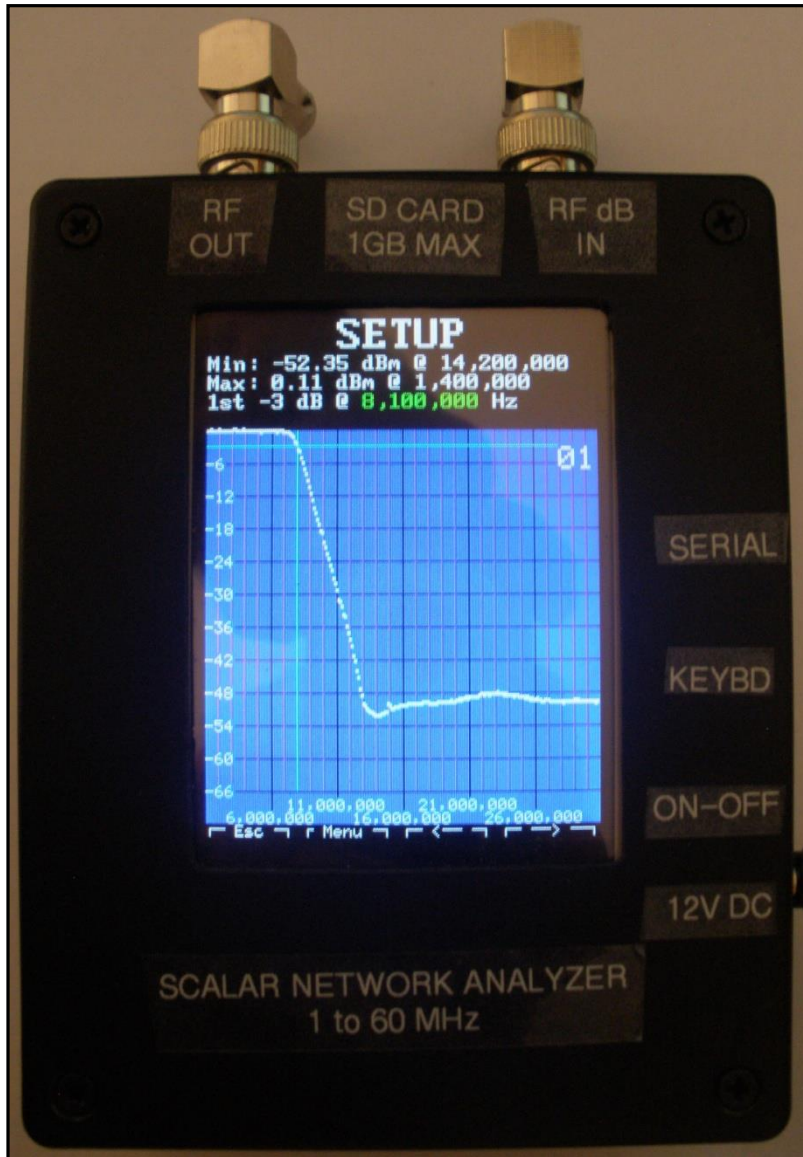


# Hardware Configurations, Firmware Versions & Document Tree

This document describes the hardware enhancements that evolve the basic Network Analyzer-Terminal (NAT) to a free-standing, fully-capable Scalar Network Analyzer (SNA). It also describes the relationships between the hardware configurations, the firmware versions, and the document tree describing the product.



# Documentation

The following documents provide basic description and user reference information. Additional documentation is available on the NAT web site (<http://midnightdesignsolutions.com/nat/>) for hardware assembly, initial startup (smoke test), and component specifications.

## **SNA Power Point Presentation**

[http://midnightdesignsolutions.com/nat/doc/SNA%20\(AD7JT-N2APB\).pdf](http://midnightdesignsolutions.com/nat/doc/SNA%20(AD7JT-N2APB).pdf)

This slide presentation gives a general overview of the NAT to SNA development project and illustrates many of the device's capabilities. This is a good starting point for gaining familiarity with the NAT/NACT/SNA and its many capabilities.

## **Quick Reference Guide**

[http://midnightdesignsolutions.com/nat/nact/NAT\\_NACT%20QUICK%20REFERENCE%20GUIDE.pdf](http://midnightdesignsolutions.com/nat/nact/NAT_NACT%20QUICK%20REFERENCE%20GUIDE.pdf)

The Quick Reference Guide describes the various screen displays and how to use them. Some step-by-step instructions are included. The format is one topic per page with oversized print and lots of screen shots.

## **Quick Start Guide**

[http://midnightdesignsolutions.com/nat/doc/NAT\\_Quick\\_Start\\_Guide.pdf](http://midnightdesignsolutions.com/nat/doc/NAT_Quick_Start_Guide.pdf)

The Quick Start Guide describes many of the basic NAT operations along with some tips for interfacing to the PHSNA. Initial setup is covered including setting the serial port's baud rate, loading the PHSNA firmware, and formatting the SD card. Basic operating modes are described along with examples. The appendix contains a listing of the hot keys available in various operating modes.

