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# Quality Instruments for RF Power Measurement





Dear Reader,

Bird Electronic Corporation is a pioneer in the engineering, manufacturing and marketing of a broad spectrum of RF coaxial test equipment and custom design components. We sincerely appreciate the loyalty and support our customers have given us over the past 40+ years. Through their acceptance of our efforts Bird products have become the standards of the industry.

This new (60) page catalog presents our comprehensive line of RF power measuring equipment as well as RF loads, attenuators, switches and directional couplers. Also included are connectors, adapters, meters and accessories. We trust that it will serve you as a helpful tool in selecting Bird products to meet your functional needs.

All of us at Bird have an on-going commitment to innovation in new product developments. We are constantly looking for new ways to do new jobs and better ways to do old jobs. Our dedication to the highest levels of quality and reliability coupled with customer oriented service make our products the best value in the marketplace.

You—our customer—are our most important asset. We give you our pledge to fulfill the trust you place in us through your continuing support.

*John J. Conway*  
John J. Conway, President

*Bruce Bird*

Bruce Bird, Executive Vice President

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*For your convenience, we have added Rack Unit (RU) sizes for panel mounted instruments. One RU equals 1 3/4".*

**MINIMUM BILLING**  
The minimum billing per order is \$25.00

## Limited Warranty

**BIRD ELECTRONIC CORPORATION**  
30303 Aurora Road, Solon, Ohio

We are proud of the high quality of our product and we warrant it to the original purchaser that each new instrument of our manufacture will for a period of one year after original shipment be free from defects in material and workmanship under normal and proper operating conditions and that properly used during such period it will perform in accordance with our applicable specifications.

Our obligation and the purchaser's exclusive remedy for any defect or failure to meet specifications shall be limited, at our option, to repair or replacement or, if we determine said defect or failure to be so defective as to preclude remedying by repair or replacement, the

purchaser's sole and exclusive remedy shall be limited to refund of the purchase price. We shall have no obligation if defects result from improper use, operation above rated capacities, repairs not made by us, or misapplication of the equipment. Our warranty does not extend to the failure of semiconductor devices and batteries, or to equipment and parts made by others except to the extent of the original manufacturer's warranty to us. No other warranty is expressed or implied. Bird Electronic Corporation is not liable for consequential damages.

Warranty returns must first be authorized by the factory office and are to be shipped prepaid.

## General Terms, Conditions of Sale

### TELEPHONE, TELEGRAPH AND CABLE ORDERS

Factory telephone: (216) 248-1200  
Telex: 706898  
Cable address: BIRDELEC  
D-U-N-S Number: 00-418-9957

Western Sales Office (California)  
Telephone: (805) 646-7255

### ADDRESS

All communications except when otherwise advised should be sent to the Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon), Ohio 44139, or to the appropriate regional sales office.

### ORDER BY NUMBER

Please order by model number or part number. Whenever possible, include name of the item, ranges or other significant specifications. Be sure to include in your order any accessories or special calibration required.

When modifications are desired to adapt an instrument for your special requirements, contact our Sales Department.

### SHIPPING INSTRUCTIONS

Unless specific instructions accompany the order, we shall use our judgement and select the best method for your shipment. If requested, repair parts or other items needed quickly will be shipped by air.

Export shipments via air-freight save time and in many cases are less expensive than surface modes.

### MINIMUM BILLING

The minimum billing per order is \$25.00

### CONDITIONS OF SALE

Determination of price, terms and conditions of sale and final acceptance of orders are made only at our factory in Cleveland (Solon), Ohio. Change orders subject to \$20 administrative charge.

### PRICE CHANGES

All prices are subject to change without notice. Formal price quotations remain valid for 60 days.

### TAXES

Applicable Federal, State or Local taxes that are in effect at the time of shipment will be added unless Certificate of Exemption is furnished by the purchaser.

### SPECIFICATIONS

We reserve the right to discontinue any item without notice and to change physical and electrical specifications at any time without incurring any obligation to incorporate new features in instruments or parts previously sold. For instruments offered with the "QC" Connector feature, maximum VSWR values listed in the specifications are obtained with the connector type shown as "normally supplied."

Listed power ratings for aircooled terminations are valid to 5000 ft. For operation at higher elevations, please contact us for applicable derating factor.

### SPECIAL DATA

Individual special performance data can be provided for most Bird products at a minimum charge of \$40 per unit.

### TERMS

All prices are F.O.B. Cleveland (Solon), Ohio. Terms net 30 days for established accounts.

Export Terms: Please request Overseas Representatives listing.

### QUANTITY DISCOUNTS

Available on most equipment when 25 pieces or more of the same model are ordered. Please inquire.

### CUSTOMER SERVICE

Bird maintains a complete repair and recalibration department at Solon. This department is set up to provide the best possible service of Bird equipment. Repairs will proceed as soon as the instrument is received with your authorization. Repair charges are kept at a minimum. If you require a firm quotation before repairs proceed, please advise and a quotation will be sent promptly. All instruments returned for repair-recalibration must be shipped prepaid and to the attention of the Customer Service Group.

Each instrument repaired is thoroughly checked and recalibrated to original specifications. The material used and work performed are warranted for 90 days with the exception of semi-conductor devices and batteries.

### DISTRIBUTORS

Bird equipment is stocked throughout the United States and overseas. Inquire at Solon or the West Coast Sales Office for distributor located closest to you.

# THRULINE® And RF POWER ANALYST® Wattmeters

In all realistic communications operations, RF Power flows in both directions in a transmission line, in forward and reflected waves whose interference produces standing waves. Only an "in-line" wattmeter with high directivity and accuracy can deliver the measurements needed for professional system performance. The THRULINE Wattmeter has proven to be such a reliable instrument, that it has been supplied to the Federal Aviation Administration (FAA) for applications critical to passenger safety, and it has been nomenclatured since 1969.

For design, operation and measurement of communications systems from a few milliwatts to hundreds of kilowatts, there is no equal to the array of THRULINE® instruments, which have become the Standard of our Industry since the '50s. We have made wattmeters for coaxial transmissions of voice, television, data, aeronautical and space guidance, medical RF applications, chip sputtering—in short any type of intelligence encoded on a carrier from 80 kilohertz to 4000 megahertz. The basic demands concerning communications power instruments have not changed since the first coax line: Since the communication often concerns emergencies (police, fire), life-dependent navigation (flight patterns, space guidance) or expensive instruments in huge audiences (broadcasting), the test equipment must be several times more reliable than the transmitters, must always be ready and must have earned your trust.

THRULINE instruments can be left in the line for continuous monitoring of either the transmitter power output or the amount reflected by the antenna. These two quantities are actually the most important transmission parameters: Tuning for **minimum reflected power** results in a good match of the load (antenna) to the line, and adjusting the transmitter for **maximum forward power** into a matched antenna approaches ideal design goals. These optimum system adjustments result in a low Voltage Standing Wave Ratio. If actual VSWR data are required, they are easily obtained from the intersection of the forward and reflected power levels on nomographs furnished (analog wattmeters) or read directly and monitored continuously (digital RF Power Analyst® wattmeters).

The frequency range and power level of most THRU-LINE® wattmeters is determined by a low cost Plug-in Element. Here are some general recommendations regarding Element selection: Since most transmission facilities are assigned a frequency and power level, one or two Elements is all that's needed. Broadcasters may want to order two identical Elements at the same time and keep one in a safe place after recording the meter readings obtained by each. If ever a question arises about recalibration (e.g. in case an Element has been dropped on a cement floor), a quick comparison with the original twin could save time, effort and

inconvenience of shipping the whole wattmeter back for a checkup. For better resolution of low reflected power levels, we recommend a second Element 1/10 the power of the forward Element. Digital RF Power Analyst® THRULINE® Wattmeters require two such Elements for VSWR and Return Loss function, while Series 4410 Wattmeters don't need a more sensitive Element since each already has 7 power levels.

Just like various razor blades that fit the same razor, not all elements that fit into the same size socket hole perform the same way. Bird Plug-in Elements are backed not only by decades of experience, assiduous and persevering circuit, material and manufacturing process improvements, but their accuracy is based on a singular set of standards and **proprietary test procedures** that result in product uniformity and field interchangeability.





## Model 43

### 0.45-2300MHz

### 0.1-10000 watts

Bird engineers designed the Model 43 for a long, trouble-free life more than 3 decades ago, and while we don't promise that every "43" purchased today will perform like new in 2016, we know that units purchased when the THRULINE® Wattmeter was first introduced are still in service today.

The key to its longevity and component interchangeability between an early or a current instrument is its modular construction of rugged, cast materials: The familiar round-cornered, diecast aluminum housing protects a recessed, shock-mounted 30 microampere meter as well as the nucleus of the power-sensing system—a silver-plated brass heavy cast line section, precision-machined to the exact same dimensions as the first one three decades ago. The heart of the system, the Plug-in Elements which determine frequency-range and power-level of the wattmeter readings, fit tightly into the precision bore and are pressed down motionless against the depth-controlling platform.

We maintain sets of highly accurate Metrology and Production Test Standards along with a history of mean deviation values, applied meticulously in exacting test procedures insuring the accuracy and integrity of original equipment and replacement components.

In case of damage—e.g. an accidental drop from an antenna tower—any of these modular components can be replaced and your Bird restored to like-new condition easily. Listed accuracies can, of course, not be guaranteed with components not supplied by Bird.

We are constantly adding special features geared to your needs in specific RF power measurement situations. Two recent examples are new very low, double-digit milliwatt level Plug-in Elements of Cellular Radio Telephone frequencies and the addition of a new Mini-UHF Quick-Change Connector to the twenty-eight choices already available.

Plug-in Elements ranging from 100 milliwatts to 10,000 watts in frequency bands from 450 kilohertz to 2300 megahertz are tabulated on page 5. More than two dozen different QC Quick-Change RF Connectors are illustrated on page 35. Accessories like the variable RF Signal Sampler (page 12), Directional Coupler Elements (page 32), a non-

#### Specifications model 43

**Power Range** 100mW to 10kW using Bird Plug-in Elements. Accuracy not guaranteed with components not supplied by Bird.

**Frequency Range** 0.45 to 2300MHz  
**Insertion VSWR** with N Connectors 1.05 max. to 1000MHz, 1.1 max. to 2300 MHz

**Accuracy** ±5% of full scale.

**Connectors** QC Type (Female N normally supplied)

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 6<sup>7</sup>/<sub>8</sub>" x 5<sup>1</sup>/<sub>8</sub>" x 3<sup>5</sup>/<sub>8</sub>" (175 x 130 x 92mm)

**Weight** 3 lbs. (1.4kg)

**Optional Carrying Case** CC-1: Wattmeter & 9 Elements; CC-3: Wattmeter & 8080 or 8362 (25W Load) & 6 Elements; EC-1: 12 Elements

Standard Element

RF Sampler Element



*Coupler Elements: For RF signal observation on a scope, for spectrum analysis or for frequency counting and control, use Model 4274-025 wide range RF Sampler Element. This non-directional coupler delivers an unrectified signal at about -50dB ±2dB from 25-1000MHz tapering down to -66dB at 2MHz. Main line power should not exceed 500W.*

directional Sampler Element (page 4) and a new Relative Field Strength Element (page 12) further enhance the usefulness of this extraordinary instrument. Carrying Cases to protect your investment (CC-1 & CC-3 for the Wattmeter, EC-1 for extra Elements) are shown on page 36, and a two-way mobile Test Set on page 27 contains a Wattmeter, load, Variable Signal Sampler and spare Elements. Whether you are a new user or an RF "pro" who goes back with Bird to the time the model 43 was launched, you'll find this THRU-LINE® Wattmeter user-friendly and simple to keep it that way. Its four components include:

**Line Section:** A very precise 50 ohm coaxial air line is designed for insertion into the transmission line between transmitter and antenna or load. The line section is equipped with a socket into which the Plug-In element with the desired power and frequency range is inserted. It is also equipped with QC Connectors described below:

**QC Type Connectors:** The Bird model 43 is normally supplied with Two Female N Connectors. However, at the time of ordering, other types of connectors may be specified including: Male or Female BNC, TNC, UHF, C, SC, LC, N, SMA, HN, LT, General Radio Type 874, 7/8" EIA Flanged and Mini-UHF. All of these QC Connectors are interchangeable in the field without affecting the instrument's calibration.

**Indicating Meter:** A shock-mounted 30 microampere meter with 3 expanded scales of 25, 50, 100 unit calibration to permit full scale direct power reading from 100 milliwatts to 10,000 watts.

**Plug-in Elements:** These elements read both forward or reflected power as indicated by the direction in which the arrow is pointing. Frequency range and full scale power are marked on each element. Use a lower power element (e.g. 10:1) for increased resolution of reflected power readings.

**Remote Installation:** When it is more convenient, the RF line section can be easily removed from the model 43 case and inserted at any desired point in the line. The meter may then be located at another point for optimum visibility. 32" of meter cable is supplied in the instrument housing for this purpose. Additional lengths available as required.



CC-3 Carrying Case with 8080 Load and Model 43 customized for cellular service

**Plug-In Elements:** When ordering, specify catalog number and THRU-LINE model number.

**Table 1**  
Standard Elements (Catalog Numbers)

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

**Table 2**  
Low-Power Elements

1 watt	Cat. No.	2.5 watts	Cat. No.
30-35 MHz	030-1	30-40 MHz	030-2
35-40 MHz	035-1	40-50 MHz	040-2
40-50 MHz	040-1	50-60 MHz	050-2
50-60 MHz	050-1	60-80 MHz	060-2
60-80 MHz	060-1	80-95 MHz	080-2
80-95 MHz	080-1	95-150 MHz	095-2
95-125 MHz	095-1	150-250 MHz	150-2
110-160 MHz	110-1	200-300 MHz	200-2
150-250 MHz	150-1	250-450 MHz	250-2
200-300 MHz	200-1	400-850 MHz	400-2
275-450 MHz	275-1	800-950 MHz	800-2
425-850 MHz	425-1		
800-950 MHz	800-1		

**Table 3**  
High-Frequency Elements (Catalog Numbers)

Power Range	Frequency Bands (MHz)			
	950-1260	1100-1800	1700-2200	2200-2300
1 watt	1J	1K	1L	1M
2.5 watts	2.5J	2.5K	2.5L	2.5M
5 watts	5J	5K	5L	5M
10 watts	10J	10K	10L	10M
25 watts	25J	25K	25L	25M
50 watts	50J			
100 watts	100J			
250 watts	250J			

Accuracy ±8% o.f.s.

**Table 4**  
Low-Frequency Elements (Catalog Numbers)

Power Range	Frequency Band .45 to 2.5 MHz
1000 watts	1000P
2500 watts	2500P
5000 watts	5000P
10000 watts	10000P

**Table 6**  
Milliwatt Elements

100 mW	Cat. No.	250 mW	Cat. No.	500 mW	Cat. No.
72-76 MHz	430-2	70 MHz	430-34	72-76 MHz	430-33
105-120 MHz	430-6	72-76 MHz	430-22	105-120 MHz	430-26
125-136 MHz	430-9	108-118 MHz	430-24	240-290 MHz	430-27
160-175 MHz	430-10	130-150 MHz	430-13	328-336 MHz	430-28
328-336 MHz	430-3	150-180 MHz	430-15	455-470 MHz	430-30
400-420 MHz	430-7	328-336 MHz	430-16	800-900 MHz	430-109
450-470 MHz	430-8	800-900 MHz	430-108		
800-900 MHz	430-107	1700-1750 MHz	430-17		

Additional Accessory Elements on pages 12, 32, 36.

## Multi Range Wattmeter model 4304

- 1 Watt to 500 Watts
- Broad Band Frequency Range: 25 to 1000MHz
- Four Built-In Power Ranges, RF Sampling Port for Frequency checks, etc.
- Low VSWR, Low Insertion Loss
- Rugged Shock-Resistant Design
- Engineered To Handle Rough In-The-Field Conditions
- Field-Changeable SQC (Small-Quick-Change) Connectors

Model 4304 features operational simplicity. The desired RF power range is selected with the right hand switch. Power is read directly and has a dependable accuracy of  $\pm 6\%$  from 100 to 512MHz and  $\pm 7\%$  from 512 to 1000MHz. In the low frequency range of 25 to 100MHz, a correction factor chart, provided on the back panel, keeps measurement tolerance below  $\pm 7\%$ . The entire length of the measurement scale is usable. With the model 4304, there are no off-limits at the scale bottom as is common in ordinary broad band wattmeters.

Unless otherwise specified, the model 4304 meter comes equipped with two female UHF type SQC connectors (SO-239). Bird SQC connectors are also available in female N (Catalog No. 4100-014).

Insertion loss with this new meter design is less than 1/10dB to 1000MHz. We call your attention to this low figure because Bird model 4304 is the wide-band meter that delivers it. And it does so consistently!



### Specifications model 4304

**Power Range** 15, 50, 150 and 500W

**Frequency Range** 25 to 1000MHz

**Insertion VSWR** with N Connectors 1.05 max. 25 to 512MHz

1.10 max. 512 to 850MHz

1.15 max. 850 to 1000MHz

(1.2 max. 800 to 1000MHz with UHF connectors)

**Accuracy**  $\pm 7\%$  of full scale (with correction factor) 25 to 100 MHz

$\pm 6\%$  of full scale 100 to 512MHz

$\pm 7\%$  of full scale 512 to 1000MHz

**RF Sample Output** Fixed at  $-43\text{dB} \pm 5\text{dB}$  from BNC (Female) port

**Connectors** SQC type (Female UHF normally supplied)

**Finish** Medium blue baked enamel

**Nominal Size**  $6\frac{7}{8}'' \times 5\frac{7}{16}'' \times 3\frac{1}{16}''$  (175 x 138 x 94mm)

**Weight** 2 $\frac{1}{4}$  lbs. (1kg)

**Optional Carrying Case** CC-1: Wattmeter; CC-3: Wattmeter & 8080 or 8362 (25W Load)

## Directional Wattmeter model 4370

**Broad-Band 25 to 520MHz, Wide Range .02 to 500 Watts:** The model 4370 THRULINE Directional Wattmeter is a portable bench-type insertion instrument for measuring forward or reflected CW power. Its wide range and broad band coverage is accomplished conveniently by switches next to the readout: Two frequency bands, a choice of forward or reflected display, and eight power ranges.

In operation, a precision machined 50-ohm reference line-section is inserted between the signal source and the antenna, load or other component under power test. Scales are calibrated in watts as well as dB. The readout unit and the line-section may be separated by as much as 3 feet for operational convenience.



### Specifications

**Thruline Directional Wattmeter  
model 4370**

**Power Ranges** FWD 10, 25, 100, 500W; RFL 1, 2.5, 10, 50W

**Frequency Ranges** 25-175MHz; 175-520MHz

**Insertion VSWR** with N conn. 1.1 max.

**Accuracy**  $\pm 5\%$  of full scale

**Connectors** QC type (Female N normally supplied)

**Finish** Dark blue enamel and brushed aluminum

**Nominal Size**  $11'' \times 9\frac{19}{32}'' \times 5\frac{7}{32}''$  (277 x 244 x 133mm)

**Weight** 7 $\frac{1}{4}$  lbs. (3.3kg)

# THRULINE® RF Directional Wattmeters with Superior Sensitivity, 7-Level Plug-Ins, $\pm 5\%$ of Reading Accuracy

- Model 4410A**—battery-powered portable  
**Model 4411**—115/230VAC 50/60 Hz or battery portable  
**Model 4410P**—115/230VAC 50/60 Hz or battery 19" rack-mount  
**Model 4412**—115/230VAC 50/60 Hz or rechargeable NiCd battery operation

You are probably familiar with our industry-standard model 43. The new series 4410 portables look a lot like the 43 and share its ruggedness and simplicity of use, but after that the similarities end. Inside the 4410 is an amplifier employing an inherently self-balancing measurement technique. A patented bridge circuit—with its four legs divided between the base and each of the proprietary Plug-in Elements—permits reading accuracies without equal in a directional wattmeter with a 5000-to-one dynamic element range, and unaffected by temperature extremes. \*\*

The 4410 series Elements are used just like those of the Industry-standard model 43. They plug into the wattmeter's element socket and are simply rotated for either forward or reflected measurements. Each Element, however, provides seven power ranges instead of one, covering 0.01/0.03/.1/.3/1/3/10 watts, 0.1/0.3/1/3/10/30/100 watts, 1/3/10/30/

100/300/1000 watts or 10/30/100/300/1000/3000/10000 watts—with full rated accuracy of meter READING from 20% to 100% of each scale of the seven overlapping ranges, i.e. a 37dB (5000 to 1) power range! The desired range is instantly selectable by a rotary switch on the front of the wattmeter.

This switch also includes a convenient battery test position.

What can the 4410's incomparable dynamic range and accuracy do for you? We can't guess all the possible applications, but consider these:

1. Field-service use where a single handful of Elements will now cover unparalleled power and frequency ranges under wide environmental conditions—and anywhere else where dozens of Elements used to be required.
2. Laboratory work where high accuracies and power levels as low as 2 milliwatts are required.
3. Any application where accurate THRULINE® measurements at milliwatts, watts or kilowatts need to be performed simply, quickly and at minimum cost.

\*\*See the specifications for temperature limits applicable to the lowest power Elements

## Series 4410 Frequency Ranges 0.2-1000 MHz Power Ranges 0.002\* -10,000 W



Seven overlapping Power levels with each Plug-in Element: 0.002-10W, 0.02-100W, 0.2-1000W or 2-10,000W, in frequency bands from 200kHz to 1000MHz

\* On the 10mW scale



AC-powered models are equipped with a Universal instrumentation-type AC connector and an external 115/230V selector switch. Batteries are easily accessible through a battery-compartment door.

Each of these special 4410- Elements is like seven elements-in-one.



## Bird 4410 Series Plug-in Elements (Catalog Numbers)

Table 9

Table 10

Table 11

Table 12

Full-Scale Power and Frequency (MHz) Ranges of 4410 Elements							
0-10, 30, 100, 300 milliwatts 1, 3, 10 watts		0-100, 300 milliwatts 1, 3, 10, 30, 100 watts		0-1, 3, 10, 30, 100, 300, 1000 watts		0-10, 30, 100, 300, 1000, 3000, 10,000 watts	
MHz	P/N	MHz	P/N	MHz	P/N	MHz	P/N
30-50	4410-20	25-80	4410-10	2-30	4410-3	0.2-0.535	4410-1
50-88	4410-21	50-125	4410-11	25-80	4410-5	0.45-2.5	4410-2
88-108	4410-27	100-250	4410-12	50-200	4410-6	2-30	4410-4
100-152	4410-22	200-500	4410-13	144-520	4410-7		
150-250	4410-23	400-1000	4410-14	200-1000	4410-8		
225-400	4410-24						
400-800	4410-25						
800-900	4410-26						

## Specifications

model 4410A, 4410P, 4411 and 4412

**Power Range** 0.01 to 10W, 0.1 to 100W, 1 to 1000W, 10 to 10000W full scale in one single Plug-in Element. Any Bird Series 4410-Element may be used.

**Frequency Range** 200kHz to 1000MHz CW or FM. Select from 4410-series Elements only.

**Insertion VSWR** with N Connectors 1.05 max. (4410P: 1.07 max.)

**Accuracy**  $\pm 5\%$  of READING, for any reading above 20% of the power range selected, for FM or CW signals without AM. This accuracy is maintained for a full 37dB dynamic range with each 4410 Element (except No. 4410-1 0.200-0.535MHz, which is accurate to  $\pm 10\%$  of reading).

**Ambient Temperature Range** Elements 4410-1 thru 8 and -10 thru 14 are temperature-compensated for rated accuracy from 0°C to 50°C (32° to 122°F), and 4410-20 thru 26 from 20°C to 30°C (68° to 86°F).

**Over-range Protection** To 120% of nominal full scale (i.e. 12W, 120W, 1200W, or 12,000W). No damage or degradation to the unit will result, regardless of the Range Selector Switch position.

**Battery Life** 4410A, 4410P and 4411: 24 hrs. minimum with standard 9V alkaline "transistor" battery (NEDA No. 1604A supplied); 180 hrs. minimum with P/N 5-1576 Lithium battery 4412: 7 hrs. minimum (rechargeable)

**Connectors** QC Type (Female N normally supplied)

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 4410A, 4411, 4412: 6 $\frac{7}{8}$ " x 5 $\frac{1}{8}$ " x 3 $\frac{5}{8}$ " (175 x 130 x 92mm)

4410P: 19" x 5 $\frac{7}{32}$ " x 3 $\frac{15}{16}$ " (483 x 133 x 100mm) 3 RU

**Weight** 4410A, 4411 and 4412 3 $\frac{1}{3}$  lbs. (1.5kg); 4410P 5 lbs. (2.3kg)

**AC Power** 4411, 4412 and 4410P 105-125/210-250VAC, 50/60Hz with integral selector switch

**Optional Carrying Cases** CC-1: Wattmeter & 7 Elements; CC-3: Wattmeter & 8080 or 8362 (25W Load) & 4 Elements; EC-1: 12 Elements

**Custom Test Sets Available:** Such as this all-in-one Test Set (4410-030) above right containing a 4410 series THRU-LINE® Wattmeter with four 1kW Elements covering 2 to 520 MHz, a 100W dry Load, a Variable RF Signal Sampler, a BNC to N adapter, 2 cable assemblies, spare Lithium battery, 2 manuals and a VSWR chart, all as currently supplied to the Armed Forces.

This Test Set (4410-025) provides storage and protection for a 4410 series Wattmeter with up to 6 Elements and Dust Plug, and is supplied with a laminated VSWR chart and manual (Elements No. 4410-3, -4, -5 and -6 are part of this specific Test Set).

A Test Set can be custom-tailored to your requirements. Please contact the plant.



4410-030



4410-025



**Model 4410P Panel-Mounted Wattmeter** is electrically equivalent to the portable model 4411. It has a side door for battery replacement, a Universal Instrument-type AC connector and 150/230V rear selector switch, and fits into 5 $\frac{1}{4}$ " space of standard 19" racks. RF Quick-Change Connectors can be changed without dismounting the 4410P from its rack.

## Wattmeter With Variable RF Tap model 4431



Provides model 43 Power Measurement Versatility plus... Convenient, Built-in, Variable RF Signal Sampler. The combination model 4431 THRULINE® Wattmeter provides the advantage of an RF signal sample (for use with counters, oscilloscopes, spectrum analyzers, etc.) at the same time a power measurement is made. Amplitude of the RF sample is readily adjusted by a depth-of-insertion control knob mounted on the front of the Wattmeter case. Model 4431 uses the same Plug-in Elements as the model 43 Wattmeter within its frequency and power ratings.

### Specifications model 4431

**Power and Frequency Range** 5kW max. 2 to 30MHz 1kW max. 30 to 1000MHz\* using Bird Plug-in Elements (page 5). Accuracy not guaranteed with components not supplied by Bird.  
**Insertion VSWR** with N Connectors 1.07 max.\*  
**Accuracy** ±5% of full scale  
**Insertion Loss** 0.1dB max. (2-512MHz); 0.2dB max. (512-1000MHz)\*  
**RF Sample Output** Variable -15 to -70dB from BNC (Female) port  
**Connectors** QC Type (Female N normally supplied)  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 6<sup>7</sup>/<sub>8</sub>" x 5<sup>1</sup>/<sub>8</sub>" x 3<sup>3</sup>/<sub>8</sub>" (175 x 130 x 92mm)  
**Weight** 3<sup>1</sup>/<sub>2</sub> lbs. (1.6kg)  
**Optional Carrying Case** CC-1: Wattmeter & 9 Elements; CC-3: Wattmeter & 8080 or 8362 (25W Load) & 6 Elements; EC-1: 12 Elements  
 \*Applies only when coupling is less than 30dB

## Fixed RF Tap model 4430



This THRULINE® Wattmeter is similar to model 4431 above, except for a fixed RF tap. RF coupling is approximately -53dB from 512MHz down to 10MHz, and decreases to

-70dB at 2MHz.

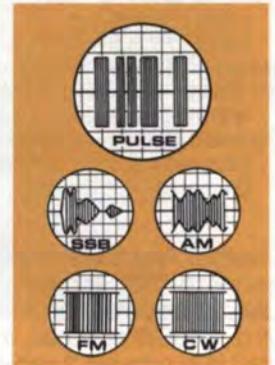
Power Rating & Frequency Range is 1000W max. 2-200MHz and 500W max. 200-512MHz. VSWR is 1.05 max.

### Specifications

**model 4430**  
**Power and Frequency Range** 1000W max. 2 to 200MHz; 500W max. 200 to 512MHz using Bird Plug-in Elements (page 5).  
**Insertion VSWR** with N Connectors 1.05 max.  
**Accuracy** ±5% of full scale  
**RF Sample Output** Fixed at approximately -53dB from 512 to 10MHz decreasing to -70dB at 2MHz from BNC (Female) port  
**Connectors** QC Type (Female N normally supplied)  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 6<sup>7</sup>/<sub>8</sub>" x 5<sup>1</sup>/<sub>8</sub>" x 3<sup>3</sup>/<sub>8</sub>" (175 x 130 x 92mm)  
**Weight** 3<sup>1</sup>/<sub>4</sub> lbs. (1.5kg)  
**Optional Carrying Case** CC-1: Wattmeter & 9 Elements; CC-3: Wattmeter & 8080 or 8362 (25W Load) & 6 Elements; EC-1: 12 Elements



## PEP Wattmeter model 4314



Model 4314 is a portable peak-reading instrument, designed specifically for the measurement of air navigational aids such as DME, ATC and other pulsed RF systems, e.g. telemetry, radar, television, command and control, and peak envelope power (PEP) measurement of SSB or AM signals.

This Wattmeter measures practically any type of coaxial transmission - pulsed, AM, FM or CW. To read the peak power of pulses or peak envelope power, the "Peak Read" button is depressed.

Model 4314 has a built-in battery charger and can, therefore, be operated as a portable or plugged-in as a bench instrument.

### Specifications model 4314

**Power Range** 100mW to 10kW using Bird Plug-in Elements. Accuracy not guaranteed with components not supplied by Bird. Element Tables 1 through 6 on page 31.  
**Frequency Range** 0.45 to 2300MHz  
**Insertion VSWR** with N Connectors 1.05 max. to 1000MHz, 1.1 max. to 2300MHz  
**Accuracy** ±5% of full scale CW, ±8% PEP  
**Pulse Parameters** (min.) Pulse width (at 10% of height) 0.4 microsec. (100-2300MHz), 1.5 microsec. (26-99MHz) and 15 microsec. (2-25MHz); Repetition Rate 30pps and Duty Factor 1 x 10<sup>-4</sup> minimum  
**Connectors** QC Type (Female N normally supplied)  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 6<sup>7</sup>/<sub>8</sub>" x 5<sup>1</sup>/<sub>8</sub>" x 3<sup>3</sup>/<sub>8</sub>" (175 x 130 x 92mm)  
**Weight** 4 lbs. (1.8kg)  
**Battery Life** 10 hrs. (rechargeable)  
**AC Power** 104-126/208-252V, 50-60Hz, 1.5W  
**Optional Carrying Case** CC-1: Wattmeter & 9 Elements; CC-3: Wattmeter & 8080 or 8362 (25W Load) & 6 Elements; EC-1: 12 Elements

## Very Low Frequency Wattmeter model 4450

For tuning and RF power measurement of AC-power-line carrier equipment and systems 0-5/25/100 watts at 20 to 1000 kilohertz. Needs no batteries and may be left in the line for continuous system monitoring. Details and specifications in Bulletin 4450.



## High Power Wattmeter model 4305

### Specifications model 4305

**Power Range** 50W to 25000W using Bird Plug-in Elements  
**Frequency Range** 0.45 to 1800MHz  
**Insertion VSWR** with N Connectors 1.05 max.  
**Accuracy** ±5% of full scale  
**Connectors** QC Type (Female N normally supplied)  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 6<sup>3</sup>/<sub>16</sub>" x 5" x 4<sup>9</sup>/<sub>32</sub>" (173 x 127 x 109mm)  
**Weight** 3<sup>1</sup>/<sub>4</sub> lbs. (1.5kg)

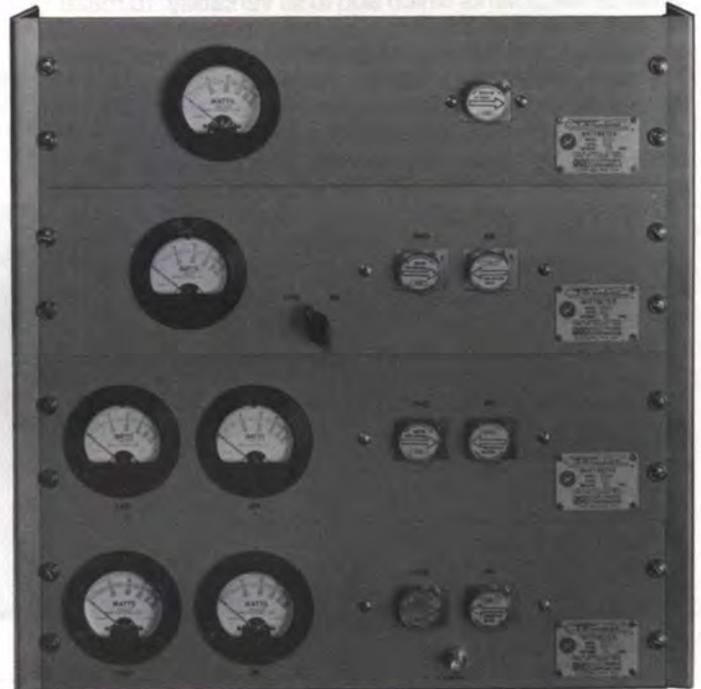
Table 8  
Plug-in Elements (usable only with Model 4305)

Frequency (MHz)	Power	Catalog No.
.45- 2.5	25kW	25KP7
2- 30	10kW	10KH7
25- 60	2500W	2500A7
25- 60	5000W	5000A7
50- 125	2500W	2500B7
50- 125	5000W	5000B7
100- 250	2500W	2500C7
200- 500	2500W	2500D7
400-1000	2500W	2500E7
1100-1800	50W	50K7
1100-1800	100W	100K7

## Panel Mounted Wattmeters models 4521, 22, 26, 27

Panel-mounted THRULINE Wattmeters Model 4521 (single socket) and 4522 (double socket) are designed for power measurement in CW and FM systems with cable or 7/8" EIA transmission lines. For forward or reflected power indication, the single Plug-in Element is rotated to the proper direction with Model 4521, while a switch selects either of two Elements with Model 4522. This double-socket wattmeter permits the use of a more sensitive Element (up to 1:10 ratio) for reflected power measurement. Model 4526 has two meters and no switch for simultaneous display of power indication in both directions. Select Elements from Tables 1, 2, 3, 4 and 6 (page 5).

