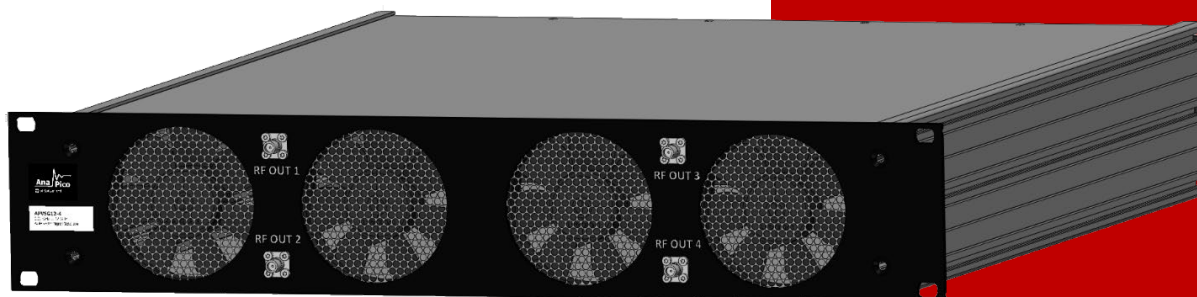




User Manual Vector Signal Generator

APVSGXX(-X)



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WARRANTY

All AnaPico instruments are warranted against defects in material and workmanship for a period of two years from the date of shipment. AnaPico will, at its option, repair or replace products that prove to be defective during the warranty period, provided they are returned to AnaPico and provided the preventative maintenance procedures are followed. Repairs necessitated by misuse of the product are not covered by this warranty. No other warranties are expressed or implied, including but not limited to implied warranties of merchantability and fitness for a particular purpose. AnaPico is not liable for consequential damages.

IMPORTANT! PLEASE READ CAREFULLY

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General Remarks

Today, digital modulation schemes are widely used in communication systems, and the increasing need for data bandwidth has pushed the signal purity and modulation bandwidth requirements for modern vector signal sources. Other applications with similar performance requirements include radio surveillance, interference analysis, radar signal analysis and electronic warfare.

Addressing these demanding requirements, AnaPico's APVSG series of vector signal generators (VSGs) provide frequency coverage to 40 GHz and are available as single output desktop units or rack-mount instruments with multiple phase-coherent outputs. The APVSG series offers a cost-effective and flexible tool for generating high-quality, complex, wideband, digitally modulated signals.

Among others, the following use cases are supported:

- Upload multiple formats of IQ Data into APVSG Memory. The APVSG internal AWG can play selected sections of the RAM upon a user trigger.
- Use APVSG to synthesize and play predefined digital modulation formats
- Use FCP interface to live stream and play digital IQ data
- Use the analog IQ inputs with up to 250 MHz IQ bandwidth
- Use FCP to instantaneously switch between pre-loaded IQ data segments
- Use FCP to control the APVSG for ultra-fast frequency hopping.

All APVSGs operate with an ultra-stable temperature compensated frequency reference (OCXO) that can be phase-locked to an external reference.

The compact unit allows for full front panel control via touch panel display, and PC GUI Software supported operation via ETHERNET, USB, FCP (fast control port) and GPIB communication ports.

Validity of this Manual

This manual is valid for the following devices and theirs extended versions:

- APVSGXX(-X)

Available Casing

The devices are available in the following cases:

Compact Portable Case (CPC)



Figure 1: Compact Portable Case with touch display

2U Case (2URM)

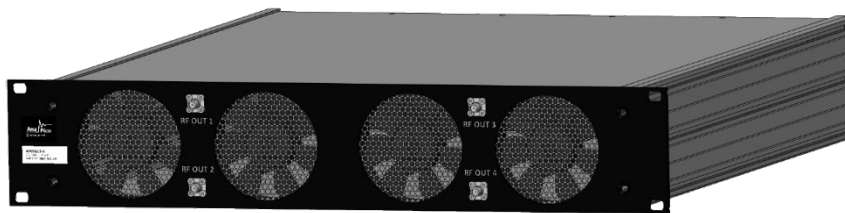


Figure 2: 2URM case for multi-channel devices

Data Connections

The devices may only be connected to a network or a computer by using a shielded LAN cable. Unless shorter lengths are prescribed, a maximum length of 3 m must not be exceeded for the LAN and the USB connection.

Signal Connections

In general, all connections between the signal generator and another device should be made as short as possible and must be well shielded. It is recommended to use a high-quality cable with low loss especially for frequencies above 20 GHz.

Transportation

The devices must only be transported with the packaging supplied by the manufacturer. The device can be lifted up or transported in any orientation.

Safety Information

The following pieces of information are important to prevent personal injury, loss of life or damage to the equipment. Please read them carefully. If the device is used in a manner not specified by this manual, the protection provided by the device may be impaired.

Signal Symbol

In this manual, the following symbols are used to warn the reader about risks and dangers.



DANGER denotes a hazard for personal health or life.



WARNING denotes a risk or danger, that could damage the device.

