

Getting Started



Getting Started
PN9000 Series
DCNTS

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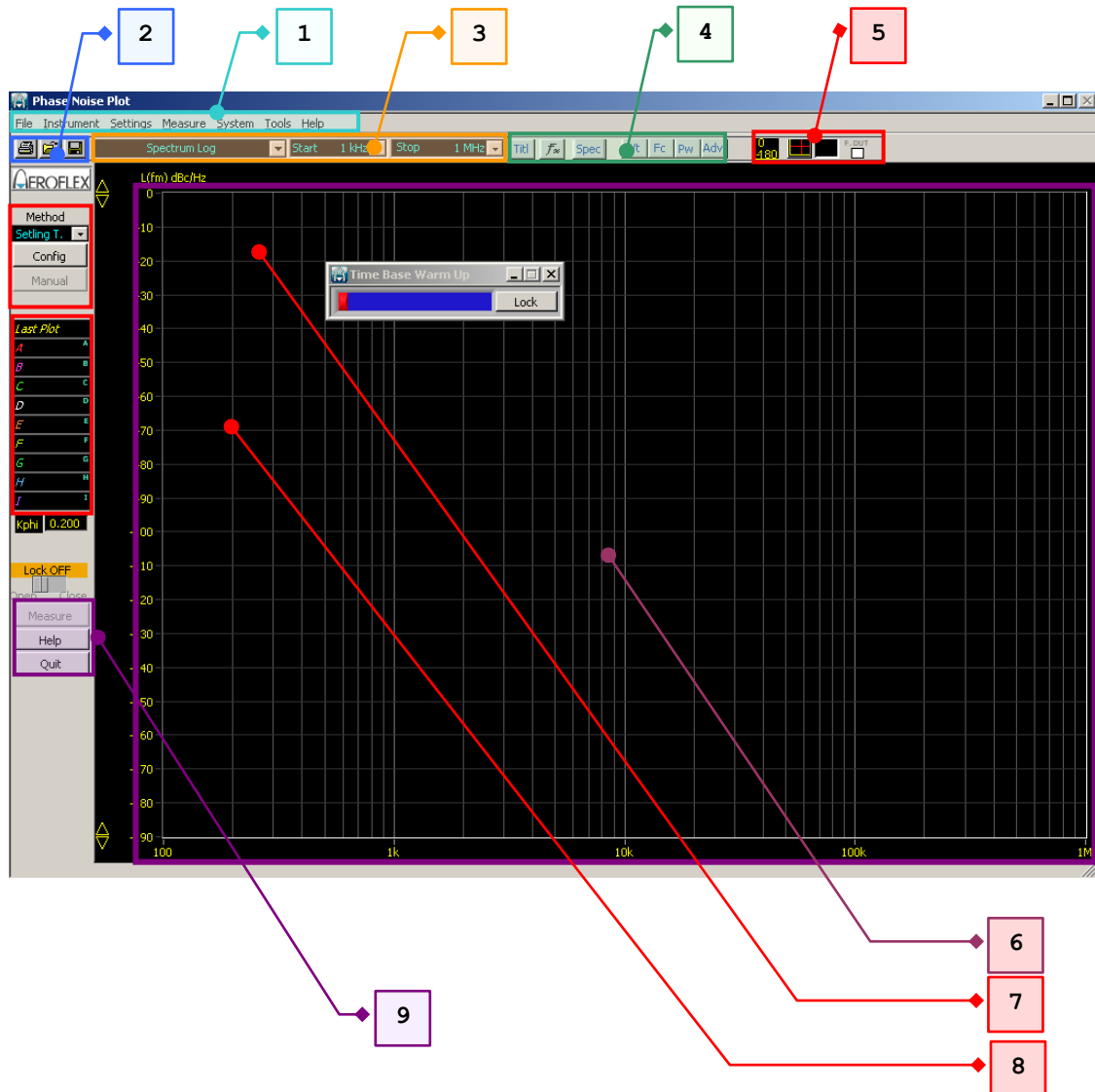
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WPN9000 MAIN DISPLAY

WPN9000 Series Panel

Main Panel WPN9000 series software:



- 1: Top Menu (All Access functions).
- 2: Files Managements (Open, Save, Print Files).
- 3: Range and Display scales environment.
- 4: Shorts cuts usually functions.
- 5: Range and display functions.
- 6: Curves Display zone.
- 7: Methods and configurations measurements mode.
- 8: Memory emplacements.
- 9: Help access, shorts cuts Measurement and Quit WPN9000 application.

Top Bar Display

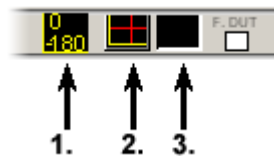
DISPLAY SCALE



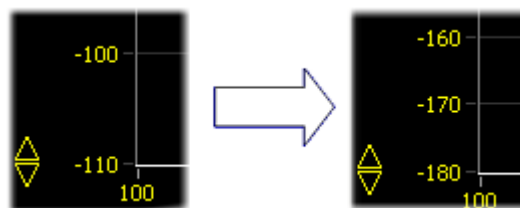
Selection of display windows: Time domain, Spectrum with Log scale, Spectrum with Log scale + Time Domain, Spectrum with Linear scale, Spectrum with Linear scale + Time Domain.

Selection of the start and stop scale: Start, Stop. To modify Scale click in Start or Ending Value in X Scale.

Title: To enter a curve title.

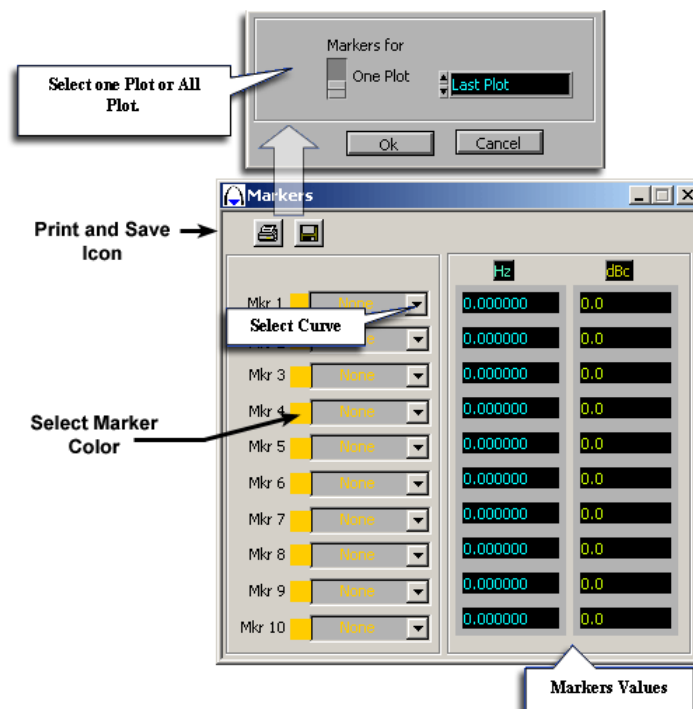


1.) **0 -180:** Set reference scale = 0dBc/Hz max / -180dBc/Hz min.

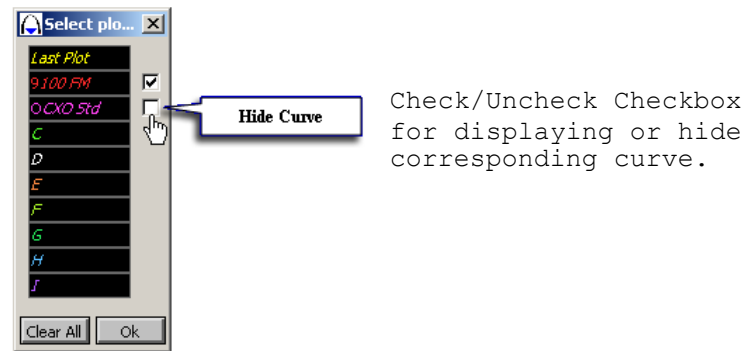


2.) **Red Cross:** Sets the markers.

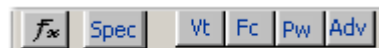
- Select the curve "Last plot, A B C To apply the markers 1 or 2.
- Then move the markers with the "mouse"



3.) **Black Box:** The user can select the curves he wants to clear. But they will not be erased.



SHORT CUT BAR



Short cut for the math tools, see Tools in WPN9000 Manual for more information.



Short cut for the menu spec line, see Specline in WPN9000 Manual for more information.



Short cut for the menu Tune Voltage, see Tune Voltage in WPN9000 Manual for more information.



Short cut for the menu Frequency counter, see Frequency Counter in WPN9000 Manual for more information.



Short cut for the menu Power meter, see Power Meter in WPN9000 Manual for more information.

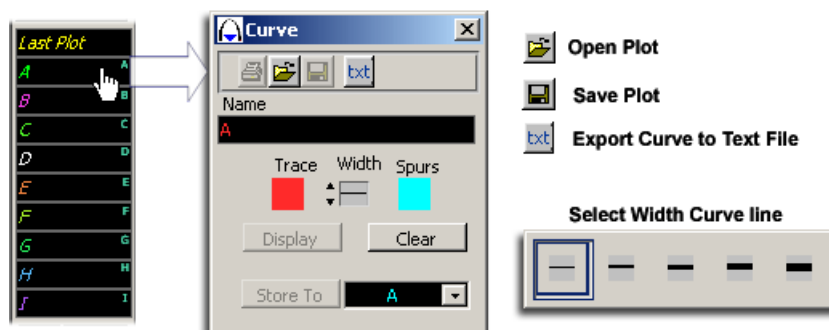


Short cut for the menu Advanced, see Advanced in WPN9000 Manual for more information.

Left Bar Menu

Memory:

There are ten direct memories to store the current curves. After a measurement was run, the curve is stored in the first memory, called "Last Plot". This memory can be stored in the nine other memories from A to I.



When opening the menu of each memory, the user can change the name, display the curve, clear the memory, and store a memory into another one. He can change these parameters when he selects "Trace", "Width", "Spurs".

Kphi Measurement

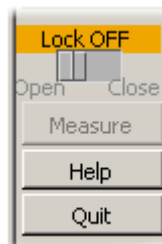


➡ More information see : Demodulation Factor.

Measurement

After selecting the measurement menu (either Manual or Auto mode), the user has a direct access to the main commands to run a measurement:

- Run the calibration: OdB Ref.



Lock OFF (Open/Close): Open or Close the Loop.

Measurement: Run a measurement.

Help: Open WPN9000 Series local help file.

For these processes, calibration lock measurement, use the parameters defined in Manual mode.

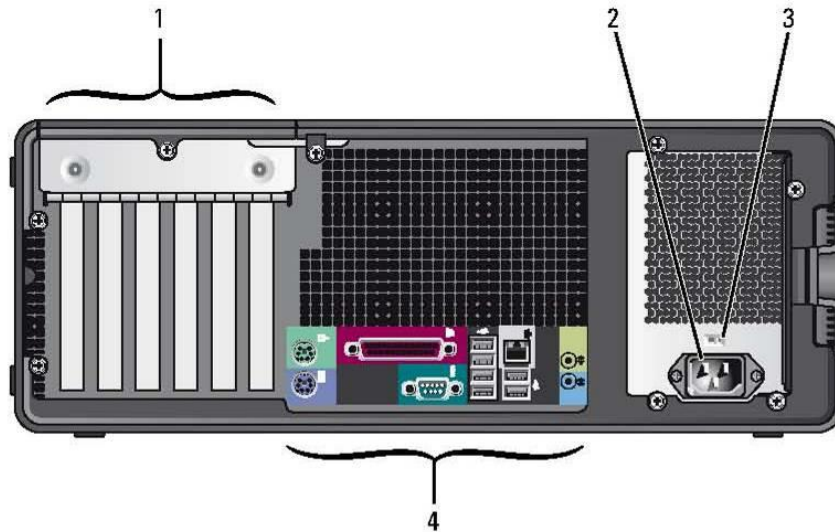
Quit: Exit WPN9000 software.

