RF Power Meters

Bird® offers a wide selection of portable insertion-type instruments for measuring forward and reflected power in coaxial transmission lines. Thruline® instruments can be left in the line for continuous monitoring of the transmitter power output or the amount of RF power reflected by an antenna.

1 TYPES OF POWER METERS

- **Terminating Power Meters –** measures the RF energy that is terminated in a load using either a thermistor, thermocouple, or diode detector. To measure RF power and not damage the RF sensor, a terminating sensor must use an attenuator or directional coupler. This method will introduce mismatch errors which contribute to the overall measurement accuracy.
- **In-line Power Meters –** measures forward and reflected RF energy in a transmission line without disrupting service. Unlike a terminating power meter, the in-line meter is non-intrusive and there is no need for additional equipment to make the measurement. In addition to measuring transmitter power, they can be used to install and maintain wireless base stations, RF generators or repeaters.

2 WHAT ARE ELEMENTS?

Bird wattmeters and other thru-line instruments are based on a “lumped constant” directional coupler. The directional coupler is called an element. Many users also call it a “slug” or a “plug-in”.

Each plug-in element (or coupler) samples the voltage at the point of insertion and samples the current via a loop. Turning the element 180° reverses the loop (and consequently the current pick-up) while the voltage sample remains unchanged. By proper combination of the two parameters, we obtain an RF voltage proportional to the square root of main line RF power. The RF sample is then rectified and a DC signal proportional to the RF envelope is delivered to the meter.

Unlike terminating sensors, Bird elements are carefully designed, manufactured, and calibrated to ensure proper directional RF measurements, without the need for calibration charts or instrument adjustments.

3 BEST PRACTICES

To make an accurate RF power measurement, you need to choose the right wattmeter or sensor and follow these best practices:

Type of Signals – the type of signals to be measured greatly influence the reading. Are you measuring a CW signal or one that has analog or digital modulation? How about a pulsed signal? Make sure the wattmeter or sensor is designed to measure your desired signal.

Eliminate adapters - Best practice for making a RF power measurement is to eliminate or minimize connector adapters. Your power meter may have great directivity, but the reading will be degraded when using many adapters. Use the proper connector to minimize mismatch errors that will impact your RF power reading.

Connectors & Cables – many errors when making an RF power measurement are due to worn connectors or damaged cables. RF measurements depend on the integrity of your cables and connectors used to interconnect the various instruments and devices. Inspect for damage and dirt before connections are made. Metal shavings, bent/cracked center pins can cause poor repeatability and high/variable VSWR.

Directivity – a directional coupler is a key component of every in-line, directional power meter element or “slug”. The directivity parameter, expressed in decibels (dB), is a measure of how well the coupler is capable of distinguishing between the energy traveling towards the load, and the energy that is being reflected due to the load impedance mismatch.

Portable Thruline Wattmeters

MODEL 43 SERIES, 44 SERIES, & APM-16

The Model 43 Series, Model 44 Series, and APM-16 of Thruline Directional Wattmeters provide accurate forward and reflected power in 50 Ohm coaxial transmission lines providing instant readings or continuous monitoring. Bird's Plug-in elements determine the power rating and the frequency range so there is no need for calibration charts or instrumentation adjustments. Bird offers a broad selection of portable wattmeters ranging from broadband, fixed, peak, and variable signal measurements.

PRODUCT FEATURES

- Insertion-type instrument designed to measure both forward and reflected CW power in coaxial transmission lines under any load condition.
- Full-scale accuracy of ±5%
- QC (quick change) type connectors
- Full range of plug-in elements provide a wide choice of frequency ranges and power levels

BENEFITS

- Measures power as it is being delivered to the load; allows the power meter to be kept in the circuit as the load is active
- Rugged metal housing for the most demanding environments
- Remote installation with removable RF line section
- High directivity and accuracy measurements needed for exceptional system performance