Labels on Products

The following labels are on the products. Familiarize yourself with the meaning of each of the labels before using the product.

	Direct Current (DC)
	Alternating Current (AC)
	Earth (Ground)
	EU label for separate collection of electrical and electronic waste.
	Caution, general danger zone. Attend the manual and/or a notice on the device.

General Safety Considerations

FCC notice

This equipment has been tested and found to comply with the limits for a Class A device, pursuant to **Part 15 of the FCC Rules**. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area may cause harmful interference in which case the user will be required to correct the interference at his or her expense.



The instrument meets the EMC directive and the Low Voltage Directive described in the CE declaration in **Fehler! Verweisquelle konnte nicht gefunden werden..**



If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as nickel) may be released. For this reason, the product may only be disassembled or opened by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

Connector View

Front & Rear View

CPC with Touch display

The front panel contains a touch display, RF output female SMA connector (up to 20 GHz), or a K connector (40 GHz devices). The touch display shows information on the current function. Information includes status indicators, frequency and amplitude settings, current connectivity status, and error messages.

Front Panel



Figure 3: APVSG Front Panel View

1. **Main touch display** The main display shows information on the current function, such as frequency, power, reference.
2. **Rotary Button** The rotary button is used to change the value selected on the screen.
3. **RF 50Ω connector** This female SMA respectively K connector provides the output for generator signals. The impedance is 50Ω. Please check the data sheets for more details.

Rear Panel

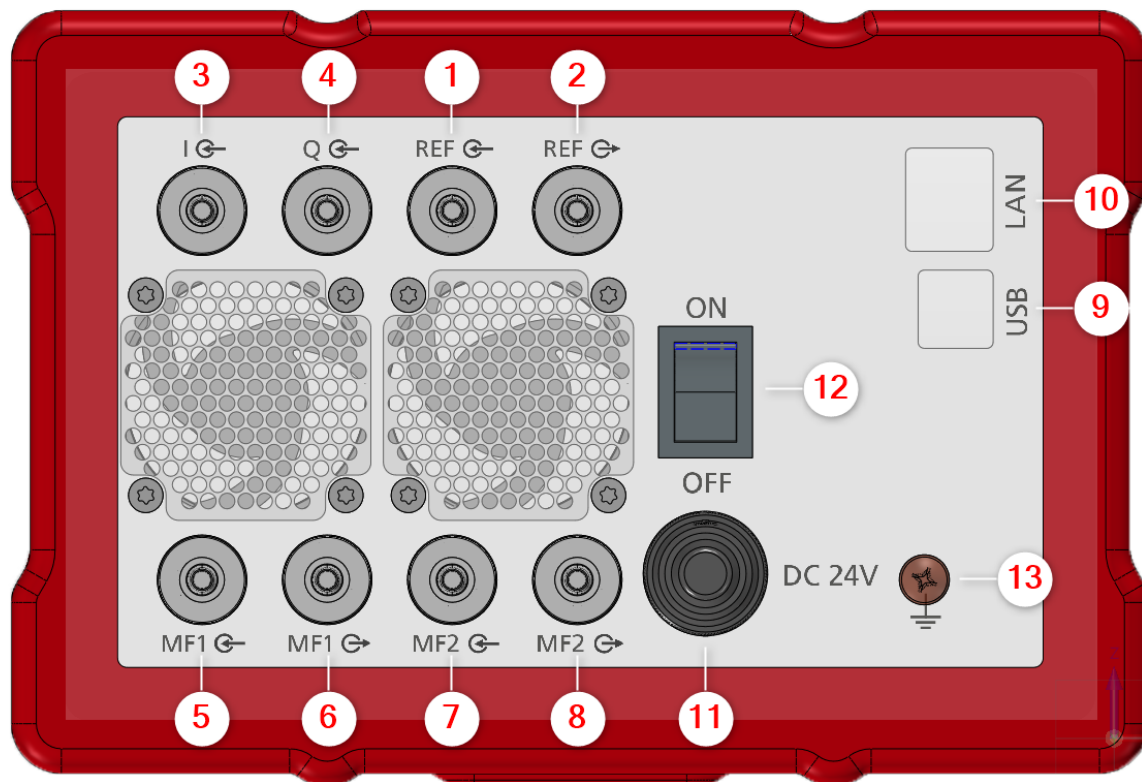


Figure 4: APVSG Rear Panel View

1. **REF input** This BNC female Connector is the input for the reference signal.
2. **REF output** This BNC female Connector is the output of the reference signal.
3. **I input** This BNC female Connector is the input for analogue in-phase signals.
4. **Q input** This BNC female Connector is the input for analogue quadrature signals.
5. **MF1 input** This BNC female Connector is a multifunction input.
6. **MF1 output** This BNC female Connector is a multifunction output.
7. **MF2 input** This BNC female Connector is a multifunction input.
8. **MF2 output** This BNC female Connector is a multifunction output.
9. **USB B** The USB B connector is used to connect the device to a computer.
10. **LAN** The LAN connector is used to connect the device to a network.
11. **Power Supply** Connector for the AnaPico power adaptor.
12. **ON/OFF Switch** Turns the device on or off.
13. **Ground Screw** The screw can be used to connect the device to ground reference