2

CABLINGS SYSTEM AND PN9000 PHASE NOISE TEST SET

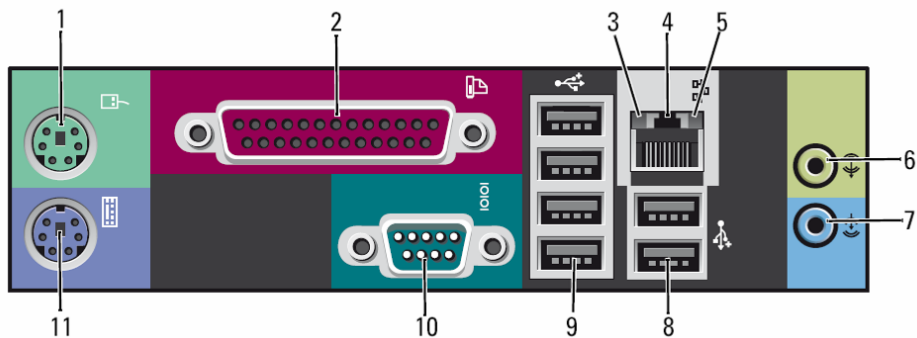
DELL Computer Rear Panel

Standard Computer Tower case or desktop orientation compatible.



- | | |
|----|--|
| 1. | Slots Cards Extension |
| 2. | Power connector |
| 3. | Voltage selection switch (may not be available on all computers) |
| 4. | CPU Motherboard and other devices |
| 5. | PN96 ,Sampling Board version |
| 6. | GPIB Card |

Motherboard Rear I/O



- | | |
|-----|----------------------------------|
| 1. | Mouse connector |
| 2. | Parallel connector |
| 3. | Link integrity light |
| 4. | Network adapter connector |
| 5. | Network activity light |
| 6. | Line-Out connector |
| 7. | Line-in connector |
| 8. | Rear Dual USB 2.0 connectors (2) |
| 9. | Rear Quad USB 2.0 connectors (4) |
| 10. | Serial connector |
| 11. | Keyboard connector |

Cabling Devices to DELL Computer (Standard)

HOW TO CONNECT MOUSE AND KEYBOARD TO COMPUTER:

Plug a PS/2 mouse into the green mouse connector. Turn off the computer and any attached devices before you connect a mouse to the computer. If you have a USB mouse, plug it into a USB connector.

If you have a PS/2 keyboard, plug it into the purple keyboard connector. If you have a USB keyboard, plug it into a USB connector.

(Keyboard and Mouse graphic is for illustration only. Product appearance may vary.)



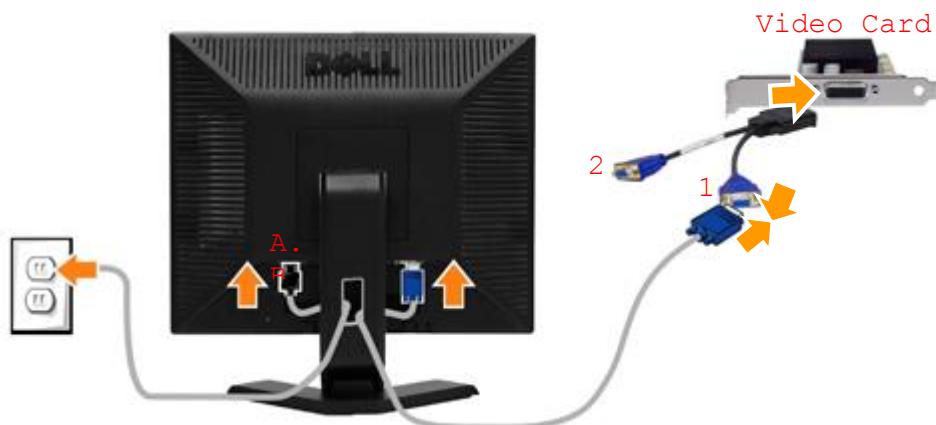
HOW TO CONNECT MONITOR TO COMPUTER:

Turn off your computer and unplug its power cable.

The NVIDIA® Quadro NVS 280/290 PCIe-based graphics card is equipped with one high-density single-link DVS-59 Connector.

Connect the Dual DVI-I or Dual VGA Connector to Graphic card connector from your computer. Plug blue connector number 1 (analog D-sub) to display's cable.

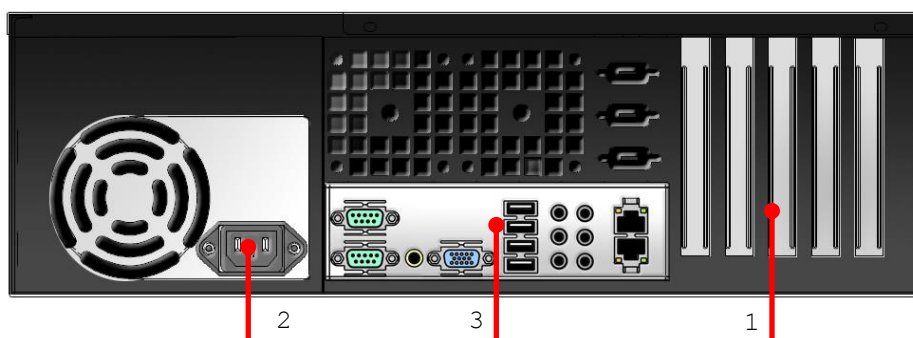
(Monitor graphic is for illustration only. Product appearance may vary.)



- | | |
|----|--|
| A. | Power Cord, plugs into monitor and wall receptacle |
| B. | 15-pin D-sub signal cable(Used for analog video and is detachable) |
| 1. | VGA analog connector Number 1 |
| 2. | VGA analog connector Number 2 (Mode Dual Monitors) |

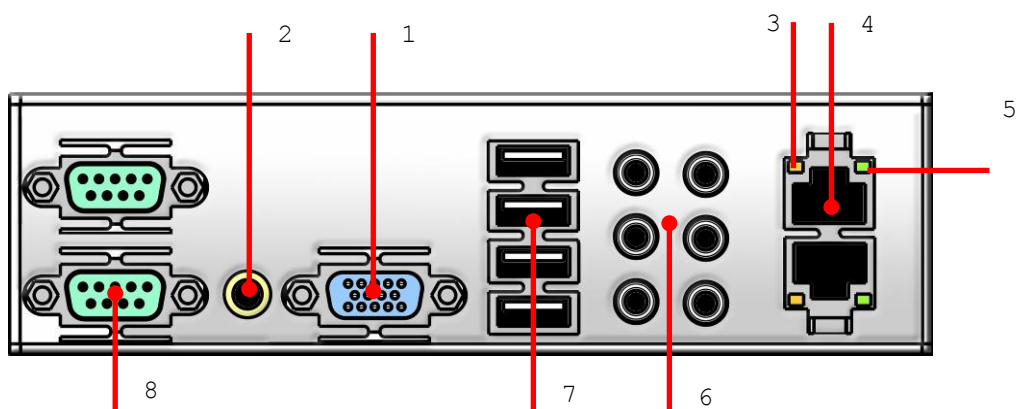
Rack-Mount Computer Rear Panel (Optional)

3U 19" Rack-mount Computer standard form.



- | | |
|----|-----------------------------------|
| 1. | Slots Cards Extension |
| 2. | AC Power connector |
| 3. | CPU Motherboard and other devices |

Motherboard Rear I/O



- | | |
|----|----------------------------------|
| 1. | HD15 Video connector |
| 2. | SPDIF Audio connector |
| 3. | Link integrity light |
| 4. | Network adapter connector |
| 5. | Network activity light |
| 6. | Audio connectors |
| 7. | Rear Quad USB 2.0 connectors (4) |
| 8. | Serial connector COM1 |

Cabling Devices to Rack-mount Computer

The Keyboard + Mouse and the Display monitor Pack are not included with the default rack-mount computer, this is an option.

HOW TO CONNECT MOUSE AND KEYBOARD TO COMPUTER:

Plug a USB mouse into the USB connector. Turn off the computer and any attached devices before you connect a mouse to the computer.

If you have a USB keyboard, plug it into the free USB connector.

(Keyboard and Mouse graphic is for illustration only. Product appearance may vary.)



HOW TO CONNECT MONITOR TO COMPUTER:

Turn off your computer and unplug its power cable.

Connect the blue (analog D-sub) display connector cable to the corresponding video port on the back of your computer.

(Monitor graphic is for illustration only. Product appearance may vary.)



- | | |
|----|--|
| A. | Power Cord, plugs into monitor and wall receptacle |
| B. | 15-pin D-sub signal cable(Used for analog video and is detachable) |
| 1. | VGA analog connector Number 1 |
| 2. | VGA analog connector Number 2 (Mode Dual Monitors) |

Cabling KVM devices to Rack-mount Computer

The KVM pack is not included with the default system rack-mount computer, this is an option.

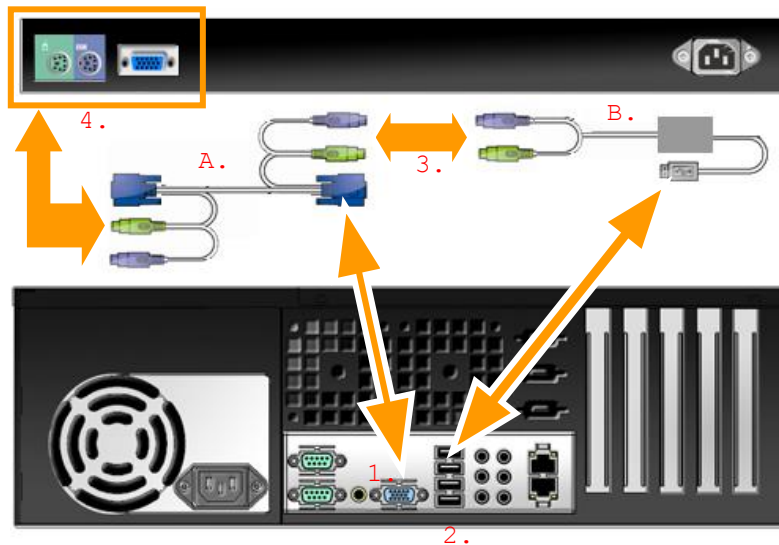


Insert Rack-mount computer and KVM controller on the cabinet rail. Fix the slider rack-mount bracket to cabinet rail, and then slide the unit into the bracket.



HOW TO CONNECT KVM TO COMPUTER:

Turn off your computer and unplug its power cable.
Connect cables between KVM and Rack-mount computer, see figure.



- | | |
|----|---|
| A. | Specifically KVM octopus Cable |
| B. | Converter USB / PS2 cable (Only if Motherboard do not have PS2 ports) |
| 1. | VGA analog connector |
| 2. | USB motherboard connectors |
| 3. | PS2 M/F connectors |
| 4. | KVM rear I/O connectors |

Computers Common Cablings

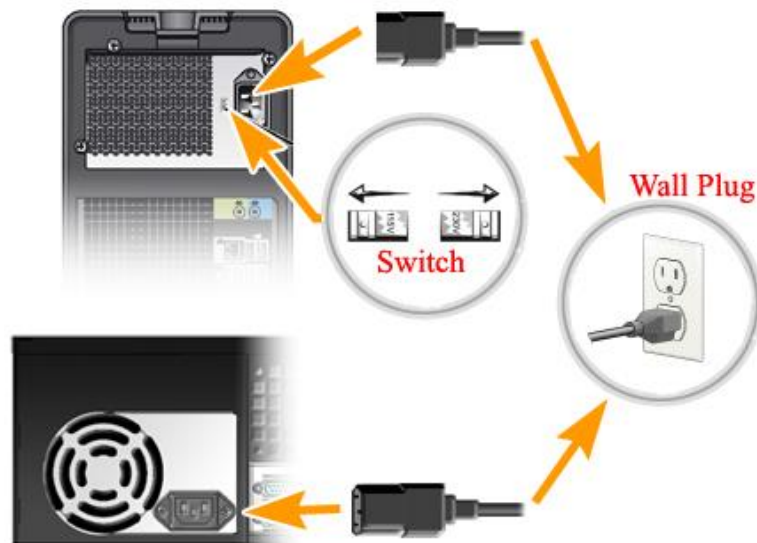
Cabling Computers Power Supply

Insert the power cable.