Portable Thruline Wattmeters

MODEL 43 SERIES, 44 SERIES, & APM-16

43 SERIES WATTMETER SELECTION GUIDE

	43	43P	4314C	4304A	4391A
Type	Broadband Wattmeter	Broadband Wattmeter with Peak Power	Broadband Wattmeter with Peak Envelope & Pulsed Power	Single Element Wattmeter	Dual-element Wattmeter
Modulation	CW, AM, FM, and analog TV	CW, AM, FM, SSB and analog TV	CW, AM, FM, SSB, analog TV, and pulsed signals	CW, AM, FM, and analog TV	CW, Pulsed RF (air navigation, DME, ATC, telemetry, radar etc.)
Measurement	Average RF power	Peak pulsed power, average RF power	Peak envelope, peak pulsed, average RF power	Average RF power	Peak envelope, peak pulsed, average RF power
RF Power Range	100 mW to 10 kW (depending on element)	100 mW to 10 kW (depending on element)	100 mW to 10 kW (depending on element)	5 W, 15 W, 50 W, 150 W, 500 W	100 mW to 10 kW (depending on element)
Frequency Range	450 kHz to 1.2 GHz (depending on element)	450 kHz to 1.2 GHz (depending on element)	450 kHz to 1.2 GHz (depending on element)	25 MHz to 1.0 GHz	450 kHz to 1.2 GHz (depending on element)
Power Accuracy	±5% of full scale	**CW Mode:** ±5% of full scale **Peak Mode:** ±8% of full scale	**CW Mode:** ±5% of full scale **PEP Mode:** ±8% of full scale	±6 to 7% full scale	**CW Mode:** ±5% of full scale **PEP Mode:** ±8% of full scale
Pulse Parameters	NA	**Pulse width:** 200 us min **Duty cycle:** 2% min **Pulse repetition:** 100 pps min	**Pulse width:** 0.4 us min (100 to 2300 MHz), 1.5 us (26 to 99 MHz), 15 us (2 to 25 MHz) **Duty cycle:** 0.01% min **Pulse repetition:** 30 pps min	NA	**Pulse width:** 0.8 us min (100 to 1260 MHz), 1.5 us (26 to 99 MHz), 15 us (2 to 25 MHz) **Duty cycle:** 0.01% min Pulse repetition: 25 pps min
Connectors	Two Type-N(F) QC	Two Type-N(F) QC	Two Type-N(F) QC	Two Type-N(F) QC Two UHF(F) QC	Two Type-N(F) QC
Elements*	Tables 1, 2, 3, 4, 6, 13, 14	Tables 1, 2, 3, 4, 5, 6	Tables 1, 2, 3, 4, 5, 6, 13, 14	One 4240-050 & one 4304A-1 elements supplied with unit	Tables 1, 2, 3, 4, 5, 6, 13, 14
Power	None required	Two 9 V alkaline	Two 9 V alkaline	None required	AC power cord or six rechargeable C cell batteries

*All Bird® Wattmeters require Bird's Plug-in Elements.

44 SERIES/APM-16 WATTMETER SELECTION GUIDE

	4431	4410A	APM-16
Type	Broadband Wattmeter with Variable RF Sample Port	Wattmeter with Multi-power Level Elements	Wattmeter for Digital Mobile Radio
Modulation	CW, AM, FM, and analog TV	CW or FM signals	CDMA, TDMA, FDMA & other digitally modulated signals
Measurement	Average RF power	Average RF power	Average RF power
RF Power Range	5 kW max (2 to 30 MHz) 1 kW max (30 to 1000 MHz)	100 W, 1000 W or 10,000 W in single plug-in element	1 to 1000 W
Frequency Range	2 MHz to 1.2 GHz	200 kHz to 1.0 GHz	2 MHz to 960 MHz
Power Accuracy	±5% of full scale	±5% of reading	±4% of reading, ±1% of full scale
Pulse Parameters	NA	NA	NA
Connectors	Two Type-N(F) QC	Two Type-N(F) QC	Two Type-N(F) QC
Elements*	Tables 1, 2, 3, 4, 6, 13, 14	4410 elements	APM elements
Power	None required	One 9 V alkaline	One 9 V alkaline

*All Bird® Wattmeters require Bird's Plug-in Elements.