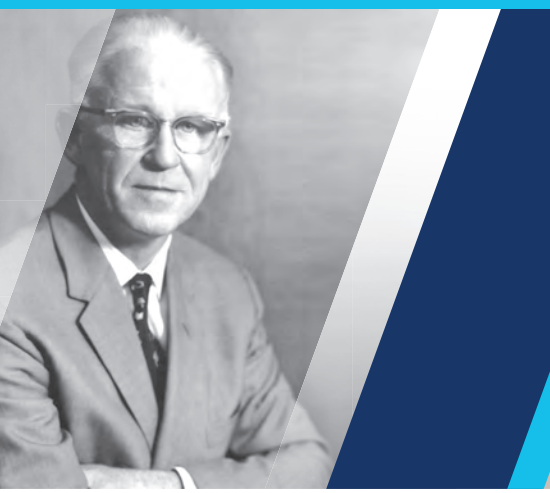
Bird®
The RF Experts

Test & Measurement
Equipment Catalog



Bird®
The RF Experts

For over eight decades, Bird has been at the forefront of radio frequency (RF) measurement technology, ever since the revolutionary RF wattmeter debut by J. Raymond Bird in the 1940s.

As we surpass our 84th year, we remain committed to leading the industry, evolving alongside the dynamic RF test and measurement field. Our latest innovations, showcased at the beginning of this catalog, have been developed with ingenuity, precision, and simplicity to address the growing demands of the RF test and measurement industry.

1942

Bird Engineering Company was founded in 1942 by J. Raymond Bird

Bird introduced the standard on which all future wattmeters would be judged – the **Model 43 Thruline Wattmeter.**

1952

1960's

Oil and water-cooled load families expand

World's first microprocessor controlled Model 4381 directional wattmeter

1978

1978

Pushing the accuracy bar to 3% with the new 4421 power meter.

First handheld antenna & cable tester simplifies RF testing

1998

2000's

Wideband sensors easily measure complex waveforms from digital TV, cellular and radio

0.5% precision pulse & CW sensors push the accuracy envelope for Semiconductor

2019

2025

Bird's next-generation digital wattmeter for accurate modern RF measurements.

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PRECISION RF PRODUCTS

RF POWER SENSORS

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Full Spectrum of RF Intelligence

GenHawk™ Vector Signal Generator

GH-60

- Generate custom analog and digital modulations along with recreating cellular and IoT standards
- Output signals from 10 MHz to 6 GHz, optionally 300 kHz to 6.5 GHz
- Additive pulse and noise allow testing poor conditions
- Up to +15 dBm output power allows easy over-the-air testing

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SignalHawk® Spectrum Analyzers

SH-75S-AOA, SH-75S-TC

- SH-75S-AOA combines digital maps, GPS, and signal vectoring for enhanced tracking and awareness
- SH-75S-TC tests comprehensive signals up to 7.5 GHz
- Predefined measurements scan and discover spectrum events other analyzers miss
- View the spectrum with trace display, spectrogram display, or both

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Vector Network Analyzers

BNA100, BNA1000

- USB connected for ease and reliability with free TVNA control software
- Frequency ranges starting at 300 kHz to 6.5 GHz and up to 20 GHz
- 2 and 4 port models for multi-port device testing
- Optional electronic calibration modules reduce time spent compensating and ensure repeatable results

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Digital Wattmeter

4480A

- True average power measurements for CW + digitally modulated signals
- Frequency coverage: 2–30 MHz (Low Band) and 25–1000 MHz (High Band)
- Power range: 10 W–10 kW (2–30 MHz) and 1 W–1 kW (25–1000 MHz)
- ±4% of reading accuracy (±0.18 dB)
- Measures Forward Power, Reflected Power, VSWR, and Return Loss (RL)
- Display readings in Watts or dBm

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Ethernet Power Sensor w/PTT

4042E-PTT

- 16 Push-To-Talk (PTT) inputs for active transmit event monitoring
- Alarm + I/O connector for external alarms and site integration
- Two HCA relay outputs with NC/NO configurations
- Web-based GUI for fast setup, status, and alarm configuration
- Secure Ethernet remote management over LAN networks
- Ethernet with built-in webserver + SNMP for network monitoring systems

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Precision Pulse/CW RF Power Sensors

7027 & 7037 SERIES

- Capable of ±0.5% and ±1% power measurement accuracy
- Measure pulse state widths down to 1us (sensor dependent)
- Measure pulse rep rates up to 100kHz (sensor dependent).
- Gated power measurements with up to four sets of gates available
- Time domain display
- Automate with SCPI command set
- External sync input
- NIST traceable calibration

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BIRD SERVICE CENTER

Repair & Calibration Services

Restore your instrument or equipment to original functionality, specifications and like-new condition, every time. Our worldwide service centers are staffed by experienced technicians, and use factory diagnostic methods, test fixtures, test and verification software, firmware upgrades, and service notes to ensure you get the most of your test budget.

All repair work includes any calibration and adjustments necessary to restore your equipment to published accuracy specifications, ensuring that all measurements can be trusted.

Calibration Options

Bird provides different calibration service levels depending on your requirements. Standard and accredited calibration services provide the traceability needed for regulatory requirements.

1 STANDARD CALIBRATION (ANSI/NCSL Z540.1)

This service provides a calibration certificate with a calibration date and a recommended calibration due date. A traceability statement is provided. As-Found and As-Left condition statements (i.e. in-tolerance or out-of-tolerance) are included.

2 STANDARD CALIBRATION (ANSI/NCSL Z540.1) WITH TEST REPORT

This service provides a calibration certificate with a calibration date and a recommended calibration due date. A traceability statement is provided. As-Found and As-Left measurement data and respective limits for each parameter tested during the calibration is provided. Measurement parameters not meeting the test specifications (out-of-tolerance) are identified and reported on the certificate. Product measurement uncertainties are available upon request. Additional charge will apply.

3 17025 ACCREDITED CALIBRATION WITH TEST REPORT

Instrumentation is calibrated in accordance with ISO/IEC 17025 within our approved scope of accreditation. Accredited calibrations provide a certificate of calibration with the accrediting body's logo on the document. This service provides a calibration certificate with a calibration date on the certificate and the recommended calibration due date. A traceability statement is provided. As-Found and As-Left measurement data and respective limits for each parameter tested during the calibration is provided. Measurement parameters not meeting the test specifications (out-of-tolerance) are identified and reported on the certificate. Product measurement uncertainties are available upon request. Additional charge will apply.

RF Training & Certification Services

Measurement challenges are increasing as standards and technologies constantly evolve. Build confidence and gain new skills to make accurate measurements through our Training and Certification services by Bird RF experts. E-Learning and Instructor-led courses enable you to build expertise in both technology and solutions. Instructor-led courses are customized to meet specific requirements and training can occur at your site.

E-Learning

- Available 24/7, free web-based courses enable you to learn at your pace.
- Go in-depth in specific topics, skip those you know, or repeat topics.
- Boost your measurement and technology knowledge.

Instructor-Led

- Customized courses to meet your specific requirements.
- Training can occur at your site using your equipment or ours.
- Certification available for select courses to demonstrate your mastery.

RF Technical Support

At Bird, we help companies address their toughest RF measurement, system, or application. Our dedicated technical applications engineers are a phone call or email away to help solve your problem. For self-service support, search our technical support center on BirdRF.com for FAQs, documentation, product videos and more.

Extended Warranties

Extend your factory warranty to protect your equipment beyond the standard coverage period. Keep your Bird products performing at their best with added coverage.

RF ANALYZERS

Measure with Confidence and Withstand Your Toughest Working Environments

Install and maintain wireless systems, perform in-depth troubleshooting, conduct routine maintenance and ensure your team's preparedness with Bird's portable RF analyzers. The rugged, hand-held equipment is not only used to maintain communication systems, but to also verify field performance with our Spectrum Analyzers, and identify and locate faults in the transmission system with our SiteHawk series of Cable and Antenna test equipment.

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Cable & Antenna Analyzers

The SiteHawk® series has been the preferred choice for installers, contractors and service providers for troubleshooting antenna and RF feedlines. Utilizing built-in measurement capabilities including precision return loss, VSWR, distance-to-fault and insertion loss, novice and expert technicians can perform testing for applications such as LMR, avionics, railway, cellular, and industrial communication systems to name a few.

1 WHAT DOES A CABLE AND ANTENNA ANALYZER DO?

- Assess the health of antenna and cable systems without the need for RF power
- Provides an operational baseline during antenna site commissioning
- Tests the overall integrity of the antenna system installation
- Verifies antenna system components meet manufacturer's design specification
- Pinpoints the location of the antenna systems faults prior to usage

2 WHO NEEDS A CABLE AND ANTENNA ANALYZER?

Anyone who is working on a cable and antenna RF system and needs to troubleshoot the common causes of Signal Reflections: Land Mobile Radio, Public Safety, Semiconductor, Wireless, Cellular and Broadcast, Military & Government, Medical, Aviation, Marine, Amateur Radio and Automotive.

Utilized for commissioning, maintenance and fault-finding of ground-to-air radios, airborne radios, repeaters, antennas, antenna combiners and transmission cables. Locate opens, shorts, improper crimps, bends, moisture, loose connectors, and defective antenna elements that lead to weak or intermittent RF operations. Common causes include:

- **Cable problems -** Open, shorted, dented, kinked, crimped, deformed, bullet hole, over tightened ground kit, over tightened clamp, water intrusion, improper bend radius
- **Connector problems -** Poor quality, improperly installed, improper center pin depth, corroded, water intrusion
- **Defective Antenna -** Improperly mounted, UV damage, damage from icing, lightning damaged, wrong frequency range

3 WHAT ARE THE KEY TYPES OF MEASUREMENTS?

FDR (Frequency Domain Reflectometry) measurement method results in a highly reliable assessment of the health of critical components in your system; ultimately providing a "heads-up" before a failure occurs. An FDR tests and verifies the antennas and cables in your RF system individually, or as a complete system.

VSWR is an abbreviation for Voltage Standing Wave Ratio and is a measurement of how well the components in a system match impedance. VSWR is expressed as a ratio without units.

Return Loss is the ratio of the maximum forward power in a transmission line to the power reflected back to the source. It is the power produced by a transmitter that is reflected back to the transmitter that could result in damage to the transmitter and does not add to the carrier's signal. Expressed in decibels, it is a measurement of how well systems components "match".

Insertion Loss is also known as cable loss and is the signal power lost within the feed line itself, including signal loss at joints, connectors, transitions, adapters, etc. Insertion loss takes place in one direction in a feed line and is the amount "lost" between the input end of a cable and the output connector of the same cable or system. Insertion loss is measured in dB.

Distance to Fault (DTF) is a measurement of how far from the test point a fault occurs. Instead of "hand-over-hand" checking of the feed line up a tower, the device will give a distance to the problem.

Spectrum Analyzers

With the expansion of wireless communications, spectrum analyzers like the Bird SignalHawk®, are an essential part of the RF tool kit and are increasingly critical. Although traditionally stand-alone bench top test equipment, our handheld spectrum analyzers are ready for any field application.

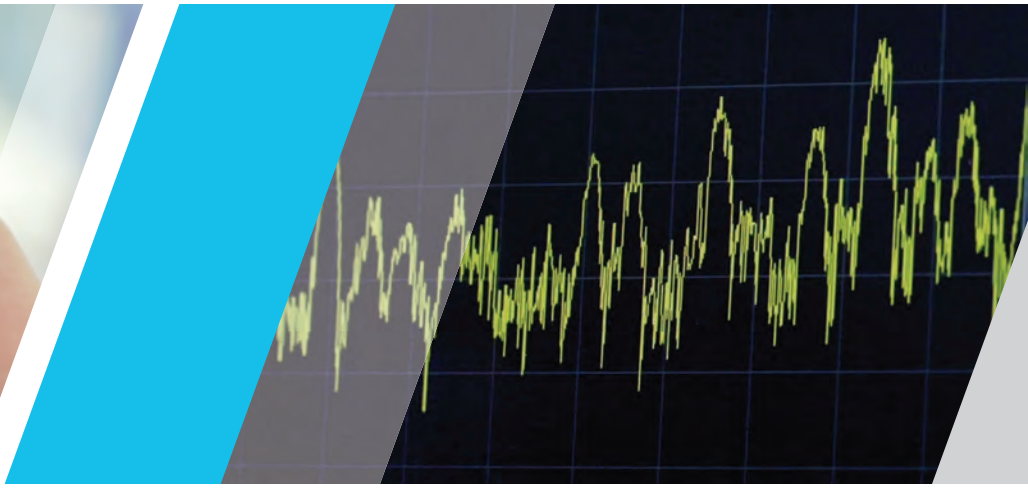
1 WHAT IS A SPECTRUM ANALYZER?

Spectrum analyzers are designed for use in the installation and maintenance of Radio Frequency (RF) and wireless systems. They are important pieces of instrumentation to test radio frequency circuits and systems and provide effective insight into RF performance of a system, circuit, or module. This information provides detailed measurements about the spectrum of a signal. Signals of different frequencies and complex waveforms can be displayed to determine if they are falling within the required limits within the specified frequency.

2 HOW ARE SPECTRUM ANALYZERS USED?

When looking at the frequency spectrum of a signal you can see the following:

- The overall spectrum of a modulated signal which determines if the signal is too wide or narrow and causing interference
- Any unwanted or illegitimate signal that would cause interference to users on other frequencies when transmitted
- Determine if a signal is on the correct frequency and not in another band
- Power, frequencies, and phase noise in a signal
- Frequencies and the nature of a signal that may be causing an issue



3 SPECTRUM ANALYZER MEASUREMENTS

Bird's spectrum analyzers provide the user with quick predefined measurements for field use. This is very useful for field service applications where radio or wireless transmissions or other radio frequencies signals need to be monitored and the spectrum needs to be checked. Here are some key measurements you can perform with our analyzers.

Channel Power Measurement measures the Integration Bandwidth, the total power over a frequency range, concentrated on the center frequency of the sweep. It is useful for channelized (frequency-division multiplexed) signals. Results are shown in both total power in the channel (in dBm or Watts), and spectral density (dBm or W per Hz).

Adjacent Channel Power Ratio (ACPR) measures the relative power of frequency bands adjacent to a central channel. This is often used to identify power leakage from the center channel into the adjacent channels. The total power in the center (main) channel is displayed in dBm and the power in the adjacent channels (Lower and Upper) are given in dBc and dBm.

Phase Noise is signal fluctuations appearing as noise spreading out above and below the carrier. High Phase noise can reduce signal quality possibly increasing the communications link's error rate.

Occupied Bandwidth (OBW) measures the frequency band bandwidth that contains a specified percentage of the total power of the signal. It gives best results with single-peaked signals. Bandwidth measurement results are in Hz units.

N dB Measurement measures the frequency bandwidth at a user selected value in decibels below the signal peak. Bandwidth measurement results are in Hz units.

Field Strength measurement can be used to measure a single frequency (point) or a band of frequencies (the full span set on the SignalHawk), measurement results are in mV/m units. Field strength measurements are typically used to determine the amount of RF radiation emitted by electronic equipment.

FM Demodulation measurement may be used to demodulate a signal in the FM spectrum. When an FM signal of interest is tuned as the center frequency, the demodulated signal may be listened to through the SignalHawk's speakers or recorded (.wav) for playback later.

GNSS Signal Quality measurement is used to analyze Global Navigation Satellite System (GNSS (GPS, BeiDou)) signal quality through Carrier-to-Noise Ratio (CNR) Loss and Jammer-to-Noise Ratio (JNR).

Spectrum Masking allows limit lines to be placed on the display. Multiple limit lines may be added creating elaborate mask around signals of interest.

4 WHAT IS ANGLE OF ARRIVAL (AOA)?

AOA stands for "Angle of Arrival", also known as automatic direction finding and is an added software feature in the SH-60S-AOA. Using a technique called Triangulation, a signal strength sample is recorded in different locations, and the position is marked on a map, forming a triangle.

- AOA is the direction from which an RF Signal is received and is used to discover the location of an interfering signal, such as an unlicensed radio transmission, or other types of generators, producing RF signals disrupting lawful transmissions
- AOA measurement locates and senses the direction of the arriving transmitting signal, then calculates the relative orientation or angle
- Triangulation is when three or more measurements cross, identifying the location of the unknown signal

5 WHAT ARE SOME APPLICATIONS OF AOA?

When identifying situations that require AOA functionality, there are some common interfering sources:

- Faulty or poorly shielded electronic devices that allow energy to leak and interfere with other RF devices by creating inadvertent transmissions that broadcast in unknown locations, frequencies, and times.
- Incorrectly configured electronic devices
- Electronic devices that are not compliant with local regulations
- Jammers and deliberate interference

Vector Signal Generator

The GenHawk™ GH-60 Vector Signal Generator is a compact, yet powerful handheld signal generator designed for professionals who require precise RF signals across a broad frequency range. Operating from 10 MHz to 6 GHz (with an upgrade option from 300 kHz to 6.5 GHz), it supports a wide array of analog and digital modulation techniques—from AM/FM and pulse modulation to advanced cellular standards like GSM, WCDMA, LTE, and 5G NR.

1 WHAT DOES A VECTOR SIGNAL GENERATOR DO?

Signal Generators output RF waveforms used in testing and verification of devices and systems. These signals can range from basic analog sinewaves at RF frequencies to complex digital modulations. The requirements of a signal generator vary quite a bit from case-to-case with some tests needing only some amount of RF power to be delivered, while validation of a system might require a specific form of modulation to ensure a receiver behaves properly or rejects unwanted signals.

2 WHAT ARE THE MODULATION OPTIONS?

Because signal requirements vary so widely, GenHawk offers a host of modulation options.

GENHAWK MODULATION OPTIONS

NAME	TYPE	DESCRIPTION	MODEL NUMBER
Digital Modulation	Generic	Enables digital signal generation: ASK, PSK, QAM, FSK, and subvariants	MTX-S008
ARB	Generic	Enables arbitrary I/Q file signal generation	MTX-S009
Sweep Mode	Generic	Enables Frequency Sweeps	MTX-S012
Analog Modulation	Generic	Enables analog modulation: AM, FM, and phase	MTX-S011
Multi-Tone	Generic	Enables multi-tone generation: USB, LSB, DSB, and multi sideband	MTX-S013
Linear Frequency Modulation	Generic	Enables chirp generation	MTX-S016
300 kHz to 6.5 GHz Frequency expansion	Functionality	Enables expanded frequency range for all enables modulations	MTX-S020
100 MHz Modulation Bandwidth	Functionality	Enables 100 MHz modulation bandwidth for all enables modulations	MTX-S019
Additive Noise Generator	Additive	Enables noise generation as standalone or additive signal	MTX-S018
Pulse Modulation	Additive	Enables pulse modulation and additive pulse to other modulations	MTX-S010
GSM Modulation	Standard	Enables GSM uplink, downlink generation	MTX-S001
WCDMA Modulation	Standard	Enables WCDMA uplink, downlink generation	MTX-S002
TDD-LTE Modulation	Standard	Enables TDD-LTE uplink, downlink generation	MTX-S003
FDD-LTE Modulation	Standard	Enables FDD-LTE uplink, downlink generation	MTX-S004
NB-IoT Modulation	Standard	Enables NB-IoT uplink, downlink generation	MTX-S005
LoRa Modulation	Standard	Enables LoRa generation	MTX-S006
5G-NR	Standard	Enables 5G-NR uplink, downlink generation	MTX-S014

Vector Network Analyzers

Bird's BNA Series VNAs offer exceptional performance, balancing the demands of productivity, budget, and space. Merging affordability with high-end VNA functionalities, the BNA Series brings models suitable for both education and manufacturing, enabling a seamless transition from school to the workforce, and from design to production.

1 WHAT IS A VECTOR NETWORK ANALYZER?

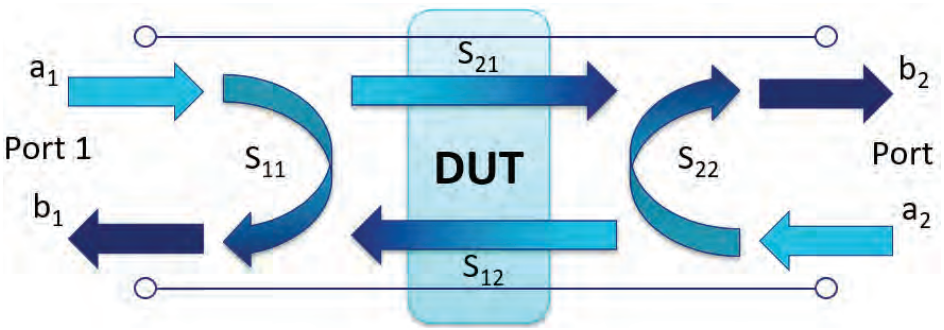
A vector network analyzer (VNA) is a sophisticated instrument capable of characterizing impedance of electrical networks with measurements offering magnitude and phase details that enable thorough behavioral insights. The device under test (DUT) often tends to be used in radio frequency (RF) applications that involve understanding the response of things such as individual components, cables, antennas, filters, amplifiers, and much more. In all cases, it is the job of the VNA to compare its source signal to measurements of reflected and transmitted signals, yielding impedance and scattering parameter (S-parameter) data to inform the user of a device's power-handling capabilities.

2 HOW ARE VNAS USED?

Vector network analyzers are used almost anywhere RF is. By outputting a test signal and precisely measuring the return, a VNA extracts an enormous amount of information about how a device or system will respond to various RF stimuli. A multi-port VNA is required for complex systems where multiple inputs or outputs need to be characterized. VNAs are also useful across different scientific and medical fields, where they are used to analyze samples for electrical characteristics and RF absorption, among other things.

3 WHAT ARE S-PARAMETERS?

Scattering parameters, or S-parameters, encompass the magnitude and phase of incident, reflected, and transmitted RF signals. S11 and S22 are reflected signals, while S12 and S21 are transmitted. While S21 is usually the star of the show, as it tells us about signal gain or loss, S12 can be just as important, especially when isolating signals is a key concern.



SiteHawk® Cable & Antenna Analyzers

SK-4500-TC, SK-6000-TC, SK-9000-TC

Save critical time, components, and money by eliminating time swapping out components until you find and locate the issue. Discontinuities can be a real problem and cause significant reflections by damaged cables, loose or improperly installed connectors, and environmental factors. With Bird's SiteHawk, find the exact location of the problem over a wide frequency range - from 1 MHz to 9000 MHz using Distance to Fault, return loss and cable loss measurements techniques.

PRODUCT FEATURES

- Locate RF cable, connector, and antenna problems at the source
- Test RF cables and antennas at the frequency of operation
- Fault location or DTF mode plots VSWR or Return Loss levels at each distance point along the cable and antenna system length
- Cable Loss function measures insertion loss of the cable system over a given frequency range
- Use FDR (Frequency Domain Reflectometry) measurement methods that will results in a highly reliable assessment of the health of critical components in your system; ultimately providing a "heads-up" before a failure occurs
- Single-port cable loss measurement

APPLICATIONS

- Cellular Networks 3G, 5G (2.4, 4.2 GHz & 600, 850 MHz), PCS/DCS, CDMA, GSM and LTE Protocols, Broadcast, Paging, Government, Tactical Military, Microwave, Public Safety, Trunking, TETRA, Network Coverage WLAN, WLL (802.11), Semiconductor calibration load/RF cable test
- C-Band (4 to 8GHz) satellite communications and some X-Band radar frequency sub-bands with SK-9000-TC

COMPATIBLE WITH

- Basic, Wideband, and Statistical Power Sensors
- Bird RF Meter App

MEASUREMENT

Frequency Range **SK-4500-TC** **SK-6000-TC** **SK-9000-TC**	 1 MHz to 4500 MHz 1 MHz to 6000 MHz 1 MHz to 9000 MHz
Frequency Resolution	1 kHz
Output Power	-10 dBm, typical
Trace Noise Magnitude (IFBW 1kHz)	0.05 dB rms
Measurement Speed	1 ms/data point
Measurement Points	51 to 3201
Measure Bandwidth	100 Hz to 30 kHz
Temperature Stability	0.01 dB/°F (0.02 dB/°C)
Return Loss Measurement Range	0 dB to -60 dB
Resolution	0.01 dB
VSWR Measurement Range	1.0 to 65.0
Cable Loss Measurement Range	0 dB to 30 dB
DTF Range	0 to 5000 ft (0 to 1500 m)
Corrected Directivity	>38 dB
Maximum Input Voltage	50 V
Immunity to Interfering Signals	+13 dBm
Power Measurement	Yes, with external sensor

ACCURACY

Frequency Accuracy	±2.5 ppm @25 °C
Reflect Amplitude Accuracy SK-4500-TC & SK-6000-TC	**–10 dB to 0 dB:** ±0.6 dB **–20 dB to –10 dB:** ±0.8 dB **–35 dB to –20 dB:** ±3.0 dB
Reflect Amplitude Accuracy SK-9000-TC	**–10 dB to 0 dB:** ±0.6 dB **–25 dB to –10 dB:** ±1.5 dB **–35 dB to –25 dB:** ±4.0 dB

SYSTEM

Display	5.5 in, 1920 x 1080 p
Languages	English, Chinese, Spanish
Battery Type	Lithium-ion rechargeable
Battery Operating Time	10 hours typical
Battery Charge Time	5 hours typical
Storage Capacity	Thousands of trace and setups
Recommended Calibration Interval	3 years

CONNECTORS

Connector	USB Type-C, USB 3.0
Test Port Connector Impedance	N-type, Female 50 Ohms

ENVIRONMENTAL

Operating Temperature	14 °F to 131 °F (-10 °C to +55 °C)
Storage Temperature	-40 °F to 176 °F (-40 °C to +80 °C)
Battery Charging Temperature	32 °F to 95 °F (0 °C to +35 °C)

PHYSICAL

Size	7.7 in x 3.6 in x 2.4 in (195 mm x 90 mm x 60 mm)
Weight	1.98 lb (0.9 kg)

CERTIFICATIONS

CE	**EMC:** Standard EN 61326-1:2006

SignalHawk® Spectrum Analyzers

SH-60S-AOA, SH-60S-TC, SH-75S-AOA, SH-75S-TC

The SignalHawk family of handheld spectrum analyzers brings you the best in class functionality in a compact, portable, and affordable package. With an intuitive touchscreen user interface, you can unlock your potential and get the most out of your work. Our powerful spectrum analyzers help you detect, identify, and resolve interference issues quickly and accurately.

PRODUCT FEATURES

- Leverages OpenStreetMap mapping technology from allowing users to triangulate the source
- Spectrogram/Waterfall display shows intermittent power levels at a glance
- View the spectrum with trace display, spectrogram display, or both
- More than 2x faster sweep times than the competition
- High-resolution, full-color display for indoor/outdoor, and multi-screen viewing
- Rugged and weather resistant

COMPATIBLE WITH

- Basic, Wideband, and Statistical Power Sensors
- Bird RF Meter App

BUILT-IN MEASUREMENTS

MODELS	INCLUDED MEASUREMENTS
SH-60S-TC SH-75S-TC	ACPR, CH Power, OBW, N dB BW, Phase Noise
SH-60S-AOA	The above plus: Field Strength, FM Demodulation, AoA Locate, GPS Signal Quality, Spectrum Mask, PeakHold Zoom
SH-75S-AOA	The above plus: AM/FM Demodulation, Digital Mod Check, I/Q Modulation Check, Time-Slot/Gate Scan, Spectrum Monitoring

MEASUREMENT

Frequency Range **SH-60S-AOA, SH-60S-TC** **SH-75S-AOA, SH-75S-TC**	 9 kHz to 6 GHz 9 kHz to 7.5 GHz
Aging	±1 ppm
Sweep Time **SH-60S-AOA, SH-60S-TC** **SH-75S-AOA, SH-75S-TC**	 1.1 ms to 1600 s full span, 2.69 ms to 1600 s settable zero span 1.2 ms to 1600 s full span, 3.99 ms to 1600 s settable zero span
Resolution Bandwidth	10 Hz to 5 MHz in 1, 2, 3, 5, 10 steps
Second Harmonic Distortion	1.6 GHz to 70 dBc
Third Order Intercept (TOI)	+15 dBm (–10 dBm tones, 1 MHz apart, preamp off, reference level –10 dBm)
P1dB **SH-60S-AOA, SH-60S-TC** **SH-75S-AOA, SH-75S-TC**	 +5 dBm nominal 0 dBm nominal
Phase Noise	-95 dBc/Hz, @10 kHz (typical -97 dBc/Hz) -115 dBc/Hz, @1 MHz (typical -116 dBc/Hz)
Measurement Range	DANL to +20 dBm
Input Attenuator Range	0 to 30 dB, 1 dB step
Input Attenuator Uncertainty	±0.6 dB
Display Average Noise Level (DANL)	**Preamp Off:** 1 GHz, -129 dBm/Hz (typical -132 dBm/Hz) **Preamp +20 dB:** 1 GHz, -149 dBm/Hz (typical -152 dBm/Hz) **Preamp +40 dB:** 1 GHz, -168 dBm/Hz (typical -169 dBm/Hz) (Input terminated, detector set to positive, trace average set to 1000, span set to 50 kHz, reference level of -100 dBm, all other settings auto-coupled, 23±5 °C normalized to 1 Hz RBW)
Residual Responses **SH-60S-AOA, SH-60S-TC** **SH-75S-AOA, SH-75S-TC**	 -75 dBm -60 dBm
Max Safe Input Level	**Preamp Off :** +30 dBm **Preamp +20 dB:** 0 dBm **Preamp +40 dB:** -20 dBm
Reference Level Range	-140 dBm to +20 dBm, -190 dBm to +70 dBm (Ref level offset: ON)
RBW Switching Uncertainty	±0.3 dB

CONNECTORS

RF In	N(f)
USB	USB type C
Power Interface	Slim tip, DC 20 V

ACCURACY

Frequency Span Accuracy	±1%
RBW Accuracy	≥1 MHz, ±10%, <1 MHz, ±2%
Amplitude Accuracy	±1.5 dB (ATT set to 0 dB, input signal -5 to -30 dBm, detector set to positive, sensitivity set to low, RBW auto-coupled, all other settings auto-coupled, 23±5 °C. Half hour warm-up required.)
Reference Level Accuracy	≥-60 dBm, ±0.8 dB

SYSTEM

Display	5.5 in, 1280 *720p
OS	Android
Languages	English, Chinese
Battery Type	Lithium-ion rechargeable
Battery Operating Time	5 hours typical
Battery Charge Time	6 hours typical

ENVIRONMENTAL

Operating Temp	0 °C to 50 °C
Storage Temp	-20 °C to 70 °C

PHYSICAL

Size	7.8 in x 3.7 in x 2.4 in (197 mm x 93 mm x 61 mm)
Weight	1.98 lb (0.9 kg)

PRODUCT FEATURES

- With a form factor that can easily slip into a bag, the GenHawk offers up to 5 hours of usage and can be charged without interrupting the RF output
- Based on Android, GenHawk allows users to install other applications as needed, allowing a wider variety of field testing on a single device
- Uses digital modulation for better anti-interference ability and safety that allows an output of a variety of digital modulated signals as used in standards like Wi-Fi, DVB or ATSC, IEC 60601 and more

APPLICATIONS

- Testing in applications like Distributed Antenna Systems (DAS)/Indoor Coverage, field interference, noise immunity, EMC susceptibility, receiver sensitivity, and more
- Design validation of IoT devices during development

GenHawk™ Vector Signal Generator

GH-60

The GenHawk signal generator keeps up with a durable form factor, 5 hour battery life, touch-screen interface, 145 dBm dynamic range, and many supported digital modulation formats. With a base frequency range up to 6 GHz and 20 MHz modulation bandwidth (optionally up to 100 MHz), the GH-60 supports emulating the most common wireless standards from 5G to WCDMA.

