



DC-3001

**Short-wave / HF all-band, Direct
Conversion / SDR Amateur Radio QRP
Transceiver**



User Manual / Operating Guide

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Update History

Revision	Date	Comments
1.0	3/2018	Initial Version
2.0	7/2019	New firmware, expansion of digimode section, text corrections, edits and updates, table of contents and Appendices

Introduction

The QRPver DC-3001 “Minion” is a small-size multi-band short-wave QRP transceiver, following up on the popular and successful QRPVer 1v3 SSB/CW/Digimode pocket size monoband transceivers.

The DC-3001 is conceived as a direct frequency conversion transceiver with digital signal and Software Defined Radio (DSP /SDR) processing; using the phase shifting technique. The device is controlled by a STaM32F100 microcontroller. The SI5351 chip is used for frequency synthesis (local oscillator). A Fairchild FST3253 is used as the mixer for receive.

The transceiver provides lower (LSB) and upper (USB) sideband SSB, telegraphy (CW) and digital communication (DIGI) modes. Computer Aided Tuning (CAT), using external software, is very simple using the transceiver’s USB port and the Kenwood TS-440 CAT protocol. A built-in VOX eliminates the need for any additional interfaces.

The transceiver has extremely small dimensions of 10 x 10 x 3 cm and is very light. The power consumption both in the receive and transmit modes is low. This means that only small batteries are required for portable operation. It is thus perfect for use in the field, hiking and other outdoor activities / SOTA, at the weekend cottage or even as a main station for everyday QSOs at home.

The transceiver is controlled by four buttons, an encoder and a volume control - all located on the front panel. A small OLED display shows all essential information required for operation.

The QRPver DC-3001 “Minion” transceiver is easy to operate and use. Menu functions are easily accessed in one level only, increasing the fun factor of owning and operating this tiny, state-of-the art QRP rig.

Technical Specifications and Key Capabilities

General	
Frequency bands	1.8, 3.5, 5, 7, 10, 14, 18, 21, 24, 28 MHz
Operating modes	CW, LSB, USB, DIGI
Frequency tuning steps	10 Hz, 100 Hz, 1 kHz; - accelerated tuning rate with fast spinning of knob (“intelligent VFO”)
Power supply voltage:	9.5-14.8V Rated supply voltage = 13.8V
CW keying and features	<ul style="list-style-type: none"> • manual/straight, single paddle or iambic key; integrated adjustable speed electronic keyer; • automatic T/R switching, delay adjustable from 1-500 ms; • side-tone
Dimensions	100 x 103 x 30 mm (3.9 x 4.1 x 1.2 in.)
Weight	430 grams (15.2 oz.)
Software Version	r4.4
Receiver	
Sensitivity	<~0.5 μ V (all bands)
Receiver bandwidth	
CW mode:	400-1500 Hz with a step of 100Hz
LSB / USB mode	1600-3200 Hz with a step of 100Hz
DIGI mode	3400Hz
AGC dynamic range	~ 80 dB
Dynamic range	~ 120dB at 25kHz from receive frequency
AGC modes	fast, slow, disabled
Receiver CW SHIFT / tone	0-1500Hz with a step of 100Hz
Receive current, 25% volume	120mA (~ 250mA max. at full volume)
AF amplifier	< 1W max. output / 8 Ohm
Transmitter	
Nominal output power	~ 5W at rated supply voltage; 9 W max. output
TX current transmission mode	~ 500-700 mA
Antenna / output impedance	50 Ohm*
Carrier signal suppression	~ 90dB
Opposite sideband suppression	~ 80dB
Tx bandwidth SSB	2900Hz**
DIGI mode	3400Hz** **Limited to 2600 Hz in the 60 m range
CAT Interface	
Protocol	Kenwood TS-440
Baud rate	57600, 115200 bps
Connector	Mini-USB



**Antennas with unknown characteristics, high VSWR or reactance must not be connected for transmitting. A SWR of 2.5 is acceptable for long-term operation, and 3-3.5 for short periods. However, we generally do not recommend the use of antennas with a SWR >2.*

Transmitter Lowpass Output Filtering



The DC-3001 transmitter output stage contains a 30 MHz low pass filter (LPF) only. If you transmit on frequencies below the 18 MHz band, with the possible exception of when using magnetic loops or other high-Q monoband antennas, an external low-pass filter (LPF) must be inserted between the transceiver and your antenna. Such filters are available from several sources and can be easily built.