2URM

Front panel

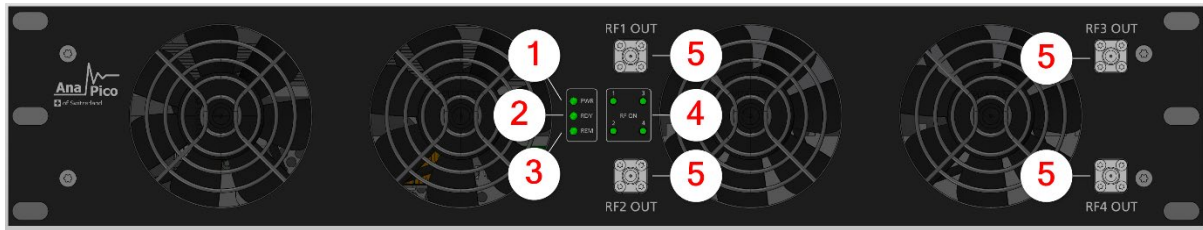


Figure 5: APVSG 2URM Front Panel View (Model with 4 RF channels)

- 1. Power LED** The power LED is indicating whether the device is on or off.
- 2. Ready LED** The ready LED indicates that the boot process is completed and ready to be used.
- 3. Remote LED** The remote LED is indicating whether the device connected to a Computer or not.
- 4. RF LED [1..4]** This LED indicates whether the RF signal on or off.
- 5. RF OUT [1..4]** This female K- type respectively SMA connector provides the output for generator signals. The impedance is 50Ω. Please check the data sheets for more details.

Rear Panel

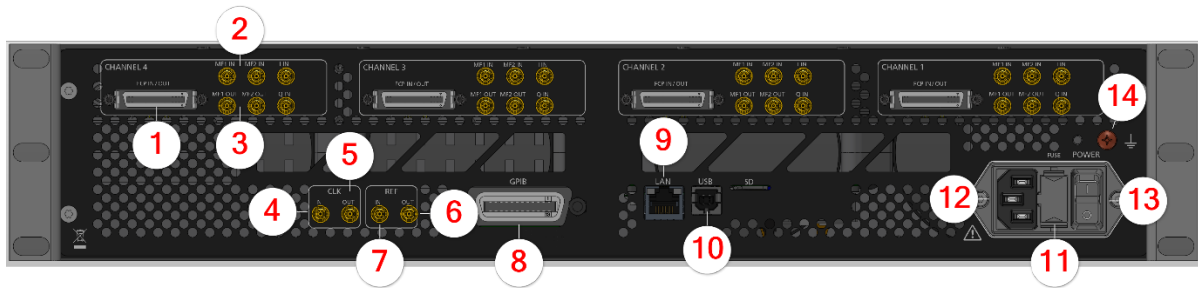


Figure 6: APVSG 2URM Rear Panel View

Ports available per RF channel:

1. **FCP** Fast Control Port, see application note
2. **MF input [1..2]** SMB jack is a multifunction input port
3. **MF output [1..2]** SMB jack is a multifunction output port

Ports belong to the instrument:

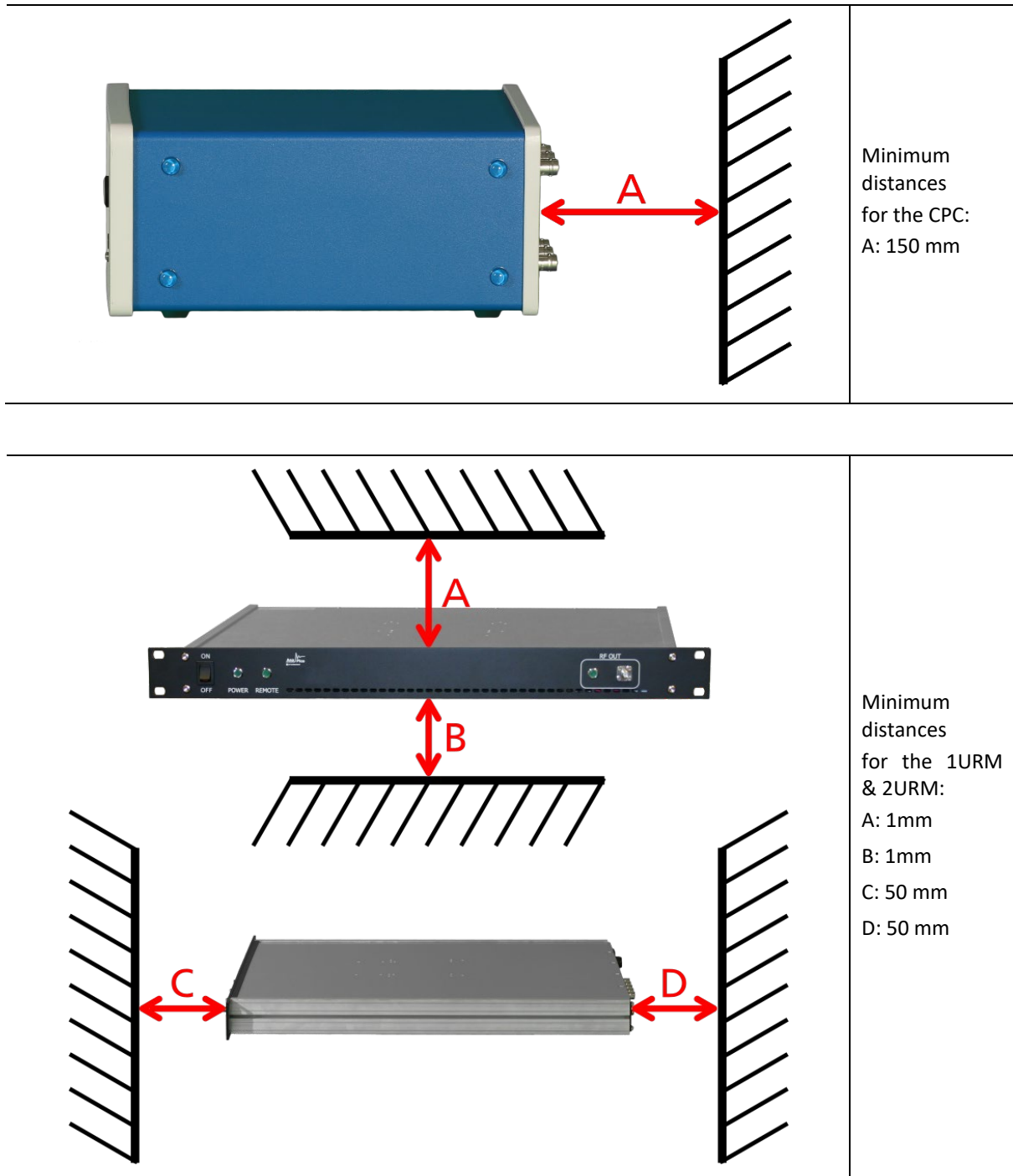
4. **CLK IN** Proprietary port for multi-device synchronization: SMB jack
5. **CLK OUT** Proprietary port for multi-device synchronization: SMB jack
6. **REF OUT** This BNC female Connector is the output for the reference signal.
7. **REF IN** This BNC female Connector is the input for the reference signal.
8. **GPIB Connector** In case the device has the option “GPIB”, on this position is the GPIB connector.
9. **LAN** The LAN connector is used to connect the device to a network
10. **USB B** The USB B connector is used to connect the device to a computer.
11. **FUSE Holder** This holder contains an exchangeable fuse.
12. **AC Power** Connector for AC power
13. **ON/OFF Switch** Turns the device on or off.
14. **Ground Screw** The screw can be used to connect the device to ground reference

Minimum Distances



For an adequate cooling, the minimum distances between the device and another object, such as walls, rack cabinet walls or other equipment must be respected.

The minimum distances are:



Operating Conditions



Use only the supplied power adapter from AnaPico to supply the CPC.

If the back side of the 2URM case is not accessible during operation, it is recommended that the rack has a power switch.

Proper operation conditions

The devices are designed for use in dry and clean environments. The CPC can also be used in field as long as the operating conditions are met. Operation in an environment with high dust content, high humidity, danger of explosion or chemical vapors is prohibited.

In case of condensation 2 hours are to be allowed for drying prior operation. Operation is only allowed from a 3-terminal mains connector with a safety ground connection and a mains plug used in your specific country. For sufficient ventilation, ensure open ventilation holes.

Environmental Information

1. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately. Contact the AnaPico customer service center for environmentally responsible disposal of the product.
2. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via AnaPico service center.

Getting Started

Included Material

Your signal generator kit contains the following items:

- Signal Generator
- Universal power adaptor (AC 100 – 240V) with corresponding country specific plugs
- Ethernet Cable
- Memory Stick with graphical user interface for Windows and documentation

System Requirements

The AnaPico graphical user interface requires at least the minimum system requirements to run one of the supported operating systems.

Operating system Windows™ 7, 8, 10

Remote 10/100/1000M Ethernet or USB 2.0 Port

Unpacking the Instrument

Remove the instrument materials from the shipping containers. Save the containers for future use.

For a list of material included in the standard package, please refer to chapter **Fehler! Verweisquelle konnte nicht gefunden werden..**

Initial Inspection

Inspect the shipping container for damage. If container is damaged, retain it until contents of the shipment have been verified against the packing list and instruments have been inspected for mechanical and electrical operation.

Starting the Instrument

This section describes installation instructions and verification tests.

Applying Power

Place the instrument on the intended workbench and connect the appropriate DC power supply to the receptacle on the rear of the unit. Make sure you use the included DC power supply.



Using other supplies may lead to malfunction and damage of the Instrument.