Model 4527 is tailored for 2-way mobile applications from 2-512MHz and has an RF sampling output (Female BNC) for frequency counting and analysis. Select Elements up to 1000 watts from 2-200MHz, and up to 500 watts from 200-512MHz from the same Tables.



### Specifications

#### model 4521, 4522, 4526 and 4527

**Power Range** 100mW to 10kW using Bird Plug-in Elements.  
 Accuracy not guaranteed with components not supplied by Bird.  
**Frequency Range** 0.45 to 2300MHz (4527: 2-512MHz)  
**Insertion VSWR** with N Connectors 1.05 max. to 1000MHz, 1.1 max. to 2300MHz  
**Accuracy** ±5% of full scale  
**RF Sample Output** (Model 4527 only) Fixed at -53dB from 512 to 10MHz decreasing to -70dB at 2MHz, from BNC (Female) port  
**Connectors** QC Type (Female N normally supplied)  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** 19" x 5<sup>7</sup>/<sub>32</sub>" x 1<sup>11</sup>/<sub>16</sub>" (483 x 133 x 43mm) 3 RU  
**Weight** 3<sup>1</sup>/<sub>2</sub> lbs. (1.6kg)

## Relative Field Strength Measurement

For a modest investment, the new model 4030 Relative Field Strength Element expands the usefulness of models 43, 4430, and 4431 Wattmeters to help you optimize the radiated signal of any transmitter from 2-1000MHz. Increase the reach of business or personal transceivers, extend the range of H.T.s. by tuning, adjusting, positioning antennas for maximum meter indication on Bird THRULINE® Wattmeters.

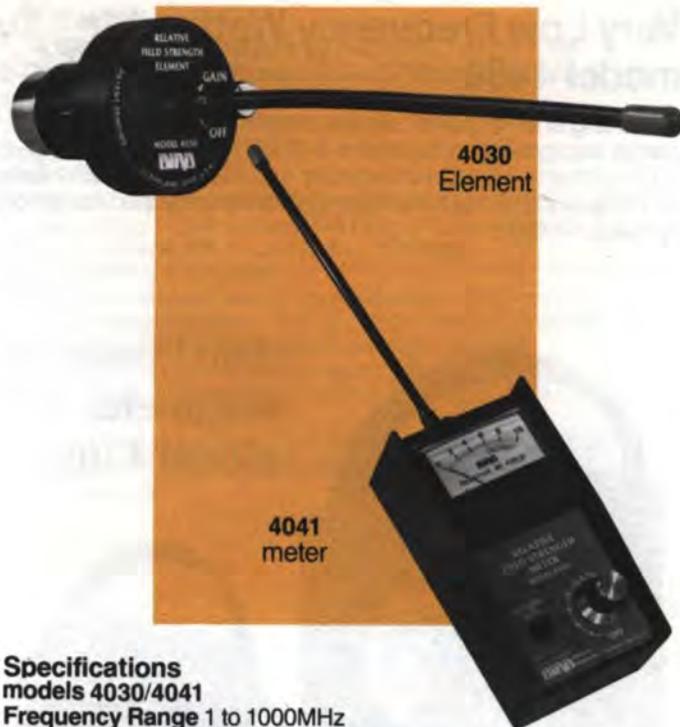
Most field strength meters are built with resonant reactive networks which limit their utility. The advent of broadband RF chips made it feasible for us not only to design a broadband non-reactive field-strength circuit, but to contain it—along with its energy source—within the confines of a Plug-in Element. The advantage to you, our customer, is that even though you may have bought your model 43 anytime between now and 30-35 years ago, it has been ready for the latest developments which add to its versatility. To make measurements is simple, quick and convenient—and you are half-way there with your model 43 or other model THRULINE Wattmeter with its precision sensitive and rugged meter. Just insert the new Element, and read.

The 4030 Elements consist of a flexible receiving antenna, a high pass filter network, and a variable gain RF amplifier/detector. The amplifier is turned on automatically when the Element is plugged in. The amplifier's DC output drives the 30 microampere meter of the listed model THRULINE Wattmeters to indicate the presence of an RF field at the receiving antenna. A GAIN control adjusts sensitivity of the device to various field intensities.

Since the model 4030 responds to the field intensity at a particular location, it is easy to perform antenna-transmitter peaking simply by obtaining the maximum field intensity reading on the meter while optimizing antenna match.

If you prefer an independent instrument, the model 4041 Relative Field Strength Meter performs exactly the same functions as the 4030 Element, plus a battery level test.

Typical 4041 sensitivity (or 4030 plugged into a model 43) with the gain control at maximum is a full scale meter deflection with one watt of radiated power at 150MHz from a 2-meter H.T. at 8 feet distance.



### Specifications

#### models 4030/4041

**Frequency Range** 1 to 1000MHz

**Dynamic Range** 30dB minimum

**Typical Sensitivity** Full scale deflection at 8 ft. (2½m) from a 1W source broadcasting at 150MHz through a quarter wave antenna

**Output Characteristics** (4030) compatible with 30 microampere meter instruments (e.g. models 43, 4431, etc.)

**Battery Life** 4030:100 hours minimum, 4041:200 hours minimum

**Battery Type** 4030:Three 3V Lithium-Manganese Dioxide cells (Duracell DL2032 or equivalent); 4041:One 9V Alkaline "Transistor" battery (NEDA No. 1604A)

**Ambient Temperature Range** 0°C to +50°C

**Weight** (incl. batteries) 4030:3 oz. (85g), 4041:10 oz. (283g)



### Specifications

#### Variable RF Signal Samplers model 4273 and 4275

**Power Ratings** 4273 5000W max., 4275 1000W max.

**Frequency Range** 4273 1.5 to 35MHz, 4275 20-1000MHz

**Impedance** 50 ohms nominal

**Insertion VSWR** with N Connectors 4273 1.07 max.; 4275

1.1 max. 2 to 512MHz, 1.25 max. 512 to 1000MHz

**Insertion Loss** 4273 0.1dB max.; 4275 0.1dB max. 2 to 512MHz, 0.2dB max. 512 to 1000MHz

**Coupling** Adjustable as shown within ±3dB

**Ambient Temperature Range** -40°C to +45°C

**Connectors** QC type as specified (No connectors required for 4273-100 or 4275-100, which are Sampler accessories for Bird instruments already equipped with QC-Connectors)

**Finish** Bright silver plate

**Nominal Size** 2<sup>5</sup>/<sub>16</sub>" x 2<sup>7</sup>/<sub>8</sub>" x 1<sup>1</sup>/<sub>4</sub>" (71 x 73 x 32mm)

**Weight** 10 oz. (280g)

**Model/Part No.**

4273-020 4275-020

4273-025 4275-025

4273-030 4275-030

4273-035 4275-035

4273 4275

#### QC—Connectors

N: Male/Female

N: Two Female

UHF: Male/Female

UHF: Two Female

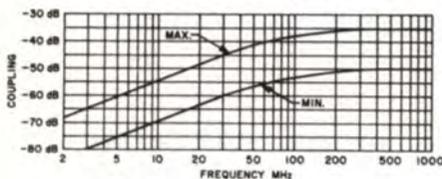
None\*

\* Choose any two connectors from listing on page 35.

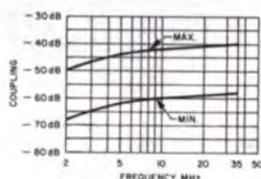
## Variable RF Signal Samplers

Models 4273 and 4275 are "stand alone," wide-range, THRULINE® RF coupling probes for spectrum analysis, RF signal observation on a scope, or frequency counting and control. They feature a very low VSWR throughout their broad frequency and attenuation range. Insertion loss is a negligible 0.1dB.

For low frequency RF sampling (between 1.5 and 35MHz), order a model from the 4273 line. For frequencies between 20 and 1000MHz, order a 4275 model. Note that, once it is adjusted, the setting can be locked.



model 4275



model 4273

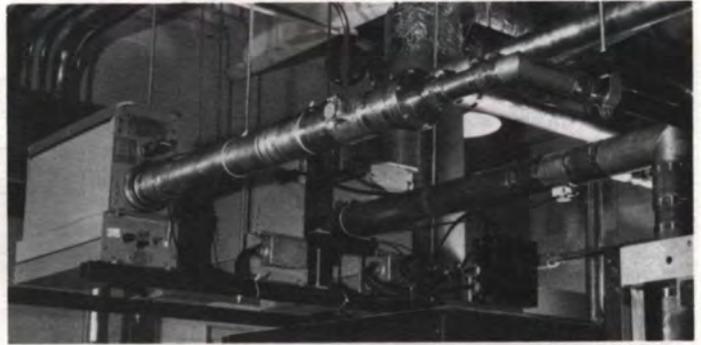
## High-Power THRULINE® Directional Wattmeters

Now in its fifth decade of serving the broadcasting industry, Bird Electronic Corporation has been the pioneer in developing products for measurement, filtering and termination of RF power. The Company's products, originally developed in response to specific design requirements of broadcast equipment manufacturers, have since become standards of the industry.

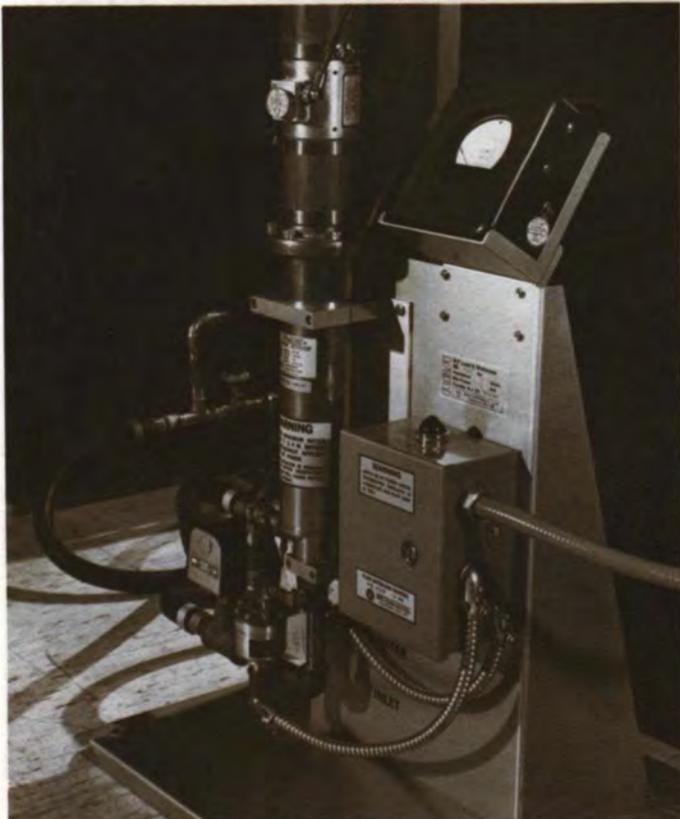
Recognizing that broadcast test equipment must be even more reliable than the transmitter, must be constantly on-call and totally trustworthy, Bird has achieved an enviable record of reliability.

Government regulations have been based on the measurement accuracy of Bird instruments, and agencies have continued to consult with Bird engineers to evaluate the feasibility of new regulations under consideration.

Confining itself in the broadcasting field to products for frequencies from 2 to 1000MHz at power levels to 250kW, Bird has developed a high degree of expertise in its technology. The expertise, combined with an understanding responsiveness to customers' requirements, makes Bird the dependable choice of both manufacturers and users of broadcasting equipment.



*This TT50FL dual transmitter installation at WKYC-TV is the first in the country. Shown above are three TERMALINE "Reject Loads" with their THRULINE Wattmeters. The 50kW Test Load/Wattmeter is switched remotely (including water flow) from the studio 10 miles distant, where the reject power levels and main feed power are monitored (below left and right).*



## Wattmeters For 1 $\frac{5}{8}$ " , 3 $\frac{1}{8}$ " & 6 $\frac{1}{8}$ " Lines

Each Bird High Power Rigid Line THRULINE® RF Directional Wattmeter is comprised of a Line Section and a direct reading 3 scale meter housed in a convenient carrying case. Measuring Element(s) are ordered separately.

**Line Section:** A precise 50 ohm 1 $\frac{5}{8}$ " , 3 $\frac{1}{8}$ " or 6 $\frac{1}{8}$ " coaxial air line is designed for insertion into your transmission line between transmitter and antenna or load. Each Line Section is equipped with one or two sockets into which Plug-in Element(s) with the desired power and frequency range are inserted. Double-socket Line Sections are for simultaneous measurement of forward and reflected power.

**Indicating Meter:** A shock-mounted sensitive micro-ampere meter with 3 expanded scales of 5/10/25 (or 15/30/60) unit calibration to permit full scale direct power reading from 250 watts to 250kW. Sockets for storing extra elements are provided on the side of the rugged cast aluminum case. A 10-foot (3 meters) shielded cable for connecting meter to Line Section is standard, other cable lengths on request. A special meter for 8/80kW is also available.

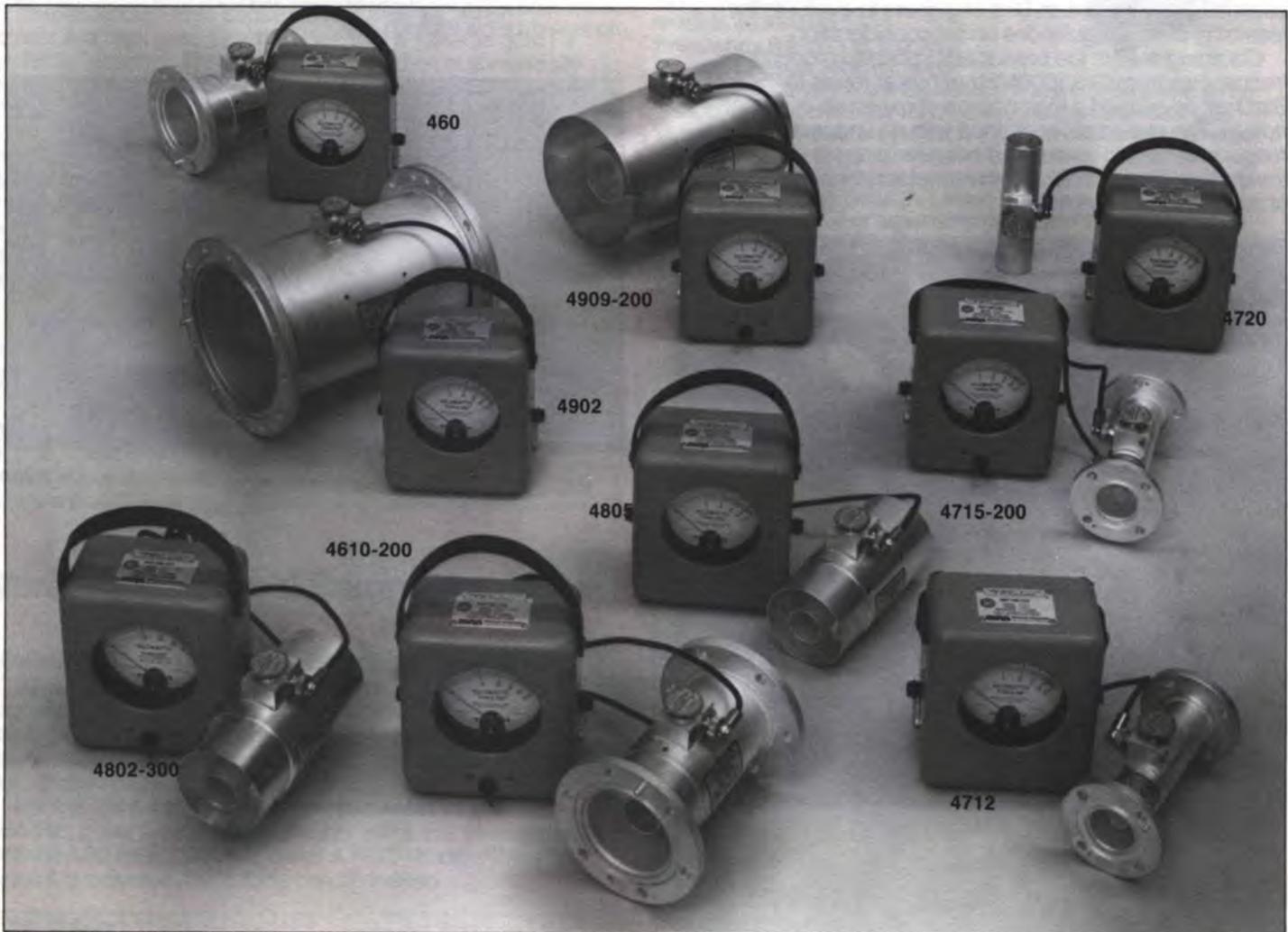
Wattmeters with two separate element sockets (one for FORWARD and one for REFLECTED power measurement)

are equipped with a dual dc-input meter case and two shielded cables. A switch mounted on the meter face selects the desired reading.

Wattmeters ordered by MODEL NUMBER are supplied with the appropriate Line Section, connecting cable(s) and portable meter. If panel-mounted meter(s) for 19" equipment racks are preferred, Line Section, and meter panels should be ordered individually (see page 16). In case of doubt, select a MODEL from these pages and ask for a quote on replacing the portable meter by a meter panel.

**Plug In Elements:** (See Tables 1 $\frac{5}{8}$ " , 3 $\frac{1}{8}$ " , 6 $\frac{1}{8}$ " A or B). These elements read both forward and reflected power as indicated by the direction in which the arrow is pointing. Frequency range and full scale power are marked on each Element. Since Elements are **not** interchangeable between different THRULINE models, be sure to specify wattmeter model number (or Line Section part number) for which elements are intended. For periodic verification convenience, we recommend ordering Elements in identical pairs for each socket.

**Finish:** Line Sections are bright silver plated, meter housings and panels are finished in Light Navy Grey Baked Enamel (MIL-E-15090).



### Series 4700, 4600 & 4800, 4900

**Specifications: Accuracy:** ±5% of full scale

**Insertion VSWR:** 1.05 max.

**Finish** Line Section—Silverplated, Meter Housing—Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** Meter Housing 5 $\frac{9}{16}$ " x 6 $\frac{1}{2}$ " x 3 $\frac{3}{8}$ " (141 x 165 x 85mm)

**Weight** Meter 5 lbs. (2.3kg)

# High-Power Rigid Line Series

Model No.	Freq. Range MHz	Power Range kW	Fig/Unflg	No. of Sockets	Scale Divisions	Element Table	Overall Length	Weight
<b>1 1/2" LINE 50 ohms nominal</b>								
4712	2-1000	1/4-25	EIA Flg	Single	5/10/25	1% A	6 3/4" (171mm)	3 lbs (1 1/4kg)
4715-200	2-1000	1/4-25	EIA Flg	Double	5/10/25	1% A	6 3/4" (171mm)	3 1/4 lbs (1.4kg)
4720	2-1000	1/4-25	Unflg	Single	5/10/25	1% A	6 3/4" (162mm)	1 1/4 lbs (0.6 kg)
4723-200	2-1000	1/4-25	Unflg	Double	5/10/25	1% A	6 3/4" (162mm)	1 1/2 lbs (0.7kg)
4712-037	50- 250	0.3-6	EIA Flg	Single	15/30/60	1%B	6 3/4" (171mm)	3 lbs (1 1/4kg)
4715-300	50- 250	0.3-6	EIA Flg	Double	15/30/60	1%B	6 3/4" (171mm)	3 1/4 lbs (1.4kg)
<b>3 1/2" LINE 50 ohms nominal</b>								
460	2-1000	1-100	EIA Flg	Single	5/10/25	3% A	7 1/32" (179mm)	7 lbs (3kg)
4610-200	2-1000	1-100	EIA Flg	Double	5/10/25	3% A	7 1/32" (179mm)	7 1/4 lbs (3.1kg)
4805	2-1000	1-100	Unflg	Single	5/10/25	3% A	6 1/2" (165mm)	4 lbs (2kg)
4802-200	2-1000	1-100	Unflg	Double	5/10/25	3% A	6 1/2" (165mm)	4 1/4 lbs (2.1kg)
4600-037	50- 250	1 1/2-30	EIA Flg	Single	15/30/60	3%B	7 1/32" (179mm)	7 lbs (3kg)
4610-300	50- 250	1 1/2-30	EIA Flg	Double	15/30/60	3%B	7 1/32" (179mm)	7 1/4 lbs (3.1kg)
4805-037	50- 250	1 1/2-30	Unflg	Single	15/30/60	3%B	6 1/2" (165mm)	4 lbs (2kg)
4802-300	50- 250	1 1/2-30	Unflg	Double	15/30/60	3%B	6 1/2" (165mm)	4 1/4 lbs (2.1kg)
<b>6 1/2" LINE 50 ohms nominal</b>								
4902	2-1000	2 1/2-250	EIA Flg	Single	5/10/25	6% A	10 7/32" (260mm)	16 3/4 lbs (7 1/2kg)
4905-200	2-1000	2 1/2-250	EIA Flg	Double	5/10/25	6% A	10 7/32" (260mm)	17 lbs (7 3/4kg)
4907	2-1000	2 1/2-250	Unflg	Single	5/10/25	6% A	9 9/8" (245mm)	12 1/2 lbs (5 1/2kg)
4909-200	2-1000	2 1/2-250	Unflg	Double	5/10/25	6% A	9 9/8" (245mm)	12 3/4 lbs (5 3/4kg)
4902-037	50- 750	3-60	EIA Flg	Single	15/30/60	6%B	10 7/32" (260mm)	16 3/4 lbs (7 1/2kg)
4905-300	50- 750	3-60	EIA Flg	Double	15/30/60	6%B	10 7/32" (260mm)	17 lbs (7 3/4kg)
4902-080	50- 750	8, 80	EIA Flg	Single	8/80	6%C	10 7/32" (260mm)	16 3/4 lbs (7 1/2kg)
4907-080	50- 750	8, 80	Unflg	Single	8/80	6%C	9 9/8" (245mm)	12 1/2 lbs (5 1/2kg)

## Plug-In Elements

(Elements must be calibrated with the Wattmeter to insure stated accuracy.)

Table 1 1/2" A Standard Elements

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
250 watts		250A1	250B1	250C1	250D1	250E1
500 watts		500A1	500B1	500C1	500D1	500E1
1000 watts	1000H1	1000A1	1000B1	1000C1	1000D1	1000E1
2500 watts	2500H1	2500A1	2500B1	2500C1	2500D1	2500E1
5000 watts	5000H1	5000A1	5000B1	5000C1	5000D1	5000E1
10kW	10KH1	10KA1	10KB1			
25kW	25KH1					

Table 3 1/2" A Standard Elements

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
1000 watts		1000A3	1000B3	1000C3	1000D3	1000E3
2500 watts		2500A3	2500B3	2500C3	2500D3	2500E3
5000 watts	5000H3	5000A3	5000B3	5000C3	5000D3	5000E3
10kW	10KH3	10KA3	10KB3	10KC3	10KD3	10KE3
25kW	25KH3	25KA3	25KB3	25KC3	25KD3	25KE3
50kW	50KH3	(50KA4	50KB4	50KC4)**		
100kW	100KH3					

\*\* The special 50kW Elements inside the parentheses must be used with special line sections 4616-000, 4617-000, 4808-000, 4808-010 or 4808-020 listed on page 37. The 50KC4 Element should not be used above rated 3 1/2" line power of 35kW.

Table 6 1/2" A Standard Elements

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
2500 watts		2500A6	2500B6	2500C6	2500D6	2500E6
5000 watts		5000A6	5000B6	5000C6	5000D6	5000E6
10kW		10KA6	10KB6	10KC6	10KD6	10KE6
25kW	25KH6	25KA6	25KB6	25KC6	25KD6	25KE6
50kW	50KH6	50KA6	50KB6	50KC6	50KD6	50KE6
100kW	100KH6					
250kW	250KH6					

Table 1 1/2" B

Power Range	50-125MHz	100-250
300 watts	300B1	300C1
600 watts	600B1	600C1
1500 watts	1500B1	1500C1
3000 watts	3000B1	3000C1
6000 watts	6000B1	6000C1

Table 3 1/2" B

Power Range	50-125MHz	100-250
1500 watts	1500B3	1500C3
3000 watts	3000B3	3000C3
6000 watts	6000B3	6000C3
15kW	15KB3	15KC3
30kW	30KB3	30KC3

Table 6 1/2" B

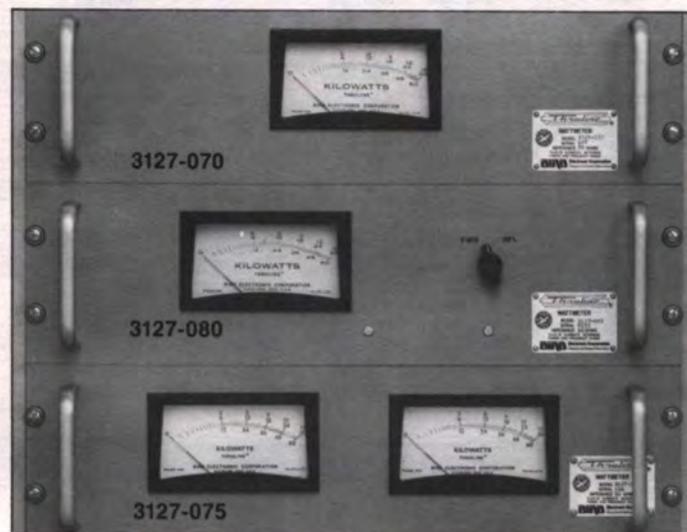
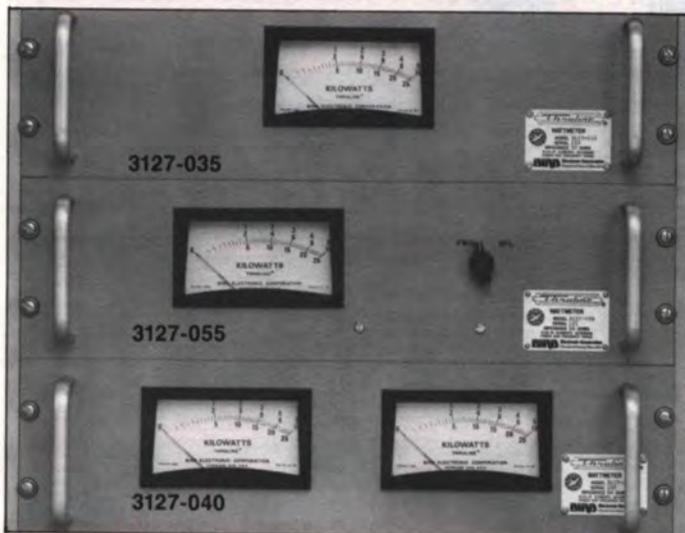
Power Range	Frequency Bands (MHz)		
	50-125	100-250	470-750
3000 watts	3000B6	3000C6	3000U6
6000 watts	6000B6	6000C6	6000U6
15kW	15KB6	15KC6	15KU6
30kW	30KB6	30KC6	30KU6
60kW	60KB6	60KC6	60KU6

Table 6 1/2" C

Power Range	Frequency Bands (MHz)		
	50-125	100-250	470-750
8kW	8KB6	8KC6	8KU6
80kW	80KB6	80KC6	80KU6

For Coupling Kits, see page 36.

## To assemble a rack-mounted Wattmeter, use selection guides below.



### Specifications

#### Assembled Rack-Mounted Wattmeters

**Finish** Line Sections—Silverplated; Panel—Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size and Weight** Line Sections: see preceding page  
Panels 19" x 5<sup>7</sup>/<sub>32</sub>" x 4<sup>3</sup>/<sub>16</sub>" (483 x 133 x 111mm) 3 RU; 3 lbs. (1.4kg)



Typical Line Sections

## Selection guides (For Element Tables, see page 15)

	5/10/25 scale-division meters	15/30/60 scale-division meters
<b>for 1<sup>5</sup>/<sub>8</sub>" systems</b>	<p><b>Meter:</b> No. 3127-035  <b>Line Section:</b> 4712-000 single socket 1<sup>5</sup>/<sub>8</sub>" EIA Fig or 4720-000 single socket 1<sup>5</sup>/<sub>8</sub>" Unflanged  <b>Element:</b> Choose one from Table 1<sup>5</sup>/<sub>8</sub>A</p> <p>or</p> <p><b>Meter:</b> No. 3127-055 with switch or No. 3127-040 double meters  <b>Line Section:</b> 4715-000 double socket 1<sup>5</sup>/<sub>8</sub>" EIA Fig or 4723-000 double socket 1<sup>5</sup>/<sub>8</sub>" Unflanged  <b>Elements:</b> Select two in 10:1 power ratio from Table 1<sup>5</sup>/<sub>8</sub>A</p>	<p><b>Meter:</b> No. 3127-070  <b>Line Section:</b> 4712-000 single socket 1<sup>5</sup>/<sub>8</sub>" EIA Fig or 4720-000 single socket 1<sup>5</sup>/<sub>8</sub>" Unflanged  <b>Element:</b> Choose one from Table 1<sup>5</sup>/<sub>8</sub>B</p> <p>or</p> <p><b>Meter:</b> No. 3127-080 with switch or No. 3127-075 double meters  <b>Line Section:</b> 4715-000 double socket 1<sup>5</sup>/<sub>8</sub>" EIA Fig or 4723-000 double socket 1<sup>5</sup>/<sub>8</sub>" Unflanged  <b>Elements:</b> Select two in 10:1 power ratio from Table 1<sup>5</sup>/<sub>8</sub>B</p>
<b>for 3<sup>1</sup>/<sub>8</sub>" systems</b>	<p><b>Meter:</b> No. 3127-035  <b>Line Section:</b> 4600-000 single socket 3<sup>1</sup>/<sub>8</sub>" EIA Fig or 4805-000 single socket 3<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Element:</b> Choose one from Table 3<sup>1</sup>/<sub>8</sub>A</p> <p>or</p> <p><b>Meter:</b> No. 3127-055 with switch or No. 3127-040 double meters  <b>Line Section:</b> 4610-000 double socket 3<sup>1</sup>/<sub>8</sub>" EIA Fig or 4802-000 double socket 3<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Elements:</b> Select two in 10:1 power ratio from Table 3<sup>1</sup>/<sub>8</sub>A</p>	<p><b>Meter:</b> No. 3127-070  <b>Line Section:</b> 4600-000 single socket 3<sup>1</sup>/<sub>8</sub>" EIA Fig or 4805-000 single socket 3<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Element:</b> Choose one from Table 3<sup>1</sup>/<sub>8</sub>B</p> <p>or</p> <p><b>Meter:</b> No. 3127-080 with switch or No. 3127-075 double meters  <b>Line Section:</b> 4610-000 double socket 3<sup>1</sup>/<sub>8</sub>" EIA Fig or 4802-000 double socket 3<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Elements:</b> Select two in 10:1 power ratio from Table 3<sup>1</sup>/<sub>8</sub>B</p>
<b>for 6<sup>1</sup>/<sub>8</sub>" systems</b>	<p><b>Meter:</b> No. 3127-035  <b>Line Section:</b> 4902-000 single socket 6<sup>1</sup>/<sub>8</sub>" EIA Fig or 4907-000 single socket 6<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Element:</b> Choose one from Table 6<sup>1</sup>/<sub>8</sub>A</p> <p>or</p> <p><b>Meter:</b> No. 3127-055 with switch or No. 3127-040 double meters  <b>Line Section:</b> 4905-000 double socket 6<sup>1</sup>/<sub>8</sub>" EIA Fig or 4909-000 double socket 6<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Elements:</b> Select two in 10:1 power ratio from Table 6<sup>1</sup>/<sub>8</sub>A</p>	<p><b>Meter:</b> No. 3127-070  <b>Line Section:</b> 4902-000 single socket 6<sup>1</sup>/<sub>8</sub>" EIA Fig or 4907-000 single socket 6<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Element:</b> Choose one from Table 6<sup>1</sup>/<sub>8</sub>B</p> <p>or</p> <p><b>Meter:</b> No. 3127-080 with switch or No. 3127-075 double meters  <b>Line Section:</b> 4905-000 double socket 6<sup>1</sup>/<sub>8</sub>" EIA Fig or 4909-000 double socket 6<sup>1</sup>/<sub>8</sub>" Unflanged  <b>Elements:</b> Select two in 10:1 power ratio from Table 6<sup>1</sup>/<sub>8</sub>B</p>

## New RF Power/Frequency Meter model 3900 offers the two most frequently needed measurement capabilities in one compact, rugged portable instrument.

THRULINE® RF Power/Frequency Meter is a versatile portable or bench-type instrument for design or maintenance testing of communications equipment from 5-1000MHz and from 100 milliwatts to 5000 watts. In short, the model 3900 provides model 43 Power Measurement Versatility plus a built-in 8 digit Frequency Counter.

