

DG8SAQ VNWA 3 - Expansion board Manual v1.3

Fig 1. VNWA 3 Expansion Board fitted to VNWA 3 Main PCB

1. Introduction:

The DG8SAQ VNWA 3 Expansion Board is a small optional Printed Circuit Board which provides the DG8SAQ Vector Network Analyzer with additional functionality as follows:

- ▲ 2nd Audio Codec allowing S11 and S21 measurements to be performed in a single sweep instead of 2 sweeps.
- 2.7V Switched mode power supply for DDS Supply USB power consumption reduced to from 0.41 Amp without Expansion board to 0.33 Amp despite additional power consumption of 2nd Audio Codec on the Expansion board.
- A RJ11 connector making the VNWA3 control signals and power accessible to the outside world
- A Optional SMA connector to obtain the multiplied 12 MHz internal TCXO clock or to feed in an external 36 MHz clock source.

This document describes how to fit the Expansion Board into the VNWA 3 and how to configure the VNWA Software to obtain full performance.

2. Important Information

Copyright notice

The design of the VNWA 3 and Expansion Board is copyright by Thomas Baier DG8SAQ & SDR-Kits - all rights reserved -

2.1 Caution - Safety Information:

- 1. The VNWA Expansion Board must **only** be fitted to VNWA3. It will **NOT** fit the older VNWA 2.x equipment.
- 2. VNWA 3 with serial numbers **2201 and higher allow** for the VNWA Expansion Board to be plugged in.
- 3. VNWA 3 with serial numbers **2200 and below** will require soldering of the SIP connectors to the Main PCB assembly and removal of a resistor. Soldering should only be carried out by persons who have the required skills and previous experience of this type of work.
- 4. The VNWA 3 is powered and controlled through a USB-cable. The USB-cable should be connected to the USB port of a Personal Computer capable of supplying +5V DC at 500mA
- The maximum safe input voltage into the TX-out and Rx-in ports is an RF Voltage of 225mV RMS = 0dBm with a frequency between 1 kHz up to 1300 MHz). Exceeding this limit may cause damage to the VNWA and may invalidate product warranty. Do NOT apply any DC voltages to the VNWA RF Ports.
- Exercise caution when connecting external equipment to the RJ11 connector of the Expansion Board. Carefully review the information given in section 7. of this Manual. If in doubt ask first
- 7. Always check the SDR-Kits Website for current Product information including Safety Information and latest Product Updates.

http://www.sdr-kits.net/VNWA/VNWA_Documentation.html

2.2 **Product Documentation:**

The documentation of this product is supplied as a VNWA Application Helpfile, through the VNWA Installer or may be downloaded from the Internet from <u>http://sdr-kits.net/DG8SAQ/VNWA/VNWA_HELP.pdf</u>

VNWA 3 Expansion Board installation Preparation

3.1 Ensure the VNWA is properly functioning prior to installing the VNWA 3 Expansion Board

- If in doubt, see the information in the VNWA helpfile "Verification of Proper Performance "
- 3.2 Observe antistatic precautions when unpacking and fitting the VNWA 3 Expansion Board.
- 3.3 Check the Serial Number label on the VNWA back panel.
 - If the serial number of your VNWA 3 is 2201 or higher then VNWA the Female SIP connectors are already fitted. The VNWA 3 Expansion Board just plugs in and soldering is NOT required.
 - If the serial number of the VNWA 3 is between 2001 and 2200 then the female SIP connectors supplied will need to be fitted and soldered to the VNWA 3 Printed Circuit board. Some previous soldering skills are required.

3.