Press the line on/off switch on the rear panel. If available, the front panel display will illuminate. The instrument will initialize and momentarily display the model number, firmware revision and product serial number. The display will then switch to the factory default display setting, showing preset frequency and

power, phase lock status (of internal reference) and instrument connectivity status (Ethernet IP or USB identifier).

Note, the instrument booting process may take up to 60 seconds (depending on configuration) to complete.

Connecting to LAN

Connect the instrument to your local area network (LAN) using the Ethernet cable. By default, the instrument is configured to accept its dynamic IP number from the DHCP server of your network. If it is configured properly, your network router will assign a dynamic IP number to the instrument which will be automatically displayed on the screen. Your instrument is now ready to receive remote commands.

Direct connectivity to host via Ethernet cable (no router)

You can connect to the instrument to your computer with the Ethernet cable without using a local area network with DHCP server. To work properly, the network controller (NIC) of your computer must be set to an IP address following the ZEROCONF standard, beginning with 169.254.xxx.xxx (excluding 169.254.1.0 and 169.254.254.255) and network mask 255.255.0.0 to match the ZEROCONF IP that the signal generator will assign itself after DHCP timeout. Any fixed address in the abovementioned range is admissible as well. The generators ZEROCONF address cannot be predicted as it is assigned dynamically, however the ZEROCONF address assignment process ensures it will not conflict with any other address used in the network.

Connection from a NIC that is configured to use DHCP is also possible. After a pre-set timeout, the NIC will assume that no DHCP is available and self-assign a fallback IP that will fall into the range 169.254.xxx.xxx.

Alternatively, you may assign the instrument a fixed IP. Please refer to a later section of this manual to learn how to do this.

Connecting through USB

Connect the (powered on) instrument to the computer using a quality USB type-A to type-B cable. If properly connected, the computer host should automatically recognize your instrument as a USBTMC device.

Note if you want to work with the AnaPico GUI, it must be installed with USB support selected. Then the GUI will detect all attached devices automatically. Open the GUI and follow the instructions given in Chapter

Fehler! Verweisquelle konnte nicht gefunden werden..

Alternatively, a VISA runtime environment (NI, Keysight or comparable) must be installed.

Use VISA Write to send the *IDN? Query and use VISA Read to get the response. The USBTMC protocol supports service request, triggers and other GPIB specific operations.

Connecting through GPIB

Connect the instrument to the GPIB controller using the rear panel GPIB connector (option GPIB is required). Once connected properly, use VISA Write to send the *IDN? query and use VISA Read to get the response. The protocol supports service request, triggers and other GPIB specific operations.

Installing the AnaPico Signal Generator Remote Client

AnaPico's graphical user interface provides an intuitive control of the instruments. It runs under Windows™ operating system with minimum requirements. To install the GUI on the computer, insert the AnaPico memory stick, double click on the **setup.exe** to run the auto-installer.

The self-extracting setup provides easy installation and de-installation of the software. The setup program guides you in a few steps through the installation process.

Troubleshooting the LAN Interconnection

Software does not install properly

- Make sure your memory stick is not damaged.

Software cannot detect any instrument

- Make sure you have connected both computer and instrument to a common network.
- If a direct connection is used you may require to reset your computer Ethernet controller (depending on the configuration). Note that in that case detection of the instrument can take a considerable amount of time if your computer is configured to work with an external DHCP server. In some cases the detection may even fail completely. Configure your computer network controller to an appropriate fixed IP instead.
- Make sure that your software firewall enables the GUI to setup a TCP/IP connection via the LAN. Under Windows 7/10 you can do that like this:
Open *Control Panel* under *Settings* in your *Start* menu. Then go to *Windows Firewall*. Click on *Exceptions* and then *add Program*. If the GUI is in this list, choose it and click *OK* otherwise you have to browse for the path to GUI installation directory. Finally close all open dialogs with *OK*. Now your Windows™ Firewall will not block requests from the GUI.

Shutting Down the Signal Generator

Press the line on/off switch on the rear panel to off.

Replacing the Fuse

The 2URM case has a fuse, accessible from the outside. To change the fuse, pull out the mains plug and pull the fuse holder out. Replace the old fuse with a new one. It is forbidden to repair defect fuses or to bridge them by any means. Use only a fuse with same specifications.

Using the Graphical User Interface (GUI)

AnaPico's graphical user interface provides an intuitive control of the signal generator. It runs under any Windows™ operating system. Make sure the software is installed correctly and the computer's firewall is configured properly.