It is good practice to always have an external SWR meter in-line to check that the tx is not transmitting into high SWR loads.

User Interface and Controls

Front Panel Controls

All controls are located on the front panel of the transceiver. Four buttons provide access to the full functionality of the device.



1 Volume control

2-5 Pushbutton keys

	2 Band	3 Mode	4 BWF	5 AGC
Short press	Band/ range selection *	- LSB / USB - CW/Digi	receive low-pass filter bandwidth	fast/slow
Long press >0.4 sec	-	- SSB - CW/Digi	Menu (exit with short press)	AGC off

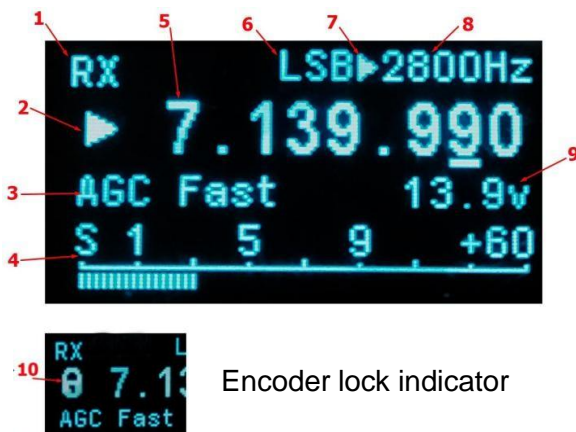
7 Encoder knob/button: frequency tuning, scrolling through menu options.

(short press): frequency tuning 10 Hz, 100 Hz, 1 KHz steps.

(long press): encoder LOCK.

Display

All essential information is shown on a small 23 x 18mm (0.96") OLED display with 128x64 px. Despite its small size it is perfectly readable both in- and outdoors in sunlight.



1. Operating mode: RX / TX
2. Switch mode indicator
3. AGC setting
4. Receive signal strength indicator (S-Meter)
5. Transmit/receive frequency
6. Mode (LSB / USB / CW / DIGI)
7. Setting receiver bandwidth select indicator
8. Receiver bandwidth setting
9. Power supply voltage

10. Encoder lock indicator

The display features a brightness adjustment (0-250), auto-off after 30 s idle, and an inverted display mode, accessible through the "Menu" function, described below.

Transceiver Control Functions

Volume adjust: Turn the volume knob clockwise to increase, and counterclockwise to lower the volume of the loudspeaker.

Transceiver operating frequency: Rotate the encoder knob clockwise to increase, and counterclockwise to decrease the frequency. Press the encoder knob briefly to switch the frequency tuning step. Press/hold down the knob to lock the encoder, the symbol "10" appears on the display.

Switching ranges: Press the "Band" button. The symbol "2" appears on the screen. Rotate the encoder knob clockwise or counterclockwise to select the range. Press the "Band" button again to exit the band switching mode.

Selecting the type of emission: Briefly press the "MODE" button to switch "LSB / USB". Press and hold this button to enter CW mode, press it briefly to switch between "CW / DIGI" modes. Press and hold again to switch to the "LSB / USB" switching mode.

Adjusting the receiver's bandwidth: Press the "BWF" button and "7" will appear on the display. Rotate the encoder knob clockwise to extend the bandwidth, and counterclockwise to narrow the receiver's bandwidth. To exit the setting, briefly press the same button repeatedly.

Selecting the speed of the AGC system: Press the "AGC" button to toggle the AGC delay between "FAST" and "SLOW" AGC. Hold the button to turn off the AGC.

