Keysight Technologies
N1918A Power Analysis Manager

Technical Overview
Power instrumentation has evolved from being a mere combination of hardware devices to PC-based instruments and application software. This further extends the computation and analysis capability of power measurements, which provides a higher performance and more variety of data computation and analysis.

The Keysight Technologies, Inc. N1918A Power Analysis Manager is a PC-based application software that is targeted to extend the capabilities of some of Keysight’s power meters and power sensors. This application software provides a powerful power analysis in multiple test and measurement formats that facilitate the process of problem identification and tracking.

This technical overview provides a detailed description of the features and capabilities of the Power Analysis Manager application software. The contents of this technical overview enable engineers to understand the software operation and performance capabilities offered in N1918A Power Analysis Manager.
PC-Based Power Meter Application Software to Uncover and Identify Problems in Many Ways

The Power Analysis Manager is a PC-based application software that runs on Microsoft Windows platform and aims to enhance the capabilities of some of Keysight’s power meters and sensors. The N1918A can interface with various hardware devices like N1911A single-channel and N1912A dual-channel P-Series power meters, U2000 Series USB power sensors and N8262A P-Series modular power meters. Once power measurements are digitized from power meters, USB power sensors or any other supported hardware system, the data can be analyzed in many different ways. The application software is flexible and able to accept data from multiple front ends. Thus, users can perform power measurements, time-based recording, pulse characterization analysis, trace data processing, waveform math computations, and many other data analysis using single or multiple hardware devices (Figure 1).

The Power Analysis Manager is a suite of application software that comprises basic version (Power Panel) and advanced version (Power Analyzer). The Power Panel is bundled with the purchase of U2000 Series USB power sensors, N1911A/N1912A P-Series power meters, and N8262A P-Series modular power meters. Power Panel offers an easy-to-use standard GUIs for these hardware devices.

The N1918A Option 100 Power Analyzer is an optional licensed software that is available for purchase separately. Power Analyzer offers advanced functions like pulse analysis, multi-channels power measurement, statistical analysis and recording function. Users can use this software to perform tests and measurements, and to track problems at any stage of the design process—from simulation to the final prototype.

For more information on the Power Panel and Power Analyzer, please refer to N1918A Power Analysis Manager Data Sheet, literature number 5989-6612EN.

Figure 1. The architecture of the Power Analysis Manager that illustrates the different measurement formats from various sources that include the different hardware that is supported, different instrumentations, and recorded or saved files that can be processed and displayed using the software.
More Than Just Power Meters

Power Analysis Manager provides conventional power measurements and measurement displays. However, this is not enough for today’s power instrumentation. The Power Analysis Manager offers a wider range of measurement capabilities like statistical analysis, pulse parameters characterization, limits and alert function, and many other advanced functions.

The Power Analysis Manager leverages the power measurement data available from the data output of the power meter instrument. The software provides you the tools you need to identify the root cause of a problem. Furthermore, it also provides tools such as minimum, maximum, and average measurement, trace marker (in strip chart) and gating, pulse analysis, and the Complementary Cumulative Distribution Function (CCDF) measurement for a qualitative understanding of a signal behavior. Multi-instrument measurements and overlay graphs with math (delta, sum, and ratio) operations, play, stop, record and restore options, save and load graph data (MS Excel compatible), multi-tab display, limits and alerts, and pulse reference point defined are some of the extended capabilities of the Power Analysis Manager, which is more than just a power meter.

PC-Based for Ease of Use

The Power Analysis Manager is PC-based, thus any improvements made on the PC capabilities will contribute to the improvement of the application software performance. Furthermore, the LAN and USB plug-and-play connectivity are common standard connectivity in PCs today, thus enabling easier instrumentation setup at lower startup cost. Besides, the Power Analysis Manager offers powerful power measurement tools and an easy-to-use GUI as the software platform for your instrumentation that allows comprehensive power measurement analysis.
Start and Stop Measurement Function

Users are able to control their power measurements via the Power Analysis Manager using the start and stop options. Users can start or stop the measurements at any time or at any point.