RF OUTPUT

Frequency Range	10 MHz to 6 GHz (upgradable to 300 kHz to 6.5 GHz with MTX-S020)
Frequency Accuracy	+/- 0.5 ppm
Frequency Resolution	0.1 Hz
Output Settling Time	<1.5 ms (CW)
Power Range	-110 dBm to +10 dBm when f < 2 MHz -130 dBm to +15 dBm when f ≥ 2 MHz
Power Resolution	0.1 dB
Power Accuracy	±0.75 dB @ ≥-80 dBm ±1.5 dB @ -110 dBm to -80 dBm ±2.5 dB @ <-110 dBm
VSWR	<2.0 (typ.)
Max Reverse Power	0.01 W
Harmonic CW, ≤+10 dBm	≤-22 dBc @ 300 kHz ≤ f < 2 MHz ≤-30 dBc @ 2MHz ≤ f ≤ 6.5 GHz
Nonharmonic CW, ≤+10 dBm	≤-25 dBc @ 300 kHz ≤ f < 10 MHz ≤-35 dBc @ 10 MHz ≤ f < 500 MHz ≤-50 dBc @ 500 MHz ≤ f < 6.5 GHz
Phase Noise	≤-119 dBc/Hz (typ.) @ 1 GHz ≤-110 dBc/Hz (typ.) @ 3 GHz ≤-104 dBc/Hz (typ.) @ 6.5 GHz
Temperature Stability	± 1 ppm @ 0 °C to 50 °C
Error Vector Magnitude (EVM)	≤2% (typ.)
Wave Quality ρ	> 0.9999

MODULATION

Modulation Bandwidth	20 MHz (upgradeable to 100 MHz with MTX-S019)
Pulse Modulation (with MTX-S010)	Pulse Period: 10 µs to 40 s Pulse Width: 100 ns to 40 s Width Resolution: 10 ns
Analog Modulation Types	Analog Modulation: AM | FM | PM Multi-Tone: MSB | USB | LSB
Mobile Communication Standards (optional)	GSM | WCDMA | TDD-LTE | FDD-LTE | NB-IoT | LoRa | 5GNR
Digital Modulation Types (with MTX-S008)	BPSK | QPSK | OQPSK | 8PSK | MSK | FSK | ASK | 16QAM | 32QAM | 64QAM | 128QAM | 256QAM
LTE Channels (with MTX-S003, MTX-S004)	PSS | SSS | CSRS | PBCH | PCFICH | PHICH | PDCCH | PDSCH | PUSCH | PUCCH | PRACH | SRS

CONNECTORS

Connections	**RF Output:** Type N, female, 50 Ω USB (for communication): USB type-C **Power:** DC 12V barrel

ENVIRONMENTAL

Operating Temperature	32 °F to 122 °F (0 °C to +50 °C)
Storage Temperature	-4 °F to 158 °F (-20 °C to +70 °C)

SYSTEM

Power Supply	**AC Input:** 110 to 240 V, 1.5 A, 50 to 60 Hz **DC Output:** 12V, 3A
Recommended Calibration Interval	1 Year
Warranty	3 Years

PHYSICAL

Size	7.8 in (h) x 3.7 in (w) x 2.4 in (d) 197 mm (h) x 93 mm (w) x 61 mm
Weight	2 lbs. / 0.9 kg

CABLE & ANTENNA ANALYZER FEATURES

- Wide frequency range from 1 MHz to 6 GHz or 9 GHz
- Test RF cables and antennas at the frequency of operation
- Distance to Fault, return loss, cable loss
- Frequency domain reflectometry
- RF Power Measurement Support with RF Meter App and Bird's USB Wideband Power Sensors through OTG USB communication port

SPECTRUM ANALYZER FEATURES

- Wide frequency range between 9 kHz to 6 GHz providing real-time spectrum monitoring and analysis of RF frequency circuits
- Predefined Measurements: Channel Power, ACPR, OBW, Phase Noise, N dB Down Bandwidth, Field Strength, FM Demodulation and more
- View the spectrum with trace display, spectrogram display, or both

RF Master Test Kits

SK-SH-KIT

Bird's RF Master Test Kit puts every critical RF tool in one rugged, field-ready case—giving technicians everything they need to install, verify, troubleshoot, and maintain coaxial and antenna systems. It includes the SiteHawk® Cable & Antenna Analyzer, SignalHawk® Spectrum Analyzer, wideband power sensor, calibration combo, adapters, cables, and a termination/load, all organized for fast access in the field.

Built for demanding environments, the kit delivers complete coverage for cable and antenna testing, system performance checks, and interference hunting across cellular, LMR, and Wi-Fi networks. Perfect for wireless service providers, contractors, military, aerospace/defense, and public safety applications.

KITS INCLUDE

SITEHAWK CABLE & ANTENNA ANALYZER

SIGNALHAWK SPECTRUM ANALYZER

5017D OR 5017D-AV POWER SENSOR

CALIBRATION COMBO

FH-AV-CC HARD CARRYING CASE

4240-401 ADAPTER KIT

25-T-MN TERMINATION/LOAD RESISTOR

RF MASTER TEST KIT SELECTION GUIDE

MODEL	SITEHAWK	SIGNALHAWK	SENSOR
SK-SH-KIT	SK-6000-TC	SH-60S-TC	5017D-AV
SK-SH-KIT-3	SK-6000-TC	SH-75S-TC	5017D
SK-SH-KITA	SK-6000-TC	SH-60S-AOA	5017D
SK-SH-KITA-1	SK-9000-TC	SH-60S-AOA	5017D-AV
SK-SH-KITA-3	SK-9000-TC	SH-75S-AOA	5017D

SiteHawk® Test Kits

7003A001 SERIES

Bird's SiteHawk Test Kits provide all the necessary equipment needed to perform precise power measurements to quickly identify faulty antennas, cables, and connectors in order to resolve issues and return radio systems to service. Easily select your kit by frequency range and power range with a variety of combinations of sensors and analyzers for expanded capabilities.

Kits include a Bird SiteHawk SK-4500-TC Cable and Antenna Analyzer (substitutable with the SK-6000-TC or SK-9000-TC), along with a calibration combo, adapter kit, termination/load, and cables all housed in a rugged, organized hard-shell case. Avoid the downtime and expense of trial-and-error component swapping to quickly identify and resolve RF system issues.

PRODUCT FEATURES

- Determine if there is a problem with your cable and antenna system using the Measure Match function
- Locate the problem source with the Use Distance to Fault measurement
- Multiple models available utilizing Bird power sensors with varying frequency and power ranges in order to select the model best suited to the application

KITS INCLUDE

CABLE & ANTENNA ANALYZER

CALIBRATION COMBO

4240-401 ADAPTER KIT

25-T-MN TERMINATION/LOAD RESISTOR

5000-035 HARD CARRYING CASE

5A2970-16-120B 10' RG142 CABLE

SITEHAWK OPTION

- SK-6000-TC can be substituted for SK-4500-TC by adding -6 to the part number, e.g. 7003A001-5-6
- SK-9000-TC can be substituted for SK-4500-TC by adding -9 to the part number, e.g. 7003A001-5-9

SITEHAWK TEST KIT SELECTION GUIDE

MODEL	SENSOR	FREQUENCY RANGE	POWER RANGE
7003A001-5	None	N/A	N/A
7003A001-6	7020-1-010101	350 MHz to 4.0 GHz	150 mW to 150 W
7003A001-7	7020-1-030301*	25 MHz to 1.0 GHz	500 mW to 500 W
7003A001-8	5017D*	25 MHz to 1.0 GHz	500 mW to 500 W 1000 W Peak
7003A001-9	7022-1-020201	350 MHz to 4.2 GHz	150 mW to 150 W
7003A001-19	5019D	25 MHz to 1.0 GHz	100 mW to 100 W 260 W Peak

*Derate maximum average power rating from 500 W at 300 MHz to 100 W at 1 GHz using a straight line on a log-log scale.

FlightHawk® Aviation RF Cable & Antenna Analyzer Kits

FH-AV-KIT, FH-AV-BASIC

The basic kit, FH-AV-BASIC, provides all of the essential RF measurement capabilities required for installing and maintaining aircraft antenna systems. Ideal for identifying failing RF cables, connectors, antennas, and more.

The master kit, FH-AV-KIT, is a comprehensive solution that adds RF power measurement capabilities. Included are Bird's wideband power sensor, a 25 W compact load, and all necessary adapters and cables.

MEASUREMENT

Frequency Range	1 MHz to 6000 MHz
Frequency Resolution	1 kHz
Output Power	-10 dBm, typical
Trace Noise Magnitude (IFBW 1kHz)	0.05 dB rms
Measurement Speed	1 ms/data point
Measurement Points	51 to 3201
Measure Bandwidth	100 Hz to 30 kHz
Temperature Stability	0.01 dB/°F (0.02 dB/°C)
Return Loss Measurement Range	0 dB to -60 dB
Resolution	0.01 dB
VSWR Measurement Range	1.0 to 65.0
Cable Loss Measurement Range	0 dB to 30 dB
DTF Range	0 to 5000 ft (0 to 1500 m)
Corrected Directivity	>38 dB
Maximum Input Voltage	50 V
Immunity to Interfering Signals	+13 dBm
Power Measurement	Yes

ACCURACY

Frequency Accuracy	±2.5 ppm @25 °C
Reflect Amplitude Accuracy	**<–10 dB to 0 dB:** ±0.6 dB **<–20 dB to –10 dB:** ±0.8 dB **–35 dB to –20 dB:** ±3.0 dB

SYSTEM

Display	5.5 in, 720p
Languages	English, Chinese, Spanish
Battery Type	Lithium-ion rechargeable
Battery Operating Time	10 hours typical
Battery Charge Time	5 hours typical
Storage Capacity	Thousands of trace and setups
Recommended Calibration Interval	2 years
Compatible With	For a complete list of compatible sensors see Bird's RF Meter page

CONNECTORS

Connector	USB Type-C, USB 3.0
Test Port Connector Impedance	N-type, Female 50 Ohms

PRODUCT FEATURES

- Locate opens, shorts, improper crimps, bends, moisture, loose connectors, and defective antenna elements that lead to weak or intermittent RF operations.
- Utilize the FDR technology to perform a VSWR test by transmitting a continuous RF sweep of the cables & antenna at their operating frequencies.
- Easy to use handheld tester, enabling the user to configure a Go/No-Go test by using the Pass/Fail, Limit Line, and Marker tools. This option can be used for a Measure/Match or Distance to Fault sweep.
- Identifies issues easily from the equipment rack, eliminating the need to disassemble the airplane to test the RF system.

THE MASTER FH-AV-KIT INCLUDES

FLIGHTHAWK

5017D-AV POWER SENSOR

SK-CAL-MN-C6 CALIBRATION COMBO

FH-AV-CC HARD CARRYING CASE

4240-401 ADAPTER KIT

25-T-MN TERMINATION/LOAD RESISTOR

THE FH-AV-BASIC INCLUDES

FLIGHTHAWK

FH-AV-CC HARD CARRYING CASE

SK-CAL-MN-C6 CALIBRATION COMBO

PHYSICAL

Size	7.7 in x 3.6 in x 2.4 in (195 mm x 90 mm x 60 mm)
Weight	1.98 lb (0.9 kg)

CERTIFICATIONS

CE	**EMC:** Standard EN 61326-1:2006

RailHawk® Railway RF Cable & Antenna Analyzer Kits

RH-RR-KIT

Bird's Railway RF Cable & Antenna Analyzer Kit gives railway technicians the tools they need to keep critical communication networks operating at peak performance. Built for systems that require redundancy and high reliability, the kit enhances uptime, improves maintainability, and supports the communication protocols essential to modern railway operations.

PRODUCT FEATURES

- FDR (Frequency Domain Reflectometry) pinpoints faults at the frequency of operation, ensuring issues aren't masked by DC measurements.
- Locate RF cable, connector, and antenna problems at the source.
- Distance-to-Fault (DTF) mode plots VSWR or Return Loss along the system.
- Cable Loss function measures insertion loss across the selected frequency range.

KIT INCLUDES

RAILHAWK

7020-1-010101 POWER SENSOR

SK-CAL-MN-C6 CALIBRATION COMBO

FH-AV-CC HARD CARRYING CASE

4240-401, 4240-550, 4240-565 ADAPTER KITS

25W or 50W TERMINATION/LOAD RESISTOR

MEASUREMENT

Frequency Range	1 MHz to 6000 MHz
Measurement Points	51 to 3201
Return Loss Measurement Range	0 dB to -60 dB
VSWR Measurement Range	1.0 to 65.0
Cable Loss Measurement Range	0 dB to 30 dB
DTF Range	0 to 5000 ft (0 to 1500 m)
Maximum Input Voltage	50 V
Immunity to Interfering Signals	+13 dBm
Power Measurement	Yes

ACCURACY

Frequency Accuracy	±2.5 ppm @25 °C
Reflect Amplitude Accuracy	**<–10 dB to 0 dB:** ±0.6 dB **<–20 dB to –10 dB:** ±0.8 dB **–35 dB to –20 dB:** ±3.0 dB

SYSTEM

Display	5.5 in, 720p
Battery Operating Time	10 hours typical
Recommended Calibration Interval	2 years
Compatible With	Bird's RF Meter App utilizing RF compatible sensors

CONNECTORS

Connector	USB Type-C, USB 3.0
Test Port Connector Impedance	N-type, Female 50 Ohms

ENVIRONMENTAL

Operating Temperature	14 °F to 131 °F (-10 °C to 55 °C)
Storage Temperature	-40 °F to 176 °F (-40 °C to 80 °C)

PHYSICAL

Size	7.7 in x 3.6 in x 2.4 in (195 mm x 90 mm x 60 mm)
Weight	1.98 lb (0.9 kg)

CERTIFICATIONS

CE	**EMC:** Standard EN 61326-1:2006

RAILHAWK ANALYZER KIT SELECTION GUIDE

MODEL	SITEHAWK	SENSOR	LOAD	ADAPTERS
RH-RR-KIT	SK-6000-TC	7020-1-010101	25-T-MN	4240-401, 4240-550 (DIN)
RH-RR-KIT-3	SK-6000-TC	7020-1-030301	25-T-MN	4240-401, 4240-560 (4.3/10)
RH-RR-KIT-4	SK-6000-TC	7020-1-010101	50-T-MN	PA-MNFE, PA-MNME, PA-MNM4.3, PA-MNF4.3

Compact Vector Network Analyzers

BNA100-2P6G5, BNA100-2P8G5

The BNA100 Series Compact Vector Network Analyzer offers exceptional performance in a compact package, balancing the demands of productivity, budget, and space. Merging affordability with high-end VNA functionalities, the BNA100 Series is the perfect tool for those seeking cost-effective solutions without compromising on performance and accuracy.

PRODUCT FEATURES

- Wide Frequency Range
- High Dynamic Range
- Low Trace Noise
- Excellent Directivity and Source Match
- Advanced Calibration Techniques
- Multiple Port Capability
- Time Domain Analysis
- User-Friendly Interface and Software
- Automation and Connectivity Options

APPLICATIONS

- Fault Location in Cables and Transmission Lines
- PCB Trace Characterization
- Material Characterization
- Antenna Design and Testing
- Radar and Microwave Component Testing
- Filter and Network Analysis
- Quality Control and Manufacturing

MEASUREMENT

Frequency Range BNA100-2P6G5 BNA100-2P8G5	 300 kHz to 6.5 GHz 300 kHz to 8.5 GHz
Impedance	50 Ohms
Frequency Accuracy	±5 ppm
Frequency Resolution	1 Hz
Measurement Points	2 to 20001
Measurement Bandwidth	1 Hz to 100 kHz
Measurement Time/Point	68 µs
Dynamic Range (IFBW=10Hz)	112 dB
Accuracy of Transmission Measurements (magnitude/phase)	-+5 dB to +15 dB (0.2 dB/2°) -50 dB to +5 dB (0.1 dB/1°) -70 dB to -50 dB (0.5 dB/3°) -90 dB to -70 dB (2.5 dB/8°)
Accuracy of Reflection Measurements (magnitude/phase)	-15 dB to 0 dB (0.4 dB/3°) -25 dB to -15 dB (1.0 dB/6°) -35 dB to -25 dB (3.0 dB/20°)
Trace Noise (IFBW=3kHz)	5 mdB rms
Temperature Stability	0.03 dB/°C
Effective Directivity[1]	38 dB
Effective Source Match[1]	35 dB
Effective Load Match[1]	37 dB

[1]Applied over them temperature range of 23°C± 5°C after 40 minutes of warming-up, with less than 1°deviation from the full two-port calibration temperature, at output power of -5dBm and IF bandwidth 10Hz.

TEST PORT OUTPUT

Match	18 dB (W/O system error correction)
Power range (Option-70 to +10dBm)	-20 dBm to +10d Bm
Power Accuracy	±1.5dB
Power Resolution	0.05dB

TEST PORT INPUT

Match	18 dB (W/O system calibration))
Max Input Level	+23 dBm
Max Input Voltage	+35 V
Noise Level	-120 dBm/Hz

CONNECTORS

Connectors	N(f)
Test Ports	2-port

SYSTEM

Power Supply	110/220 VAC, 50 /60 Hz
Recommended Calibration interval	3 years
Warranty	3 years

ENVIRONMENTAL

Operating Temp	+5 °C to +40 °C (+41 °F to +104 °F)
Storage Temp	-45°C to +55 °C (-49 °F to +131 °F)
Humidity	90%, 25 °C (77 °F)

PHYSICAL

Size	6.9 in x 2.6 in x 11.5 in (175 mm x 65 mm x 292 mm)
Weight	5.1 lb (2.3kg)

Modular Vector Network Analyzers

BNA1000-4P6G5, BNA1000-2P8G5, BNA1000-4P8G5

Exceeding the constraints of typical lab-focused analyzers and the restricted capabilities of portable models, the BNA1000 offers a broad dynamic range and rapid measurement speed that superbly caters to the diverse requirements of both manufacturing and RF engineering. This ensures a seamless transition from design to production, enhancing both innovation and efficiency.

PRODUCT FEATURES

- Wide Frequency Range
- High Dynamic Range
- Low Trace Noise
- Excellent Directivity and Source Match
- Advanced Calibration Techniques
- Multiple Port Capability
- Time Domain Analysis
- User-Friendly Interface and Software
- Automation and Connectivity Options

APPLICATIONS

- Manufacturing Test
- Passive/Active Component Characterization
- RF & Microwave Product Design
- Filter Design and Testing
- Fault Location
- Antenna Tuning
- Quality Control and Incoming Inspection

MEASUREMENT

Frequency Range BNA1000-4P6G5 BNA1000-2P8G5 BNA1000-4P8G5	 300 kHz to 6.5 GHz 300 kHz to 8.5 GHz
Impedance	50 Ohms
Frequency Accuracy	±5 ppm
Frequency Resolution	1 Hz
Measurement Points	2 to 20001
Measurement Bandwidth	1 Hz to 2 MHz
Measurement Time/Point	42 µs
Dynamic Range (IFBW=10Hz)	112 dB
Accuracy of Transmission Measurements (magnitude/phase)	-112dB, typ.115dB (300kHz to 10MHz) 125dB, typ.130dB (10MHz to 6GHz) 124dB, typ.129dB (6GHz to 7GHz) 123dB, typ.128dB (7GHz to 8.5GHz)
Accuracy of Reflection Measurements (magnitude/phase)	+5 dB to +15 dB (0.2 dB/2°) -50 dB to +5 dB (0.1 dB/1°) -70 dB to -50 dB (0.5 dB/3°) -90 dB to -70 dB (2.5 dB/8°)
Trace Noise (IFBW=3kHz)	2 mdB rms
Temperature Stability	0.01 dB/°C
Effective Directivity[1]	38 to 49 dB
Effective Source Match[1]	35 to 41 dB
Effective Load Match[1]	37 to 49 dB

TEST PORT OUTPUT

Match	18 dB (W/O system error correction)
Power range (Option-70 to +10dBm)	-50 dBm to +10d Bm (300 kHz to 7 GHz) -50 dBm to +8 dBm (7 GHz to 8.5 GHz)
Power Accuracy	±1.5dB
Power Resolution	0.05dB

TEST PORT INPUT

Match	18 dB (W/O system calibration))
Max Input Level	+23 dBm
Max Input Voltage	+35 V
Noise Level	-107 dBm/Hz (300 kHz to 10 MHz) -123 dBm/Hz (10 MHz to 5 GHz) -124 dBm/Hz (5 GHz to 6 GHz) -120 dBm/Hz (6 GHz to 8.5 GHz)

CONNECTORS

Connectors	N(f)
Test Ports BNA1000-4P6G5 BNA1000-2P8G5 BNA1000-4P8G5	 4-port 2-port 4-port

[1]Applied over them temperature range of 23°C± 5°C after 40 minutes of warming-up, with less than 1°deviation from the full two-port calibration temperature, at output power of -5dBm and IF bandwidth 10Hz.

SYSTEM

Power Supply	110/220 VAC, 50 /60 Hz
Recommended Calibration interval	3 years
Warranty	3 years

ENVIRONMENTAL

Operating Temp	+5 °C to +40 °C (+41 °F to +104 °F)
Storage Temp	-20°C to +60 °C (-68 °F to +140 °F)
Humidity	90%, 25 °C (77 °F)

PHYSICAL

Size	18.8 in x 21.5 in x 4.1 in (470 mm x 545 mm x 105 mm)
Weight	17.9 lb (8.1 kg)

PRODUCT FEATURES

- 1 MHz to 20 GHz frequncy range
- > 125 dB dynamic range
- Up to +10 dBm output power
- 2 ports
- 0.008 dB rms (IFBW=3 kHz) trace noise
- 70 us/point measurement speed
- User interface software included

APPLICATIONS

- Manufacturing Test
- Passive/Active Component Characterization
- RF & Microwave Product Design
- Filter Design and Testing
- Fault Location
- Antenna Tuning
- Quality Control and Incoming Inspection

Modular Vector Network Analyzers

BNA1000-2P20G0

Bird's BNA1000 20GHz model represents a new era in vector network analyzers, offering high performance through an innovative, PC-controlled design. By transferring the complex data processing demands typically found within the instrument to a sophisticated software platform, Bird offers a cost-effective and feature-rich VNA solution suitable for every testing environment.

MEASUREMENT

Frequency Range	1 MHz to 20 GHz
Impedance	50 Ohms
Frequency Accuracy	±1 ppm
Frequency Resolution	1 Hz
Measurement Points	2 to 20001
Measurement Bandwidth	1 Hz to 2 MHz
Measurement Time/Point	70 µs
Dynamic Range (IFBW=10Hz)	125 dB, typ. (1 MHz to 8 GHz) 120 dB, typ. (8 MHz to 12 GHz) 118 dB, typ.129dB (12 GHz to 18 GHz) 115 dB, typ.128dB (18 GHz to 20 GHz)
Accuracy of Transmission Measurements (magnitude/phase)	0 dB to +10 dB (±0.4 dB/±4°) -50 dB to 0 dB (±0.2 dB/±2°) -70 dB to -50 dB (±0.4 dB/+4°) -85 dB to -70 dB (±2.0 dB/±10°)
Accuracy of Reflection Measurements (magnitude/phase)	-15 dB to 0 dB (±1 dB/±6°) -25 dB to -15 dB (±2 dB/±15°) -35 dB to -25 dB (± dB/±35°)
Trace Noise (IFBW=3kHz)	8 mdB rms
Temperature Stability	0.01 dB/°C
Effective Directivity[1]	38 to 44 dB
Effective Source Match[1]	34 to 46 dB
Effective Load Match[1]	36 to 42 dB

TEST PORT OUTPUT

Match	18 dB (W/O system error correction)
Power range	-30 dBm to +10d Bm
Power Accuracy	±1.5dB
Power Resolution	0.05dB

TEST PORT INPUT

Match	18 dB (W/O system calibration))
Max Input Level	+26 dBm
Max Input Voltage	+35 V
Noise Level	-107 dBm/Hz (300 kHz to 10 MHz) -123 dBm/Hz (10 MHz to 5 GHz) -124 dBm/Hz (5 GHz to 6 GHz) -120 dBm/Hz (6 GHz to 8.5 GHz)

CONNECTORS

Connectors	NMD 3.5 mm(m)
Test Ports	2-ports
External Trigger Port	SMA(f), Input Voltage Range: 0 to +5V
External Reference Input Port Output Port	 BNC(f), 10 MHz; 2 dBm ± 2 dB BNC(f), 10 MHz; 2 dBm ± 2 dB

SYSTEM

Power Supply	110/220 VAC, 50 /60 Hz
Power Consumption	65 W
Recommended Calibration interval	3 years
Warranty	3 years

ENVIRONMENTAL

Operating Temp	+5 °C to +40 °C (+41 °F to +104 °F)
Storage Temp	-20°C to +60 °C (-68 °F to +140 °F)
Humidity	90%, 25 °C (77 °F)
Operating Pressure	84 to 106.7 k Pa

PHYSICAL

Size	18.8 in x 21.5 in x 4.1 in (470 mm x 545 mm x 105 mm)
Weight	26.5 lb (12 kg)

PRECISION RF PRODUCTS

MADE IN USA

Minimize Process Variability with Precision RF Measurement Tools

RF-powered processes — such as semiconductor plasma fabrication, medical device manufacturing, and surface treatment — require strict control, because even small RF power shifts can affect outcomes. The 4020 (3% accuracy) and 4027 (1% accuracy) Series provide stable, accurate continuous-wave power measurements to maintain process consistency. Mobile Calibration Carts streamline on-site verification with an all-in-one sensor, meter, and load setup. For advanced applications, the 7027 (1% accuracy) and 7037 (0.5% accuracy) Series sensors offer continuous wave and pulsed RF precision needed for tight process windows. To gain deeper visibility into plasma changes, the Bird Diagnostic System (BDS) delivers voltage, current, and phase data for fingerprinting, endpoint recognition, and transient detection.

RF POWER METERS

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PRECISION RF POWER SENSORS

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V-I-Φ MEASUREMENT SOLUTION

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CALIBRATION CARTS

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RF CALIBRATION KIT

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MEDICAL MRI CALIBRATION TEST KIT

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Improving Process Consistency with Precision RF Power Measurement

Technological innovation continues to intensify with semiconductor designs that incorporate smaller features and higher densities. To fabricate these latest designs, an advanced level of process control is paramount. For processes that rely on plasma generation, RF power consistency is essential for optimizing performance, maximizing yields, and minimizing downtime.

Bird's Precision RF Products enable you to address RF measurement challenges with the highest precision instruments in the market. Our power sensor solutions that measure both continuous wave and pulsed signals future proof your RF measurement needs. In addition, the Bird Diagnostic System provides detailed insight with measurements made in close proximity to the plasma chamber. Further, calibration carts with built in sensor, meter and load simplifies the task of verifying RF performance across a site's entire fleet of tools.

1 WHAT IS THE DIFFERENCE BETWEEN POWER MEASUREMENTS AND VOLTAGE, CURRENT & PHASE MEASUREMENTS?

Power Measurements - Power measurements are made using directional couplers that sample the RF signal present in the delivery path. However, due to a coupler's finite directivity, the system's characteristic impedance needs to be maintained close to 50 Ohms. Within this part of the RF delivery system, Bird's Power Sensors have been the industry standard for precision power measurements. These sensors are easy to use with excellent accuracy and repeatability.

Voltage, Current & Phase Measurements - The impedance of a plasma chamber is complex and changes with each step of a process recipe. Measurements made with a power sensor in this impedance space will result in directivity errors. In this situation, the RF Signal can be measured by its voltage and current. In addition, the phase relationship between the voltage and current measurements can also be determined to provide a complete description of the signal. The Bird Diagnostic System provides the ideal RF measurement solution for applications such as delivered power measurement, end-point detection, and transient detection.

2 WHY IS CALIBRATION IMPORTANT?

Calibration that is traceable to the National Institute of Standards and Technology (NIST) is crucial in ensuring sensor accuracy and consistency across multiple measurement devices. This consistency enables an organization to develop a process at one location and then to proliferate it to multiple production lines across the globe.

Bird has a long history of calorimetry, which is the most accurate method of measuring RF power. Over the past decades, Bird has continued to refine this technology to achieve better and better accuracy. The proprietary calorimeters developed by Bird are NIST traceable and are many times more accurate than the products that are calibrated through them. Our 1% and 0.5% power sensors would not be a success without the technological advances Bird has made to calorimetry.

3 WHAT ARE APPLICATIONS FOR AN RF POWER SENSOR?

- Calibrate RF generators to ensure setpoint accuracy
- Fingerprint systems to identify performance drifts and to predict failures
- Troubleshoot RF delivery path to root cause performance issues
- Capture critical-to-quality parameters for site-to-site comparisons

4 WHAT ARE APPLICATIONS FOR THE BIRD DIAGNOSTIC SYSTEM?

- Improve process control with recipe step end-point detection
- Identify excursions such are arcing within a plasma chamber
- Monitor performance for determining maintenance needs
- Compare chamber-to-chamber performance differences

Precision RF Products Selection Guide

PRECISION POWER SENSOR SELECTION GUIDE

SERIES	ACCURACY	ACCURACY RANGE	SIGNAL TYPE	FREQUENCY RANGE	MEASUREMENT
7037	0.5%	At calibration frequencies, across specified power range	Multi-level pulse & CW	0.4 MHz to 60 MHz	Forward Average Power, Forward Pulse Power, Reflected Average Power, Match
7027	1%	At calibration frequencies, across specified power range	Multi-level pulse & CW	0.4 MHz to 60 MHz	Forward Average Power, Forward Pulse Power, Reflected Average Power, Match
4027A	1%	At calibration frequencies, at 1700 W	CW	0.25 MHz to 170 MHz	Forward Average Power, Reflected Average Power, Match
4027F	1%	At calibration frequencies, at 1700 W	CW (with harmonic filtering)	1.8 MHz to 63 MHz	Forward Average Power, Reflected Average Power, Match
4028	2%	At calibration frequencies, at 1700 W	CW	0.25 MHz to 30 MHz	Forward Average Power, Reflected Average Power, Match
4020	3%	Across specified frequency and power ranges	CW	0.1 MHz to 3 GHz	Forward Average Power, Reflected Average Power, Match

V-I-Φ SYSTEM SELECTION GUIDE

SERIES	VOLTAGE & CURRENT ACCURACY	CALIBRATION	SIGNAL TYPE	FREQUENCY RANGE	MEASUREMENT
BDS2-Locked System	Up to 1%	As a system	Multi-level pulse & CW	0.307 MHz to 252 MHz	V, I, Phase, Power
BDS2-Unlocked System	Up to 2%	Individual components	Multi-level pulse & CW	0.307 MHz to 252 MHz	V, I, Phase, Power

CALIBRATION CART SELECTION GUIDE

SERIES	ACCURACY	# OF SENSORS	FREQUENCY	POWER LEVEL
SCC7	Up to 1% or 3%, depending on sensor	1	Up to 170 MHz	Up to 1 kW, 2.5 kW, 5 kW or 10 kW, depending on load and sensor
SCC8	Up to 2%, depending on sensor	1	Up to 30 MHz	Up to 25 kW, depending on sensor
MSCC7	Up to 1% or 3%, depending on sensor	2 (only one can be powered up at a time)	Up to 30 MHz	Up to 5 kW or 10 kW, depending on load and sensors

RF POWER METER SELECTION GUIDE

SERIES	# OF SENSORS	# OF SENSOR CHANNELS	INTERFACES
4421A-10-00-0	Single 402x Sensor	1	None
4421A-20-00-0	Dual 402x Sensors	2	None
4421A-10-11-0	Single 402x Sensor	1	RS-232, LAN
4421A-20-11-0	Dual 402x Sensors	2	RS-232, LAN
4421A-12-11-1	Single 402x Sensor Dual 702x/703x Sensors	2	RS-232, LAN

MADE IN USA

RF Power Meters

MODEL 4421A

The Model 4421A is a Multifunction Power Meter to be used in combination with Bird's Precision Power Sensors to display RF power readings with up to .5% accuracy. This intuitive unit clearly displays the Forward and Reflected power measurements within the RF path. In addition, return loss readings can also be shown to provide additional insight into the RF system being monitored.

PRODUCT FEATURES

- Compatible with the full line of Bird's 402x-Series CW sensors, 702x and 703x-Series CW and Pulsed power sensors
- Automatic sensor detection for seamless integration
- Large 9.7 in full color LCD touchscreen display for easy readability
- Dual sensor option expands measurement capabilities
- Compact, lightweight, and portable design enhances functionality

FUNCTIONS

- Forward Power in W or dBm
- Reflected Power in W or dBm
- Return Loss in VSWR, RL, or Reflection Coefficient
- Graph of Power in W Over Time

	4421A-10-00-0	4421A-20-00-0	4421A-10-11-0	4421A-20-11-0	4421A-12-11-1
# of Sensors	Single 402x Sensor	Dual 402x Sensors	Single 402x Sensor	Dual 402x Sensors	Single 402x Sensor Dual 702x/703x Sensors
# of Sensor Channels	1	2	1	2	2
Interface	None	None	RS-232, LAN	RS-232, LAN	RS-232, LAN
# of Latch-n-Lock Cables included	1	2	1	2	1

MEASUREMENT

Compatible Bird Sensors	4021, 4022, 4023, 4024, 4025, 4027 Series, 4028 Series, 702x, 703x
Frequency Range	Sensor dependent
Power Range	Sensor dependent
Sensor Channels	Model dependent, 1 or 2
VSWR Display	1.0 to 199.9
Return Loss Display	0 to 40 dB

CONNECTORS

Interfaces	Model dependent: RS-232, RJ-45

SYSTEM

Display	9.7 in TFT full color LCD with touch screen
AC Power	100-240 VAC, 50/60 Hz, 30 W
Fuse Rating	1A, IEC (5 x 20 mm), time-delay
Battery Type	Internal, rechargeable
Battery Operating Time	Up to 7 hours
Battery Charger	Built-in. Approximately 4 hours to fully recharge.

PHYSICAL

Size	10.6 in x 9.7 in x 3.6 in (269 mm x 246 mm x 91 mm)
Weight	Less than 5 lb

ENVIRONMENTAL

Operating Temperature	0 °C to 40 °C
Storage Temperature[1]	10 °C to 50 °C < 1 month 10 °C to 35 °C < 6 months 10 °C to 25 °C > 6 months
Humidity	95% max, non-condensing
Altitude	4,600 m max

CERTIFICATIONS

CE	CE Compliant
Shock and Vibration	MIL-PRF-28800F Class 4 Compliant

[1]Storage temperature limited by battery specification. Storage outside this range may degrade battery performance. For best performance, a full recharge is recommended every 6 months or if stored below 0 °C.

MADE IN USA

Pulse/CW RF Power Sensors

7037 SERIES

0.5% ACCURACY

Bird's® 7037 Series RF Power Sensor is capable of a stunning 0.5% accuracy for measurements of CW and pulsed signals. This precision sensor is an invaluable tool for development and production engineers who require the most precise accuracy in lab and semiconductor fab environments. Calibration is NIST traceable.