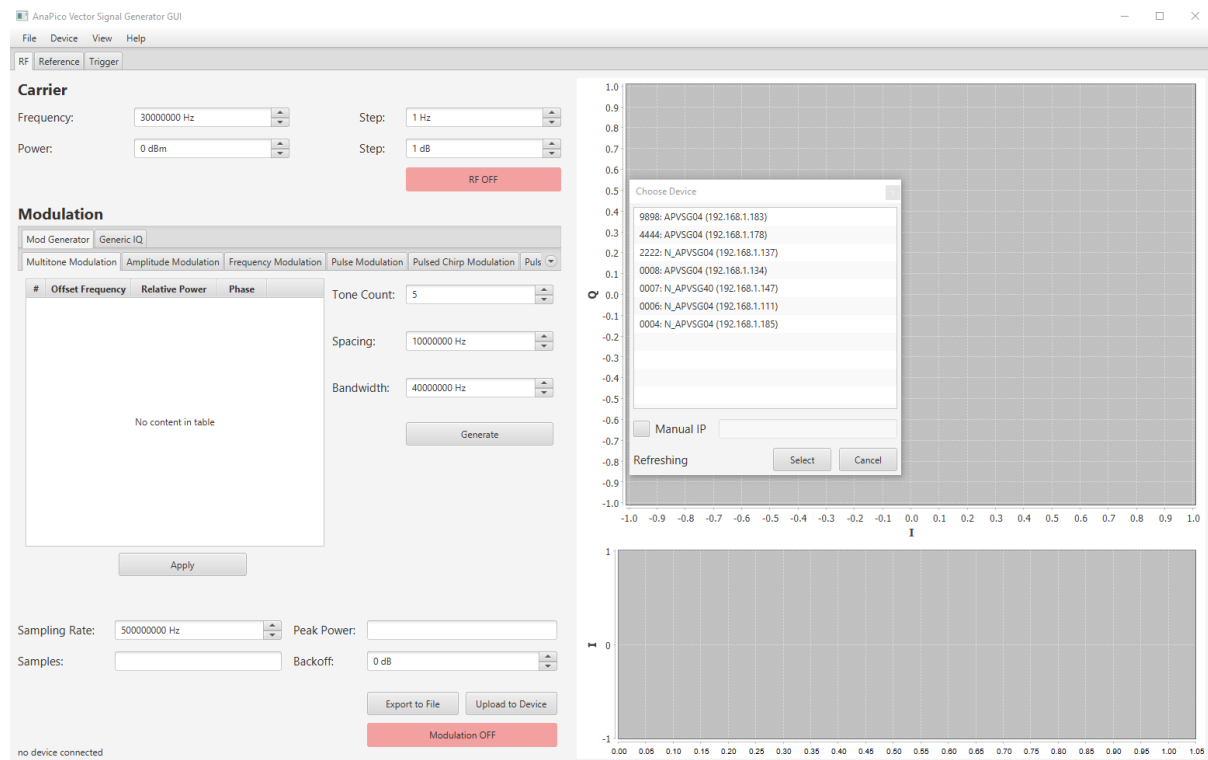


Figure -7 Vector Signal Generator UI

Start Vector Signal Generator GUI

After successful installation of the software double-click the software shortcut that has been created on your desktop.

After start, the GUI will automatically detect existing AnaPico instruments that are connected to the computer (network) via local area network, USB, or GPIB. In the **CONTROL** tab the detected instruments are listed. Clicking on one of the devices will instantly establish connection. Clicking on an alternate device will disconnect the old device and reconnect to the new device.

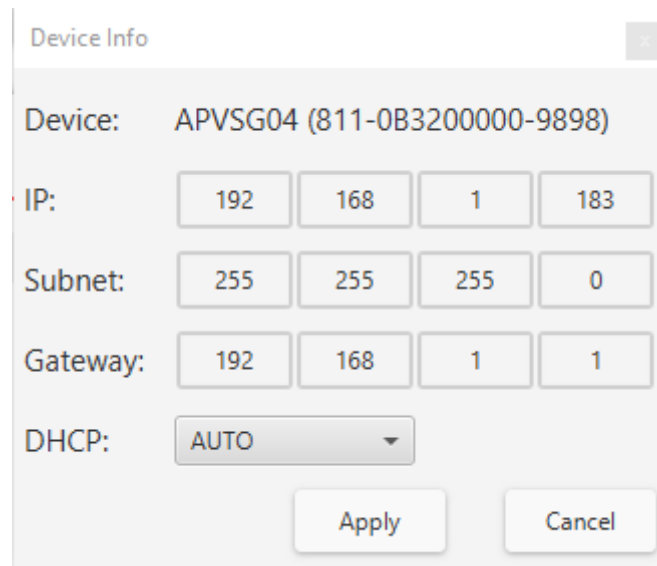
Simultaneously controlling Multiple Signal Generators from one PC

You can easily control multiple AnaPico instruments from a single computer but you need to start a separate GUI for every instrument as only one instrument is controlled by the GUI at once.

Setting Network Configuration

The **Network Configuration** button allows configuring the LAN settings as shown in Figure **Fehler! Kein Text mit angegebener Formatvorlage im Dokument.-8**. You may choose from three distinct network addressing modes: setting to Auto will check for a DHCP server on the network but if this fails, will fall back to assigning an address automatically using zeroconf. Setting to DHCP will check for a DHCP server on the network with no fallback option if one doesn't exist. Setting to manual will require the user to supply all

network settings for the device manually below. Additionally, the device name can be modified as desired. The unit serial number and firmware revision are displayed at the bottom of the dialog box.