User Menu and Menu Functions

To enter the menu, press and hold the "BWF" button for > 0.4 seconds. Rotating and pressing the encoder knob scrolls through and selects the menu items. To exit the menu, press the same button again briefly.

1. The first menu item sets the automatic or manual telegraphy key. Press the encoder knob and rotate it to select, depending on firmware version, as follows:

FW V 4.3

CW KEY AUTO

select "Yes" for automatic (single lever key only), and "NO" for manual key

FW V 4.4

CW KEY TYPE

- manual = straight key, or external automatic keyer
 - single-lever = single or dual (iambic) lever keyer, internal keyer

Press the encoder again to complete the setting.

2. **CW KEY WPM:** Press the encoder knob to select the speed setting for the electronic key. Rotate the encoder knob to adjust the desired speed. Press the encoder again to complete the setting.
3. **CW KEY TX:** Automatic "Transmit" switchover when the telegraph key is first closed (CW VOX). Press the encoder button to enter the setting. Rotate the encoder to select the mode - "Yes" to enable CW VOX, "No" to disable this mode.
4. **CW SHIFT:** Adjust the receiver detuning relative to the operating frequency in Hertz. Press the encoder to enter the setting mode. Rotating the encoder, select the desired shift. Press the encoder again to exit.
5. **CW TX DELAY:** This item sets the TX-RX switchover delay after the releasing the CW key. Press the encoder to enter the setting mode. Rotating the encoder, select the desired delay. Press the encoder again to exit. 150 ms is a good setting for break-in between words at 20 WPM.
6. **CW TONE:** Enable side-tone in CW mode. Press the encoder button to enter the setting. Rotate the encoder to select the mode - "Yes" to enable side-tone; "No" to disable.
7. **DIGI VOX:** presence of an AF signal on the line input of the transceiver will key the transceiver for transmit in "DIGI" mode. Press the encoder button to enter the setting. Rotate the encoder to select "Yes" to turn on the DIGI VOX, "No" to turn it off.
8. **UART BAUD RATE:** Selects the "CAT" data rate on the serial port. Press the encoder to enter the setting mode. Rotating the encoder, select the desired speed (57600, 115200). Press the encoder again to exit.
After changing this setting, the transceiver must be rebooted by disconnecting and reconnecting the power.
9. **BEEPER:** audio confirmation when pressing transceiver control buttons. Press the encoder button to enter the setting. Rotate the encoder to select "Yes" to enable "BEEP", "No" to disable.
10. **AUTO BRIGHT:** Automatically dims the display brightness when not used for 30 seconds. Press the encoder button to enter the setting. Rotate the encoder to select "Yes" to enable, "No" mode to turn off.
11. **BRIGHTNESS:** Adjust the brightness of the display. Press the encoder button to enter the setting. Rotate the encoder to adjust the desired brightness (0...250). Press the encoder again to exit.

12. **INVERT COLORS:** Inverts the display. Rotate the encoder to select "Yes" to enable the "No" mode to turn off.

Operating the Transceiver

Connect a 9.5 - 13.8 Volt power supply to the "Power" connector, and an antenna to the "Antenna" connector. Make the necessary settings and adjust receive volume level.

For optimal performance make sure that the power supply is free from RF noise (as typical for low cost switching-type power supplies) and is capable of delivering sufficient current.

SSB Operation

Connect the microphone to the "Handset" connector. Press the PTT switch to talk, release to listen.

CW

Connect the key to the "CW Key" connector. Automatic T/R switching, switchover delay, active keying of TX (vs. CW practice tone only), type of key and internal automatic keyer speed are all set in the appropriate menu items described above.

Digimodes (DIGI)

Preparation for Transceiver control via CAT (Computer-aided Tuning)

The DC-3001 transceiver is fully compatible with CAT and digimode software, such as Ham Radio Deluxe¹, Fldigi, multi-psk or WSJT-X and JTDX for the popular FT8 mode, but also SDR-type software such as HD-SDR and SDR console.