No external pick-up modules are required as the precision cast brass line section is mounted behind the instrument's front panel. Since frequency and power range depend on the Plug-in Elements used, storage for 5 Elements is provided in the Wattmeter—one in the line section socket and four in rear panel receptacles. Select Elements within the power and frequency ranges listed here from model 43 Tables 1-6 on page 31. No AC power is required for RF power measurement.

The frequency counter is battery powered for portability, but a 115V (or 230V) adapter/charger stored in the rear is provided for extended periods of service on the bench. The counter has a range of 5 to 1000MHz and gives stable reading with as little as 100mW in the main line (above 50MHz). A variable level RF sampler permits changes in coupling to accommodate the wide range of signal levels the instrument is designed to measure.

While model 3900 RF Power/Frequency Meter is normally supplied with female N connectors, the QC Quick-Change feature permits the use of any RF connector in this series such as UHF, TNC, the new Mini-UHF, etc. (see page 35).

## Specifications

**Power and Frequency Range** 5kW max. 5-30MHz 1kW max. 30-1000MHz\* using Bird Plug-in Elements (page 5). Accuracy not guaranteed with components not supplied by Bird.

**Impedance** 50 ohms nominal

**Insertion VSWR** with N Connectors 1.07 max. \*

**Insertion Loss** 0.1 dB max. 2 to 400MHz, 0.2dB max. 400 to 1000MHz\*

**Accuracy** Power  $\pm 5\%$  of full scale, Frequency  $\pm 1$  ppm

**Frequency Display** Eight 0.3" red LED's (leading zero suppression)

**Ambient Temperature Range**  $+17^{\circ}\text{C}$  to  $+35^{\circ}\text{C}$

**Minimum RF Power** (for stable frequency counts) 5MHz 7W, 10MHz 2W, 25MHz 1W, 50 to 1000MHz 100mW

**Connectors** QC Type (Female N normally supplied)

**Nominal Size** incl. conn.  $9\frac{1}{16}'' \times 9\frac{1}{16}'' \times 5\frac{29}{64}''$  (233 x 230 x 142mm)

**Weight** 6 lbs. 1 oz. (2.75kg)

**Battery Life** 4 hours max. (rechargeable)

**AC Power** 115V or 230V 50/60Hz

\*When coupling is  $-30\text{dB}$  and below



## A New Generation of Microprocessor-Based THRULINE® RF Directional Wattmeters

**0.45-2300MHz  
0.1-10,000 watts**

**Models for Two-way Communications, Avionics, C<sup>3</sup>, Radar etc.** At the push of a button, these new digital RF Wattmeters with nine-mode system versatility:

- **read** incident and reflected CW and FM power in watts or dBm, incident and reflected peak-envelope-power of SSB/DSB and symmetrical AM in watts, incident and reflected peak pulse power as narrow as 0.8µsec in watts (Model 4391),
- **calculate** SWR, dB return loss, percent modulation,
- **remember** your peak and valley readings when you adjust for maximum or minimum signal levels,
- **overrange** at least 20% beyond nominal full scale, and will do all this **with Plug-in Elements you may already own from other Bird THRULINE Wattmeters.**



Model 4387



Model 4383

### Specifications

**models 4381/83/85/87 and 4381/83/85/87-832\*\***

**Power Range** 100mW to 10kW using Bird Plug-in Elements.

Accuracy not guaranteed with components not supplied by Bird.

**Frequency Range** 0.45 to 2300MHz

**Insertion VSWR** with N Connectors 1.05 max. to 1000MHz, 1.1 max. to 2300MHz (4381, 4385)

### Accuracy

**Power Readings** ±5% of full scale CW, ±8% PEP

**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

**Display** 3½ digit, LED-strobed, 0.8" (4385, 4387)  
0.3" (4381, 4383)

**Modulation Frequency** 50 to 10,000Hz (Audio)

**Pulse Parameters** (min.) Pulse width 50 microsec., repetition rate 100pps and Duty Factor 1%

**Connectors** QC Type (Female N normally supplied)

**Finish** 4381 Blue vinyl overlaid control panel with silver anodized side panels; 4383 Light Navy grey baked enamel (MIL-E-15090) with black anodized panels; 4385, 4387 Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** 4381 (incl. conn.) 8<sup>29/32</sup>" x 6<sup>7/32</sup>" x 3<sup>21/32</sup>" (226 x 158 x 93mm); 4383 7<sup>11/16</sup>" x 4<sup>3/4</sup>" x 3<sup>3/8</sup>" (195 x 121 x 86mm); 4385 19" x 6<sup>31/32</sup>" x 7<sup>1/8</sup>" (483 x 165 x 181mm) 4 RU; 4387 19" x 5<sup>7/32</sup>" x 4<sup>7/16</sup>" (483 x 133 x 113mm) 3 RU

**Weight** 4381 4 lbs. (1.8kg); 4385 5½ lbs. (2.5kg); 4383 2¼ lbs. (1 kg); 4387 3¼ lbs. (1.5kg)

**Battery Life** 4381/83 8 hours (rechargeable)

**AC Power** 4381/83 115V or 230V, 50/60Hz, 6W (with AC Adapter—specify voltage) 4385/87 115/230V, 50/60Hz, 8W (with integral selector switch)

**Optional Carrying Case** (4381 only) 4300-080: Power Analyst & 6 Elements & 4275-100 (Signal Sampler). Also suitable for Model 4383.

**CARRYING CASE**  
4300-080 for portable  
4380 series instruments  
includes space for  
optional RF Signal  
Sampler and spare  
Elements.



Model 4385



Model 4381

**Model 4381** is portable with a built-in coax line section, with an 8 hour battery and separate charger, optional carrying case. **Model 4385** is the stationary, rack-mounted version.

**Model 4383** is similar to the Model 4381, but without a coax line section. **Model 4387** is the stationary, rack-mounted version. These are intended for use with permanently installed line sections.

RF POWER ANALYST® Digital Directional Wattmeters also calculate parameter products that used to require tracing on a graph or chart, reveal whether AM modulation is present and—if so—how much, and make min./max. power searches a breeze.

**1** To measure forward and reflected power, insert two Elements with a 10:1 power ratio (for better resolution of the lower reflected levels) and set the range switches to match. Push FWD/CW or RFL/CW to read in watts while you make adjustments to your equipment, or push SWR to find the optimum match.

**2** A transmitter or signal source—rated to say 10, or 250 or 1000 watts nominally—is always designed with capacity to spare. As a matter of fact, some FCC rules **require** measurement at 110% of rated power. The instrument's 120% of over-range on each Plug-in Element lets you measure there without changing Elements AND does so with "up-scale" accuracy. Think of it: You get to use the same Plug-in Elements you probably already own from one of the more than 100,000 Model 43 THRULINE® Wattmeters in the field; you get an additional 20% beyond full-scale power, and at much better accuracy than obtainable if you had to switch to the next higher-power Element and read it downscale.

**3** Desired minimum levels (e.g. of reflected power or of SWR) are found easily through the  $\Delta$  function, which displays a "greater than" or "less than" symbol in place of the last digit, indicating increasing or decreasing levels. Or run through equipment adjustments from one extreme to the other—even with your eyes closed—then push the MIN memory button to display the optimum achievable value, and tune your gear to match it. The same easy procedure is available for desired maximum levels, by use of the MAX memory button. This is even faster than tweaking with an analog display meter, since you need not pass the signal dip (or peak) several times to be certain you have reached the optimum condition: The memory shows exactly what MIN or MAX value to aim for.

**4** The new RF POWER ANALYST reads peak envelope power in either forward or reflected direction, all with the same Elements used for CW power. It is so sensitive that you can measure a 1% ripple of hum on a carrier by pushing %MOD, if you notice a difference in the PEP and CW readings. That feature alone is likely to solve signal "mysteries".

**5** There is more: By detecting peaks and valleys, AM modulation up to 99.9 percent is displayed with one button. For convenience in the lab or on the production line, three additional keyboard functions furnish CW in dBm—instead of watts—in both directions, and return loss in dB.

\*\*  RF Power Analyst units equipped with the proper rear panel connector for IEEE-488 as well as RS-232 interface capability require addition of the suffix -832 to the model number (e.g. order model 4383-832 or 4387-832). Requires Bird GPIB Interface unit on page 21.

**Plug-In Elements** When ordering, specify catalog number and THRULINE Model number.

**Table 1 Standard Elements (Catalog Numbers)**

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H	—	—	—	—	—
5000 watts	5000H	—	—	—	—	—

**Table 2 Low-Power Elements**

1 watt	Cat. No.	2.5 watts	Cat. No.
30-35 MHz	030-1	30-40 MHz	030-2
35-40 MHz	035-1	40-50 MHz	040-2
40-50 MHz	040-1	50-60 MHz	050-2
50-60 MHz	050-1	60-80 MHz	060-2
60-80 MHz	060-1	80-95 MHz	080-2
80-95 MHz	080-1	95-150 MHz	095-2
95-125 MHz	095-1	150-250 MHz	150-2
110-160 MHz	110-1	200-300 MHz	200-2
150-250 MHz	150-1	250-450 MHz	250-2
200-300 MHz	200-1	400-850 MHz	400-2
275-450 MHz	275-1	800-950 MHz	800-2
425-850 MHz	425-1		
800-950 MHz	800-1		

**Table 3 High-Frequency Elements (Catalog Numbers)**

Power Range	Frequency Bands (MHz)			
	950-1260	1100-1800	1700-2200	2200-2300
1 watt	1J	1K	1L	1M
2.5 watts	2.5J	2.5K	2.5L	2.5M
5 watts	5J	5K	5L	5M
10 watts	10J	10K	10L	10M
25 watts	25J	25K	25L	25M
50 watts	50J			
100 watts	100J			
250 watts	250J			

Accuracy  $\pm 8\%$  o.f.s.

**Table 4 Low-Frequency Elements (Catalog Numbers)**

Power Range	Frequency Band .45 to 2.5 MHz
1000 watts	1000P
2500 watts	2500P
5000 watts	5000P
10000 watts	10000P

**Table 5 High Power Elements (Peak Only)**

Power Range	Frequency Bands (MHz)					
	25-60	50-125	100-250	200-500	400-1000	950-1260
500 watts	—	—	—	—	—	500J
1000 watts	—	—	—	—	—	1000J
2500 watts	2500A	2500B	2500C	2500D	2500E	2500J
5000 watts	5000A	5000B	5000C	5000D	5000E	5000J
10000 watts	10000A	10000B	10000C	10000D	10000E	—

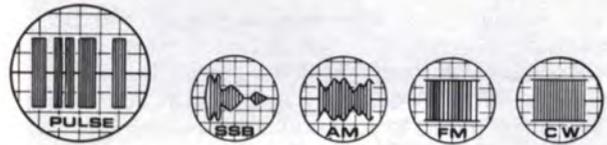
**Table 6 Milliwatt Elements**

100 mW	Cat. No.	250 mW	Cat. No.	500 mW	Cat. No.
72-76 MHz	430-2	70 MHz	430-34	72-76 MHz	430-33
105-120 MHz	430-6	72-76 MHz	430-22	105-120 MHz	430-26
125-136 MHz	430-9	108-118 MHz	430-24	240-290 MHz	430-27
160-175 MHz	430-10	130-150 MHz	430-13	328-336 MHz	430-28
328-336 MHz	430-3	150-180 MHz	430-15	455-470 MHz	430-30
400-420 MHz	430-7	328-336 MHz	430-16	800-900 MHz	430-109
450-470 MHz	430-8	800-900 MHz	430-108		
800-900 MHz	430-107	1700-1750 MHz	430-17		

Additional Accessory Elements on pages 32, 36.



## THRULINE® RF POWER ANALYST® model 4391



### New Peak/CW Digital Wattmeter:

Rugged RF Power Analyst® Model 4391 THRULINE® Wattmeters monitor 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., they need no attenuators, directional couplers or charts.

Model 4391 features a brighter display, abuse-tested long-stroke keyboard and range switches, built-in international power supply and charger, low-battery indication, RFI protection, and more.

It performs all the functions the 4380 series does as described on page 18, plus the measurement of peak envelope power of pulsed signals, as narrow as 0.8 microseconds at duty cycles of 0.01 percent or more, in either forward or reflected direction, all with the same Elements used for CW power.

Model 4391 has a built-in line section.

### Specifications models 4391, 4391-832 \*\*

**Power Range**<sup>①</sup> 100mW to 10kW using Bird Plug-in Elements.  
Accuracy not guaranteed with components not supplied by Bird.

**Frequency Range**<sup>②</sup> 0.45 to 2300MHz

**Insertion VSWR** with N Connectors 1.05 max. to 1000MHz,  
1.1 max. to 2300MHz

#### Accuracy

**Power Readings** ±5% of full scale CW, ±8% PEP

**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 & Return Loss)

**Sampling Rate** 2 to 3 readings per second

**Display** 3½ digit, 0.3" LED-strobed

**Modulation Frequency** 25 to 10,000Hz (Audio)

**Pulse Parameters** (min.) Pulse width 0.8 microsec. (100-2300MHz), 1.5 microsec. (26-99 MHz) and 15 microsec. (2-25MHz); Repetition Rate 25pps, and Duty Factor 1 x 10<sup>-4</sup> minimum

**Connectors** QC Type (Female N normally supplied)

**Finish** Blue vinyl with silver-anodized side panels

**Nominal Size** incl conn. 9<sup>9</sup>/<sub>16</sub>" x 6<sup>7</sup>/<sub>32</sub>" x 4<sup>9</sup>/<sub>16</sub>" (243 x 158 x 110mm)

**Weight** 5¾ lbs. (2.6kg)

**Battery Life** 8 hours (rechargeable)

**AC Power** 100-130/200-260V, 50/60Hz, 6W

**Optional Carrying Case** 4300-085: Power Analyst & 6 Elements & 4275-100 (Signal Sampler)

<sup>①</sup>Frequency band and power range is determined by Plug-in Element. Select two Elements in a 10:1 power ratio from Tables on pages 19, 31 or 32.

\*\*  RF POWER ANALYST units equipped with the proper rear panel connector for IEEE-488 as well as RS-232 interface capability require addition of the suffix -832 to the model number (e.g. order Model 4391-832). Requires Bird GPIB Interface unit on page 21.

## IEEE-488 Bus Interface Unit model 4380A-488

### IEEE-488 Bus Interface Unit model 4380A-488

**Applications:** Bird model 4380A-488 GPIB Interface enables:

- Automatic Measurement of data
- Unattended periodic measurement of one to nine RF signal parameters
- Parameter measurement at real-time level and/or minimum/maximum level occurring during logging interval
- Hard-copy print-out of large amount of tedious data
- Elimination of potential human error
- Graphic terminal or curve plotter feed for dependent variables display (e.g. attenuation vs frequency, output or SWR vs frequency, power vs time, etc.)
- Remote RF Power Analyst® interrogation and responsive readout
- Alarm or warning functions with decaying performance levels
- Go/no-go component quality control

**Description:** Combining microprocessor technology with the THRULINE® RF measurement system created not only speed, and digital readout with decimal point in place, but this new series 4380 RF Power Analyst® Wattmeters is now further enhanced by capability to tie to the IEEE-488 General Purpose Interface Bus (GPIB).

Bird model 4380A-488 Interface Unit provides access to the GPIB system for all Bird RF Power Analyst® Wattmeters. These new instruments can now become talker and listener by command of a controller on the bus.

The model 4380A-488 provides the following 488 Bus interface and subsets as set forth in the 488-1978 standard.

- Acceptor Handshake (AH1)—complete capability
- Source Handshake (SH1)—complete capability
- Talker Function (T5)—unaddressed to talk on MLA
- Listener Function (L4)—no listen only mode and unaddressed to listen on MTA
- Service Request (SR1)—complete capability
- Remote/Local (RL2)—no local lock out
- Parallel Poll (PPO)—no capability
- Device Clear (DC1)—complete capability
- Device Trigger (DT1)—complete capability

The addition of an optional 15-pin connector on the rear of all model 4380/4390 series portable or rack mounted Wattmeters provides signal paths which carry measurement commands, and return the resultant values. This connector and internal cabling is installed at the time of order when the suffix -832 is added to the model number (e.g. 4381-832). 4380/4390 series Wattmeters without this connector can be retrofitted at our plant.

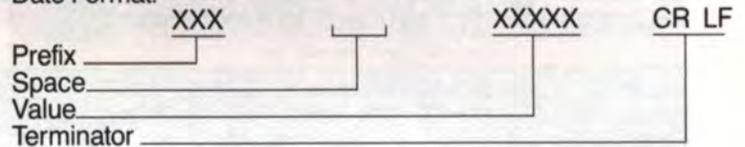


4380A-488  
(with 4391)★

### Specifications, model 4380A-488 Interface Unit

**Output:** 3½-digit ASCII format

Date Format:



Example 

N	F	C	0	.	1	2	3	CR	LF
---	---	---	---	---	---	---	---	----	----

Normal Forward Carrier at 0.123

**Logic Levels:** Meets all IEEE std. 488-1978 specifications

**Modes of Operation:** (Switch-selectable and Bus-selectable)

**Talk Only:** Allows the Wattmeter to output its keyboard initiated measurements to the Bus. This information can then be accepted by an IEEE-compatible listener.

**Addressable:** Allows the 4380A-488 to be addressed as a talker or a listener under the command of an IEEE-compatible controller.

**Logger:** A Bus-selected operation that allows measurements to be made repeatedly at time intervals chosen by the operator.

**Environment:** Operating Temp. Range +10°C to +50°C  
Storage Temp. Range -40°C to +100°C

**A.C. Power:** 100-130/200-260 VAC 50/60Hz

**Dimensions & Weight:** 5¾" x 3¼" x 10½" (137 x 82 x 267mm) overall; 2 lb. 10 oz. (1.2kg)

**Output Connector:** 24-pin IEEE-488 standard connector

**Cable Supplied:** 1—Connecting cable to Bird Wattmeter under control; length: 20 inches.

**Cable Optional:** 1m (3¼ ft) IEEE-488 Bus Interface cable, Bird P/N 5-317-1; 2m (6½ ft) IEEE-488 Bus Interface cable, Bird P/N 5-1317-2; Use of longer Bus Interface cables is not recommended.

\*Also available with Panel Mounted P/N 4380-600. See photo on page 22.

# THRULINE® RF POWER ANALYST® Digital Directional Wattmeters 2-1000MHz, 250W-250kW

For CW, FM, AM and TV transmission  
in 1 5/8", 3 1/8" and 6 1/8" Lines.

At the push of a button, these new digital RF Wattmeters:

- **Read** incident and reflected CW, FM, SSB/DSB and symmetrical AM power (Models 4382 and 4386) or CW, FM and TV power (Models 4384 and 4388).
- **Calculate** dB return loss, percent modulation and/or SWR.
- **Remember** your high and low readings when you adjust for specific levels.
- **Overrange** at least 20% beyond nominal full scale and will do all this with Plug-in Elements and RF Line Sections you may already own from other Bird THRULINE Wattmeters.

**Model 4382** Portable ① ②

**Model 4384** Portable ① ②

**Model 4300-080** Carrying Case for above

**Model 4386** Panel Mounted 4382 ②

**Model 4388** Panel Mounted 4384 ②

① *Charger included. Specify 115V or 230V*

② *Less line section, Elements and DC cables*

## Specifications

models 4382/84/86/88 and 4382/84/86/88-832\*\*

**Power Range** 250W to 250kW using Bird Plug-in Elements

**Frequency Range** 2 to 1000MHz

**Insertion VSWR** 1.05 max.

**Accuracy** ±5% of full scale CW (for Elements calibrated with the

line section and the RF Power Analyst); VSWR ±10% of reading

**Usable Overrange** to 120% of nominal full scale (for compliance with FCC 110% regulations without the need to buy and use higher power Elements)

**Sampling Rate** 2 to 3 readings per second

**Display** 3 1/2 digit LED-strobed 0.8" (4386, 4388)  
0.3" (4382, 4384)

**Finish** 4382, 4384 Light Navy grey baked enamel (MIL-E-15090) with black anodized side panels; 4386, 4388 Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** 4382, 4384 7 1/16" x 4 3/4" x 3 3/8" (195 x 121 x 86mm);

4386, 4388 19" x 5 7/32" x 4 7/16" (483 x 133 x 113mm) 3 RU

**Weight** 4382, 4384 2 1/4 lbs. (1kg); 4386, 4388 3 1/4 lbs. (1.5kg)

**Battery Life** 4382, 4384 8 hours (rechargeable)

**AC Power** 4382, 4384 115V or 230V, 50/60Hz, 6W (with AC Adaptor—specify voltage); 4388 115/230V, 50/60Hz, 8W (with integral selector switch)

① *Frequency band and power range is determined by Plug-in Elements. Select two Elements in a 10:1 power ratio from tables on right. For a calibrated back-up Element to verify your working Element's accuracy, we recommend buying two identical Elements—at least for forward power—at time of order and storing one in a safe, cool place.*

\*\*  RF Power Analyst units equipped with the proper rear panel connector for IEEE-488 as well as RS-232 interface capability require addition of the suffix -832 to the model number (e.g. order model 4382-832 or 4386-832). Requires Bird GPIB Interface unit on page 21. For offsite attended remote measurements (e.g. via telephone lines), a BIRD model 4380-232 instrument link will be available shortly. Call or write for information.



RF POWER ANALYST® Wattmeters also calculate parameter products that used to require tracing on a graph or chart, reveal whether AM modulation is present—desirable or undesirable, such as hum—and how much, and they make min./max. power level searches a breeze.

**1** To measure forward and reflected power, insert in the Line Selections two Elements with a 10:1 power ratio (for better resolution of the lower reflected levels) and set the range switches to match. Push FWD/CW or RFL/CW to read in watts or kilowatts while making equipment adjustments, or push SWR to find the optimum match. The memory circuit also retains MIN and MAX readings when monitoring transmitter stability over an extended period of time.

**2** Transmitters are routinely measured at higher than rated power—some FCC rules **require** measurement at 110%. The instrument's 120% of overrange on each Plug-in Element lets you measure at these levels without changing Elements and with "up-scale" accuracy. Think of it: You get an additional 20% beyond full-scale power, and at much better accuracy than obtainable if you had to switch to the next higher-power Element and read it downscale.

**3** Built-in memory recalls max. and min. signal levels which occurred since the last measurement, at the push of the MIN or MAX buttons. Keep track of level excursions during specified intervals (e.g. 24 hours, a week, etc.)

**Models 4382 and 4386** read peak envelope power in either direction with the same Elements used for CW power. They are so sensitive that you can measure a 1% ripple of hum on a carrier by pushing %MOD, if you notice a difference in the PEP and CW readings. That feature alone is likely to solve signal mysteries. Desirable AM modulation up to 99.9 percent is also displayed.

**Models 4384 and 4388** are designed to read average power of Black Level TV transmissions (as well as CW and FM signals), in exactly the same fashion as Bird THRU-LINE® analog wattmeters in current broadcast use. With either type of instrument, PEP is obtained by multiplying the black level readings by 1.68.

**Plug-in Elements and Line Sections:** Models 4382, 4384, 4386, 4388 RF POWER ANALYST are designed to work with the double socket Line Sections and Elements listed here. Select 2 Elements with a Power Range ratio of 10:1. (Elements must be calibrated with the Wattmeter to insure stated accuracy.)

**For 1½" systems:** 4715-000 1½" EIA Flg double socket line or 4723-000 1½" Unflg double socket line and two Elements from:

**Table 1½A**  
Standard Elements (Catalog Numbers)\*

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
250 watts		250A1	250B1	250C1	250D1	250E1
500 watts		500A1	500B1	500C1	500D1	500E1
1000 watts	1000H1	1000A1	1000B1	1000C1	1000D1	1000E1
2500 watts	2500H1	2500A1	2500B1	2500C1	2500D1	2500E1
5000 watts	5000H1	5000A1	5000B1	5000C1	5000D1	5000E1
10kW	10KH1	10KA1	10KB1			
25kW	25KH1	*When ordering, specify catalog number and line section model number.				

**For 3½" systems:** 4610-000 3½" EIA Flg double socket line; or 4802-000 3½" Unflg double socket line and two Elements from:

**Table 3½A**  
Standard Elements (Catalog Numbers)\*

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
1000 watts		1000A3	1000B3	1000C3	1000D3	1000E3
2500 watts		2500A3	2500B3	2500C3	2500D3	2500E3
5000 watts	5000H3	5000A3	5000B3	5000C3	5000D3	5000E3
10kW	10KH3	10KA3	10KB3	10KC3	10KD3	10KE3
25kW	25KH3	25KA3	25KB3	25KC3	25KD3	25KE3
50kW	50KH3	(50KA4	50KB4	50KC4)	**	
100kW	100KH3	*When ordering, specify catalog number and line section model number.				

\*\*The special 50kW Elements inside the parentheses must be used with special line sections 4616-000 or 4808-010 listed on page 34. The 50KC4 Element should not be used above rated 3½" line power of 35kW.

**For 6½" systems:** 4905-000 6½" EIA Flg double socket line; or 4909-000 6½" Unflg double socket line and two Elements from:

**Table 6½A**  
Standard Elements (Catalog Numbers)\*

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
2500 watts		2500A6	2500B6	2500C6	2500D6	2500E6
5000 watts		5000A6	5000B6	5000C6	5000D6	5000E6
10kW		10KA6	10KB6	10KC6	10KD6	10KE6
25kW	25KH6	25KA6	25KB6	25KC6	25KD6	25KE6
50kW	50KH6	50KA6	50KB6	50KC6	50KD6	50KE6
100kW	100KH6	*When ordering, specify catalog number and line section model number.				
250kW	250KH6					

Order two P/N 3170-058-3 DC cable assemblies (25') to complete your package (except for 6½" systems; order two P/N 3171-010)

Also see Coupling Kits (page 36)

# High Speed WATTCHER® RF Monitoring Systems models 3170/71

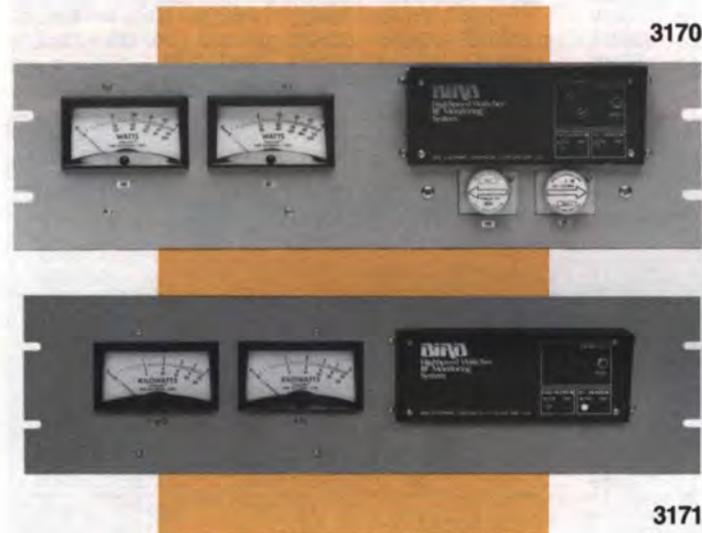
Adds protection for your substantial investment in transmitting equipment from damage—and loss of air time—when faults cause high standing waves.

Based on the accurate power level measurements of its reliable THRULINE® Directional Wattmeter, this solid state Watcher System will...

- display a continuous, simultaneous view of VSWR conditions and power output, which can be remoted.
- provide a fast fault response time—250 times faster than other monitors—for forward and reflected power monitoring.
- signal forward power drop-off below a set level (e.g. to conform to appropriate FCC requirements).
- activate audible/visual alarms when reflected power increases.
- allow remote reset in event of false alarm or momentary disturbance which leaves transmission unimpaired.

Watcher 3170/71 RF Monitoring System warns a remote operator of (1) low power due to detuning, component deterioration, or AC line difficulties, (2) high VSWR due to antenna icing, transmission line problems, physical accidents, lightning strikes, etc.

If the disturbance is not catastrophic and equipment returns to acceptable operating status, the alarm system can be reset from many miles away. An engineer needs to be dispatched to the transmitter site only when the alarm cannot be deactivated by the remote reset.



## Specifications

### model 3170

- Power Range** 100mW to 10kW using Bird Plug-in Elements.  
Accuracy not guaranteed with components not supplied by Bird.
- Frequency Range** 0.45 to 2300MHz see Element Tables (page 31)
- Accuracy** ±5% of full scale
- Meter Scales** FWD and RFL 25, 50, and 100W
- Insertion VSWR** with N Connectors 1.05 max. to 1000MHz, 1.1 max. to 2300MHz
- Connectors** QC Type (Female N normally supplied)
- Controls** Front Panel: Push-to-RESET button; Behind Front Panel: FWD and RFL trip level set controls (screwdriver adjust)
- Alarms** Audible: Front Panel Buzzer, Visual: "Active" and "Trip" LED's for both FWD and RFL Monitors
- Response Time** 25 microsec., max.
- Activate Forward Monitor Delay** 73 microsec. to 50 millisecond nominal (adjustable)
- Inputs and Outputs** TTL compatible +5V logic. Outputs for remote meter
- Finish** Light Navy grey baked enamel (MIL-E-15090)
- Nominal Size** 19" x 5<sup>7</sup>/<sub>32</sub>" x 9<sup>5</sup>/<sub>16</sub>" (488 x 133 x 237mm) 3 RU
- Weight** 9 lbs. (4.1kg)
- AC Power** 115/230V, 50/60Hz, 10W max. (rear panel selector switch)

### models 3171 and 3171-020

- Power Range** 250W to 100kW using special Bird Plug-in Elements
- Frequency Range** 2 to 1000MHz see 3171 and 3171-020 Element Tables (page 33)
- Accuracy** ±5% of full scale (for Elements calibrated with the Watcher)
- Meter Scales** FWD and RFL (3171) 5, 10, and 25, (3171-020) 15, 30 and 60
- Insertion VSWR** 1.05 max.
- Controls** Front Panel: Push-to-RESET button; Behind Front Panel: FWD and RFL trip level set controls (screwdriver adjust)
- Alarms** Audible: Front Panel Buzzer, Visual: "Active" and "Trip" LED's for both FWD and RFL Monitors
- Response Time** 25 microsec., max.
- Activate Forward Monitor Delay** 73 microsec. to 50 millisecond nominal (adjustable)
- Inputs and Outputs** TTL compatible +5V logic. Outputs for remote meter
- Finish** Light Navy grey baked enamel (MIL-E-15090)
- Nominal Size** 19" x 5<sup>7</sup>/<sub>32</sub>" x 9<sup>5</sup>/<sub>16</sub>" (488 x 133 x 237mm) 3 RU
- Weight** 9 lbs. (4.1kg)
- AC Power** 115/230V, 50/60Hz, 10W max. (rear panel selector switch)

Also available for rigid line systems with full scale requirements of 300 to 6000W (1<sup>5</sup>/<sub>8</sub>"\*), 1.5 to 30kW (3<sup>1</sup>/<sub>8</sub>"\*) and 3 to 60kW (6<sup>1</sup>/<sub>8</sub>"\*) is high speed WATTCHER Model 3171-020 (above group) and WATTCHER Model 3126 (group on top of next page), with meter scales marked 15/30/60. Except for Plug-in Elements, all other accessories and specifications are identical to the respective models above.

# WATTCHER® RF Power Monitor/ Alarm model 3127/28

Installations which do not require the fast response time and the forward-power drop-off alarm of Models 3170/71 are protected from high VSWR by WATTCHER Models 3127 and 3128.

Abnormal load conditions quickly cause transmitter shut-down, a buzzer alarm and a change of illumination color of the reset button from green to red. Audible and visual alarms indicating system malfunction may be removed. Fail-Safe or Non-Fail-Safe Modes are switch-selectable and the Reflected Power meter-relay has a front-adjustable trip-level.

3127



3128

## Specifications

models 3126 and 3127

**Power Range** 250W to 250kW using Bird Plug-in Elements

**Frequency Range** 2 to 1000MHz

**Accuracy** ±5% of full scale (for Elements calibrated with the Wattcher)

**Meter Scales** 3126: FWD 15, 30, and 60; RFL 1.5, 3 and 6;  
3127: FWD 5, 10, and 25; RFL 1, 2.5 and 5

**Insertion VSWR** 1.05 max.

model 3128

**Power Range** 100mW to 10kW using Bird Plug-in Elements

**Frequency Range** 0.45 to 2300MHz

**Accuracy** ±5% of full scale

**Meter Scales** FWD and RFL 25, 50 and 100

**Insertion VSWR** with N Connectors 1.05 max. to 1000MHz,  
1.1 max. to 2300MHz

## Common Specifications (3126, 3127, 3128)

**Controls** Front Panel: Push-to-RESET button & Reflected Power Limit Set (Screwdriver adjust), Rear Panel: Fail-Safe/Non Fail-Safe Mode Selector Switch, Normal Open/Normal Closed Alarm Contacts (8 Amps at 115 VAC non-inductive) and Fuse-out Indicator

**Alarms** Audible: Front Panel Buzzer; Visual: Reset Button lights red

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size:** 19" x 5<sup>7</sup>/<sub>32</sub>" x 6<sup>5</sup>/<sub>8</sub>" (483 x 133 x 127mm) 3 RU

**Weight** 9 lbs. (4.1kg)

**AC Power** 115/230V, 50/60Hz, 10W

## Ordering List

WATTCHER	Model No.					
	3170	3171	3171-020	3126	3127	3128
Line Section from Table No.		D	D	D	D	C
Incident Power Element — W Full Scale from Tables	1,2 3,4 & 6	1½A A	1½BB	1½B	1½A	1,2
Reflected Power Element — W Full Scale from Tables		3½A A	3½BB	3½B	3½A	3,4
Two DC Cables from Tables		6½A A	6½BB	6½B	6½A	& 6
		F	F	E	E	E

For Element Tables 1, 2, 3, 4, 6 and 1½, 3½, 6½A or B, and 1½, 3½ or 6½AA or BB see pages 31, 33.