The screenshot shows a 'Device Info' dialog box with the following fields and values:

Device:	APVSG04 (811-0B3200000-9898)			
IP:	192	168	1	183
Subnet:	255	255	255	0
Gateway:	192	168	1	1
DHCP:	AUTO			

Buttons: Apply, Cancel

Figure Fehler! Kein Text mit angegebener Formatvorlage im Dokument.-8 Network Configuration Submenu

Multi-Session Option

The 'Multi-Session' checkbox can be selected to enable the device to be accessed from more than one instance of the UI. This enables users on multiple computers on the network to connect to and configure the device simultaneously. It is the user's responsibility to manage access conflicts whilst this mode is enabled (i.e. 2 users changing the same option from different PCs).

Device Port Setting

The 'Port' option allows the listening TCP port to be customized for the device. The default setting for all devices is port 18. If changed, the device will no longer be accessible using this port number. Any instances of the UI (or other VISA applications connecting to the device over a network) will need to modify their destination port number to match the device to connect to.

Connecting to devices using a non-default port

There are 2 options for connecting to a device when its default listening port has been changed.

1. Specify a temporary connection port

Click the menu 'Info' -> 'Connection Settings' -> 'Specify Connection Port'. This will cause a new setting 'Custom Port' to be displayed on the 'Control' tab of the UI (see figures 6-d and 6-e). The connection port to use can then be entered (within the range of permissible TCP port numbers). Beware that this setting will overwrite the default port until it is removed. To remove, select 'Specify Connection Port' again – this will remove the 'Custom Port' setting from the UI and revert to using the current default port. Deleting the port number from the 'Custom Port' text box will also cause the UI to revert to using the default port.

2. Change the application's default port setting

The global default port to use for connections can be changed by selecting menu 'Info' -> 'Connection Settings' -> 'Change Default Port' (see figure 6-d). A default port can be entered into the dialog box which appears and set by clicking button 'Set Default' – only permissible TCP ports can be entered here. If the new default port is accepted, the '[Default=]' text above will display the new setting. Beware that the new default setting will now persist until changed again – including after restarting the UI or rebooting your system.

Setting the GPIB Address

If the instrument has the GPIB option installed, the GPIB address can be changed in the GPIB submenu in the control tab. Valid GPIB addresses range from 1 to 30.

To verify GPIB functionality, use the VISA Assistant available with the Agilent IO Library or the Getting Started Wizard available with the National Instrument IO Library. These utility programs enable you to communicate with the signal generator and verify its operation over GPIB. For information and instructions on running these programs refer to the Help menu available in each utility.

Perform Firmware Upgrade

A firmware upgrade of the instrument can be done directly via the GUI. First make sure you are connected to the right instrument and have the correct firmware binary file (.tar) ready. Then apply **Controller → Update Firmware** and select the appropriate binary file that you have received from AnaPico or downloaded from the AnaPico website. The update will take a few seconds and after completion your instrument will reboot. Reconnect to the instruments after booting is completed and continue with the updated firmware.



Do not disconnect and power off device during firmware update.

Local Operation via Front Panel



Figure Fehler! Kein Text mit angegebener Formatvorlage im Dokument.-APVSG Front Panel

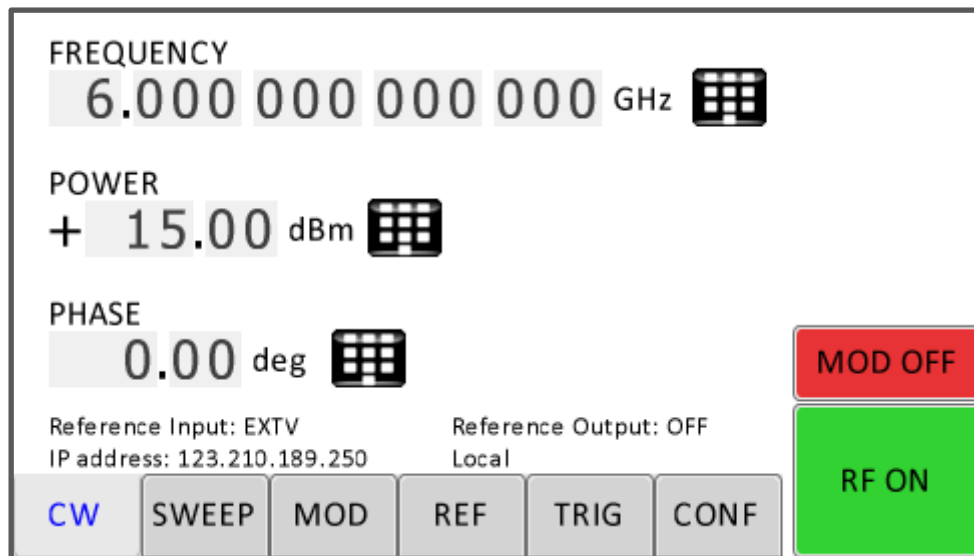
The currently active display position is shown by the cursor (underline symbol, or different background colour). The cursor does not move beyond the field of the currently selected parameter. Rotate the front panel knob to modify the value. Clockwise rotation increases the parameter and counter-clockwise rotation decreases the parameter. The parameter value will continue to increase or decrease by the amount of the selected resolution until it reaches the maximum or minimum limit of the parameter.

