Chroma 66203/66204 Power Meters are designed for multiple phase power measurement applications. The wiring mode function allows the user to take accurate power measurements for various wiring modes (see figure below) as well as providing accurate standard power measurements common for most electrical devices. A unique feature of the 66203/204 is its state-of-the-art DSP digitizing technology instead of less accurate and slower traditional analog circuits. The internal 16 bits analog/digital converters with sampling rates of up to 250kHz provide both high speed and high accuracy measurements which is unprecedented within the industry for this class of power meters.

The 66203/66204 power meters include a 2-shunt design to provide high accurate readings for both low and high current measurements. The power meters also support features such as Inrush current, Total Harmonic Distortion of V/I, and Energy measurements. With these practical functions, the 66203/66204 power meters are suitable for meeting the demanding tasks of R&D, production and quality control departments.

**Key Features:**
- **Voltage Ranges:** 15/30/60/150/300/600 Vrms, 1200 Vrms (optional kit)
- **Current Ranges:** 0.005/0.02/0.05/0.2/0.5/2/5/20 Arms
- **Frequency Range:** DC, 15Hz–10kHz
- **Embedded high speed DSP, 16 bits Analog/Digital converters**
- **Half rack size, up to 4 input modules**
- **Supports various single and 3 phase wiring configurations (see diagram)**
- **Supports external shunt and CT for higher current applications**
- **5 mA minimum current range & 0.1 mW power resolution**
- **Meets ENERGY STAR / EN 50564 / IEC 62301 / ErP**
- **Includes accumulated energy methods for unstable power measurement**
- **User-de/define criteria provides automatic PASS/FAIL indications**
- **Dual current shunt design provides high accuracy over a wide current range**
- **THD and user-specify order distortion measurement**
- **Inrush current and energy measurements**
- **Voltage / Current harmonics measurements up to 50 orders**
**FUNCTIONS AND APPLICATIONS**

The multi-channel of 66203/66204 Power Meters are capable of supporting different wiring modes. As shown the instruments can be configured for single and 3 phase configurations by selection preset modes.

<table>
<thead>
<tr>
<th></th>
<th>Channel 1</th>
<th>Channel 2</th>
<th>Channel 3</th>
<th>Channel 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1P2W (Single Phase Two Wire)</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>1P3W (Single Phase Three Wire)</td>
<td>1P3W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>3P3W (Three Phase Three Wire – Two Watt meter Method)</td>
<td>3P3W</td>
<td>1P2W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
<tr>
<td>3P4W (Three Phase Four Wire)</td>
<td></td>
<td>3P4W</td>
<td>1P2W</td>
<td>1P2W</td>
</tr>
</tbody>
</table>

Each channel of 66203/66204 has the ability to provide independent measurements; hence the meters are suitable for multi-point measurement applications such as PV inverter testing. Instruments are designed for measuring DC input parameters as well as three phase AC readings on the output side. The overall efficiency for the PV inverter can easily be obtained by built-in functions. In order to meet high voltage applications (up to 1200Wrms) Chroma offers an HV option kit.

User could implement 3P3W (Three Phase Three Wire) wiring mode for three phase power measurement application. Such as AC motor inverter testing.
With the wiring mode set as 1P2W, the 66204 Power Meter has the capability of performing up to 4 simultaneous power measurements as shown. The meters are also designed to comply with power measurement requirements in accordance to many international standards such as Energy Star/EN 50564/IEC 62301/ErP.

**User-defined Criteria for GO/NG Test**
The Power Meters allow users to perform GO/NG functions by presetting pass/fail limits. If the measured values are within these limits, the Pass indicator illuminates green. Fail results in red illumination.

66203/66204 Power Meters support external shunt function for high current (>20A) measurement application.

Compact size design allows two 66203/66204 Power Meters to be configured side-by-side in a standard 19” rack.

**Average Mode and Integration Mode for Power Measurement**
When using a traditional power meter, unstable measurements can occur if the UUT’s power consumption are unstable or operating in non-linear modes (i.e. a power supply’s hiccup mode). In these cases the load levels maybe different at different measurement aperture windows (T1, T2, T3 and T4 below). A simple averaging calculation can only provide a visual stable value but provides inaccurate power readings.

The 66203/66204 includes a Window Mode method which calculates all data within the user-defined time window (Tw). In this manner users can obtain a real average value without data lose. An accumulated energy approach method (i.e. integration mode) for power measurements is also provided. This integration mode calculates active power values by integrating energy from V and I in a user-defined time period (T1). In this way, users can achieve accurate readings with guaranteed transient-free variations. The 66200 meters provide a 10mA minimum current range with crest factor 4, and 0.1mW measurement resolution for low power application (<10W), and less than 2% uncertainty even for No-Load mode power measurements. These functions make 66200 an ideal choice for ENERGY STAR / IEC 62301 / ErP measurement.
Low Pass Filter
The maximum measurement bandwidth of the 66203/66204 Power Meters is 50kHz. However, the high frequency component is not desirable in all applications. For example, the input switching noise of some power supplies may influence the power measurement. In order to achieve a proper value, a low pass filter is necessary to reject the switching component. Users can set the parameter filter ON in the system configuration setting. The bandwidth will be reduced to 5kHz to reject high frequency content but still meets the 3kHz requirement of ENERGY STAR test.