Your computer is equipped with either an auto-sensing voltage selector or a manual voltage selection switch.

Computers with an auto-sensing voltage selector (Rack-mount Power supply) do not have a voltage selection switch on the back panel and can automatically detect the correct operating voltage.

To help avoid damaging a computer with a manual voltage selection switch, set the switch for the voltage that most closely matches the AC power available in your location.



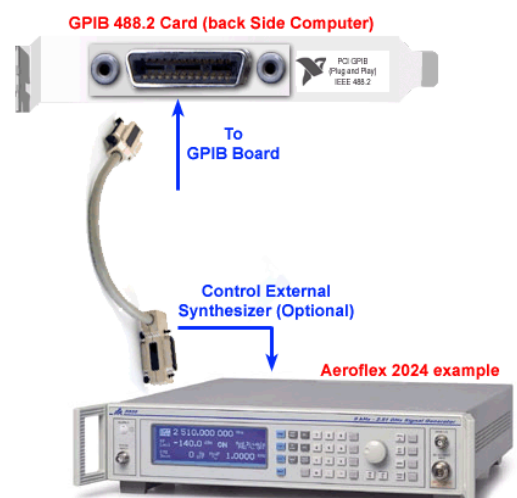
NOTICE: The voltage selection switch must be set to the 115-V position even though the AC power available in Japan is 100-V.

Connect NI GPIB 488.2 Computer Card



For Control an External GPIB Synthesizer or Colby Instruments' Programmable Delay Line (PDL) Series instruments (Optional with Microwave Pulse measurements).

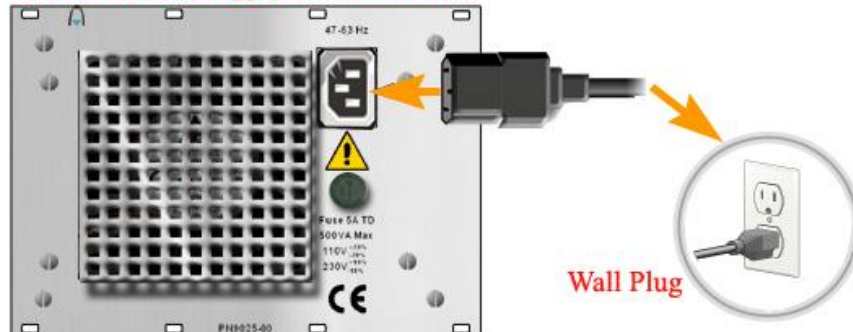
Connect Internal GPIB computer card to Devices.



PN9000 Series and DCNTS Cablings

Cabling PN9000 Series Power Supply

PN9000 Power Supply (Back Side PN9000)



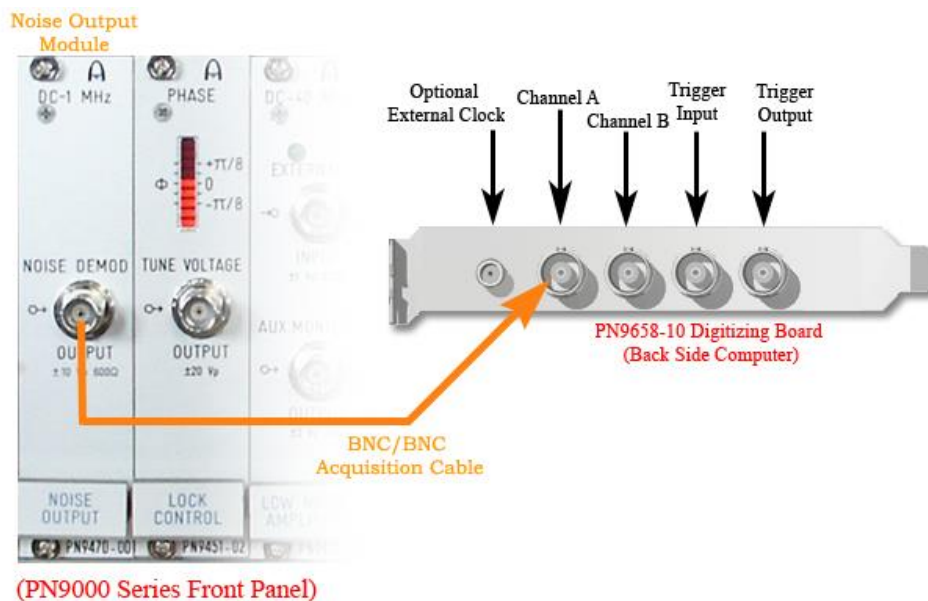
Insert the power cable.

Your PN9000 is equipped with either an auto-sensing voltage selector or a manual voltage selection switch.

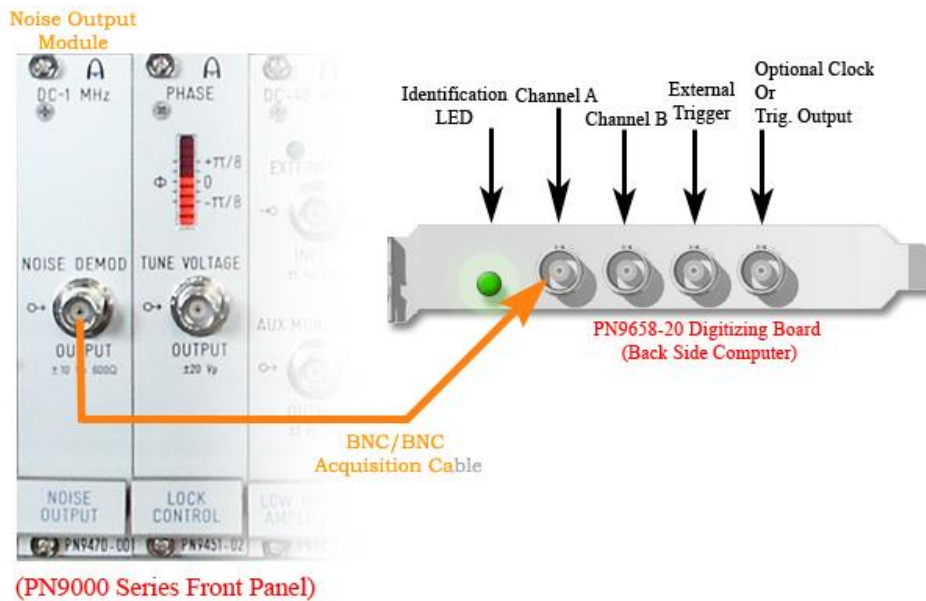
PN9000 with an auto-sensing voltage selector (PN9025-00 for example) do not have a voltage selection switch on the back panel and can automatically detect the correct operating voltage.

Cabling First Sampling Board (PN9658-XX)

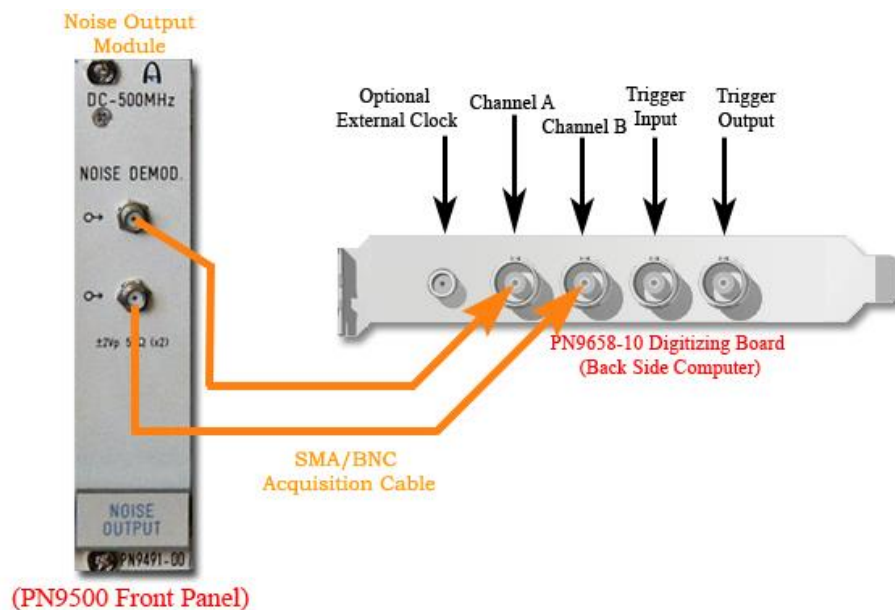
Cabling Acquisition board PN9658-10 or PN9658-15 for PN9000 Series with noise Output modules up to 20MHz bandwidth and WPN9000 Standard, HR software versions:



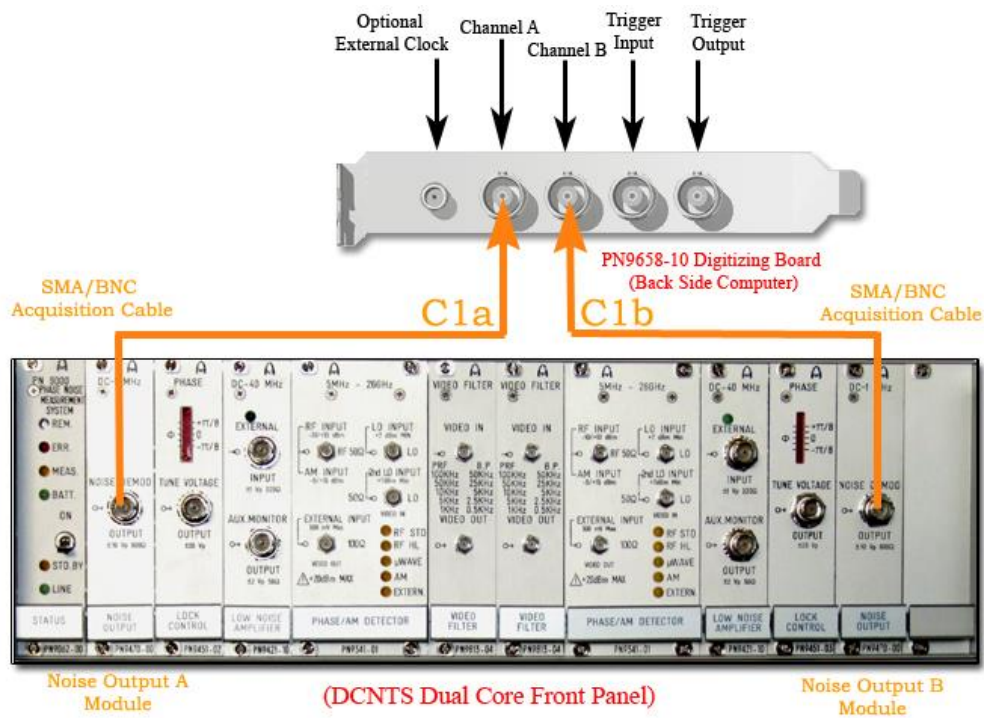
Cabling Acquisition board PN9658-20 for PN9000 Series with noise Output module 1MHz bandwidth and WPN9000 Standard, HR software versions:



Cabling Acquisition board PN9658-10 or PN9658-15 for PN9500 with noise Output module 500MHz bandwidth and WPN9500 software version:



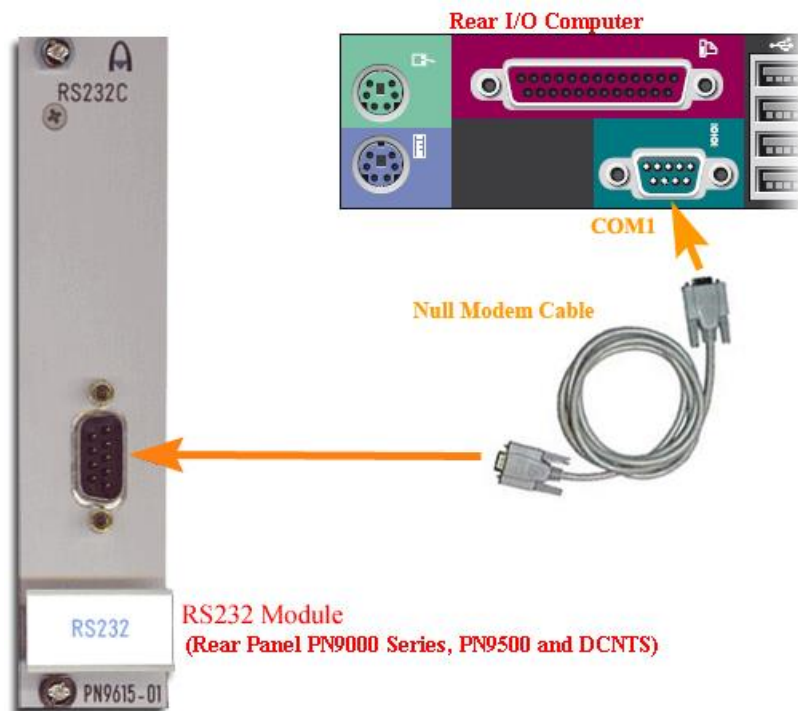
Cabling Acquisition board PN9658-10 or PN9658-15 for DCNTS (Dual Core) with noise Output module 40MHz bandwidth and DCNTS software versions:



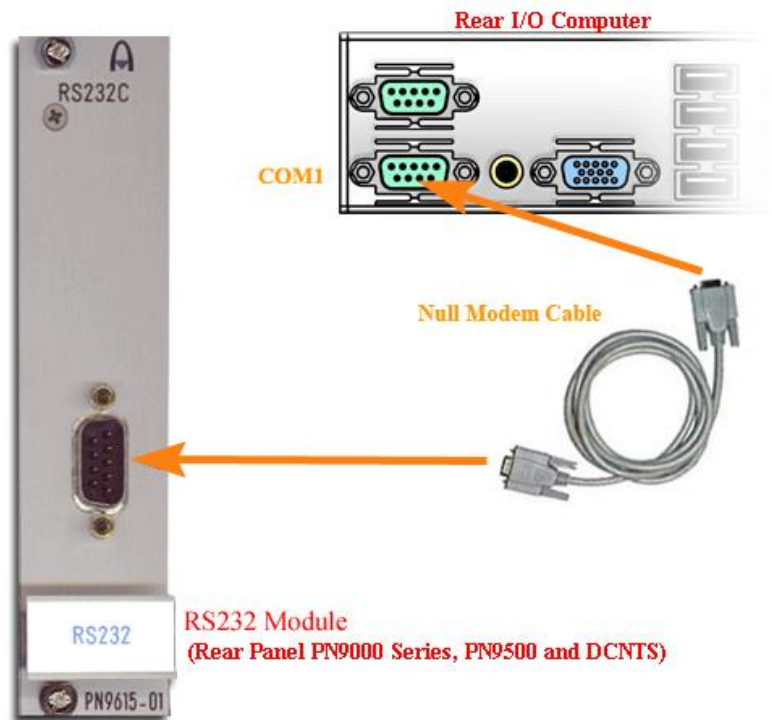
Cabling Serial Control PN9000 (PN9615-XX)

Only with the PN9615-XX module.

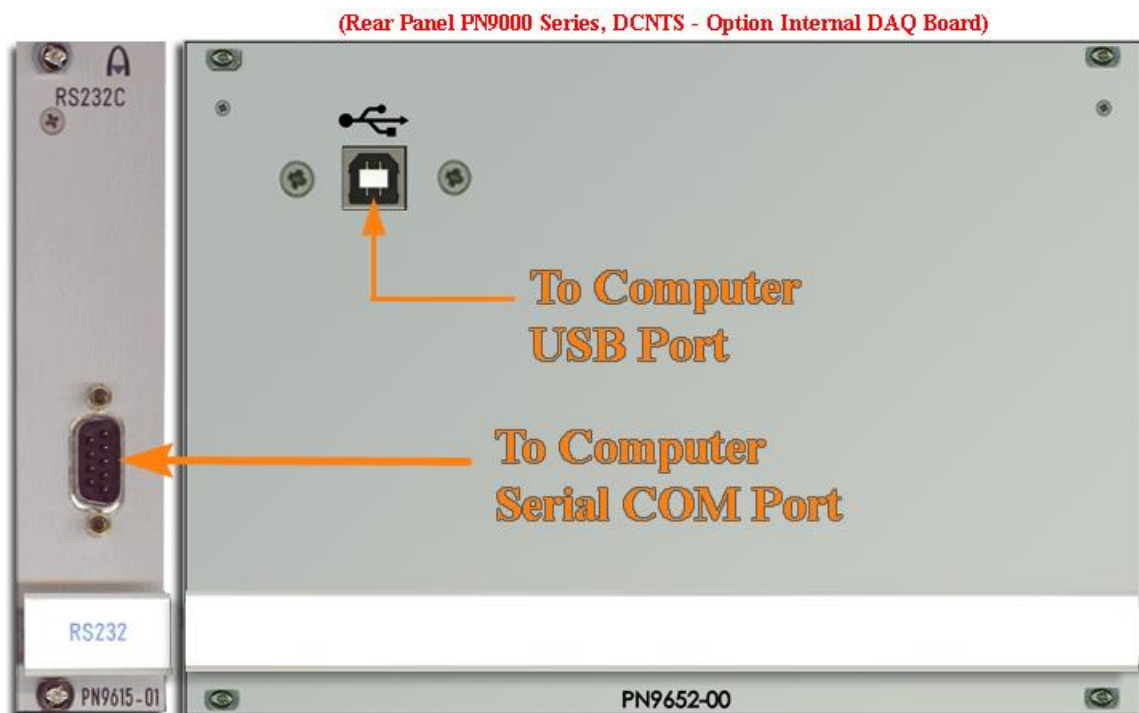
Connect the serial Null-Modem cable from COM port DELL computer's to PN9000 Series module RS232.



Connect the serial Null-Modem cable from COM port Rack-Mount computer's to PN9000 Series module RS232.



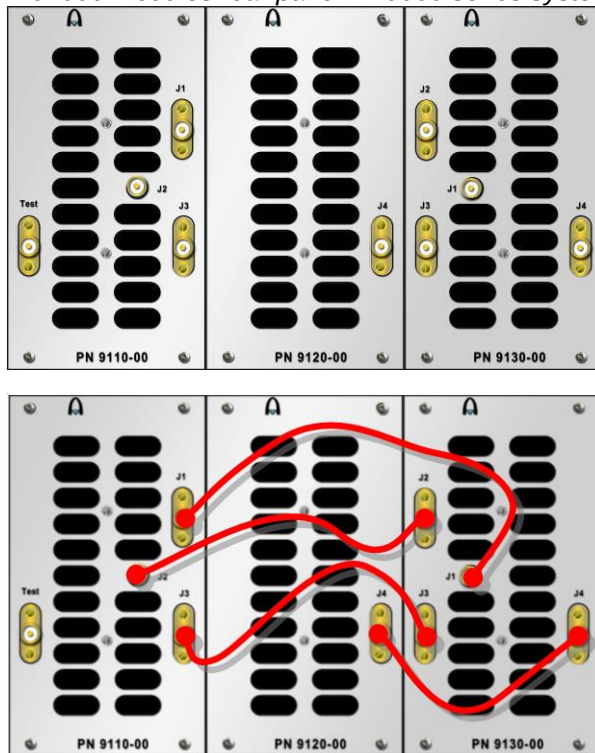
(With option Internal DAQ board) Connect the serial Null-Modem cable from COM port computer's to PN9000 Series module RS232 and USB Cable between Computer and PN9000 system.



SMA cabling internal source synthesizer (Option PN9100-XX)

Only with the PN9100-XX Option, internal low noise synthesizer 4.5 GHz up to 18 GHz with optionally Doublers modules.

PN91000 modules rear panel PN9000 series system



Coax Cabling List:

J1 → J1 PN9130-00
J2 → J2 PN9130-00
J3 → J3 PN9130-00
J1 → J4 PN9120-00

Test → Support Only

3

CABLINGS PN9000

Getting Started with PN9000

A) CONNECTING THE SYSTEM

Switch the right Voltage range on the back of the PN9000 chassis. The computer is automatically switched to the right Voltage range.

Connect the computer and the PN9000 chassis to the Line.

Connect the computer to the PN9000 chassis using :

- An IEEE cable (PN9000 address should be : 1)
- A "dedicated" coaxial cable from the PN9000 NOISE OUTPUT module to the digitizing board on the back of the computer.

Connections of the others coaxial cables depend on the measurement method see the user interface menu: Device type/Config, showing the cabling for each method.

B) STARTING THE SYSTEM UP

The PN9000 chassis has to be switched on few seconds before launching the software. After loading the software the red Bar Graph should be lighted on all the way up to the "0" guide mark. The Blue led of the status module, Remote Led, should be lighted. By acting the "Lock on/Lock off" command, bottom left of the main screen, the Bar Graph must change from several bars to one bar display. This command tests if the chassis is right controlled through IEEE by the computer.

C) STARTING A MEASUREMENT

Select first the right type of Device under test: menu "**Method**".

There are three main configurations :

- Stable source (PLL, Synthesizer, Crystal) measured with a remote controllable synthesizer as reference, with the PLL method.



See method PLL "Phase noise method PLL measurement"

- Stable source (Crystal) measured with a Crystal oscillator as reference, with the PLL method.



See method Crystal "Phase noise method Crystal measurement"

- Unstable source (VCO) measured with the delay line method.

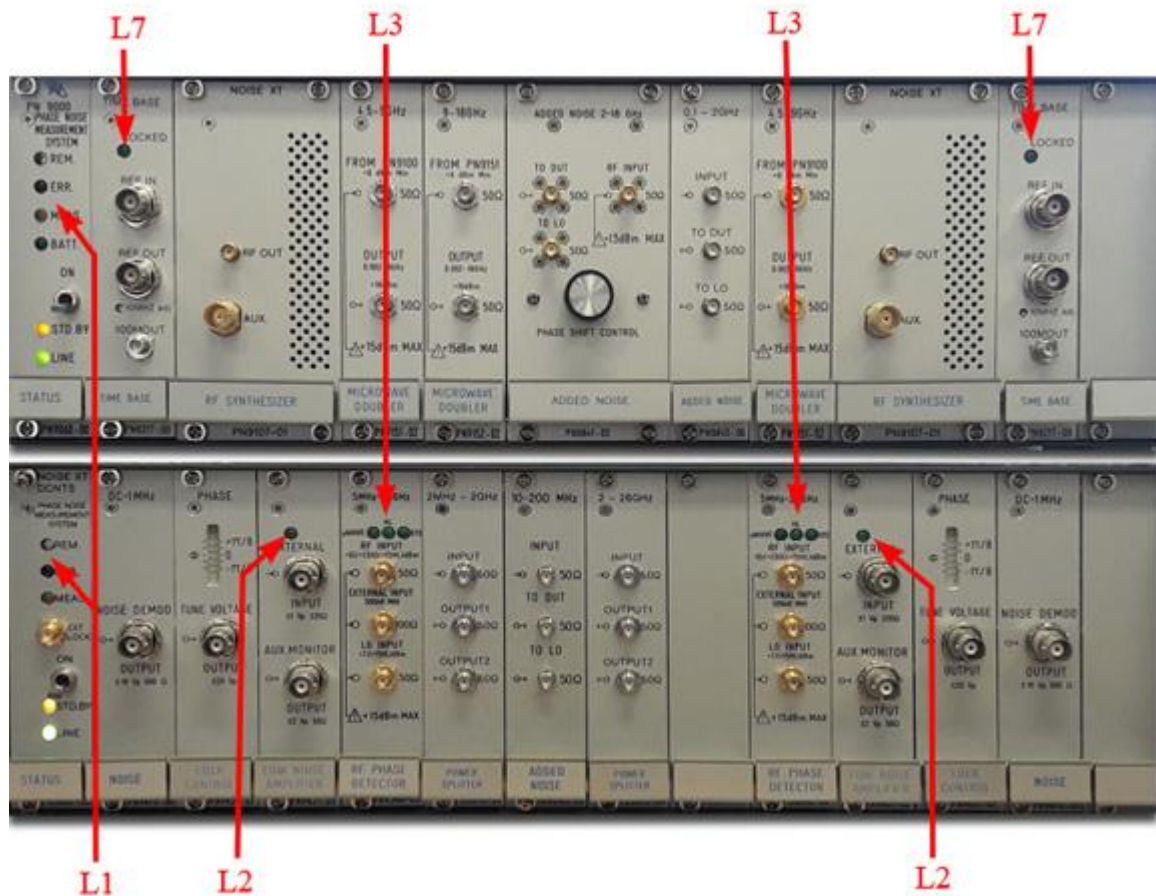


See method VCO "Phase noise method VCO measurement"