## **Tutorials**

<http://midnightdesignsolutions.com/nat/nact/index.html>

A set of tutorials describes common, basic operations as step-by-step procedures. The tutorials also describe various accessory test fixtures and how to construct them as well as how to use them. The tutorial set will be added to as new features are added to the SNA.

## **User Guide**

[http://midnightdesignsolutions.com/nat/doc/NAT\\_User\\_Guide\\_v2\\_00j.pdf](http://midnightdesignsolutions.com/nat/doc/NAT_User_Guide_v2_00j.pdf) (V1 and V2)

<http://midnightdesignsolutions.com/nat/nact/NAT%20USER%20GUIDE%20EXTENSION%20FOR%20V3.pdf> (V3)

<http://midnightdesignsolutions.com/nat/doc/NAT%20USER%20GUIDE%20EXTENSION%20FOR%20V4.pdf> (V4)

The User Guide and its extensions are the most detailed reference source. The basic User Guide covers the Basic NAT and firmware versions 1 and 2. The extension for V3 includes the NAT-to-NACT hardware upgrade instructions. The extension for V4 includes the NACT-to-SNA hardware upgrade instructions.

# Hardware Configurations

## **NAT:** Network Analyzer Terminal

The NAT hardware configuration relies on the PHSNA hardware for network analysis. It interfaces to the PHSNA controller through a simple serial interface. The PHSNA controller consists of an Arduino micro controller (UNO or NANO) and a direct digital synthesizer (DDS). The DDS generates the RF input to the device under test (DUT). The DUT output power level is measured by a separate RF Power Meter and read by the PHSNA controller. The NAT defines the operation to be performed and records and plots the results.

## **NACT:** Network Analyzer Controlling Terminal

A NAT is upgraded to a NACT with a couple, simple hardware enhancements. The DDS-60 output is wired to a new BNC connector (RF OUT) mounted on the top edge of the NAT PCB. The RF OUT BNC connector is connected direct to the DUT input. A second BNC connector (RF IN) is added to interface the output of an external RF Power Meter to an analog input on the NAT's micro controller (dsPIC). These hardware enhancements enable the NACT to perform SNA functions without the external controller. An external RF Power Meter is still required.

## **SNA:** Scalar Network Analyzer

A NACT is upgraded to an SNA with a couple more hardware enhancements. A daughter board containing an RF Power Meter is attached to the NAT PCB and the input of which is connected to the RF IN BNC connector and the output is connected to the dsPIC's analog input. This enhancement eliminates the need for the external RF Power Meter. The DUT output is connected direct to the RF IN BNC connector. A second, optional, hardware enhancement adds a calibrated signal source that can be used for setting the RF Power Meter slope and intercept point for accurate power readings in dBm using only an external digital volt meter (DVM or DMM).

# Firmware Versions

## **Version 1: Basic Functionality**

Firmware V1 was the original firmware release providing basic functionality and operates either in Menu mode or in PLX mode. It only supports the keyboard for human input.

In Menu mode, PHSNA firmware generates menus that are displayed on the NAT display. Responses are input by the operator and sent to the PHSNA controller to specify operating parameters and to initiate various operations. Results are returned to the NAT for display and spooling to files on an SD card.

The PHSNA firmware can interface to an Excel spread sheet through a PLX-DEQ macro to access spread sheet cells via a port on the PC. The NAT emulates the spreadsheet-macro combination providing a more automated mode of operation. The PHSNA controller reads parameters from virtual spread sheet cells and returns results to other virtual spread sheet cells. The parameters defining the operation are contained in PLX forms that can be edited by the NAT operator.

## **Version 2: Touch Screen Input**

Firmware V2 supports both the keyboard and the touch screen for human input. A numeric pad display was added to facilitate numeric input and some editing and navigating functions. The resulting functionality is about the same as V1 with the addition of some bug fixes and operating enhancements such as context menus, multi-color plots, spool file overwrite, and calibration interpolation and extrapolation. This version also added Signal Generator mode with which the user can manually specify and control the RF signal frequency.

## **Version 3: NACT Support**

Firmware V3 incorporates the PHSNA controller functions. These functions are either controlled in PLX mode or in Command mode; Menu mode is not required. In addition to the obvious operating functions (frequency sweeps, power level capture, etc.) a number of new functions are implemented to help generate required operating parameters such as slope and intercept values and the DDS reference clock frequency. Since the serial interface is now available, DOS commands were added to upload and download files on the SD card to and from PC applications. Support was also added to allow a PC application to remotely control the SNA operations over the serial interface.

## **Version 4: SNA Full Support**

In theory, since the RF Power Meter has no control interface to the firmware, the firmware cannot tell the difference between a NACT and a SNA hardware configuration. There are, however, some new setup functions that simplify the calibration process. A power meter mode was also added in V4 that measures and displays current, average and peak power levels. The power meter range can be scaled using attenuators to cover picowatts to kilowatts.