Table F

Part No.	Length
3170-058-1	14 Inches
3170-058-2	15 Feet
3170-058-3	25 Feet*
3170-010	25 Feet**
3170-058-4	40 Feet
3170-058-5	50 Feet

\*included with WATTCHER

\*\*included with 6½" Line Section

## DC Cables

(order only if length other than 25 ft. is desired)

Table E

Part No.	Length
4220-097-7	10 Feet
4220-097-9	15 Feet
4220-097-10	25 Feet*
4220-077-1	25 Feet**
4220-097-17	50 Feet

\*included with WATTCHER

\*\*included with 6½" Line Section

Table D

Line Section Model Numbers	Connector
4715-000	1½" EIA FI
4610-000	3½" EIA FI
4802-000	3½" Unfl
4905-000	6½" EIA FI
4723-000	1½" Unfl
4909-000	6½" Unfl
4616-000	3½" EIA FI } 50kW
4808-010	3½" Unfl } only

## Line Sections

Table C

Line Section Model Numbers	Connector
4230-053	QC
4522-002-5	QC

Notes: 4230-053 has two element sockets on opposite sides, while 4522-002-5 has two sockets side by side (for ease of panel mounting).

Order two QC-Quick Change Connectors of your choice (page 35).

## Test Sets

Specific instruments and accessories have been assembled into Test Sets as our response to customers' general needs to support either an industry function (e.g. 2-way servicing), or to facilitate maintenance of a specific piece of equipment, such as tactical radios (e.g. PRC-77, VRC-12, PRC-68, etc.) or flight control site installations. A good illustration of Bird military test sets are the 4110-182 and 4110-200 sets shown on the next page, 4410-025 and 4410-030 sets (page 9), as well as the series 4130 Tactical Radio Test Sets below.

More than a dozen Test Sets have been configured with cables, as many as 18 Plug-in Elements and a ruggedized version of the model 43 Wattmeter. These have been devised and supplied to the Federal Aviation Administration (FAA) to meet critical Flight Safety needs and applications.

Our first involvement with Test Sets for the Armed Forces was the AN/URM-43, replaced subsequently by the TS-118, the 4110-182 and currently the 4130. These state-of-the-art analog and digital instruments provide simple operation and accurate RF measurement under field conditions. We would be pleased to discuss a specific design for your particular application.



**Tactical Radio Test Sets series 4130** are self-contained in a rugged case designed to withstand very adverse environmental conditions including immersion. Available functions include RF power and frequency measurement such as forward power, reflected power, VSWR, relative field strength, and transmitter frequency. Also included is a complex output signal for checking relative FM receiver sensitivity and tone squelch performance. Available models cover the 30-90MHz range, with other ranges currently in design.

The Test Set shown is customized for radios with output power of 1-100 watts at 30-80MHz and has direct-reading VSWR capability. This feature makes it unnecessary for

field personnel to take forward and reflected power readings and calculate VSWR. Acceptable transmitter/antenna match conditions can be specified in VSWR levels only, thus simplifying maintenance of tactical communications equipment.

Please contact us for quantity applications of this or other frequency/power range Test Sets.



**A Professional Mobile-Service Test Kit!** The outfitted carrying case pictured here (Test Set 4300-064) is equipped to specifically meet the needs of the technician who services mobile communications equipment.

This compact, super-convenient kit is comprised of:

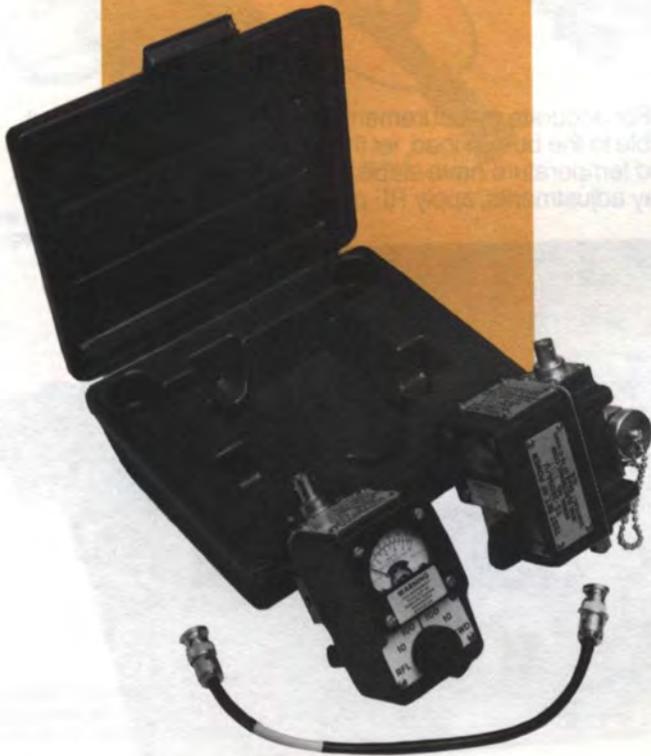
- One Model 43 THRULINE® Wattmeter (standard QC-N/F connectors)
- One Model 4275-100 RF Sampler with variable level control and mounting screws
- Two UHF/F QC Connectors (SO-239)
- One Model 8164 100W "dry load" TERMALINE® Load Resistor (standard QC-N/F connector)

Included FREE of extra charge:

- Instruction Manual (P/N 920-43)
- Laminated VSWR chart (P/N 4400-012)
- Cushion-fit inset equipped, one-piece, hi-density, polyethylene carrying case (P/N 4300-061) with nests for seven Plug-in Elements and all of the other items listed above.

When purchasing Test Set 4300-064, order as many or as few elements as your present needs dictate. They will be added to the price of the kit.

(If you just need a case for your present equipment, order P/N 4300-061.)



**Mobile & Avionics Communications** support test equipment is available with an integral conduction-cooled load resistor (e.g. model 4127 for AN/PRC-70 radios) or Test Sets like the 4110-182 shown. Thousands of these have already been purchased by the U.S. Army and foreign governments.

Units in this group are manufactured from materials specially selected for critical environments.

## High Accuracy Power Measurement

RF or AC power can be expressed or measured as  $EI \cos\theta$ ,  $I^2R$ ,  $E^2/R$  or heat/time. Since RF power is a derived quantity—i.e. it cannot be measured directly—the final accuracy depends on how precisely the individual parameters (E, I, R, heat) can be measured. Bird wattmeters sample voltages proportional to line voltage or directional currents, rectify them and display the resulting DC on a meter. The overwhelming advantage of this method is time and convenience. However, the most accurate means known to measure high RF power (e.g. 50-80,000 watts) is to terminate it in a liquid-cooled 50 ohm Load and measure the rise in coolant temperature at a constant flow rate, then recreate identical conditions at 50-60Hz AC power which can be measured with NBS traceable accuracy.

Almost as accurate is the direct RF power measurement using Bird Calorimeters with separate or built-in loads (page 28, 29) or with a MODULOAD® heat-exchanger load system (page 30). While substitution calorimetry can, of course, be performed with all models, making direct measurements with accuracies exceeding FCC regulations requires no special skill and little time.

With CW or FM, the power indicated is the same as that measured by our average reading THRULINE® Wattmeters, which makes the Bird Calorimeter an ideal in-house calibration instrument. With a black-level TV transmission, the indicated power will be 60.1% of peak (as compared to 59.6% on an analog wattmeter).

Modulating an AM carrier 100% with a pure single tone will increase the calorimeter reading by 50%, measuring the average power contained in the sidebands in addition to the carrier. In other words, the calorimeter's digital readout always indicates the heating power dissipated **in the load resistor**.

## Digital wide-range RF Calorimeter models 6090-115, 230

This Digital RF Calorimeter/Load Resistor combines convenience, speed and simplicity below 1000 watts with a self-cooled 50 ohms termination.

For accurate measurement simply connect the RF input cable to the built-in load, let the system run until coolant flow and temperature have stabilized, make two simple zero display adjustments, apply RF power and read.



### Specifications

model 6090 -115, 230

**Power Range** 50 to 1000W

**Frequency Range** dc to 3500MHz

**VSWR** with N Connectors 1.10 max. from dc to 1000MHz; 1.25 max. from 1000 to 3500MHz

**Accuracy** ±1.5% of reading with Correction factor (100 to 1000W)  
±3.0% of reading without Correction factor (50 to 1000W)

**Ambient Temperature Range** +10°C to +30°C

**AC Power** 115V 60Hz units with -115 suffix, 230V 50Hz  
-230 suffix 280W

**Connector N** (Female)

**Cooling Liquid Volume** .74 quarts (700 ml)

**Finish** Housing: Semi-Gloss black enamel; Panel: Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** 23<sup>3</sup>/<sub>8</sub>" x 17<sup>3</sup>/<sub>4</sub>" x 7<sup>1</sup>/<sub>4</sub>" (600 x 451 x 184mm)

**Weight** incl. coolant 36 lbs. (16.4kg)



6080-115

## Digital Hi-Power Wide-range Calorimeter 1000W to 80kW models 6080/81-115, -230

- Measure RF power quickly with precision after simple set-up
- Automatically processes all sensor inputs
- Display power directly without charts or calibration
- Conveniently portable or rackmounted

The 6080 Calorimeter is designed for use with well-matched water-cooled line terminations such as the Bird 10kW-80kW TERMALINE® Load Resistors (which must be ordered separately). To make precision measurements, place the flow and temperature sensors in series with the cooling water, let the liquid run until readings have stabilized, adjust the display to indicate zero, apply RF power and read!

No waiting for stabilization after the first reading, i.e. power readings can be taken in seconds with ±3% accuracy. The sensor outputs are transferred through a heavily shielded cable (up to 40 ft. long) to the main control unit, which processes the data for direct digital reading in kilowatts:

Flow-rate x Temperature differential x Specific heat x Conversion constant = RF Power.

Interpolation of flow rates, position of mercury columns in hard-to-read thermometers, and of system constants has been completely eliminated.



Flow and temperature sensors



Sensors mounted on a Load, which must be ordered separately

### Specifications

**Power Range** Low Range 1 to 10kW; High Range 10 to 80kW

**Frequency Range** Not frequency dependent

**Accuracy** ±3% of reading

**Digital Display** ½" Red LED

**Output Signal** BCD with positive TTL logic

**Ambient Temperature Range** +5°C to +40°C

**Shielded Cable Length** 8 ft. (2.4m). Longer lengths to 40 ft. optional at time of order

**Overrange Protection** Limited only by load used

**Water Flow** Low Range: 2 to 4 GPM (7.6 to 15.1 liters/min.); High Range: 5 to 10 GPM (18.9 to 37.9 liters/min.)

**Stabilization Time** 5 minutes min.

**Water Purity** Any potable water

**Finish** Housing (6080) Dark blue enamel with brushed aluminum trim; Panel (6081) Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** Housing (6080) 11" x 57/32" x 9 5/8" (279 x 133 x 245mm); Panel Version (6081) 19" x 7" x 11" (483 x 178 x 279mm) 4 R.U.

**Weight** Housing 7 lbs. 6 oz. (3.4kg); Panel Version (6081) 8 lbs. (3.6kg); Sensor Array 2 lbs. 10 oz. (1.2kg)

**AC Power** 115V 50/60Hz units with -115 suffix, 230V 50/60Hz -230 suffix

**Load Resistor** Optional—see Econoload® Series of water cooled loads, 10 to 80kW



6081-230

# MODULOAD® RF Calorimeter/ Load Resistors 10kW, 25kW & 50kW series

This calorimetric system combines the sensors, data processing and readout unit described on the preceding page with the economy of MODULOAD self-cooled RF Load Resistors. No connections to a running water supply are necessary and the large digital display can be separated from the load by as much as 40 ft.

The traditionally low VSWR of MODULOAD terminating systems contributes to measurement certainty, and assures accurate termination of 50-ohm lines during off-line or off-the-air tests and maintenance of transmitters in locations where water supply is unreliable, expensive or simply not available. The Loads are protected by electrical interlocks

and by a time delay before application of RF power. Resistor elements are rugged, withstand shock and—in the event of accidental burn-out—can be replaced on site in 30 minutes, a unique critical time and money saving feature.



8645-632  
on optional Dolly  
6771-011

## Specifications

**VSWR** 1.1 max.

**Accuracy** ±2½% of reading (above 5kW for 8645 & 10kW for 8655 series)

**Digital Display** ½" Red LED's

**Output Signal** BCD with positive TTL logic

**Cable** connecting Load and Calorimeter: 8 ft. (2.4m) shielded cable. Longer lengths (to 40 ft.) optional at time of order

**Stabilization Time** 5 minutes min.

**Coolant** 100% Water or 65% Water with 35% industrial Ethylene Glycol

**Operating Position** Horizontal only

**Finish** Load Light navy grey baked enamel (MIL-E-15090)

Calorimeter Dark blue enamel

**AC Power** 115V, 60Hz or 230V, 50Hz (In the model number, the 7th digit identifies line power: Insert 1 for 115 volts 60Hz or 2 for 230 volts 50Hz)\*\*\*

**Optional Dolly** 8630/8640 6771-011, 8650 6772-011

Power Rating	Frequ. Range	Connector			Ambient Temperature Range	Coolant	Nominal Size (Load)	Weight
		1½ EIA FI	3½ EIA FI	3½ Unfl				
10kW series	1kHz-1GHz	8635-60_	8631-60_	8638-60_	+5° to +40°C	Potable Water	{ 22½" x 15½" x 15½" (562 x 405 x 402mm)	{ 115 lbs. (52kg)
10kW series	1kHz-1GHz	8635-63_	8631-63_	8638-63_	-5° to +35°C	⅓ Ethylene Glycol		
25kW series	1kHz-900MHz		8645-60_	8646-60_	+5° to +30°C*	Potable Water	{ 25½" x 19½" x 19½" (659 x 487 x 497mm)	{ 184 lbs. (84kg)
25kW series	1kHz-900MHz		8645-63_	8646-63_	-5° to +25°C*	⅓ Ethylene Glycol		
50kW series	1kHz-900MHz		8655-60_	8656-60_	+5° to +30°C**	Potable Water	{ 46½" x 19½" x 19½" (1181 x 487 x 497mm)	{ 227 lbs. (126kg)
50kW series	1kHz-900MHz		8655-63_	8656-63_	-5° to +25°C**	⅓ Ethylene Glycol		

\* for power not exceeding 20kW: add +10°C to upper limit

\*\* for power not exceeding 40kW: add +10°C to upper limit

## BIRD Plug-In Elements

All Bird Elements are calibrated in accordance with meticulous Bird calibration procedures, supported by a quarter century 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. Listed accuracies can, of course, not be guaranteed with components not supplied by Bird.

We have assembled here the 445 most popular Elements for your choice, yet in most applications one or two will suffice. The large selection, however, permits you to almost customize your Bird Wattmeter. Also, when ordering Elements always specify the wattmeter or line section number for which they are intended.

**Consult match-confirmation table on page 32 (top).**

**Plug-In Elements:** When ordering, specify catalog number and THRULINE model number.

**Table 1**  
Standard Elements (Catalog Numbers)

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

**Table 2**  
Low-Power Elements

1 watt	Cat. No.	2.5 watts	Cat. No.
30-35 MHz	030-1	30-40 MHz	030-2
35-40 MHz	035-1	40-50 MHz	040-2
40-50 MHz	040-1	50-60 MHz	050-2
50-60 MHz	050-1	60-80 MHz	060-2
60-80 MHz	060-1	80-95 MHz	080-2
80-95 MHz	080-1	95-150 MHz	095-2
95-125 MHz	095-1	150-250 MHz	150-2
110-160 MHz	110-1	200-300 MHz	200-2
150-250 MHz	150-1	250-450 MHz	250-2
200-300 MHz	200-1	400-850 MHz	400-2
275-450 MHz	275-1	800-950 MHz	800-2
425-850 MHz	425-1		
800-950 MHz	800-1		



**Table 3**  
High-Frequency Elements (Catalog Numbers)

Power Range	Frequency Bands (MHz)			
	950-1260	1100-1800	1700-2200	2200-2300
1 watt	1J	1K	1L	1M
2.5 watts	2.5J	2.5K	2.5L	2.5M
5 watts	5J	5K	5L	5M
10 watts	10J	10K	10L	10M
25 watts	25J	25K	25L	25M
50 watts	50J			
100 watts	100J			
250 watts	250J			

Accuracy ±8% o.f.s.

**Table 4**  
Low-Frequency Elements (Catalog Numbers)

Power Range	Frequency Band .45 to 2.5 MHz
1000 watts	1000P
2500 watts	2500P
5000 watts	5000P
10000 watts	10000P

**Table 5**  
High Power Elements (Peak Only)

Power Range	Frequency Bands (MHz)					
	25-60	50-125	100-250	200-500	400-1000	950-1260
500 watts	—	—	—	—	—	500J
1000 watts	—	—	—	—	—	1000J
2500 watts	2500A	2500B	2500C	2500D	2500E	2500J
5000 watts	5000A	5000B	5000C	5000D	5000E	5000J
10000 watts	10000A	10000B	10000C	10000D	10000E	

**Table 6**  
Milliwatt Elements

100 mW	Cat. No.	250 mW	Cat. No.	500 mW	Cat. No.
72-76 MHz	430-2	70 MHz	430-34	72-76 MHz	430-33
105-120 MHz	430-6	72-76 MHz	430-22	105-120 MHz	430-26
125-136 MHz	430-9	108-118 MHz	430-24	240-290 MHz	430-27
160-175 MHz	430-10	130-150 MHz	430-13	328-336 MHz	430-28
328-336 MHz	430-3	150-180 MHz	430-15	455-470 MHz	430-30
400-420 MHz	430-7	328-336 MHz	430-16	800-900 MHz	430-109
450-470 MHz	430-8	800-900 MHz	430-108		
800-900 MHz	430-107	1700-1750 MHz	430-17		

Consult this table to confirm that you selected Elements for your meter or instrument from the right table(s).

Elements in Tables Nos:	Are useable with the following model instruments and mounted meters (within limits listed in Specifications)
1, 2, 3, 4, 6, 14	43, 4430, 4431, 4521, 4522, 4526, 4527, 3128, 3170, 3900, 6151
1, 2, 3, 4, 5, 6, 14	4314, 4381, 4383, 4385, 4387, 4391
8	4305 only
9, 10, 11, 12, 14	4410, 4410A, 4410P, 4411, 4412
1% <i>A</i> , 3% <i>A</i> , 6% <i>A</i>	4712, 4715-200, 4720, 4723-200, 460, 4610-200, 4805, 4802, 4902, 4905-200, 4907, 4909-200, 4382, 4384, 4386, 4388, 3127. Mounted meters: 3127-035, 3127-055, 3127-040, 6810-009-7, 6810-020
1% <i>B</i> , 3% <i>B</i> , 6% <i>B</i>	4712-037, 4715-300, 4600-037, 4610-300, 4805-037, 4802-300, 4902-037, 4905-300, 3126. Mounted meters: 3127-070, 3127-080, 3127-075, 6810-007, 6810-030
6% <i>C</i>	4902-080, 4907-080, Meter 6810-005
1% <i>AA</i> , 3% <i>AA</i> , 6% <i>AA</i>	3171
1% <i>BB</i> , 3% <i>BB</i> , 6% <i>BB</i>	3171-020
15	All of the above models using 1% Line Sections
16	All of the above models using 3% Line Sections
17	All of the above models using 6% Line Sections

Table 8  
Plug-in Elements (usable only with Model 4305)

Frequency (MHz)	Power	Catalog No.
.45-2.5	25kW	25KP7
2-30	10kW	10KH7
25-60	2500W	2500A7
25-60	5000W	5000A7
50-125	2500W	2500B7
50-125	5000W	5000B7
100-250	2500W	2500C7
200-500	2500W	2500D7
400-1000	2500W	2500E7
1100-1800	50W	50K7
1100-1800	100W	100K7

For Signal Leveling, Frequency Control, Wave-shape Monitoring, Local Oscillator or Marker Signal Injection, etc. Series 4274 RF Directional Coupler Plug-in Elements are similar in design to the many power measuring Elements available for the various 50 ohm THRULINE Wattmeters. They extract a calibrated amount of power from the main line signal flowing in the direction of the arrow. This attenuated signal is NOT rectified (as in the standard measuring Elements), but is brought out through a female BNC connector on top of the Element. Even though the 4274 series Coupler Elements fit the standard sockets, there are no dc output tabs on the Element body since no dc is produced. There is an added convenience to this construction which has not received the deserved attention: Since the couplers are directional, rotating them between 0° and 180° varies the amount of coupling like a variable attenuator. Minimum attenuation of the main line signal is the NOMINAL COUPLING ±1dB shown for each unit within the stated FREQUENCY BAND.

Table 14

Catalog Number	Frequency Band	Nominal Coupling	Max. Main Line Power	
400-50	50-100MHz	-40dB	1,000W	FOR QC-TYPE, CABLE, OR 1/8" EIA LINE*
400-75	75-150	-40dB	1,000W	
400-125	125-250	-40dB	1,000W	
400-225	225-450	-40dB	1,000W	
350-400	400-800	-35dB	500W	
300-750	750-1250	-30dB	100W	

Table 15

Catalog Number	Frequency Band	Nominal Coupling	Max. Main Line Power	
501-50	50-100MHz	-50dB	10,000W	FOR 1/8" EIA LINE
501-75	75-150	-50dB	10,000W	
501-125	125-250	-50dB	10,000W	
501-225	225-450	-50dB	10,000W	
451-400	400-800	-45dB	5,000W	
401-750	750-1250	-40dB	1,000W	

Table 16

Catalog Number	Frequency Band	Nominal Coupling	Max. Main Line Power	
553-50	50-100MHz	-55dB	25,000W	FOR 3/8" EIA LINE
553-75	75-150	-55dB	25,000W	
553-125	125-250	-55dB	25,000W	
553-225	225-450	-55dB	25,000W	
503-400	400-800	-50dB	15,000W	
503-750	750-1250	-50dB	10,000W	

Table 17

Catalog Number	Frequency Band	Nominal Coupling	Max. Main Line Power	
606-50	50-100MHz	-60dB	50,000W	FOR 6/8" EIA LINE
606-75	75-150	-60dB	50,000W	
606-125	125-250	-60dB	50,000W	
606-225	225-450	-60dB	50,000W	
556-400	400-800	-55dB	25,000W	

\*Wide-Range non-directional RF Sampler Element model 4274-025 covers 2-1000MHz. Approximate signal-sample levels are -50dB ±2dB from 1000MHz to 25MHz, decreasing to -66dB at 2MHz, Max. Main Line Power is 500W. Typical series 4274 photo on page 4.

Table 9

Table 10

Table 11

Table 12

Full-Scale Power and Frequency (MHz) Ranges of 4410 Elements							
0-10, 30, 100, 300 milliwatts 1, 3, 10 watts		0-100, 300 milliwatts 1, 3, 10, 30, 100 watts		0-1, 3, 10, 30, 100, 300, 1000 watts		0-10, 30, 100, 300, 1000, 3000, 10,000 watts	
MHz	P/N	MHz	P/N	MHz	P/N	MHz	P/N
30-50	4410-20	25-80	4410-10	2-30	4410-3	0.2-0.535	4410-1
50-88	4410-21	50-125	4410-11	25-80	4410-5	0.45-2.5	4410-2
88-108	4410-27	100-250	4410-12	50-200	4410-6	2-30	4410-4
100-152	4410-22	400-1000	4410-14	200-1000	4410-8		
150-250	4410-23						
225-400	4410-24						
400-800	4410-25						
800-900	4410-26						

Elements on this page must be calibrated in the Wattmeter with which they will be used to insure stated accuracy. To avoid the inconvenience of returning an entire wattmeter for recalibration (e.g. if an Element has been dropped, etc.), we recommend ordering Elements in identical pairs and storing one in a safe place, after recording the meter readings of each twin.

**Table 1½ A Standard Elements**

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
250 watts		250A1	250B1	250C1	250D1	250E1
500 watts		500A1	500B1	500C1	500D1	500E1
1000 watts	1000H1	1000A1	1000B1	1000C1	1000D1	1000E1
2500 watts	2500H1	2500A1	2500B1	2500C1	2500D1	2500E1
5000 watts	5000H1	5000A1	5000B1	5000C1	5000D1	5000E1
10kW	10KH1	10KA1	10KB1			
25kW	25KH1					

**Table 1½ AA**

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
250 watts		250A12	250B12	250C12	250D12	250E12
500 watts	500H12	500A12	500B12	500C12	500D12	500E12
1000 watts	1000H12	1000A12	1000B12	1000C12	1000D12	1000E12
2500 watts	2500H12	2500A12	2500B12	2500C12	2500D12	2500E12
5000 watts	5000H12	5000A12	5000B12	5000C12	5000D12	5000E12
10kW	10KH12	10KA12	10KB12			

**Table 3½ A Standard Elements**

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
1000 watts		1000A3	1000B3	1000C3	1000D3	1000E3
2500 watts		2500A3	2500B3	2500C3	2500D3	2500E3
5000 watts	5000H3	5000A3	5000B3	5000C3	5000D3	5000E3
10kW	10KH3	10KA3	10KB3	10KC3	10KD3	10KE3
25kW	25KH3	25KA3	25KB3	25KC3	25KD3	25KE3
50kW	50KH3	(50KA4	50KB4	50KC4)**		
100kW	100KH3					

**Table 3½ AA**

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
1000 watts		1000A32	1000B32	1000C32	1000D32	1000E32
2500 watts	2500H32	2500A32	2500B32	2500C32	2500D32	2500E32
5000 watts	5000H32	5000A32	5000B32	5000C32	5000D32	5000E32
10kW	10KH32	10KA32	10KB32	10KC32	10KD32	10KE32
25kW	25KH32	25KA32	25KB32	25KC32	25KD32	25KE32
50kW	50KH32	(50KA42	50KB42	50KC42)**		
100kW	100KH32					

\*\* The special 50kW Elements inside the parentheses must be used with special line sections 4616-000, 4617-000, 4808-000, 4808-010 or 4808-020 listed on page 37. The 50KC4 and 50KC42 Elements should not be used above rated 3½" line power of 35kW.

**Table 6½ A Standard Elements**

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
2500 watts		2500A6	2500B6	2500C6	2500D6	2500E6
5000 watts		5000A6	5000B6	5000C6	5000D6	5000E6
10kW		10KA6	10KB6	10KC6	10KD6	10KE6
25kW	25KH6	25KA6	25KB6	25KC6	25KD6	25KE6
50kW	50KH6	50KA6	50KB6	50KC6	50KD6	50KE6
100kW	100KH6					
250kW	250KH6					

**Table 6½ AA**

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
2500 watts		2500A62	2500B62	2500C62	2500D62	2500E62
5000 watts		5000A62	5000B62	5000C62	5000D62	5000E62
10kW	10KH62	10KA62	10KB62	10KC62	10KD62	10KE62
25kW	25KH62	25KA62	25KB62	25KC62	25KD62	25KE62
50kW	50KH62	50KA62	50KB62	50KC62	50KD62	50KE62
100kW	100KH62					

**Table 1½B**

Power Range	50-125MHz		100-250	
300 watts	300B1	300C1		
600 watts	600B1	600C1		
1500 watts	1500B1	1500C1		
3000 watts	3000B1	3000C1		
6000 watts	6000B1	6000C1		

**Table 1½ BB**

Power Range	50-125MHz		100-250	
300 watts	300B12	300C12		
600 watts	600B12	600C12		
1500 watts	1500B12	1500C12		
3000 watts	3000B12	3000C12		
6000 watts	6000B12	6000C12		

**Table 3½B**

Power Range	50-125MHz		100-250	
1500 watts	1500B3	1500C3		
3000 watts	3000B3	3000C3		
6000 watts	6000B3	6000C3		
15kW	15KB3	15KC3		
30kW	30KB3	30KC3		

**Table 3½ BB**

Power Range	50-125MHz		100-250	
1500 watts	1500B32	1500C32		
3000 watts	3000B32	3000C32		
6000 watts	6000B32	6000C32		
15kW	15KB32	15KC32		
30kW	30KB32	30KC32		

**Table 6½B**

Power Range	Frequency Bands (MHz)			
	50-125	100-250	470-750	
3000 watts	3000B6	3000C6	3000U6	
6000 watts	6000B6	6000C6	6000U6	
15kW	15KB6	15KC6	15KU6	
30kW	30KB6	30KC6	30KU6	
60kW	60KB6	60KC6	60KU6	

**Table 6½ BB**

Power Range	Frequency Bands (MHz)			
	50-125	100-250	470-750	
3000 watts	3000B62	3000C62	3000U62	
6000 watts	6000B62	6000C62	6000U62	
15kW	15KB62	15KC62	15KU62	
30kW	30KB62	30KC62	30KU62	
60kW	60KB62	60KC62	60KU62	

**Table 6½C**

Power Range	Frequency Bands (MHz)		
	50-125	100-250	470-750
8kW	8KB6	8KC6	8KU6
80kW	80KB6	80KC6	80KU6

## Line Sections

50 ohms nominal

These precision sections of coaxial air line are inserted into the transmission line between the transmitter and antenna or load. For use with proper Plug-in Elements, Line Sections are equipped with either one socket, two sockets opposite

each other or two sockets adjacent to each other (to facilitate panel mounting). Most of our portable instruments, as well as rigid-line high power wattmeters on pages 14 and 15 are sold complete with their appropriate Line Sections. Models and panel-mounted meters which require a Line Section are listed in Groups I to V below.

50 ohm LINE SECTIONS					
Connector Type	Element Sockets	Length in.	Weight lbs.	Part No.	Used with Group No.
<b>For use with RF cable connectors</b>					
QC-N (F)	1	5.5	1 1/3	4230-018	
QC (not incl.)	1	4	1	4230-006-1	
QC (not incl.)	1 w/bracket	4	1 1/4	4230-059	
QC (not incl.)	2	4	1	4230-053	I
QC (not incl.)	2 panel mtg	6.22	1 1/4	4522-002-5	I
<b>7/8" Rigid Line</b>					
Flg	1	4	1	4501-000	
Flg	2	4	1 1/4	4502-000	I
<b>1" Rigid Line</b>					
Flg	1	6.75	3	4712-000	IV, V
Flg	2	6.75	3 1/4	4715-000	II, III
Unfl	1	6.375*	1 1/4	4720-000	IV, V
Unfl	1	6.375	1 1/4	4720-025	IV, V
Unfl (51.5 ohms)	1	6.375	1 1/4	4713-000	IV, V
Unfl	2	6.375	1 1/2	4723-000	II, III
<b>3 1/8" Rigid Line</b>					
Flg	1	6.375	7	4600-000	IV, V
Flg	2	7.03	7 1/4	4610-000	II, III
Unfl	1	6.5	4	4805-000	IV, V
Unfl	1	6.5*	4	4801-000	IV, V
Unfl (51.5 ohms)	1	6.5	4	4800-000	IV, V

50 ohm LINE SECTIONS					
Connector Type	Element Sockets	Length in.	Weight lbs.	Part No.	Used with Group No.
<b>3 1/8" Rigid Line (continued)</b>					
Unfl	2	6.5	4 1/4	4802-000	II, III
Unfl	2	6.5*	4 1/4	4801-100	II, III
Unfl (51.5 ohms)	2	6.5	4 1/4	4810-000	II, III
<b>3 1/8" Specials for use with 50kW High Power Elements 50KA4, 50KB4, 50KC4, 50KA42, 50KB42, 50KC42</b>					
Flg	1 High	7.03	7	4617-000	IV
Flg	1 High 1 Reg.	7.03	7 1/3	4616-000	II
Unfl	1 High	6.5	4	4808-000	IV
Unfl	1 High	6.5*	4	4808-020	IV
Unfl	1 High 1 Reg.	6.5	4 1/3	4808-010	II
<b>6 1/8" Rigid Line</b>					
Flg	1	10.22	16 3/4	4902-000	IV, V
Flg	2	10.22	17	4905-000	II, III
Unfl	1	9.63	12 3/4	4907-000	IV, V
Unfl	2	9.63	12 3/4	4909-000	II, III

\* Recessed center conductors. (All other unflanged 1 1/8" and 3 1/8" Line Sections have flush center conductors.)

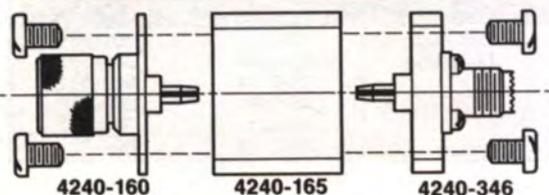
Note: For Quick-Change QC Connector choices, see page 35.

The following Meter Panel, Wattcher and RF Power Analyst models require a Line Section to function as a wattmeter. Select a Line Section with a matching Group Number and with the Connector Type used in your transmission line or cable.

Group No. I	Group No. II	Group No. III	Group No. IV	Group No. V
4383	4382 3127	3126	3127-035	3127-070
4387	4384 3171	3127-075		
3128	4386 3127-040	3127-080		
	4388 3127-055	3171-020		



The Quick-Change QC-Connector feature makes not only the THRULINE Wattmeter and the TERMALINE Load versatile with a minimum investment, but any two QC-Connectors and the 4240-165 Adapter Block form an adapter between different coaxial series or within the same series. A Bird QC Adapter assembled as in this drawing exhibits very low VSWR, unlike most commercial adapters which can foil and frustrate accurate measurement efforts.