- 3.3 Contents of the VNWA 3 Expansion Board kit is shown below. check off against the list.
 - ▲ 1 pc assembled VNWA 3 Expansion Board
 - ▲ 1 pc 2mm Allen key to remove VNWA 3 covers
 - ▲ 3 pcs 2.5mm dia 8mm long spacers
 - ▲ 3 pcs 2.5mm steel washers
 - ▲ 6 pcs 2.5mm dia 6mm screws
 - ▲ 6 pcs fibre washers 2. mm dia
 - ▲ 3 pcs 3 pin female SIP connectors
 - ▲ 1 pc 2 pin female SIP connector
 - ▲ 1 pc 6 pin female SIP connector
 - ▲ 15 cm solder
 - ▲ 10 cm solder braid



Fig 2. VNWA 3 Expansion Board kit contents

3.2 Tools required

- ▲ 2mm allen key (supplied with kit)
- Small crosshead screwdriver
- A Sharp Scalpel or hobby knife
- ▲ Tweezers
- ▲ 25W or 40W soldering preferably temperature controlled
- small inspection mirror

4.0 Fitting VNWA 3 Expansion Board

4.1 VNWA Expansion Board fittings

- 4.1.1 Caution observe Antistatic precautions -
- 4.1.2 Remove the Top and Bottom enclosure covers of the VNWA 3 using the Allen key supplied.
- 4.1.3 If you are planning to use the RJ11 connector for external VNWA connections, cut out the square hole for the RJ11 in the rear panel label using a sharp hobby knife or scalpel as shown in fig 4.
- 4.1.4 If you plan to fit the optional clock input/output cut out the round hole to fit an SMA connector as shown in fig 3.



Fig 3. Holes cut in Rear label for RJ11 and optional SMA external Clock connector. Also shown is the Jumper which needs to be removed for VNWA 3 with s/n 2201 and higher note: Chassis Hole Clock connector is only provided in VNWA3 with s/n 2201 and higher

- 4.1.5 Remove VNWA Expansion Board from packaging and fit the 3 spacers as shown below. the correct sequence is:
 - ▲ 2.5 mm screw
 - ▲ 2.5 mm fibre washer on top of the PCB
 - ▲ then 2.5mm steel wash below the PCB
 - ▲ followed by the 8mm long spacer



Fig 4. VNWA 3 Expansion Board - bottom view

4.2 VNWA 3 with Serial numbers between A2001 and A2200 requiring Soldering:

- 4.2.1 Fit the female SIP connectors to the male SIP connectors to the VNWA 3 Expansion Board.
- 4.2.3 Next fit the VNWA 3 Breakout PCB with the mating SIP connectors to the VNWA 3 main pcb. Make sure that all SIP connector pins are visible as shown below.
- 4.2.3 Check whether Breakout PCB is correctly positioned and fasten the VNWA 3 Breakout PCB to the main VNWA PCB using 3 pcs 2.5 mm screws and fibre washers as shown in Fig 6.
- 4.2.4 Now solder the connectors J31, J52, J36, J34 and J53 on the VNWA Main PCB
- 4.2.5 Refer to figure 5. Locate **Zero Ohm resistor A** which is fitted on VNWA 3 with s/n 2200 or less. Resistor A **must be removed** for operation of the DDS with DC power from the VNWA 3 Expansion board.
- 4.2.6 **Caution** do not cut the resistor or use force as the PCB track could be damaged.
- 4.2.7 The best method is to remove excess solder with solder wick first and heat both ends of the resistor at the same time. The resistor can now be "swiped sideways" and removed.



Fig 5. VNWA 3 - Removing Jumper A

4.2.8 Refit VNWA top and bottom enclosures. Make sure the EMC shield strips fit properly on the horizontal chassis to avoid RF leakage. **Do Not overtighten** the eclosure screws



