Frequency range: 300 kHz to 1.3 GHz

Measured parameters: $S_{11}$, $S_{21}$

Dynamic range of transmission measurement magnitude: 130 dB

Measurement time per point: 150 μs

Output power adjustment range: -55 dBm to +3 dBm
PLANAR TR1300/1 Network Analyzer is designed for use in the process of development, adjustment and testing of various electronic devices in industrial and laboratory facilities, including operation as a component of an automated measurement system. PLANAR TR1300/1 is designed for operation with external PC, which is not supplied with the Analyzer.

To learn more about the software functions, please download the demo software from our website and install it on your PC.

### MEASUREMENT RANGE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance</td>
<td>50 Ω (75 Ω connectors via adapters)</td>
</tr>
<tr>
<td>Test port connector</td>
<td>N-type, female</td>
</tr>
<tr>
<td>Number of test ports</td>
<td>2</td>
</tr>
<tr>
<td>Frequency range</td>
<td>300 kHz to 1.3 GHz</td>
</tr>
<tr>
<td>Full CW frequency accuracy</td>
<td>±5x10⁻⁶</td>
</tr>
<tr>
<td>Frequency setting resolution</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Number of measurement points</td>
<td>2 to 10,001</td>
</tr>
<tr>
<td>Measurement bandwidths</td>
<td>10 Hz to 30 kHz (with 1/3 step)</td>
</tr>
<tr>
<td>Dynamic range (IF bandwidth 10 Hz)</td>
<td>130 dB</td>
</tr>
</tbody>
</table>
**MEASUREMENT ACCURACY**

| Accuracy of transmission measurements (magnitude / phase)¹ |  
|---|---|---|---|
| +10 dB to +13 dB | 0.2 dB / 2° |  
| -50 dB to +10 dB | 0.1 dB / 1° |  
| -70 dB to -50 dB | 0.2 dB / 2° |  
| -90 dB to -70 dB | 1.0 dB / 6° |  

**Accuracy of reflection measurements (magnitude / phase)¹**

| Accuracy of reflection measurements (magnitude / phase)¹ |  
|---|---|---|---|
| -15 dB to 0 dB | 0.4 dB / 4° |  
| -25 dB to -15 dB | 1.5 dB / 7° |  
| -35 dB to -25 dB | 4.0 dB / 22° |  

**Trace stability**

| Trace noise magnitude |  
|---|---|---|---|
| (IF bandwidth 3 kHz) | 0.002 dB rms |  

| Temperature dependence |  
|---|---|---|---|
| (per one degree of temperature variation) | 0.02 dB |  

**EFFECTIVE SYSTEM DATA¹**

| Effective directivity | 45 dB |  
| Effective source match | 40 dB |  

¹ Applies over the temperature range of 23°C ± 5°C after 40 minutes of warming-up, with less than 1°C deviation from the one-path two-port calibration temperature, at -10 dBm output power and 10 Hz IF bandwidth.
## TEST PORT

Directivity  
(without system error correction) 18 dB

## TEST PORT OUTPUT

Match  
(without system error correction) 18 dB

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power range</td>
<td>-55 dBm to +3 dBm</td>
</tr>
<tr>
<td>Power accuracy</td>
<td>±1.5 dB</td>
</tr>
<tr>
<td>Power resolution</td>
<td>0.05 dB</td>
</tr>
</tbody>
</table>

## TEST PORT INPUT

Match 28 dB

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage level</td>
<td>+26 dBm</td>
</tr>
<tr>
<td>Damage DC voltage</td>
<td>35 V</td>
</tr>
<tr>
<td>Noise level</td>
<td>-127 dBm</td>
</tr>
</tbody>
</table>