Multiple Instrument, Tab, and Measurement Displays

The Power Analyzer allows users to create multiple tabs, each of which may contain up to four measurement displays from multiple instruments input such as the USB sensors or the P-Series power meters. Measurement displays include Soft Panel, Gauge, Strip Chart, Trace Graph, Overlay Trace Graph, and statistical graph such as CCDF graph. This allows users to analyze measurement signals in different formats simultaneously for more comprehensive analysis.

Figure 2. Measurement start and stop options

Figure 3. Instrument Navigation View panel with multiple instruments connected
Instrument Properties Panel

Conventionally, power meters allow users to change the instrument properties physically such as the system and channel configuration, trigger settings, and measurement setups through the instrument front panel or via SCPI commands. The Power Analysis Manager allows users to remotely configure the instrument properties prior to performing power measurements.

Figure 4. Instrument properties panel consist of six tabs—Base Setting, System, Channel, Gate, Trigger, and Measurement—for remote configuration of power meters using Power Analysis Manager.
Instrument Properties Toolbar

Preset Predefined Setting
The built-in predefined instrument settings, Preset option, simplify the measurement setup. These preset options are identical to the P-Series power meters’ predefined settings that enable users to easily set up their instrumentation.

Save and Restore Instrument Settings
The Power Analysis Manager provides an option that allows users to save the instrument settings in *.prop format files. This allows users to restore their instrument settings whenever the same settings are required. It is done by simply loading the instrument property files.

Instrument Screen Capture
The Power Analysis Manager allows users to capture the instrument screen and save it in a picture format file. This feature is only applicable for power meters.
Local Mode Options

The Power Analysis Manager allows users to switch their instruments to local mode or remote control mode via Unlock Local Access option. Unlocking the local access enables users to perform power measurements using the instrument. When the local access is locked, power measurements is performed remotely via the Power Analysis Manager.

Reset

The Power Analysis Manager allows users to reset their instruments to its default settings via Reset Instrument option.

FDO Table

The Power Analysis Manager provides a quick and convenient method of compensating the power corresponding to the frequency in user’s test system via the FDO Table. The FDO table is only applicable when a U2000 Series USB power sensor is connected.
Multi-list Measurement with Measurement Mathematics

The Power Analysis Manager provides multi-list measurement display that supports more than 10 channels simultaneously in one window. Mathematical operations, such as difference and ratio computations, can be computed between two different channels. Multi-list measurement computations are displayed in numerical format only.

Save and Load Graph Data (Excel-Compatible)

The strip chart data point can be saved in comma separated value (*.csv) format that is compatible with Microsoft Excel. Users can load the saved graph data in the Power Analysis Manager or export the CSV file to Microsoft Excel for graph plotting and analysis.
Power Panel (Basic)

The Power Panel is bundled with the purchase of U2000 Series USB power sensors that provides an easy-to-use GUI that offers basic features that can be found in a typical power meter providing the minimum baseline capability for simple power measurements. The Power Panel pushes capabilities further by offering multi-list measurement display of more than 10 channels simultaneously on one window. Math operations can be computed between the different channels, such as difference and ratio.

The Power Panel provides the following key features:
- Processes and displays multi-channel power measurements with more than 10 channels simultaneously
- Provides larger, enhanced visual display including power versus time graph (trend chart)
- Performs difference and ratio computation between data from two channels
- Saves and restores instrument settings of instruments
- Stores data up to 10,000 measurement points
- Stores data in comma separated value (CSV) files that are compatible with Microsoft Excel
- Provides up to 10 frequency dependent offset (FDO) tables
- Supports time-gated measurement capability

Numeric and Analog Display

Power measurements using power meters will be displayed in numerically or analog format based on the option selected by users. The Power Panel allows users to view the results in both formats simultaneously.

Users are required to configure the instrument settings prior to acquiring any power measurements. The instrument settings can be reconfigured when the measurement acquisition has stopped.