PRODUCT FEATURES

- Time domain display
- Gated power measurements with up to four sets of gates available
- Capable of ±0.5% power measurement accuracy
- NIST traceable calibration
- Measure pulse state widths down to 1us (sensor dependent)
- Measure pulse rep rates up to 100kHz (sensor dependent)
- External sync input
- RF Interlock (optional)
- Automate with SCPI command set

BENEFITS

- Enhances the set point accuracy of the RF sources
- Optimizes source-to-source consistency across the fleet
- Delivers power measurements to 0.5% accuracy across its dynamic range
- Simplifies measurements of multilevel pulses
- Streamlines data collection efforts via UI or API

7037	FREQUENCY RANGE	POWER RANGE	PULSE REP RATE
7037-1-524001-xxyy	0.4 MHz ±10%	25 W to 25 kW	10 Hz to 11.25 kHz
7037-1-544301-xxyy	2 MHz ±10%	10 W to 10 kW	10 Hz to 50 kHz
7037-1-595701-xxyy	13.56 MHz ±5%	100 W to 10 kW	100 Hz to 100 kHz
7037-1-605801-xxyy	27.12 MHz ±5%	60 W to 6 kW	100 Hz to 100 kHz
7037-1-616101-xxyy	40.68 MHz ±5%	75 W to 7.5 kW	100 Hz to 100 kHz
7037-1-625801-xxyy	60 MHz ±5%	60 W to 6 kW	100 Hz to 100 kHz

Connector Options (xxyy): 7/16 DIN, N, HN, LC, QRM and others that are available on request

MEASUREMENT

Measurement Type	CW & Multi-State Pulsed RF Power
Impedance	50 Ohms nominal
7037 Series Power Measurement Accuracy	.5% at calibrated frequencies 1.5% at all other frequencies within sensor bandwidth
VSWR Range	1.0:1 to 2.0:1
Insertion Loss	<0.05 dB max
Insertion VSWR	1.05 max
Directivity	28 dB min

CONNECTORS

RF Connectors	QC 7/16 DIN, N, HN, LC, QRM and others that are available on request

SYSTEM

Recommended Calibration Interval	6 months
Interface	USB 2.0
Power Supply	Via supplied USB Cable
External Sync Input	TTL High, 2-5 V TTL Low, 0-0.85 V

ENVIRONMENTAL

Operating Temperature	15 °C to 35 °C (59 °F to 95 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	95% max (non-condensing)
Altitude	15,000 ft max (4,500 m max)

PHYSICAL

Size	6.0 in x 3.7 in x 1.9 in (155 mm x 95 mm x 50 mm) Not including QC connectors
Weight	Less than 3 lb

CERTIFICATIONS

Mechanical Shock and Vibration	Designed to meet MIL-PRF-28800F class 3
EMC	**EMC Directive (2004/108/EC)** **European Standard:** EN 61326 Electrical Equipment for measurement, control and laboratory use **EMC Requirements:** Test Spec (for radiated immunity) EN 61000-4-3 - Testing and measurement techniques - 10V/meter
CE	CE Compliant
RoHS	Compliant

Pulse/CW RF Power Sensors

7027 SERIES

1% ACCURACY

Bird's® 7027 Series RF Power Sensors for precision semiconductor applications bring reliable and traceable accuracy to development and production engineers in lab and semiconductor fab environments. At calibrated frequencies, this sensor is capable of 1% accuracy for measurements of CW and pulsed signals. Calibration is NIST traceable.

PRODUCT FEATURES

- Time domain display
- Gated power measurements with up to four sets of gates available
- Capable of ±1% power measurement accuracy
- NIST traceable calibration
- Measure pulse state widths down to 1us (sensor dependent)
- Measure pulse rep rates up to 100kHz (sensor dependent)
- External sync input
- RF Interlock (optional)
- Automate with SCPI command set

BENEFITS

- Enhances the set point accuracy of the RF sources
- Optimizes source-to-source consistency across the fleet
- Delivers power measurements to 1% accuracy across its dynamic range
- Simplifies measurements of multilevel pulses
- Streamlines data collection efforts via UI or API

7027	FREQUENCY RANGE	POWER RANGE	PULSE REP RATE
7027-1-524001-xxyy	0.4 MHz ±10%	25 W to 25 kW	10 Hz to 11.25 kHz
7027-1-544601-xxyy	2 MHz ±10%	10 W to 5 kW	10 Hz to 50 kHz
7027-1-594301-xxyy	13.56 MHz ±5%	10 W to 10 kW	100 Hz to 100 kHz
7027-1-615501-xxyy	40.68 MHz ±5%	7.5 W to 7.5 kW	100 Hz to 100 kHz
7027-1-624901-xxyy	60 MHz ±5%	30 W to 6 kW	100 Hz to 100 kHz

Connector Options (xxyy): 7/16 DIN, N, HN, LC, QRM and others that are available on request

MEASUREMENT

Measurement Type	CW & Multi-State Pulsed RF Power
Impedance	50 Ohms nominal
7027 Series Power Measurement Accuracy	1% at calibrated frequencies 2% at all other frequencies within sensor bandwidth
VSWR Range	1.0:1 to 2.0:1
Insertion Loss	<0.05 dB max
Insertion VSWR	1.05 max
Directivity	28 dB min

CONNECTORS

RF Connectors	QC 7/16 DIN, N, HN, LC, QRM and others that are available on request

SYSTEM

Recommended Calibration Interval	6 months
Interface	USB 2.0
Power Supply	Via supplied USB Cable
External Sync Input	TTL High, 2-5 V TTL Low, 0-0.85 V

ENVIRONMENTAL

Operating Temperature	15 °C to 35 °C (59 °F to 95 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	95% max (non-condensing)
Altitude	15,000 ft max (4,500 m max)

PHYSICAL

Size	6.0 in x 3.7 in x 1.9 in (155 mm x 95 mm x 50 mm) Not including QC connectors
Weight	Less than 3 lb

CERTIFICATIONS

Mechanical Shock and Vibration	Designed to meet MIL-PRF-28800F class 3
EMC	**EMC Directive (2004/108/EC)** **European Standard:** EN 61326 - Electrical Equipment for measurement, control and laboratory use **EMC Requirements** Test Spec (for radiated immunity) EN 61000-4-3 - Testing and measurement techniques - 10V/meter
CE	CE Compliant
RoHS	Compliant

CW Directional RF Power Sensors

4027A SERIES

±1% ACCURACY

The 4027A Series Power Sensors from Bird bring superb accuracy and ease of use together for the laboratory engineer. In semiconductor processing and other precision process applications where accuracy is critical, these sensors are capable of 1% accuracy at the calibrated frequency and power level. Calibration is traceable to the National Institute of Standards and Technology (NIST), providing additional confidence in sensor measurement.

PRODUCT FEATURES

- 1% accuracy at specified frequencies and power levels
- Models do not need to be field calibrated before use and only need to be calibrated once every six months
- Plug and Play with the 4421A Multifunction Meter
- Dozens of connector options available
- Calibration traceable to the National Institute of Standards and Technology

FOR USE WITH

- 4421A Multifunction Power Meters
- SCC7 Calibration Cart
- MSCC7 Calibration Cart

BENEFITS

- Enhances the set point accuracy of the CW RF source
- Optimizes source-to-source consistency across the fleet
- Delivers forward power measurements down to 1% accuracy
- Reduces ambiguity with straightforward operation and measurement display

4027A	FREQUENCY RANGE	POWER RANGE
4027A12M-xxyy	10 to 15 MHz	300 mW to 1 kW
4027A250K-xxyy	250 to 400 kHz	3 W to 10 kW
4027A400K-xxyy	400 to 550 kHz	3 W to 10 kW
4027A800K-xxyy	800 to 950 kHz	3 W to 10 kW
4027A2M-xxyy	1.5 to 2.5 MHz	3 W to 10 kW
4027A4M-xxyy	3 to 5 MHz	3 W to 10 kW

	FREQUENCY RANGE	POWER RANGE
4027A10M-xxyy	10 to 15 MHz	3 W to 10 kW
4027A25M-xxyy	25 to 30 MHz	3 W to 9 kW
4027A35M-xxyy	35 to 45 MHz	3 W to 7.5 kW
4027A60M-xxyy	45 to 65 MHz	3 W to 6 kW
4027A100M-xxyy	95 to 105 MHz	3 W to 4 kW
4027A150M-xxyy	150 to 170 MHz	3.75W to 3.75 kW

Connector Options (xxyy): 7/16 DIN, N, HN, LC, QRM and others that are available on request

MEASUREMENT

Accuracy	±1% at calibration frequencies and power levels ±2% at other frequency and power levels - add 2% to uncertainty outside 25 ±10 °C
Uniformity	2% maximum unit to unit, at calibration frequency and power levels
Speed	2 readings per second
Harmonic Content	-50 dBc max
VSWR Range	1.00 to 2.00
Directivity	28 dB
Insertion Loss	<0.05 dB

Calibration Power Level	1000 W units: 700 W Other units: 1700 W
Maximum Power	Sensor Frequency Dependent

CONNECTORS

RF Connectors	Customer specified

SYSTEM

Recommended Calibration Interval	6 month. Performance before and performance after data supplied with recalibrations
Power Supply	External DC, 12 VDC, supplied from Bird 4421A Power Meter

ENVIRONMENTAL

Operating Temperature	0 °C to 50 °C (32 °F to 122 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	95% max (non-condensing)
Altitude	Up to 10,000 ft (3,048m)

PHYSICAL

Size	5.2 in x 2.5 in x 3.25 in (137 mm x 64 mm x 83 mm)
Weight	1 lb 13 oz (0.8 kg)

CERTIFICATIONS

EMC	Designed to carry CE mark

CW Filtered RF Power Sensors

4027F SERIES

±1% ACCURACY

The Bird 4027F Series RF Power Sensors are designed specifically for use in semiconductor processing and other precision process applications where the effects of amplitude modulation and harmonics need to be eliminated from the measurement. Because accuracy is critical, these sensors are capable of ±1% accuracy at the calibrated frequency and power level. Calibration is traceable to the National Institute of Standards and Technology (NIST), providing additional confidence in sensor measurement.

PRODUCT FEATURES

- Provides filtered measurement where the effects of amplitude modulation and harmonics need to be eliminated
- ±1% accuracy at specified frequencies and power levels
- Models do not need to be field calibrated before use and only need to be calibrated once every 6 months
- Plug and Play with the 4421A Series Multifunction Power Meter
- Dozens of connector options available

FOR USE WITH

- 4421A Multifunction Power Meters
- SCC7 Calibration Cart
- MSCC7 Calibration Cart

BENEFITS

- Enhances the set point accuracy of the CW RF source
- Optimizes source-to-source consistency across the fleet
- Delivers forward power measurements down to 1% accuracy
- Maximizes the measurement accuracy of your main signal by filtering harmonics

	4027F2M-xxyy	4027F10M-xxyy	4027F60M-xxyy
Frequency Range	1.8 to 2.2 MHz	12 to 15 MHz	57 to 63 MHz
Power Range	100 W to 10 kW	100W to 10 kW	100W to 6 kW
Calibration Frequency, Type	1.8, 2.0, 2.17 MHz	12.0, 12.5, 13.56, 14.0, 15.0 MHz	57.0, 58.5, 60.0, 61.5, 63 MHz
Harmonic Rejection, Min	26 dB@3.6 MHz to 3.8 MHz, 30 dB@>3.8 MHz	30 dB@>25 MHz	30 dB@>114.0 MHz
LF Rejection	Not specified	30 dB@<1 MHz	30 dB@<15.0 MHz
Max Error Induced by 10% AM	0.2%@<5 kW, 1%@5 kW to 10 kW	0.2%@<5 kW, 1%@5 kW to 10 kW	0.2%@<1.5 kW, 1%@1.5 kW to 3 kW

Connector Options (xxyy): 7/16 DIN, N, HN, LC, QRM and others that are available on request

MEASUREMENT

Accuracy	±1% at calibration frequencies and power levels, ±2% at other frequency and power levels Add 2% to uncertainty outside 25 ±5 °C
Uniformity	2% maximum unit to unit, at calibration frequency and power levels
Speed	2 readings per second
VSWR Range	1.00 to 2.00
Directivity	28 dB
Insertion Loss	<0.05 dB
Calibration Power Level	1700 W
Maximum Power	**10 kW units:** 12 kW max **6 kW units:** 7.2 kW max

CONNECTORS

RF Connectors	Customer specified

SYSTEM

Recommended Calibration Interval	6 month. Performance before and performance after data to be supplied for units
Power Supply	External DC, 12 VDC, supplied from Bird 4421A Power Meter

CERTIFICATIONS

EMC	Designed to carry CE mark

ENVIRONMENTAL

Operating Temperature	0 °C to 50 °C (32 °F to 122 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	95% max (non-condensing)
Altitude	Up to 10,000 ft (3,048 m)

PHYSICAL

Size	5.2 in x 2.5 in x 3.25 in (137 mm x 64 mm x 83 mm)
Weight	1 lb 13 oz (0.8 kg)

CW Directional RF Power Sensors

4028 SERIES

±2% ACCURACY

The Bird 4028 Series RF Directional Thruline Power Sensors are designed specifically for use in high power LCD, TFT and Solar processing as well as other precision high power applications. Because accuracy is critical, these sensors are capable of ±2% accuracy at the calibrated frequency and power level which can improve accuracy and long-term repeatability for significant improvements on your process yields

PRODUCT FEATURES

- Specifically designed for use in high power LCD, TFT and Solar processing and other precision high power applications up to 50 kW
- ±2% accuracy at specified frequencies and power levels
- Models do not need to be field calibrated before use and only need to be calibrated once every year
- Plug and Play with the 4421A Series Multifunction Power Meter
- Dozens of connector options available
- Calibration traceable to the National Institute of Standards and Technology

FOR USE WITH

- 4421A Multifunction Power Meters
- SCC8 Calibration Cart

BENEFITS

- Enhances the set point accuracy of the CW RF source
- Optimizes source-to-source consistency across the fleet
- Delivers forward power measurements down to 2% accuracy
- Supports measurements of higher power signals used in industrial processes

4028	FREQUENCY RANGE	POWER RANGE
4028A250K-xxyy	250 to 400 kHz	1.0 to 20 kW
4028A400K-xxyy	400 to 550 kHz	1.0 to 20 kW
4028A2M-xxyy	1.5 to 2.5 MHz	1.0 to 25 kW
4028A3M-xxyy	2.5 to 3.5 MHz	1.0 to 25 kW
4028A4M-xxyy	3.5 to 4.5 MHz	1.0 to 25 kW

	FREQUENCY RANGE	POWER RANGE
4028A10M-xxyy	10 to 15 MHz	1.0 to 25 kW
4028A25M-xxyy	25 to 30 MHz	1.0 to 25 kW
4028B3M	2.5 to 4 MHz	1.0 to 25 kW
4028B10M	10 to 15 MHz	1.0 to 25 kW
4028C10M	10 to 15 MHz	500 W to 50 kW

Connector Options (xxyy): 7/16 DIN, N, HN, LC, QRM and others that are available on request

MEASUREMENT

Accuracy	±2% at calibration frequencies and power levels ±3% at other frequency and power levels Add 2% to uncertainty outside 25 ±10 °C
VSWR, Max	2.00:1
Directivity, Min	28 dB
Insertion Loss, Max	0.05 dB (with female 7/16 DIN connectors)
Impedance, Nominal	50 Ohms
Speed	2 readings per second
Calibration Power Level	1.7 kW

CONNECTORS

RF Connectors	
A Series **B Series** **C Series**	Customer specified 1 5/8" EIA Flanged 3 1/8" EIA Flanged
Sensor Interface	Latch-n-Lock

SYSTEM

Recommended Calibration Interval	1 year
Power Supply	Supplied by power meter via sensor cable

ENVIRONMENTAL

Operating Temperature	0 °C to 50 °C (32 °F to 122 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	95% max (non-condensing)
Altitude	10,000 ft (3,000 m)

PHYSICAL

Size, Nom	
A Series (w/o connectors)	4.7 in x 3.2 in x 3.8 in (120 mm x 82 mm x 97 mm)
B Series	6.8 in x 3.5 in x 4.8 in (171 mm x 89 mm x 121 mm)
C Series	8.0 in x 5.2 in x 6.4 in (203 mm x 131 mm x 162 mm)
Weight, Nom	
A Series	1.7 lb (0.8 kg)
B Series	3.3 lb (1.5 kg)
C Series	7.3 lb (3.3 kg)

CERTIFICATIONS

EMC	Designed to carry CE mark

CW Directional RF Power Sensors

4020 SERIES

±3% ACCURACY

Five models of the Bird 4020 Directional RF Power Sensor Series cover the frequency range of 100 kHz to 3 GHz and power range from 300 mW to 10 kW. These sensors have low insertion loss and full-scale accuracy ±3% for applications requiring accurate forward and reflected power measurement. Also offers direct plug-in operation with industry-standard Bird 4421A Series Multifunction Power Meters.

PRODUCT FEATURES

- Models cover frequency range of 100 kHz to 3 GHz
- Models cover power range from 300 mW to 10 kW
- Low insertion loss and full-scale accuracy ±3%
- Direct plug-in operation with industry-standard Bird 4421A Series Multifunction Power Meters

FOR USE WITH

- 4421A Multifunction Power Meters
- SCC7 Calibration Cart
- MSCC7 Calibration Cart

BENEFITS

- Enhances the set point accuracy of the CW RF source
- Optimizes source-to-source consistency across the fleet
- Delivers forward measurements down to 3% accuracy
- Provides the flexibility of measuring various sources with its wideband capability

	4021	4022	4023A3G	4024	4025
Frequency Range	1.8 to 32 MHz	25 MHz to 1 GHz	800 to 3 GHz	1.5 to 32 MHz	100 kHz to 2.5 MHz
Power Range	300 mW to 1 kW (1.2 kW max)	300 mW to 1 kW (1.2 kW max)	300 mW to 200 W	3 W to 10 kW (12 kW max)	3 W to 10 kW (12 kW max)
Insertion Loss Max (with female "N" connector)	0.05 dB	0.05 dB, 25 to 512 MHz, 0.13 dB, 512 MHz to 1 GHz	0.15 dB	0.05 dB	0.05 dB
Insertion VSWR (with female "N" connector)	1.05:1	1.05:1: 25 to 512 MHz, 1.10:1: 512 MHz to 1 GHz	1.10:1	1.05:1	1.05:1
Directivity	30 dB	30 dB: 25 to 400 MHz 26 dB: 400 to 1000 MHz	28 dB	28 dB: 1.5-2.5 and 25 to 32 MHz 30 dB: 2.5 to 25 MHz	28 dB: 100 to 125 kHz 30 dB: 125 to 2500 kHz

MEASUREMENT

Impedance, Nominal	50 Ohms
Accuracy	±3% of reading, with no more than 1% AM, harmonics -50 dBc or less, terminating VSWR 2:1 or less
VSWR Range	1.00 to 2.00 (40.0 to 9.5 dB Return Loss)

CONNECTORS

RF Connectors	N(f) standard, other customer specified from QC list appropriate for frequency and power.

SYSTEM

Recommended Calibration Interval	Nominal 1 year
Power Supply	External DC, 12 VDC, supplied from Bird 4421A Power Meter

ENVIRONMENTAL

Operating Temperature	0 °C to 50 °C (32 °F to 122 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	95% max (non-condensing)
Altitude	Up to 10,000 ft (3,048 m)

PHYSICAL

Size	5.2 in x 2.5 in x 3.25 in (137 mm x 64 mm x 83 mm)
Weight	1 lb 11 oz (0.8 kg)

CERTIFICATIONS

EMC	Designed to carry CE mark

V-I-Φ Measurement Solution

BIRD DIAGNOSTIC SYSTEM (BDS2)

Using sophisticated parallel signal processing, the BDS2 simultaneously measures and reports voltage, current, and phase angle at multiple fundamental, harmonic and intermodulation frequencies. A robust frequency tracking algorithm guarantees accurate measurements under dynamic signal conditions. With this data, power and impedance are calculated at each frequency, giving users the ability to identify small discrepancies that may make the difference between a successful and a failed process.

PRODUCT FEATURES

- 1% accurate measurement of RF voltage and current with a locked system
- Calculated impedance, RF power
- Multi-level pulse or CW waveforms
- 1-3 fundamental frequencies
- 4 harmonics per fundamental frequency
- 6 intermodulation products per fundamental pair
- Time-domain mode
- Tracking & Spectral search mode
- Ethernet enabled

APPLICATIONS

- Chamber to chamber matching
- RF process monitoring
- Impedance matching
- Troubleshooting RF delivery system
- Identify process drifts
- Harmonic levels up to 252 MHz are available for analysis
- Voltage, current, phase and delivered power comparison

MEASUREMENT

Measurements	Voltage, current, phase, frequency, impedance, power at frequencies selected by user
Frequency Range	307 kHz to 252 MHz (Sensor Dependent)
Frequency Resolution	100 Hz
Frequency Accuracy	±1 kHz
Number of Fundamentals	Up to 3 simultaneously. For more than 1 fundamental, choose from the following (or contact the factory for custom combinations): - 0.4, 13.56, 160 MHz - 0.4, 60 MHz - 1, 13.56 MHz - 2, 27.12, 60 MHz - 3.2, 40.68 MHz - 3.2, 60 MHz - 12.88, 40.68 MHz - 13.56, 100 MHz

Tracking Frequency Slew Rate	2 GHz/sec
Tracking Minimum Pulse Width	5 µsec
Number of Harmonics	4 harmonics per fundamental, 6 intermodulation products per pair of fundamentals up to 252 MHz Limited by the maximum number of measurement channels Tracking & Spectral search mode: 12 harmonics standard mode 6 in time domain mode
Update Rates	100 Hz typical
Network Protocol	Ethernet
RF Power Max	Determined by RF sensor, (Typically 10 kW or higher)
RF Connector	Custom or QC
Operating Modes	Tracking mode, Spectral Search mode

ENVIRONMENTAL

Receiver Operating Temperature	20 °C to 40 °C (68 °F to 104 °F)
Receiver Storage Temperature	-20 °C to 80 °C (-4 °F to 176 °F)
Cable Operating Temperature	0 °C to 100 °C (32 °F to 212 °F)
Cable Storage Temperature	-20 °C to 100 °C (-4 °F to 212 °F)
Sensor Operating/ Storage Temperature	Refer to sensor specification
Humidity	85% max (non-condensing)
Air Pressure	745 mbar (equivalent to 2,500 m/ 8,200 ft max altitude)

POWER

Operating Power	15 VDC, 2.5 A nominal

V-I-Φ Measurement Solution BIRD DIAGNOSTIC SYSTEM (BDS2)

SYSTEM PROFILES

	VOLTAGE	CURRENT	PHASE ANGLE
Measurement	RF: 1 to 3000V_{rms} (Note 1)	0.1 to 100 A_{rms} (Note 1)	-180° to + 180°
Resolution	IEEE 754 Single Precision Floating Point		
Uncertainty 307 kHz to 1 MHz Locked System (Note 2)	for $F_\circ$, ±0.5 V or 1% of reading whichever is greater for F_n, ±1.0 V or 2% of reading, whichever is greater (95% confidence interval)	for $F_\circ$, ±0.05 A or 1% of reading whichever is greater for F_n, ±0.1 A or 2% of reading, whichever is greater (95% confidence interval)	**Absolute Angle:** $F_\circ \geq 10$ V, 1A: ±1° $F_\circ < 10$ V, 1A: ±4° $F_n \geq 10$ V, 1A: ±2° $F_n < 10$ V, 1A: ±6° (95% confidence interval)
Uncertainty 1 to 252 MHz Locked System (Note 2)	for $F_\circ$, ±0.1 V or 1% of reading whichever is greater for F_n, ±0.2 V or 2% of reading, whichever is greater (95% confidence interval)	for $F_\circ$, ±0.01 A or 1% of reading whichever is greater for F_n, ±0.02 A or 2% of reading, whichever is greater (95% confidence interval)	
Uncertainty 307 kHz to 1 MHz Unlocked System (Note 2)	for $F_\circ$, ±1.0 V or 2% of reading whichever is greater for F_n, ±2.0 V or 4% of reading, whichever is greater (95% confidence interval)	for $F_\circ$, ±0.1 A or 2% of reading whichever is greater for F_n, ±0.2 A or 4% of reading, whichever is greater (95% confidence interval)	**Absolute Angle:** $F_\circ \geq 10$ V, 1A: ±1° $F_\circ < 10$ V, 1A : ±4° $F_n \geq 10$ V, 1A: ±2° $F_n < 10$ V, 1A: ±6° (95% confidence interval)
Uncertainty 1 to 252 MHz Unlocked System (Note 2)	for $F_\circ$, ±0.2 V or 2% of reading whichever is greater for F_n, ±0.4 V or 4% of reading, whichever is greater (95% confidence interval)	for $F_\circ$, ±0.02 A or 2% of reading whichever is greater for F_n, ±0.04 A or 4% of reading, whichever is greater (95% confidence interval)	

*Contact factory for a custom designed sensor and custom frequency combinations.
Note 1: Maximum power is limited by the size of the RF frequency (25 kW max average power at 13.56 MHz).
Note 2: At customer specified frequencies.

SYSTEM COMPONENTS - UNLOCKED SYSTEM

	DESCRIPTION	CONNECTION OPTIONS
7001A900-2	BDS2 Single Ch. Receiver w/Ethernet	N/A
7001B040-5M	RF/Data Cable Set 5 M straight	N/A
7001B550-1-xxyy	Sensor, BDS2, QC Connector (Choose xx yy options from connection options)	**Input (xx) and Output (yy) Connectors** 01 = N(f) 12 = HN(f) 14 = 7/16(f) 34 = LC(f) 02 = N(m) 13 = HN(m) 15 = 7/16(m) 35 = LC(m)
7001A550-2	Sensor, BDS2, Protruding Dielectric Connection	N/A

*Contact Bird for additional connector options

SYSTEM KITS - LOCKED SYSTEM

	DESCRIPTION	CONNECTION OPTIONS
7001B500-1-xxyy	BDS2 Kit (Receiver, Cable and Sensor Kit), QC Connectors (Choose xx yy options from connection options)	**Input (xx) and Output (yy) Connectors** 01 = N(f) 12 = HN(f) 14 = 7/16(f) 34 = LC(f) 02 = N(m) 13 = HN(m) 15 = 7/16(m) 35 = LC(m)
7001A500-1-2	BDS2 Kit (Receiver, Cable and Sensor Kit), Protruding Dielectric Connection	N/A

*Contact Bird for additional connector options

TIME DOMAIN MEASUREMENT MODE (OPTIONAL)

	DESCRIPTION
License Options	Factory Install (7001A993-1) or Field Install (7001A993F-1)
Time Resolution	500 ns
Configurable Time Scale	0.1 to 10 ms
Average	Trace Average
Trigger	Voltage or current waveform, Rising or falling edge, External triggering, Upper/lower thresholds, Holdoff
Pre- and Post- Trigger Buffer	5% to 95%

Single Sensor Calibration Cart

SCC7 SERIES

The SCC7 Calibration Cart provides the ideal solution for the calibration of RF generators. It combines a high accuracy Bird Power Sensor, a user friendly 4421A Multifunction Power Meter, and a low reflection load in an easily transportable mobile package. The system is indispensable for semiconductor fabs with multiple RF generators in various locations.

PRODUCT FEATURES

- Suitable for use in a clean room environment
- Stainless steel cart is designed for easy transportation and effortless use
- Customizable with choice of power sensor and load configuration
- High return loss ensures minimal power measurement error contribution

INCLUDES

- **4421A Multifunction Power Meter** to display RF power readings with up to 1% accuracy
- **A 4020, 4027A or 4027F Series Power Sensor** for accurate RF measurement
- **An Ultra-Stable SC13 or High Power Load** for precision RF power regulation and control

MODEL 4421A

SYSTEM

Meter	4421A Multifunction Power Meter
Sensor Options	4020 Series, 4027A Series, or 4027F Series
Load Options	Ultra-Stable Load or High Power Load
Sensor Frequency Range	
4020 Series	100 KHz to 1000 MHz
4027A Series	250 KHz to 170 MHz
4027F Series	1.8 MHz to 63 MHz
Sensor Accuracy	
4020 Series	±3% across power and frequency range
4027A Series	±1% at calibration frequency and power levels
4027F Series	±1% at calibration frequency and power levels

Impedance	50 Ohms nominal
Power Requirements	115 or 230 VAC, 50/60 Hz
Connector Type	Customer specified
Operating Position	Vertical only
Casters	4 swivel
Material of Construction	Stainless steel cart

PHYSICAL

Size (fully assembled)	
1 kW & 2.5 kW Models	42 in x 20 in x 42 in (107 cm x 51 cm x 107 cm)
5 kW & 10 kW Models	52 in x 20 in x 42 in (132 cm x 51 cm x 107 cm)
Weight (fully assembled)	
1 kW & 2.5 kW Models	175 lb (80kg)
5 kW & 10 kW Models	250 lb (114kg)

ENVIRONMENTAL

Ambient Temperature	0 °C to 35 °C (32 °F to 95 °F), (10 kW Model 0 °C to 40 °C/ 32 °F to 104 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	85% max (non-condensing)
Altitude	Load derated above 5,000 ft (1,524 m)

CERTIFICATIONS

CE	CE Compliant

Single Sensor Calibration Cart

SCC7 SERIES CONFIGURATION GUIDE

RF POWER SENSORS - CHOOSE ONE (1)

4020 SERIES Directional Thruline	FREQUENCY RANGE	POWER INPUT
4021	1.8 to 32 MHz	300 mW to 1 kW at 1.2 kW max
4022	25 to1000 MHz	300 mW to 1 kW at 1.2 kW max
4024	1.5 to 32 MHz	3 W to 10 kW at 12 kW max
4025	100 to 2500 kHz	3 W to 10 kW at 12 kW max

4027A SERIES Precision Directional	FREQUENCY RANGE	POWER INPUT
4027A250k	250 to 400 kHz	3 W to 10 kW
4027A400k	400 to 550 kHz	3 W to 10 kW
4027A800k	800 to 950 kHz	3 W to 10 kW
4027A2M	1.5 to 2.5 MHz	3 W to 10 kW
4027A4M	3 to 5 MHz	3 W to 10 kW
4027A10M	10 to 15 MHz	3 W to 10 kW
4027A12M	10 to 15 MHz	300 mW to 1 kW
4027A25M	25 to 30 MHz	3 W to 9 kW
4027A35M	35 to 45 MHz	3 W to 7.5 kW
4027A60M	45 to 65 MHz	3 W to 6 kW
4027A100M	95 to 105 MHz	3 W to 4 kW
4027A150M	150 to 170 MHz	3.75 W to 3.75 kW

4027F SERIES Precision Filtered	FREQUENCY RANGE	POWER INPUT
4027F2M	1.8 to 2.2 MHz	100 W to 10 kW
4027F10M	12 to15 MHz	100 W to 10 kW
4027F60M	57 to 63 MHz	100 W to 6 kW

RF LOADS - CHOOSE ONE (1)

HIGH POWER LOADS	FREQUENCY RANGE & VSWR	POWER INPUT
8251	DC to 1 GHz @ 1.1 max	1 kW continuous
8890-300-34	DC to 1 GHz @ 1.1 max, 1 GHz to 2 GHz @ 1.25 max 2 GHz to 2.4 GHz @ 1.3 max	2500 W continuous
8921-34	DC to 1 GHz @ 1.1 max	5000 W continuous
8931-115-34	DC to 400 MHz @ 1.15 max 400 MHz to 1 GHz @ 1.20 max	10 kW continuous w/blower on 2.5 kW continuous w/blower off
8931-230-34	DC to 400 MHz @ 1.15 max 400 MHz to 1 GHz @ 1.20 max	10 kW continuous w/blower on 2.5 kW continuous w/blower off

ULTRA-STABLE LOADS	FREQUENCY RANGE & VSWR	POWER INPUT
8890-300SC13-34	DC to 28 MHz @ 1.1 max	2.5 kW continuous
8921SC13-34	DC to 28 MHz @ 1.1 max	5 kW continuous
8931-115SC13-34	DC to 28 MHz @ 1.1 max	10 kW continuous
8931-230SC13-34	DC to 28 MHz @ 1.1 max	10 kW continuous

Dual Sensor Calibration Cart

MSCC7 SERIES

The MSCC7 Calibration Cart is a unique calibration solution in that it is designed to support two Power Sensors. In addition, it includes a user friendly 4421A Multifunction Power Meter and a high power load in an easily transportable mobile cart. The system is indispensable for semiconductor clean room applications.