Fig 6. Top view of VNWA 3 Main PCB showing where SIP connectors are soldered

4.3 VNWA 3 with Serial numbers A2201 and higher (SIP connectors already fitted)

- 4.3.1 Remove the 2 pin Jumper as shown in fig 3. The jumper is secured with a blob of hot glue on the side which should removed with a pen knife first
- 4.3.2 Plug in the VNWA 3 Breakout PCB onto the main VNWA PCB. Use a small inspection mirror to check the connectors are properly aligned before pressing down. Do not exert undue force, if necessary remove the PCB and start again.
- 4.3.3 After Breakout PCB has been fitted check with inspection mirror whether all the connectors are mated.
- 4.3.4 Fasten the VNWA 3 Breakout PCB to the main VNWA PCB using the 3 2.5 mm screws and fibre washers as shown in Fig 6.
- 4.3.5 Refit VNWA top and bottom enclosures. Make sure the EMC shield strips fit properly on the horizontal chassis to avoid RF leakage. **Do Not overtighten** the eclosure screws

5. Commissioning & Configuring VNWA 3 Audio Codec

- 5.1.1 Plug the VNWA 3 with Expansion Board fitted into USB port of Personal Computer.
- 5.1.2 Monitor briefly for any unusual symptoms and/or messages from Windows Operating System: If window pops up that the USB-current is exceeded, remove VNWA **immediately** and check for any short circuits and errors in the VNWA 3 Breakout board installation
- 5.1.3 Start the VNWA Application, then goto "File" and "Setup" "USB Settings" and perform "Test

USB Interface" to confirm that VNWA is operational.

- 5.1.4 Select Tab "Audio Level" and tick the box "Auxilary Audio Capture Device Available" in fig 7. which is applicable for Windows XP operating system.
 This will bring up the configuration of the Auxilary Audio Capture Device. Change the settings as shown in fig 7. as appropriate.
- Troubleshooting: If "Auxiliary Audio Capture Device available" is NOT shown, then exit VNWA application and add the line *AuxAudio=1* to the file VNWA.ini with a text editor and then restart the VNWA Application. See also VNWA helpfile

Note: With the VNWA 3 Breakout PCB fitted there are now two USB Codec devices, a) USB Audio Codec and b) USB Audio Codec 2. The built-in USB codec must be the main capture device, as it is hard wired to the multiplexing switch. USB-Codec configuration is done in the following step:

5.1.5 Press button "Calibrate Sample Rate" as shown in fig 7. If Sample Calibration Rate fails (First pulse not detected) then reverse the two USB Audio Codec devices and test again. (ie Audio Capture becomes "USB Audio Codec" and Aux. Audio Capture becomes "USB Audio Codec 2")

Audio Lapture Device		Misc Audio Settings	2000
Capture Microphone Test Audio Max=15368	ADC Resolution C 8 Bit C 16 Bit C 24 Bit 48000 Hz Min=-15352	Samples / IF Period 10 x4 # Presamples 3 # Postsamples 3 Calibrate Sample Rate Sample Rate = UnCal.	=> IF = 1200.00 Hz => Minimum Sampling Time = 0.96 ms
Auxiliary Audio Capture Devi	ice available	Reference = Left Channel	restart on no sync
Auxiliary Audio Capture Device USB Audio CODEC Capture	ADC Resolution C 8 Bit • 16 Bit C 24 Bit	Auxiliary Audio Settings Aux. Audio Channels measure Main Audio Channels measure REF Sample Rate = UnCal.	THRU LECT

Fig 7. Configuration of Auxiliary Audio Capture Device

5.1.6 Now select the tab "Audio Level" and select "Reflect" mode and with no termination on the TX-port, and check the blue main Reference signal and blue Reflected signal are as shown in fig8. Do not worry about the lighter red Aux Audio signal, which may also be visible.

