E (GPO)
Bit 1: Enable alarm output F (GPO)
Bit 0: Enable alarm output G (GPO)

For example, *1001000* to enable alarm outputs A and D.

3.3.3 *VALS* command with an argument (update settings)

The *VALS* command, with an argument, takes a Pipe-Delimited Values string containing a large number of new tuner board parameter values (tuner mode, frequency, volume level, alarm settings, etc), updates the tuner board with those settings, and writes the new settings to EEPROM.

Example VALS argument:
FM|8910|0|1000|5|15|15|1000|1000|5|1000|50|1000000|0100000|0010000|0000000|0000000|0000000|75|1|0

The required fields for the *VALS* argument are as follows.

NOTE: the field numbers below are a bit different from the VALS fields listed in section 3.3.1

1. Tuner mode (FM, AM, or WX)
2. Tuner frequency (or NOAA channel number)
3. Volume level (0-10, 0=muted)
4. SNR Monitor timeout (milliseconds)
5. SNR Monitor minimum SNR level
6. Audio Monitor timeout (seconds)
7. Audio Monitor audio / noise floor
8. RDS Monitor timeout (milliseconds)
9. RSS Monitor timeout (milliseconds)
10. RSS Monitor minimum RSS level
11. Pilot Monitor timeout (milliseconds)
12. NOAA 1,050 Hz Monitor minimum duration (this field may change in an upcoming firmware version)
13. SNR Monitor alarm output mask (see above)
14. Audio Monitor alarm output mask (see above)
15. RDS Monitor alarm output mask (see above)
16. RSS Monitor alarm output mask (see above)
17. Pilot Monitor alarm output mask (see above)
18. NOAA 1,050 Hz Monitor alarm output mask (see above)
19. FM De-emphasis Time Constant (DTC)
20. Stereo/mono audio output
21. Alarm output latch time (seconds)

3.3.4 *RT* command (get real-time measurements)

The *RT* command, without an argument, returns a Pipe-Delimited Values string containing a large number of current tuner board measurement values (Received Signal Strength, Signal-to-Noise Ratio, Left & Right audio levels, etc).

This command can be called over and over again, very rapidly, and is suitable for driving various meters, etc. See our accompanying GUI for Windows 7 & 10, the *RFEngineers, Inc. Watch Dog Dashboard*, for a good example of the *RT* command in action. See also *Watch Dog Dashboard* screenshot on next page.

Example RT output:
18|39|11|1|16|0|0|0|35341|90.1 ...|Public|WUFT 89.1 / 90.1 ... wuft.org|0|0|0

The fields available in the *RT* output are as follows:

1. Signal-to-Noise Ratio
2. Received Signal Strength
3. FM Multi-path %
4. FM Pilot indicator (0=absent, 1=present)
5. Audio activity level
6. SNR Monitor alarm active
7. Audio Monitor alarm active
8. RDS Monitor alarm active
9. FM RDS *PI* value
10. FM RDS *PS* value
11. FM RDS *PTY* value
12. FM RDS *RadioText* value
13. RSS Monitor alarm active
14. Pilot Monitor alarm active
15. NOAA 1,050 Hz Monitor alarm active

4 *RFEngineers, Inc. Watch Dog Dashboard* GUI for Windows 7 & 10

Below is a screenshot of the *RFEngineers, Inc. Watch Dog Dashboard* in action, which uses the *VALS* and *RT* commands to fetch the current tuner settings on load and to drive the GUI's various meters and alarm states in real-time, respectively.

4.1 Firmware update

From time to time, updated firmware will be made available for the tuner board (*.bin* file). The tuner board's firmware can be updated using the *Update firmware* button in the *Watch Dog Dashboard.*