PRODUCT FEATURES

- Designed to support two power sensors
- Suitable for use in a clean room environment
- Stainless steel cart is designed for easy transportation and effortless use
- Customizable with choice of power sensor and load configuration
- High return loss ensures minimal power measurement error contribution

INCLUDES

- **4421A Multifunction Power Meter** to display RF power readings with up to 1% accuracy
- **Two 4020, 4027A, or 4027F Power Sensors** for accurate RF measurement
- **A High Power Load** for precision RF power regulation and control

MODEL 4421A

SYSTEM

Meter	4421A Multifunction Power Meter
Sensor Options	Two 4020, 4027A, or 4027F Series
Load	One Bird High Power Load
Frequency Range	100 kHz to 30 MHz, depending on sensor
Sensor Accuracy	
4020 Series	±3% across power and frequency range
4027A Series	±1% at calibration frequency and power levels
4027F Series	±1% at calibration frequency and power levels

Impedance	50 Ohms nominal
Power Requirements	115 or 230 VAC, 50/60 Hz
Connector Type	Customer specified
Operating Position	Vertical only
Casters	4 swivel
Material of Construction	Stainless steel cart

ENVIRONMENTAL

Operating Temperature	0 °C to 35 °C (32 °F to 95 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity	85% max (non-condensing)
Altitude	Load derated above 5,000 ft (1,524 m)

PHYSICAL

Size	52 in x 20 in x 42 in (132 cm x 51 cm x 107 cm)
Weight	290 lb (132 kg)

CERTIFICATIONS

CE	CE Compliant

Dual Sensor Calibration Cart

MSCC7 SERIES CONFIGURATION GUIDE

RF POWER SENSORS - CHOOSE TWO (2)

4020 SERIES Directional Thruline	FREQUENCY RANGE	POWER INPUT
4021	1.8 to 32 MHz	300 mW to 1 kW at 1.2 kW max
4024	1.5 to 32 MHz	3 W to 10 kW at 12 kW max
4025	100 to 2500 kHz	3 W to 10 kW at 12 kW max

4027A SERIES Precision Directional	FREQUENCY RANGE	POWER INPUT
4027A250k	250 to 400 kHz	3 W to 10 kW
4027A400k	400 to 550 kHz	3 W to 10 kW
4027A800k	800 to 950 kHz	3 W to 10 kW
4027A2M	1.5 to 2.5 MHz	3 W to 10 kW
4027A4M	3 to 5 MHz	3 W to 10 kW
4027A10M	10 to 15 MHz	3 W to 10 kW
4027A12M	10 to 15 MHz	300 mW to 1 kW
4027A25M	25 to 30 MHz	3 W to 9 kW

4027F SERIES Precision Filtered	FREQUENCY RANGE	POWER INPUT
4027F2M	1.8 to 2.2 MHz	100 W to 10 kW
4027F10M	12 to15 MHz	100 W to 10 kW

RF LOADS - CHOOSE ONE (1)

HIGH POWER LOADS	FREQUENCY RANGE & VSWR	POWER INPUT
8921A100	DC to 30 MHz @ 1.1 max	5 kW continuous
8931A400-115	DC to 30 MHz @ 1.1 max	10 kW continuous
8931A400-230	DC to 30 MHz @ 1.1 max	10 kW continuous

High Power Calibration Cart

SCC8 SERIES

The SCC8 Calibration Cart provides the ideal solution for the calibration of high power RF generators with power measurement up to 25 kW. It combines the high-accuracy Bird 4028 Series Power Sensor, a user-friendly 4421A Multifunction Power Meter, and a Bird Moduload in an easily transportable mobile package.

PRODUCT FEATURES

- Designed for effortless, immediate use
- Suitable for use in a clean room environment
- High return loss ensures minimal power measurement error contribution
- Stainless steel cart with locking wheels is designed for easy transportation and effortless use

INCLUDES

- **4421A Multifunction Power Meter** to display RF power readings with up to 2% accuracy
- **A 4028 Series Power Sensor** for accurate RF measurement
- **A Bird Moduload** with low reflection 50 Ohm terminations that can dissipate up to 25 kW

MODEL 4421A

RF POWER SENSORS - CHOOSE ONE (1)

4028 SERIES Directional Thruline	FREQUENCY RANGE	POWER INPUT
4028A10M	10 to 15 MHz	1 kW to 25 kW
4028A250K	250 to 400 kHz	1 kW to 20 kW
4028A25M	25 to 30 MHz	1 kW to 25 kW
4028A2M	1.5 to 2.5 MHz	1 kW to 25 kW
4028A3M	2.5 to 3.5 MHz	1 kW to 25 kW
4028A400K	400 to 550 kHz	1 kW to 20 kW
4028A4M	3.5 to 4.5 MHz	1 kW to 25 kW
4028B10M	10 to 15 MHz	1 kW to 25 kW
4028B3M	3 to 4 MHz	1 kW to 25 kW

SYSTEM

Meter	4421A Multifunction Power Meter
Sensor	4028 Series
Load	Bird Moduload
Frequency Range	250 kHz - 30 MHz, depending on sensor
Accuracy	±2% (2s) at calibration frequency and power levels, ±3% (2s) of reading at other power levels and frequencies within sensor range (add 2% to uncertainty outside 25 ±10 °C)
Impedance	50 Ohms nominal
Power Requirements	115 or 230 VAC, 50/60 Hz
Connector Type	Customer specified

Sensor VSWR	1.05 max (32.2 dB return loss)
Load VSWR	1.1 max (26.4 dB return loss)
Coolant	100% water or 35% industrial ethylene glycol / 65% water, 9 quarts (8.5 liters), forced air cooling
Particle Generation	156 per cfm (0.5 µm) 29 per cfm (1 µm) 0 per cfm (3 µm)
Casters	4 locking swivel
Material of Construction	Stainless steel cart

PHYSICAL

Size	39.5 in x 21.5 in x 39.5 in (100.3 cm x 54.6 cm x 100.3 cm)
Weight	240 lb (109 kg)

ENVIRONMENTAL

Operating Temperature	5 °C to 30 °C (41 °F to 86 °F), < 25 kW, 100% water, (derate sensor accuracy outside 25 ±10 °C), 5 °C to 35 °C (41 °F to 95 °F), < 20 kW, 100% water, (derate sensor accuracy outside 25 ±10 °C) 0 °C to 25 °C (32 °F to 77 °F), < 25 kW, 35% ethylene glycol/65% water 0 °C to 35 °C (32 °F to 95 °F), < 20 kW, 35% ethylene glycol/65% water
Storage Temperature	5 °C to 50 °C (41 °F to 122 °F), 100% water -20 °C to 50 °C (-4 °F to 122 °F), 35% ethylene glycol/65% water
Humidity	85% max (non-condensing)
Altitude	Load derated above 5,000 ft (1,524 m)

CERTIFICATIONS

CE	CE Compliant

RF Calibration Kit

SMK-3000 SERIES

The SMK-3000 calibration kits are precision, high power calibration standards used to calibrate RF radios, wattmeters, directional couplers and other high-power RF test equipment in the field or metrology lab. Available in a single- or dual-sensor option, these kits provide a much faster time-to-calibration with lab precision and accuracy. Covering a frequency range of 1 to 1000 MHz, these kits enable users to calibrate at 3% accuracy in just minutes.

KIT INCLUDES

- Low band Directional Power Sensor
- Medium band Directional Power Sensor
- High band Directional Power Sensor
- 4421A Multifunction Power Meter to display RF power readings with up to 3 % accuracy
- Rugged carrying case
- Latch & Lock cable

MODEL 4421A

SMK-3000 SERIES	PRODUCT TYPE	FREQUENCY RANGE	ACCURACY	POWER RANGE
SMK-3003-LB	3% Sensor	1 to 10 MHz	±3% of reading (2σ)	1 to 1000 W
SMK-3003-MB	3% Sensor	10 to 100 MHz	±3% of reading (2σ)	1 to 1000 W
SMK-3003-HB	3% Sensor	100 to 1000 MHz	±3% of reading (2σ)	1 to 1000 W

MEASUREMENT

Directivity	28 dB minimum
Impedance	50 Ohms
Insertion Loss	< .05 dB
Insertion VSWR	<1.05:1

UNCERTAINTY

Forward Power Uncertainty*	**SMK-3003A Series:** ±3% of reading*, 2σ Calibration plane location: Connector output
Reflected Power Uncertainty*	±3% of reading*, 2σ Calibration plane location: Connector output

*Measurement conditions: Harmonics <35 dBc, Load VSWR <1.1:1, AM modulation <1%

CONNECTORS

RF Input	N(m), Quick Change (QC)
RF Output	N(f), Quick Change (QC)
Display	1-meter Latch & Lock coiled cable

ENVIRONMENTAL

Operating Humidity	20% to 50%
Operating Temperature	19.4 °C to 26.1 °C (73 °F to 6 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)

PHYSICAL

Weight (excluding 4421A)	5 lb (2.27 kg)

Medical MRI Calibration Test Kit

MRI3T Kit

Bird's MRI test kit provides a complete set of equipment to carry out precise and independent measurements of RF power encountered. It also determines if the equipment is not in the appropriate exposure limits during device or pulse sequencing test.

Technicians can have confidence when performing MRI safety measurements and test the accuracy of the specific absorption rate over the range of operating conditions encountered in MRI.

PRODUCT FEATURES

- Designed to support two power sensors
- Suitable for use in a clean room environment
- Stainless steel cart is designed for easy transportation and effortless use
- Customizable with choice of power sensor and load configuration
- High return loss ensures minimal power measurement error contribution

INCLUDES

- 5000-XR RF Power Meter Display
- 8581A Load
- 5014M Sensor
- 4300B672-2 Hard Carrying Case
- Elements
- Adapters

Medical MRI Calibration Test Kit

MRI3T Kit

5000-XR
RF Power Meter Display

8581A Load

5014M Sensor

4300B672-2
Hard Carrying Case

Elements

Adapters

MEASUREMENT

Frequency Range	10 MHz to 130 MHz
RF Power	
Average, Max	2.2 kW
Peak, Max	37 kW
Pulse Width, Max	10 ms
Duty Cycle	Duty cycle such that avg. power rating is never exceeded
Acceleration, Max.	± 1.5 G along any axis
Magnetic Field, Max.	500 G
Acoustic Noise	75 dBa max, 1m from external surfaces

TEST CABLES

Connectors	7/16 (M) to 7/16 (M)
Material	RG393

ELEMENTS

Dynamic Range	20 dB
Labeling, Element	Label lists max power (W)

ENVIRONMENTAL

Operating Temperature	5 °C to 40 °C (41 °F to 104 °F)
Storage Temperature	-20 °C to 70 °C (-40 °F to 158 °F)
Humidity, Relative	
Operating	30% to 75%
Storage	95% noncondensing max.
Altitude, Above Sea Level (ASL)	
Operating	–984 to +11,800 ft ASL (–300 to +4000 m)
Storage	–984 to +18,000 ft ASL (–300 to +5490 m)

ADAPTERS

Connector	7/16 (F) to HN (M) 7/16 (F) to N (M) 7/16 (M) to HN (F) 7/16 (M) to N (F)

SYSTEM

Display	Full-Color 8 in 1280 x 1920-pixel display with backlight
Languages	English
Battery Type	Removable, Rechargeable, 10 Ah 3.8V Li-Ion Battery
Battery Life	9 hours typical
OS	Android 14
Maintenance Interval	≥ 1 year
Calibration Interval	≤ 12 months
AC Input	100-240 VAC @ 50/60 ± 3 Hz, single phase, current ≤ 10A. US & CE plugs included

PHYSICAL

Size	21 in x 15 in x 25 in (535 mm x 381 mm x 635 mm)
Weight	75 lb (34.1 kg)
Material	No toxic materials, Metals are corrosion resistant, no sharp edges or projections on accessible components, Ferrous materials present.

STANDARD ACCESSORIES

Power Meter Display	5000-XR
USB Sensor	5014M
Forced-Air Cooled Load	8581A200-1
Case, Cards & Manual	4300B672-2
AC Adapter (5000-XR)	5B5003-1
AC Adapter (Load)	5A2436
Stylus	SK-TP-112
Cables, 6 ft (7/16DIN(M)–7/16DIN(M)	4300A676-8 (2)
USB Cable	5A2653-6L
Manual	920-4300A750-1

RF POWER SENSORS

Simple to Complex Power Measurement for Communications and Process Control

Bird provides power sensor solutions for virtually all types of RF applications. From simple true-average power measurement applications to complex waveforms associated with today's modern communication systems. Bird's plug and play solution provides an inline measurement that can be displayed on multiple types of devices providing basic power measurements, to highly accurate or statistical readings. You can rely on Bird sensor products to meet the needs of your unique applications.

RF POWER METER DISPLAY

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WIDEBAND POWER SENSORS

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BASIC POWER SENSORS

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STATISTICAL POWER SENSOR

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DIRECTIONAL POWER SENSORS

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Rugged Solutions for Measuring a Broad Range of Critical RF Parameters

Bird offers a comprehensive range of RF Sensors, meters and monitors, all easy-to-use solutions for users of all skill levels. The RF power sensors range from the economical, element based Directional Power Sensor to the multi-functional Wideband Power Sensor capable of measuring a broad range of critical RF parameters.

From simple true-average power measurement applications, to the measurement of the complex waveforms associated with modern communications systems, where peak power or burst power measurement are essential. All Bird RF Sensors are rugged, highly accurate, and provide high value power measurement solutions.

1 WHAT IS AN RF POWER SENSOR?

The most common RF transmitter measurement is RF power. Before performing any other tests, the engineer or technician will want to confirm that the source is outputting power, at the correct level. RF power is the first indication of a system's health.

Most power sensors fall into three categories: thermistors, thermocouples and diode detectors. Thermistors operate by changing resistance due to a change in temperature. The change in temperature is a result from converting RF energy into heat.

Thermocouples are heat-based sensors and are considered true averaging detectors. Thermocouples generate a voltage due to temperature differences at the junction of two dissimilar metals.

Diode detectors convert or rectifies an RF signal to DC with an amplitude that is proportional to the input power. For a certain range of power levels, a detector's output voltage is proportional to the square-root of power otherwise called the square-law range.

2 SIGNAL TYPES AFFECT MEASUREMENT UNCERTAINTY

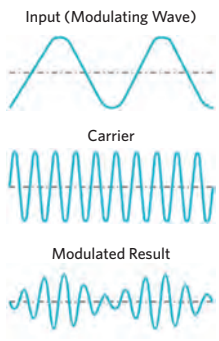
For a radio signal to carry information, it must be varied or modulated - there are various types of modulation, each best in different situations. It is important to know what type of modulation is being measured since signal waveform effects measurement uncertainty.

RF modulation techniques are roughly divided into four types: Analog modulation, Digital modulation, Pulse modulation, and Spread spectrum method. Analog modulation is typically used for AM, FM radio, and short-wave broadcasting. Digital modulation involves transmission of binary signals (0 and 1) found in digital broadcast TV and radio, mobile communications, tactical military radios etc.

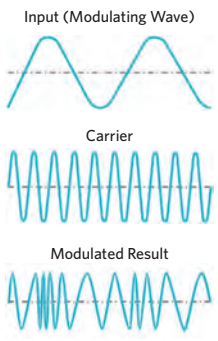
Among the types of RF power measurements, the steady state of a CW tone is perhaps the simplest. Peak power, such as the overshoot of an RF pulse or IQ waveform, is the maximum value over some period of time. The power measurement can be averaged across a time period, such as across a series of RF pulses, yielding the average power.

For many mobile communication signals, RF power can be integrated over a frequency band. Digitally modulated signals tend to be noise-like in nature and often have specified average and peak power values. A true averaging sensor will provide average power measurements for all types of signal formats from continuous wave (CW) to complex digital modulations.

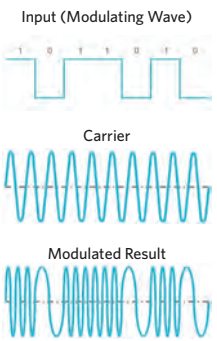
Amplitude Modulation (AM)



Frequency Modulation (FM)



Digital Modulation



3 BASIC FACTORS TO CONSIDER WHEN SELECTING AN RF POWER SENSOR

- **Frequency Range:** the range of frequencies that the sensor will cover.
- **Dynamic Range:** the range of power over which a sensor is capable of making useful measurements.
- **Accuracy** of the measurement based on uncertainty factors
- **Zero Calibration Requirements**
- **Speed** of measurements

4 POWER SENSOR MEASUREMENTS

Choosing the right power sensor for your application is dependent on the signal characteristics you need to measure.

True Average Power is the RF power level independent of the waveform. The measurement is "true" regardless of whether the waveform is CW, AM, FM, PM, pulsed, has a large crest factor, or consists of some other complex waveform.

Peak Power measures the highest single power of a pulsed RF signal waveform. This is important for evaluating signals where peaks outside the pulse lead to distortion.

Burst Average Power are appropriate RF power measurements for GSM and TDMA signal waveforms. They are characterized by long pulse widths and long periods.

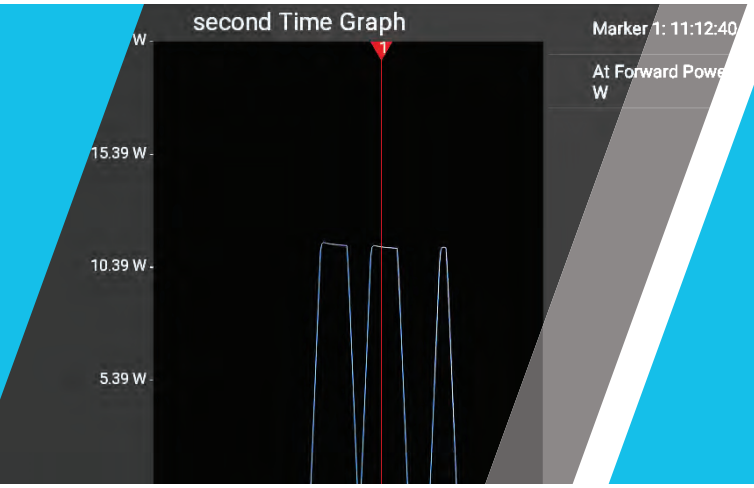
Crest Factor measures the ratio between average and peak RF power, in dB. If the crest factor is too large, the transmitter will not be able to handle the peak powers and amplitude distortion will occur. Crest factor can also detect overdrive and overshoot problems.

CCDF (Duty Cycle) is a statistical characterization of the time-domain waveform that completely describes the power characteristics of the signal. A CCDF graph relates average signal power (X axis) to signal power statistics (Y axis) such that each point on the CCDF curve shows how much time a signal spends at or above a given power level. The power level is expressed in dB relative to the average signal power level.

Statistical Signal Analysis (7022 Series Only) provides the statistical measurement capability required to accurately characterize modern communications system waveforms independent of the modulation technique or channel access method used in the system.

5 HOW TO DISPLAY YOUR DATA

Most RF power sensors are used in conjunction with a separate power meter or software. Bird offers the following options for measurement viewing; 5000-XR, RF Meter App for Android and Windows. Whether you are using a PC or a stand-alone meter, you can view data logging, power versus time graphs, and offset table that enable quick and accurate measurements.



RF Power Meter Display

5000-XR, 5000-XR-WD

Bird's new 5000-XR RF Power Meter Display provides another dimension for viewing your RF power meter measurements when connected to Bird's Power Sensors. Operating over a broad frequency range using one of Bird's USB RF power sensors, the 5000-XR allows you to instantly view measurements like True Average Power, VSWR, Return Loss, and more. For secure locations, the 5000-XR-WD disables all wireless and camera capabilities of the display.

PRODUCT FEATURES

- Rugged, 8" color touch screen display for worry-free field use
- Automatic sensor detection that works with 12 supported Bird field sensors
- Field-swappable battery for extended use
- Built-in camera to document equipment serial numbers and model number for warranty documentation and installation validation.
- Tried and true power measurement with simple set-up
- Data logging, numerical & graphics display
- Easy data transfer via USB, Bluetooth, or WiFi
- 5000-XR-WD disables all wireless and camera capability for work in secure sites

KEY MEASUREMENTS WHEN PAIRED WITH A BIRD POWER SENSOR

- True Average Power (Forward and Reflected)
- VSWR, Return Loss, rho, Match Efficiency
- Peak Power, Peak to Average Ratio, Crest Factor, PEP
- Burst and Burst Average Power
- CDF, CCDF, Confidence %
- Pulse Parameters
- Sensor Temperature

MODELS

5000-XR	Power Meter Display
5000-XR-WD	Power Meter Display, Wireless & Camera disabled

MEASUREMENT

Frequency Range	2 MHz to 6 GHz with external power sensors (not included)
Key Measurements	True Average Power (Forward and Reflected) VSWR, Return Loss, rho, Match Efficiency Peak Power, Peak to Average Ratio, PEP, Crest Factor, Burst and Burst Average Power, CDF, CCDF, Confidence %, IEEE 194 Pulse Parameters, Sensor Temperature

CONNECTORS

USB-C	Charging, Communication with sensors
USB-A	Communication with sensors
12-pin Pogo Pin	Charging

PHYSICAL

Size	8.8 in x 6.0 in x 0.8 in (233 mm x 151 mm x 20 mm)
Weight	2.0 lb (0.91 kg)

SYSTEM

Display	Full-Color 8" 1280 x 1920-pixel display w/backlight
Operating System	Android 14
Languages	English
Storage	128 GB
Data Transfer	USB drive, PC, WiFi, or Bluetooth
Battery Life	9 hours typical
Recommended Calibration Interval	No calibration required (sensor calibration recommended)
Power Supply	AC: 100 to 240 V / 50-60 Hz; DC: 5V/2.5 A
Upgradeability	Firmware field-upgradeable via USB port
Additional Functions	Data logging, numerical & graphing display
Sensor Detection	Automatic USB Sensors WiFi 802.11 Network scan for ACMI, BPME & CPM

OPTIONAL ACCESSORIES

5B5001-1	10 Ah Li-Ion Battery, spare
5B5005-1	Charging stand: charges 5000-XR and spare battery

COMPATIBLE SENSORS

5012D	Wideband Power Sensor, 350 MHz to 4 GHz, 150 mW to 150 W, 400 W Peak
5014	Directional Power Sensor, 2 MHz to 2.7 GHz, 125 mW to 1 kW, Full scale
5016D	Wideband Power Sensor, 350 MHz to 4.0 GHz, 25 mW to 25 W, 60 W Peak
5017D	Wideband Power Sensor, 25 MHz to 1.0 GHz, 500 mW to 500 W, 1300 W Peak
5017D-AV	Wideband Power Sensor, 100 MHz to 1.3 MHz, 500 mW to 500 W, 1300 W Peak
5018D	Wideband Power Sensor, 150 MHz to 4.0 GHz, 100 mW to 25 W, 60 W Peak
5019D	Wideband Power Sensor, 25 MHz to 1.0 GHz, 100 mW to 100 W, 250 W Peak
7020-1-010101	Wideband Power Sensor, 350 MHz to 4.0 GHz, 150 mW to 150 W
7020-1-020101	Wideband Power Sensor, 350 MHz to 4.2 GHz, 150 mW to 150 W
7020-1-030301	Wideband Power Sensor, 25 MHz to 1.0 GHz, 500 mW to 500 W
7022	Statistical RF Power Sensor, 350 MHz to 6 GHz, 0.25 W to 500 W
4042 Series	Channel Power Sensor, 100 MHz to 1.0 GHz, 50 W
4043 Series	Directional Power Sensor 118 MHz to 940 MHz
4044 Series	Non-Directional Power Sensor, 144 MHz to 940 MHz, 125 W

MADE IN USA

Wideband Power Sensors

5012D, 5016D, 5017D, 5017D-AV, 5018D, 5019D

±4% ACCURACY

Bird's Wideband Power Sensor Series provides high performance and accurate in-line field measurements that never require field calibration. These Thruline sensors can measure average, peak, or burst power, VSWR, crest factor, and Complementary Cumulative Distribution Function (CCDF). They can be used with Bird's 5000-XR Power Meter Display, Site Analyzers, SignalHawk, and Bird's RF meter App.

PRODUCT FEATURES

- Digital, analog, and multi-carrier signals regardless of modulation type
- Measures True Average Power, Peak Power and Duty Cycle directly with exceptional accuracy
- Calculations performed: VSWR, Return Loss, Reflection Coefficient, Crest Factor, Average Burst Power and CCDF
- Sensor plug and plays with 5000-XR Power Meter Display and Bird's RF Meter App

BENEFITS

- Monitor and perform maintenance for monitoring while DUT (Device Under Test) is in-service
- No field calibration required, annual factory calibration only

SUPPORTED MODULATIONS

- Wide coverage of applications: WPS measures: Analog Cellular, Digital Cellular, 3G, 4G, Tetra, APCO/P25, Trunking, CDMA, TDMA, WCDMA, GSM, Transportation, Tactical Military, Radar, Avionics, Marine, LMR, Analog Broadcast, Digital Broadcast, GSM, GPRS, EDGE, UMTS, HSDPA, Bluetooth, Fire, GPS, NPSPAC, Paging, Project 25, Public Safety, Telematics, Utilities, WIMAX and WLAN

	5012D	5016D	5017D	5017D-AV	5018D	5019D
Frequency Range	350 MHz to 4.0 GHz	350 MHz to 4.0 GHz	25 MHz to 1.0 GHz	100 MHz to 1.3 GHz	150 MHz to 4.0 GHz	25 MHz to 1.0 GHz
Power Range	150 mW to 150 W Avg 400 W Peak	25 mW to 25 W Avg 60 W Peak	500 mW to 500 W Avg 1300 W Peak*	500 mW to 500 W Avg 1300 W Peak*	100 mW to 25 W Avg 60 W Peak	100 mW to 100 W 260 W Peak
Insertion VSWR	<1.05 from 0.35 to 2.5 GHz <1.10 from 2.5 to 4 GHz	<1.05 from 0.35 to 2.5 GHz <1.10 from 2.5 to 4 GHz	<1.05	<1.05	<1.05 from 0.15 to 2.5 GHz <1.10 from 2.5 to 4 GHz	<1.05
Insertion Loss	<0.05 dB from 0.35 to 1.0 GHz <0.1 dB from 1 to 4 GHz	<0.05 dB from 0.35 to 1.0 GHz <0.1 dB from 1 to 4 GHz	<0.05 dB	<0.1 dB	<0.05 dB from 0.35 to 1.0 GHz <0.1 dB from 1 to 4 GHz	<0.05 dB
Directivity	30 dB up to 3.0 GHz, 28 dB from 3.0 to 4.0 GHz	30 dB up to 3.0 GHz, 28 dB from 3.0 to 4.0 GHz	29 dB 25 MHz to <50 MHz 30 dB from >50 MHz to 1000 MHz	28 dB up to 100 MHz, 30 dB from 100 to 1000 MHz	30 dB up to 3.0 GHz, 28 dB from 3.0 to 4.0 GHz	28 dB up to 100 MHz, 30 dB from 100 to 1000 MHz

*Derate maximum average power rating from 500 W at 300 MHz to 100 W at 1 GHz using a straight line on a log-log scale

SYSTEM

Power Supply	USB Port: Less than one low-power, USB load DC Input Connector: 7-18, VDC at less than 0.1A
Impedance	50 Ohms nominal
Data Logging	Via software

CONNECTORS / INTERFACES

Connectors	N Female (Both)
DPM	DB9 proprietary interface
PC Interface (1)	RS-232, 9600 Baud, no parity, 8 data bits, 1 stop bit, DB9
PC Interface (2)	USB 2.0 Type B

ENVIRONMENTAL

Operating Temperature	-10 °C to 50 °C (14 °F to 122 °F)
Storage Temperature	-40 °C to 80 °C (-40 °F to 176 °F)

PHYSICAL

Size	4.8 in x 4.6 in x 1.3 in (120 mm x 82 mm x 97 mm)
Weight	1.2 lb (.54 kg)

CERTIFICATIONS

CE	EMC EN 61326-1-2006
Mechanical Shock & Vibration	IAQ MIL-PRF-28800F class3

STANDARD ACCESSORIES

5A2653-10	USB Cable
920-5012S	Instruction Book

OPTIONAL ACCESSORIES

PA-MNME	Male N to Male 7/16 (DIN)
PA-MNFE	Male N to Female 7/16 (DIN)
5A2226	Power Supply, Intl
5A2229	Power Supply, US
5A2264-09-MF-10	DB9 Cable, 10 in
5A2653-0R5NL5	USB Interface Cable, 15 cm

Wideband Power Sensors 5012D, 5016D, 5017D, 5017-AV, 5018D, 5019D

AVERAGE POWER

MODEL	AVERAGE FORWARD POWER RANGE	PEAK POWER RANGE	ACCURACY, AVERAGE FORWARD POWER	MINIMUM FORWARD POWER FOR REFLECTED MEASUREMENT	RETURN LOSS	VSWR
5012D	150 mW to 150 W	400 W Peak	±4% of reading, + 0.05 W	0.5 W	0.0 to 23 dB	1.15 to 99.9
5016D	25 mW to 25 W	60 W Peak	±4% of reading, + 0.008 W	0.1 W	0.0 to 23 dB	1.15 to 99.9
5017D/5017D-AV*	500 mW to 500 W	1300 W Peak	±4% of reading, + 0.17 W	0.5 W	0.0 to 23 dB	1.15 to 99.9
5018D	100 mW to 25 W	60 W Peak	±4% of reading, + 0.008 W	0.1 W	0.0 to 23 dB	1.15 to 99.9
5019D	100 mW to 100 W	260 W Peak	±4% of reading, + 0.04 W	0.3 W	0.0 to 23 dB	1.15 to 99.9

*Derate maximum average power rating from 500 W at 300 MHz to 100 W at 1GHz using a straight line on a log-log scale

BURST AVERAGE POWER

MODEL	BURST AVERAGE POWER RANGE	BURST WIDTH	REPETITIONS RATE	DUTY CYCLE (D)	ACCURACY, BURST AVERAGE POWER
5012D	4 W to 150 W avg	1 µs to 5 ms	5 Hz, Min	.002 to 1.0	±6% of reading, + 0.05 W
5016D	.7 W to 25 W avg	1 µs to 5 ms	5 Hz, Min	.002 to 1.0	±6% of reading, + 0.008 W
5017D/5017D-AV	13.5 W to 500 W avg	1 µs to 5 ms	5 Hz, Min	.002 to 1.0	±6% of reading, + 0.17 W
5018D	.7 W to 25 W avg	1 µs to 5 ms	5 Hz, Min	.002 to 1.0	±6% of reading, + 0.008 W
5019D	2.7 W to 100 W avg	1 µs to 5 ms	5 Hz, Min	.002 to 1.0	±6% of reading, + 0.04 W

PEAK ENVELOPE POWER & ACCURACY**

MODEL	PEAK ENVELOPE POWER RANGE	BURST WIDTH > 200 MS	1 MS < BURST WIDTH < 200 MS	0.5 MS < BURST WIDTH < 1 MS	BURST WIDTH < 0.5 MS
5012D	4 W to 400 W	±7% of reading, + 0.20 W	±10% of reading, + 0.40 W	±15% of reading, + 0.40 W	±20% of reading, + 0.40 W
5016D	.7 W to 60 W	±7% of reading, + 0.05 W	±10% of reading, + 0.10 W	±15% of reading, + 0.10 W	±20% of reading, + 0.10 W
5017D/5017D-AV	13.5 W to 1300 W	±7% of reading, + 0.70 W	±10% of reading, + 1.40 W	±15% of reading, + 1.40 W	±20% of reading, + 1.40 W
5018D	.7 W to 60 W	±7% of reading, + 0.05 W	±10% of reading, + 0.10 W	±15% of reading, + 0.10 W	±20% of reading, + 0.10 W
5019D	2.7 W to 260 W	±7% of reading, + 0.13 W	±10% of reading, + 0.26 W	±15% of reading, + 0.26 W	±20% of reading, + 0.26 W

**For temperatures above 35 °C or below 15 °C add 3.0% to stated accuracies

COMPLEMENTARY CUMULATIVE DISTRIBUTION FUNCTION (CCDF)

MODEL	CCDF MEASUREMENT RANGE	THRESHOLD MEASUREMENT RANGE	MEASUREMENT UNCERTAINTY	LEVEL SET ACCURACY
5012D	0.1 to 100%	4.0 W to 400 W	±2%	As Peak Envelope Power Accuracy + 2.0%
5016D	0.1 to 100%	0.7 W to 25 W	±2%	As Peak Envelope Power Accuracy + 2.0%
5017D/5017D-AV	0.1 to 100%	13.5 W to 500 W	±2%	As Peak Envelope Power Accuracy + 2.0%
5018D	0.1 to 100%	0.7 W to 25 W	±2%	As Peak Envelope Power Accuracy + 2.0%
5019D	0.1 to 100%	2.7 W to100 W	±2%	As Peak Envelope Power Accuracy + 2.0%

CREST FACTOR

MODEL	CREST FACTOR MEASUREMENT RANGE	ACCURACY, CREST FACTOR
5012D	150 mW to 150 W	Linear Sum of Peak and Average Power Accuracies
5016D	25 mW to 25 W	Linear Sum of Peak and Average Power Accuracies
5017D/5017D-AV	500 mW to 25 W	Linear Sum of Peak and Average Power Accuracies
5018D	25 mW to 25 W	Linear Sum of Peak and Average Power Accuracies
5019D	100 mW to 100 W	Linear Sum of Peak and Average Power Accuracies

PRODUCT FEATURES

- Digital, analog, and multi-carrier signals regardless of modulation type
- Measures forward and reflected power and VSWR to troubleshoot system failures
- Monitor and perform maintenance for monitoring while DUT (Device Under Test) is in-service
- Economical power measurement solution
- Supported by 5000-XR Power Meter Display
- No field calibration required

Basic Power Sensors

7020 SERIES

±4% ACCURACY

The 7020 Series of RF Power Sensors is an economical, plug and play solution to your power measurement needs. The 7020 determines and reports Forward and Reflected True Average Power and VSWR over a wide frequency range of 25 MHz to 1.0 GHz or 350 MHz to 4.2 GHz. It also never requires field calibration, only requires factory calibration once per year and is traceable to National Institute of Standards and Technology (NIST).