Filter Off: Bandwidth = 50kHz
Filter On: Bandwidth = 5kHz
(meets the 3kHz requirement of Energy Star)

Inrush Current Measurement
The 66203/66204 Power Meters include built-in inrush current (Is) measurement functions. Users can even set a current level for triggering the starting point of the measurement. Users also can use an external TTL signal to trigger inrush current measurements through the control I/O signal port located at the rear side. The delay parameter can help users to bypass the peak value B after the trigger point A. The parameter, T, allows a set time period to be established for measuring the peak value during a preset time (T). The main purpose is to avoid measuring the inrush current value that is generally caused by X-capacitor of a power supply.

THD Measurement and User Define Level of Distortion
The 66203/66204 Power Meters can measure voltage and current Total Harmonic Distortion (THD) directly which can be displayed in percentage format. For some requirements (ENERGY STAR), users need to verify the THD of AC supply voltage when supplying the UUT in the specified mode not to exceed 2%, up to and including the 13th harmonic (as specified in IEC 62301). The Model 66202 also provides a function to define a user-specify level of distortion n, (n is from 2 to 50) for measuring harmonic distortion. The calculation formula is listed below. Thus, the instrument can easily measure distortion values as required by the ENERGY STAR requirements.

\[
\text{THD}_v = \sqrt{\frac{V_2^2 + V_3^2 + V_4^2 + V_5^2 + \ldots + V_n^2}{V_1^2}}
\]

Where \( V_n \) = rms value of nth harmonic of the voltage signal.

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Filter Off: Bandwidth = 50kHz
Filter On: Bandwidth = 5kHz
(meets the 3kHz requirement of Energy Star)
The 66200 Power Meters provide graphical user interface software (Softpanels) which allow users to control and read measured parameters from a computer via USB or GPIB interface. Users can easily observe measured voltage and current waveforms and monitor the changes in parameter readings by using the chart function. Additional features include a recording function which can record selected parameters and write data to a file for further analysis. The 66200 Softpanels supports IEC 61000-3-2 harmonic current limit test (pre-compliance) allowing users to examine whether the UUT has met the harmonic current requirement. The Power Efficiency Softpanels also integrates with Chroma’s electronic loads and AC Sources to provide an easy method of power efficiency testing and recording of data using the test report function which automatically generates a report at the completion of testing.
**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Model</th>
<th>66203</th>
<th>66204</th>
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</thead>
<tbody>
<tr>
<td>Meas. Channel</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Parameters</td>
<td>V, Vpk, I, Ipk, Is, W, VA, VAR, PF, CF, THD V, THD I, E</td>
<td></td>
</tr>
</tbody>
</table>

**AC/DC Voltage**

- **Voltage Range (V)**: 15V/30V/60V/150V/300V/600Vrms (CF=2), 6 range HV option up to 1200Vrms
- **Voltage Accuracy**: 15Hz to 1kHz: ±0.1% RD + 0.08% RNG
  1kHz to 10kHz: (0.1 + 0.05*kHz)% RD + 0.05% RNG
- **Voltage Harmonics Accuracy**: 15Hz to 1kHz: ±0.1% RD + 0.08% RNG
  1kHz to 10kHz: (0.1 + 0.05*kHz)% RD + 0.05% RNG
- **DC Voltage Accuracy**: 0.1% RD + 0.08% RNG

**AC/DC Current**

- **Current Range (I)**: 5mA/20mA/50mA/200mA/500mA/2A/5A/20Arms (CF=4)
- **Current Accuracy**: 15Hz to 1kHz: ±0.1% RD + 0.12% RNG
  1kHz to 10kHz: (0.1 + 0.05*kHz)% RD + 0.1% RNG
- **Current Harmonics Accuracy**: 15Hz to 1kHz: ±0.1% RD + 0.12% RNG
  1kHz to 10kHz: (0.1 + 0.05*kHz)% RD + 0.1% RNG
- **DC Current Accuracy**: 0.1% RD + 0.1% RNG

**Power**

- **Power Range (W)**: 75mW ~ 12kW (48 ranges)
- **Power Accuracy**: 47Hz to 63Hz: ±0.1% RD + 0.1% RNG
  1kHz to 10kHz: (0.1 + 0.1*kHz + 0.3/PF*kHz)% RD + 0.18% RNG
- **Power Factor accuracy**: 0.001+(15ppm/PF)*Hz

**Frequency**

- **Fundamental Frequency Range**: DC, 15Hz ~ 10kHz
- **THD Frequency Range**: 40Hz ~ 70Hz (100 order)
  70Hz ~ 440Hz (50 order)
- **Bandwidth**: 50kHz

**Others**

- **Display Resolution**: 5 Digits
- **Display Update Rate**: 0.25sec/0.5sec/1sec/2sec
- **Input Voltage**: 100~240V ± 10%, 50/60Hz
- **Interface**: USB+GPIB (Standard)
- **Operation Temperature**: 0°C ~ 40°C
- **Storage**: -40°C ~ 85°C
- **Safety & EMC**: CE (include EMC & LVD)
- **Dimension (H x W x D)**: 133 x 212 x 420 mm / 5.25 x 8.25 x 16.3 inch
- **Weight**: 7.5 kg / 16.5 lbs

The specifications are valid only after the power meter is turned on more than one hour in a thermally stable environment.

**ORDERING INFORMATION**

- **66203**: Digital Power Meter (3 channels)
- **66204**: Digital Power Meter (4 channels)
- **A662006**: External CT 50Arms for 66200 Series
- **A662007**: External CT 100Arms for 66200 Series
- **A662008**: Power Efficiency Test Softpanel
- **A662009**: Softpanel for 66200 Series
- **A662010**: Rack Mount Kit for 1 unit
- **A662011**: rack mount kit for 2 unit (side by side)
- **A662012**: 1200V HV option kit

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