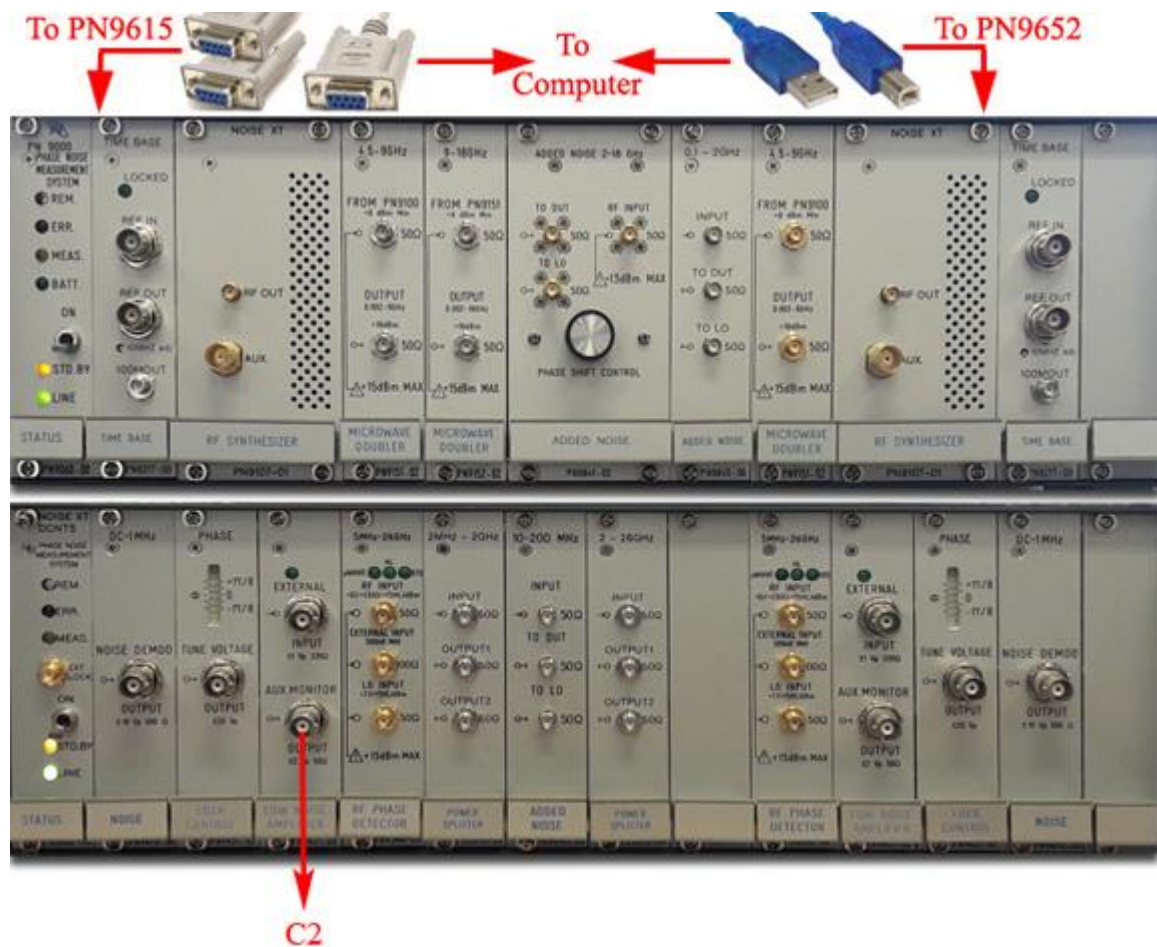
There are two ways of running a measurement: manual or automatic: The manual mode allows the operator to run the measurement step per step: calibration, lock, spectral analysis. The automatic mode runs all the measurement in one step.

D) LED INDICATOR



- **L1:** Status led:
- REM: remote control always lighted-on.
- ERR: error control lighted-on in case of measurement error.
- MEAS: lighted-on during the spectral analysis.
- BATT: not used.
- **L2:** Noise channel indicator: External input (lighted-on) or internal phase detector (lighted-off).
- **L3:** Phase detector selection indicator.
- **L4:** 10 MHz / 100 MHz OCXO power indicator.
- **L5:** PN 9100 power indicator (Present software version, always on).
- **L6:** Microwave DRO lock indicator, locked = lighted-on.
- Always lighted-on except for the 2GHz and off position.
- **L7:** Time Base lock indicator. An internal 100 MHz is locked on a 10 MHz OCXO.. Always on.

D) INITIAL CABLING



- **C1 or C1_a & C1_b**: Connection to the computer. Always connected.
- **C2**: Auxiliary output can be connected to a scope or a spectrum analyzer.
- **C3**: Connection to the delay-line 100 / 20 nsec.
- **C4**: Microwave down converter reference frequencies.
- **C5**: Internal 10 MHz Time Base. Always connected.

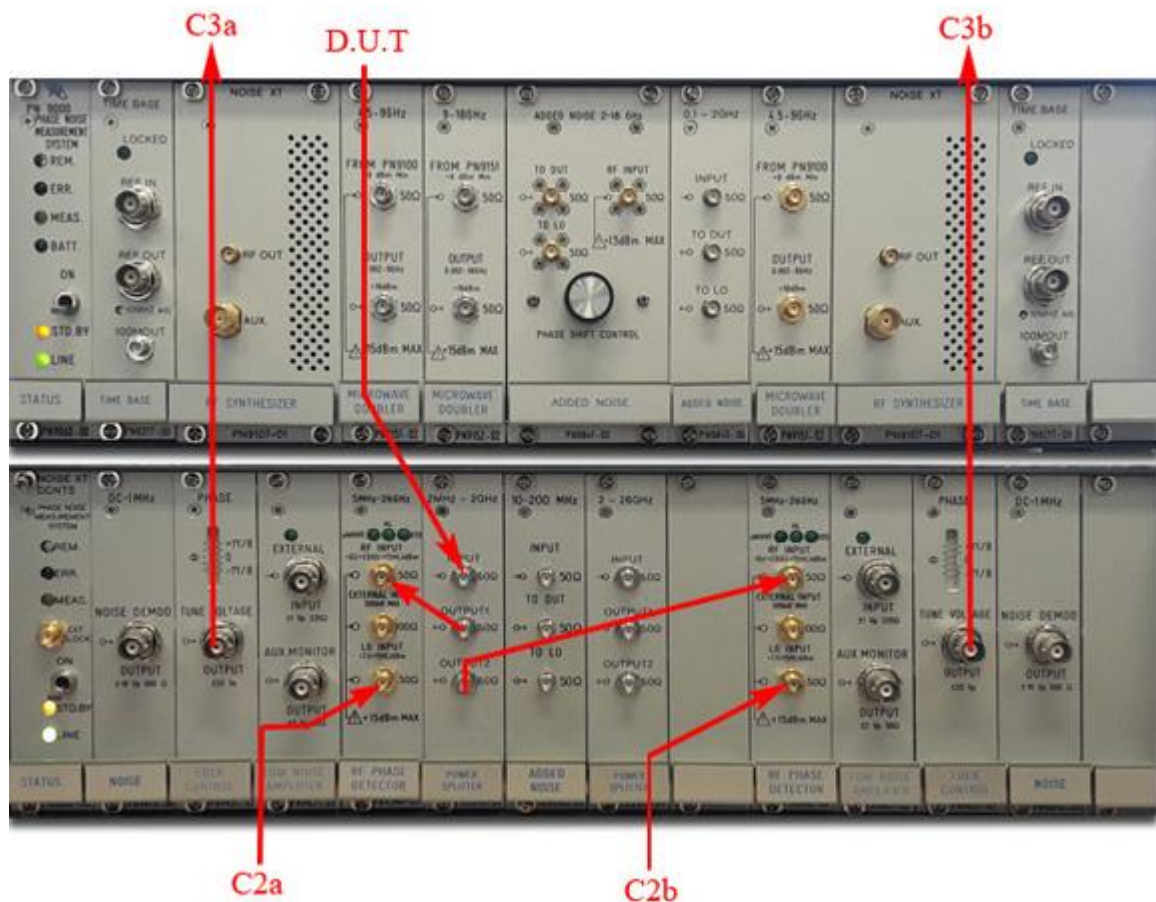
Crystal oscillator source measured with an internal crystal oscillator as reference

NOISE XT



- **C1 or C1_a & C1_b**: Connection to the computer.
 - **C2**: 10 MHz or 100 MHz VCXO Reference source (others frequencies are available).
 - **C3**: Reference VCXO locking control.
 - **L1**: The corresponding led 10 MHz/100 MHz should be lighted-on.
 - **D.U.T**: Device Under Test.
 - Should be very stable source.
 - Very close to 10 MHz and 100 MHz.
 - The DUT can be connected to a PN9820 Buffer to adapt the input impedance and Power.
- For theory of process see: [Application note PLL](#).
- For software menu see: [Operating mode: method VCO](#).

Crystal oscillator source measured with an external crystal oscillator as reference



- **C1 or C1_a & C1_b:** Connection to the computer.
- **C2 or C1_a & C1_b:** External VCXO Reference source (this source should have a DC frequency control).
- **C3 or C3_a & C3_b:** Reference VCXO locking control (DC frequency control).
- **D.U.T:** Device Under Test.
 - Should be very stable source.
 - Very close to the reference source.
 - The DUT can be connected to a PN9820 Buffer to adapt the input impedance and Power.

- For theory of process see: [Application note PLL](#).
- For software menu see: [Operating mode: Crystal](#).