SUPPORTED MODULATIONS

- Wide coverage of applications: Analog Cellular, Digital Cellular, 3G, 4G, Tetra, APCO/P25, Trunking, CDMA, TDMA, WCDMA, GSM, Transportation, Tactical Military, Radar, Avionics, Marine, LMR, Analog Broadcast, Digital Broadcast, GSM, GPRS, EDGE, UMTS, HSDPA, Bluetooth, Fire, GPS, NPSPAC, Paging, Project 25, Public Safety, Telematics, Utilities, WIMAX and WLAN

	7020-1-030301	7020-1-010101	7020-1-020101
Frequency Range	25 MHz to 1.0 GHz	350 MHz to 4.0 GHz	350 MHz to 4.2 GHz
Power Range	0.5 W to 500 W*	0.15 W to 150 W	0.15 W to 150 W

*Derate maximum average power rating from 500 W at 300 MHz to 100 W at 1 GHz using a straight line on a log-log scale.

MEASUREMENT

Accuracy	±4% of reading + 0.05 W Add 3% to uncertainty above 35 °C or below 15 °C
Forward Power for Reflected Measurement	5.0 W min
Peak/Average Ratio	12 dB max
Insertion Loss	0.1 dB max
Insertion VSWR	1.10 max
VSWR Range	1.15 to 99.9
Impedance	50 Ohms nominal
Response Time	100 ms
PIM Rating	-130 dBc @ 460 MHz
Directivity	<-30 dB, 350 to 1000 MHz min <-28 dB, 1000 to 4000 MHz min <-24 dB, 4000 to 6000 MHz min

CONNECTORS

RF Connectors	N Female
Display Interface	USB 2.0 Type 'B' with "SeaLATCH" locking USB connector

SYSTEM

Recommended Calibration Interval	1 year
Power Supply	5 VDC from USB host, 35 mA current draw
Data Logging	Via software
Upgradeability	Firmware field-upgradeable via the USB port

ENVIRONMENTAL

Operating Temperature	-10 °C to 50 °C (14°F to 122 °F)
Storage Temperature	-40 °C to 80 °C (-40 °F to 176 °F)
Humidity	95% max (non-condensing)
Altitude	Up to 15,000 ft (4,572 m)

PHYSICAL

Size	4.8 in x 2.6 in x 1.3 in (122 mm x 66 mm x 32 mm)
Weight	1 lb (0.45 kg)

CERTIFICATIONS

CE	**EMC Directive (2004/108/EC):** European Standard EN 61326-1:2006 – Electronic Equipment for measurement, control and laboratory use **EMC Requirements:** in accordance with EMC Directive (2004/108/EC)
RoHS	Compliant
Mechanical Shock & Vibration	Mil-PRF-28800F Class 3

STANDARD ACCESSORIES

5A2653-6L2	SeaLATCH USB Cable
920-7020S	Instruction Manual (Sensor)

COMPATIBLE DEVICES

5000-XR	Digital Power Meter Display
Bird RF Meter	Android App

MADE IN USA

Statistical Power Sensor

7022-1-020201

±3% ACCURACY

The 7022-1-020201 Statistical RF Power Sensor is a rugged, easy to use field instrument that uses statistical sampling techniques. In modern communications, signal average power, although important is no longer a sufficient control variable. These communication signals often require more diagnostic measurements. In the statistical mode, the power sensor measures the percentage of time the signal exists at a specific peak-to-average ratio. In the time domain mode, the sensor adds a variety of functions similar to an oscilloscope to our standard suite of measurements.

PRODUCT FEATURES

- Digital, analog, and multi-carrier signals regardless of modulation type
- Provides Forward and Reflected Power, Peak/Pulse Power, Time Domain and Statistical Measurements
- Three operating modes: Conventional Time Domain and Statistical
- Analytical results of Signal of Interest using CCDF parameters
- Detailed breakdown of a single or multiple pulses
- Isolate and identify specific breakpoints with the use of markers
- Includes a wide range of IEEE pulse parameters

APPLICATIONS

- Analog Cellular, Digital Cellular, 3G, 4G, Tetra, APCO/P25 Phase 1 & 2, DMR, MOTOTRBO, Trunking, CDMA, TDMA, WCDMA, GSM, Transportation, Tactical Military, Radar, Avionics, Marine, LMR, Analog Broadcast, Digital Broadcast, GSM, GPRS, EDGE, UMTS, HSDPA, Bluetooth, Fire, GPS, NPSPAC, Paging, Public Safety, Telematics, Utilities, WIMAX, WLAN, EVDO, UMTS, LTE, and HDT

MEASUREMENT

Measurement Type	Thruline Power
Frequency Range	350 MHz to 6 GHz
Frequency Measurement Accuracy	±3% of reading with CW signals
Power Measurement Range*	0.25 W to 500 W average, 1500 W peak
Dynamic Range	33 dB
Peak to Average Ratio	12 dB, absolute peak power limited to 1500 W
Impedance	50 Ohms nominal
Insertion Loss	0.05 dB max
Insertion VSWR	1.065, 350 to 2500 MHz max 1.12, 2500 to 6000 MHz max
Directivity, Min	<-30 dB, 350 to 1000 MHz, <-28 dB, 1000 to 6000 MHz <-24 dB, 4000 to 6000 MHz (min)

*Derate maximum average power rating from 500 W at 350 MHz to 100 W at 6 GHz using a straight line on a log-log scale.

CONNECTORS

RF Connectors	N Female
Display Interface	USB 2.0 Type B (USBTMC)
Trigger Input	BNC female (1MΩ Impedance; 3 V High, 1.2 V Low)

SYSTEM

Factory Calibration	NIST traceable
Field Calibration	No field calibration required
Data Logging	Via software
Power Supply	USB Port
Sample Rate	44 M samples/s max
Time Resolution	50 nSec to 10 Sec
Time Base Accuracy	.01%
Display Refresh Rate	10 times/sec (Limited by communication)
Video Bandwidth	Settable: 20 MHz (none), 5 MHz, 400 kHz, 4.5 kHz
Points per screen	1001 max

ENVIRONMENTAL

Operating Temperature	-10 °C to 50 °C (14 °F to 122 °F)
Storage Temperature	-40 °C to 80 °C (-40 °F to 176 °F)
Humidity	95% max (non-condensing)
Altitude	Up to 15,000 ft (4,572 m)

PHYSICAL

Size	5.8 in x 4.8 in x 1.3 in (147 mm x 122 mm x 33 mm)
Weight	1.5 lb (0.68 kg)

CERTIFICATIONS

CE	**EMC Directive (2004/108/EC):** European Standard: EN 61326 - Electrical Equipment for measurement, control and laboratory use **EMC Requirements;** Test Spec (for radiated immunity): EN 61000-4-3 - Testing and measurement techniques - 10 V/meter
Mechanical Shock & Vibration	Mil-PRF-28800F Class 3
RoHs	Compliant

STANDARD ACCESSORIES

5A2653-6L2	USB SeaLatch™ Cable
920-7022	Manual for Statistical Power Sensor
5A2918-11-6	BNC / BNC Trigger Cable

Directional Power Sensors

5014

±5% ACCURACY

The Bird 5014 directional power sensor is a flexible power measurement solution that can be tailored to a multitude of applications. Measures True Average Power or Peak Power using Bird elements.

No field calibration is required and factory calibration is only suggested once per year. Calibration is traceable to the National Institute of Standards and Technology (NIST), providing additional confidence in your RF measurements.

PRODUCT FEATURES

- Bird's Directional Power Sensor measures True Average Power using APM/DPM elements
- Measure Peak Power using 43 Series elements.
- Supported modulation types include: AM, FM, CW, 8VSB, COFDM
- Provides Forward & Reflected RF power, VSWR, Return loss, Reflection Coefficient
- Operate your sensor by connecting USB cable to an Android device utilizing the Bird RF Meter app or power meter display (5000-XR)

COMPATIBLE DEVICES

5000-XR
SK-4500-TC
SK-6000-TC
SK-9000-TC
RF Meter App
SH-60S-TC
SH-60S-AOA
SH-75S-TC
SH-75S-AOA

MEASUREMENT

Frequency Range	Element dependent, 2 MHz to 1000 MHz
Power Range	Element dependent, 125 mW to 1 kW full
Accuracy	**True Average Power:** ±5% of reading (15 °C to 35 °C); ±7% of reading (-10 °C to 50 °C) **Peak Power:** ±8% of full scale
Peak/Average Ratio	10 dB maximum with DPM elements
Insertion VSWR	1.05:1 from 0.45 to 1000 MHz (with N connectors)
Impedance	50 Ohms
Directivity	30 dB typical (element dependent)
Dynamic Range	16 dB
Pulse Width Parameters	**>100 MHz:** 800 ns minimum **26 to 99 MHz:** 1.5 µs minimum **2 to 25 MHz:** 15 µs minimum
Pulse Rep. Rate Peak	15 pps minimum
Pulse Duty Factor	1 x 10-4 minimum

CONNECTORS

RF Connectors	QC Type. Female N normally supplied
Display Interface	**5014:** USB 1.1 Type 'B'

SYSTEM

Settling Time	<2.5 seconds
Recommended Calibration Interval	1 year
Power Supply	From host instrument via cable connection

ENVIRONMENTAL

Operating Temperature	-10 °C to 50 °C (14°F to 122 °F)
Storage Temperature	-40 °C to 75 °C (-40 °F to 167 °F)
Humidity	95% max (non-condensing)

PHYSICAL

Size (excluding connectors)	2.3 in x 2.1 in x 3.5 in (58 mm x 53 mm x 89 mm)
Weight	1.12 lb (0.51 kg)

Directional Power Sensors

5014

DPM ELEMENT SELECTION GUIDE

FREQUENCY RANGE	FORWARD POWER RANGE	REFLECTED POWER RANGE	FORWARD ELEMENT	REFLECTED ELEMENT
25 to 60 MHz	1.25 to 50 W 12.5 to 500 W	125 mW to 5 W 1.25 to 50 W	DPM-50A DPM-500A	DPM-5A DPM-50A
50 to 125 MHz	1.25 to 50 W 12.5 to 500 W 25 to 1.0 kW	125 mW to 5 W 1.25 to 50 W 25 to 100 W	DPM-50B DPM-500B DPM-1000B	DPM-5B DPM-50B DPM-100B
100 to 250 MHz	1.25 to 50 W 12.5 to 500 W 62.5 to 2.5 kW	125 mW to 5 W 1.25 to 50 W 6.25 to 250 W	DPM-50C DPM-500C DPM-2500C	DPM-5C DPM-50C DPM-250C
200 to 500 MHz	125 mW to 5 W 1.25 to 50 W	12.5 mW to 500 mW 125 mW to 5 W 1.25 to 50 W	DPM-5D DPM-50D	DPM-.5D DPM-5D DPM-50D

Note: Elements must be chosen from the same series and the forward and reflected elements chosen in a 10:1 power ratio

APM ELEMENT SELECTION GUIDE

POWER RANGE	FREQUENCY BANDS (MHz)				
	2 to 30	25 to 60	500 to 125	100 to 250	200 to 500
1 W	—	—	APM-1B	APM-1C	—
2.5 W	—	—	—	—	APM-2.5D
5 W	APM-5H	APM-5A	APM-5B	APM-5C	APM-5D
10 W	—	APM-10A	APM-10B	APM-10C	APM-10D
25 W	—	—	APM-25B	APM-25C	APM-25D
50 W	—	—	—	APM-50C	APM-50D
100 W	APM-100H	APM-100A	APM-100B	APM-100C	APM-100D
250 W	APM-250H	APM-250A	APM-250B	APM-250C	—
500 W	—	—	APM-500B	—	—
1000 W	APM-1000H	—	APM-1000B	—	—

Note: Elements must be chosen from the same series and the forward and reflected elements chosen in a 10:1 power ratio

43 SERIES ELEMENT SELECTION GUIDE

- Select from Element Tables 1,2,3,4,6,13, and 14 starting on page 74
- 43 series elements can be used to measure average power if peak to average ratio is close to 1

REMOTE RF MONITORING

Continuous RF Visibility
Across Your RF System

MADE IN USA

Continuously monitor the health of your RF system — without waiting for failures. Bird remote RF monitoring solutions measure forward and reflected power, VSWR/return loss, and trigger alarms when performance drifts outside expected limits. Deploy monitoring points from transmitter output to the antenna feedline and receive path to detect degradation early, reduce blind spots, and protect system uptime.

ETHERNET RF MONITORING SENSORS

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ETHERNET RF RECEIVE MONITORING SENSOR

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CHANNEL POWER MONITORING SYSTEM

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CHANNEL POWER MONITORING POWER SENSORS

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RF MONITORS & ALARMS

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Remote RF Monitoring

Anyone responsible for a multiple-site, multiple-channel land mobile radio communications system knows that management of even just a single site can often be a complex task. Failures or degradation in performance multiple trips to the site to correct the issue.

Bird's RF Power Monitors includes a range of products that not only measure power and VSWR but also provide hard contact alarms, logging, and remote monitoring to protect your system in the event of a system failure.

Remote 24/7 monitoring of transmitter RF power output and antenna performance in multi-channel and trunked radio networks allow you to efficiently monitor the performance of transmitters, transmission lines, and antennas at many remote sites.

1 WHAT ARE THE VARIOUS COMPONENTS WITHIN A COMMUNICATIONS SYSTEM THAT NEED TO BE MONITORED?

Transmitter output monitoring - Identify radios with reduced output. Monitoring will allow repair or replacement prior to failure

Isolator performance - Identify isolator degradation leading to an increase in reflected power that may harm the transmitter

Combiner loss by channel - Identify increases in insertion loss due to combiner detuning or drifting

Antenna VSWR by channel - Detailed monitoring of the antenna to identify frequency related VSWR shifts due to weather, aging, etc.

Composite antenna VSWR - Identify failures in the post combiner feedline or antenna

Receive antenna return loss / VSWR (dedicated RX antenna) – Identify degradation that reduces receive sensitivity and coverage before users notice.

2 TYPE OF COMMUNICATION AND ALERTS

Determining the type of communication is required to manage a site is dependent on the type of system you choose. Here are some typical ways that sensors and monitoring devices can communicate feedback on the health of your system.

- **Local User Interface -** This typically is a local rack panel that provides setup and configuration menu's, and diagnostic screens.
- **Web Server management -** Webpage dedicated for setup and display of all measurement parameters and alarm functions
- **Data files** that can be logged and exported to view historical information and perform trend analysis
- **Configurable alarms -** alarm levels are settable by the user, locally or remotely
- **SNMP Enabled with traps** for end user interface with an SNMP management system

3 WHAT ARE SOME QUESTIONS YOU SHOULD ASK WHEN SELECTING YOUR COMMUNICATION SYSTEM?

Whether you need a Broadcast solution to change over from analog to digital signals or need to monitor radio performance, combiner loss and antenna/feedline characteristics, we have a solution for you.

- How many antennas will I have? How many sites?
- What is the provided input voltage at the site/sites?
- What type of network connection do I have? Cellular, Ethernet?
- Do you have an SNMP Manager?
- What are the frequencies I need to measure?
- How much power am I measuring?
- Do I need receive antenna monitoring (in addition to transmit)?

Ethernet RF Sensors

Ethernet RF sensors enable modern, always-on remote RF monitoring. Installed directly in the RF path, they continuously measure critical RF parameters and deliver real-time data from remote sites to operations teams over secure Ethernet networks. This continuous insight helps system managers detect degradation earlier, reduce reactive truck rolls, and maintain confidence in RF system health between scheduled site visits.

MONITORING ROLES SUPPORTED BY ETHERNET SENSORS

Ethernet RF sensors can monitor different parts of an RF system depending on system design and operational priorities. Understanding what you want to monitor is the first step toward choosing the right sensor.

- **Transmit Path Monitoring -** Confirms transmitted signal presence, power levels, and channel performance.
- **Composite & Multi-Channel Monitoring -** Provides visibility into multiple carriers or combined RF signals from a single measurement point.
- **Receive Path Monitoring -** Identifies gradual degradation in receive antennas and feedlines—issues that are often missed until coverage complaints occur.

ETHERNET RF SENSOR SELECTION GUIDE

	4042E	4043E	4042E-PPT	4046E
Type	Channel, Directional	Composite, Directional	Channel, Directional	In-Line, Switched Reflectometer
Frequency Range	100 MHz to 1000 MHz	118 MHz to 940 MHz (Model Dependent)	100 MHz to 1000 MHz	101 MHz to 1000 MHz
Measurement Range-FWD Power	10 W to 500 W	25 W to 500 W 2.5W to 50 W(LP)*	25 W to 500 W 2.5 W to 50 W(LP)*	—
Measurement Range-RFL Power	1 W to 50 W	2.5 W to 50 W .25 W to 5 W(LP)*	2.5 W to 50 W .25 W to 5 W(LP)*	—
Measurement Accuracy	±5% of reading	±5% of reading	±5% of reading	—
Channel Bandwidth	6.25, 12.5, 25 kHz selectable	N/A	N/A	25 kHz
Connector Options	01 = N(f) 02 = N(m) 03 = 4.3/10(f) 04 = 4.3/10(m) 05 = 7/16 DIN(f) 06 = 7/16 DIN(m)	01 = N(f) 02 = N(m) 03 = 4.3/10(f) 04 = 4.3/10(m) 05 = 7/16 DIN(f) 06 = 7/16 DIN(m)	01 = N(f) 02 = N(m) 03 = 4.3/10(f) 04 = 4.3/10(m) 05 = 7/16 DIN(f) 06 = 7/16 DIN(m)	01 = N(f) 02 = N(m)
Interface	RJ-25	RJ-25	RJ-25	RJ-25
Communication	Ethernet	Ethernet	Ethernet	Ethernet

*Low power version

MADE IN USA

Ethernet RF Monitoring Sensors

4042E & 4043E SERIES

Ethernet RF sensors are the foundation of modern remote RF monitoring and provide ongoing visibility into system performance. With on-board processing, these sensors reduce the need for separate monitoring hardware while helping teams detect change earlier, reduce reactive truck rolls, and maintain confidence in system health between site visits. Connect to a private IP network (or Internet where permitted) and access setup and monitoring through a secure, browser-based Web UI with advanced password protection.

4042E FEATURES

- Frequency Range 100 to 1000 MHz
- Monitor antenna failure and radio power output simultaneously
- Single PTT power alarms allowing cycling through the frequencies
- Install a post-combiner to monitor antenna VSWR

4043E FEATURES

- Frequency range includes 7 bands between 118 and 940 MHz
- Provides composite power monitoring
- Alarm limits can be set by the user to provide alerts when crossed

APPLICATIONS

Commercial, industrial, and government land-mobile-radio (LMR) wireless-communications systems including:

- Public Safety
- Utilities
- Marine/Coast Guard
- Private Networks
- Railroad

4042E/4043E	FREQUENCY RANGE (ff)	FORWARD POWER (ww)	COMMUNICATION INTERFACE (xx)	CONNECTOR OPTIONS
4042E-1-ffwwxx-yyzz	43 = 100 to 1000 MHz	05 = 10 W to 500 W	03 = Ethernet	**Input (yy) and Output (zz) Connectors** 01 = N(f) 04 = 4.3/10(f) 02 = N(m) 05 = 7/16 DIN(f) 03 = 4.3/10(f) 06 = 7/16 DIN(m)
4043E-1-ffwwxx-yyzz	42 = 118 MHz to 144 MHz 44 = 144 MHz to 244 MHz 45 = 380 MHz to 450 MHz 46 = 450 MHz to 512 MHz 47 = 762 MHz to 806 MHz 48 = 806 MHz to 869 MHz 49 = 896 MHz to 940 MHz 50 = 225 MHz to 400 MHz*	02 = .25 W to 5 W 03 = 2.5 W to 50 W 05 = 25 W to 500 W	03 = Ethernet	**Input (yy) and Output (zz) Connectors** 01 = N(f) 04 = 4.3/10(f) 02 = N(m) 05 = 7/16 DIN(f) 03 = 4.3/10(f) 06 = 7/16 DIN(m)

MEASUREMENT

Impedance	50 Ohms nominal
Insertion Loss	0.2 dB max
Insertion VSWR	1.15 max
Directivity	25 dB min
Peak/Average Ratio	12 dB max
Accuracy	±5% of reading

CONNECTORS

Interface	Ethernet 10/100/1000BASE-T (auto-sensing) Version 2.0/IEEE 802.3
RF Connectors	**Input:** N(f), N(m), 4.3/10(f), 43/10(m), 7/16 DIN(f), 7/16 DIN(m) **Output:** N(f), N(m), 4.3/10(f), 43/10(m), 7/16 DIN(f), 7/16 DIN(m)

SYSTEM

Supported Protocols	TCP/IP Hosted web page, SNMP v2.0 Client
Power Supply	5.5-25 VDC, 3W max, 0.08 in (2 mm) power jack. 15 VDC adapter included
Operating Position	Any
Push-to-Talk input (PTT) for spurious alarm suppression	NO or NC logic (software selectable), 3.5mm terminal push-lock, optically isolated

ENVIRONMENTAL

Humidity	95% max, non-condensing
Altitude	15,000 ft (4,572 m) max
Operating Temp.	0 °C to 50 °C (32 °F to 122 °F)
Storage Temp.	-40 °C to 80 °C (-40 °F to 176 °F)

PHYSICAL

Size (without connectors)	5.4 in x 3.8 in x 1.4 in (137 mm x 97 mm x 36 mm)
Weight	0.6 lb (.27 kg)

CERTIFICATIONS

Certifications	CE, RoHs

Ethernet Power Sensor w/PTT

4042E-PTT

The 4042E-PTT is a high-performance RF power monitoring sensor for modern multi-channel systems. It measures forward power and VSWR at the antenna input and uses 16 Push-To-Talk (PTT) inputs to trigger alarms only during transmission, preventing false alerts. Secure Ethernet management, a web-based GUI, SNMPv2, and flexible I/O support remote visibility and easy system integration.

PRODUCT FEATURES

- 16 push-to-talk PTT inputs
- Alarm plus I/O Connector
- 2 HCA outputs, NC/NO configurations
- Web-based GUI and secure Ethernet-based remote management

APPLICATIONS

- Public safety emergency communications monitoring
- Telecom RF diagnostics and alarm management
- Utility remote site RF performance monitoring
- Aviation air and ground communications monitoring
- Marine communications and navigation monitoring
- Medical and industrial RF system monitoring

MEASUREMENT

Frequency Range	100 to 1000 MHz
Measurement Type	In-Line, Directional RF True Average Power by Channel, or aggregate Power (by scanning channels)
Channel Bandwidth	6.25, 12.5, 25 kHz selectable
Forward Power Measurement Range	10W to 500W Single Channel or Aggregate Forward Average Power
Reflected Power Measurement Range	1W to 50W Single Channel or Aggregate Reflected Average Power
Impedance	50 Ohms nominal
Insertion Loss	0.2 dB max
Insertion VSWR	1.15 max
Directivity	25 dB min
Peak/Average Ratio	12 dB max
Measurement Accuracy	± 5% of reading

CONNECTORS

Interfaces	Ethernet 10/100/1000BASE-T (auto-sense) Version 2.0/IEEE 802.3
User I/O Connectors Terminal block, push-in (3) 2.5mm pitch, 20-28AWG wire range	16 Push-to-talk (PTT), 2 User Inputs & Ground, 2 NO/NC alarm relay switches
RF Connectors	**Input:** See selection guide below **Output:** See selection guide below

SYSTEM

User I/O	
Push-to-Talk	16 channels, 3.3V,10k internal pull-up, NO or NC logic (UI selectable)
User Input	2 channels, 3.3V, 10k internal pull-up, NO or NC logic (UI selectable)
Alarm Relay	2 Form-C hard-contact alarm relay switches, NO/NC/COM, 110 VDC/125 VAC, 1A Max. contact rating
Power Supply	5.5-25 VDC, 3W max, 0.08 in (2 mm) power jack. 15 VDC adapter included
Operating Position	Any

ENVIRONMENTAL

Operating Temperature	0 °C to 50 °C (32 °F to 122 °F)
Storage Temperature	-40 °C to 80 °C (-40 °F to 176 °F)
Humidity	95% max, non-condensing
Altitude	15,000 ft (4,600 m) max

PHYSICAL

Size (excluding connectors)	5.4 in x 3.8 in x 1.4 in (137 mm x 97 mm x 36 mm)
Weight	0.6 lb (0.27 kg)
Mounting	Integrated rear threaded bosses

CERTIFICATIONS

Certifications	CE, RoHs

MONITOR SELECTION GUIDE

MODEL NUMBER	FREQUENCY RANGE (ff)	FORWARD POWER (ww)	COMMUNICATION INTERFACE (xx)	INPUT CONNECTOR (yy)	OUTPUT CONNECTOR (zz)
4042E-1-ffwwxx-yyzz	43 = 100 to 1000 MHz	05 = 10 W to 500 W	13 = Ethernet	01 = N(f) 02 = N(m) 03 = 4.3/10(f) 04 = 4.3/10(f) 05 = 7/16 DIN(f) 06 = 7/16 DIN(m)	01 = N(f) 02 = N(m) 03 = 4.3/10(f) 04 = 4.3/10(f) 05 = 7/16 DIN(f) 06 = 7/16 DIN(m)

Ethernet RF Receive Monitoring Sensor

4046E

The 4046E RX Antenna Monitoring Sensor provides real-time visibility into receive antenna performance—enabling early detection of degradation without disrupting communications. Installed between the receive antenna and base station, it monitors return loss and alerts users when conditions deviate from defined baselines.

PRODUCT FEATURES

- Return loss and signal detection
- Displays real-time results and alarms
- Remote access and alarm management
- Flexible deployment with user-defined frequency lists, schedules and thresholds

APPLICATIONS

- Public Safety: Police, fire, EMS, and emergency response
- Transportation: Rail, transit, and aviation systems
- Utilities & Energy: Substations, smart grid, and SCADA
- Industrial: Factory automation and RF-linked operations
- Telecom & Broadcast: Base stations and RF infrastructure
- Military & Government: Secure, mission-critical RF networks

SENSOR CHARACTERISTICS

Measurement Type	In-Line, switched reflectometer, single or swept frequency
Frequency Range	101 MHz to 1000 MHz
Return Loss, Measurement Range	0 to -26dB
Test Signal Output (to antenna)	-10 dBm, nominal
Test Signal Leakage (to radio)	-30 dBm, max
Measurement Duration	250 ms per measurement frequency, max
Test Signal Application Interval	User selectable, time window
Impedance, Nominal	50 Ohms
Insertion Loss	0.7 dB max
Insertion VSWR	1.3:1, typical

MEASUREMENT CHARACTERISTICS

RSSI, max Signal Level	-10 dBm
Range VSWR (Return Loss)	1.1 to 10 (-26 dB to -0 dB)

INTERFERING SIGNAL DETECTOR

Max. Signal Level	-10 dBm
Frequency Range	100 MHz to 1000 MHz
RSSI, Measurement Bandwidth	25 kHz
RSSI Interference Detection Threshold Level	User selectable from -55 dBm to -35 dBm

CONNECTORS

Interface	Ethernet 10/100BASE-T (auto-sense) Version 2.0/IEEE 802.3
RF Connectors	N(f), N(m)

SYSTEM

Power Supply	5.5-25 VDC, 3.5 W max, 0.08 in (2 mm) power input. 15V AC adapter included
Indication	Via WebUI display and via SNMP trap

ENVIRONMENTAL

Humidity	95% max, non-condensing
Altitude	15,000 ft (4,572 m) max
Operating Temperature	0 °C to 50 °C (32 °F to 122 °F)
Storage Temperature	-40 °C to 80 °C (-40 °F to 176 °F)

PHYSICAL

Size (with connectors)	5.4 in x 3.8 in x 1.4 in (137 mm x 97 mm x 36 mm)
Weight	0.6 lb (0.27 kg)

CERTIFICATIONS

Certifications	CE, RoHs, UKCA

MONITOR SELECTION GUIDE

MODEL NUMBER	FREQUENCY RANGE (ff)	COMMUNICATION INTERFACE (xx)	RX ANTENNA (IN) (yy)	RADIO (OUT) (zz)
4046E-1-ffxx-yyzz	43 = 100 to 1000 MHz	0003 = Ethernet	01 = N(f) 02 = N(m)	01 = N(f) 02 = N(m)

Channel Power Monitoring System

CPM SERIES

Comprised of a central processor and a variety of sensors, the Bird Channel Power Monitor System can be set up to monitor radio performance, combiner loss, and antenna/feedline characteristics providing continuous information on the health of each component it monitors.

This multiple-channel power monitoring system is capable of continuously monitoring power and VSWR performance simultaneously for up to 16 analog or digital channels and is scalable to accommodate any size radio system operating between 118 and 940 MHz. The CPM evaluates and monitors LMR systems by checking the key elements of the transmission path in real time and alerting users of degraded performance or failures.

CPM SOLUTIONS

- Power monitor display and sensors allow you to build a system around your needs
- Measures forward, reflected, composite and individual channel power as well as antenna system VSWR
- Monitoring of the system is accomplished via interface with the front panel or accessed through the built in web server and web page
- Configurable alarming for high and low level power and high antenna VSWR, utilizing hard contact and SNMP formats
- Standard Push-to-Talk (PTT) compatibility

3141 PRODUCT FEATURES

- The central display user interface via the front panel display and buttons or via an Internet connection and a network accessible web page (GUI interface)
- Designed for a 19 in rack and 1 RU
- Two digital sensor inputs, up to 16 digital sensors may be serially connected (daisy-chained)
- 16 analog inputs. RJ-25 Connectors are used to connect each analog channel to an analog sensor
- Three user-defined inputs which can be connected to sensors/contacts of the customer's choice

MONITOR SELECTION GUIDE

3141 SERIES	INPUT VOLTAGE	INPUT CURRENT	FUSE RATING
3141A15	+15 VDC (supplied by 115/230 VAC Adapter)	<3 Amps	5 Amp
3141A48	±48 VDC (+48 or -48)	<1 Amp	1.25 Amp

MADE IN USA

Channel Power Monitoring Sensors

4042, 4043, & 4044 SERIES

Bird power sensors used with the CPM, support analog and digitally modulated radio. Our non-directional sensor model 4044 and directional sensor model 4043 are both available in seven models covering bands from 118 to 940 MHz. The 4042 channel sensor covers a frequency range of 100 to 1000 MHz. It is capable of measuring up to 16 single channels in the presence of multiple channels at the output of a frequency combiner. Analog and digital power sensors may be used together with a single CPM.

4042 SERIES FEATURES

- Frequency Range 100 to 1000MHz
- Monitor antenna failure and radio power output simultaneously
- Single PTT power alarms allowing cycling through the frequencies
- Install post-combiner to monitor antenna VSWR

4043 SERIES FEATURES

- Frequency range includes bands between 118 and 940 MHz
- Provides composite power monitoring
- Alarm limits can be set by the user to provide alerts when crossed

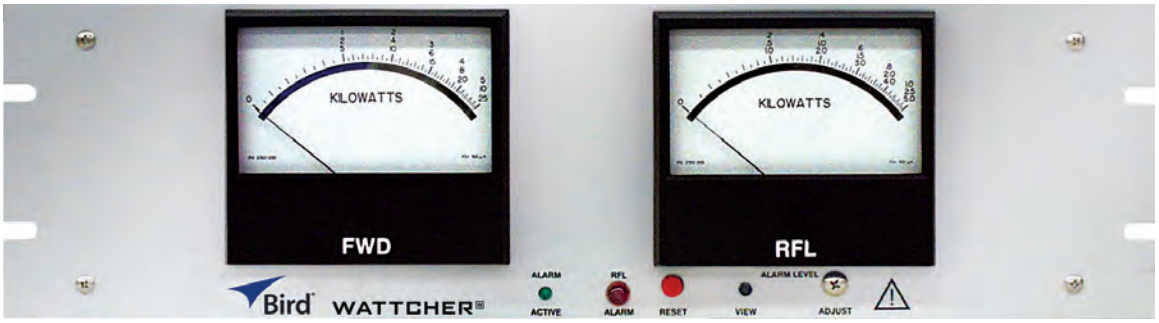
4044 SERIES FEATURES

- Measures output of either analog or digitally modulated radios up to 125 W
- Ideal for use at the input to each channel of the transmit combiner
- Frequency bands of 118 to 940 MHz

4042 SERIES Channel, Directional	FREQUENCY RANGE	MAX FORWARD POWER MEASUREMENT RANGE	MAX REFLECTED POWER MEASUREMENT	CONNECTOR OPTIONS
4042-1-410505-yyzz	30 MHz to 200 MHz	10 W to 500 W	10 dB below Forward Power Range	**Input (yy) and Output (zz) Connectors** 01 = N(f) 03 = 4.3/10(f) 05 = 7/16 DIN(f) 02 = N(m) 04 = 4.3/10(m) 06 = 7/16 DIN(m)
4042-1-430505-yyzz	100 MHz to 1000 MHz	25 W to 500 W		

4043 SERIES Composite, Directional	FREQUENCY RANGE	MAX FORWARD POWER MEASUREMENT RANGE	MAX REFLECTED POWER MEASUREMENT	ACCURACY	CONNECTOR OPTIONS
4043-1-420505-yyzz	118 MHz to 144 MHz	25 W to 500 W	10 dB below Forward Power Range	±5% of reading	**Input (yy) and Output (zz) Connectors** 01 = N(f) 02 = N(m) 03 = 4.3/10(f) 04 = 4.3/10(m) 05 = 7/16 DIN(f) 06 = 7/16 DIN(m)
4043-1-440505-yyzz	144 MHz to 244 MHz				
4043-1-450505-yyzz	380 MHz to 450 MHz				
4043-1-460505-yyzz	450 MHz to 512 MHz				
4043-1-470505-yyzz	762 MHz to 806 MHz				
4043-1-480505-yyzz	806 MHz to 869 MHz				
4043-1-490505-yyzz	896 MHz to 940 MHz				
4043-1-500505-yyzz	225 MHz to 400 MHz				

4044 SERIES Non-Directional	FREQUENCY RANGE	POWER RANGE	ACCURACY	CONNECTOR OPTIONS
4044-1-420404-yyzz	118 MHz to 144 MHz	2.5 W to 125 W	±5% of reading	**Input (yy) and Output (zz) Connectors** 01 = N(f) 03 = 4.3/10(f) 02 = N(m) 04 = 4.3/10(m)
4044-1-440404-yyzz	144 MHz to 244 MHz			
4044-1-450404-yyzz	380 MHz to 450 MHz			
4044-1-460404-yyzz	450 MHz to 512 MHz			
4044-1-470404-yyzz	762 MHz to 806 MHz			
4044-1-480404-yyzz	806 MHz to 869 MHz			
4044-1-490404-yyzz	896 MHz to 940 MHz			



MADE IN USA

Single Carrier RF Monitors/Alarms

3128A SERIES

The 3128A Wattcher® RF Power Monitors/Alarms are designed to protect and monitor your RF frequency transmission system by connecting the power meter to a Bird dual port Thruline® line section and two elements compatible with the RF coaxial line.