Figure 13. Numeric and analog display of the Power Panel comprising an analog dial and digital readout with instrument settings on the right panel.
Strip Chart Display

The Power Panel also provides Strip Chart view that displays the power versus time graph where the power measurements are plotted in a time-based chart to display the measurement trend over time. Figure 3 shows a sample plotted graph of power versus time in the Strip Chart display. Users are required to configure a Continuous or FreeRun trigger mode to enable data plotting in the strip chart. The strip chart can store up to 10 K data points, while the frame navigation on the strip chart allows users to navigate the chart to any frame of data points preferred.

Marker

On the Strip Chart display, users can place a marker on the chart. By default, the marker will appear at the center of the chart. Users can move the marker by clicking and dragging the marker to any point of the trace to obtain power measurement value of the marked location.
Power Analyzer (Advanced)

The Power Analyzer is a licensed version, that can be ordered separately as N1918A Option 100. The Power analyzer offers more features and capabilities for more complex data analysis and applications. It also offers powerful pulse analysis and power statistics analysis in various formats.

Power analyzer offers the following key features:
- Enhanced visualization with larger and more flexible display formats which includes Soft Panel display, Gauge display, Strip Chart display, Trace Graph display, and multiple tabs.
- Complete 15-point pulse parameters characterization for peak power analysis
- Overlay measurements and waveform math computations
- Computation of statistical power routines on CCDF measurements
- Up to seven days of data storage configured via preprogrammed measurement schedules
- Limits and alert function for remote monitoring
- Data logging and timestamp for deviation monitoring
- Provides up to 10 frequency dependent offset (FDO) tables
- Supports time-gated measurement capability

![Powerful customizable display configuration of various types of data input. The figure shows four different types of display—Soft Panel, Gauge, Trace Graph and Strip Chart displays with multiple tabs.](image)
Pulse Waveform With Complete 15-Point Pulse
Parameters Characterization

Pulse parameter characterization involves complicated computations that can be rather tedious when performed manually. The Power Analyzer provides a complete 15-point pulse parameters characterization for peak power analysis.

For radio frequency (RF) pulse in radar or time division multiple access (TDMA) systems, pulse measurement is very important for the systems designers. Pulse power is often made in radar application and defined as energy transfer rate over the pulse period.

Average power is the most common power measurement and known as energy transfer rate averaged over several cycles of the lowest frequency present in a waveform. Peak power measurement is a peak envelope power that is defined as average power (over a short interval) and is used to describe the maximum envelope power of the signal. In addition, it is used to determine the design or system operating within the design goals and may comply with the regulation that power does not exceed a certain limit. It can also be used to check whether the power transmitted may damage any components of a system.

The repetition of pulses is expressed as a pulse repetition interval (PRI) or pulse repetition period (PRP). The pulse width (PW) is a period of pulse in ON status. The pulse repetition frequency (PRF) is defined as one over PRI (1/PRI) in a frequency domain.

Duty cycle (DC) is the total count of pulse is ON, compared to the period of pulses. A duty cycle of 1 (100%) would be a continuous wave (CW) signal. A duty cycle of 0.1% (10%) means that the pulse is ON for one-tenth of the overall pulse period. For a fixed pulse, increasing the PRF will increase the duty cycle.

Example: DC = PW / PRI

Average Power = Pulse power * DC

Pulse modulation rise/fall time is defined as the amount of time it takes the pulse envelope to transit from the 10% pulse envelope level to 90% pulse envelope level on both the rising and falling edges of the pulse. This significance of measuring rise/fall time for the speed of the signal (slew rate) can be very critical for a pulse modulation.

Figure 17. Display of trace graph with 15-point pulse parameters characterization automatically determined by the Power Analyzer.
Gate

The P-Series power meters have an extensive triggering and time-gated measurement functions. The triggering capabilities include level, external and GPIB triggering, plus the ability to have four separate measurements on a single burst. For instance, gates controlled by and referenced to a trigger point are used to obtain measurement data from a captured trace. The trace data within each gate period is subsequently used for the individual measurement calculations.

Custom gate is applicable in trace graphs, which is similar to the power meter instrument gating measurement. The Power Analyzer places two vertical lines in a trace graph to mark the boundary of the gate according to the user’s selection. This enables you to determine gate measurements that are applicable in real-time capture mode or file loaded mode.