## MEASUREMENT SPEED

Measurement time per point 150 μs

<table>
<thead>
<tr>
<th>Number of points</th>
<th>51</th>
<th>201</th>
<th>401</th>
<th>1601</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start 0.3 MHz, stop 1.3 GHz, IF bandwidth 30 kHz</td>
<td>9 ms</td>
<td>31 ms</td>
<td>60 ms</td>
<td>235 ms</td>
</tr>
</tbody>
</table>
## GENERAL DATA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output reference signal level at 50 Ω impedance</td>
<td>3 dBm ± 2 dB</td>
</tr>
<tr>
<td>«OUT 10 MHz» connector type</td>
<td>BNC female</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>+5°C to +40°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-45°C to +55°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>90% at 25°C</td>
</tr>
<tr>
<td>Atmospheric pressure</td>
<td>84 to 106.7 kPa</td>
</tr>
<tr>
<td>Calibration interval</td>
<td>3 years</td>
</tr>
<tr>
<td>External PC system requirements:</td>
<td></td>
</tr>
<tr>
<td>- Operating system</td>
<td>WINDOWS XP / VISTA / 7</td>
</tr>
<tr>
<td>- CPU frequency</td>
<td>1 GHz</td>
</tr>
<tr>
<td>- RAM</td>
<td>512 MB</td>
</tr>
<tr>
<td>Power supply:</td>
<td></td>
</tr>
<tr>
<td>- AC circuit</td>
<td>110 - 240 V, 50/60 Hz</td>
</tr>
<tr>
<td>- external DC power supply</td>
<td>9-15 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>8 W</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>11.2 x 5.6 x 1.6 in</td>
</tr>
<tr>
<td>Weight</td>
<td>3.3 lb</td>
</tr>
</tbody>
</table>
## MEASUREMENT CAPABILITIES

<table>
<thead>
<tr>
<th>Measured parameters</th>
<th>( S_{11}, S_{21} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of measurement channels</td>
<td>Up to 4 independent logical channels. Each logical channel is represented on the screen as an individual channel window. A logical channel is defined by such stimulus signal settings as frequency range, number of test points, power level, etc.</td>
</tr>
<tr>
<td>Data traces</td>
<td>Up to 8 data traces can be displayed in each channel window. A data trace represents one of such parameters of the DUT as S-parameters, response in time domain, input power response.</td>
</tr>
<tr>
<td>Memory traces</td>
<td>Each of the 8 data traces can be saved into memory for further comparison with the current values.</td>
</tr>
<tr>
<td>Data display formats</td>
<td>Logarithmic magnitude, linear magnitude, phase, expanded phase, group delay, SWR, real part, imaginary part, Smith chart diagram and polar diagram.</td>
</tr>
</tbody>
</table>
## SWEEP FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sweep type</strong></td>
<td>Fixed stimulus power value: linear frequency sweep, logarithmic frequency sweep, segment frequency sweep. Fixed frequency value: linear power sweep.</td>
</tr>
<tr>
<td><strong>Measured points per sweep</strong></td>
<td>Set by the user from 2 to 10,001.</td>
</tr>
<tr>
<td><strong>Segment sweep features</strong></td>
<td>A frequency sweep within several independent user-defined segments. Frequency range, number of sweep points, source power, and IF bandwidth should be set for each segment.</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>Source power from –55 dBm to +3 dBm with resolution of 0.05 dB. In frequency sweep mode the power slope can be set to up to 2 dB/GHz for compensation of high frequency attenuation in connection wires.</td>
</tr>
<tr>
<td><strong>Sweep trigger</strong></td>
<td>Trigger modes: continuous, single, hold.</td>
</tr>
</tbody>
</table>
## TRACE FUNCTIONS

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace display</td>
<td>Data trace, memory trace, or simultaneous display of data and memory traces.</td>
</tr>
<tr>
<td>Trace math</td>
<td>Data trace modification by math operations: addition, subtraction, multiplication or division of measured complex values and memory data.</td>
</tr>
<tr>
<td>Autoscaling</td>
<td>Automatic selection of scale division and reference level value for the most effective display of the trace.</td>
</tr>
<tr>
<td>Electrical delay</td>
<td>Moving of the calibration plane to compensate for the delay in the test setup. Compensation for electrical delay in a DUT during measurements of phase deviation from linearity.</td>
</tr>
<tr>
<td>Phase offset</td>
<td>Phase offset defined in degrees.</td>
</tr>
</tbody>
</table>
**ACCURACY ENHANCEMENT**

**Calibration**
Calibration of a test setup (which includes the Analyzer, cables, and adapters) significantly increases the accuracy of measurements. Calibration allows for correction of the errors caused by imperfections in the measurement system: system directivity, source and load match, tracking and isolation.