The elements are selected by the user to cover the desired power levels and frequency ranges. Remote access is available for resetting audible and visual alarms. Fail-safe or non fail-safe modes are user selectable and the reflected power trip level is adjustable.

	3128A
Frequency Range	450 kHz to 1 GHz
Power Range	100 mW to 5 kW using Bird® Plug-in Elements
Insertion VSWR	with N connectors 1.05 max to 1000 MHz, 1.1 max to 2700 MHz
Accuracy	±5% of full scale
Meter Scales FWD	25, 50, 100 W
Meter Scales RFL	25, 50, 100 W
Meter Sensitivity	30 µA/1400 Ω
Required Products	Line Section: 4522A002-5 QC Connectors: Two
Elements	Two from Tables 1, 2, 3, 4, or 6

SYSTEM

AC Power	115/230 V, 50/60 Hz @ 0.125 A max
DC Power	9 to 16 V @ 1 A max
Front Control Panel	Reset push-button, reflected power limit display button, adjust alarm level recessed screw
Back Control Panel	FWD/RFL DC signal inputs (BNC), DC power/remote reset connector, DPDT interlock relay connector, fail-safe/nonfail-safe selector, alarm buzzer disable, AC line voltage selector,safety fuses and IEC 320 AC receptacle.
Alarms	Front panel buzzer and red LED
Cable	Includes two 25 ft DC cables

ENVIRONMENTAL

Operating Temperature	-10 °C to 50 °C (-14 °F to 122 °F)
Storage Temperature	-40 °C to 80 °C (-40 °F to 176 °F)
Humidity	95% ±5% (non-condensing)
Altitude	Up to 10,000 ft (3,048 m)

PHYSICAL

Size	5.22 in x 19 in x 3.75 in (133 mm x 483 mm x 95 mm)
Weight	5 lb (2.28 kg)
Finish	Gray powder coat

MADE IN USA

Dual Element, Single Carrier RF Monitor/Alarm

MODEL 3170B

The dual meter/dual element 3170B Wattcher® RF Monitor and Alarm System can protect your transmitting equipment from damage and loss of air time when faults cause high-standing waves. It can warn a remote operator of low power due to detuning, component deterioration, or AC line difficulties and high reflected power due to factors such as antenna icing, transmission line problems, physical accidents and lighting strikes.

This power monitoring capability is accomplished through the use of a dual-port 50 Ohm insertion-type line section. Each port must contain a standard Bird plug-in element.

	3170B
Power Range	100 mW to 5 kW using Bird® Plug-in Elements
Frequency Range	450 kHz to 1 GHz
Insertion VSWR	with N connectors 1.05 max to 1000 MHz
Accuracy	±5% of full scale
Meter Scales FWD/RFL	FWD and RFL 25, 50, 100 W
Meter Sensitivity	100 µA/3000 Ω
Elements	Two from Tables 1, 2, 3, 3A, 4, or 6

SYSTEM

AC Power	115/230 VAC, 50/60 Hz @ 56 mA
DC Power	12.7 to 16.0 VDC @ 400 mA max
Front Control Panel	Reset push-button, adjust FWD/RFL alarm levels screw, element sockets
Back Control Panel	DC FWD/RFL signal inputs, main and remote meter drive outputs, external 12 to16 VDC supply input, alarm in/out, reset in/out, AC line voltage selector, fuse, IEC 320 AC receptacle.
Alarms	Front Panel Buzzer, "Active" and "Trip" LEDs for forward/reflected
Response Time	25 µs max
Activate Forward	73 µs to 50 ms nominal (adjustable) monitor delay
Calibration Cycle	1 year for element

CONNECTORS

Inputs/Outputs	TTL compatible +5 V logic Outputs for remote meter
Connectors	QC Type (Female N normally supplied)

PHYSICAL

Size	19 in x 5.25 in x 9.3 in (483 mm x 133 mm x 237 mm)
Weight	7 lb (3.2 kg)
Finish	Gray powder coat

WATTMETERS

MADE IN USA

Reliability for Test and Measurement in the Field or on the Bench

Bird® designs and builds reliable and superior RF wattmeters and RF line sections whether for harsh conditions or the most challenging situations. Reliability is both a promise and our reality. Bird makes the world's most reliable wattmeters and RF line sections because we have to. No matter the product or its application or its customer, each is made with our single-minded devotion to reliability.

DIGITAL WATTMETERS

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CW WATTMETERS

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PANEL MOUNT CW WATTMETERS

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REPLACEMENT METER KITS

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PLUG-IN ELEMENTS

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LINE SECTIONS

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Wattmeters

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.

MADE IN USA

PRODUCT FEATURES

- Element-Free Design: Perform measurements across multiple frequency bands without managing separate elements
- True Average Power Measurements: Ensure accurate power readings for both CW and digitally modulated signals in one device
- Wide Frequency Range: Measure signals from 2 MHz to 1000 MHz
- High Power Handling: Measure up to 10,000 Watts, providing capability for high-power applications
- Precision Accuracy: ±4% accuracy ensures reliable power measurements for optimized system performance
- Customizable Readings: Display measurements in either Watts or dBm, tailored to your application

Digital Wattmeters

4480A

The Bird 4480A Wattmeter redefines RF power measurement with precision and simplicity. Its element-free design delivers accurate true average power measurements for Continuous Wave (CW) and digitally modulated signals from 2 MHz to 30 MHz and 25 MHz to 1000 MHz. Switch between Watts and dBm effortlessly. With added Return Loss (RL), plus Forward Power, Reflected Power, and VSWR, it consolidates critical data for seamless operation and performance.

Ideal for telecommunications, broadcasting, industrial RF systems, research and development and more, the 4480A is built for demanding environments, offering unmatched accuracy (±4%) and power handling up to 10,000 W.

MEASUREMENT

Power Range 2 MHz to 30 MHz 25 MHz to 1000 MHz	 10 W to 10 kW, low band 1 W to 1 kW, high band
Frequency Range Low Band High Band	 2 MHz to 30 MHz 25 MHz to 1000 MHz
Accuracy	±4% of reading (±0.18 dB)
Peak to Average Ratio	10 dB max.
Directivity	< 1 second
Impedance	50 Ω nominal
Insertion	0.1 dB max
VSWR	1.2:1.0 max
Input Attenuator Range	0 to 30 dB, 1 dB step

CONNECTORS

RF Connectors	**Input:** Type N(f); QC type, field changeable **Output:** Type N(f); QC type, field changeable

SYSTEM

LCD Display	Transflective, white LED backlit
Battery Type	Internal 9 V, included
Battery Operating Time	Minimum 8-10 hours
Battery Charge Time	6-8 hours typical (Recharge on or off)
Calibration Interval	Recommended interval of 12 months
Power Supply	DC 12V, 2A (0.6A max. draw)

ENVIRONMENTAL

Operating Temperature	0 °C to 50 °C, (32 °F to 122 °F)
Storage Temperature	-40 °C to 71°C (-40 °F to 159.8 °F)

PHYSICAL

Size	5 in W x 7.3 in H x 2.65 in D (127 mm W x 185.42 mm H x 67.31 mm D)
Weight	2.9 lb (1.32 kg) typical, including batteries

STANDARD ACCESSORIES

4480A152	Charger, Type-DC Jack, 110/220V AC, DC 12V, 2A
4421-055	Standard Power Cord

OPTIONAL ACCESSORIES

4480A046	Transit Case
5A2416UK	Cord, International (UK)
RPK7000-2	Battery Replacement Kit

MADE IN USA

PRODUCT FEATURES

- Designed especially for RF power measurement in PCS, cellular, ESMR, paging and similar communication systems
- Equally effective for measuring RF power in conventional analog systems
- Uses APM-series plug-in elements to cover a wide range of frequency and power levels. Simple Thruline® style operation for instant forward or reflected power readings
- Interchangeable QC connectors for fast hook-up

Average Reading RF Wattmeter

APM-16

The APM-16 RF Wattmeter is designed to keep pace with the ever growing complexity of digitally-based communication systems. The APM-16 employs active circuitry to deliver accuracy of ±5% for multiple-access technologies such as CDMA, TDMA, FDMA and other digitally-encoded communication systems.

ELEMENT SELECTION GUIDE

POWER RANGE	FREQUENCY BANDS (MHz)				
	2 to 30	25 to 60	50 to 125	100 to 250	200 to 500
1 W	—	—	APM-1B	APM-1C	—
2.5 W	—	—	—	—	APM-2.5D
5 W	APM-5H	APM-5A	APM-5B	APM-5C	APM-5D
10 W	—	APM-10A	APM-10B	APM-10C	APM-10D
25 W	—	—	APM-25B	APM-25C	APM-25D
50 W	—	—	—	APM-50C	APM-50D
100 W	APM-100H	APM-100A	APM-100B	APM-100C	APM-100D
250 W	APM-250H	APM-250A	APM-250B	APM-250C	—
500 W	—	—	APM-500B	—	—
1000 W	APM-1000H	—	APM-1000B	APM-1000C	—

MEASUREMENT

Power Range	1 W to 1000 W
Frequency Range	2 MHz to 500 MHz
Insertion VSWR	with N Connector 1.05 max to 1000 MHz
Accuracy	10 °C to 35 °C ±4% reading, ±1% full scale -20 °C to 50 °C ±6% reading, ±2% full scale
Peak to Average Ratio	In excess of 10 dB
Setting Time	< 1 second
Meter Scales	Shock mounted, linear scale with expanded scales of 25, 50 and 100 for full scale 1 to 1000 W readings. Mirrored scale includes 5% overrange.

CONNECTORS

RF Connectors	QC Type (Female N normally supplied)

SYSTEM

Battery Type	Internal 9 V, included

ENVIRONMENTAL

Operating Temperature	-20 °C to 50 °C (-4 °F to 122 °F)
Storage Temperature	-25 °C to 65 °C (-13 °F to 149 °F)
Humidity	95% ±5% max (non-condensing)

PHYSICAL

Size	6.88 in x 5.13 in x 3.63 in (175 mm x 130 mm x 92 mm)
Weight	3 lb (1.4 kg)
Finish	Black powder coat

OPTIONAL ACCESSORIES

4300-061	Wattmeter, Load, Signal Sampler, QC Connectors & 4 Elements Carrying Case
CC-6	Wattmeter, 5 Elements and 1 Small Load Carrying Case
EC-1	12 Plug-In Elements Carrying Case

COMPATIBLE ELEMENTS

APM Elements	See selection guide above

CW 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

CW Wattmeters

MODEL 43 SERIES, MODEL 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 5000 W (depending on element)	100 mW to 5000 W (depending on element)	100 mW to 5000 W (depending on element)	5 W, 15 W, 50 W, 150 W, 500 W	100 mW to 5000 W (depending on element)
Frequency Range	2 MHz to 1.2 GHz (depending on element)	2 MHz to 1.2 GHz (depending on element)	2 MHz to 1.2 GHz (depending on element)	25 MHz to 1.0 GHz	2 MHz 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, 6, 13, 14	Tables 1, 2, 3, 5, 6	Tables 1, 2, 3, 5, 6, 13, 14	One 4240-050 & one 4304A-1 elements supplied with unit	Tables 1, 2, 3, 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.

PRODUCT FEATURES

- Temperature-compensated accurate CW and FM power measurements from 200 kHz to 1.0 GHz and 300 mW to 10 kW
- Uses special 4410-series wide-range elements
- Wide-range accuracy over a 37 dB dynamic range and superior temperature performance
- Quick Change (QC) connectors to minimize the need for adapters when making critical measurements

Multipower RF Wattmeters

4410A

The 4410A RF Wattmeter has the basic principles of the Model 43 but transforms it into a highly accurate high dynamic range instrument. The mirrored-scale linear range meter has 2 switchable ranges, 0 to 1 and 0 to 3.

Power is read as a multiple of the value indicated by the pointer, the decimal point location depending upon the range switch position and the factor printed on the plug-in element. Power ranges covered by individual elements are 300 mW to 1 KW and 2 W to 10 KW, full scale. For most elements, accuracy is +/-5% anywhere above 20% of full scale.

ELEMENT SELECTION GUIDE

POWER RANGE	FREQUENCY BANDS (MHz)										
	0.2 to 0.535	0.45 to 2.5	2 to 30	25 to 80	50 to 125	50 to 200	100 to 250	144 to 520	200 to 500	200 to 1000	400 to 1000
0 to10 W, 30 W, 100 W, 300 W, 1000 W, 3000 W, 10,000 W	4410-1	4410-2	4410-4	—	—	—	—	—	—	—	—
0 to 1 W, 3 W, 10 W, 30 W, 100 W, 1000 W	—	—	4410-3	4410-5	—	4410-6	—	4410-7	—	4410-8	—
0 to 100 mW, 300 mW, 1 W, 3 W, 10 W, 30 W,100 W	—	—	—	4410-10	4410-11	—	4410-12	—	4410-13	—	4410-14

MEASUREMENT

Power Range	300 mW to 1 kW or 2 W to 10 kW full scale in one single Plug-in Element
Frequency Range	200 kHz to 1.0 GHz CW or FM
Insertion VSWR	With N connectors 1.25 max to 2300 MHz
Accuracy	
4410-1	±10% of reading from 200 kHz to 535 kHz ±8% of reading up to 2.3Ghz > 20% full scale, FM or CW only
4410-2 to -14	±6% of reading > 20% full scale, FM or CW only
Usable Over Range	To 120% of nominal full scale

CONNECTORS

RF Connectors	QC Type (Female N normally supplied)

SYSTEM

Battery Type	
4410A	9 V Alkaline, included
4412A	Rechargeable (see website)
Protection	(i.e. 12 W, 120 W, 1200 W, or 12,000 W). No damage or degradation to the unit will result, regardless of the Range Selector Switch position.

ENVIRONMENTAL

Ambient Temperature	Elements 4410-1 through -8 and -10 through -14 are temperature compensated for rated accuracy from 0 °C to 50 °C (32 °F to 122 °F)

PHYSICAL

Size (with connectors)	6.88 in x 5.13 in x 3.63 in (175 mm x 130 mm x 92 mm)
Weight	3 lb (1.4 kg)
Finish	Gray powder coat

OPTIONAL ACCESSORIES

4300A055	Wattmeter, Load, 4 Elements & Accessories Carrying Case
EC-1	12 Plug-In Elements Carrying Case
5-1375	9V, Alkaline Battery

COMPATIBLE ELEMENTS

4410 Elements	See selection guide above

MADE IN USA

PRODUCT FEATURES

- Frequency: .45 MHz or 45 mW to 1.5 GHz
- Power: 100 mW to 10 kW
- Measures peak or average power flow, load match, and amplitude modulation in 50 Ohm coaxial transmission lines.
- Reads forward and reflected CW or FM power in watts or dBm
- Use with CW, AM, FM, SSB, TV, and Pulse modulation envelopes.
- Calculates SWR, return loss in dB and 5 modulation
- Shock-resistant keyboard and range switches

RF Power Analyst

4391A

The 4391A is a multi-purpose RF Wattmeter designed around a microcomputer. It will compute VSWR, amplitude modulations, and various decibel variables reducing the odds of error. A program stored in permanent memory controls the operation of the instrument at all times allowing for consistent or repeatable measurements no matter who makes the reading.

Monitors Peak Pulse Power, Peak Envelope Power, or CW Power during normal equipment operations in the forward or reflected direction. Designed for air navigational aids DME, ATC and other pulsed RF systems such as telemetry, radar, command and control, etc.

It needs no attenuators, directional couplers or charts and power range and frequency band are determined by the Plug-in Elements used.

MEASUREMENT

Power Range	100 mW to 5 kW using Bird® Plug-in Elements*
Frequency Range	Built in, 450 kHz to 1.5 GHz
Insertion VSWR	with N connectors 1.05 max to 1000 MHz
Accuracy	**Power Readings:** CW: ±5% of full scale PEP: ±8% of full scale VSWR: ±10% of reading **% Modulation:** (CW power 1/3 or more of full scale), ±5% (0-90%), ±10% (90-100%)
Usable Over Range	to 120% of scale (CW, PEP, SWR and Return Loss)
Sampling Rate	2 to 3 readings per second
Modulation	25 to 10,000 Hz (Audio)
Pulse Parameters	**Pulse Width:** 0.8 µs (100 to 1260 MHz), 1.5 µs (26 to 99 MHz) and 15 µs (2 to 25 MHz); **Repetition Rate:** 25 PPS; **Duty Factor:** 1 x 10-4
Return Loss	±0.3 dB to corresponding SWR value

*Quoted accuracy only when used with other Bird® products.

CONNECTORS

RF Connectors	QC Type (Female N normally supplied)

SYSTEM

Display	3.5 digit, 0.3 in LED strobed
Battery Type	1.2V, NiMH Rechargeable
Battery Operating Time	8 hours
AC Power Supply	100-130/200-260 V, 50/60 Hz, 6 W

ENVIRONMENTAL

Operating Temperature	10 °C to 45 °C (50 °F to 113 °F)
Storage Temperature	-20 °C to 45 °C (-4 °F to 113 °F)

PHYSICAL

Size (with connectors)	9.56 in x 5.22 in x 4.31 in (243 mm x 158 mm x 110 mm)
Weight	5.75 lb (2.6 kg)
Finish	Blue vinyl with silver anodized side panels

OPTIONAL ACCESSORIES

4300A085	Carrying Case
5A1230	1.2V, NiMH Rechargeable Battery

COMPATIBLE ELEMENTS

4391A Elements	Select two elements in a 10:1 power ratio from Tables 1, 2, 3, 4, 5, 6 and 14

MADE IN USA

Panel-Mount CW Wattmeters

MODELS 4526 & 4527

The Model 4526 & 4527 panel-mount RF Wattmeters have both dual-meter and dual-element sockets. These features let you determine VSWR more precisely using a more sensitive reflected power element and simultaneously read forward and reflected power. The panel mount styles are versions of our legacy tested Model 43 and are used in rack installation. The 4527 has an RF sampler that provides a low power sample of the main RF signal. The sampler output may be fed to any RF signal suitable monitoring device, e.g., a frequency counter, spectrum analyzer, or oscilloscope. Consult with the factory for appropriate combined transmitter monitoring products.

	4526	4527
Frequency Range	450 kHz to 1.2 GHz (depending on element)	2 to 512 MHz (depending on element)
Insertion VSWR	With N Connectors 1.05 max to 1000 MHz	With N Connectors 1.05 max to 512 MHz
RF Sample Output	N/A	Fixed at -53 dB from 512 to 10 MHz decreasing to -70 dB at 2 MHz BNC(f) port
Elements	Tables 1, 2, 3, 4, 6	2 to 512 MHz models within Tables 1, 2, 6

*Quoted accuracy only when used with other Bird® Products.

MEASUREMENT

Power Range	100 mW to 5 kW using Bird Plug-in Elements (applies only when coupling is less than 30 dB)
Accuracy	±5% of full scale

*Quoted accuracy only when used with other Bird® Products.

CONNECTORS

RF Connectors	QC Type (Female N normally supplied)

PHYSICAL

Size (with connectors)	5.22 in x 19 in x 1.69 in (133 mm x 483 mm x 43 mm)
Weight	3.5 lb (1.6 kg)
Finish	Gray powder coat

Replacement Meter Kits

RPK43-4

The RPK43-4 is a complete replacement assembly kit for use with the Bird Model 43 Series of RF Wattmeters. This kit includes a 3.5 in round meter face, coaxial meter cable, shock ring, neoprene gasket -and shorting plug.

	RPK43-4
Description	3.5 in round replacement meter movement assembly kit
Current	30 µA/1400 Ohms
Meter Scales	25/50/100 W
Elements	Tables 1, 2, 3, 6
Compatible with	Bird Wattmeter models: 43, 43P, 4431, 4521, 4522, 4526 and 4527

ELEMENT SELECTION GUIDE

MODEL	TABLE(S)
3128A	1, 2, 3, 6, 13, 14
3170B	1, 2, 3, 6, 13, 14
43	1, 2, 3, 6, 13, 14
43P	1, 2, 3, 5, 6, 13
4314C	1, 2, 3, 5, 6, 13, 14

MODEL	TABLE(S)
4391A	1, 2, 3, 5, 6, 13, 14
4410A, 4412A	13
4431	1, 2, 3, 6, 13, 14
4526	1, 2, 3, 6, 13, 14
4527	2 MHz to 512 MHz elements in 1, 2, 6, 13, 14

Plug-In Elements

FOR 7/8 IN LINE SECTIONS & WATTMETERS

All Bird Plug-In Elements are calibrated in accordance with meticulous Bird calibration procedures supported by a long history of mean deviation values to assure adherence to advertised specifications of current instruments, as well as field interchangeability with equipment purchased, used and trusted in all the years since its introduction.

TABLE 1 STANDARD ELEMENTS

POWER RANGE	FREQUENCY BANDS (MHz)						
	2 to 30	25 to 60	50 to 125	100 to 250	200 to 500	400 to 800	800 to 1000
5 W	—	5A	5B	5C	5D	5E-400	5E-800
10 W	—	10A	10B	10C	10D	10E-400	10E-800
25 W	25H	25A	25B	25C	25D	25E-400	25E-800
50 W	50H	50A	50B	50C	50D	50E-400	50E-800
100 W	100H	100A	100B	100C	100D	100E-400	100E-800
250 W	250H	250A	250B	250C	250D	250E-400	250E-800
500 W	500H	500A	500B	500C	500D	500E-400	500E-800
1000 W	1000H	1000A	1000B	1000C	1000D	—	—
2500 W	2500H	2500A	2500B	2500C	2500D	—	—
5000 W	5000H	5000A	5000B	5000C	—	—	—

TABLE 2 LOW-POWER ELEMENTS

POWER RANGE	FREQUENCY BANDS (MHz)										
	40 to 50	50 to 60	60 to 80	80 to 90	95 to 125	110 to 160	150 to 250	200 to 300	275 to 450	425 to 850	800 to 1000
1 W	040-1	050-1	—	080-1	095-1	110-1	150-1	200-1	275-1	425-1	801-1

POWER RANGE	FREQUENCY BANDS (MHz)										
	25 to 30	30 to 40	40 to 50	50 to 60	60 to 80	80 to 95	95 to 150	150 to 250	200 to 300	250 to 450	400 to 850	800 to 1000
2.5 W	025-2	030-2	040-2	050-2	—	080-2	095-2	150-2	200-2	—	400-2	801-2

ELEMENT SELECTION GUIDE

MODEL	TABLE(S)
3128A	1, 2, 3, 6, 13, 14
3170B	1, 2, 3, 6, 13, 14
43	1, 2, 3, 6, 13, 14
43P	1, 2, 3, 5, 6, 13
4314C	1, 2, 3, 5, 6, 13, 14

MODEL	TABLE(S)
4391A	1, 2, 3, 5, 6, 13, 14
4410A, 4412A	13
4431	1, 2, 3, 4, 6, 13, 14
4526	1, 2, 3, 6, 13, 14
4527	2 MHz to 512 MHz elements in 1, 2, 6, 13, 14

Plug-In Elements

FOR 7/8 IN LINE SECTIONS & WATTMETERS

TABLE 3 HIGH-FREQUENCY ELEMENTS, ACCURACY ±8% OF FULL SCALE

POWER RANGE	FREQUENCY BANDS (MHz)	
	950 to 1100	1100 to 1260
1 W	1J-950	1J-1100
2.5 W	2.5J-950	2.5J-1100
5 W	5J-950	5J-1100
10 W	10J-950	10J-1100
25 W	25J-950	25J-1100
50 W	50J-950	50J-1100
100 W	100J-950	100J-1100
250 W	250J-950	250J-1100
500 W	500J-950	500J-1100
1000 W	1000J-950	1000J-1100
2500 W	2500J-950	2500J-1100
5000 W	5000J-950	5000J-1100

ELEMENT SELECTION GUIDE

MODEL	TABLE(S)
3128A	1, 2, 3, 6, 13, 14
3170B	1, 2, 3, 6, 13, 14
43	1, 2, 3, 6, 13, 14
43P	1, 2, 3, 5, 6, 13
4314C	1, 2, 3, 5, 6, 13, 14

MODEL	TABLE(S)
4391A	1, 2, 3, 5, 6, 13, 14
4410A, 4412A	13
4431	1, 2, 3, 6, 13, 14
4526	1, 2, 3, 6, 13, 14
4527	2 MHz to 512 MHz elements in 1, 2, 6, 13, 14

Plug-In Elements

FOR 7/8 IN LINE SECTIONS & WATTMETERS

TABLE 5 PEAK-POWER ELEMENTS, (PEAK ONLY) ±8% OF FULL SCALE

POWER RANGE	FREQUENCY BANDS (MHz)		
	25 to 60	50 to 125	100 to 250
2500 W	2500A	2500B	2500C
5000 W	5000A	5000B	5000C
10000 W	—	10000B	—

Refer to "Transmission Power Rating Chart" for max power ratings. Elements are capable of reading peak and average power.

TABLE 6 MILLIWATT ELEMENTS

POWER RANGE	FREQUENCY BANDS (MHz)									
	40 to 50	72 to 76	108 to 136	135 to 175	320 to 340	328 to 336	400 to 420	420 to 450	450 to 470	800 to 1000
100 mW	—	430-2	430-57	—	430-205	430-3	430-7	430-208	430-8	—

POWER RANGE	FREQUENCY BANDS (MHz)							
	72 to 76	105 to 120	116 to 126	130 to 150	190 to 210	329 to 336	450 to 470	800 to 1000
250 mW	430-22	430-20	430-48	430-13	—	430-16	430-61	430-264

POWER RANGE	FREQUENCY BANDS (MHz)									
	72 to 76	105 to 120	136 to 150	240 to 290	290 to 340	329 to 336	350 to 400	400 to 450	450 to 500	800 to 1000
500 mW	430-33	430-26	430-249	—	430-253	430-28	430-254	430-255	430-256	430-265

TABLE 13 NONDIRECTIONAL SAMPLER ELEMENTS FOR QC-TYPE OR 7/8 IN EIA LINE

MODEL	FREQUENCY BAND (MHz)	NOMINAL COUPLING	MAX MAIN LINE POWER
4274-025	25 to 1000	-50 dB ±2 dB (-66 dB @ 2 MHz)	500 W
4274-050	100 to 400	-35 to -48 dB (±1 dB) Adjustable)	500 W

ELEMENT SELECTION GUIDE

MODEL	TABLE(S)
3128A	1, 2, 3, 6, 13, 14
3170B	1, 2, 3, 6, 13, 14
43	1, 2, 3, 6, 13, 14
43P	1, 2, 3, 5, 6, 13
4314C	1, 2, 3, 5, 6, 13, 14

MODEL	TABLE(S)
4391A	1, 2, 3, 5, 6, 13, 14
4410A, 4412A	13
4431	1, 2, 3, 6, 13, 14
4526	1, 2, 3, 6, 13, 14
4527	2 MHz to 512 MHz elements in 1, 2, 6, 13, 14

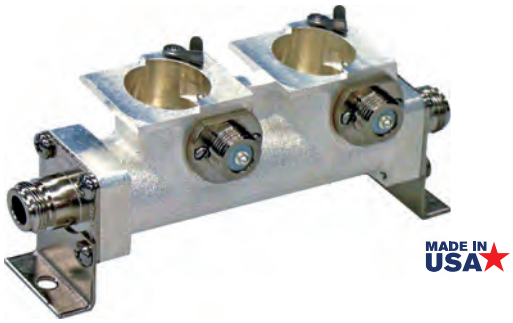
Directional Coupler Elements

FOR RIGID LINE SECTIONS & WATTMETERS

Coupler elements used for RF sampling. The wattmeter display does not read when these elements are installed.

TABLE 14 DIRECTIONAL COUPLER ELEMENTS FOR QC-TYPE OR 7/8 IN EIA LINE

MODEL	FREQUENCY BAND (MHz)	NOMINAL COUPLING	MAX MAIN LINE POWER
400-50	50 to 100	-40 dB	-
400-75	75 to 150	-40 dB	-
400-125	125 to 250	-40 dB	1 kW
400-225	225 to 450	-40 dB	1 kW
400-750	750 to 1250	-40 dB	1 kW



RF Line Sections

WATTMETER COMPONENTS

Each line section is equipped with one or two sockets where Plug-In Elements, in the desired power and frequency range, are inserted. Double-socket line sections are for simultaneous measurement of forward and reflected power. Designed for insertion between a RF transmitter and antenna or load.

LINE SECTION SELECTION GUIDE

7/8 inch	RF CONNECTOR	ELEMENT SOCKETS	LINE SIZE	LENGTH	WEIGHT
4230-006-1	QC (not included)	1	7/8 in	4 in	1 lb
4230-018	N-Type(f)	1	7/8 in	5.5 in	1.33 lb
4230-057	N-Type(f)	1 w/ Bracket	7/8 in	5.13 in	1.34 lb
4230-059	QC (not included)	1 w/ Bracket	7/8 in	4 in	1.25 lb
4522A002-5	QC (not included)	2 - Panel Mount	7/8 in	6.22 in	1.25 lb

RF ATTENUATORS & LOADS

Rugged and Reliable Solutions for Low to High Power Attenuation and Termination

MADE IN USA

ATTENUATORS, OIL-COOLED

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ATTENUATORS, CONVECTION-COOLED

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LOADS, OIL-COOLED

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LOADS, CONVECTION-COOLED

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LOADS, OIL-COOLED, MARKET-SPECIFIC

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LOADS, WATER-COOLED

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LOADS, CONDUCTION-COOLED

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Attenuators

Bird manufactures a broad spectrum of RF power attenuators from 2 W to 4000W. Our resistive product portfolio includes air-cooled, water-cooled, oil-dielectric, convection cooled, and conduction cooled RF units.

1 WHAT IS AN ATTENUATOR?

Bird's Convection cooled RF Attenuators are components that will reduce the amplitude level of an incoming signal and are used to protect systems from receiving a signal with a power level that is too high to process. Attenuators are a valuable and reliable accessory for reducing power levels, for isolating components under test, for harmonic signal analysis, and as comparison standards. Convection RF Attenuators feature a self-cooling design, frequencies up to 18GHz and fully shielded.

2 ATTENUATOR SELECTION CRITERIA

- **Attenuation Value -** most important of all is attenuation factor. Attenuators are available from 0 dB to 40 dB and above depending on applications. Attenuation is how much power is removed from the signal before the output.
- **Power Rating (Watts) -** it is recommended to pick one with higher power handling capability than your required power
- **Convection Product Type**
    1. **A =** input and output connector on the same side of the heatsink
    2. **SA and WA =** connectors in-line, or straight through the heatsink
- **Connector Gender** - Male or Female combinations
- **Connector Types -** SMA, BNC, N, TNC or IEC 7/16

RF Loads

Bird manufactures a broad spectrum of devices from one watt to eighty kilowatts. Our resistive product portfolio includes air-cooled, water-cooled, oil-dielectric, convection cooled, and conduction cooled RF attenuators and RF loads.

1 WHAT IS A RF LOAD?

RF Loads come in various shapes and sizes and provide one purpose – convert RF electrical energy into a form of energy that can be dissipated efficiently, economically, and safely. The purpose of a load or termination (also known as a "dummy load") is to absorb RF energy and turn it into heat. Many times, the load takes the place of an antenna during transmitter testing.

2 OTHER APPLICATIONS WHERE TERMINATIONS CAN BE FOUND

- Reject Loads
- Hybrid Combiners
- Isolators / Circulators
- Transmitter Tuning
- System Testing & Calibration

3 CONSIDERATION BASICS

Terminations should be properly matched to the characteristic impedance of a transmission line. The termination characteristics of primary concern are operating frequency range, average power handling capability, operating temperature range, VSWR, size and weight. Impedance is typically 50 Ohms unless otherwise stated.