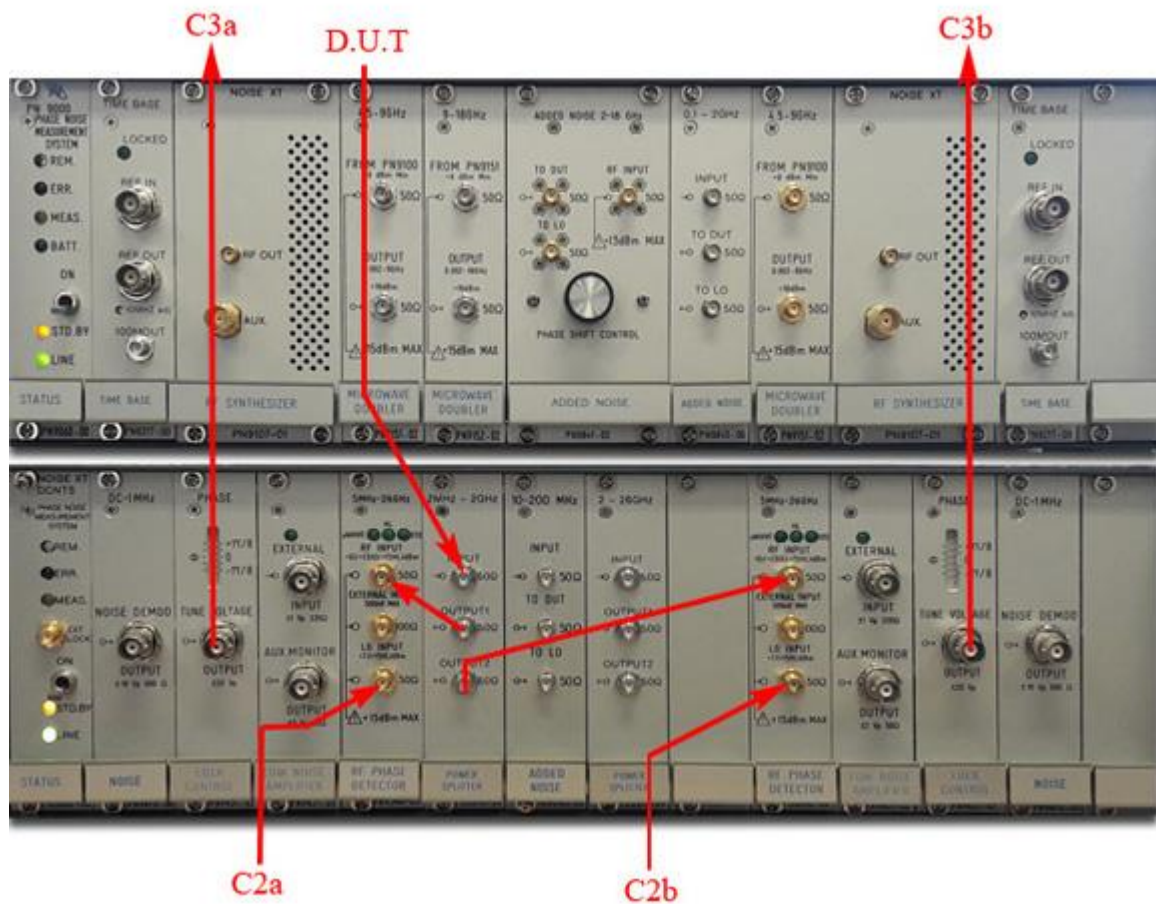
PLL, stable source measured with the synthesizer PN8100/9100 as reference

NOISE XT



- **C1 or C1_a & C1_b:** Connection to the computer.
 - **C2:** PN 9100 Reference source connected to the Phase detector LO port.
 - **C3:** PN 9100 locking control.
 - **D.U.T:** Device Under Test.
 - Should be stable source.
 - The PN 9100 is working up to 4.5 GHz.
 - In the range 5 MHz. 1.8 GHz use the RF Phase detector.
 - In the range 1.8 GHz 4.5 GHz uses the microwave Phase detector.
 - **L1:** PN9100 Power-on led.
 - **L2:** Lock control Led should be lighted-on.
- For theory of process see: [Application Note PLL](#).
- For software menu see: [Operating mode: PLL RF](#).

PLL, stable source measured with an external synthesizer as reference



- **C1 or C1_a & C1_b:** Connection to the computer.
- **C2 or C2_a & C2_b:** External Reference source (this source should be IEEE compatible).
- **C3 or C3_a & C3_b:** Reference locking control (DC frequency control). **D.U.T:** Device Under Test.

- For theory of process see: [Application Note PLL](#).
- For software menu see: [Operating mode: PLL RF](#).

Microwave PLL, stable source measured with the PN9100 and PN9151/52 doublers options up to 18GHz as reference

NOISE XT



- **C1 or C1_a & C1_b:** Connection to the computer.
 - **C2:** If no doublers options are installed, the PN 9100 Reference source is connected to the Phase detector LO port. With doubler options the PN9100 is connected to the doublers and the last doubler output is connected to the Phase detector LO port.
 - **C3:** PN9100 locking control.
 - **D.U.T:** Device Under Test.
 - Should be stable source.
 - The PN 9100 is working up to 4.5 GHz, doubler options up 18GHz.
 - **L1:** PN9100 Power-on led.
 - **L2:** Lock control led should be lighted-on.
- For theory of process see: [Application Note PLL](#).
- For software menu see: [Operating mode: PLL MW](#).

Microwave PLL, stable source measured with a PN925X down converter and the PN9100 as RF reference

NOISE XT



C1 or C1_a & C1_b: Connection to the computer.

C2: External Reference source (this source should be IEEE compatible).

C3: Reference locking control (DC frequency control).

D.U.T: Device Under Test.

- For theory of process see: [Application Note PLL](#).
- For software menu see: [Operating mode: PLL RF](#).

Free running source measured with the Delay Line method

NOISE XT



C1 or C1_a & C1_b: Connection to the computer.

PN9715 type: *This model doesn't include the phase detector.*

C2: Delay-line output Reference channel connected to the Phase detector, LO port.

C3: Delay-line output delayed channel, connected to the Phase detector, RF port.

PN9718/9 type: *This model includes the phase detector.*

C2: Delay-line DC phase detector output connected to Ext port DC coupling.

C3: Delay-line D.U.T auxiliary output connected to the Phase detector, LO port, for frequency measurement.

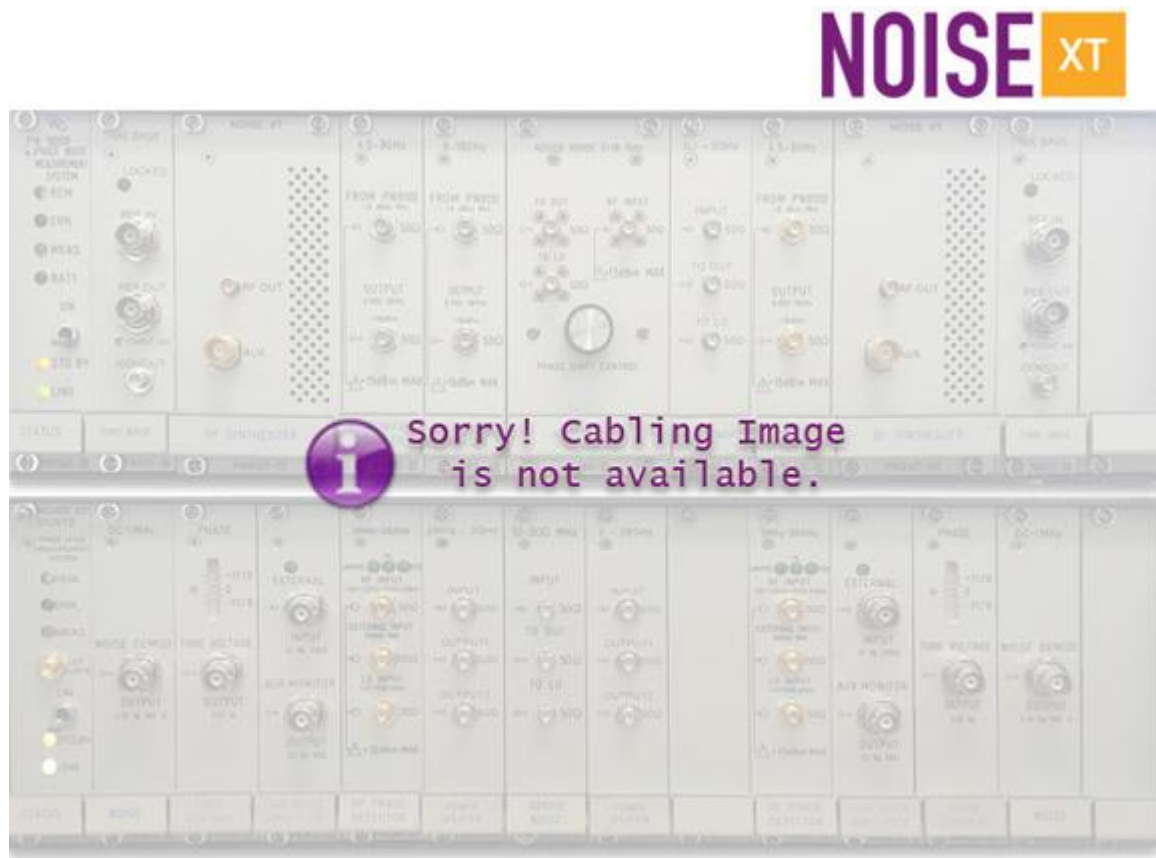
D.U.T: Device Under Test.

- Method adapted to unstable free running source, such as VCO.

To improve the residual noise, the DUT can be connected to a frequency doubler PN9908 before the delay line (the DUT is connected to the doubler and the doubler output is connected to the delay line the output doubling frequency should be compatible with the delay line frequency range).

- For theory of process see: [Application note VCO](#).
- For software menu see: [Operating mode: method VCO](#).

Microwave Free running source measured with the Delay Line and the VCO Down converter method



C1 or C1_a & C1_b: Connection to the computer.

PN9715 type:

C2: Delay-line output Reference channel, connected to the Phase detector, LO port.

C3: Delay-line output delayed channel, connected to the Phase detector, RF port.

PN9718/9 type:

C2: Delay-line output connected to the Phase detector, Ext port.

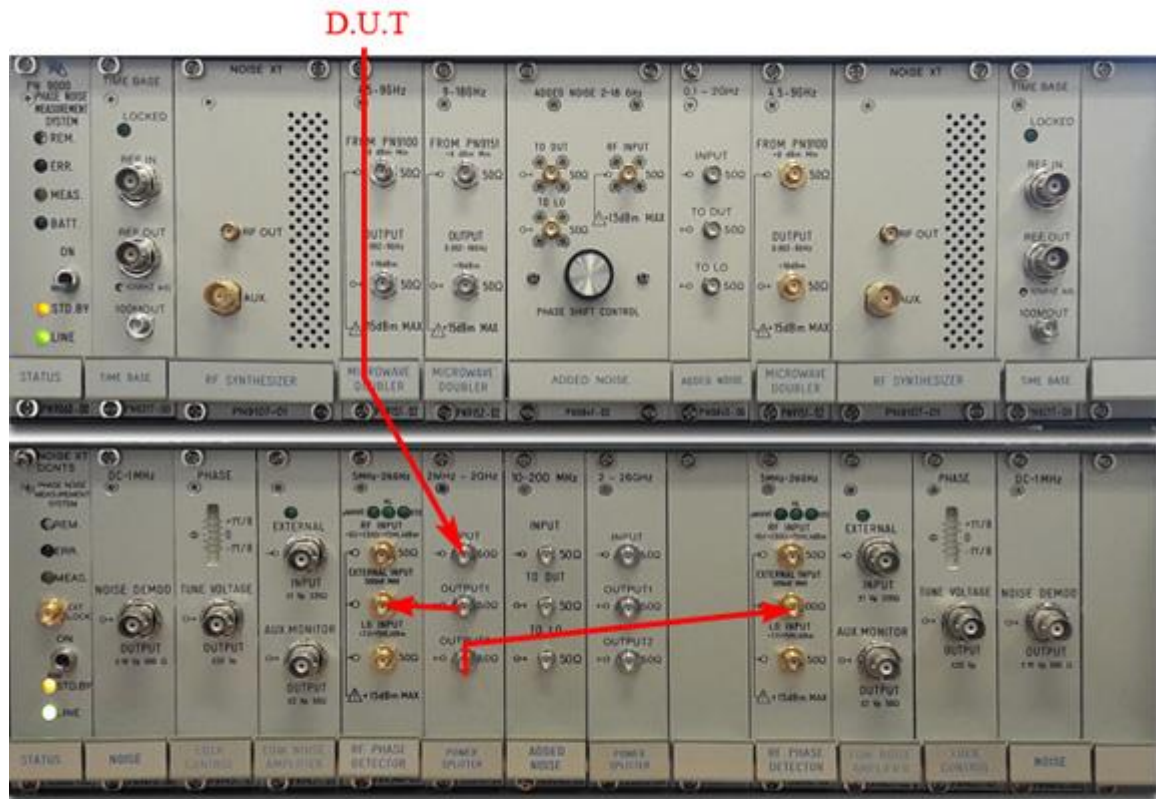
D.U.T: Device Under Test, microwave range > 2GHz.