**Calibration methods**
The following calibration methods of various sophistication and accuracy enhancement level are available:
- reflection and transmission normalization;
- full one-port calibration;
- one-path two-port calibration.

**Reflection and transmission normalization**
The simplest calibration method. It provides low accuracy.

**Factory calibration**
The factory calibration of the Analyzer allows for reduction of measurement error in reflection and transmission normalization.

**Full one-port calibration**
Method of calibration performed for one-port reflection measurements. It ensures high accuracy.

**One-path two-port calibration**
Method of calibration performed for reflection and one-way transmission measurements. It ensures high accuracy for reflection measurements and average accuracy for transmission measurements.

**Mechanical Calibration Kits**
The user can select one of the predefined calibration kits from various manufacturers or define own calibration kits.

**Electronic Calibration Modules**
Electronic calibration modules offered by Copper Mountain Technologies make the Analyzer calibration faster and easier than traditional mechanical calibration.

**Defining of calibration standards**
Different methods of calibration standard defining are available:
- standard defining by polynomial model;
- standard defining by data (S-parameters).

**Error correction interpolation**
When the user changes such settings as start/stop frequencies and number of sweep points, compared to the settings at the moment of calibration, interpolation or extrapolation of the calibration coefficients will be applied.
### SUPPLEMENTAL CALIBRATION METHODS

**Power calibration**

Method of calibration, which allows more stable maintenance of the power level setting at the DUT input. An external power meter should be connected directly, or via a USB/GPIB adapter, to a USB port of the computer running the Analyzer software.

### MARKER FUNCTIONS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data markers</strong></td>
<td>Up to 16 markers for each trace. Reference marker is available for delta marker operation. Smith chart diagram supports 5 marker formats: linear magnitude/phase, log magnitude/phase, real/imaginary, R + jX and G + jB. Polar diagram supports 3 marker formats: linear magnitude/phase, log magnitude/phase, and real/imaginary.</td>
</tr>
<tr>
<td><strong>Reference marker</strong></td>
<td>Enables display of any marker values relative to the reference marker.</td>
</tr>
<tr>
<td><strong>Marker search</strong></td>
<td>Search for max, min, peak, or target values on a trace.</td>
</tr>
<tr>
<td><strong>Marker search additional features</strong></td>
<td>User-definable search range. Switching between one-time search or tracking modes.</td>
</tr>
<tr>
<td><strong>Setting parameters by markers</strong></td>
<td>Setting of start, stop and center frequencies by the stimulus value of the marker and setting of reference level by the response value of the marker.</td>
</tr>
<tr>
<td><strong>Marker math functions</strong></td>
<td>Statistics, bandwidth, flatness, RF filter.</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>Calculation and display of mean, standard deviation and peak-to-peak in a frequency range limited by two markers on a trace.</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>Determines bandwidth between cutoff frequency points for an active marker or absolute maximum. The bandwidth value, center frequency, lower frequency, higher frequency, Q value, and insertion loss are displayed.</td>
</tr>
<tr>
<td><strong>Flatness</strong></td>
<td>Displays gain, slope, and flatness between two markers on a trace.</td>
</tr>
<tr>
<td><strong>RF filter</strong></td>
<td>Displays insertion loss and peak-to-peak ripple of the passband and the maximum signal magnitude in the stopband. The passband and stopband are defined by two pairs of markers.</td>
</tr>
</tbody>
</table>
## DATA ANALYSIS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port impedance conversion</td>
<td>The function of conversion of the S-parameters measured at 50 Ω port into the values, which could be determined if measured at a test port with arbitrary impedance.</td>
</tr>
<tr>
<td>De-embedding</td>
<td>The function allows to mathematically exclude the effect of the fixture circuit, connected between the calibration plane and the DUT, from the measurement result. This circuit should be described by an S-parameter matrix in a Touchstone file.</td>
</tr>
<tr>
<td>Embedding</td>
<td>The function allows to mathematically simulate the DUT parameters after virtual integration of a fixture circuit between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file.</td>
</tr>
<tr>
<td>S-parameter conversion</td>
<td>The function allows conversion of the measured S-parameters to the following parameters: reflection impedance and admittance; transmission impedance and admittance; inverse S-parameters.</td>
</tr>
<tr>
<td>Time domain transformation</td>
<td>The function performs data transformation from frequency domain into response of the DUT to various stimulus types in time domain. Modeled stimulus types: bandpass, lowpass impulse, and lowpass step. Time domain span is set by the user arbitrarily from zero to maximum, which is determined by the frequency step. Windows of various forms are used for better tradeoff between resolution and level of spurious sidelobes.</td>
</tr>
<tr>
<td>Time domain gating</td>
<td>The function mathematically removes unwanted responses in time domain, which allows to obtain frequency response without influence from the fixture elements. The function applies reverse transformation back to frequency domain after cutting out the user-defined span in time domain. Gating filter types: bandpass or notch. For better tradeoff between gate resolution and level of spurious sidelobes the following filter shapes are available: maximum, wide, normal, and minimum.</td>
</tr>
</tbody>
</table>
## MIXER / CONVERTER MEASUREMENTS