In order to access the transceiver's USB port, install the CH340 driver (UART to USB converter) on your Windows PC. The download link is:

<https://sparks.gogo.co.nz/ch340.html>

COM port settings: Word Length = 8bit, Parity = None, Stop Bits = 1,
 Hardware Flow Control = None
 Baud rate 115.200 or 57.600 as per UART BAUD RATE setting

RTS and DTR signals may be used for transceiver control in non-CAT systems as follows:
RTS = PTT TX, DTR = CW Key.

CAT Control for WSJT-X, JTDX and JSCall

Directly accessing the DC-3001 will not work with the current releases (mid 2019) of these programs. An excellent workaround is to run flrig first (using TS-450 settings) and then to launch WSTJ-X or JTDX, selecting "flrig" in the transceiver settings. Alternatively you can use HRD. Flrig is of course also perfectly integrated with fldigi.

Available CAT functions

The following functions of your DC-3001 transceiver are available through CAT:

- Frequency setting, including setting via memories and band switching. Tuning is usually carried out through up/down cursor keys or move/point/click slider or mouse wheel, as provided for in the CAT client.
- Mode switching, i.e. LSB / USB / CW / Digi (USB/3.500 Hz)

¹ last free version is 5.24

Other functions, such as VFO A/ VFO B, meters, access to filter bandwidth, AGC settings etc. are not available.

Operation

Receive: Connect the computer's audio input (usually microphone, pink) to the "Line Output" connector (violet) of the DC-3001. Set the "audio in" level of your PC sound card to obtain the required level in your digimode software.

Transmit: Connect the computer's audio output (usually headphone, green) to the "Line Input" connector (green) of the transceiver.

Click the "Tune" button in your digimode software and adjust the signal level of your sound card and/or the "Power" setting of your digimode software (if available) so that the signal level on the DC-3001 display indicator is within the "SET" mark for maximum, undistorted output.



Level adjust

Tune button/PWR setting (JTDX example)

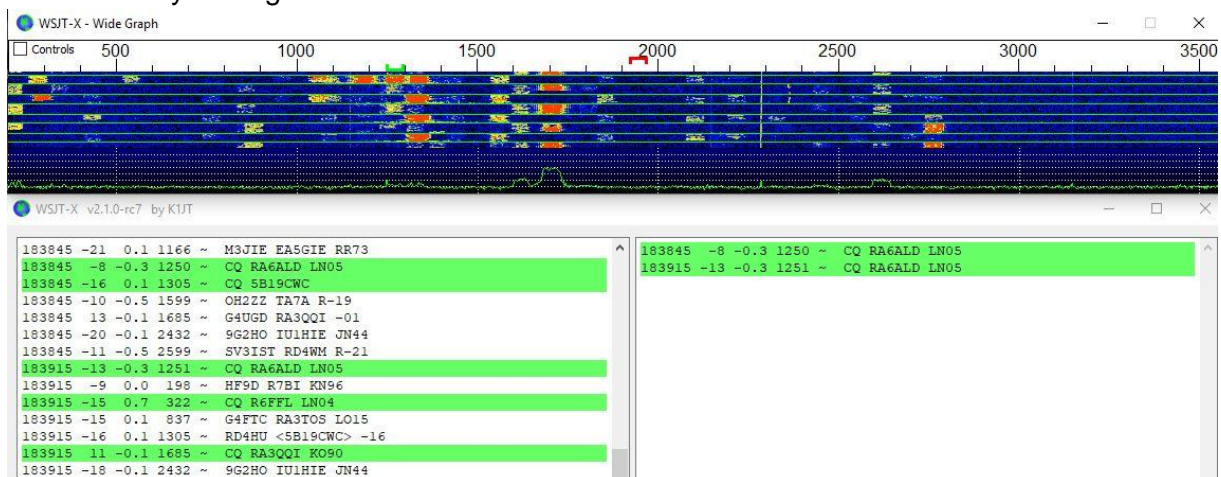
To key the tx by the audio out signal of your digimode software, the setting in the "DIGI VOX" menu must be "Yes" (and mode must be set to "Digi"). To control the transmission via CAT, set "No" and check the RTS box in the rig control settings of your digimode software.