- Method adapted to unstable free running source, such as VCO.

The microwave VCO is down converted with an internal low noise free run reference source. Inter-modulations can occur between these two input frequencies, so spurs can disturb the measurement, mainly in the 40MHz span. In this case: move the VCO under test by few MHz.

- For theory of process see: [Application note VCO](#).
- For software menu see: [Operating mode: VCO](#).

Noise voltage measurement external:



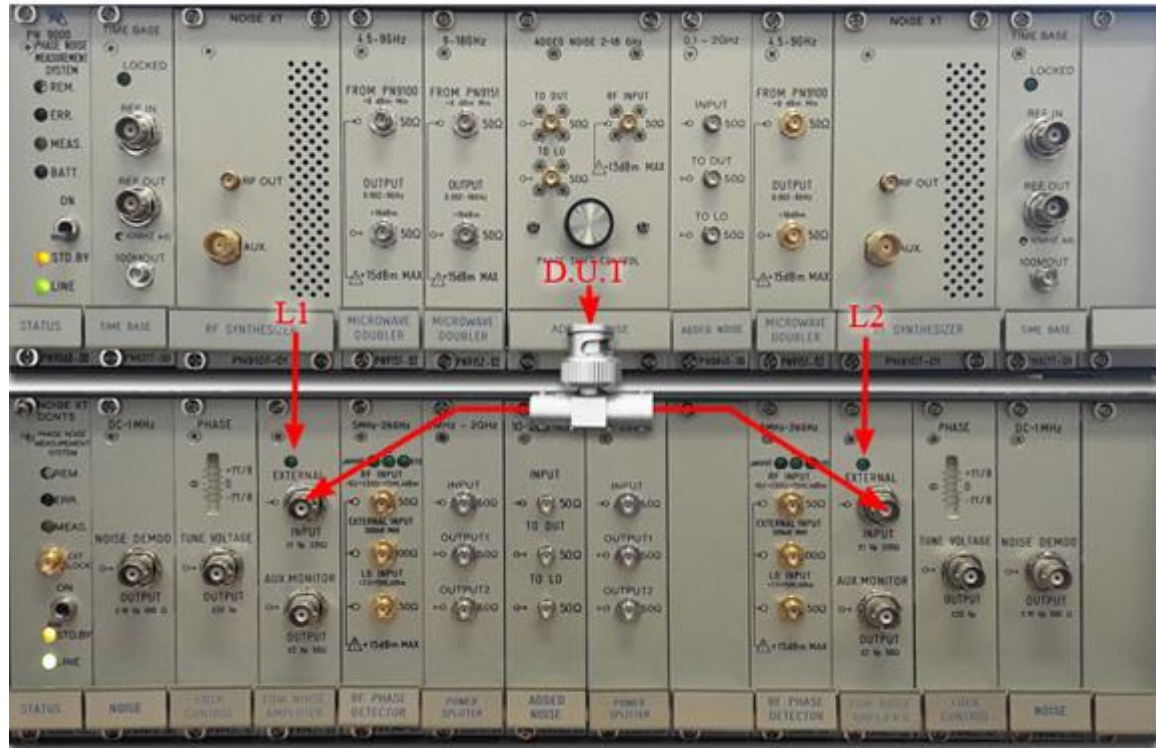
- **C1 or C1_a & C1_b**: Connection to the computer.
- **D.U.T**: External Noise Source Under Test (input impedance = 100 Ohms).

The internal connecting point is just after the RF/Microwave phase detector.

The coupling can be DC or AC, see menu.

This entry is lower noise than the External LNA input.

Noise voltage measurement Low Noise Amplifier (LNA)



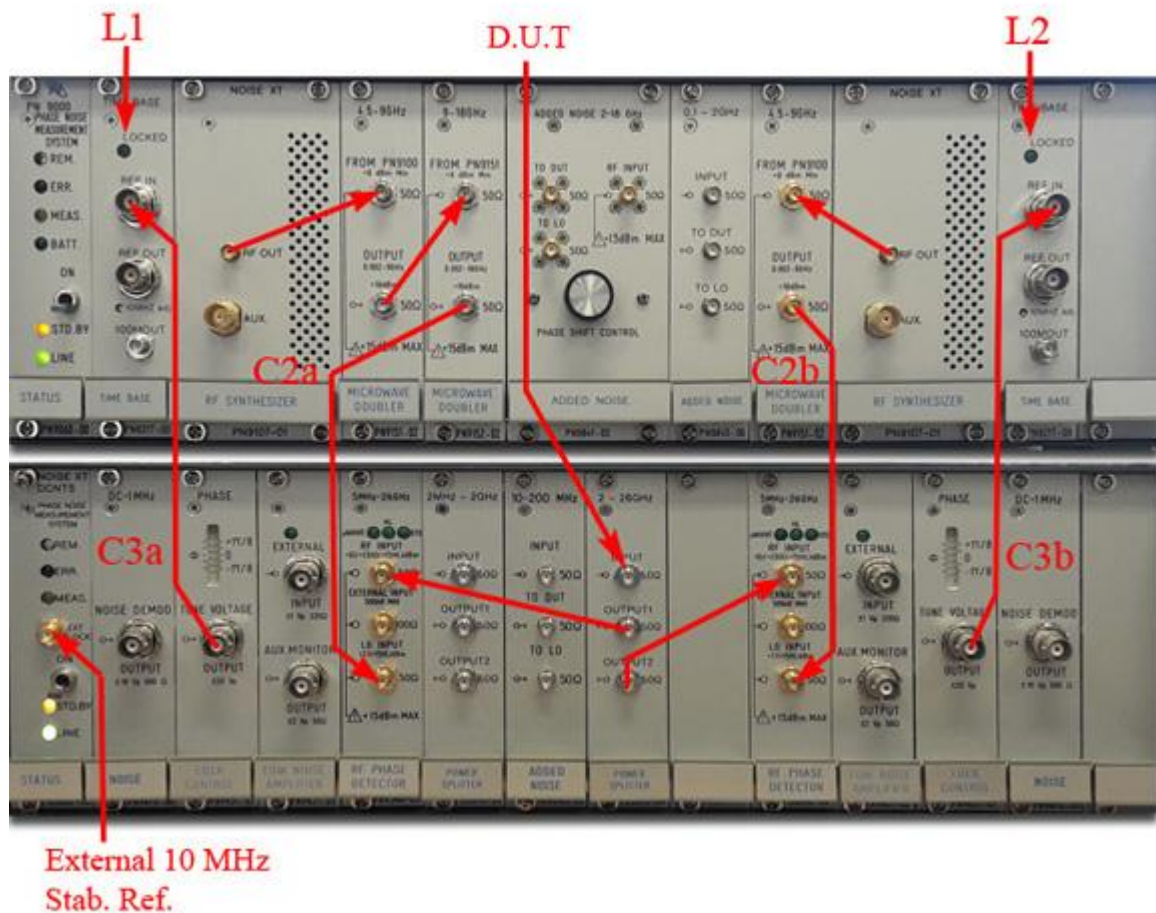
- **C1 or C1_a & C1_b** Connection to the computer.
- **L1**: Noise Amplifier Power-on led.
- **D.U.T**: External Noise Source Under Test (input impedance = 200 Ohms).

The internal connecting point is an input buffer just before the low noise amplifier chain.

The coupling is DC.

Because the input buffer, this entry is higher noise than the External input from the Phase detector module.

Frequency Stability Measurement (Option PN3100)



- **C1 or C1_a & C1_b**: Connection to the computer.
- **10 MHz Out**: Output 10 MHz Time Base; connect to 10 MHz Input Digitizing board.
- **C2**: LO input Stab source. (PN9100 or External Ultra Stab Source)
- **D.U.T** : Device Under Test

Rear Panel PN9000 Series; Input 10 MHz Reference (0dBm)



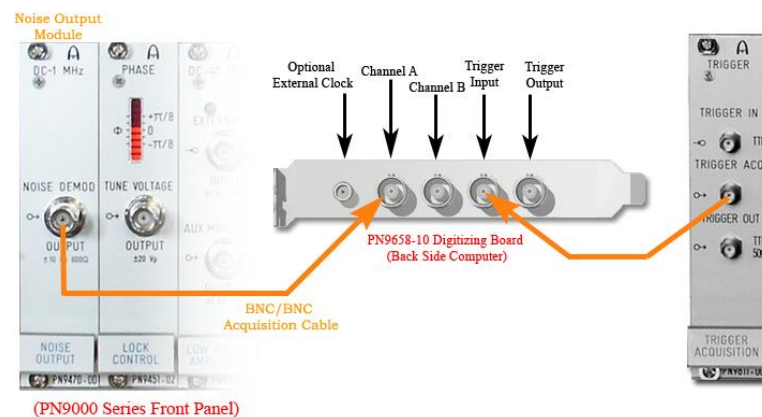
➤ For more information method measurements see: [Method Frequency Stability Measurement](#).

Phase Acquisition Measurement (Option PN3000)

NOISE XT



- **C1 or C_a & C_b**: Connection to the computer.
- **Trigger Input**: External Trigger input.
- **Trigger ACQ**: Trigger output, for start acquisition.
- **D.U.T** : Device Under Test



➤ For more information method measurements see: [Method Phase Acquisition Measurement](#).

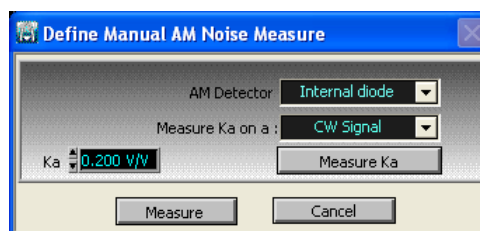
AM measurement

NOISE XT



- **C1 or C_a & C_b**: Connection to the computer.
- **D.U.T**: Device Under Test, 10MHz to 18GHz, Power range -5dBm to +15dBm.