# QC-Type (QUICK CHANGE) Connectors

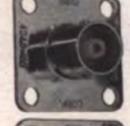
Many TERMALINE Load Resistors, Attenuators and Absorption Wattmeters, as well as THRULINE Wattmeters, are equipped with the patented QC-Type QUICK-CHANGE RF Connectors. These models may be ordered with the connector(s) most convenient for use with your equipment. Changes in connectors may be made in the field merely by removing four screws from the connector baseplate, substituting connectors, and replacing the screws. The change

from one constant impedance connector to another may be done without affecting the electrical characteristics of the QC-equipped unit.

Specifications for each model list the connector type normally supplied when no order is specified. Maximum VSWR values shown in these specifications are obtained with the normally supplied connector.

QC-Type Connectors are also used on some RF Filters and Power Sensors, and on Line Sections.

We recommend ordering QC-Types likely to be required for inter-connection with your equipment in addition to the QC Connector mounted on the BIRD product, to avoid the use of performance-degrading adapters.

<b>FEMALE HN</b> 4240-268		<b>FEMALE LC</b> 4240-031		<b>FEMALE Mini-UHF</b> 4240-346	
<b>MALE HN</b> 4240-278		<b>MALE LC</b> 4240-025		<b>FEMALE SMA</b> 4240-336	
<b>FEMALE SC</b> 4240-090		<b>FEMALE LC UG-157B/U</b> 4240-149		<b>MALE SMA</b> 4240-334	
<b>GEN. RADIO TYPE 874</b> 4240-254		<b>FEMALE LC BULKHEAD</b> 4240-075		<b>FEMALE N</b> 4240-062	
<b>OPEN TERM. #10-32 NUT</b> 4240-080		<b>MALE LC UG-156A/U</b> 4240-138		<b>MALE N</b> 4240-063	
<b>FEMALE BNC</b> 4240-125		<b>FEMALE LT</b> 4240-018		<b>1 1/8" EIA-FIXED</b> 4240-096	
<b>MALE BNC</b> 4240-132		<b>MALE LT</b> 4240-012		<b>1 1/8" EIA SWIVEL</b> 4240-208	
<b>FEMALE TNC</b> 4240-156		<b>FEMALE UHF</b> 4240-050		<b>7/8" EIA</b> 4240-002	
<b>MALE TNC</b> 4240-160		<b>MALE UHF</b> 4240-179			
<b>FEMALE C</b> 4240-100					
<b>MALE C</b> 4240-110					

Also see SQC Connectors on page 36.

## Coupling Kits

Line Type	Impedance	Part No.	Line Type	Impedance	Part No.	Line Type	Impedance	Part No.	Line Type	Impedance	Part No.
7/8" Flg	50 ohm	4240-220	3/8" Flg	50 ohm	4600-020	3/8" Unfl	51.5" ohm	5-289	6 1/8" Unfl	50 ohm	5-1322
1 1/8" Flg	50 ohm	4712-020	3/8" Unfl	50 ohm	5-726	*With adapter to 50 ohm			6 1/8" Flg	50 ohm	4902-020

## Carrying Cases

For Models	Additional Space For	Part No.	For Models	Additional Space For	Part No.	For Models	Additional Space For	Part No.
43, 4430/31, 4314, 4410, 4410A, 4304 or 4450	6 Elements	CC-1	Elements	12 Elements	EC-1	4381, 4382, 4383 & 4384	Power Supply, 4 Elements & 4273/75	4300-080
Mini Monitor	None	CC-2	Same as CC-1	4 Elements, 4273/75, 8164 & 2 spare QCs	4300-061	4391	4 Elements & 4273/75	4300-085
Same as CC-1	3 Elements & 8080 or 8362	CC-3	Same as CC-1	15 Elements, 4230-059, cables, 2 spare QCs & screwdriver	4300-070			

## DC Cable Assemblies (RG-58/U cables with P/N 7500-076 DC Plug on one end)

Connector	Length	Used with Group No.	Part No.	Connector	Length	Used with Group No.	Part No.	Connector	Length	Used with Group No.	Part No.
BNC (M)	14"	I	3170-058-1	Spade Lug	9"	II	4220-097-4	Spade Lug #	25'	III	4220-077-1
BNC (M)	6"	I	3170-058-6	Spade Lug	12"	II	4220-097-8	Spade Lug	40'	III	4220-097-19
BNC (M)	15'	I	3170-058-2	Spade Lug	16"	II	4220-097-5	Spade Lug	50'	III	4220-097-17
BNC (M)	25'	I	3170-058-3	Spade Lug	25"	II	4220-097-21	Spade Lug	60'	III	4220-097-15
BNC (M) #	25'	I	3171-010	Spade Lug	33"	II	4220-097-1	Spade Lug	65'	III	4220-097-14
BNC (M)	40'	I	3170-058-4	Spade Lug	39.5"	II	4220-097-2	Spade Lug	70'	III	4220-097-18
BNC (M)	50'	I	3170-058-5	Spade Lug	48"	II	4220-097-22	Spade Lug	75'	III	4220-097-13
BNC (M)	80'	I	3170-058-7	Spade Lug	56"	II	4220-097-6	Spade Lug	100'	III	4220-097-16
BNC (M)	90'	I	3170-058-8	Spade Lug	64"	II	4220-097-23	Spade Lug	225'	III	4420-097-20
BNC (M)	100'	I	3170-058-9	Spade Lug	10'	II	4220-097-7	DC Plug	39'	III	7500-072-1
				Spade Lug #	10'	II	6810-041-1	DC Plug	10'	III	7500-072-3
				Spade Lug	15'	II	4220-097-9	DC Plug	10'	III	7500-072-4
				Spade Lug	25'	II	4220-097-10	DC Plug #	10'	III	6810-036-1
# Use this cable if your Line Section is 6 1/8". For all other applications, use the cable listed immediately preceding it.								DC Plug	25'	III	7500-072-2
								DC Plug #	25'	III	6810-036-2
Group I	3171-020	3171-4384	4388	Group II	3126	3127-035	3127-075	Group III	6810-020	4305	
	3127-055	4382-4386			3127	3127-040			6810-030	4909	
	3127-080	4383-4387			3128	3127-070			4715	4610	
									4723	4802	

## Batteries

Used With	Volts	Type	Part No.	Used With	Volts	Type	Part No.	Used With	Volts	Type	Part No.
3900	7.5	NiCd	5-1588	4412	9	NiCd	5-1587	4030	3	Li-Mn	5-1475
4381/2/3/4	1.25	NiCd	5-1230	4314	12	NiCd	5-733-2				3 Requd.
			4 Requd.	4410A, 4411,	9	Alkaline	5-1375	4130	9	Lithium	5-1444
4391	1.25	NiCd	5-1230	4410P, 4041				Extended Life	9	Lithium	5-1576
			6 Requd.	4410				4410A, 4411, 4410P, 4410			
4314	6	NiCd	5-733-1								
			6 Requd.								

## Miscellaneous

Used With	Description	Part No.	Used With	Description	Part No.	Used With	Description	Part No.
All Element Sockets	Dummy Plug	3610-031	4381/2/3/4	Power Supply 120V/9V	5-1242	4381/2/3/4	Power Supply 230V/9V	5-1257

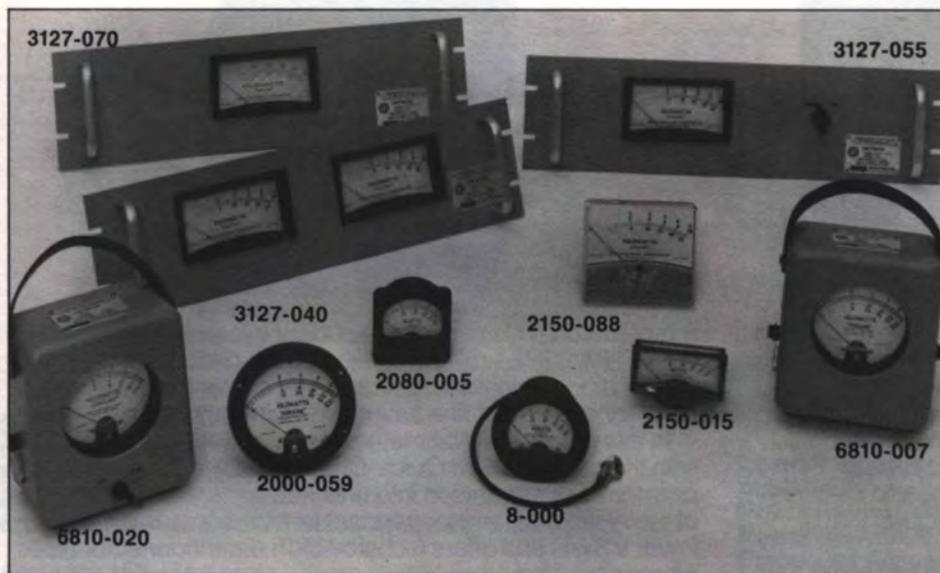
## SQC Connectors

These are similar to the QC-Type on the preceding page, except for a smaller mounting plate (hence small QC or SQC). Used with 4110 series, 4304 Wattmeters, 8072-1, 8431 Load Resistors, etc.

Description	Part No.
Female N	4100-014
Male N	4100-015
Female UHF	4100-017
Female TNC	4100-055
Female BNC	4110-014

## Miscellaneous Adapters, Connectors

Description	Part No.
QC (F) to QC (F)	4240-165
Copl. (M) to QC (F)	4240-180
3/8" Unfl/51.5 ohms to QC (F)	4240-187
3/8" FI to QC (F)	4240-194
7/8" FI to QC (F)	4240-201
Rt. Angle QC	4240-244
1% FI to QC (F)	4240-260
3/8" FI to 1 1/8" FI EIA 50 ohms	4600-025
1% FI to 7/8" FI EIA 50 ohms	4712-015
3/8" FI to 6 1/8" FI EIA 50 ohms	4902-025
DC Conn. Plug	7500-076
Copl. (M) to N (F)	8110-186



## Meters

Type	Current	Scales	Part No.
4½" round	100µA	5/10/25kW	2000-030
4½" round	100µA	15/30/60kW	2000-059
4½" round	100µA	8/80kW	2000-068
3½" round	30µA	25/50/100W	2080-002
3½" square	30µA	25/50/100W	2080-005
3½" rectangular	30µA	25/50/100W	2150-015
4½" rectangular	100µA	5/10/25kW	2150-088
4½" rect. on panel*	100µA	5/10/25kW	3127-035
two 4½" rect. on panel*	100µA	5/10/25kW	3127-040
4½" rect. + switch on panel*	100µA	5/10/25kW	3127-055
4½" rect. on panel*	100µA	15/30/60kW	3127-070
two 4½" rect. on panel*	100µA	15/30/60kW	3127-075
4½" rect. + switch on panel*	100µA	15/30/60kW	3127-080
in housing**	100µA	8/80kW	6810-005
in housing**	100µA	15/30/60kW	6810-007
in housing**	100µA	5/10/25kW	6810-009-7
in housing, w/FWD & RFL switch**	100µA	5/10/25kW	6810-020
in housing, w/FWD & RFL switch**	100µA	15/30/60kW	6810-030
Kit w/cable	30µA	25/50/100W	8-000

\*25' DC cable(s) included

\*\*10' DC cable(s) included

## RF INTERSERIES ADAPTERS



Kit No. 4240-400

	N/f	N/m	UHF/f	UHF/m	BNC/f	BNC/m	TNC/f
N/f	X						
N/m	X	X					
UHF/f	X	X					
UHF/m	X	X	X				
BNC/f	X	X	X	X			
BNC/m	X	X	X	X	X		
TNC/f	X	X	X	X	X	X	
TNC/m	X	X	X	X	X	X	X

It is easy to assemble your compact, precision 50-ohm adapter to meet any of 30 different matching requirements between four coax connector series.

The four series included in this kit are N, UHF, BNC and TNC connectors, one male and one female each—except there are two male N and two female N. Also included are five couplers, so that five complete adapters can be assembled at any one time.

This permits 28 combinations between series or with male/female of the same series. The two additional N connectors also permit assembling adapters with male N/male N and female N/female N functions.

The low VSWR of the adapters is the result of precision machining and tight mating tolerances (the male N/female N combination, for example is below 1.05 to 1GHz and below 1.1 to 2.5GHz).



### 3 Watts—models 6256, 6257



#### Specifications

models 6256, 6257

**Power Rating** 3W max.

**Power Scales** 0.2/0.8/3W

**Frequency Range & VSWR** 6256 1.1 max. 100kHz-512MHz, 6257 1.15 max. 100kHz-1000MHz

**Accuracy** ±5% of full scale 100kHz-512MHz, ±10% of full scale 512-1000MHz (6257)

**Connector** RF Input Female BNC, Demodulator Output 3.5mm miniature jack

**Load Coolant** Dry. Convection air cooled

**Finish** Semi-Gloss black enamel

**Nominal Size** excl. conn. 5" x 4" x 3<sup>5</sup>/<sub>16</sub>" (127 x 102 x 84mm)

**Weight** 1 lb. 10 oz. (0.75kg)

### 60 Watts—model 6104



#### Specifications

model 6104

**Power Rating** 60W

**Power Scales** 2/6/20/60W

**Frequency Range & VSWR** 1.1 max. 25-512MHz

**Accuracy** ±5% of full scale

**Connector** Female N

**Load Coolant** 0.1 gal. (378.5ml) Refined mineral oil

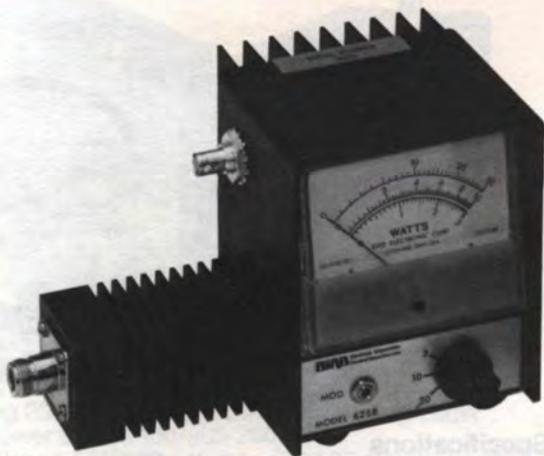
**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 9<sup>5</sup>/<sub>8</sub>" x 6<sup>3</sup>/<sub>8</sub>" x 3<sup>15</sup>/<sub>16</sub>" (244 x 162 x 100mm)

**Weight** 7 lbs. (3.2kg)

**Meter Housing** can be detached from load for convenient reading with 3 ft. cable

### 30 Watts—models 6258, 6259



#### Specifications

models 6258, 6259

**Power Rating** 30W

**Power Scales** 3/10/30W

**Frequency Range & VSWR** 6258 1.1 max. 100kHz to 512MHz, 6259 1.15 max. 100kHz to 1000MHz

**Accuracy** ±5% of full scale 100kHz-512MHz; ±10% 512-1000MHz (6259)

**Connector** RF Input: QC type (Female N normally supplied), RF Output: Female BNC, Demodulated Output: 3.5mm miniature jack

**Load Coolant** Dry. Convection air cooled

**Finish** Semi-Gloss black enamel

**Nominal Size** excl. conn. 5<sup>5</sup>/<sub>16</sub>" x 7<sup>5</sup>/<sub>8</sub>" x 4<sup>19</sup>/<sub>32</sub>" (135 x 194 x 117mm)

**Weight** 3 lbs. (1.4kg)

### 100 Watts—model 6151



#### Specifications

model 6151

**Power Rating** Up to 100W depending on Elements\*

**Frequency Range** 2-2300MHz depending on Elements\*

**Power Scales** 1/2.5/5/10/25/50/100W—one per Element\*

**VSWR** 1.1 max. dc-1000MHz, 1.25 max. 1000-2300MHz

**Accuracy** ±5% of full scale to 1GHz, ±8% to 2.3GHz

**Connector** QC Type (Female N normally supplied)

**Load Coolant** 1 pint (473 ml) Refined mineral oil

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** 12<sup>7</sup>/<sub>8</sub>" x 6<sup>3</sup>/<sub>8</sub>" x 3<sup>15</sup>/<sub>16</sub>" (326 x 162 x 100mm)

**Weight** 8 lbs. (3.6kg)

\*Select Plug-in Element(s) to suit your frequency and power range.

See page 41.

Bird liquid-dielectric Wattmeters have never and are not now manufactured with Poly Chlorinated Bi phenyls (PCBs).

## 150 Watts—models 6154, 6156



**Specifications**  
models 6154, 6156  
**Power Rating** 150W  
**Power Scales** 5/15/50/150W  
**Frequency Range & VSWR** 1.1 max. (6154) 25-1000MHz; (6156) 25-512MHz  
**Accuracy** ±5% of full scale 25-512MHz; ±10% 512-1000MHz (6154)  
**Connector** Female N  
**Load Coolant** 0.1 gal. (378.5ml) Refined mineral oil  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 12<sup>5</sup>/<sub>32</sub>" x 6<sup>3</sup>/<sub>16</sub>" x 3<sup>15</sup>/<sub>16</sub>" (309 x 162 x 100mm)  
**Weight** 8 lbs. (3.6kg)  
**Meter Housing** can be detached from load for convenient reading with 3 ft. cable

## 500 Watts—models 6734A, 6734A-030



**Specifications**  
models 6734A, 6734A-030  
**Power Rating** 500W  
**Power Scales** 25/100/500W  
**Frequency Range & VSWR** 1.1 max. 6734A 25-1000MHz, 6734A-030: 1.5-35MHz  
**Accuracy** ±5% of full scale, 6734A 25-512MHz, 6734A-030: 2-32MHz ±10% of full scale, 6734A 512-1000MHz  
**Connector** QC Type (Female N normally supplied)  
**Load Coolant** 0.9 gal. (3.4 liters) Refined mineral oil  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** Load 19<sup>15</sup>/<sub>16</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (506 x 216 x 151mm); Meter 5<sup>7</sup>/<sub>8</sub>" x 3<sup>5</sup>/<sub>8</sub>" x 3<sup>15</sup>/<sub>16</sub>" (149 x 92 x 100mm)  
**Weight** 6734A 27 lbs. (12.2kg), 6734A-030 27.5 lbs. (12.4kg)  
**Meter** can be separated from load for convenient reading with 4 ft. cable.

## 250 Watts—model 6732A



**Specifications**  
model 6732A  
**Power Rating** 250W  
**Power Scales** 10/50/250W  
**Frequency Range & VSWR** 1.1 max. 25-1000MHz  
**Accuracy** ±5% of full scale 25-512MHz, ±10% 512-1000MHz  
**Connector** QC Type (Female N normally supplied)  
**Load Coolant** 0.35 gal. (1.3 liters) Silicone Oil  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** Load 12<sup>5</sup>/<sub>8</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (321 x 216 x 151mm); Meter 5<sup>7</sup>/<sub>8</sub>" x 3<sup>5</sup>/<sub>8</sub>" x 3<sup>15</sup>/<sub>16</sub>" (149 x 92 x 100mm)  
**Weight** 16 lbs. (7.2kg)  
**Meter** can be separated from load for convenient reading with 4 ft. cable.

## 1000 Watts—models 6736, 6736-030



**Specifications**  
models 6736, 6736-030  
**Power Rating** 1000W  
**Power Scales** 50/250/1000W  
**Frequency Range & VSWR** 1.15 max. 6736 25-1000MHz, 6736-030: 1.5-35MHz  
**Accuracy** ±5% of full scale, 6736 25-512MHz, 6736-030: 2-32MHz ±10% of full scale, 6736 512-1000MHz  
**Connector** QC Type (Female LC normally supplied)  
**Load Coolant** 1.1 gal. (4.1 liters) Silicone Oil  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** Load 21" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (533 x 216 x 151mm); Meter 5<sup>9</sup>/<sub>16</sub>" x 6<sup>1</sup>/<sub>2</sub>" x 3<sup>11</sup>/<sub>32</sub>" (141 x 165 x 85mm)  
**Weight** 6736 30 lbs. (13.5kg), 6736-030 30.5 lbs. (13.7kg)  
**Meter** can be separated from load for convenient reading with 10 ft. cable.

## 1200 Watts—model 6735-300

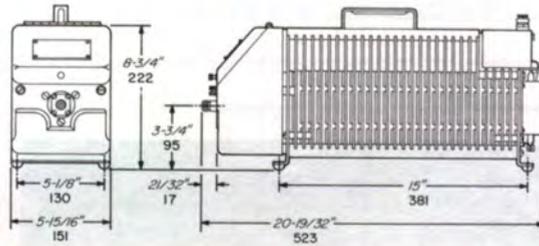


### Specifications model 6735-300

**Power Rating** 1200W for ½ hour, 1000W continuous  
**Power Scales** 120/600/1200W  
**Frequency Range & VSWR** 1.15 max. 25-1000MHz  
**Accuracy** ±5% of full scale 25-512MHz, ±10% of full scale 512-1000MHz  
**Connector** QC Type (Female LC normally supplied)  
**Load Coolant** 2.9 gal. (11 liters) Refined mineral oil  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size Load** 21½" x 17¾" x 7" (546 x 437 x 178mm);  
 Meter 5⅞" x 6½" x 3⅞" (141 x 165 x 85mm)  
**Weight** 58.5 lbs. (26.6kg)  
**Meter** can be separated from load for convenient reading with 10 ft. cable

## model 694

is a low frequency-high power TERMALINE Wattmeter which has been a reliable mainstay for HF communications equipment support for the Armed Forces. It measures up to 1000 watts on its single scale from 2-30MHz within ±5% o.f.s. The normally supplied N-connector is a QC-type and other Std. AN types are available. (see page 35).



## Options and Accessories:

Extend the frequency coverage of Models 6734A, 6736 and 6737 down to 1.5MHz. With a new meter, Wattmeter Line Section P/N 6734-024 covers measurements from 2-32MHz at ±5% of full scale and from 1.5-35MHz at ±10% of full scale. Since the new meter and the line section are calibrated as a unit, there is no need to return the Wattmeter for which this option is intended for retrofitting—simply remove the line section and meter from the front of the load and replace it with the 6734-034 and its meter whenever low frequency power measurement is desired.

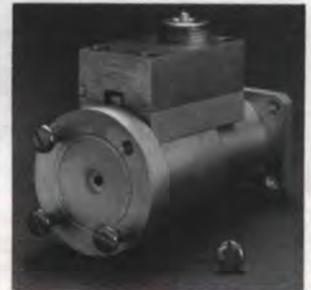
Other accessories available are Quick-Change QC Connectors (page 35) and an adapter from N to UHF (SO-239) for Models 6104, 6154 and 6156 Wattmeters (Adapter No. UG-146A/U Bird P/N 5-793-2).

## 2500 Watts—models 6737, 6737-030



### Specifications models 6737, 6737-030

**Power Rating** 2500W continuous with water cooling, 200W without. Power Scales 100/500/2500W.  
**Frequency Range & VSWR** 1.15 max. 6737 25-1000MHz, 6737-030: 1.5-35MHz  
**Accuracy** ±5% of full scale, 6737 25-512MHz, 6737-030: 2-32MHz ±10% of full scale, 6737 512-1000MHz  
**Connector** QC Type (Female LC normally supplied)  
**Load Coolant** 0.9 gal. (3.4 liters) Refined mineral oil, water cooled  
**Water Connections** ¾" tubing to accept rubber hose  
**Flow Rate** ½ gpm (2 liters/min)  
**Operating Position** Vertical—connector down above 200W when water cooled  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size Load** 20⅓" x 8½" x 5⅝" (529 x 216 x 151mm);  
 Meter 5⅞" x 6½" x 3⅞" (141 x 165 x 85mm)  
**Weight** 6737 33 lbs. (14.9kg), 6737-030 33.5 lbs. (15.1kg)  
**Meter** can be separated from load for convenient reading with 10 ft. cable



P/N 6734-034

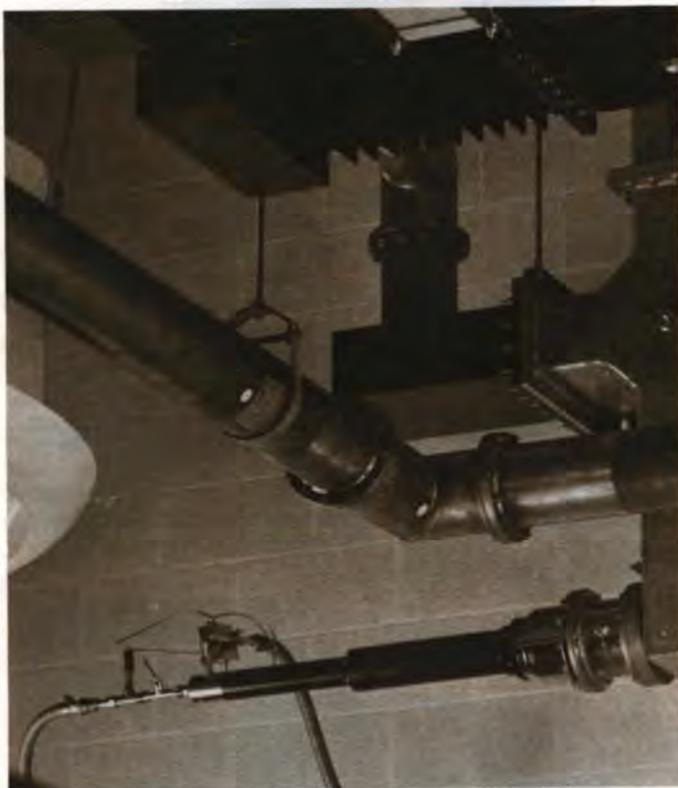
### Elements for Model 6151 (page 39)

Select one or more from here or Tables 2 and 6 (page 31)

Power Range	Frequency Bands (MHz)									
	2-30	25-60	50-125	100-250	200-500	400-1000	950-1260	1100-1800	1700-2200	2200-2300
1 watt	—	—	—	—	—	—	1J	1K	1L	1M
2.5 watts	—	—	—	—	—	—	2.5J	2.5K	2.5L	2.5M
5 watts	—	5A	5B	5C	5D	5E	5J	5K	5L	5M
10 watts	—	10A	10B	10C	10D	10E	10J	10K	10L	10M
25 watts	—	25A	25B	25C	25D	25E	25J	25K	25L	25M
50 watts	50H	50A	50B	50C	50D	50E	50J	—	—	—
100 watts	100H	100A	100B	100C	100D	100E	100J	—	—	—

Bird liquid-dielectric Wattmeters have never and are not now manufactured with Poly Chlorinated Bi phenyls (PCBs).

# TERMALINE® And Broadband RF Coaxial Load Resistors



During measurement and maintenance, station WCLQ-TV channel 61 dissipates visual and aural power in this 80kW Econoload® model 8790 mounted overhead on the waveguide switch following the filterplexer.

Bird TERMALINE® Load Resistors have been the termination of choice in place of the antenna during testing, adjustment and alignment of 50-ohm coaxial RF transmitters for over four decades.

Their low VSWR (1.1 or less at mobile, cellular and broadcast frequencies) assures an excellent match, with less than 0.25% reflected RF energy.

Bird now offers what must be the most versatile selections worldwide of termination types and power ratings to suit requirements of economy, environment, convenience, continuous or intermittent use, or of limited available space.

For low power, high performance, extended frequency range and moderate cost, select from the 2W-50W series 8360 dry convection-cooled loads. Other dry, or air-cooled loads, which are also attitude insensitive, range from 5 watts to 600 watts. Except for limitations of the RF connectors, these loads are usable up to 6GHz.

While our dry loads are conservatively rated, liquid-dielectric convection-cooled loads can even be used above their rating for a short time. Model 8135, for instance, is to Mobile RF Loads what the Bird Model 43 is to Directional Wattmeters—a “best buy”. This highly functional resistor is rated for 150W continuous dissipation. This rating, however,

may be exceeded to 250W max. for 5 minutes on, 30 minutes off. This feature eliminates the need to purchase an additional termination where requirements for power up to 250W is sporadic. (For sustained full rated power applications on models rated above 600 watts, the coolant should be changed at recommended intervals). Many TERMALINE® Loads for use with coax cable are supplied with Quick Change (QC) type connectors (see page 35). This permits a choice of connectors other than those shown as “normally supplied” without the use of adaptors. Note that, unless a different connector style is requested at time of order, units will be shipped with the one shown in the specifications.

A recent design advance is the rhombic-shaped radiator, which improves the size-to-power ratio. Capacity with forced air cooling has been extended to 10kW. The rhombic models are always ready to absorb power without requiring water or energy in standby mode. Thus they are ideal as “reject loads” used with remote, dual transmitters to absorb power in case of transmitter failure. As such, with this 10kW average power capacity, the load resistors can be used in FM installations to 40kW and TV installations to 67kW—or as prime terminations for transmitters with 1½, 2½, 5 or 10kW output. They are not designed, however, for use in uninterrupted burn-in tests of transmitters or tubes and we recommend forced-air-cooled dry loads in the 8570 series.

Besides being ruggedly built, the 15kW and 25kW Loads in the 8570 series are less expensive, run quieter than similar units on the market and can easily be ducted to the outside to prevent heat build-up inside a building. Since they contain banks of resistors, failure of one or two elements will not prevent their use, while replacement resistors are ordered. Also, because of special design, the RF input is the coolest part of the termination, and THRULINE® Wattmeters may be bolted directly to the input without concern about heating effects or damage. The most popular high-power terminations are our direct-water-cooled ECONOLOAD® Load Resistors, which are cool to the touch even at 80kW. For installations where running water is expensive or simply unavailable, we combine these loads with a heat exchanger. This MODULOAD® series is available in 10, 25, 50 and 80kW sizes. (Also, see MODULOAD Calorimeters to 50kW on page 30).

To sum up, why choose one load construction over another when a choice is offered: Dry convection loads are attitude insensitive and have fewer parts; dry conduction loads—which rely on the cabinet they are bolted to for heat dissipation—are smaller; liquid dielectric loads generally run cooler, have thermal overload elasticity and are less costly; and the choice between running water-cooled Econoloads and heat-exchanger Moduloads depends on the relative cost (and availability) of water vs. that of AC power.

**And finally, to put your mind at ease, Bird liquid-dielectric Load Resistors have never ever contained Poly Chlorinated Biphenyls (PCBs) when they left our plant. Loads in current production utilize either DC-200 silicone oil or a highly refined mineral oil as their coolant and dielectric.**

## Chapter Index

Power Rating CW	Model/Series No. and Input/Connector Choices*	Frequency Range GHz	Dielectric Medium	Cooling Method	See Page No.:
2W	8010, 8011, 8015, 8016 N(F), N(M), TNC(M), TNC(F)	dc-3	D	A	44
2W	8360NM	dc-5	D	A	44
2W	8360T TNC(M)	dc-12.4	D	A	44
2W	8360B BNC(M)	dc-4	D	A	44
5W	80M, 80F N(M), N(F)	dc-4	D	A	44
5W	80BNCM, 80BNCF, 80TNCM, 80TNCF, 80SCM, 80SCF, 80CM, 80CF	dc-4	D	A	44
10W	8052, 8053 N(F), N(M)	dc-3.5	D	A	44
10W	8361NM, 8361NF	dc-8	D	A	44
10W	8361TM, 8361TF, 8361BM, 8361BF, TNC(M), TNC(F), BNC(M), BNC(F)	dc-8	D	A	44
25W	8080 QC N(M)	dc-3.5	D	A	44
25W	8362NM, 8362NF	dc-8	D	A	45
25W	8362TM, 8362TF, 8362BM, 8362BF, TNC(M), TNC(F), BNC(M), BNC(F)	dc-8	D	A	45
50W	8085 QC-N(M)	dc-3.5	D	A	45
50W	8363NM, 8363NF	dc-8	D	A	45
50W	8363TM, 8363TF, 8363BM, 8363BF, TNC(M), TNC(F), BNC(M), BNC(F)	dc-8	D	A	45
100W	8164 QC-N(F)	dc-2.4	D	A	45
100W	8071-1 SMA(F)	dc-2	C	A	45
150W	8135 QC-N(F)	dc-4	L	A	46
150W	8166 QC-N(F)	dc-2.5	D	A	45
250W	8141 QC-N(F)	dc-2.5	L	A	46
300W	8072-1 SQC-N(F)	dc-2.5	C	A	46
300W	8173 QC-N(F)	dc-2	D	A	46
500W	8201 QC-N(F)	dc-2.5	L	A	46
600W	8401 QC-N(F)	dc-3	L	A	47
600W	8431 SQC-N(F) [500W in horizontal pos.]	dc-2.5	D	A	46
1kW	8251 QC-LC(F)	dc-2.4	L	A	47
1kW	8833-300 QC-LC(F)	dc-2.5	L	A	47
1kW	8710 series N(F,M); C(F,M); 7/8" EIA Fl.	dc-3.5	D	W	49
1½kW	8860 series QC-LC(F), 1½" and 3½" Unfl. or EIA Fl.	dc-2	L	A	47
2½kW	8230 QC-LC(F) [200W without water cooling]	dc-2.5	L	W	47
2½kW	8890-300 series QC-LC(F); 1½" and 3½" Unfl. or EIA Fl.	dc-2.4	L	A	48
5kW	8890-300 series plus BA-300 Blower [1½kW with blower turned off], connectors as above	dc-2.4	L	F	48
5kW	8890-315, -320 series assembly, connectors as above	dc-2.4	L	F	48
5kW	8720, 8726 1½" EIA Fl., QC-LC(F)	dc-2	D	W	49
5kW	8921 series QC-LC(F), 1½" EIA Fl., 3½" Unfl. or EIA Fl.	dc-1	L	A	48
10kW	8931-115, -230 series QC-LC(F), 1½" EIA Fl., 3½" Unfl. or EIA Fl.	dc-1	L	F	48
10kW	8730 series 1½" EIA Fl., 3½" Unfl. or EIA Fl.	dc-1	D	W	49
10kW	8631-115, -230 series 1½" EIA Fl., 3½" Unfl. or EIA Fl.	dc-1	D	WF	50
15kW	8570/71/74-115-6, -230-5 3½" EIA Fl., 3½" Unfl., 1½" EIA Fl.	dc-0.35	D	F	51
20kW	8745/46 3½" EIA Fl., 3½" Unfl.	dc-0.9	D	W	49
25kW	8572/73-115-6, -230-5 3½" EIA Fl., 3½" Unfl.	dc-0.25	D	F	51
25kW	8645/46-115, -230 3½" EIA Fl., 3½" Unfl.	dc-0.9	D	WF	50
30kW	8755/56 3½" EIA Fl., 3½" Unfl.	dc-0.9	D	W	49
40kW	8765/66 3½" EIA Fl., 3½" Unfl.	dc-0.9	D	W	49
50kW	8775/76 3½" EIA Fl., 3½" Unfl.	dc-0.9	D	W	50
50kW	8655/56-115, -230 3½" EIA Fl., 3½" Unfl.	dc-0.9	D	WF	51
80kW	8790/91 6½" EIA Fl., 6½" Unfl.	dc-0.8	D	W	50
80kW	8690/91-050, -060 6½" EIA Fl., 6½" Unfl.	dc-0.8	D	WF	51

### Explanation of Symbols:

**Dielectric Medium:** *D*-Dry (Air Dielectric), *L*-Liquid (Oil Dielectric)

**Cooling Method:** *A*-Air Cooled (by convection), *F*-Forced Air Cooled (Fans), *C*-Conduction Cooled (needs Heatsink), *W*-Water Cooled (Tap), *WF*-Water and Forced Air Cooled (Closed System Heat Exchanger)

\*Where QC Quick-Change Connectors are shown, the type listed is normally supplied when no other is specified. For other choices, see page 35.