Note: If the sinewaves are "clipped" (Vista or Windows 7) then the Recording level of the relevant USB Audio Codec needs to be changed. Also check whether the USB Audio Codec is set to Stereo 48 Kbps as described in the "Getting Started" booklet shipped with the VNWA or see



Fig 8. Audio Level with TX port not terminated (full Reflection)

- 5.1.7. Connect a short coax cable between TX and RX ports and check the Reflect sinewave in Fig 8. now becomes a flat blue line.
- 5.1.8 Next select the tab "Aux. Audio Level" and check the display as shown in fig 9. is obtained.
- **Note:** If the sinewaves are "clipped" (Vista or Windows 7) then the Recording level of the relevant USB Audio Codec needs to be changed. Also check whether the USB Audio Codec is set to Stereo 48 Kbps as described in the "Getting Started" booklet shipped with the VNWA or see t he VNWA Helpfile Section "Configuration Vista / Windows 7 audio issues"



Fig 9. Aux. Audio Level with TX and RX ports connected

Troubleshooting: If the above displays are not obtained then check the USB-Audio Settings in fig 7. and perform step 5.1.5 again.

6. VNWA 3 Expansion Board Interface information:

The VNWA3 combines the VNWA and the USB interface functionality on a single 100x60mm² board: The VNWA3 only requires a single USB cable to connect to a PC. The interface options are shown in 7.1 and 7.2 Also refer to the VNWA Helpfile for a block diagram and Application configuration options for the Rotor Start/stop and S-Parameter switch options.

6.1	VNWA 3 Expansion Board - External Connections
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RJ11 pin	Signal Description	Cable colour	Remarks: (see also VNWA helpfile for info on options)
Pin 1:	Rotor start/stop control signal (input)	white	Input signal, normally +3.3V. When input is grounded, VNWA sweep and the rotor engine are started for Radar type Antenna plots
Pin 2:	Not Connected	black	
Pin 3:	S-Parameter Test set Control Signal (output)	red	0 or 3.3V Logic DC Signal from AVR via 680 series resistor. See Helpfile for configuration details
Pin 4:	Not Connected	green	

Pin 5:	Internal 5V DC Power out or External 5V Power In (See Note 1)	yellow	A maximum of about 100mA may be drawn from internal power provided PC USB Hub can supply 500mA. See Note 1; when using external power
Pin 6	Ground	blue	VNWA Ground Connection

Note 1: For operating the VNWA3 from an **external 5V DC power supply**, zero Ohm **resistor B shown in Fig 5**. must be removed from the VNWA3 board **Note 2:** Cable colour refers to the colours of the optional RJ11 cable available from SDR-Kits

6.2 Optional External Clock input/output

An Optional SMA connector may be fitted for connecting an External 36 MHz Clock output or to tap the internal multiplied System clock. After the VNWA 3 Expansion Board is fitted, the SMA connector is fitted in the 8mm round hole provided only in VNWA3 with **s/n 2201 and higher** as shown in fig 1.

- A With a scalpel cut a round hole in the rear panel label and fit the SMA connector.
- solder a short wire between the SMA center connector to the PCB track. Soldering of ground connections is not required.

If the SMA connector is not used then it is recommended to fit an SMA Screening cap to prevent radiation from and damage to the SMA connector.

6.3 Specification of the VNWA Reference Clock output or External Clock input:

- Internal Clock Output: TCXO 12 MHz*x (x=2..8) 2ppm Out 1kOhm impedance, 400mVpp output
- ▲ External Reference Clock: ideally 36 MHz with level of between -6dBm...+3dBm / 50 Ohms

7.0 WEEE, Disposal of Waste Electrical Equipment



This symbol on the product indicates that this product should not be treated as household waste.

Instead it should be handed over to a suitable collection point for the recycling of electrical and electronic equipment. Users of this product in the European Community should contact SDR-Kits to specific arrangements for the disposal and recycling of this product in accordance with the relevant EEC Directives.

7.1 CE Certification,



This product is CE certified according to the provisions of 2004/108/EC and 1995/5/EC relating to the Radio and Telecommunications Terminal Equipment (R&TTE) is in compliance with the essential requirements of these directives.

8. Contact Information

SDR KITS LIMITED trading as SDR-Kits <u>www.SDR-Kits.net</u> email: <u>Orders@SDR-Kits.net</u>

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