Displayed Parameter Formats

The following sections describe how to control the instrument via the front panel control by invoking various menu functions.

CW Display

The Main or CW Display is shown after the instrument has successfully booted and is ready.



Modulation Submenu

Pulse Modulation Submenu

In the Pulse sub-menu the internal pulse modulator can be controlled

Amplitude Modulation Submenu

In the Amplitude Mod submenu the internal amplitude modulation can be accessed.

Frequency Modulation Submenu

In the frequency modulation submenu the internal and external frequency modulation can be accessed.

Phase Modulation Submenu

In the phase modulation submenu the internal and external phase modulation can be accessed.

Reference Submenu

In the reference sub-menu the input and output for RF reference can be set

Trigger Submenu

After accessing the Trigger menu, use the **rotary knob** to toggle the selected entry value or to change selected digit. The display shows up as following.

LAN Configuration Submenu

In the LAN Configuration menu, IP address, subnet mask and DHCP can be configured.

Display Settings Submenu

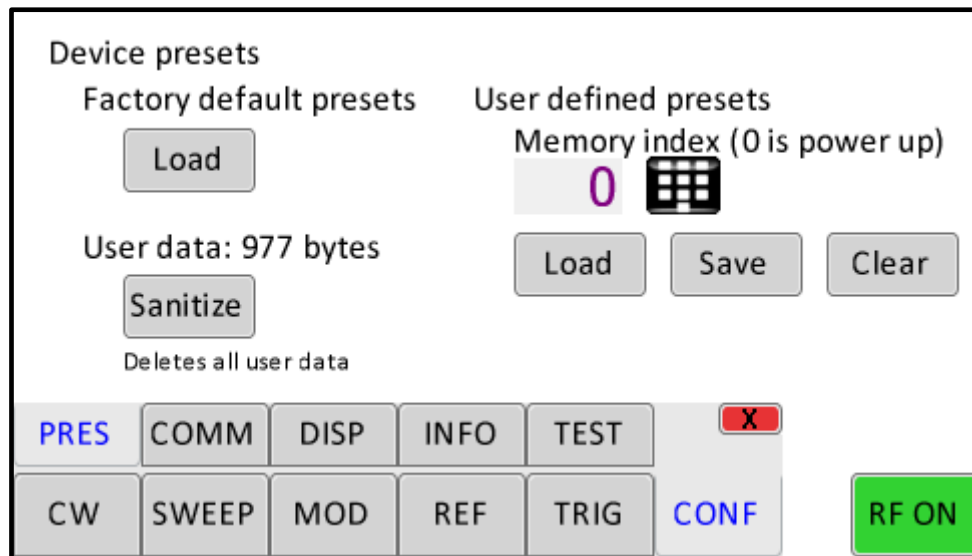


Figure Fehler! Kein Text mit angegebener Formatvorlage im Dokument.-s Restore Startup Settings

Help Submenu

This submenu provides basic information about the front panel menu control.

Remote Programming the Signal Generator

The signal generator can be remotely programmed. Please refer to the Programmer's Manual for details.

Maintenance and Warranty Information

Adjustments and Calibration

To maintain optimum measurement performance, the instrument should be calibrated every 24 months. It is recommended that the instruments be returned to AnaPico or to an authorized calibration facility. For more information please contact our Customer Service Department as indicated on www.anapico.com.

Repair

The signal generator contains no user-serviceable parts. Repair or calibration of the signal generator requires specialised test equipment and must be performed by AnaPico or its authorized repair specialists.

Warranty Information

All AnaPico instruments are warranted against defects in material and workmanship for a period of **two years** from the date of shipment. AnaPico will, at its option, repair or replace products that prove to be defective during the warranty period, provided they are returned to AnaPico and provided the preventative maintenance procedures are followed. Repairs necessitated by misuse of the product are not covered by this warranty. No other warranties are expressed or implied, including but not limited to implied warranties of merchantability and fitness for a particular purpose. AnaPico is not liable for consequential damages.

Equipment Returns

For instruments requiring service, either in or out of warranty, contact your local distributor or AnaPico Customer Service Department at the address given below for pricing and instructions before returning your instrument.

When you call, be sure to have the following information available:

- Model number.
- Serial number.
- Full description of the failure condition.

Note: Model and serial number can be found on the rear of the instrument, next to the power plug.

You will get a Return Merchandise Authorization (RMA) number from AnaPico, please put it on the outside of the package.

Instruments that are eligible for in-warranty repair will be returned prepaid to the customer. For all other situations the customer is responsible for all shipping charges. An evaluation fee may be charged for processing units that are found to have no functional or performance defects.

For out of warranty instruments, AnaPico will provide an estimate for the cost of repair. Customer approval of the charges will be required before repairs can be made. For units deemed to be beyond repair, or in situations where the customer declines to authorize repair, an evaluation charge may be assessed by AnaPico.