## Dry Loads

### 2 Watts— series 8010



#### Specifications

2 Watts— series 8010

Termaline® Load Resistor

Power Rating 2W continuous

Frequency Range & VSWR 1.06 max. dc to 1GHz, 1.08 max. 1 to 2GHz 1.12 max. 2 to 3GHz

Ambient Temperature Range -40°C to +45°C

Connector 8010 N (Female), 8011 N (Male), 8015 TNC (Male), 8016 TNC (Female)

Load Coolant Dry. Convection air cooled

Operating Position Any

Finish Nickel plated

Nominal Size incl. conn. 1 $\frac{5}{8}$ " x 1 $\frac{1}{16}$ " diameter (41 x 17mm)

Weight 1.75 oz. (50g)

### 2 Watts— series 8360



#### Specifications

2 Watts— series 8360

Broad-band Load Resistor

Power Rating 2W continuous, 1kW peak for 5 microsec. max.

Frequency Range & VSWR 8360T 1.15 max. dc to 4GHz, 1.25 max. 4 to 8GHz, 1.4 max. 8 to 12GHz; 8360B 1.15 max. dc to 4GHz; 8360NM 1.25 max. dc to 5GHz

Ambient Temperature Range -50°C to +100°C

Connector 8360T TNC (Male), 8360B BNC (Male), 8360NM N (Male)

Load Coolant Dry. Convection air cooled

Operating Position Any

Finish Silver plated

Nominal Size incl. conn. 8360T 1.12" x 0.50" dia. (28 x 13mm), 8360B 1.15" x 0.58" dia. (29 x 15mm), 8360NM 1.375" x 0.80" dia. (35 x 20mm)

Weight 8360T and 8360B 1 oz. (28g), 8360NM 1.50 oz. (42g)

### 5 Watts— series 80



#### Specifications

5 Watts— series 80

Termaline® Load Resistor

Power Rating 5W continuous

Frequency Range & VSWR 1.1 max. dc to 1GHz, 1.2 max. 1 to 3.5GHz, 1.3 max. 3.5 to 4GHz

Ambient Temperature Range -40°C to +45°C

Connector 80F N (Female), 80M N (Male), 80CF C (Female), 80CM C (Male), 80BNCF BNC (Female), 80BNCM BNC (Male), 80TNCF TNC (Female), 80TNCM TNC (Male), 80SCF SC (Female), 80SCM SC (Male)

Load Coolant Dry. Convection air cooled

Operating Position Any

Finish Silver plated

Nominal Size incl. conn. 3 $\frac{1}{4}$ " x 1 $\frac{1}{16}$ " hexagonal (82.6 x 17.5mm)

Weight 4 oz. (112g)

## Dry Loads

### 10 Watts— models 8052/53



#### Specifications

10 Watts— models 8052/53

Termaline® Load Resistor

Power Rating 10W continuous

Frequency Range & VSWR 1.10 max. dc to 1GHz, 1.20 max. 1 to 3.5GHz

Ambient Temperature Range -40°C to +45°C

Connector 8052 N (Female), 8053 N (Male)

Load Coolant Dry. Convection air cooled

Operating Position Any

Finish Semi-Gloss black enamel

Nominal Size incl. conn. 3 $\frac{15}{32}$ " x 1 $\frac{1}{16}$ " hexagonal (88 x 17.5mm)

Weight 4 oz. (112g)

### 10 Watts— series 8361



#### Specifications

10 Watts— series 8361

Broad-band Load Resistor

Power Rating 10W continuous, 4kW peak for 5 microsec. max.

Ambient Temperature Range -55°C to +70°C

Load Coolant Dry. Convection air cooled

Operating Position Any

Finish Black anodized

Nominal Size incl. conn. 2" x 1.37" dia. (51 x 35mm)

Weight 2 $\frac{1}{2}$  oz. (70g)

Model	Frequency Range & VSWR (Max.)			Connector
	dc-1GHz	1-4GHz	4-8GHz	
8361NM	1.1	1.2	1.35	Male N
8361NF	1.1	1.2	1.35	Female N
8361TM	1.1	1.2	1.35	Male TNC
8361TF	1.1	1.2	1.45	Female TNC
8361BM	1.1	1.2	N/A	Male BNC
8361BF	1.1	1.2	1.35	Female BNC

### 25 Watts— model 8080



#### Specifications

25 Watts— model 8080

Termaline® Load Resistor

Power Rating 25W continuous

Frequency Range & VSWR 1.10 max. dc to 1000MHz, 1.25 max. 1000 to 3500MHz

Ambient Temperature Range -40°C to +45°C

Connector QC Type (Male N normally supplied)

Load Coolant Dry. Convection air cooled

Operating Position Any

Finish Semi-Gloss black enamel

Nominal Size incl. conn. 5 $\frac{5}{32}$ " x 1 $\frac{1}{4}$ " sq. (131 x 32mm)

Weight 9 oz. (250g)

## Dry Loads

### 25 Watts— series 8362



#### Specifications

25 Watts— series 8362

**Broad-band Load Resistor**

**Power Rating** 25W continuous, 4kW peak for 5 microsec. max.

**Ambient Temperature Range** -55°C to +70°C

**Load Coolant** Dry. Convection air cooled

**Operating Position** Any

**Finish** Black anodized

**Nominal Size** incl. conn. 4.14" x 1.37" dia. (105 x 35mm)

**Weight** 4 oz. (112g)

Model	Frequency Range & VSWR (Max.)			Connector
	dc-1GHz	1-4GHz	4-8GHz	
8362NM	1.1	1.25	1.4	Male N
8362NF	1.1	1.25	1.4	Female N
8362TM	1.1	1.25	1.4	Male TNC
8362TF	1.1	1.25	1.4	Female TNC
8362BM	1.1	1.25	N/A	Male BNC
8362BF	1.1	1.25	N/A	Female BNC

### 50 Watts— model 8085



50 Watts— model 8085

**Termaline® Load Resistor**

**Power Rating** 50W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 3500MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** QC Type (Male N normally supplied)

**Load Coolant** Dry. Convection air cooled

**Operating Position** Any

**Finish** Semi-Gloss black enamel

**Nominal Size** incl. conn. 5<sup>9</sup>/<sub>64</sub>" x 1<sup>3</sup>/<sub>4</sub>" sq. (131 x 44mm)

**Weight** 15 oz. (400g)

### 50 Watts— series 8363



#### Specifications

50 Watts— series 8363

**Broad-band Load Resistor**

**Power Rating** 50W continuous, 4kW peak for 5 microsec. max.

**Ambient Temperature Range** -55°C to +70°C

**Load Coolant** Dry. Convection air cooled

**Operating Position** Any

**Finish** Black anodized

**Nominal Size** incl. conn. 4.61" x 1.63" dia. (117 x 41mm)

**Weight** 6 oz. (168g)

Model	Frequency Range & VSWR (Max.)			Connector
	dc-1GHz	1-4GHz	4-8GHz	
8363NM	1.1	1.25	1.4	Male N
8363NF	1.1	1.25	1.4	Female N
8363TM	1.1	1.25	1.4	Male TNC
8363TF	1.1	1.25	1.4	Female TNC
8363BM	1.1	1.25	N/A	Male BNC
8363BF	1.1	1.25	N/A	Female BNC

## Dry Loads

### 100 Watts— model 8164



100 Watts— model 8164

**Termaline® Load Resistor**

**Power Rating** 100W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2400MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** QC Type (Female N normally supplied)

**Load Coolant** Dry. Convection air cooled

**Operating Position** Any

**Finish** Semi-Gloss black enamel

**Nominal Size** incl. conn. 6<sup>63</sup>/<sub>64</sub>" x 2<sup>3</sup>/<sub>4</sub>" sq. (177 x 70mm)

**Weight** 48 oz. (1.36 kg)

### 100 Watts— model 8071-1



#### Specifications

100 Watts— model 8071-1

**Termaline® Load Resistor**

**Power Rating** 100W continuous when bolted to a suitable heat sink

**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.2 max. 1000 to 2000MHz

**Ambient Temperature Range** -40°C to +45°C

**Heat Sink Required** 100 sq. in. plate x 1/8" (650cm<sup>2</sup> x 3mm) or equivalent

**Connector** SMA (Female)

**Load Coolant** Dry. Conduction cooled

**Operating Position** Any

**Finish** Semi-Gloss black enamel

**Nominal Size** incl. conn. 1<sup>25</sup>/<sub>32</sub>" x 1" x 3<sup>3</sup>/<sub>64</sub>" (46 x 25 x 13mm)

**Weight** 1.25 oz. (35g)

### 150 Watts— model 8166



150 Watts— model 8166

**Termaline® Load Resistor**

**Power Rating** 150W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.2 max. 1000 to 2500MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** QC Type (Female N normally supplied)

**Load Coolant** Dry. Convection air cooled

**Operation Position** Any

**Finish** Semi-Gloss black enamel

**Nominal Size** incl. conn. 7<sup>3</sup>/<sub>64</sub>" x 4" sq. (190 x 102mm)

**Weight** 96 oz. (2.7kg)

## Dry Loads

### 300 Watts—model 8072-1



#### Specifications

##### 300 Watts—model 8072-1

**Power Rating** 300W continuous when bolted to a suitable heat sink

**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.2 max. 1000 to 2500MHz

**Ambient Temperature Range** -40°C to +45°C

**Heat Sink Required** 800 sq. in. plate x 1/8" (5200cm<sup>2</sup> x 3mm) or equivalent

**Connector** SQC Type (Female N normally supplied)

**Load Coolant** Dry. Conduction cooled

**Operating Position** Any

**Finish** Semi-Gloss black enamel

**Nominal Size** incl. conn. 4<sup>25</sup>/<sub>64</sub>" x 2" x 1<sup>1</sup>/<sub>32</sub>" (110 x 51 x 26mm)

**Weight** 12 oz. (340g)

### 300 Watts—model 8173



#### Specifications

##### 300 Watts—model 8173

**Power Rating** 300W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2000MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** QC Type (Female N normally supplied)

**Load Coolant** Dry. Convection air cooled

**Operating Position** Horizontal only

**Finish** Semi-Gloss black enamel

**Nominal Size** incl. conn. 9<sup>3</sup>/<sub>4</sub>" x 9<sup>9</sup>/<sub>16</sub>" x 5<sup>15</sup>/<sub>16</sub>" (247 x 243 x 151mm)

**Weight** 6<sup>1</sup>/<sub>4</sub> lbs. (2.8kg)

### 600 Watts—model 8431



#### Specifications

##### 600 Watts—model 8431

**Power Rating** 600W vertical or 500W horizontal, continuous

**Frequency Range** dc to 2500MHz

**Impedance** 50 ohms nominal

**VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2500MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** SQC Type (Female N normally supplied)

**Load Coolant** Dry. Convection air cooled

**Operating Position** Horizontal or vertical

**Finish** Semi-Gloss black enamel

**Nominal Size** incl. conn. 13<sup>1</sup>/<sub>4</sub>" x 9<sup>1</sup>/<sub>4</sub>" x 8<sup>1</sup>/<sub>2</sub>" (336 x 235 x 216mm)

**Weight** 13 lbs. (6kg)

## Oil Dielectric Loads

### 150 Watts—model 8135



#### 150 Watts—model 8135

**Power Rating** 150W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1GHz, 1.2 max. 1 to 2.5GHz, 1.3 max. 2.5 to 4GHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** QC Type (Female N normally supplied)

**Load Coolant** 0.1 gal. (380ml) Refined mineral oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 9<sup>1</sup>/<sub>2</sub>" x 6<sup>1</sup>/<sub>32</sub>" x 3<sup>15</sup>/<sub>16</sub>" (241 x 161 x 100mm)

**Weight** 6 lbs. (2.7kg)

### 250 Watts—model 8141



#### Specifications

##### 250 Watts—model 8141

**Power Rating** 250W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1GHz, 1.2 max. 1 to 1.8GHz, 1.3 max. 1.8 to 2.5GHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** QC Type (Female N normally supplied)

**Load Coolant** 0.35 gal. (1.3 liters) Silicone Oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 9<sup>9</sup>/<sub>16</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (243 x 216 x 151mm)

**Weight** 10 lbs. (4.5kg)

### 500 Watts—model 8201



#### Specifications

##### 500 Watts—model 8201

**Power Rating** 500W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2500MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** QC Type (Female N normally supplied)

**Load Coolant** 0.9 gal. (3.42 liters) Refined mineral oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 16<sup>19</sup>/<sub>16</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (427 x 216 x 151mm)

**Weight** 21 lbs. (9.5kg)

## Oil Dielectric Loads 600 Watts—model 8401



**Specifications**  
**600 Watts—model 8401**  
**Power Rating** 600W continuous  
**Frequency Range & VSWR** 1.1 max. dc to 1GHz, 1.2 max. 1 to 2.8GHz, 1.3 max. 2.8 to 3GHz  
**Ambient Temperature Range** -40°C to +45°C  
**Connector** QC Type (Female N normally supplied)  
**Load Coolant** 0.7 gal. (2.65 liters) Refined mineral oil  
**Operating Position** Horizontal only  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 16<sup>13</sup>/<sub>16</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (427 x 216 x 151mm)  
**Weight** 20 lbs. (9.1kg)

## 1kW—model 8251



**Specifications**  
**1kW—model 8251**  
**Power Rating** 1000W continuous  
**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2000MHz; 1.3 max. 2000 to 2400MHz  
**Ambient Temperature Range** -40°C to +45°C  
**Connector** QC Type (Female LC normally supplied)  
**Load Coolant** 1.1 gal. (4.1 liters) Silicone Oil  
**Operating Position** Horizontal only  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 17<sup>29</sup>/<sub>32</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (455 x 216 x 151 mm)  
**Weight** 24 lbs. (11kg)

## 1kW model 8833-300



**Specifications**  
**1kW—model 8833-300**  
**Power Rating** 1000W continuous  
**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2500MHz  
**Ambient Temperature Range** -40°C to +45°C  
**Connector** QC Type (Female LC normally supplied)  
**Load Coolant** 2.9 gal. (11 liters) Refined mineral oil  
**Operating Position** Horizontal only  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 23<sup>1</sup>/<sub>8</sub>" x 17<sup>3</sup>/<sub>16</sub>" x 7<sup>1</sup>/<sub>8</sub>" (587 x 437 x 181mm)  
**Weight** 54 lbs., 10 oz. (24.8kg)

## Oil Dielectric Loads 1.5kW—series 8860



**Specifications**  
**1.5kW—series 8860**  
**Power Rating** 1500W continuous  
**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2000MHz  
**Ambient Temperature Range** -40°C to +45°C  
**Load Coolant** 1.5 gal. (5.68 liters) Silicone Oil  
**Operating Position** Horizontal only  
**Finish** Light Navy grey baked enamel (MIL-E-15090)

Model	Connector	Overall Length	Weight
8860	QC-LC(F)	17 <sup>1</sup> / <sub>8</sub> " (445mm)	30 lbs. (13.6kg)
8861	1 <sup>1</sup> / <sub>8</sub> " Unfl	17 <sup>7</sup> / <sub>8</sub> " (454mm)	31 lbs. (14.1kg)
8862	1 <sup>1</sup> / <sub>8</sub> " EIA Fl	17 <sup>1</sup> / <sub>8</sub> " (445mm)	31 lbs. (14.1kg)
8863	3 <sup>1</sup> / <sub>8</sub> " Unfl	18 <sup>3</sup> / <sub>8</sub> " (473mm)	32 lbs. (14.5kg)
8864	3 <sup>1</sup> / <sub>8</sub> " EIA Fl	19 <sup>1</sup> / <sub>2</sub> " (495mm)	32 lbs. (14.5kg)

Width & Height (all units) 7<sup>1</sup>/<sub>2</sub>" x 13<sup>1</sup>/<sub>8</sub>" (184 x 333mm)

## Oil Dielectric Water-Cooled 2.5kW—model 8230



**Specification**  
**2.5kW—model 8230**  
**Power Rating** 2500W continuous with water cooling, 200W without  
**Frequency Range & VSWR** 1.1 max. dc to 1000MHz, 1.25 max. 1000 to 2500MHz  
**Ambient Temperature Range** -40°C to +45°C  
**Water Temperature Range** +8°C to +80°C  
**Water Flow Rate** 1/2 gal./min. (2 liters/min.) minimum  
**Connector** QC Type (Female LC normally supplied)  
**Load Coolant** 0.9 gal. (3.4 liters) Refined mineral oil  
**Operating Position** Vertical, connector down (when water cooled)  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 17<sup>29</sup>/<sub>32</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (450 x 216 x 151mm)  
**Weight** 27 lbs. (12kg)

## Oil Dielectric Loads

**2.5kW—series 8890-300**

**5kW—series 8890-300 with BA-300-115, -230**

8891-300 with BA-300-115



8890-300

### Specifications

**2.5kW—series 8890-300**

**Power Rating** 2500W continuous

**Frequency Range & VSWR** 1.1 max. dc to 1GHz, 1.25 max. 1 to 2GHz, 1.3 max. 2 to 2.4GHz

**Impedance** 50 ohms nominal (8896-300 51.5 ohms nominal)<sup>Ⓟ</sup>

**Ambient Temperature Range** -40°C to +45°C

**Load Coolant** 2.9 gal. (11 liters) Silicone Oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**NOTE:** Overload Thermoswitch P/N 8890-008 is optional

Model	Connector	Overall Length	Weight
8890-300	QC-LC(F)	23 <sup>1</sup> / <sub>8</sub> " (587mm)	57 lbs. (26kg)
8892-300	1 <sup>1</sup> / <sub>8</sub> " EIA FI	23 <sup>1</sup> / <sub>8</sub> " (587mm)	58 lbs. (26kg)
8895-300	1 <sup>1</sup> / <sub>8</sub> " Unfl	22 <sup>3</sup> / <sub>16</sub> " (564mm)	58 lbs. (26kg)
8891-300	3 <sup>1</sup> / <sub>8</sub> " EIA FI	25 <sup>1</sup> / <sub>8</sub> " (638mm)	59 lbs. (27kg)
8896-300	3 <sup>1</sup> / <sub>8</sub> " Unfl <sup>Ⓟ</sup> (Flush Ctr. Cond.)	24 <sup>5</sup> / <sub>32</sub> " (626mm)	59 lbs. (27kg)
8897-300	3 <sup>1</sup> / <sub>8</sub> " Unfl (Flush Ctr. Cond.)	24 <sup>5</sup> / <sub>32</sub> " (626mm)	59 lbs. (27kg)
8898-300	3 <sup>1</sup> / <sub>8</sub> " Unfl (Recessed Ctr. Cond.)	24 <sup>5</sup> / <sub>32</sub> " (626mm)	59 lbs. (27kg)

Width & Height (all units) 7" x 17<sup>3</sup>/<sub>16</sub>" (178 x 547mm)

### Specifications

**5kW—series 8890-300 with BA-300-115, -230**

**Power Rating** 5000W continuous with blower on, 1250W with blower off

**Frequency Range & VSWR** 1.1 max. dc to 1GHz, 1.25 max. 1-2GHz, 1.3 max. 2-4GHz

**Impedance** 50 ohms nominal (8896-300 51.5 ohms nominal)<sup>Ⓟ</sup>

**Ambient Temperature Range** -40°C to +45°C

**Load Coolant** 2.9 gal. (11 liters) Silicone Oil. With forced air cooling

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Blower AC Power** Model BA-300-115: 115V, 50/60Hz, 0.6A  
Model BA-300-230: 230V, 50/60Hz, 0.3A

Model	Connector	Overall Length	Weight
8890-300+BA-300-...	QC-LC(F)	23 <sup>1</sup> / <sub>8</sub> " (587mm)	70 lbs. (32kg)
8892-300+BA-300-...	1 <sup>1</sup> / <sub>8</sub> " EIA FI	23 <sup>1</sup> / <sub>8</sub> " (587mm)	72 lbs. (33kg)
8895-300+BA-300-...	1 <sup>1</sup> / <sub>8</sub> " Unfl	22 <sup>3</sup> / <sub>16</sub> " (564mm)	72 lbs. (33kg)
8891-300+BA-300-...	3 <sup>1</sup> / <sub>8</sub> " EIA FI	25 <sup>1</sup> / <sub>8</sub> " (638mm)	73 lbs. (33kg)
8896-300+BA-300-...	3 <sup>1</sup> / <sub>8</sub> " Unfl <sup>Ⓟ</sup> (Flush Ctr. Cond.)	24 <sup>5</sup> / <sub>32</sub> " (614mm)	73 lbs. (33kg)
8897-300+BA-300-...	3 <sup>1</sup> / <sub>8</sub> " Unfl (Flush Ctr. Cond.)	24 <sup>5</sup> / <sub>32</sub> " (614mm)	73 lbs. (33kg)
8898-300+BA-300-...	3 <sup>1</sup> / <sub>8</sub> " Unfl (Recessed Ctr. Cond.)	24 <sup>5</sup> / <sub>32</sub> " (614mm)	73 lbs. (33kg)

Width & Height (all units) 7<sup>3</sup>/<sub>8</sub>" x 22<sup>1</sup>/<sub>16</sub>" (187 x 560mm) *Continued*

## Oil Dielectric Loads

**Notes:** Overload Thermoswitch P/N 8890-008 is optional. When ordered as a package, the Load and Blower are factory assembled without additional charge.

This series is also available for stand-by service as a "Reject Load" for dual transmitter systems, equipped with two thermostats (one to turn the blower on when one transmitter fails, the second as an overtemperature interlock). For completely assembled and wired units, order 8890/91/92/95/96/97/98-315 (115V, 50/60Hz) or 8890/91/92/95/96/97/98-320 (230V, 50/60Hz)

**5kW—series 8921**



### Specifications

**5kW—series 8921**

**Power Rating** 5000W continuous

**Frequency Range & VSWR** 1.15 max. dc to 1000MHz

**Ambient Temperature Range** -40°C to +45°C

**Load Coolant** 6<sup>2</sup>/<sub>3</sub> gals. (25.3 liters) Silicone Oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

Model	Connector	Overall Length	Weight
8921	QC LC(F)	30 <sup>27</sup> / <sub>32</sub> " (783mm)	119 lbs. (54kg)
8922	1 <sup>1</sup> / <sub>8</sub> " EIA FI	30 <sup>27</sup> / <sub>32</sub> " (783mm)	121 lbs. (55kg)
8926	3 <sup>1</sup> / <sub>8</sub> " EIA FI	32 <sup>3</sup> / <sub>4</sub> " (832mm)	126.5 lbs. (57kg)
8927	3 <sup>1</sup> / <sub>8</sub> " Unfl	31 <sup>1</sup> / <sub>8</sub> " (809mm)	126 lbs. (57kg)

Width & Height (all units) 9<sup>1</sup>/<sub>2</sub>" x 25<sup>13</sup>/<sub>16</sub>" (241 x 656mm)

**10kW series**

**8931-115, -230**



### Specifications

**10kW—series 8931-115, -230**

**Power Rating** 10kW continuous

**Frequency Range & VSWR**

1.15 max. dc to 1000MHz

**Ambient Temperature Range** -40°C to +45°C

**Load Coolant** 6<sup>2</sup>/<sub>3</sub> gal. (25.3 liters) Silicone Oil. With forced air cooling

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

Model	Connector	Overall Length	Weight
8931-...*	QC-LC(F)	30 <sup>7</sup> / <sub>32</sub> " (768mm)	135 lbs. (61 kg)
8932-...*	1 <sup>1</sup> / <sub>8</sub> " EIA FI	30 <sup>7</sup> / <sub>32</sub> " (768mm)	137 lbs. (62 kg)
8936-...*	3 <sup>1</sup> / <sub>8</sub> " EIA FI	32 <sup>1</sup> / <sub>8</sub> " (816mm)	142.5 lbs. (64.8kg)
8937-...*	3 <sup>1</sup> / <sub>8</sub> " Unfl	31 <sup>1</sup> / <sub>4</sub> " (793mm)	142 lbs. (64.5kg)

Width & Height (all units) 9<sup>1</sup>/<sub>2</sub>" x 33<sup>9</sup>/<sub>16</sub>" (241 x 821mm)

\* AC Power 115 or 230V, 50/60Hz (Add suffix -115 or -230 to model number)

## Direct Water-Cooled Loads 1kW—series 8710



**Specifications**  
**1kW—series 8710**  
**Power Rating** 1000W continuous  
**Frequency Range & VSWR** 1.10 max. dc to 1GHz, 1.3 max. 1 to 3GHz, 1.35 max. 3 to 3.5GHz  
**Water Temperature Range** +8°C to +80°C  
**Water Flow Rate** 1 to 3 quarts./min. (1 to 3 liters./min.)  
**Connector** 8710F N (Female), 8710M N (Male), 8711F C (Female), 8711M C (Male), 8713 7/8" EIA FI. Waterlines 1/8" FPT Nut  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Bright Silver Plated  
**Nominal Size** (excl. 18" waterlines) 3<sup>2</sup>/<sub>31</sub>" x 1<sup>1</sup>/<sub>16</sub>" dia. (93 x 17mm)  
**Weight** 8710 and 8711 5 oz. (142g), 8713 14 oz. (397g)

## 5kW—models 8720, 8726



**Specifications**  
**5kW—models 8720, 8726**  
**Power Rating** 5000W continuous  
**Frequency Range & VSWR** 8720 1.1 max. dc to 1GHz, 1.2 max. 1 to 2GHz; 8726 1.1 max. dc to 1GHz, 1.15 max. 1 to 1.5GHz, 1.2 max. 1.5 to 2GHz  
**Water Temperature Range** +5°C to +80°C  
**Water Flow Rate** 1 to 4 gal./min. (4 to 15 liters./min.)  
**Connector** 8720 1 5/8" EIA FI, 8726 QC Type (Female LC normally supplied), water lines 8720 1/4" FPT Nut, 8726 3/4" Hose Fittings  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Bright Nickel Plated  
**Nominal Size** (excl. 8" waterlines) 8720 8<sup>1</sup>/<sub>32</sub>" x 1 5/8" dia. (204 x 41mm), Input FI 3 1/2" dia. (89mm); 8726 8 7/8" x 1 5/8" dia. (225 x 41mm)  
**Weight** 8720 2 lbs. (900g), 8726 1 1/4 lbs. (850g)

## 10kW—models 8730, 8731, 8738



**Specifications**  
**10kW—Econoload® models 8730/1/8**  
**Power Rating** 10kW continuous  
**Frequency Range & VSWR** 1.1 max. 1kHz to 1000MHz (dc for continuity checks)  
**Water Temperature Range** +5°C to +60°C  
**Water Flow Rate** 4 to 6 gals./min. (15.1 to 22.7 liters./min.)  
**Connector** 8730 1 5/8" EIA FI, 8731 3 3/8" EIA FI, 8738 3 3/8" Unfl; Waterlines 1/2" FPT or 3/4" hose  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Semi-Gloss black enamel  
**Nominal Size** 14 3/4" x 2 3/4" dia. (375 x 70mm). Input Flg. Dia. 8730 3 1/2" (89mm), 8731 5 3/16" (132mm)  
**Weight** 8730 7 lbs. 14 oz. (3.6kg), 8731 6 lbs. 10 oz. (3kg), 8738 6 lbs. (2.8kg)  
 For Coupling Kits, Dolly, etc. see Load Accessories (page 52)

## 20kW—models 8745, 8746



**Specifications**  
**20kW—Econoload® models 8746/7**  
**Power Rating** 20kw continuous  
**Frequency Range & VSWR** 1.1 max. 1kHz to 900MHz (dc for continuity checks)  
**Water Temperature Range** +5°C to +60°C  
**Water Flow Rate** 6 to 8 gals./min. (22.7 to 30.3 liters./min.)  
**Connector** 8745 3 3/8" EIA FI, 8746 3 3/8" Unfl. Waterlines 1/2" FPT or 3/4" hose  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Semi-Gloss black enamel  
**Nominal Size** 19 1/2" x 3 1/2" dia. (495 x 90mm). Input Flg 5 3/16" dia. (132mm)  
**Weight** 8745 13 lbs. (5.9kg), 8746 12 1/2 lbs. (5.7kg)  
 For Coupling Kits, Dolly, etc. see Load Accessories (page 52)

## 30kW—models 8755, 8756



**Specifications**  
**30kW—Econoload® models 8755/6**  
**Power Rating** 30kW continuous  
**Frequency Range & VSWR** 1.1 max. 1kHz to 900MHz (dc for continuity checks)  
**Water Temperature Range** +5°C to +60°C  
**Water Flow Rate** 7 to 9 gals./min. (26.5 to 34.1 liters./min.)  
**Connector** 8755 3 3/8" EIA FI, 8756 3 3/8" Unfl. Waterlines 1/2" FPT or 3/4" hose  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Semi-Gloss black enamel  
**Nominal Size** 19 1/2" x 3 1/2" dia. (495 x 90mm). Input Flg. 5 3/16" dia. (132mm)  
**Weight** 8755 13 lbs. (5.9kg), 8756 12 1/2 lbs. (5.7kg)  
 For Coupling Kits, Dolly, etc. see Load Accessories (page 52)

## 40kW—models 8765, 8766



**Specifications**  
**40kW—Econoload® models 8765/6**  
**Power Rating** 40kW continuous  
**Frequency Range & VSWR** 1.1 max. 1kHz to 900MHz (dc for continuity checks)  
**Water Temperature Range** +5°C to +60°C  
**Water Flow Rate** 8 to 10 gals./min. (30.3 to 37.9 liters./min.)  
**Connector** 8765 3 3/8" EIA FI, 8766 3 3/8" Unfl. Waterlines 1/2" FPT or 3/4" hose  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Semi-Gloss black enamel  
**Nominal Size** 19 1/2" x 3 1/2" dia. (495 x 90mm) Input Flg. 5 3/16" dia. (132mm)  
**Weight** 8755 13 lbs. (5.9kg), 8756 12 1/2 lbs. (5.7kg)  
 For Coupling Kits, Dolly, etc. see Load Accessories (page 52)

**Direct Water-Cooled Loads**  
**50kW— models 8775, 8776**



**Specifications**

**50kW— Econoload® models 8775/6**  
**Power Rating** 50kW continuous  
**Frequency Range & VSWR** 1.1 max. 1kHz to 900MHz (dc for continuity checks)  
**Water Temperature Range** +5°C to +60°C  
**Water Flow Rate** 9 to 11 gals./min. (34.1 to 41.7 liters/min.)  
**Connector** 8775 3/8" EIA FI, 8776 3/8" Unfl Waterlines 1/2" FPT or 3/4" hose  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Semi-Gloss black enamel  
**Nominal Size** 19 1/2" x 3 1/2" dia. (495 x 90mm). Input Flg. 5 13/16" dia. (132mm)  
**Weight** 8775 13 lbs. (5.9kg), 8776 12 1/2 lbs. (5.7kg)  
 For Coupling Kits, Dolly, etc. see Load Accessories (page 52)

**80kW— models 8790, 8791**



**Specifications**

**80kW— Econoload® models 8790/1**  
**Power Rating** 80kW continuous  
**Frequency Range & VSWR** 1.15 max. 1kHz to 800MHz (dc for continuity checks)  
**Water Temperature Range** +5°C to +60°C  
**Water Flow Rate** 10 to 12 gals./min. (37.9 to 45.4 liters/min.)  
**Connector** 8790 6 1/8" EIA FI, 8791 6 1/8" Unfl  
**Load Coolant** Potable water  
**Operating Position** Any  
**Finish** Semi-Gloss black enamel  
**Nominal Size** 35" x 5" dia. (889 x 127mm). Input Flg. 8 1/8" dia. (206mm)  
**Weight** 27 lbs. (12.3kg)  
 For Coupling Kits, Dolly, etc. see Load Accessories (page 52)

**MODULOAD® Systems**  
**10kW— series 8631-115, -230**



8635-115 on optional 6771-011 Dolly.