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalar mixer / converter measurements</td>
<td>The scalar method allows measurement of the transmission coefficient (magnitude only) of mixers and other frequency translating devices. The scalar method employs port frequency offset when there is a difference between source port frequency and receiver port frequency.</td>
</tr>
<tr>
<td>Scalar mixer / converter calibration</td>
<td>The most accurate calibration method applicable to mixer measurements in frequency offset mode. The OPEN, SHORT, and LOAD calibration standards are used. An external power meter should be connected directly, or via a USB/GPIB adapter, to a USB port of the computer running the Analyzer software.</td>
</tr>
<tr>
<td>Automatic frequency offset adjustment</td>
<td>The function performs automatic frequency offset adjustment when the scalar mixer / converter measurements are performed to compensate for internal LO setting inaccuracy in the DUT.</td>
</tr>
</tbody>
</table>
### OTHER FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzer control</td>
<td>Using external personal computer, which runs the Analyzer software.</td>
</tr>
<tr>
<td>Familiar graphical user interface</td>
<td>Graphical user interface based on Windows operating system ensures fast and easy Analyzer operation by the user.</td>
</tr>
<tr>
<td>Saving trace data</td>
<td>Features saving trace data in *.csv and *.s1p formats; and saving the screen captures in *.png format.</td>
</tr>
<tr>
<td>State save/recall</td>
<td>The program allows to save the current state configuration for further recall. A state configuration includes signal source parameters, data traces, memory traces, markers, calibration, etc.</td>
</tr>
<tr>
<td>Diagram printout/saving</td>
<td>The diagram and data printout function has preview feature. The preview, saving and printout can be performed using MS Word, Image Viewer for Windows, or Analyzer Print Wizard.</td>
</tr>
</tbody>
</table>

### REMOTE CONTROL AND DATA EXCHANGE

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM/DCOM</td>
<td>COM/DCOM automation is used for remote control and data exchange with the user software. The Analyzer program runs as COM/DCOM server. The user program runs as COM/DCOM client. The COM client runs on Analyzer PC. The DCOM client runs on a separate PC connected via LAN.</td>
</tr>
</tbody>
</table>
For a complete listing of our global sales network, please visit www.coppermountaintech.com/sales/