Make sure a 50 Ohm dummy load is connected to the transceiver's antenna socket before any such tests!

Waterfall Diagram

Your digimode software will display a waterfall diagram within the bandwidth of the transceiver's AF filter. Digimode automatically uses the 3500 kHz bandwidth, all filtering is carried out by the digimode software.



Waterfall diagram (WSJT-X example)

Appendix 1 - External Periphery Connectors

Eight connectors are provided on the back side of the transceiver for external interfacing as follows:



Input / Output	Type of Connector
1. Power	5mm o/d, 1.5mm i/d
2. CAT interfacing	Mini-USB female
3. Line input	3.5mm stereo jack
4. Line output	3.5mm stereo jack
5. Handset (Microphone/PTT)	3.5mm stereo jack
6. CW key	3.5mm stereo jack
7. External speaker	3.5mm stereo jack
8. Antenna input	BNC female, 50 Ohm

The pinout for the connectors is provided in Appendix 2.

Note: the QRPver DC3001 transceiver uses 3.5 mm stereo plugs throughout for interfacing for your convenience. Make sure to employ good quality plugs, as low quality plugs may damage the PCB-mounted sockets and cause intermittents.

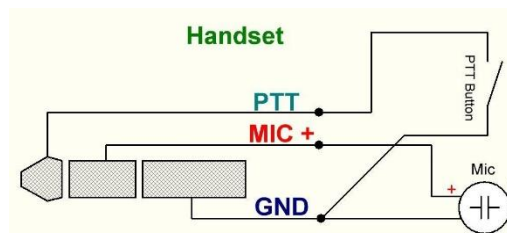
General Note:

Circuit diagram and appearance details may differ for a particular device. This does not affect its performance.

Appendix 2: Pinout for external peripherals

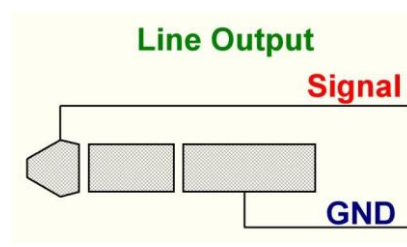
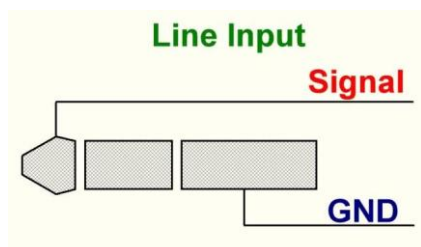
Microphone Connector:

Connecting the microphone (PTT button and electret microphone).



Note: The DC-3001 mic input is designed for (electret) microphones providing high audio output (50 mV AF nominal), such as the MIC-01 accessory microphone. Low level (standard) 5 mV electret cartridges will not provide sufficient audio and require an external preamplifier (gain >10). An active microphone offers the additional advantage of an adjustable AF level.

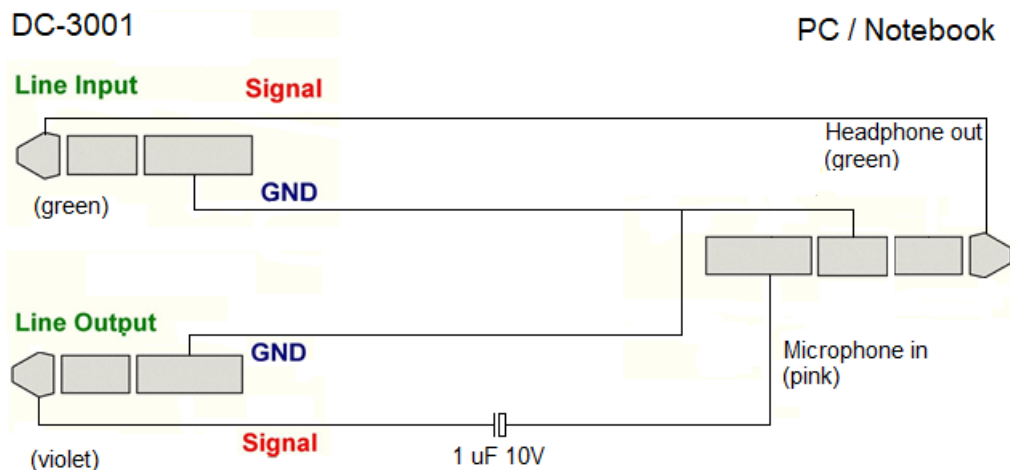
Line In / Out Connector:



“Y” Cable for Devices with 4 pole 3.5mm sockets

A “Y” cable conveniently replaces 2 AF stereo cables and an adapter, if your notebook has a single 4pole headset socket instead of 2 separate connectors for headphones and mike. It is not difficult to make and can be cut to the desired length.

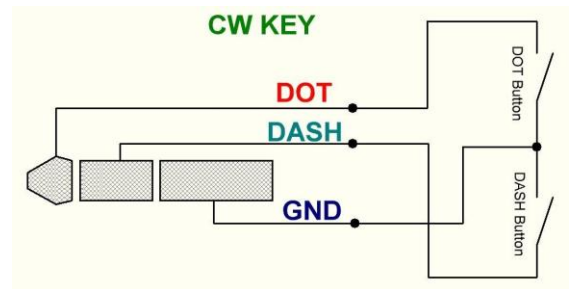
A small (e.g. SMD) 1 uF decoupling capacitor, necessary only in case larger volume settings mute the DC-3001 loudspeaker output, may be fitted inside the 3.5mm plug.



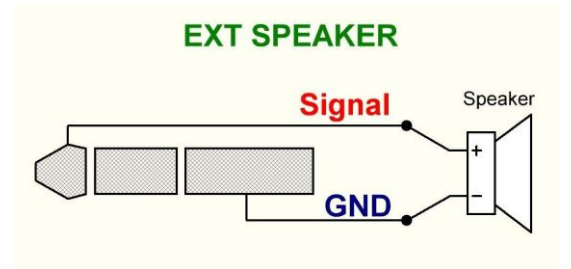
CW KEY/Paddle Connector:

Connecting the CW key or (single lever) paddle.
In the straight key mode, the DOT pin (tip) is used.

Automatic keyers are also connected to the dot (tip) pin.



EXT Speaker Connector: Connecting an external loudspeaker or headphones. Output impedance is 8..32 Ohm.



Appendix 3 – Firmware Release Information

The QRPver DC-3001 transceiver has been shipped with the following software versions:

Version	Date	Comments
4.3	3/2018	Initial release
4.4	11/2018	CW iambic mode keyer update

It is possible for users to update older versions of the firmware. The latest firmware version and installation instructions can be downloaded from the "files" section of the QRPver website

Website: <http://qrpver.com>

E-mail: support@qrpver.com

Appendix 4 – Removing the main PCB

Opening the transceiver to remove and inspect the board is easily achieved:

- unscrew the screws fastening the front and rear panels using a 2mm hex key / screwdriver
- Remove the encoder knob after loosening the grub screw with a 2mm flat head screwdriver. Pull off the volume knob
- Unscrew the Philips screw on the bottom of the case (securing the PA FET)
- Push the PCB about 3 cm to the rear. This will make the loudspeaker lead connector visible. Carefully release the connector
- Pull out the PCB to the front.

Reassemble in the reverse order. Make sure that the bottom screw is well tightened (but do not over-tighten), to ensure good cooling of the PA FET.



If you wish to power the board when removed, exercise extreme care not to cause any shorts which will void the warranty.



Without the case cooling the PA FET, the transceiver may only be keyed for a few seconds at a time, then wait to cool off (quiescent current generating several W of power). **DO NOT** key the transceiver in CW mode or feed normal audio levels to the transceiver, as the PA FET will definitely be damaged, again voiding the warranty!