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QDX - Digital Transceiver

Details

 Created: 09 October 2021
 Last Updated: 31 January 2022
 Hits: 97471



QDX: a feature-packed, high performance, four-band (80, 40, 30, 20m) 5W Digi-modes transceiver kit, including embedded SDR, 24-bit 48 ksps USB sound card, CAT control, synthesized VFO with TCXO reference.

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\$65 (<http://shop.qrp-labs.com/qdx>)

The "QDX" (QRP Labs Digital Xcvr): a feature-packed, high performance, four-band (80, 40, 30, 20m) 5W Digi-modes transceiver kit, including embedded SDR receiver, 24-bit 48 ksps USB sound card, CAT control, synthesized VFO with TCXO reference. QDX transmits a SINGLE SIGNAL, it is not an SSB modulator with associated unwanted sideband and residual carrier, or intermodulation due to amplifier non-linearity. QDX outputs a pure single signal.

The Optional enclosure is black anodized extruded aluminium, very sturdy and elegant. The enclosure size is 89 x 63 x 25mm without protrusions. The front and rear panels are drilled and cut to match the QDX PCB with laser-etched lettering. The enclosure includes four self-adhesive feet.

List of features:

- Four bands 80, 40, 30 and 20m
- Also works well on 60m, see John AE5X measurements <https://ae5x.blogspot.com/2021/11/spectrum-analysis-qdx-on-60m.html> (<https://ae5x.blogspot.com/2021/11/spectrum-analysis-qdx-on-60m.html>)
- 5W output at 9V supply (can be built for 4-5W at 12-13V supply)
- Single signal transmission (zero unwanted sideband, zero residual carrier, zero intermodulation distortion)
- Solid-state band switching and transmit/receive switching under CAT control
- High performance embedded SDR SSB receiver with 60-70dB of unwanted sideband cancellation
- Built-in 24-bit 48ksps USB sound card
- Built-in USB Virtual COM Serial port for CAT control
- Si5351A Synthesized VFO with 25MHz TCXO as standard

- Easy to build single-board design, Professional quality double-sided, through-hole plated, silk-screen printed PCBs
- All SMD components factory assembled
- Connectors: 2.1mm power barrel connector, USB B (for audio and CAT control), BNC RF input/output
- Built-in test signal generator and testing tools
- Receive current 100mA, Transmit current 1.0-1.1A for 5W output with 9V supply (around 0.7A for 5W with 13V supply).
- I-Q output mode if you wish to use a PC SDR program for demodulation rather than the internal SDR
- QFU firmware update for lifetime free firmware updates, easy installation on any PC without drivers, software or hardware e.g. programmer
- Optional aluminium extruded cut/drilled/laser-etched black anodized enclosure (88.6 x 63 x 25 mm)

QDX also works well on 60m, as documented by John AE5X at <https://ae5x.blogspot.com/2021/11/spectrum-analysis-qdx-on-60m.html> (<https://ae5x.blogspot.com/2021/11/spectrum-analysis-qdx-on-60m.html>). Outside the range 3.4-14.5MHz, QDX can be used as a receiver, with some loss of sensitivity.

NOTE: Due to the global semiconductor shortage, the price of many ICs has increased dramatically, and there have also been (less drastic) price increases in other parts of the production. Accordingly it has been necessary to pass on some of these costs to the price of the QDX, this is why it is now \$65 when the original price was \$60 for the first batch. The first batch was produced in Jan 2020, a whole world away.

PC Software

Standard digi modes software like WSJT-X and JS8Call works fine with QDX, because QDX acts as a USB Sound card (for Audio) and a Virtual COM port (for CAT control).

There are three types of USB devices in QDX: USB Audio, USB Virtual COM port, and USB mass storage (like a USB Flash memory stick) for firmware update. Drivers for all of these types of audio device are already present on your PC if you are using Mac, Linux, MS Windows 10 or MS Windows 11. If you are using older versions of Windows, then you need to install a driver for the Virtual COM port (audio and USB Flash drivers are already present even on older Windows), the details are in the QDX manual.

Video

Here's a YouTube video about QDX: <https://youtu.be/j6Vnh8eiEpg> (<https://youtu.be/j6Vnh8eiEpg>)

Here's a build-video series by Ryan W7RLF <https://www.youtube.com/playlist?list=PLDP9oGiu60jJdiQOQx6-5DRn3l5GrfQQM> (<https://www.youtube.com/playlist?list=PLDP9oGiu60jJdiQOQx6-5DRn3l5GrfQQM>) (for Ryan's interesting website see <https://miscdotgeek.com/> (<https://miscdotgeek.com/>))

Documentation

Please MAKE SURE you use the correct documentation for your PCB Revision and your firmware version! Batch 1 (Rev 1) PCBs were sold in October 2011 and do not have a PCB Revision printed on them. Subsequent PCB revisions have a large "Rev 2" (etc) printed on the PCB silkscreen.

Latest documentation

You need TWO manuals, one contains the Operating instructions, one contains the Assembly instructions, Theoretical design information, and performance measurements.