The following list contains some of the available gate measurements:

- Gate delta time
- Gate peak power
- Gate average power
- Gate peak-average power
- Gate minimum power
- Gate delta (peak – min) power

Average power is measured in a pulse over a certain time frame with a specific delta time. Peak power measurement in a given time period is crucial and measures how much the instantaneous or peak power rises above the average power of a signal. This is useful for designers who need to specify the headroom needed for components to stay within the specification, especially with regard to modulation signal where the signal randomly peaks during power transmission.

Figure 18. Gate that is placed on a Trace Graph with gate measurements displayed on the Measurement Information panel.
Marker

Similarly, the Power Analyzer also allows markers to be placed on graph displays. Dual markers placed on the pulse measurements enable users to obtain the delta measurement of the pulse. Multiple markers are allowed and are especially useful when placed on signals that show variable burst lengths behavior within one or several timeslots.

The following list shows non behavior pulse characteristics that can be calculated using dual markers:

- Pulse ripple
- Pulse droop
- Pulse undershoot
- Pulse overshoot
- Pulse delay

![Figure 19. Variety of marker options available](image1)

![Figure 20. Multiple placed markers on the trace graph with data measurements obtained and displayed on the Measurement Information panel](image2)
Overlay Graph with Math Function (Delta, Sum & Ratio)

The Power Analyzer provides an Overlay Graph that allows users to compare two trace lines that are displayed in a graph and to combines the two trace lines using math computation such as delta, sum, and ratio. Overlay is a function that compares two different trace measurements that are compatible. It is essentially a measurement view of a trace graph with two trace lines and a resulting computed trace graph below. Examples of using the overlay graph include the comparison of input and output power statistics in amplifier tests, and the comparison of measured pulse versus reference or known good pulse.

The source of the overlay trace can be measurements from connected instruments or loaded from a saved file, where the combination of the overlay source can be from instrument with instrument, instrument with file, or file with file.

The following list provides the math calculations that can be performed on two signals with the results displayed in a separate graph as shown in Figure 21:

- Delta (Source 1 – Source 2)
- Sum (Source 1 + Source 2)
- Ratio (Source 1 / Source 2)

Figure 21. Sample overlay trace graph with Delta measurement.
Power Statistical Graph (CCDF)

The Power Analyzer offers a statistical analysis function that measures and computes the Complementary Cumulative Distribution Function (CCDF) in one graph.

The CCDF is a plot of probability versus peak-to-average ratio (PAR) and it characterizes the power statistics of a signal. The CCDF curve shows how long a signal remains at or above a given power level. The power is expressed in dB relative to the average power.

The CCDF plot is primarily used in the wireless communications industry for evaluating multi-carrier power amplifier performance. It provides a measurement of the percentage of time where the PAR is at or exceeds a specific power level. The Y-axis represents the percentage of time the signal power is at or exceeds the power specified by the X-axis. For instance, CCDF parameters in both tabular and graphical display provide the PAR power data needed by component and system designers.

Figure 22 shows the CCDF curves plotted on the graph with the measurement information displayed on the Measurement Information panel. Users are able to place a marker on the CCDF graph on the curves as shown in Figure 23.

![Figure 22. The CCDF plot with measurement data in table format displayed on the Measurement Information panel.](image_url)
Figure 23. Display of the CCDF plot with reference trace and moveable marker measurement.

Figure 24. CCDF graph options allow users to a marker or reference signal on the graph.
Record and Load Functions

The Power Analyzer is able to record real-time measurements and archive the measured data for later viewing. The recording start and stop time can be set to record measurements at a specific window. The data will be stored in CSV format, which is Excel-compatible that can be easily exported into Excel worksheet for graph plotting and analysis.

Figure 25. Record option

Figure 26. Record Options dialog box for recording configuration

Figure 27. Record function setting. The software offers write-protect option for the PC mass memories to prevent creation of non-volatile user memories with instrument states, measurement and trace.
Limits and Alert Function

The Power Analyzer enables users to define the limits of acquired power measurements that subsequently triggers the alert system when limits are violated. For Soft Panel and Gauge view, the violation of defined limits will be alerted by a red “ALERT” indicator.