**Specifications**

**10kW— series 8631-115, -230**  
**Power Rating** 10kW continuous  
**Frequency Range & VSWR** 1.1 max. 1kHz to 1000MHz (dc for continuity checks)  
**Ambient Temperature Range** Coolant 100% water +5°C to +45°C or 35% Ethylene Glycol -20° to +35°C  
**Connector** 8635 1 1/8" EIA FI, 8631 3/8" EIA FI, 8638 3/8" Unfl  
**Load Coolant** 10 pts. (4.75 liters) 100% water or 65% water/35% industrial Ethylene Glycol. With forced air cooling  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** excl. conn. 22 1/8" x 15 15/16" x 15 13/16" (562 x 405 x 402mm)  
**Weight** 110 lbs. (50kg)  
**AC Power** 9 1/2 amps @ 115 V 60Hz—Models with -115 suffix  
 4 3/4 amps @ 230V 50Hz—Models with -230 suffix  
**Optional Dolly** P/N 6771-011

**25kW— series 8645-115, -230**



Moduload 8646-115 on optional Dolly 6771-011 with optional Wattmeter 4805.

**Specifications**

**25kW— series 8645-115, -230**  
**Power Rating** 25kW continuous  
**Frequency Range & VSWR** 1.1 max. 1kHz to 900MHz (dc for continuity checks)  
**Ambient Temperature Range** Coolant 100% Water +5°C to +30°C. To +45°C below 20kW; Coolant 35% Ethylene Glycol -20°C to +25°C. To +35°C below 20kW  
**Connector** 8645 3/8" EIA FI, 8646 3/8" Unfl  
**Load Coolant** 9 qts. (8.5 liters) 100% water or 65% water/35% industrial Ethylene Glycol. With forced air cooling  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** excl. conn. 25 15/16" x 19 5/32" x 19 1/16" (659 x 487 x 497mm)  
**Weight** 115 lbs. (70kg)  
**AC Power** 11 amps @ 115V 60Hz—Models with -115 suffix  
 5 1/2 amps @ 230V 50Hz—Models with -230 suffix  
**Optional Dolly** P/N 6771-001

# MODULOAD® Systems

## 50kW— series 8655-115, -230



### Specifications

**50kW— series 8655-115, -230**

**Power Rating** 50kW continuous

**Frequency Range & VSWR** 1.1 max. 1kHz to 900MHz (dc for continuity checks)

**Ambient Temperature Range** Coolant 100% Water +5°C to +30°C. To +45°C below 40kW; Coolant 35% Ethylene Glycol -20°C to +25°C. To +35°C below 40kW

**Connector** 8655 3/8" EIA FI, 8656 3/8" Unfl

**Load Coolant** 17 qts. (16.1 liters) 100% water or 65% water/35% industrial Ethylene Glycol. With forced air cooling

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** excl. conn. 46 1/2" x 19 5/8" x 19 9/16" (659 x 487 x 497mm)

**Weight** 275 lbs. (125kg)

**AC Power** 14 amps @ 115V 60Hz—Models with -115 suffix  
7 amps @ 230V 50Hz—Models with -230 suffix

**Optional Dolly** P/N 6772-011

# Dry, Forced-Air Cooled Loads

## 15kW— models 8570/71/ 74-115-6, -230-5



### Specifications

**15kW— models 8570/71/74-115-6, -230-5**

**Power Rating** 15kW continuous. Also, without blower: 15kW one minute, 10kW two minutes (for "Reject Load" applications)

**Frequency Range & VSWR** 1.1 max. dc to 110MHz, 1.15 max. 110 to 350MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** 8570 3/8" EIA FI, 8571 3/8" Unfl, 8574 1 1/8" EIA FI

**Load Coolant** Dry. Forced air cooled

**Resistors** 12 tubular type, series/parallel

**Operating Position** Any

**Finish** Light Navy grey baked enamel (MIL-E-15090) and black Semi-Gloss enamel

**Nominal Size** incl. conn. 70 3/4" x 16 1/4" x 16 1/4" (1797 x 413 x 413mm)

**Weight** 106 lbs. (48kg)

**AC Power** 115V 60Hz add suffix -115-6, 230V 50Hz add -230-5 to model number. Uses 1150W

**Optional Hot Air Duct** P/N 8572-078

## 80kW— series 8690-050, -060



### Specifications

**80kW— series 8690-050, -060**

**Power Rating** 80kW continuous

**Frequency Range & VSWR** 1.15 max. 1kHz to 800MHz (dc for continuity checks)

**Ambient Temperature Range** Coolant 100% Water +5°C to +45°C; Coolant 35% Ethylene Glycol -20°C to +35°C

**Connector** 8690 6 1/8" EIA FI, 8691 6 1/8" Unfl

**Load Coolant** 10 gals. (37.9 liters) 100% water or 65% water/35% industrial Ethylene Glycol. With forced air cooling

**Operating Position** Load: Any, may be mounted up to 20 ft. (6m) from cabinet. 6 ft. of hoses normally supplied

**Finish** Load: Semi-Gloss black enamel, Heat Exchanger: Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** Load 35" x 5" diameter (889 x 127mm), Heat Exchanger 72 1/2"H x 58 1/4"W x 27"D (1842 x 1480 x 686mm)

**Weight** with water 826 lbs. (375kg), without water 742 lbs. (337kg)

**AC Power** 10 amps @ 230V/3-phase. Add suffix -050 for 50Hz and -060 for 60Hz

## 25kW— models 8572/73-115-6, -230-5



### Specifications

**25kW— models 8572/73-115-6, -230-5**

**Power Rating** 25kW continuous

**Frequency Range & VSWR** 1.1 max. dc to 110MHz, 1.15 max. 110 to 250MHz

**Ambient Temperature Range** -40°C to +45°C

**Connector** 8572 3/8" EIA FI, 8573 3/8" Unfl

**Load Coolant** Dry. Forced air cooled

**Resistors** 20 tubular type, series/parallel

**Operating Position** Any

**Finish** Light Navy grey baked enamel (MIL-E-15090) and black Semi-Gloss enamel

**Nominal Size** incl. conn. 70 3/4" x 16 1/4" x 16 1/4" (1797 x 413 x 413mm)

**Weight** 118 lbs. (54kg)

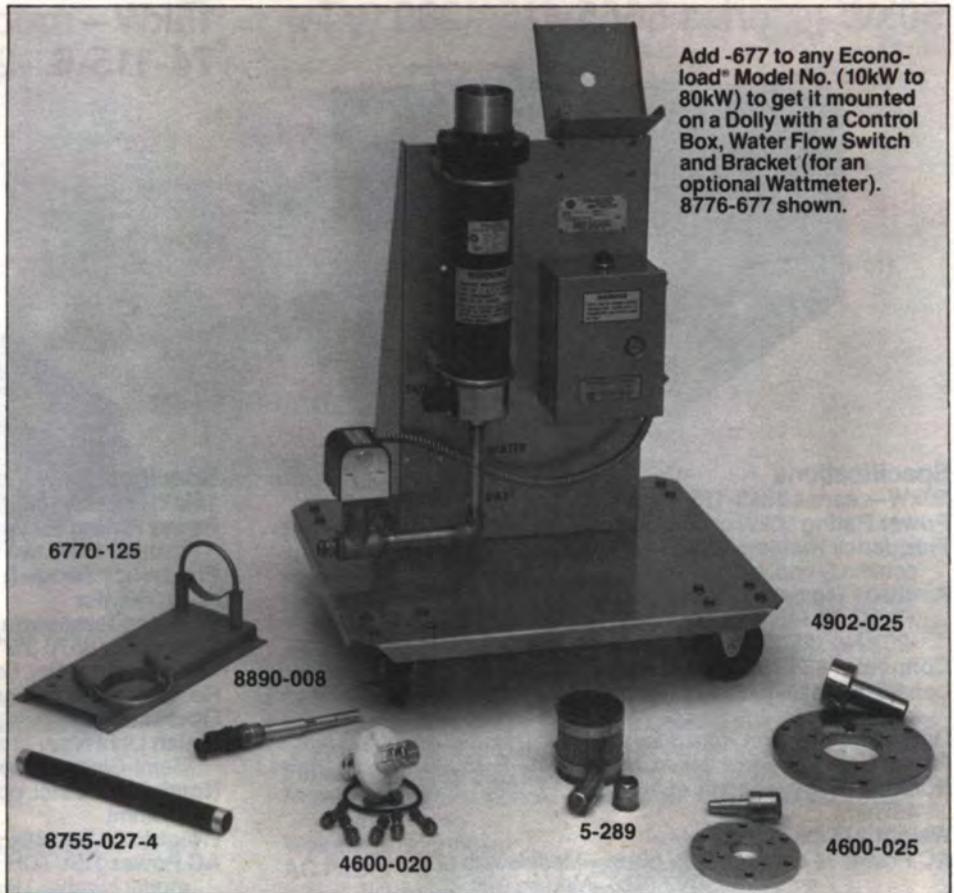
**AC Power** 115V 60Hz add suffix -115-6, 230V 50Hz add -230-5 to model number. Uses 1150W

**Optional Hot Air Duct** P/N 8572-078

## Load Accessories

### Miscellaneous Adapters, Connectors

Description	Part No.
3/8" Unfl/51.5 ohms to QC (F)	4240-187
3/8" Fl to QC (F)	4240-194
7/8" Fl to QC (F)	4240-201
Rt. Angle QC	4240-244
1 1/8" Fl to QC (F)	4240-260
3/8" Fl to 1 1/8" Fl EIA 50 ohms	4600-025
1 1/8" Fl to 7/8" Fl EIA 50 ohms	4712-015
3/8" Fl to 6 1/8" Fl EIA 50 ohms	4902-025
DC Conn. Plug	7500-076



Add -677 to any Econoload® Model No. (10kW to 80kW) to get it mounted on a Dolly with a Control Box, Water Flow Switch and Bracket (for an optional Wattmeter). 8776-677 shown.

### Coupling Kits

Line Type	Impedance	Part No.	Line Type	Impedance	Part No.	Line Type	Impedance	Part No.	Line Type	Impedance	Part No.
7/8" Flg	50 ohm	4240-220	3 1/8" Flg	50 ohm	4600-020	3 1/8" Unfl	51.5* ohm	5-289	6 1/8" Unfl	50 ohm	5-1322
1 1/8" Flg	50 ohm	4712-020	3 1/8" Unfl	50 ohm	5-726	*With adapter to 50 ohm			6 1/8" Flg	50 ohm	4902-020

### For Water-Cooled Loads Wall Mounting Brackets

Power	Part No.	Power	Part No.	Power	Part No.	Power	Part No.	Power	Part No.
10kW	6770-120	20kW, 30kW	6770-125	20kW	5-898-2	10kW	5-898-6	8750-100	For all Econoloads
80kW	6770-130	40kW, 50kW		30kW	5-898-3	80kW	5-898-7		
				40kW, 50kW	5-898-4				

### Water Flow Switch

### Control Box Assembly

### Replacement Resistors— Econoloads

Power	Part No.	Power	Part No.	Power	Part No.
10kW	8731-021	40kW	8755-027-4	15kW	8570-032
20kW	8755-029-2	50kW	8755-027-5	25kW	8572-021
30kW	8755-027-3	80kW	8790-035 Two Req'd.		

### Econoloads

### Forced-Air Loads

### Coolants (in 1 gallon can)

Description	Part No.	Description	Part No.
Refined Mineral Oil	5-030-3	For 10 & 25kW Moduloads	6771-011
DC-200 Silicon	5-1070-2	For 50kW Moduloads	6772-011
Ethylene Glycol, Industrial Grade	5-1134-3		

### Dollies

### For Air Cooled Loads Thermoswitches

Used On	Functions	Temperature set point— at which switch	Thermoswitch Part Number
8630 Series	Over Temperature Interlock	86°C opens	8630-013
8640 Series	Over Temperature Interlock	77°C opens	8640-066
8650 Series	Over Temperature Interlock	77°C opens	8640-066
8890 Series	Over Temperature Interlock	236°C opens	8890-008
8920 Series	Over Temperature Interlock	236°C opens	8890-008
8930 Series	Blower	155°C closes	2450-085
8930 Series	Over Temperature Interlock	226°C opens	8890-017
BA-300-115, -230	Automatic	100°C closes	8896-012

# TENULINE<sup>®</sup> and Broadband RF Coaxial Attenuators

TENULINE Attenuators are a valuable and reliable accessory for reducing power levels and VSWR, for isolating components under test, for harmonic signal analysis, and as comparison standards. Bird is the only source offering units from as low as 2 watts and 1dB to 4000 watts and 30dB attenuation. We have recently added 31 models from 2W to 75W and are planning additional models in that series at even higher power. The output level of a, say, 4000 watt/30dB attenuator at full power is 4 watts, which means that 5 watt and 2 watt units may be piggy-backed for specific attenuation requirements.

Until the introduction of the TENULINE High-Power Attenuator, directional couplers were used for scope signal observation, frequency checks and wide-band frequency analyses.

Bird Attenuators have several advantages over directional couplers in applications such as Radio Frequency

Interference (RFI), where a transmitter's output must be analyzed for the presence of undesirable signal components. First of all, the attenuators are the proper termination for the transmitter and 99.9% of the output power is dissipated in them. No additional load resistors are needed when used as an attenuator, and the units are also self-sufficient when used as dummy loads. Where four individual couplers may be needed to span the range from 30 to 500MHz, the High-Power Attenuator covers the entire range and below. Obviously the attenuation curve of one resistive device is more uniform than that of four resonant reactive devices.

Certainly the most important advantage offered by High-Power TENULINE units as compared to couplers is the fact that the attenuation can be verified at 60Hz or with direct current and Wheatstone bridge measurements. Bird Series 8320 and 8340 TENULINE Attenuators are laboratory calibrated at six RF frequencies and at DC.

## Attenuator Selection Table

Average Power (W)	Frequency Range (GHz)	Nominal Attenuation (dB)	Maximum VSWR	Connector	Model No.
2	dc-2	1, 2, 3, 6, 8, 10, 14, 20	1.20	BNC	8302
5	dc-4	3, 6, 10, 20, 30	1.25	N	8303
10	dc-4	3, 6, 10, 20, 30	1.25	N	8304
15	dc-4	3, 6, 10, 20, 30	1.25	N	8305
25	dc-4	3, 6, 10, 20, 30	1.25	N	8306
25	dc-1	3, 6, 10, 20	1.1-1.15 <sup>(2)</sup>	QC-N(F)	8340
40 <sup>(1)</sup>	dc-1	3, 6, 10, 20	1.1-1.15 <sup>(2)</sup>	QC-N(F)	8341
50	dc-2	3, 6, 10, 20	1.25	N	8307 <sup>(3)</sup>
50	dc-0.5	30	1.1	QC-N(F)	8321
75	dc-2	3, 6, 10, 20, 30	1.25	N	8308
100	dc-1	3, 6, 10, 20	1.1-1.15 <sup>(2)</sup>	QC-N(F)	8343
100	dc-0.5	30	1.1	QC-N(F)	8323
200	dc-0.5	30	1.1	QC-N(F)	8322
500	dc-0.5	30	1.1	QC-N(F)	8325
1000	dc-0.5	30	1.1	QC-LC(F)	8327-300
2000	dc-0.5	30	1.1	QC-LC(F)	8329-300
4000	dc-0.5	30	1.1	QC-LC(F)	8329-300 + BA-300

(1) Heat sink required

(2) Varies with frequency and attenuation

(3) Coming in 1986

## 2 Watts—Series 8302



### Broad-band Attenuator

Power Rating 2W continuous, 2.5kW peak (for 5 microsec. max.)

Frequency Range & VSWR 1.20 max. dc to 2GHz

Ambient Temperature Range -55°C to +70°C

Connectors Male BNC, Female BNC, bidirectional  
Coolant Dry. Convection air cooled

Finish Nickel plated

Nominal Size incl. conn. 1.95" x 0.63" (50 x 16mm)

Weight 1 oz. (28g)

dB Atten.	Accuracy ± dB	Model No.
1	0.3	8302-010
2	0.3	8302-020
3	0.3	8302-030
6	0.3	8302-060
8	0.3	8302-080
10	0.3	8302-100
14	0.3	8302-140
20	0.3	8302-200

## 5 Watts— series 8303



### Broad-band Attenuator

**Power Rating** 5W continuous, 3kW peak (for 5 microsec. max.)  
**Frequency Range & VSWR** 1.25 max. dc to 4GHz  
**Ambient Temperature Range** -55°C to +70°C  
**Connectors** Male N, Female N, bidirectional  
**Coolant** Dry. Convection air cooled  
**Finish** Silver plated  
**Nominal Size** incl. conn. 3.26" x 0.82" dia. (83 x 21 mm)  
**Weight** 3 oz. (84g)

dB Atten.	Accuracy ±dB		Model No.
	dc-2GHz	2-4GHz	
3	0.3	0.5	8303-030-N
6	0.3	0.5	8303-060-N
10	0.4	0.8	8303-100-N
20	0.5	1.0	8303-200-N
30	0.8	1.3	8303-300-N

## 10 Watts— series 8304



### Broad-band Attenuator

**Power Rating** 10W continuous, 3kW peak (for 5 microsec. max.), 5W max. reverse (8304-030-N bidirectional)  
**Frequency Range & VSWR** 1.25 max. dc to 4GHz  
**Ambient Temperature Range** -55°C to +70°C  
**Connectors** Male N (Input), Female N  
**Coolant** Dry. Convection air cooled  
**Finish** Black Anodized  
**Nominal Size** incl. conn. 3.26" x 1" dia. (83 x 25mm)  
**Weight** 2½ oz. (70g)

dB Atten.	Accuracy ±dB		Model No.
	dc-2GHz	2-4GHz	
3	0.3	0.5	8304-030-N
6	0.3	0.5	8304-060-N
10	0.4	0.8	8304-100-N
20	0.5	1.0	8304-200-N
30	0.8	1.3	8304-300-N

## 15 Watts— series 8305



### Broad-band Attenuator

**Power Range** 15W continuous, 3kW peak (for 5 microsec. max.), 5W max. reverse (8305-030-N bidirectional)  
**Frequency Range & VSWR** 1.25 max. dc to 4GHz  
**Ambient Temperature Range** -55°C to +70°C  
**Connectors** Male N (Input), Female N  
**Coolant** Dry. Convection air cooled  
**Finish** Black Anodized  
**Nominal Size** incl. conn. 3-6dB 3.24", 10-30dB 4.28" x 1" dia. (82 or 109 x 25mm)  
**Weight** 3 oz. (84g)

dB Atten.	Accuracy ±dB		Model No.
	dc-2GHz	2-4GHz	
3	0.3	0.5	8305-030-N
6	0.3	0.5	8305-060-N
10	0.4	0.8	8305-100-N
20	0.5	1.0	8305-200-N
30	0.8	1.3	8305-300-N

## 25 Watts series 8306



### Broad-band Attenuator

**Power Rating** 25W continuous, 3kW peak (for 5 microsec. max.), 5W max. reverse (8306-030-N bidirectional)  
**Frequency Range & VSWR** 1.25 max. dc to 4GHz  
**Ambient Temperature Range** -55°C to +70°C  
**Connectors** Male N (Input), Female N  
**Coolant** Dry. Convection air cooled  
**Finish** Black Anodized  
**Nominal Size** incl. conn. 3-6dB 4.28", 10-30dB 5.32" x 1" dia. (109 x 135 x 25mm)  
**Weight** 3½ oz. (90g)

dB Atten.	Accuracy ±dB		Model No.
	dc-2GHz	2-4GHz	
3	0.3	0.5	8306-030-N
6	0.3	0.5	8306-060-N
10	0.4	0.8	8306-100-N
20	0.5	1.0	8306-200-N
30	0.8	1.3	8306-300-N

## 25 Watts— series 8340



### Tenuline® Attenuator

**Power Rating** 25W continuous  
**Frequency Range** dc to 1000MHz  
**Ambient Temperature Range** -40°C to +45°C  
**Connectors** QC Type (Female N normally supplied)  
**Coolant** Dry. Convection air cooled  
**Finish** Semi-Gloss black enamel  
**Nominal Size** incl. conn. 3, 6, 20dB 5<sup>3</sup>/<sub>16</sub>" (132mm), 10dB 4<sup>1</sup>/<sub>16</sub>" (119mm) long x 1<sup>3</sup>/<sub>4</sub>" sq. (44mm)  
**Weight** 12½ to 15 oz. (350 to 420g)

dB Atten.	Accuracy ±dB & VSWR		Model No.
	dc-0.5GHz	0.5-1GHz	
3	0.5dB, 1.15	0.75dB, 1.2	8340-030
6	0.5dB, 1.15	0.75dB, 1.2	8340-060
10	0.5dB, 1.15	0.75dB, 1.15	8340-100
20	0.5dB, 1.1	0.75dB, 1.15	8340-200

## 40 Watts— series 8341



### Tenuline® Attenuator

**Power Rating** 40W continuous when bolted to a heat sink  
**Frequency Range** dc to 1000MHz  
**Ambient Temperature Range** -40°C to +45°C  
**Heat Sink Required** Aluminum panel 1/8" x 400 sq. in. (3mm x 1/4 sq. m), or equivalent  
**Connectors** QC Type (Female N normally supplied)  
**Coolant** Dry. Conduction cooled  
**Finish** Semi-Gloss black enamel

Continued on next page

**Nominal Size** incl. conn. 3, 6, 20dB 5<sup>3</sup>/<sub>16</sub>" (132mm), 10dB 4<sup>11</sup>/<sub>16</sub>" (119 mm) long x 1<sup>1</sup>/<sub>8</sub>" x 1<sup>1</sup>/<sub>4</sub>" (41 x 32mm)

**Weight** 12<sup>1</sup>/<sub>2</sub> to 15 oz. (350 to 420g)

dB Atten.	Accuracy ±dB & VSWR		Model No.
	dc-0.5GHz	0.5-1GHz	
3	0.5dB, 1.15	0.75dB, 1.2	8341-030
6	0.5dB, 1.15	0.75dB, 1.2	8341-060
10	0.5dB, 1.15	0.75dB, 1.15	8341-100
20	0.5dB, 1.1	0.75dB, 1.15	8341-200

## 50 Watts— model 8307



### Broad-band Attenuator

**Power Rating** 50W continuous, 2kW peak (for 5 microsec. max.), (bidirectional)  
**Frequency Range & VSWR** 1.25 max. dc-2GHz  
**Ambient Temperature Range** -55°C to +70°C  
**Connectors** Male N (Input), Female N  
**Coolant** Dry. Convection air cooled  
**Finish** Black Anodized  
**Nominal Size** 7.062" x 1.625" dia. (179 x 41mm)  
**Weight** 15.5 oz. (440g)

dB Atten.	Accuracy ± dB	Model No.
3	0.5	8307-030
6	0.6	8307-060
10	0.8	8307-100
20	1.0	8307-200

## 50 Watts— model 8321



### Tenuline® Attenuator

**Power Rating** 50W continuous  
**Frequency Range & VSWR** Input 1.1 max. dc to 500MHz  
**Attenuation** 30dB  
**Accuracy** ±0.5 dB (±0.2dB at 30, 100, 200, 300, 400 and 500MHz when using calibration data)  
**Ambient Temperature Range** -40°C to +45°C  
**Connectors** QC Type (Female N normally supplied)  
**Coolant** 1 pint (0.31 liters) Refined mineral oil  
**Operating Position** Horizontal only  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 10<sup>7</sup>/<sub>32</sub>" x 6<sup>11</sup>/<sub>32</sub>" x 3<sup>15</sup>/<sub>16</sub>" (260 x 161 x 100mm)  
**Weight** 6.5 lbs. (3kg)

## 75 Watts— series 8308



### Broad-band Attenuator

*Bird liquid-dielectric Attenuators have never and are not now manufactured with Poly Chlorinated Bi phenyls (PCBs).*

**Power Rating** 75W continuous, 3kW peak (for 5 microsec. max.), 5W max. reverse

**Frequency Range & VSWR** 1.25 max. dc—2GHz

**Ambient Temperature Range** -55°C to +70°C

**Connectors** Male N (Input), Female N

**Coolant** Dry. Convection air cooled

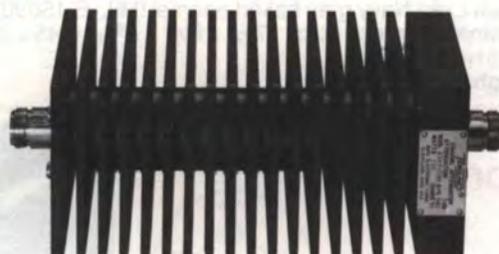
**Finish** Black Anodized

**Nominal Size** incl. conn. 3-6dB 6.61", 10-30dB 8.15" x 2" dia. (168 to 207 x 51 mm)

**Weight** 12 to 15 oz. (336 to 420g)

dB Atten.	Accuracy ± dB	Model No.
3	0.4	8308-030
6	0.4	8308-060
10	0.5	8308-100
20	0.8	8308-200
30	1.0	8308-300

## 100 Watts— series 8343



### Tenuline® Attenuator

**Power Range** 100W continuous  
**Frequency Range** dc to 1000MHz  
**Ambient Temperature Range** -40°C to +45°C  
**Connectors** QC Type (Female N normally supplied)  
**Coolant** Dry. Convection air cooled  
**Finish** Semi-Gloss black enamel  
**Nominal Size** incl. conn. 7<sup>23</sup>/<sub>32</sub>" x 2<sup>3</sup>/<sub>4</sub>" sq. (196 x 70mm)  
**Weight** 44 oz. (1.25kg)

dB Atten.	Accuracy ±dB & VSWR		Model No.
	dc-0.5GHz	0.5-1GHz	
3	0.5dB, 1.15	0.75dB, 1.2	8343-030
6	0.5dB, 1.15	0.75dB, 1.2	8343-060
10	0.5dB, 1.1	0.75dB, 1.15	8343-100
20	0.5dB, 1.1	0.75dB, 1.15	8343-200

## 100 Watts model 8323



### Tenuline® Attenuator

**Power Rating** 100W continuous  
**Frequency Range & VSWR** Input 1.1 max. dc to 500MHz  
**Attenuation** 30dB  
**Accuracy** ±0.5dB (±0.2dB at 30, 100, 200, 300, 400 and 500MHz when using calibration data)  
**Ambient Temperature Range** -40°C to +45°C  
**Connectors** QC Type (Female N normally supplied)  
**Coolant** 0.35 gal. (1.3 liters) Refined mineral oil  
**Operating Position** Horizontal only  
**Finish** Light Navy grey baked enamel (MIL-E-15090)  
**Nominal Size** incl. conn. 10<sup>11</sup>/<sub>32</sub>" x 8<sup>1</sup>/<sub>2</sub>" x 5<sup>15</sup>/<sub>16</sub>" (263 x 216 x 151mm)  
**Weight** 11 lbs. (5kg)

## 200 Watts model 8322



### Tenuline® Attenuator

**Power Rating** 200W continuous  
**Frequency Range & VSWR** 1.1 max.  
dc to 500MHz

**Attenuation** 30dB

**Accuracy** ±0.5dB (±0.2dB at 30, 100, 200, 300, 400 and 500MHz  
when using calibration data)

**Ambient Temperature Range** -40°C to +45°C

**Connectors** QC Type (Female N normally supplied)

**Coolant** 0.7 gal. (2.65 liters) Refined mineral oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 17½" x 8½" x 5<sup>15</sup>/<sub>16</sub>" (445 x 216 x  
151mm)

**Weight** 19 lbs. (9kg)

## 500 Watts model 8325



### Tenuline® Attenuator

**Power Range** 500W continuous  
**Frequency Range & VSWR** Input 1.1 max. dc to 500MHz

**Attenuation** 30dB

**Accuracy** ±0.5dB (±0.2dB at 30, 100, 200, 300 400 and 500MHz  
when using calibration data)

**Ambient Temperature Range** -40°C to +45°C

**Connectors** QC Type (Female N normally supplied)

**Coolant** 0.9 gal. (3.4 liters) Refined mineral oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 17½" x 8½" x 5<sup>15</sup>/<sub>16</sub>" (445 x 216 x  
151mm)

**Weight** 25 lbs. (11kg)

## 1kW— model 8327-300



### Tenuline® Attenuator

**Power Rating** 1000W continuous  
**Frequency Range & VSWR** Input 1.1 max.  
dc to 500MHz

**Attenuation** 30dB

**Accuracy** ±0.5dB (±0.2dB at 30, 100, 200, 300,  
400 and 500MHz  
when using calibration data)

**Ambient Temperature Range** -40°C to +45°C

**Connectors** QC Type (Female LC Input, Female N Output  
normally supplied)

**Coolant** 2.9 gals. (11 liters) Refined mineral oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 23<sup>15</sup>/<sub>32</sub>" x 17<sup>3</sup>/<sub>16</sub>" x 7<sup>1</sup>/<sub>8</sub>" (596 x 437 x  
181mm)

**Weight** 57 lbs. (26kg)

**Note:** Overload Thermoswitch P/N 2450-056 is optional

## 2kW model 8329-300



### Tenuline® Attenuator

**Power Range** 2000W continuous  
**Frequency Range & VSWR** Input 1.1 max. dc to 500MHz

**Attenuation** 30dB

**Accuracy** ±0.5dB (±0.2dB at 30, 100, 200, 300, 400 and 500MHz  
when using calibration data)

**Ambient Temperature Range** -40°C to +45°C

**Connectors** QC Type (Female LC Input Female N Output  
normally supplied)

**Coolant** 2.9 gals. (11 liters) Silicone Oil

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 23<sup>15</sup>/<sub>32</sub>" x 17<sup>3</sup>/<sub>16</sub>" x 7<sup>1</sup>/<sub>8</sub>" (596 x 437 x  
181mm)

**Weight** 57 lbs. (26kg)

**Note:** Overload Thermoswitch P/N 8329-028 is optional

## 4kW— model 8329-300 plus BA-300-115, -230



### Tenuline® Attenuator

**Power Rating** 4000W continuous with blower on, 1000W with  
blower off

**Frequency Range & VSWR** Input 1.1 max. dc to 500MHz

**Attenuation** 30dB

**Accuracy** ±0.5dB (±0.2dB at 30, 100, 200, 300, 400 and 500MHz  
when using calibration data)

**Ambient Temperature Range** -40°C to +45°C

**Connectors** QC Type (Female LC Input, Female N Output  
normally supplied)

**Coolant** 2.9 gals. (11 liters) Silicone Oil. With forced air cooling

**Operating Position** Horizontal only

**Finish** Light Navy grey baked enamel (MIL-E-15090)

**Nominal Size** incl. conn. 23<sup>15</sup>/<sub>32</sub>" x 22<sup>1</sup>/<sub>16</sub>" x 7<sup>1</sup>/<sub>8</sub>" (596 x 560 x  
181mm)

**Weight** 70½ lbs. (32kg)

**Blower AC Power** Model BA-300-115: 115V, 50/60Hz, 0.6A  
Model BA-300-230: 230V, 50/60Hz, 0.3A

**Notes:** Overload Thermoswitch P/N 8329-028 is optional. When  
ordered as a package, the Attenuator and Blower are factory  
assembled without additional charge.

# COAXWITCH® Coaxial Selector Switches

50 ohms nominal



**Description:** BIRD COAXWITCH 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 4½" of RG-87/U Teflon cable which is pulled away from the mating Male N connectors and rotated to the desired switch position. 75 ohm versions of all models shown available on special order.

**Installation:** BIRD Switches may be panel-mounted. All connectors are located on the rear of the housing and are parallel to the shaft of the switch. All connecting cables may be laced together without the use of right-angle adapters.

**Operation:** BIRD Switches have the valuable advantage that they cannot be operated accidentally, but must be operated by intentional sequential movement. The knob must be grasped, pulled out, rotated, and pushed in to make contact.

## Switching Configurations

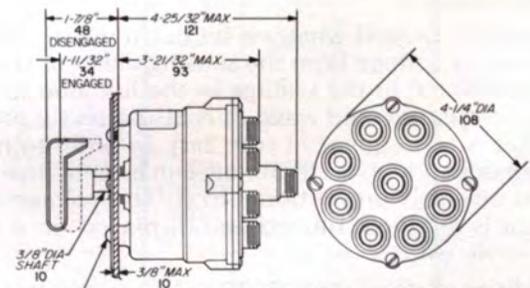
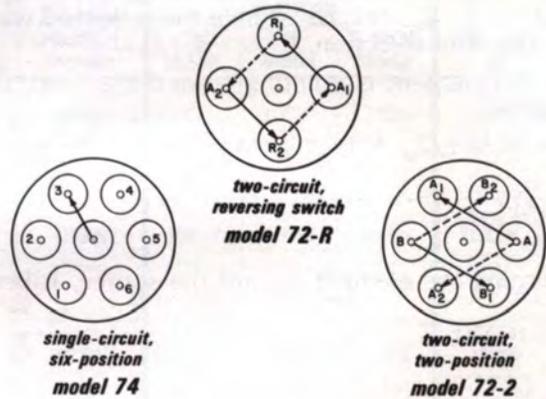
Model	7422	7441	7431	74	718	7181	72-2	72-R
Positions	2	3	4	6	8	10	2	reversible
Coaxial Circuits	1	1	1	1	1	1	2	2

## Typical Operating Values

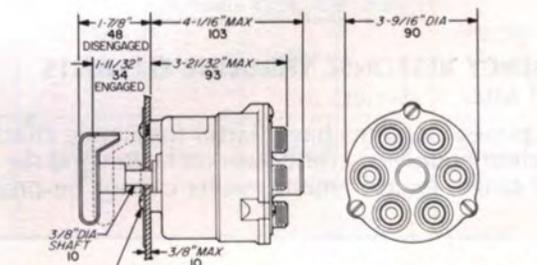
Frequency	VSWR	Insertion Loss	Maximum RF Power Rating at +65°C.
100 MHz	negligible	.02 dB	850 watts
1000 MHz	1.06 max.	.09 dB	200 watts
4000 MHz	1.30 max.	.22 dB	75 watts

## Specifications (all models)

Useful Frequency Range	dc to 10 GHz
Maximum RF Voltage	500 volts rms
Attenuation to Unused Channel	75 dB (cross talk)
Ambient Temperature Range	-60° to +65°C.
Weight	2½ lbs. (approx.) (1 kg)



MOUNTING DIMENSIONS 7/32" (6mm) MTG HOLES FOR FOUR 10-32 SCREWS SPACED AT 90° ON 1¼" (33mm) RADIUS



MOUNTING DIMENSIONS 7/32" (6mm) MTG HOLES FOR THREE 10-32 SCREWS SPACED AT 120° ON 1¼" (32mm) RADIUS

# ThruLine Principle

The basic sensing circuit of a THRULINE Plug-in Element consists of the mutual inductance  $M$  between the loop and the center conductor and the voltage divider  $C$  and  $R$ . In Fig. 1,  $E$  is the voltage between outer and center conductor and  $I$  is the current. Elements can be rotated 180°, resulting in either a positive or a negative  $M$  (Fig. 2 and 3). The output voltage in this lumped-constant directional coupler is the sum of two samples:

$$e_R \text{ from the division of } E \text{ by } R \text{ and } C, e_R = \frac{RE}{X_C} = RE \cdot j\omega C$$

$$\text{(if } R \ll X_C), \text{ and } e_M \text{ by induction } e_M = I \cdot j\omega (\pm M).$$

$$\text{The sum } e_R + e_M = j\omega(CRE \pm MI) = e$$

Besides selecting  $R$  very much smaller than  $X_C$ , the components of the circuit are chosen so that  $CR = M/Z_0$ .

$$\text{The output voltage is now } e = j\omega(EM/Z_0 \pm MI) = j\omega M(E/Z_0 \pm I).$$

At any one point on a transmission line, the voltage  $E$  is the sum of the forward and reflected voltages  $E_f + E_r$ , and the current  $I$  is  $E_f/Z_0 - E_r/Z_0$  (Since the reflected wave travels in the opposite direction,  $I_r = -E_r/Z_0$ ).