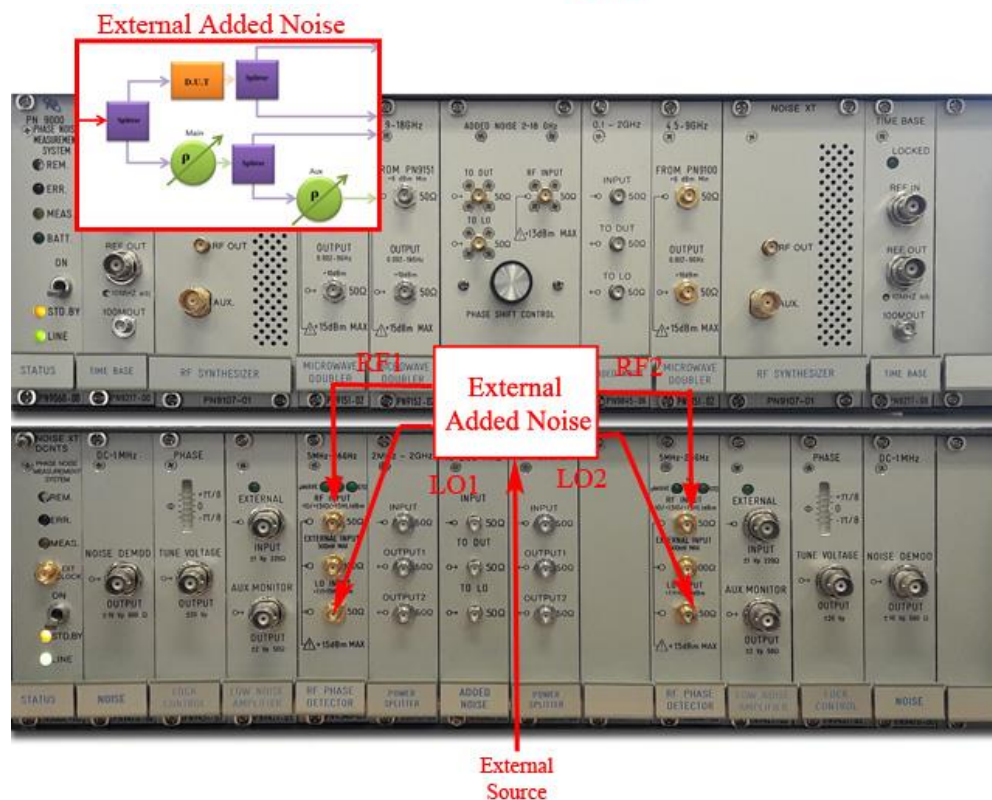
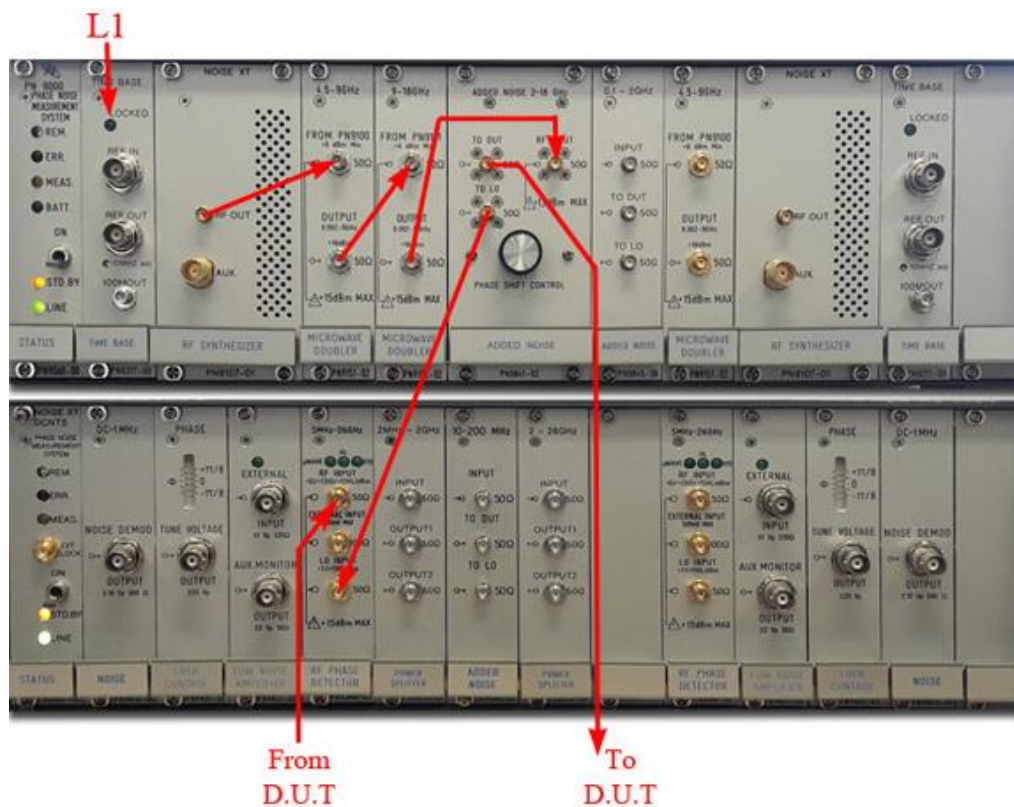
AM Noise Method



With the internal AM detector, to test a source with no AM modulation capability:

- 1) Connect the source to the RF port of the phase detector module .The frequency range is 10MHz to 18GHz.
- 2) Select internal diode and CW Signal.
- 3) Press the key "Measure Ka»: the system measures the demodulation factor and reports the value in the parameter box "Ka", expressed in Volt/Volt.
- 4) Press the key "Measure" to run the spectral analysis. The low frequency range is limited to 10Hz.

Added Noise Measurement



- **C1 or C_a & C_p:** Connection to the computer.
- **C2 & C3:** Other connections.
- **D.U.T:** Device Under Test.

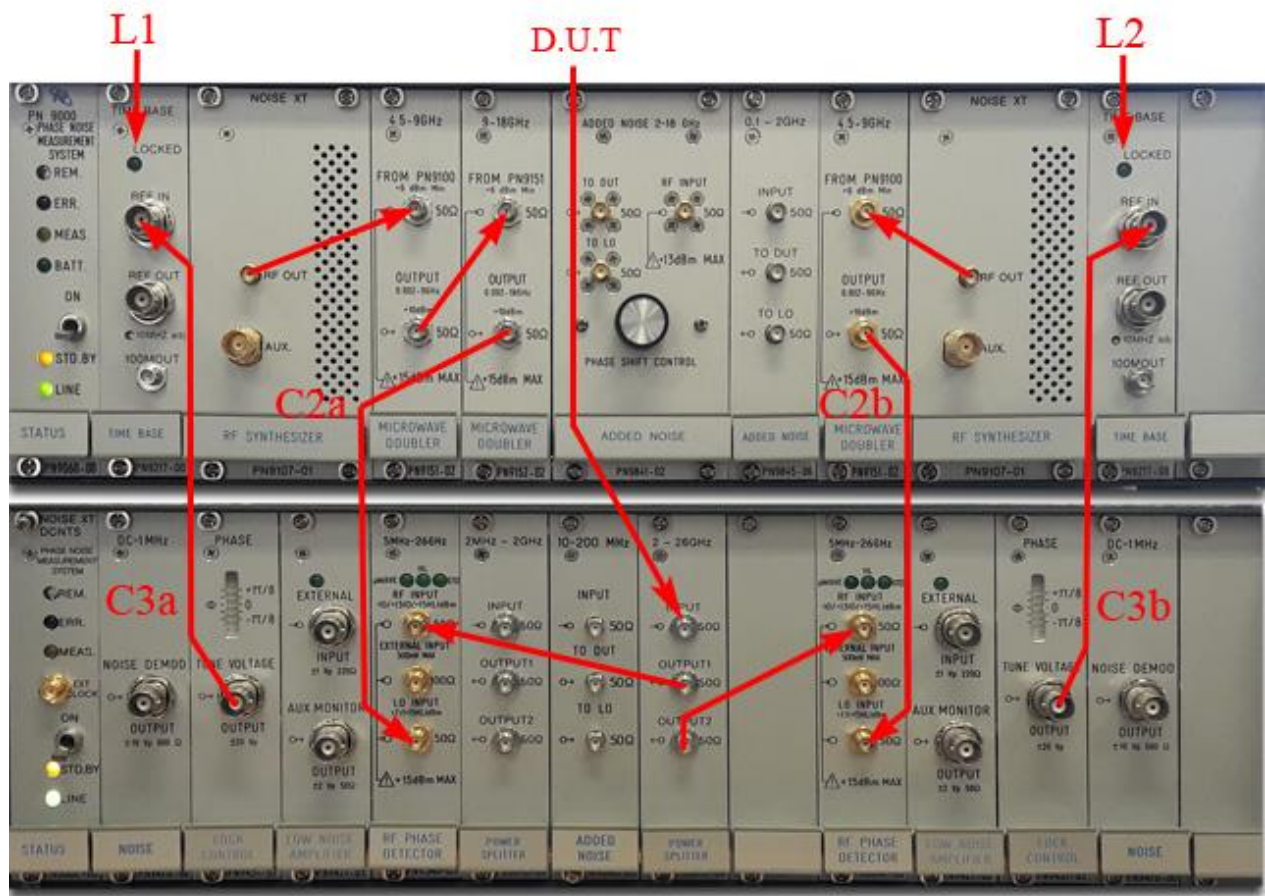
Pulse Measurement

NOISE XT



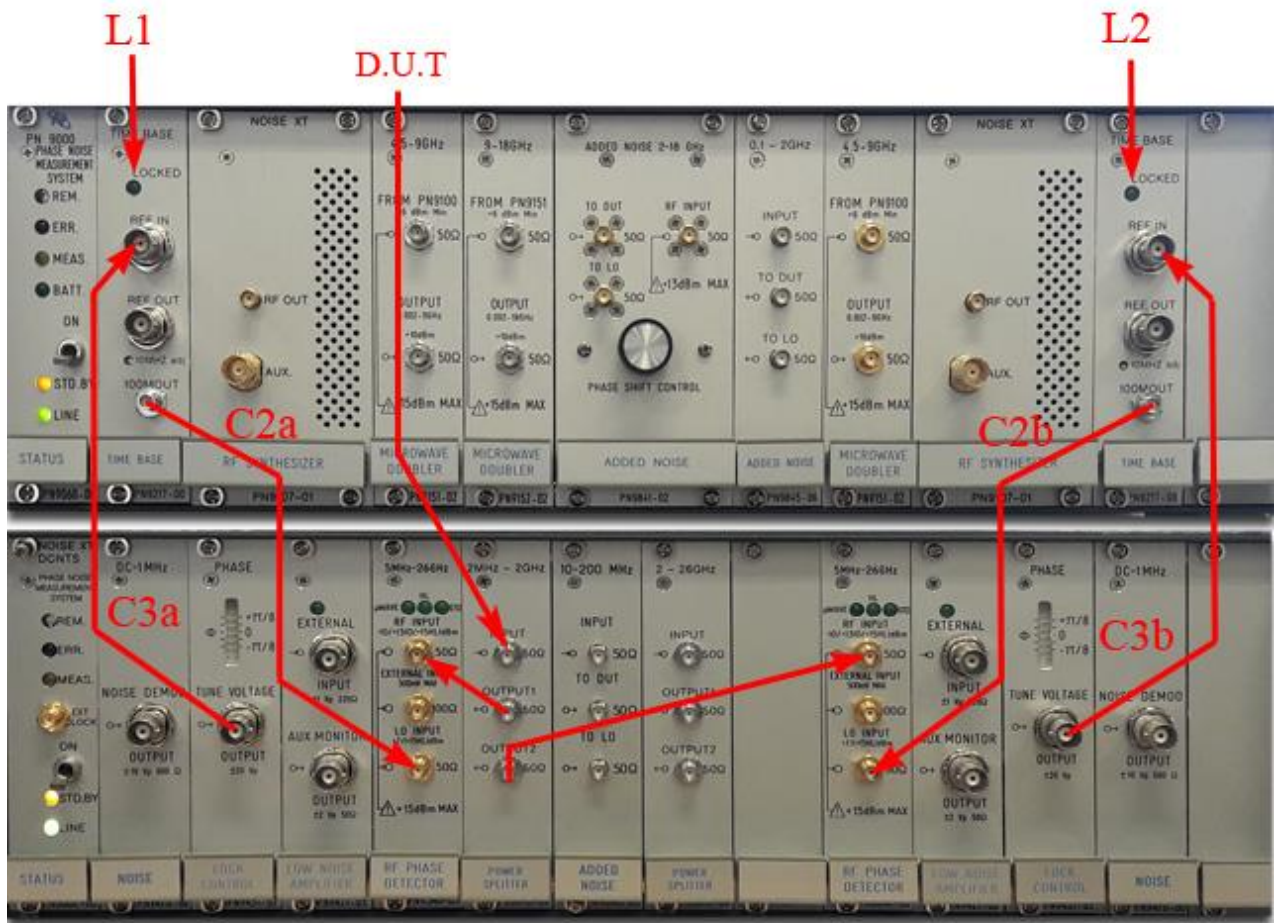
- **C1 or C_a & C_b**: Connection to the computer.
- **C2 & C3**: Other connections.
- **D.U.T**: Device Under Test.

Option Internal Synthesizer PN9107



- **C1 or C_a & C_b:** Connection to the computer.
- **C2 or C2a & C2b:** LO Reference(s).
- **C3 or C3a & C3b:** Tune Voltage.
- **D.U.T:** Device Under Test.

Option Crystal oscillator source measured with oscillator reference 10 or 100MHz ULN



- **C1 or C_a & C_b:** Connection to the computer.
- **C2 or C_{2a} & C_{2b}:** LO Reference(s).
- **C3 or C_{3a} & C_{3b}:** Tune Voltage.
- **D.U.T:** Device Under Test.