- **Electrical Considerations**
  1. **Frequency Range -** the exact operating frequency range of each dummy load should be specified
  2. **Maximum VSWR -** measure of how well the load is "matched" to the transmission line
  3. **Peak to Average Power Ratio -** how much "Instantaneous" power can be absorbed
  4. **Power Rating** - the amount of energy (heat) a load can absorb. The average and peak powers are interrelated in that the peak power capacity is a function of the operating temperature which in turn is a function of the average power. These are then impacted by the ambient temperature of the cooling medium (air or water).
- **Mechanical considerations -** Connectors or Flanges, Dimensions, mounting provisions, Coolant
- **Environmental Consideration -** Ambient Temperature Range, Coolant Flow, Coolant Temp, Humidity, Shock, Vibration and Altitude

4 WHAT ARE THE TYPES OF LOADS?

Load types are defined by cooling methods: Convection, Conduction, Oil Cooled, Water Cooled and Forced air (Moduloads). Bird offers power levels from 2 W to 80 kW.

- **Convection cooling** describes a termination equipped with a heat sink with cooling fins. A heat sink with cooling fins increases the effective heat exchange toward the environment. The heat sink is characterized by its thermal resistance or by the increase of surface temperature per watt (in °C per W). The shorter this value is, the greater the power will be.

- **Conduction cooling** describes the termination heat transfer by means of molecular agitation within the material without any motion of the material as a whole, this is considered a passive cooling device. Important considerations are ambient temperature and how much free airflow is available and the amount of heat needed to dissipate.

- **Water-cooled loads** use pressurized water of proper temperature and flow rate to carry heat away from the resistive element. The water-cooling system can be sub-divided into two groups: water that is contained totally inside the resistor and water that flows on both the inside and outside of the resistor. Advantages include superior efficiency, small size and common for calorimetry due to containment of heat flux paths. Typical mixtures are 50/50 water/glycol mixture or potable water.

- **Moduload** is for those installations that do not have water access or good water quality but still desire high power capabilities, Bird manufactures a water-cooled load (Moduload series) that is completely self-contained.

- **Oil-dielectric loads** surround the resistive element with oil, which transfers heat to an exterior, finned shell for dissipation into the surrounding air.

Typical Peak Power Ratings For Bird Loads

Understanding your application and criteria for the heat sink when using a conductive load for proper operation will assure your needs are met in thermal performance and will help eliminate any unwanted effects in the entire system.

OIL-COOLED LOADS

MODEL	POWER RATING	PULSE WIDTH (MICROSECONDS)					FREQUENCY RANGE	VSWR
		1µ	10µ	100µ	1000µ	5000µ		
8135	150 W	10 kW	8 kW	5.75 kW	3.5 kW	2 kW	DC to 1 GHz 1 to 2.5 GHz 2.5 to 4 GHz	1.1:1 1.2:1 1.3:1
8201	500 W	200 kW	150 kW	105 kW	57 kW	25 kW	DC to 1 GHz 1 to 2.5 GHz	1.1:1 1.25:1
8251	1 kW	200 kW	150 kW	105 kW	57 kW	25 kW	DC to 1 GHz 1 to 2 GHz 2 to 2.4 GHz	1.1:1 1.25:1 1.3:1
8890 Series	2.5 kW	150 kW	115 kW	80 kW	54 kW	22 kW	DC to 1 GHz 1 to 2 GHz 2 to 2.4 GHz	1.1:1 1.25:1 1.3:1
8920 Series	5 kW	150 kW	115 kW	80 kW	54 kW	22 kW	DC to 1 GHz	1.1:1
8930 Series	10 kW	150 kW	120 kW	85 kW	55 kW	30 kW	DC to 400 MHz 400 MHz to 1 GHz	1.15:1 1.2:1

Note: Duty factor should be such that the average power rating of the load is never exceeded.

WATER-COOLED LOADS

MODEL	POWER RATING	PULSE WIDTH (MICROSECONDS)					FREQUENCY RANGE	VSWR
		1µ	10µ	100µ	1000µ	5000µ		
8730 Series	10 kW	100 kW	77 kW	50 kW	32 kW	16 kW	DC to 1 GHz	1.1:1
8740 Series	20 kW	250 kW	190 kW	135 kW	75 kW	35 kW	1 kHz to 900 MHz	1.1:1
8750 Series	30 kW	250 kW	190 kW	135 kW	75 kW	40 kW	1 kHz to 900 MHz	1.1:1
8760 Series	40 kW	250 kW	197 kW	145 kW	90 kW	55 kW	1 kHz to 900 MHz	1.1:1
8770 Series	50 kW	250 kW	197 kW	145 kW	97 kW	65 kW	1 kHz to 900 MHz	1.1:1
8790 Series	80 kW	250 kW	210 kW	170 kW	130 kW	100 kW	1 kHz to 800 MHz	1.15:1

Note: Duty factor should be such that the average power rating of the load is never exceeded.

MADE IN USA

RF Attenuators

OIL CONVECTION-COOLED

The Bird oil convection-cooled attenuator 8320 Series may be used for the isolation of power sources up to their maximum power rating and for low level monitoring. They are valuable and reliable accessories for reducing power levels and VSWR, for isolating components under test, for harmonic signal analysis, and as comparison standards.

PRODUCT FEATURES

- Self-contained instruments that require no external source of power
- Equipped with Quick-Change (QC) connectors
- Self cooling design
- Fully shielded against production of extraneous radiation
- Rugged construction

SYSTEM

Coolant Method	Oil convection-cooled
Frequency Range/VSWR	DC to 500 MHz at 1.1:1 max
Impedance	50 Ohms
Standard Attenuation Value	30 dB
Operating Position	Horizontal

ENVIRONMENTAL

Operating Temperature	-40 °C to 45 °C (-40 °F to 113 °F)
Humidity	95% non-condensing

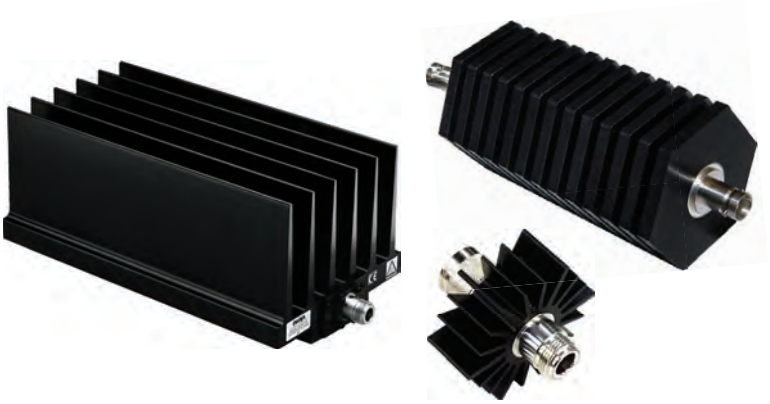
ATTENUATOR SELECTION GUIDE

MODEL	POWER RATING	CONNECTOR	FREQ. RANGE & VSWR	COOLING METHOD	DIMENSIONS	WEIGHT
8325	500 W	QC - N(f) Input QC - N(f) Output	DC to 500 MHz at 1.10:1 max	Convection	17.5 in x 6.0 in x 8.5 in (445 mm x 151 mm x 216 mm)	25 lb (11.0 kg)
8327-300	1 kW	QC - LC(f) Input QC - N(f) Output	DC to 500 MHz at 1.10:1 max	Convection	24.0 in x 7.2 in x 17.2 in (596 mm x 181 mm x 437 mm)	57 lb (26.0 kg)
8329-300	2 kW	QC - LC(f) Input QC - N(f) Output	DC to 500 MHz at 1.10:1 max	Convection	24.0 in x 7.2 in x 17.2 in (596 mm x 181 mm x 437 mm)	57 lb (26.0 kg)
8329-300 w/ BA-300-115	4 kW	QC - LC(f) Input QC - N(f) Output	DC to 500 MHz at 1.10:1 max	Forced Convection, 115 VAC Fan	23.5 in x 7.2 in x 22.1 in (596 mm x 181 mm x 560 mm)	70.5 lb (32 kg)
8329-300 w/ BA-300-230	4 kW	QC - LC(f) Input QC - N(f) Output	DC to 500 MHz at 1.10:1 max	Forced Convection, 230 VAC Fan	23.5 in x 7.2 in x 22.1 in (596 mm x 181 mm x 560 mm)	70.5 lb (32 kg)

BLOWER SELECTION GUIDE

MODEL	INPUT VOLTAGE	FUSE RATING	COMPATIBLE WITH MODELS
BA-300-115	115 VAC - 0.6A at 50-60 Hz	115 VAC - 1 A	889X-300 RF Termination 8329-300 RF Attenuators
BA-300-230	230 VAC - 0.3 A at 50/60 Hz	230 VAC - 500 mA	889X-300 RF Termination 8329-300 RF Attenuators
BA-310-115**	115 VAC - 0.6A at 50-60 Hz	115 VAC - 1 A	889X-300 RF Termination 8329-300 RF Attenuators
BA-310-230**	230 VAC - 0.3 A at 50/60 Hz	230 VAC - 500 mA	889X-300 RF Termination 8329-300 RF Attenuators

**Selectable manual or standby mode, control thermoswitch included.



RF Attenuators

CONVECTION-COOLED

Bird's Convection-Cooled RF Power Attenuators are a valuable and reliable accessory for reducing power levels, for isolating components under test, for harmonic signal analysis and as comparison standards. They are world renowned for their high-quality, robust construction and conservative power ratings. These attenuators are fully shielded against production of extraneous radiation and the self-cooling design needs no cooling plate.

PRODUCT FEATURES

- Self cooling design, needs no cooling plate
- Frequencies up to 18 GHz
- Attenuator requires no AC power
- Rugged construction, fully shielded
- Full broadband operation and models to cover all LTE frequencies

SYSTEM

Coolant Method	Dry, convection-cooled
Impedance	50 Ohms
AC Power	None except 1.5 kW models require 115/230V AC power
PIM	-110 dBc min
Standard Attenuation Values	3, 6, 10, 20, 30 dB
Operating Position	Any

ENVIRONMENTAL

Ambient Temperature	-40 °C to 40 °C (-40 °F to 104 °F)
Humidity	95% non-condensing

ATTENUATOR CONFIGURATION GUIDE

POWER RATING	PRODUCT TYPE	CONNECTOR GENDER	CONNECTORS*	ATTENUATION VALUE**
See selection guide	**A, SA, WA** = Attenuator	**M/F** = Male/Female **F/F** = Female/ Female	**N** = N **T** = TNC	**10** = 10 dB **20** = 20 dB **30** = 30 dB **40** = 40 dB

*Call for custom connector options not shown in this catalog
**All attenuations are not available for every model

Example: 2-A-MFN-10= Model 2-A, 2 W, A-Type Attenuator with Male/Female N connectors with an attenuation value of 10 dB.
Note: Not all combinations are valid. If assistance is needed consult the factory to define the model that is right for you.

ATTENUATOR SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	FREQUENCY RANGE & VSWR	DIMENSIONS	WEIGHT	FINISH
2-A	2 W	N	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	2.4 in x 0.8 in dia (61 mm x 21 mm dia)	3.1 oz (88 g)	Tri-Alloy
2-6A	2 W	N	DC to 6 GHz @ 1.25:1 max	1.8 in x 0.9 in dia (46 mm x 23 mm dia)	2.5 oz (71 g)	Stainless Steel
2-18A	2 W	N	DC to 4 GHz @ 1.15:1 max 4 to 12.4 GHz @ 1.25:1 max 12.4 to 18 GHz @ 1.35:1 max	1.8 in x 0.9 in dia (46 mm x 23 mm dia)	2.5 oz (71 g)	Stainless Steel
3-A	3 W	BNC	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	1.5 in x 0.6 in dia (39 mm x 16 mm dia)	3.1 oz (88 g)	Tri-Alloy
5-A	5 W	N, TNC	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	2.6 in x 0.8 in dia (67 mm x 21 mm dia)	3.1 oz (88 g)	Tri-Alloy

RF Attenuators CONVECTION-COOLED

ATTENUATOR SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	FREQUENCY RANGE & VSWR	DIMENSIONS	WEIGHT	FINISH
5-6A	5 W	N	DC to 6 GHz @ 1.25:1 max	2.4 in x 0.9 in dia (61 mm x 23 mm dia)	3.0 oz (86 g)	Stainless Steel
5-18A	5 W	N	DC to 4 GHz @ 1.15:1 max 4 to 12.4 GHz @ 1.25:1 max 12.4 to 18 GHz @ 1.35:1 max	2.5 in x 0.9 in dia (64 mm x 23 mm dia)	3.5 oz (100 g)	Stainless Steel
10-A	10 W	N	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	2.8 in x 2.3 in dia (72 mm x 59 mm dia)	5.0 oz (142 g)	Black Anodized Aluminum
10-6A	10 W	N	DC to 4 GHz @ 1.20:1 max 4 to 6 GHz @ 1.30:1 max	2.5 in x 1.1 in dia (64 mm x 28 mm dia)	3.5 oz (100 g)	Stainless Steel
10-18A	10 W	N	DC to 4 GHz @ 1.20:1 max 4 to 12.4 GHz @ 1.30:1 max 12.4 to 18 GHz @ 1.45:1 max	2.5 in x 0.9 in dia (64 mm x 23 mm dia)	3.5 oz (100 g)	Stainless Steel
25-A	25 W	N	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	5.3 in x 2.3 in dia (135 mm x 59 mm dia)	9.0 oz (256 g)	Black Anodized Aluminum
25-6A	25 W	N	1 to 6 GHz @ 1.20:1 max	4.2 in x 2.3 in x 2.3 in (107 mm x 59 mm x 59 mm)	13.5 oz (383 g)	Stainless Steel
25-18A	25 W	N	DC to 4 GHz @ 1.20:1 max 4 to 12.4 GHz @ 1.30:1 max 12.4 to 18 GHz @ 1.40:1 max	4.2 in x 2.3 in x 2.3 in (107 mm x 59 mm x 59 mm)	13.5 oz (383 g)	Stainless Steel
50-A	50 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3 GHz @ 1.25:1 max	6.4 in x 2.3 in dia (163 mm x 59 mm dia)	1.0 lb (454 g)	Black Anodized Aluminum
50-6A	50 W	N	DC to 6 GHz @ 1.20:1 max	4.7 in x 3.0 in x 3.0 in (120 mm x 77 mm x 77 mm)	1.7 lb (772 g)	Stainless Steel
50-18A	50 W	N	DC to 6 GHz @ 1.25:1 max 6 to 12.4 GHz @ 1.35:1 max 12.4 to 18 GHz @ 1.45:1 max	4.7 in x 3.0 in x 3.0 in (120 mm x 77 mm x 77 mm)	1.7 lb (772 g)	Stainless Steel
75-A	75 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3 GHz @ 1.25:1 max	7.3 in x 2.3 in dia (186 mm x 59 mm dia)	1.6 lb (726 g)	Black Anodized Aluminum
100-A	100 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3 GHz @ 1.25:1 max	7.3 in x 2.6 in x 6.4 in (186 mm x 67 mm x 163 mm)	3.6 lb (1.6 kg)	Black Anodized Aluminum
100-6A	100 W	N	DC to 2 GHz @ 1.20:1 max 2 to 4 GHz @ 1.35:1 max 4 to 6 GHz @ 1.40:1 max	6.4 in x 2.7 in x 3.8 in (163 mm x 69 mm x 97 mm)	2.4 lb (1.7 kg)	Stainless Steel
100-SA	100 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	8.4 in x 2.8 in x 2.8 in (214 mm x 72 mm x 72 mm)	3.0 lb (1.4 kg)	Black Anodized Aluminum
150-A	150 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3 GHz @ 1.25:1 max	6.7 in x 2.6 in x 11.9 in (171 mm x 67 mm x 303 mm)	6.6 lb (3.0 kg)	Black Anodized Aluminum
150-SA	150 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	9.1 in x 4.0 in x 5.0 in (232 mm x 102 mm x 127 mm)	5.5 lb (2.5 kg)	Black Anodized Aluminum
150-WA	150 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	5.6 in x 5.4 in x 4.3 in (143 mm x 138 mm x 110 mm)	2.5 lb (1.2 kg)	Black Anodized Aluminum
300-A	300 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	7.3 in x 5.4 in x 10.9 in (186 mm x 138 mm x 277 mm)	12.0 lb (5.5 kg)	Black Anodized Aluminum
300-WA	300 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	9.0 in x 5.4 in x 4.8 in (229 mm x 138 mm x 122 mm)	4.6 lb (2.1 kg)	Black Anodized Aluminum
500-WA	500 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.5 GHz @ 1.25:1 max	12.4 in x 5.4 in x 4.8 in (315 mm x 138 mm x 122 mm)	7.9 lb (3.6 kg)	Black Anodized Aluminum
600-A	600 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	12.7 in x 9.4 in x 9.6 in (323 mm x 239 mm x 244 mm)	21.5 lb (9.8 kg)	Black Anodized Aluminum
1000-A*	1 kW	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	13.6 in x 12.8 in x 9.6 in (346 mm x 326 mm x 244 mm)	26.5 lb (12.0 kg)	Black Anodized Aluminum
1000-WA*	1 kW	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	19.6 in x 10.6 in x 4.8 in (498 mm x 270 mm x 122 mm)	26.5 lb (12.0 kg)	Black Anodized Aluminum
1500-WA*	1.5 kW	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	20.4 in x 10.7 in x 5.9 in (519 mm x 272 mm x 150 mm)	30.0 lb (13.6 kg)	Black Anodized Aluminum

*Attenuators 1 kW and above are not available in attenuation values less than 10 dB

RF Loads

OIL-COOLED

Bird's Oil-Cooled RF Loads are self-contained high-power 50 Ohm coaxial transmission line terminations requiring no outside power source or additional equipment. These units provide accurate, dependable, and practically non-reflective termination for testing and adjusting transmitters under non-radiating conditions. The loads consist essentially of a cylindrical film type resistor immersed in a dielectric coolant. The resistor, individually selected for its accuracy, is enclosed in a special tapered housing which provides a linear reduction in surge impedance directly proportional to the distance along the resistor.

PRODUCT FEATURES

- Self-contained cooling system that includes cooling fans for higher power models
- Capable of up to 10 dB peak to average power ratios
- Wide range of available RF input connectors
- Compact design
- Broadband operation

SYSTEM

Coolant Method	**8135, 8201, 8251:** Refined mineral oil **All Others:** Silicone oil
Impedance	50 Ohms
Finish	Gray powder coat
AC Power	None except 1500 W models require 115/230V AC power
Operating Position	Vertical

ENVIRONMENTAL

Ambient Temperature	-40 °C to 45 °C (-40 °F to 113 °F)
Storage Temperature	-40 °C to 45 °C (-40 °F to 113 °F)
Humidity	95% non-condensing
Altitude	1520 m (5000 ft)

CERTIFICATIONS

Safety	EMC EN 61326-1:2006 (units w/blowers) and Safety EN 61010-1:2001 (all units)

LOAD SELECTION GUIDE

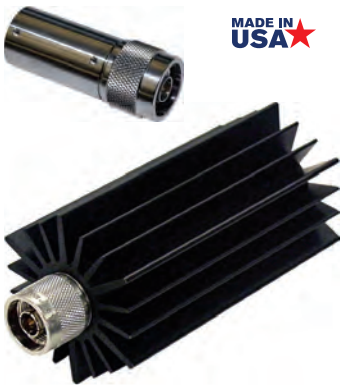
MODEL	POWER RATING	CONNECTORS	COOLING METHOD	FREQ. RANGE & VSWR	DIMENSIONS	WEIGHT
8135	150 W	QC - N(f)	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2.5 GHz @ 1.2:1 max 2.5 to 4 GHz @ 1.3:1 max	9.6 in x 4 in x 6.5 in (242 mm x 102 mm x 164 mm)	6.0 lb (2.7 kg)
8141	250 W	QC - N(f)	Convection	DC to 1 GHz @ 1.1:1 max 1 to 1.8 GHz @ 1.2:1 max 1.8 to 2.5 GHz @ 1.3:1 max	9.6 in x 4 in x 6.5 in (242 mm x 102 mm x 164 mm)	10 lb (4.5 kg)
8201	500 W	QC - N(f)	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2.5 GHz @ 1.25:1 max	16.8 in x 6 in x 8.5 in (427 mm x 151 mm x 216 mm)	20 lb (9.1 kg)
8401	600 W	QC - N(f)	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2.8 GHz @ 1.2:1 max 2.8 to 3 GHz @ 1.35:1 max	16.2 in x 6 in x 8.5 in (408 mm x 151 mm x 216 mm)	20 lb (9.1 kg)
8251	1 kW	QC - N(f)	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3:1 max	18 in x 6 in x 8.5 in (455 mm x 151 mm x 216 mm)	25 lb (11.5 kg)
8860	1.5 kW	QC - N(f)	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max	19.5 in x 7.5 in x 13.2 in (496 mm x 184 mm x 334 mm)	32 lb (14.5 kg)
8861	1.5 kW	1 5/8 in EIA Unflanged	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max	19.5 in x 7.5 in x 13.2 in (496 mm x 184 mm x 334 mm)	32 lb (14.5 kg)
8862	1.5 kW	1 5/8 in EIA Flanged	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max	19.5 in x 7.5 in x 13.2 in (496 mm x 184 mm x 334 mm)	32 lb (14.5 kg)

RF Loads

OIL-COOLED

LOAD SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	COOLING METHOD	FREQ. RANGE & VSWR	DIMENSIONS	WEIGHT
8890-300	2.5 kW	QC - LC(f)	Convection	DC to 1 GHz @ 1.1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.5 in x 17.2 in (638 mm x 191 mm x 437 mm)	59 lb (27 kg)
8891-300	2.5 kW	3 1/8 in EIA Flanged	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.5 in x 17.2 in (638 mm x 191 mm x 437 mm)	59 lb (27 kg)
8892-300	2.5 kW	1 5/8 in EIA Flanged	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.5 in x 17.2 in (638 mm x 191 mm x 437 mm)	59 lb (27 kg)
8895-300	2.5 kW	1 5/8 in EIA Unflanged	Convection	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.5 in x 17.2 in (638 mm x 191 mm x 437 mm)	59 lb (27 kg)
8890-315	5 kW	QC - LC(f)	115 VAC Fan	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.4 in x 22.7 in (638 mm x 187 mm x 560 mm)	59 lb (27 kg)
8890-320	5 kW	QC - LC(f)	230 VAC Fan	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.4 in x 22.7 in (638 mm x 187 mm x 560 mm)	59 lb (27 kg)
8891-320	5 kW	3 1/8 in EIA Flanged	230 VAC Fan	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.4 in x 22.7 in (638 mm x 187 mm x 560 mm)	59 lb (27 kg)
8892-315	5 kW	1 5/8 in EIA Flanged	115 VAC Fan	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.4 in x 22.7 in (638 mm x 187 mm x 560 mm)	59 lb (27 kg)
8892-320	5 kW	1 5/8 in EIA Flanged	230 VAC Fan	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.4 in x 22.7 in (638 mm x 187 mm x 560 mm)	59 lb (27 kg)
8895-315	5 kW	1 5/8 in EIA Unflanged	115 VAC Fan	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.4 in x 22.7 in (638 mm x 187 mm x 560 mm)	59 lb (27 kg)
8895-320	5 kW	1 5/8 in EIA Unflanged	230 VAC Fan	DC to 1 GHz @ 1.1:1 max 1 to 2 GHz @ 1.25:1 max 2 to 2.4 GHz @ 1.3 max	25.2 in x 7.4 in x 22.7 in (638 mm x 187 mm x 560 mm)	59 lb (27 kg)
8921	5 kW	QC - LC(f)	Convection	DC to 1 GHz @ 1.1:1 max	32.8 in x 9.5 in x 26.9 in (832 mm x 241 mm x 681 mm)	119 lb (54 kg)
8922	5 kW	1 5/8 in EIA Flanged	Convection	DC to 1 GHz @ 1.1:1 max	32.8 in x 9.5 in x 26.9 in (832 mm x 241 mm x 681 mm)	119 lb (54 kg)
8926	5 kW	3 1/8 in EIA Flanged	Convection	DC to 1 GHz @ 1.1:1 max	32.8 in x 9.5 in x 26.9 in (832 mm x 241 mm x 681 mm)	119 lb (54 kg)
8931-115	10 kW	QC - LC(f)	115 VAC Fan	DC to 400 MHz @ 1.15:1 max 400 MHz to 1 GHz @ 1.2:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)
8931-230	10 kW	QC - LC(f)	230 VAC Fan	DC to 400 MHz @ 1.15:1 max 400 MHz to 1 GHz @ 1.2:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)
8932-115	10 kW	1 5/8 in EIA Flanged	115 VAC Fan	DC to 400 MHz @ 1.15:1 max 400 MHz to 1 GHz @ 1.2:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)
8932-230	10 kW	1 5/8 in EIA Flanged	230 VAC Fan	DC to 400 MHz @ 1.15:1 max 400 MHz to 1 GHz @ 1.2:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)
8936-115	10 kW	3 1/8 in EIA Flanged	115 VAC Fan	DC to 400 MHz @ 1.15:1 max 400 MHz to 1 GHz @ 1.2:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)
8936-230	10 kW	3 1/8 in EIA Flanged	230 VAC Fan	DC to 400 MHz @ 1.15:1 max 400 MHz to 1 GHz @ 1.2:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)



RF Loads

CONVECTION-COOLED

Bird manufactures a broad line of Convection-Cooled RF Loads. They are known for their high-quality, rugged construction and conservative power ratings. These loads are fully shielded against production of extraneous radiation and the self-cooling design needs no cooling plate.

PRODUCT FEATURES

- Self-cooling design, needs no cooling plate
- Frequencies up to 18 GHz
- Load requires no AC power
- Rugged construction
- Broadband operation

SYSTEM

Coolant Method	Dry, convection-cooled
Impedance	50 Ohms
AC Power	None except 1500 W models require 115/230V AC power
Operating Position	Any

ENVIRONMENTAL

Ambient Temperature	-40 °C to 40 °C (-40 °F to 104 °F)
Humidity	95% non-condensing

LOAD CONFIGURATION GUIDE

POWER RATING	PRODUCT TYPE	CONNECTOR GENDER	CONNECTORS*
See selection guide	**T, WT** = Convection-cooled **CT** = Conduction-cooled **ST** = Square convection-cooled	**F** = Female **M** = Male	**B** = BNC **N** = N **T** = TNC

*Call for custom connector options not shown in this catalog

Example: 2-18T-N = Model 2-18T, 2 W, convection-cooled load with female N connectors.
Note: Not all combinations are valid. If assistance is needed consult the factory to define the model that is right for you.

RF Loads

CONVECTION-COOLED

LOAD SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	FREQUENCY RANGE& VSWR	DIMENSIONS	WEIGHT	FINISH
2-18T	2 W	N	DC to 12.4 GHz @ 1.20:1 max 12.4 to 18 GHz @ 1.25:1 max	1.0 in x 0.9 in dia (26 mm x 23 dia mm)	2.0 oz (57 g)	Stainless Steel
5-T	5 W	N, TNC	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	2.9 in x 1.4 in dia (74 mm x 36 dia mm)	4.6 oz (131 g)	Tri-Alloy
5-NT	5 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3 GHz @ 1.15:1 max	2.9 in x 1.4 in dia (74 mm x 36 dia mm)	4.6 oz (131 g)	Tri-Alloy
5-18T	5 W	N	DC to 4 GHz @ 1.15:1 max 4 to 12.4 GHz @ 1.25:1 max 12.4 to 18 GHz @ 1.35:1 max	1.4 in x 0.9 in dia (36 mm x 23 dia mm)	2.0 oz (57 g)	Stainless Steel
10-T	10 W	N, BNC, TNC	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.15:1 max	2.2 in x 2.3 in dia (56 mm x 59 dia mm)	5.9 oz (168 g)	Black Anodized Aluminum
25-T	25 W	N, BNC, TNC	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	5.3 in x 2.3 in dia (135 mm x 59 dia mm)	7 oz (199 g)	Black Anodized Aluminum
25-6T	25 W	N	DC to 6 GHz @ 1.20:1 max	3.5 in x 2.3 in x 2.3 in (89 mm x 59 mm x 59 mm)	14.0 oz (397 g)	Black Anodized Aluminum
25-18T	25 W	N	DC to 6 GHz @ 1.20:1 max 6 to 12.4 GHz @ 1.30:1 max 12.4 to 18 GHz @ 1.40:1 max	3.5 in x 2.3 in x 2.3 in (89 mm x 59 mm x 59 mm)	14.0 oz (397 g)	Black Anodized Aluminum
50-T	50 W	N	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	5.3 in x 2.3 in dia (135 mm x 59 dia mm)	1.3 lb (590 g)	Black Anodized Aluminum
75-T	75 W	BNC, N	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	7.2 in x 2.3 in dia (183 mm x 59 dia mm)	1.5 lb (682 g)	Black Anodized Aluminum
100-T	100 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3 GHz @ 1.25:1 max	6.8 in x 6.4 in x 2.6 in (173 mm x 163 mm x 67 mm)	3.6 lb (1.6 kg)	Stainless Steel
100-ST	100 W	N	DC to 1 GHz @ 1.10:1 max 1 to 4 GHz @ 1.25:1 max	7.4 in x 2.8 in x 2.8 in (188 mm x 72 mm x 72 mm)	2.7 lb (1.2 kg)	Black Anodized Aluminum
100-6T	100 W	N	DC to 2 GHz @1.20:1 max 2 to 4 GHz @ 1.30:1 max 4 to 6 GHz @ 1.40:1 max	5.5 in x 3.5 in x 3.8 in (140 mm x 89 mm x 97 mm)	2.2 lb (1.0 kg)	Black Anodized Aluminum
150-ST	150 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3.0 GHz @ 1.25:1 max	8.1 in x 4.0 in x 4.0 in (206 mm x 102 mm x 102 mm)	5.0 lb (2.3 kg)	Black Anodized Aluminum
300-T	300 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	7.4 in x 5.4 in x 10.9 in (188 mm x 138 x 277 mm)	11.5 lb (5.3 kg)	Black Anodized Aluminum
300-WT	300 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	8.2 in x 5.4 in x 4.8 in (209 mm x 138 x 122 mm)	4.7 lb (2.2 kg)	Black Anodized Aluminum
500-WT	500 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	11.0 in x 5.4 in x 4.8 in (280 mm x 138 mm x 122 mm)	7.8 lb (3.6 kg)	Black Anodized Aluminum
1000-T	1 kW	N	DC to 1 GHz @ 1.15:1 max 1 to 2.4 GHz @ 1.25:1 max	12.3 in x 9.6 in x 12.8 in (313 mm x 244 mm x 326 mm)	26.5 lb (12.0 kg)	Black Anodized Aluminum
1000-WT	1 kW	N	DC to 1 GHz @ 1.15:1 max 1 to 2.4 GHz @ 1.25:1 max	18.5 in x 10.6 in x 4.8 in (470 mm x 270 mm x 122 mm)	26.5 lb (12.0 kg)	Black Anodized Aluminum
1500-WT**	1.5 kW	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	20 in x 10.6 in x 6.0 in (508 mm x 270 mm x 152 mm)	30.0 lb (13.6 kg)	Black Anodized Aluminum
1500-WA**	1.5 kW	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	20.4 in x 10.7 in x 5.9 in (519 mm x 272 mm x 150 mm)	30.0 lb (13.6 kg)	Black Anodized Aluminum

**1.5 kW Models require 115/230V AC Power

Market Specific RF Loads

OIL-COOLED

Bird's Oil-Cooled RF Loads for Digital Broadcast and Semiconductor Precision applications are self-contained high-power 50 Ohm coaxial transmission line terminations requiring no outside power source or additional equipment. These coaxial load resistors provide accurate, dependable, and practically non-reflective termination for testing and adjusting transmitters under non-radiating conditions.

PRODUCT FEATURES

- Self-contained cooling system that includes cooling fans for higher power models
- Tuned for optimal performance over target frequency ranges
- Capable of up to 10 dB peak to average power ratios
- Wide range of available RF input connectors
- Compact design

SYSTEM

Coolant Method	Silicone oil
Impedance	50 Ohms
Finish	**Digital Broadcast:** Gray powder coat **Semiconductor:** Black powder coat
AC Power	None except 1.5 kW models require 115/230V AC power
Operating Position	Vertical

ENVIRONMENTAL

Ambient Temperature	**Digital Broadcast:** -40 °C to 45 °C (-40 °F to 113 °F) **Semiconductor:** 5 °C to 40 °C (41 °F to 104 °F)
Storage Temperature	-40 °C to 45 °C (-40 °F to 113 °F)
Humidity	95% non-condensing
Altitude	1520 m (5000 ft)

DIGITAL BROADCAST LOAD SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	COOLING METHOD	FREQ. RANGE & VSWR	DIMENSIONS	WEIGHT
8251D	1 kW	1 5/8 in EIA Flanged	Convection	470 to 860 MHz @ 1.065:1 max	17.9 in x 8.5 in x 6 in (455 mm x 216 mm x 151 mm)	25 lb (11.5 kg)
8251D7-16	1 kW	7/6 Jack, IEC	Convection	470 to 860 MHz @ 1.065:1 max		
8862D	1.5 kW	1 5/8 in EIA Flanged	Convection	470 to 860 MHz @ 1.065:1 max	19.5 in x 7.5 in x 13.2 in (496 mm x 184 mm x 334 mm)	32 lb (14.5 kg)
8892D300	2.5 kW	1 5/8 in EIA Flanged	Convection	470 to 860 MHz @ 1.065:1 max	25.2 in x 7 in x 17.2 in (638 mm x 178 mm x 437 mm)	59 lb (27 kg)
8926D	5 kW	3 1/8 in EIA Flanged	Convection	470 to 860 MHz @ 1.065:1 max	32.8 in x 9.5 in x 26.9 in (832 mm x 241 mm x 681 mm)	126 lb (57 kg)
8927D	5 kW	3 1/8 in EIA Unflanged	Convection	470 to 860 MHz @ 1.065:1 max		
8936D115	10 kW	3 1/8 in EIA Flanged	115 VAC Fan	470 to 860 MHz @ 1.15:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)

SEMICONDUCTOR PRECISION LOAD SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	COOLING METHOD	FREQ. RANGE & VSWR	DIMENSIONS	WEIGHT
8890-300SC13	2.5 kW	QC-LC(f)	Convection	DC to 28 MHz @ 1.10:1 max	25.2 in x 7 in x 17.2 in (638 mm x 178 mm x 437 mm)	59 lb (27 kg)
8921SC13	5 kW	QC-LC(f)	Convection	DC to 28 MHz @ 1.10:1 max	32.8 in x 9.5 in x 26.9 in (832 mm x 241 mm x 681 mm)	126 lb (57 kg)
8931-115SC13	10 kW	QC-LC(f)	115 VAC Fan	DC to 28 MHz @ 1.10:1 max	32.8 in x 9.5 in x 33.4 in (832 mm x 241 mm x 847 mm)	142 lb (65 kg)
8931-230SC13	10 kW	QC-LC(f)	230 VAC Fan	DC to 28 MHz @ 1.10:1 max		
8941-115SC13	15 kW	QC-7/16DIN(f)	115 VAC Fan	DC to 20 MHz @ 1.10:1	43 in x 9.5 in x 33.4 in (1092 mm x 241 mm x 847 mm)	236 lb (107 kg)
8941-230SC13	15 kW	QC-7/16DIN(f)	230 VAC Fan	DC to 20 MHz @ 1.10:1		

Econoloads

WATER-COOLED

Econoloads are designed as a compact, low VSWR and non-radiating termination for high-power transmitter/transmission line systems. It generates almost no ambient heat, making installation space minimal and convenient, in any position. The RF power is converted to heat in the hollow resistive film load resistor and directly absorbed by the water flowing through it.