Assembly manual for PCB Rev 2 (/images/qdx/manual_1_10.pdf) (document version 1.10 published 06-Jan-2022)

Operating manual for firmware version 1_03 (/images/qdx/manual_operation_1_03.pdf) (document published 23-Dec-2021)

Old documentation (PCB Rev 1)

The manual includes assembly instructions, operating instructions, design details, performance details

Manual for PCB Rev 1 (/images/qdx/manual_1_06.pdf) (document version 1.06 published 10-Nov-2021, for Rev 1 PCB and firmware up to 1_02)

Photographs

QDX in its beautiful black-anodized extruded aluminium enclosure, CNC machined to suit the QDX and with durable laser-etched lettering:

These are screenshots of the built-in terminal applications, that may be used for testing, investigating, learning and configuration - but are not needed for operation of the transceiver.

Selected performance measurements - see manual for full details...

WSJT-X operating screenshots

Firmware

Please refer to the manual for the firmware update procedure, which is very easy and does not require any special hardware, software, drivers etc. It requires only a PC and a USB cable. Click the file in the first column of the table below, to download the firmware file of interest. Note that firmware files are encrypted and can only be used on the QRP Labs QDX.

The downloads are a zip file; please unzip the file before copying the .QDX into the QDX

Firmware version history:

Version	Date	Contents
1_03 (/images/qdx/firmware/1_03.zip)	23-Dec-2021	- Firmware for PCB Rev 2. Backwardly compatible with PCB Rev 1 - Changes OpenDrain RX, TX and LPF switching signals to Push-Pull (pull-up resistors removed in Rev 2) - Allows transmit on 160m, and receive acts as direct conv., poor performance through the 80m filters.
1_02 (/images/qdx/firmware/1_02.zip)	25-Nov-2021	- New "transmitter test" terminal application, lets you test PTT and Transmit - New items in "Configuration" terminal application, let you disable transmit by band - 'Log end' timestamp written at end of log, to indicate current elapsed time since power-up - Bug fix: prevent log file overflow - Bug fix: White noise intermittent on power-up is fixed
1_01e (/images/qdx/firmware/1_01e.zip)	25-Nov-2021	- Bug fix: Now AF and RF sweep terminal applications work
1_01d (/images/qdx/firmware/1_01d.zip)	24-Nov-2021	- Log entries now have a timestamp, HH:MM:SS since power-up. - Error entries now appear in red, ordinary logging in white. - Startup log entry "START" appears in yellow. - Bug fix: Occasional CAT communications dropping should not happen anymore.
1_01c (/images/qdx/firmware/1_01c.zip)	12-Nov-2021	- Status LED flashes more info during TX to aid audio debugging on PC: 3 flashes means all OK, TXing power; 2 flashes means transmit mode, but audio level (volume) is too low; 1 flash means transmit mode, but there is no audio at all
1_01b (/images/qdx/firmware/1_01b.zip)	08-Nov-2021	- Apply validation to config ref clock to make sure 25MHz +/- 1kHz.
1_01a (/images/qdx/firmware/1_01a.zip)	05-Nov-2021	- Bug fix: RX did not work after changing bands, until you changed freq again, or TX then RX again
1_01 (/images/qdx/firmware/1_01.zip)	27-Oct-2021	- IQ Mode, if enabled, transfers raw I & Q data to the PC for SDR programs. - Japanese band limits mode, if enabled, prevents transmission outside Japanese band limits. - Prevent QDX trying to transmit outside the range 3.4 MHz to 14.5 MHz, to avoid damage. - CAT command MD can be used now to set mode LSB or USB - CAT commands Q0, Q1 to QB allow get/set of all parameters on the Configuration screen
1_00_003 (/images/qdx/firmware/1_00_003.zip)	11-Oct-2021	- Initial firmware release for QDX

QDX on RTTY using fldigi software, tips from Peter G3SPL

The following notes are provided by Peter G3SPL in this forum post <https://groups.io/g/QRPLabs/message/79386> (<https://groups.io/g/QRPLabs/message/79386>).

Well, I have had my first QSO today with the QDX running RTTY. Yippee! I used the fldigi software (on Windows 10 laptop) which took quite a bit of effort to set up; certainly compared to WSJT-X.

The first thing was to change the QDX configuration using my terminal emulator to only require one sample of tone before setting the output frequency (the default being 480). This is to allow the QDX to keep up with the tone frequency potentially changing every 22mS.

With the fldigi configuration, under the soundcard, devices option, choose the QDX as both capture and playback device. I checked "port audio" - not sure what that does but it works!

Under "Audio device shared by Audio Alerts and Rx Monitor", choose Speaker/Headphones and check the "Enable" box.

Next, under the rig control option, select Hamlib and check the "Use Hamlib" box at the top.

The rig should be Kenwood TS440S, device is COM3 (i.e. whatever you use with your terminal emulator to get to the QDX menu) and check the box "PTT via Hamlib command". Other items can remain at their default values. Finally, press the "Initialize" button to make it all work.

Then you need to go into your Windows sound settings and put all the volume controls for the QDX to maximum.

Finally, choose the "Save config" option from the top of screen menu (otherwise you'll have to do all this next time you boot up fldigi!)

Expect to spend an hour or two browsing the help files to see how to operate the various buttons and options. One thing which I found difficult to find was how to turn on the Rx Monitor to hear what's going on on receive. This is done from the "View" menu: choose the top option "Rx Audio Dialog". On my setup, the received audio was very quiet for some reason. Maybe I will discover how to adjust it to a reasonable volume in due course.

By the way, I spent an hour or two wondering why the QDX wasn't going into transmit, to find that I had not checked the "Use Hamlib" box for rig control. Quite exasperating, but with perseverance I got there: it does work, so I am happy!

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