Figure 20. Alert indicator. The alert is indicated by the following red coloured ALERT. The alert indicator remains in red if limits are violated and the alert system is triggered. Clicking on the alert summary stops the alert and displays the Alert Summary log.

Alert summary details include measurement result, limit settings, and other information, as shown in Figure 30.

Figure 30. Alert Summary log that can store up to 500 lines.

Figure 29. Alert indicator. The alert is indicated by the following red coloured ALERT. The alert indicator remains in red if limits are violated and the alert system is triggered. Clicking on the alert summary stops the alert and displays the Alert Summary log.

Figure 30. Alert Summary log that can store up to 500 lines.

Figure 28. Limits configuration setup. Default alert limits are -90 dBm and 90 dBm for lower and upper limits. Measurement unit applied to Watt or dBm.
System Requirements

The following list provides an overview of the minimum requirements to run and use your Power Analysis Manager. For best immunity to electrostatic discharge (ESD), use a desktop PC.

### System Requirements

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<tr>
<th>Processor</th>
<th>Desktop PC: 1.3 GHz Pentium IV or higher recommended</th>
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<tbody>
<tr>
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<td>Laptop PC: 900 MHz Pentium M or higher recommended</td>
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<tr>
<td>Operating System</td>
<td>Windows XP Professional (Service Pack 2 or higher)</td>
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<tr>
<td>Monitor</td>
<td>800 X 600 screen resolution (1280 X 1024 recommended)</td>
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<tr>
<td>Browser</td>
<td>Microsoft Internet Explorer 5.1 or higher (6.0 or higher recommended)</td>
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<tr>
<td>Available Ram</td>
<td>512 MB or higher (1.0 GB recommended)</td>
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<tr>
<td>Hard Disk Space</td>
<td>1.0 GB free disk space at runtime</td>
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<tr>
<td>Prerequisites</td>
<td>Keysight IO Libraries Suite 14.2(^1) or higher</td>
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<tr>
<td></td>
<td>Microsoft .NET Framework 2.0 Runtime version(^2)</td>
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<tr>
<td></td>
<td>Microsoft Visual C++ 2005 Runtime Libraries(^2)</td>
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</table>

\(^1\) Available in Keysight Automation-Ready CD.
\(^2\) Bundled with N1918A Power Analysis Manager installer.

### Running Your Software

The Power Analysis Manager runs on Windows-based desktop or laptop PCs and is connected to the supported hardware via LAN, GPIB, LAN/GPIB gateway, a USB/GPIB converter, USB, or an IEEE 1394 (FireWire) interface, depending on the hardware selected.

Any PC of your choice that meets the minimum system requirements specified in the section to the left can be used for your instrumentation.

### Ordering Information

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
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<td>N1918A-100</td>
<td>Power Analyzer</td>
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### Related Literature

<table>
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<tr>
<th>Publication title</th>
<th>Pub number</th>
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<tr>
<td>Data Sheet: Keysight N1918A Power Analysis Manager</td>
<td>5989-6612EN</td>
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<tr>
<td>Data Sheet: Keysight N1911A/N1912A P-Series Power Meters and N1921A/N1922A Wideband Power Sensors</td>
<td>5989-2471EN</td>
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<tr>
<td>Configuration Guide: P-Series Power Meter and Power Sensor</td>
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<tr>
<td>Data Sheet: Keysight U2000 Series USB Power Sensors</td>
<td>5989-6280EN</td>
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<tr>
<td>Data Sheet: Keysight N8262A P-Series Modular Power Meter and N1921A/N1922A Wideband Power Sensors</td>
<td>5989-6605EN</td>
</tr>
<tr>
<td>Technical Overview: P-Series Power Meter and Sensor</td>
<td>5989-1049EN</td>
</tr>
<tr>
<td>Application Note: Characterizing Digitally Modulated Signal with CCDF Curves</td>
<td>5989-6875E</td>
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Published in USA, December 1, 2017
5989-6613EN
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