PRODUCT FEATURES

- Econoloads are the smallest load design for power dissipation
- Utilizes an external water supply where there is a source of potable water
- Compact size may be carried easily, mounted in any orientation
- Load requires no AC power
- Surface cool to the touch
- Standard EIA RF connections and NPT water connection

SYSTEM

Coolant Method	Water-cooled
Impedance	50 Ohms
AC Power	None
Operating Position	Any
Waterlines	**5 kW, 8720:** 1/4 in FPT **5 kW, 8726:** 3/4 in hose **10 kW to 80 kW:** 3/4 in hose

ENVIRONMENTAL

Water Inlet Temperature	**5 kW:** -8 °C to 40 °C (17.6 °F to 104 °F) **10 kW to 80 kW:** -5 °C to 60 °C (23 °F to 140 °F)

LOAD SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	FREQUENCY RANGE & VSWR	FLOW RATE	DIMENSIONS	WEIGHT
8720	5 kW	1 5/8 in EIA Flanged	DC to 500 MHz @ 1.10:1 max 500 to 900 MHz @ 1.15:1 max 900 to 2000 MHz @ 1.25:1 max	1 GPM (4 LPM) @ 5 °C to 4 GPM (15 LPM) @ 80 °C	8.1 in x 3.5 in dia (204 mm x 89 mm dia)	2 lb 2 oz (964 g)
8726	5 kW	QC - LC(f)	DC to 500 MHz @ 1.10:1 max 500 to 2000 MHz @ 1.25:1 max	1 GPM (4 LPM) @ 5 °C to 4 GPM (15 LPM) @ 80 °C	10.5 in x 1.7 in dia (265 mm x 43 mm dia)	2 lb 8 oz (1.1 kg)
8730A	10 kW	1 5/8 in EIA Flanged	DC to 1 GHz @ 1.10:1 max	4 GPM (15 LPM) @ 5 °C to 6 GPM (23 LPM) @ 60 °C	16.0 in x 4.4 in dia (406 mm x 111 mm dia)	8 lb (3.6 kg)
8731	10 kW	3 1/8 in EIA Flanged	1 kHz to 1 GHz @ 1.10:1 max	4 GPM (15 LPM) @ 5 °C to 6 GPM (23 LPM) @ 60 °C	14.7 in x 5.2 in dia (372 mm x 132 mm dia)	6 lb 4 oz (2.9 kg)
8738A	10 kW	3 1/8 in EIA Unflanged	1 kHz to 1 GHz @ 1.10:1 max	4 GPM (15 LPM) @ 5 °C to 6 GPM (23 LPM) @ 60 °C	16.0 in x 4.4 in dia (406 mm x 111 mm dia)	6 lb (2.8 kg)
8745	20 kW	3 1/8 in EIA Flanged	1 kHz to 900 MHz @ 1.10:1 max	6 GPM (23 LPM) @ 5 °C to 8 GPM (30 LPM) @ 60 °C	19.5 in x 5.2 in dia (495 mm x 132 mm dia)	15 lb 13 oz (7.2 kg)
8746	20 kW	3 1/8 in EIA Unflanged	1 kHz to 900 MHz @ 1.10:1 max	6 GPM (23 LPM) @ 5 °C to 8 GPM (30 LPM) @ 60 °C	19.5 in x 5.2 in dia (495 mm x 132 mm dia)	15 lb 5 oz (7.0 kg)
8755	30 kW	3 1/8 in EIA Flanged	1 kHz to 900 MHz @ 1.10:1 max	7 GPM (26 LPM) @ 5 °C to 9 GPM (34 LPM) @ 60 °C	19.5 in x 5.2 in dia (495 mm x 132 mm dia)	15 lb 13 oz (7.2 kg)
8756	30 kW	3 1/8 in EIA Unflanged	1 kHz to 900 MHz @ 1.10:1 max	7 GPM (26 LPM) @ 5 °C to 9 GPM (34 LPM) @ 60 °C	19.5 in x 5.2 in dia (495 mm x 132 mm dia)	15 lb 5 oz (7.0 kg)
8765	40 kW	3 1/8 in EIA Flanged	1 kHz to 900 MHz @ 1.10:1 max	8 GPM (30 LPM) @ 5 °C to 10 GPM (38 LPM) @ 60 °C	19.5 in x 5.2 in dia (495 mm x 132 mm dia)	15 lb 13 oz (7.2 kg)
8775	50 kW	3 1/8 in EIA Flanged	1 kHz to 900 MHz @ 1.10:1 max	9 GPM (34 LPM) @ 5 °C to 11 GPM (42 LPM) @ 60 °C	19.5 in x 5.2 in dia (495 mm x 132 mm dia)	15 lb 13 oz (7.2 kg)
8776	50 kW	3 1/8 in EIA Unflanged	1 kHz to 900 MHz @ 1.10:1 max	9 GPM (34 LPM) @ 5 °C to 11 GPM (42 LPM) @ 60 °C	19.5 in x 5.2 in dia (495 mm x 132 mm dia)	15 lb 5 oz (7.0 kg)
8792	80 kW	6 1/8 in EIA Flanged	1 kHz to 800 MHz @ 1.15:1 max	9 GPM (34 LPM) @ 5 °C to 12 GPM (46 LPM) @ 60 °C	35.2 in x 8.2 in dia (891 mm x 206 mm dia)	25 lb (11.3 kg)

MADE IN USA

Moduloads

FORCED AIR-COOLED

Bird's Moduloads are self-cooling, low reflection, non-radiating terminations for higher power 50 Ohm RF transmission lines and are efficient at dissipating RF over a wide frequency range. The equipment consists of three basic systems: the RF load assembly, the control system, and the heat exchanger system. Usable with CW, AM, FM, SSB, and TV modulation, and certain pulse types.

PRODUCT FEATURES

- Forced-air heat exchanger cooled load for high-power applications up to 900 MHz
- High power RF dissipation with 10, 25 and 50 kW versions are available
- Compact, low-profile design saves space in crowded transmitter sites
- Interlock control circuit provides fail-safe protection of the transmitter
- Available in models to work with 115 or 230 V at 50 or 60 Hz
- Optional Load Protection Switch available as a safeguard against costly damage and downtime

SYSTEM

Coolant Method	Forced air
Load Coolant	Dependent on power rating, 100% water or 35% Ethylene glycol/65% water
Frequency Range/VSWR	**10 kW:** 1 kHz to 1000 MHz at 1.1:1 max **25 kW & 50 kW:** 1 kHz to 900 MHz at 1.1:1 max
Operating Position	Horizontal
Finish	Grey powder coat

ENVIRONMENTAL

Operating Temperature	Dependent on power rating and load coolant. See chart.

CERTIFICATIONS

CE	**EMC:** EN 61326-1:2006 and **Safety:** EN 61010-1:2001

LOAD SELECTION GUIDE

MODEL	INPUT POWER	POWER RATING & OPERATING TEMPERATURE	CONNECTOR	DIMENSIONS	WEIGHT
8631B115	9.5 A @ 115 V, 60 Hz	**10 kW -** **100% Water:** 5 °C to 45 °C **35% Ethylene Glycol/65% Water:** -20 °C to 35 °C	3 1/8 in EIA Flanged	24.6 in x 15.9 in x 17.5 in (623 mm x 402 mm x 443 mm)	113 lb (50.9 kg)
8631B230	4.75 A @ 230 V, 50 Hz		3 1/8 in EIA Flanged	24.6 in x 15.9 in x 17.5 in (623 mm x 402 mm x 443 mm)	113 lb (50.9 kg)
8635B115	9.5 A @ 115 V, 60 Hz		1 5/8 in EIA Flanged	24.6 in x 15.9 in x 17.5 in (623 mm x 402 mm x 443 mm)	113 lb (50.9 kg)
8635B230	4.75 A @ 230 V, 50 Hz		1 5/8 in EIA Flanged	24.6 in x 15.9 in x 17.5 in (623 mm x 402 mm x 443 mm)	113 lb (50.9 kg)
8645B115	11 A @ 115 V, 60 Hz	**25 kW -** **100% Water:** 5 °C to 30 °C **35% Ethylene Glycol / 65% Water:** -20 °C to 25 °C **20 kW -** **100% Water:** 5 °C to 45 °C **35% Ethylene Glycol / 65% Water:** -20 °C to 35 °C	3 1/8 in EIA Flanged	28.5 in x 19.6 in x 20.9 in (723 mm x 497 mm x 528 mm)	155 lb (70 kg)
8645B230	5.5 A @ 230 V, 50 Hz		3 1/8 in EIA Flanged	28.5 in x 19.6 in x 20.9 in (723 mm x 497 mm x 528 mm)	155 lb (70 kg)
8645B230-6	5.5 A @ 230 V, 60 Hz		3 1/8 in EIA Flanged	28.5 in x 19.6 in x 20.9 in (723 mm x 497 mm x 528 mm)	155 lb (70 kg)
8655B115-6	15 A @ 115 V, 60 Hz	**50kW -** **100% Water:** 5 °C to 35 °C **35% Ethylene Glycol / 65% Water:** -20 °C to 25 °C **40kW -** **100% Water:** 5 °C to 45 °C **35% Ethylene Glycol / 65% Water:** -20 °C to 35 °C	3 1/8 in EIA Flanged	53 in x 19.6 in x 20.9 in (1347 mm x 497 mm x 528 mm)	275 lb (125 kg)
8655B230-5	8 A @ 230 V, 50 Hz		3 1/8 in EIA Flanged	53 in x 19.6 in x 20.9 in (1347 mm x 497 mm x 528 mm)	275 lb (125 kg)
8655B230-6	8 A @ 230 V, 60 Hz		3 1/8 in EIA Flanged	53 in x 19.6 in x 20.9 in (1347 mm x 497 mm x 528 mm)	275 lb (125 kg)

LOAD PROTECTION SWITCH GUIDE

MODEL	INPUT POWER	POWER RATING	CONNECTOR	DESCRIPTION
8640A930-1	24VDC (from included universal input power adapter)	60kW at 2MHz 20kW at 60MHz 16kW at 120MHz	3-1/8 in EIA Flanged	Provides an added layer of safety for the water-cooled Moduloads by preventing RF power from reaching it before proper coolant flow has been established, protecting it from damage that can result in costly downtime.

RF Loads

CONDUCTION-COOLED

Dry Conduction-Cooled RF Power Loads are world-renowned for their high-quality, robust construction and conservative power ratings. The use of non-magnetic materials and plating provide safety when used in applications with high magnetic fields such as MRI.

PRODUCT FEATURES

- Ultra-compact, lightweight design
- Economical design
- Fully shielded against production of extraneous radiation
- Load requires no AC power
- Requires a heatsink capable of maintaining a case temperature at or below 100°C

SYSTEM

Coolant Method	Dry, conduction-cooled
Impedance	50 Ohms
AC Power	None
Finish	Tri-alloy
Operating Position	Any

ENVIRONMENTAL

Water Inlet Temperature	-40 °C to 40 °C (-40 °F to 104 °F)

LOAD CONFIGURATION GUIDE

POWER RATING	PRODUCT TYPE	CONNECTOR GENDER	CONNECTORS*
See selection guide	**T, WT** = Convection-cooled **CT** = Conduction-cooled **ST** = Square convection-cooled	**F** = Female **M** = Male	**A** = SMA **N** = N

*Call for custom connector options not shown in this catalog

Example: 25-CT-FA= Model 25-CT, 25 W, conduction-cooled load with female SMA connectors.
Note: Not all combinations are valid. If assistance is needed consult the factory to define the model that is right for you.

LOAD SELECTION GUIDE

MODEL	POWER RATING	CONNECTORS	FREQUENCY RANGE & VSWR	DIMENSIONS	WEIGHT
100-CT	100 W	SMA	DC to 2 GHz @ 1.15:1 max 2 to 3 GHz @ 1.25:1 max	1.4 in x 1.4 in x 0.6 in (36 x 36 x 16 mm)	1.0 oz (30 g)
150-CT	150 W	N	DC to 2 GHz @ 1.15:1 max 2 to 3 GHz @ 1.25:1 max	1.9 in x 1.2 in x 1.1 in (49 x 31 x 28 mm)	2.2 oz (63 g)
250-CT	250 W	N	DC to 1 GHz @ 1.10:1 max 1 to 2.4 GHz @ 1.25:1 max	2.5 in x 2.2 in x 1.1 in (64 x 56 x 28 mm)	5.2 oz (148 g)
300-CT	300 W	N	DC to 1 GHz @ 1.10:1 max 1 to 3 GHz @ 1.25:1 max	4.8 in x 2.0 in x 1.2 in (122 x 51 x 31 mm)	12 oz (340 g)
500-CT	500 W	N	DC to 1 GHz @ 1.15:1 max 1 to 3 GHz @ 1.30:1 max	2.7 in x 2.0 in x 1.2 in (69 x 51 x 31 mm)	8.2 oz (233 g)

ACCESSORIES

Precision RF Components and Accessories to Modify and Enhance Bird Products

VARIABLE RF SIGNAL SAMPLERS

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LOAD & COOLING ACCESSORIES

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Variable RF Signal Samplers

4273 & 4275 SERIES

Models 4273 and 4275 are wide range adjustable Thruline® RF Couplers for signal observation on an oscilloscope, spectrum analyzer, or frequency counter. The output signal produced at the BNC output connector is an attenuated, unrectified signal. Both couplers have locking devices on their attenuation control.

PRODUCT FEATURES

- Very low insertion VSWR across the operating frequency range with an insertion loss less than 0.2 dB
- Available with a wide variety of Quick Change (QC) connectors
- Passive device requiring no external source of power or utility service
- Includes locking devices on the attenuation control knob

SYSTEM

Impedance	50 Ohms nominal
Finish	Bright silver plate

ENVIRONMENTAL

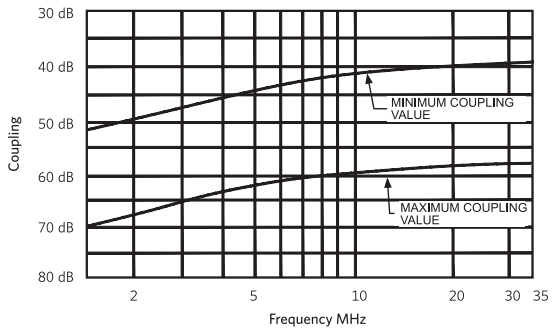
Ambient Temperature	-40 °C to 45 °C (-40 °F to 113 °F)

PHYSICAL

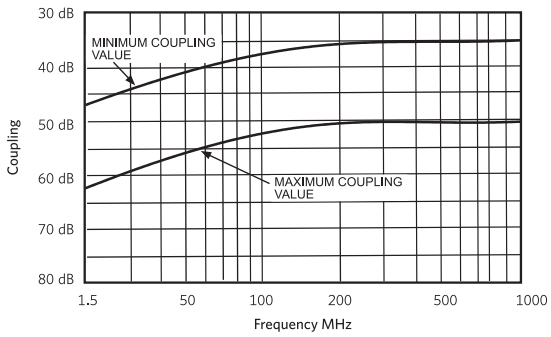
Size	2.8 in x 2.875 in x 1.25 in (71 mm x 73 mm x 32 mm)
Weight	10 oz (280 g)

	4273	4273-020	4275	4275-020	4275-025
Power Rating	5 kW max	5 kW max	1 kW max	1 kW max	1 kW max
Frequency Range	1.5 to 35 MHz	1.5 to 35 MHz	20 to 1000 MHz	20 to 1000 MHz	20 to 1000 MHz
Insertion Loss with N Connectors	1.07 max	1.07 max	1.1 max 2 to 512 MHz 1.25 max 512 to 1000 MHz	1.1 max 2 to 512 MHz 1.25 max 512 to 1000 MHz	1.1 max 2 to 512 MHz 1.25 max 512 to 1000 MHz
Coupling	Adjustable as shown in chart within ±3 d		N/A	N/A	N/A
Connectors	Not included, choose 2 Bird QC Type	QC Type (N) Male/Female	Not included, choose 2 Bird QC Type	QC Type (N) Male/Female	QC Type (N) Female/Female

4273 SERIES



4275 SERIES



PRODUCT FEATURES

- Designed for use in switching antenna, transmitters, receivers, and other gear using 50 Ohm coaxial impedance.
- Multiple models available with options for the required number of positions and circuits
- Prevents accidental operation
- May be panel-mounted
- Rugged design for field use

Coaxial Selector Switches

COAXWITCH SERIES

Bird's® 50 Ohm Coaxial Selector Switches employ a unique, rugged and reliable design which permits positive contact, low insertion VSWR and negligible cross talk between channels. The switching mechanism is 4 1/2 in of RG-87/U Teflon cable which is pulled away from the mating Male N connectors and rotated to the desired switch position. The design is focused on precision and requires intentional sequential movement making accidental operation impossible.

SELECTION GUIDE

MODEL	POSITIONS	COAXIAL CIRCUITS
7422	2	1
7441	3	1
7431	4	1
718	8	1
7181	10	1
72R	Reversing	2

MEASUREMENT

Frequency Range	DC to 10 GHz
VSWR	100 MHz: Negligible 1 GHz: 1.06 max 4 GHz: 1.30 max
Insertion Loss	100 MHz: 0.02 dB 1 GHz: 0.09 dB 4 GHz: 0.22 dB
RF Power	Max Rating @ 65°C 100 MHz: 850 W 1 GHz: 200 W 4 GHz: 75 W

SYSTEM

RF Voltage	500 V max
Attenuation	For unused channel - 75 dB (cross talk)

CONNECTORS

Connector	F(N)

ENVIRONMENTAL

Operating Temperature	-60 °C to 65 °C (-76 °F to 149 °F)

PHYSICAL

Weight	2.5 lb (1.1 kg)

Quick-Change Solderless RF Connectors QC SERIES

Many Termaline® load resistors, attenuators and absorption wattmeters, as well as Thruline® wattmeters, employ our patented QC-type "Quick-Change Solderless" RF Connectors. These products may be ordered with the connector (s) most convenient for use with your equipment. Many customers order additional connectors to avoid using performance robbing adapters. QC Solderless Connectors are easily changed in the field by removing and replacing four screws.

Because of the wide variety of connectors and possible applications, electrical specifications for QC-equipped products are quoted with the standard connectors normally supplied with the equipment.

7/8 in EIA Swivel Flanged
4240-002

LT(m)
4240-012

LT(f)
4240-018

LC(m)
4240-025

LC(f)
4240-031

UHF(f) S0239
4240-050

N(f)
4240-062

N(m)
4240-063

Open Term.
#10-32 Nut
4240-080

SC(f)
4240-090

1 5/8 in EIA
Fixed Flange(m)
4240-096

C(f)
4240-100

BNC(f)
4240-125

BNC(m)
4240-132

TNC(f)
4240-156

TNC(m)
4240-160

UHF(m) PL259
4240-179

1 5/8 in EIA
Swivel(m)
4240-208

HN(f)
4240-268

HN(m)
4240-278

SMA(m)
4240-334

SMA(f)
4240-336

7/16 DIN(f),
IEC 169-4
4240-344

Mini UHF(f)
4240-346

7/16 DIN(m),
IEC 169-4
4240-363

SQS(m)
4240-370

SQS(f)
4240-371

SQS(m) Polarized
4240-372

QDS-UL(f)
4240-373

QDS-UL(m)
4240-374

SQS(f) Polarized
4240-375

QRM(f)
4240-376

GQMJ(f)
4240-376-10

GQL(f)
4240-376-20

QRM(m)
4240-377

QRM(f)
Polarized
4240-377-2

QRM(m)
Polarized
4240-378

Adapters, Connectors & Couplers

Bird® manufactures a variety of Adapter Accessories for your application needs.

INTERSERIES RF ADAPTERS

N(m)
4240-402

N(f)
4240-403

BNC(m)
4240-404

BNC(f)
4240-405

TNC(m)
4240-406

TNC(f)
4240-407

UHF(m)
4240-408

UHF(f)
4240-409

SMA(m)
4240-410

SMA(f)
4240-411

QC SERIES, RF ADAPTERS

QC(f) to QC(f)
4240-165

3 1/8 in Flanged
to QC(f)
4240-194

1 5/8 in Flanged
to QC(f)
4240-260

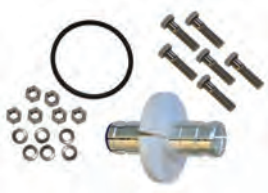
FLANGE-TO-FLANGE RF ADAPTERS

3 1/8 in Flanged to 1 5/8 in EIA
Flanged 50 Ohm
4600-025

1 5/8 in Flanged to 7/8 in EIA
Flanged 50 Ohm
4712-015

RF COUPLING KITS

7/8 in Flanged
4240-220



3 1/8 in Flanged
4600-020

RF Connector/Adapter Kit

MODEL 4240-400

Assemble compact, precision 50 Ohm adapters to meet up to 45 different matching requirements. The adapters offer low VSWR because of precision matching and tight mating tolerances. The kit lets you create 30 combinations and includes enough couplers to assemble 5 complete adapters at the same time.

KIT INCLUDES

(2) N(m)
4240-402

(2) N(f)
4240-403

(1) BNC(m)
4240-404

(1) BNC(f)
4240-405

(1) TNC(m)
4240-406

(1) TNC(f)
4240-407

(1) UHF(m)
4240-408

(1) UHF(f)
4240-409

(5) 50 Ohm Couplers
4240-413

RF Interseries Adapter Kit with SMA

MODEL 4240-401

The 4240-401 RF Adapter Kit lets you assemble compact, precision 50 Ohm adapters to meet up to 45 different matching requirements. The adapters offer low VSWR because of precision matching and tight mating tolerances. Adapters and couplers are perfectly fitted in a hard carrying case.

KIT INCLUDES

(1) N(m)
4240-402

(1) N(f)
4240-403

(1) BNC(m)
4240-404

(1) BNC(f)
4240-405

(1) TNC(m)
4240-406

(1) TNC(f)
4240-407

(1) UHF(m)
4240-408

(1) UHF(f)
4240-409

(1) SMA(m)
4240-410

(1) SMA(f)
4240-411

(5) 50 Ohm Couplers
4240-413

Aviation RF Connector/Adapter Kit

MODEL 4240-401AV

The 4240-401AV RF Adapter Kit is designed specifically for the aviation industry and allows you to assemble compact, precision 50 Ohm adapters to meet up to 45 different matching requirements. The adapters offer low VSWR because of precision matching and tight mating tolerances. Adapters and couplers are perfectly fitted in a hard carrying case.

KIT INCLUDES

(1) N(m) **4240-402**
(1) N(f) **4240-403**
(1) BNC(m) **4240-404**
(1) BNC(f) **4240-405**
(1) TNC(m) **4240-406**
(1) TNC(f) **4240-407**

(1) SMA(m) **4240-410**
(1) SMA(f) **4240-411**
(5) 50 Ohm Couplers **4240-413**
(1) C(f) **4240-418**
(1) C(m) **4240-419**

7/16 DIN Precision RF Adapter Kit

MODEL 4240-550

The 4240-550 RF Adapter Kit is a general purpose kit for any 7/16 DIN adapter application Recommended use with Cable & Antenna Analyzers and features low passive intermodulation and low VSWR. Adapters are perfectly fitted in a hard carrying case.

KIT INCLUDES

(1) N(m) to 7/16 DIN(m) **PA-MNME**
(1) N(m) to 7/16 DIN(f) **PA-FNFE**
(1) N(f) to 7/16 DIN(m) **PA-FNME**

(1) N(f) to 7/16 DIN(f) **PA-MNFE**
(1) 7/16 DIN(f) to Right Angle 7/16 DIN(m) **PA-FEME-R**
(1) 7/16 DIN(f) to 7/16 DIN(f) **PA-FEFE**

4.3/10, Interseries RF Adapter Kit

MODEL 4240-560

Assemble compact, precision 50 Ohm adapters to meet up to 45 different matching requirements. The adapters offer low VSWR because of precision matching and tight mating tolerances.

KIT INCLUDES

(1) 4.3-10(f) to 4.3-10(f)
PA-F4.3F4.3

(1) 4.3-10(f) to 4.3-10(m) RA
PA-F4.3M4.3-R

(1) N(m) to 4.3-10(f)
PA-MNF4.3

(1) N(f) to 4.3-10(m)
PA-FNM4.3

(1) N(f) to 4.3-10(f)
PA-FNF4.3

(1) N(m) to 4.3-10(m)
PA-MNM4.3

Equipment Cases

Protect and easily transport your equipment with this sturdy carrying cases from Bird®. Most carrying cases include shock-absorbing laminated die-cut foam inserts, durable polyurethane shell, folding handle and quick release latches to keep everything secure.

RF Wattmeter Hard Carrying Case, 5 Elements and 1 Small RF Load
CC-6

Plug-In Element Hard Carrying Case, 12 Elements
EC-1

RF Wattmeter Hard Carrying Case, RF Load, Signal Sampler, QC Connectors and 4 Elements
4300-061

4391A RF Power Analyst Hard Carrying Case, RF Signal Sampler and Accessories
4300A085

4410A RF Wattmeter Hard Carrying Case, RF Load, 4 Elements and Accessories
4300A055

4421A RF Wattmeter Hard Carrying Case, 4 RF Power Sensors and Accessories
4300B215

Equipment Cases

4480A RF Wattmeter Hard Carrying Case **4480A046**

RF Digital Power Meter and Antenna Tester Hard Carrying Case **5000-035**

FlightHawk™ Hard Carrying Case **FH-AV-CC**

RF Coaxial Cables DC SERIES

Bird® provides a wide selection of cable assemblies to suit any RF application. For use with Bird's Wattmeters and Watcher Series Monitors.

14 in DC to BNC(m)
3170-058-1

6 ft DC to BNC(m)
3170-058-6

25 ft DC to BNC(m)
3170-058-3

50 ft DC to BNC(m)
3170-058-5

12 in DC to Snap Spade
4220-097-1

10 ft DC to Snap Spade
4220-097-7

25 ft DC to Snap Spade
4220-097-10

48" DC to Snap Spade
4220-097-22

Load & Cooling Accessories

Bird® manufactures a variety of RF Termination Accessories for your Bird Products.

THERMOSWITCHES FOR AIR-COOLED LOADS

PART#	FUNCTION	TEMP. SET POINT	USE WITH
8890-008	Over Temp. Interlock	Opens at 236 °C	8890 and 8920 Series
8890-017	Over Temp. Interlock	Opens at 226 °C	8930 Series
8329-028	Over Temp. Interlock	Opens at 200 °C	8929 Series

WATER-COOLED LOAD ACCESSORIES

PART#	DESCRIPTION	USE WITH
RPK6770A120	RF Termination Wall Mount Bracket	8730A Econoload Series (10 kW)

LIQUID COOLANTS*

PART#	DESCRIPTION	VOLUME/PKG.
5-030-2	Refined Mineral Oil	1/2 Gallon (1.89L)
5-030-3	Refined Mineral Oil	1 Gallon (3.79 L)
5-030-4	Refined Mineral Oil	5 Gallons (18.93L)
5-1070-2	PMX-200, Silicone Oil	1 Gallon (3.79 L)
5-1070-3	PMX-200, Silicone Oil	5 Gallon (18.93 L)
5-1134-3	Ethylene Glycol, Industrial Grade	1 Gallon (3.79 L)

*Includes SDS sheet with shipment

REPLACEMENT RESISTORS

PART#	USE WITH
RPK8738A072	8730A/8738A Econoload Series (10 kW)
RPK8755-027-2	8745/8746 Econoload Series (20 kW)
RPK8755-027-3	8755/8756 Econoload Series (30 kW)
RPK8755-027-4	8765/8766 Econoload Series (40 kW)
RPK8755-027-5	8775/8776 Econoload Series (50 kW)
RPK8792-010-1	8792 Econoload Series (80 kW)
RPK5A2388	8578A100 Forced-Air Load (10 kW)

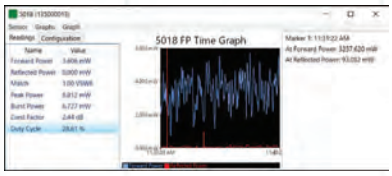
DOLLIES

PART#	DESCRIPTION
6771-011	For 10 and 25 kW Moduload
6772B011	For 50 kW Moduload
6773-011	For 892X, 893X Oil Loads

SOFTWARE

Enhance the Management and Performance of Bird RF Sensor and Monitor Products

Bird has developed intuitive and flexible software applications that provide set up and monitoring of a wide range of Bird RF sensor and monitor products.



RF METER

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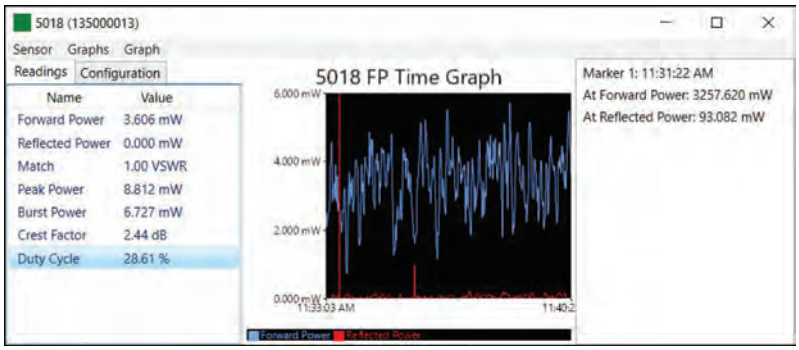

RF Meter

FOR BIRD USB FIELD POWER SENSORS

Ideally suited for field techs and engineers who need to make power measurements anywhere they go. RF Meter is available for both Windows computers and Android mobile devices. Connection to compatible RF power sensors is automatic once connected via a USB cable. 3141 CPM and networked sensors are also compatible. The app also includes the ability to enable smoothing level for more stable readings or max hold to detect the maximum measured power.

PRODUCT FEATURES

- Automatically detects sensor and opens the application
- Identifies multiple sensors and saves session information
- Displays only the information appropriate to sensor indicated
- Digital Display function, bar and time graphing and logging capabilities
- Share results directly to messaging, email or WiFi printer.
- Plug and Play in Seconds
- Displayable Parameters (sensor dependent): True Average Power (Forward and Reflected), VSWR, Return Loss, rho, Match Efficiency, Peak Power, Peak to Average Ratio, Crest Factor, PEP, CDF, CCDF, Confidence %, Burst and Burst Average Power, IEEE 194 Pulse Parameters, Sensor temperature.

COMPATIBLE DEVICES

- Power Sensors: 5012D, 5014, 5016D, 5017D, 5017D-AV, 5018D, 5019D, 7020 Series, 7022 Series
- Power Monitors: 4042, 4043, 4044, 3141 Channel Power Monitor

ANDROID SYSTEM REQUIREMENTS

- Android version 4.0.3 or higher
- Hardware must support On-The-Go (OTG) host functionality
- Available through Google Play Store

WINDOWS SYSTEM REQUIREMENTS

- Windows 10
- Adobe Reader
- 1280 x 720, 16 bit or higher resolution recommended
- 100 MB free disk space
- 1 available USB port
- Mouse or pointing device

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Since 1942, Bird has been developing and manufacturing cutting-edge, high power RF sensors, test equipment, and RF coverage products that engineers, field techs, and manufacturers worldwide, rely on for accuracy, precision, and dependability. Bird continues to innovate precision and performance products for public safety, cellular, semiconductor, military, aviation, broadcast, and medical markets.

The past 80 years have brought many changes. However, Bird remains as committed today as we were in 1942 to a continuous improvement culture, innovative products that please our customers, and a dedication to advancing RF for tomorrow's applications.

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