When the element is pointing toward the load, the output voltage is

$$e \rightarrow = j\omega M(E/Z_0 + I) = j\omega M \left\{ \frac{E_f + E_r}{Z_0} + \frac{E_f - E_r}{Z_0} \right\} =$$

$$= \boxed{\frac{j\omega M}{Z_0} (2E_f)}$$

and turning the element toward the source, it becomes. . .

$$e \leftarrow = j\omega M(E/Z_0 - I) = j\omega M \left\{ \frac{E_f + E_r}{Z_0} - \frac{E_f - E_r}{Z_0} \right\} =$$

$$= \boxed{\frac{j\omega M}{Z_0} (2E_r)}$$

We have now proved what we set out to show, namely that the RF output voltage from the sensing element is directional and proportional to the voltage in the line due to either the forward or the reflected wave. It is also directly proportional to  $\omega$ , that is to frequency ( $\omega = 2\pi f$ ). In order to make it frequency independent, we terminate  $e$  in a capacitive reactance which is inversely proportional to  $\omega$ . The voltage across this capacitor is rectified, filtered and displayed on a meter calibrated in RF watts.

For additional details on THRULINE principles, write for "WATT'S NEW FROM BIRD" vol. 2 no. 2.

Fig. 4.

## FREQUENCY RESPONSE THRULINE ELEMENTS 100-250 MHz (C-Series)

Higher power Elements have flatter frequency characteristics than tighter coupled lower-power units. Beyond the stated frequency range, measurement results cannot be predicted.

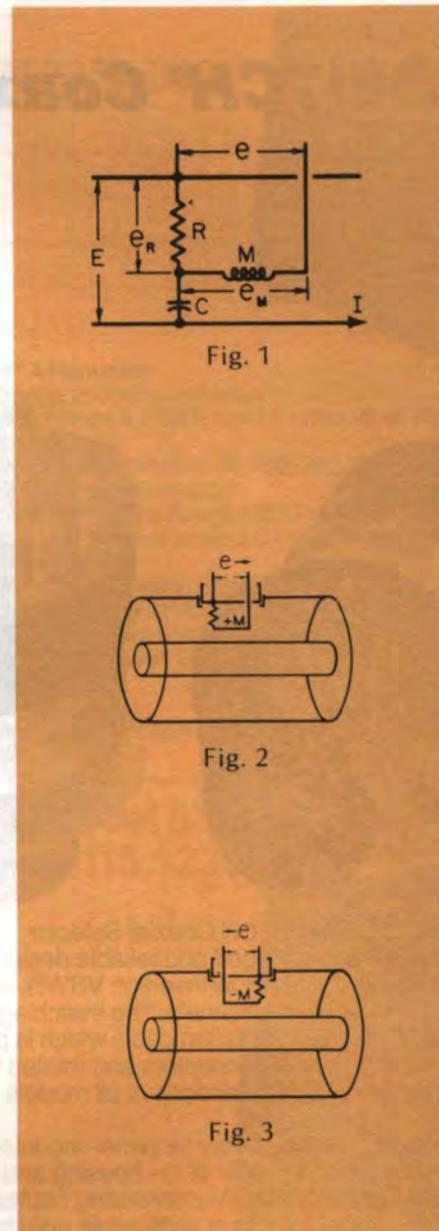
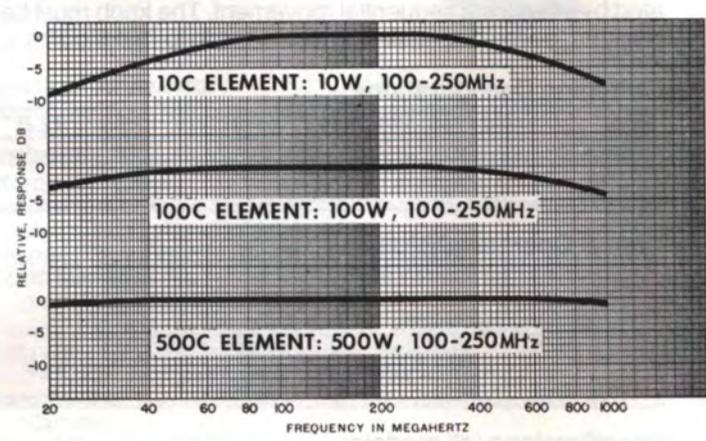


Fig. 1

Fig. 2

Fig. 3



# Interpreting Readings on Peak Wattmeters With CW, AM, SSB and Pulsed Signals

For a detailed essay on this subject, write for "WATT'S NEW FROM BIRD" vol. 4 no. 2.

For TV Black Level measurement (Table G), refer to vol. 5, no. 3.

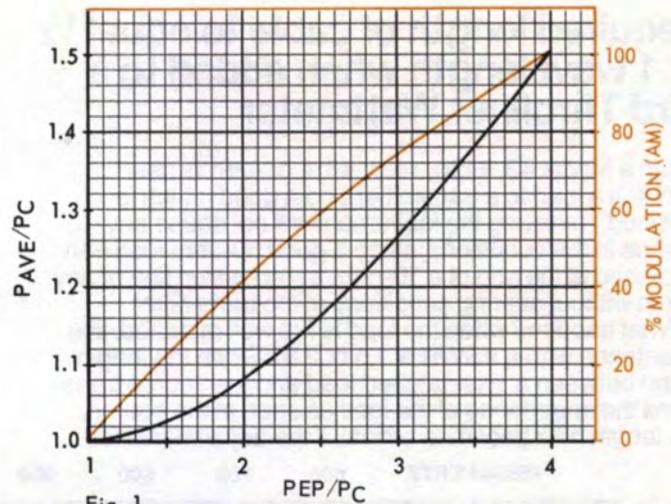


Fig. 1

Correlation of PEAK-ENVELOPE-POWER (PEP), CARRIER POWER ( $P_C$ ), AVERAGE HEATING POWER ( $P_{AVE}$ ) and % MODULATION of AM signals of Table A, B or C below.

Transmission Type and Scope Pattern	Frequency Spectrum (C: Carrier)	PEV <sub>rms</sub> (arbitrary)	PEP = $PEV_{rms}^2/Z_0$	Average (Heating) Power	4380 Series, Models 4314, 4391			Model 43
					CW Mode	PEP Mode	% MOD Mode	
Table A CW 		$\frac{100}{\sqrt{2}}$ V	100W	100W	100W	100W	0%	100W
Table B AM 100% Mod. 		$\frac{200}{\sqrt{2}}$ V	400W	150W	100W	400W	100%	100W
Table C AM 73% Mod. 		$\frac{173}{\sqrt{2}}$ V	300W	127W	100W	300W	73%	100W
Table D SSB 1 tone 		$\frac{100}{\sqrt{2}}$ V	100W	100W	100W	100W	0%	100W
Table E SSB 2 tone 		$\frac{100}{\sqrt{2}}$ V	100W	50W	25W (model 4314 40.5W)	100W	100%	40.5W
Table F SSB Voice 		$\frac{100}{\sqrt{2}}$ V	100W	—	—	100W	—	—
Table G TV Black Level 		$\frac{100}{\sqrt{2}}$ V	100W	60.1W	models 4314, 4391 only			59.6W
Table H Pulse 		$\frac{100}{\sqrt{2}}$ V	100W	10W	—	100W*	100%	—

\*Also applicable to series 4380, if pulses are over 50 microseconds long.

In the table above,  $Z_0 = 50$  ohms, PEP is Peak Envelope Power, and PEV is Peak Envelope Voltage. The PEV of the Carrier (or suppressed Carrier) C was arbitrarily chosen at

100 volts in all examples.  $PEV_{rms} = PEV/\sqrt{2}$ .

For a detailed essay on this subject, write for "WATT'S NEW FROM BIRD" vol. 4, no. 2.

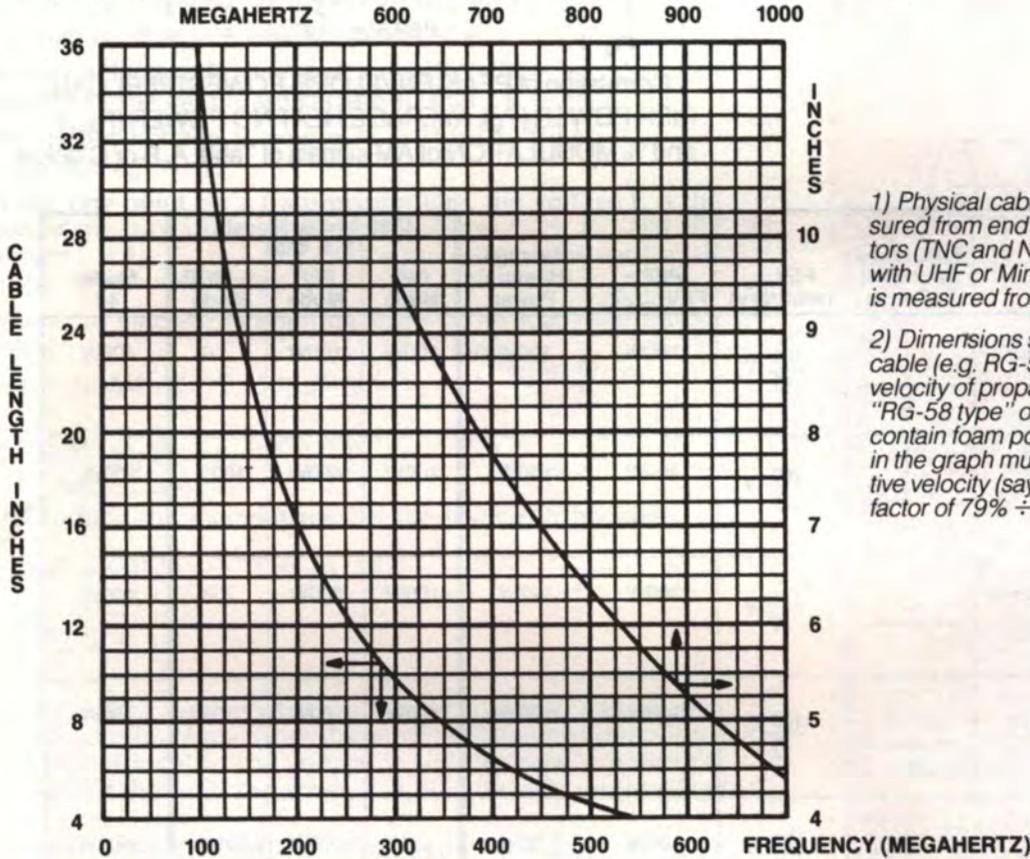
# Required length of cable to equal 1/2 or 1 wavelength when added to a Bird Thruline® Wattmeter

When a Model 43, 4430, 4431, 4314 or 4381 is used to match a load to a transmitter and a good match is obtained, removing the instrument will not cause any change in the conditions, since a good 50-ohm load can be placed at the end of a 50-ohm transmission line of any length without altering conditions at the transmitter.

What happens when the load is not well matched, like an antenna with a VSWR of 1.5 or 2.0? Since the length of line between a mismatched load and the source transforms the impedance of the load as seen at the source, line length now becomes critical. If the adjustments for

maximum power transfer were made with the Model 43 in place, removing it shortens the line by four inches, plus two connectors. This still is no cause for concern at low frequencies where four to five inches is a small fraction of a wavelength. At higher frequencies, e.g. above 100MHz, power output and frequency of the source may be affected.

It is a principle of transmission line theory that the impedance is identical on either side of 1/2 wavelength. In order to duplicate the conditions in your transmission line with the above model wattmeters either in or out of the line, it is only necessary to insert or remove one or more 1/2 wavelengths. This is easily done by making up a length of cable which, when added to the THRULINE® equals one or more 1/2 wavelengths at the frequency of measurement. If more than one frequency is involved, one cable is needed for each frequency.



1) Physical cable length shown in inches is measured from end to end of outer conductor of connectors (TNC and N Male connectors), except for cables with UHF or Mini-UHF plugs where the cable length is measured from tip to tip of the center pins.

2) Dimensions shown are for SOLID polyethylene cable (e.g. RG-58C/U, RG-8/U) which has 66% the velocity of propagation relative to air. If so-called "RG-58 type" or "RG-8 type" cables (which often contain foam polyethylene) are used, the dimensions in the graph must be multiplied by that cable's relative velocity (say 79%) divided by 66% (i.e. by a factor of  $79\% \div 66\% = 1.2$ ).

## Typical Peak Power Ratings

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

Models	Avg. Power	Pulse Width (Microseconds)				
		1	10	100	1000	5000
<b>Dry Dielectric Loads</b>						
80M-80F	5W	4kW	3.1kW	2.2kW	1.4kW	0.8kW
8052-8053	10W	10kW	7.6kW	5.2kW	2.8kW	1.2kW
8080	25W	10kW	7.6kW	5.2kW	2.8kW	1.2kW
8160-8164	100W	35kW	26.5kW	18.2kW	10kW	4.0kW
<b>Liquid Dielectric Loads</b>						
8135	150W	10kW	8.0kW	5.75kW	3.5kW	2.0kW
*8135 A	150W	35kW	26.5kW	18.2kW	10kW	4.0kW
8201	500W	200kW	150kW	105kW	57kW	25kW
8251	1000W	200kW	150kW	105kW	57kW	25kW
8890-Series	2.5kW	150kW	115kW	80kW	54kW	22kW
8920-Series	5kW	150kW	115kW	80kW	54kW	22kW
8930-Series	10kW	150kW	120kW	85kW	55kW	30kW
<b>Direct Water-Cooled Loads</b>						
8730	10kW	100kW	77kW	56kW	32kW	16kW
8740	20kW	250kW	190kW	135kW	75kW	35kW
8750	30kW	250kW	190kW	135kW	75kW	40kW
8760	40kW	250kW	197kW	145kW	90kW	55kW
8770	50kW	250kW	197kW	145kW	97kW	65kW
8790	80kW	250kW	210kW	170kW	130kW	100kW

\*Special High Peak Power Resistor is used.



*The President of the United States Award for Excellence in Exports*



# **BIRD**

## **Electronic Corporation**

**Main Office and Plant**

30303 Aurora Road Cleveland (Solon), OH 44139

Phone: 216-248-1200 Cable: BIRDELEC Telex: 706898 Bird Elec UD

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[www.SteamPoweredRadio.Com](http://www.SteamPoweredRadio.Com)



## THRULINE® RF Directional Wattmeters

for use with 50 Ω cables

MODEL	CONNECTORS	PAGE	PRICE
43 CW/Portable	50 Ω cable	4	\$172
Elements (Table 1)	25-1000MHz	5, 31	48
Elements (Table 1)	50H thru 1000H	5, 31	59
Elements (Table 1)	2500H, 5000H	5, 31	85
Elements (Table 2)	Low power	5, 31	64
Elements (Table 3)	950-2300MHz	5, 31	100
Elements (Table 4)	0.45-2.5MHz	5, 31	100
Elements (Table 5)	Peak only	19, 31	105
Elements (Table 6)	Milliwatts	5, 31	90
CC-1 Carrying Case		36	30
CC-3 Carrying Case		5, 36	30
EC-1 Element Case		36	22
440 Wattmeter Only		—	350
440 RF Test Set		—	Inq.
3900 RF Power/Freq. Meter		17	775
4030 Field Strength Element		12	95
4041 Field Strength Meter		12	149
4110-182 RF Test Set		27	425
4300-064 Mobile Service Test Set		27	476
Includes: 43, 4275-100, 8164, 4240-050(2), 4400-012 in 4300-061 Carrying Case			
4301 Wattmeter Only	50 Ω cable	—	375
4304 Wide Band	50 Ω cable	6	375
4305 Hi Power	50 Ω cable	11	475
Elements (4305)(Table 8)	0.45-2.5MHz	11, 32	105
Elements (4305)(Table 8)	2-1800MHz	11, 32	80
4314 pk/CW(AC/DC)	50 Ω cable	10	650
Use 43 Elements		31	
Additional Elements (4314) (Table 5)		31	105
4370 Multirange	50 Ω cable	6	1200

## RF Power Analyst® Series (less elements)

MODEL	CONNECTORS	PAGE	PRICE
4380A-488 IEEE-488 Bus Interface Unit		21	\$1040
4380-600 Panel mtg. kit for above		21, 22	75
4381 Portable	50 Ω cable	18	675
4381-832 Bus-compatible			
4381	50 Ω cable	18	790
4382 Portable	1%, 3% or 6%	22	620
4382-832 Bus-compatible			
4382	1%, 3% or 6%	22	735
4383 Portable	50 Ω cable	18	620
4383-832 Bus-compatible			
4383	50 Ω cable	18	735
4384 Portable	1%, 3% or 6%	22	650
4384-832 Bus-compatible			
4384	1%, 3% or 6%	22	765
4300-080 Carrying Case for above		18, 36	95
4391 (AC/DC) Portable	50 Ω cable	20	830
4391-832 Bus-compatible			
4391	50 Ω cable	20	945
4300-085 Carrying Case (4391)		36	95

## RF Power Analyst® Panel Wattmeters

4385 Panel mounted 4381	50 Ω cable	18	\$829
4385-832 Bus-compatible			
4385	50 Ω cable	18	947
4386 Panel mounted 4382	1%, 3% or 6%	22	750
4386-832 Bus-compatible			
4386	1%, 3% or 6%	22	865
4387 Panel mounted 4383	50 Ω cable	18	750
4387-832 Bus-compatible			
4387	50 Ω cable	18	865
4388 Panel mounted 4384	1%, 3% or 6%	22	750
4388-832 Bus-compatible			
4388	1%, 3% or 6%	22	865
3170-058-3 25' DC cable, two rqd.		36	26
3171-010 25' DC cable for 6%, two rqd.		36	45
Use 43 Elements for 4381, 4383, 4385, 4387, 4391		19, 31	
Elements for 4382, 4384, 4386, 4388		23, 33	75+
DC Feed-in Element P/N 4381-050		—	75
+ H-series ELEMENTS (2-30MHz) for all high-power Wattmeters		23, 33	85
① Charger included. Specify 115V or 230V		36	
② Less line section and DC cables		34, 36	
4400-012 VSWR Chart		5	

## THRULINE® WATTMETERS (CONT'D)

MODEL	CONNECTORS	PAGE	PRICE
4410A CW w/7-range Elements, DC portable	50 Ω cable	7	\$495
4410-P AC/DC Panel	50 Ω cable	7	775
4411 AC/DC Portable	50 Ω cable	7	650
4412 AC/DC NiCd Port.	50 Ω cable	7	795
4410-1 0.2-0.535MHz, 10-10000W (Table 12)		8, 32	175
4410-2 0.45-2.5MHz, 10-10000W (Table 12)		8, 32	175
4410-3 2-30MHz, 1-1000W (Table 11)		8, 32	150
4410-4 2-30MHz, 10-10000W (Table 12)		8, 32	150
4410-5 25-80MHz, 1-1000W (Table 11)		8, 32	125
4410-6 50-200MHz, 1-1000W (Table 11)		8, 32	125
4410-7 144-520MHz, 1-1000W (Table 11)		8, 32	125
4410-8 200-1000MHz, 1-1000W (Table 11)		8, 32	125
4410-10 25-80MHz, 100mW-100W (Table 10)		8, 32	125
4410-11 50-125MHz, 100mW-100W (Table 10)		8, 32	125
4410-12 100-250MHz, 100mW-100W (Table 10)		8, 32	125
4410-13 200-500MHz, 100mW-100W (Table 10)		8, 32	125
4410-14 400-1000MHz, 100mW-100W (Table 10)		8, 32	125
4410-20 30-50MHz, 10mW-10W (Table 9)		8, 32	125
4410-21 50-88MHz, 10mW-10W (Table 9)		8, 32	125
4410-22 100-152MHz, 10mW-10W (Table 9)		8, 32	125
4410-23 150-250MHz, 10mW-10W (Table 9)		8, 32	125
4410-24 225-400MHz, 10mW-10W (Table 9)		8, 32	125
4410-25 400-800MHz, 10mW-10W (Table 9)		8, 32	125
4410-26 800-900MHz, 10mW-10W (Table 9)		8, 32	125
4410-27 88-108MHz, 10mW-10W (Table 9)		8, 32	125
4410-070 Calibration Element		—	170
4410-025 Test Set		9	Inq.
4410-030 Test Set		9	Inq.
4430 43 w/RF Tap - 512MHz	50 Ω cable	10	260
4431 43 w/variable RF Tap	50 Ω cable	10	290
Use 43 Elements		5	
4450 Very Low Freq. Wattmeter		—	425

## Thruline® Panel Wattmeters

for use with rigid coax lines:

MODEL	CONNECTORS	PAGE	PRICE
460	50 Ω 3/8" EIA FI	15	\$500
Elements (460) Table 3 1/8" A		15, 33	75+
480	51.5 Ω 3/8" Unfl	—	410
Elements (480) Table 3 1/8" A		15, 33	75+
4600-037	50 Ω 3/8" EIA FI	15	600
Elements (4600-037) Table 3 1/8" B		15, 33	75+
4610-200	50 Ω 3/8" EIA FI	15	705
Elements (4610-200) Table 3 1/8" A		15, 33	75+
4610-300	50 Ω 3/8" EIA FI	15	705
Elements (4610-300) Table 3 1/8" B		15, 33	75+
4712	50 Ω 1 1/8" EIA FI	15	460
Elements (4712) Table 1 1/8" A		15, 33	75+
4712-037	50 Ω 1 1/8" EIA FI	15	460
Elements (4712-037) Table 1 1/8" B		15, 33	75+
4715-200	50 Ω 1 1/8" EIA FI	15	565
Elements (4715-200) Table 1 1/8" A		15, 33	75+
4715-300	50 Ω 1 1/8" FI	15	565
Elements (4715-300) Table 1 1/8" B		15, 33	75+
4720	50 Ω 1 1/8" Unfl	15	400
Elements (4720) Table 1 1/8" A		15, 33	75+
4723-200	50 Ω 1 1/8" Unfl	15	535
Elements (4723-200) Table 1 1/8" A		15, 33	75+
4802-200	50 Ω 3/8" Unfl	15	575
Elements (4802-200) Table 3 1/8" A		15, 33	75+
4802-300	50 Ω 3/8" Unfl	15	575
Elements (4802-300) Table 3 1/8" B		15, 33	75+
4805	50 Ω 3/8" Unfl	15	450
Elements (4805) Table 3 1/8" A		15, 33	75+

## THRULINE® WATTMETERS (CONT'D)

MODEL	CONNECTORS	PAGE	PRICE
4805-037	50 Ω 3/8" Unfl	15	\$450
Elements (4805-037) Table 3 1/8" B		15, 33	75+
4902	50 Ω 6 1/8" EIA FI	15	1025
Elements (4902) Table 6 1/8" A		15, 33	75+
4902-037	50 Ω 6 1/8" EIA FI	15	1025
Elements (4902-037) Table 6 1/8" B		15, 33	75+
4905-200	50 Ω 6 1/8" EIA FI	15	1180
Elements (4905-200) Table 6 1/8" A		15, 33	75+
4905-300	50 Ω 6 1/8" EIA FI	15	1180
Elements (4905-300) Table 6 1/8" A		15, 33	75+
4907	50 Ω 6 1/8" Unfl	15	690
Elements (4907) Table 6 1/8" A		15, 33	75+
4909-200	50 Ω 6 1/8" Unfl	15	850
Elements (4909-200) Table 6 1/8" A		15, 33	75+
4902-080	50 Ω 6 1/8" EIA FI	15	1025
Elements (4902-080) Table 6 1/8" C		15, 33	75+
4907-080	50 Ω 6 1/8" Unfl	15	690
Elements (4907-080) Table 6 1/8" C		15, 33	75+
+ H-series ELEMENTS for all high-power Wattmeters above		15, 33	85

## Directional Coupler Elements Couplers & Samplers

MODEL	PAGE	PRICE
Couplers for cable or 1/8 lines (Table 14)	32	\$ 75
Couplers for 1%, 3% or 6% lines (Tables 15, 16, 17)	32	105
4266 HF Coupler, 1500 watts	—	285
4273 Variable RF Sampler 1.5-35MHz	12	85*
4273-020, 4275-020 e/w N(M), N(F)	12	104
4273-025, 4275-025 e/w N(F), N(F)	12	99
4273-030, 4275-030 e/w UHF(M), UHF(F)	12	111
4273-035, 4275-035 e/w UHF(F), UHF(F)	12	99
4273-100 for installation on Bird equipment	12	95
4274-025 Wide Range RF Sampler	4, 32	60
4275 Variable RF Sampler 20-1000MHz	12	85*
4275-100 for installation on Bird equipment	12	95

## Laboratory Standard RF Wattmeters

MODEL	PAGE	PRICE
4340 100W insertion type	—	\$1460
4341 (4340 less elements)	—	600
Special Elements (4341)	—	185

## WATTCHER® RF Power Monitor/Alarm

MODEL	PAGE	PRICE
3126 for rigid lines (15/30/60-scale meters) ①②	25	\$ 960
3127 for rigid lines (5/10/25-scale meters) ①②	25	875
3128 for cables (25/50/100-scale meters) ①②	25	925
3170 High Speed RF Monitoring System for cables (25/50/100) ②	24	1050
3171 High Speed RF Mon. Sys. (rigid lines) (5/10/25) ①②	24	1000
3171-020 High Speed RF Mon. Sys. (rigid lines) (15/30/60) ①②	24	1000
Elements for 3171, 3171-020	33	75+
+ H-series ELEMENTS for 3171	33	85
① less line section	34	
② less elements	31, 33	
25' DC Cables included with WATTCHER (except 3170), other lengths optional. See CABLE ASSEMBLIES	36	—

## Digital Hi-Power RF Calorimeter

MODEL	PAGE	PRICE
6080-115 (less TERMALINE® load)	29	\$3600
6080-230 (less TERMALINE® load)	29	3635
6081-115 Panel (less TERMALINE® load)	29	3700
6081-230 Panel (less TERMALINE® load)	29	3735
6090-115	28	5750
6090-230	28	5750



## MODULOAD® RF Calorimeter Load Systems

MODEL	CONNECTOR	POWER	PAGE	PRICE
8631-601	3/8" EIA FI	10kW	30	\$7465
8631-602	3/8" EIA FI	10kW	30	7500
8635-601	1 1/8" EIA FI	10kW	30	7465
8635-602	1 1/8" EIA FI	10kW	30	7500
8638-601	3/8" Unfl	10kW	30	7465
8638-602	3/8" Unfl	10kW	30	7500
8645-601	3/8" EIA FI	25kW	30	9500
8645-602	3/8" EIA FI	25kW	30	9535
8646-601	3/8" Unfl	25kW	30	9500
8646-602	3/8" Unfl	25kW	30	9535
8655-601	3/8" EIA FI	50kW	30	12000
8655-602	3/8" EIA FI	50kW	30	12035
8656-601	3/8" Unfl	50kW	30	12000
8656-602	3/8" Unfl	50kW	30	12035

Above models' coolant is 100% water. For Glycol use, replace "0" in model number with "3" (e.g. 8635-601 becomes 8635-631). Same price.

LINE VOLTAGE SUFFIX: -601 115V 60Hz  
-602 230V 50Hz

## TERMALINE® RF Absorption Wattmeters

MODEL	POWER	PAGE	PRICE
694	1000W	41	\$ 975
6104 4-range	2/6/20/60W	39	475
6151 Select range	100W	39	400A
6154 4-range to 1000MHz	5/15/50/150W	40	495
6156 4-range to 512MHz	5/15/50/150W	40	475
6256 3-range to 512MHz	0.2/0.8/3W	39	310
6257 3-range to 1000MHz	0.2/0.8/3W	39	350
6258 3-range to 512MHz	3/10/30W	39	500
6259 3-range to 1000MHz	3/10/30W	39	550
6732A 3-range	10/50/250W	40	625
6734A 3-range	25/100/500W	40	725
6734A-030 3-range	25/100/500W	40	800
6734-034 Low Freq. Line Section with Meter		41	475
6735-300 3-range	120/600/1200W	41	1150
6736 3-range	50/250/1000W	40	1100
6736-030 3-range	50/250/1000W	40	1175
6737 3-range	100/500/2500W	41	1100
6737-030 3-range	100/500/2500W	41	1175
ΔPlus Elements	2-30MHz	41	59
	25-1000MHz	41	48
	950-2300MHz	41	100

## TERMALINE® RF Coaxial Load Resistors

MODEL	CONNECTOR	POWER	PAGE	PRICE
80BNC(F), 80BNC(M)		5W	44	\$ 65
80CF, 80CM		5W	44	65
80F, 80M		5W	44	50
80SC(F), 80SC(M)		5W	44	65
80TNC(F), 80TNC(M)		5W	44	65
8010, 8011 N(F), (M)		2W	44	50
8015, 8016 TNC(M), (F)		2W	44	50
8052, 8053 N(F), (M)		10W	44	65
8071-1 SMA(F) Heat sink reqd.		100W	45	180
8072-1 SQC-N(F) Heat sink reqd.		300W	46	250
8080 QC-N(M)		25W	44	75
8085 QC-N(M)		50W	45	105
8135 QC-N(F)		150W	46	160
8135A QC-N(F)		150W	60	200
8141 QC-N(F)		250W	46	240
8164 QC-N(F)		100W	45	190
8166 QC-N(F)		150W	45	225
8173 QC-N(F)		300W	46	375
8201 QC-N(F)		500W	46	300
8230 air/water cooled QC-LC(F)	0.2/2-1/2kW	47	450	
8251 QC-LC(F)		1kW	47	525
8360 Series				
N(M), BNC(M), TNC(M)		2W	44	35
8361 Series N(M), (F); BNC(M), (F); TNC(M), (F)		10W	44	49
8362 Series N(M), (F); BNC(M), (F); TNC(M), (F)		25W	45	75
8363 Series N(M), (F); BNC(M), (F); TNC(M), (F)		50W	45	105
8401 QC-N(F)		600W	47	330
8431 SQC-N(F)		600/500W	46	550

## MODULOAD® Self-Cooled Load Systems

MODEL	CONNECTOR	POWER	PAGE	PRICE
8631-115 3/8" EIA FI		10kW	50	\$3980
8631-230 3/8" EIA FI		10kW	50	4015
8635-115 1 1/8" EIA FI		10kW	50	3980

## MODULOAD® SYSTEMS (CONT'D)

MODEL	CONNECTOR	POWER	PAGE	PRICE
8635-230 1 1/8" EIA FI		10kW	50	\$4015
8638-115 3/8" Unfl		10kW	50	3980
8638-230 3/8" Unfl		10kW	50	4015
8645-115 3/8" EIA FI		25kW	50	5300
8645-230 3/8" EIA FI		25kW	50	5335
8646-115 3/8" Unfl		25kW	50	5300
8646-230 3/8" Unfl		25kW	50	5335
8655-115 3/8" EIA FI		50kW	51	7400
8655-230 3/8" EIA FI		50kW	51	7435
8656-115 3/8" Unfl		50kW	51	7400
8656-230 3/8" Unfl		50kW	51	7435
8690-060 6 1/8" EIA FI 230V 60Hz		80kW	51	Inq.
8690-050 6 1/8" EIA FI 230V 50Hz		80kW	51	Inq.
8691-060 6 1/8" Unfl 230V 60Hz		80kW	51	Inq.
8691-050 6 1/8" Unfl 230V 50Hz		80kW	51	Inq.

LINE VOLTAGE SUFFIX: -115: 115V 60Hz  
-230: 230V 50Hz (except 80kW units)

## Water Cooled, Air Dielectric

MODEL	CONNECTOR	POWER	PAGE	PRICE
8710 N/M or F		1kW	49	\$ 340
8711 C/M or F		1kW	49	375
8713 1/8" EIA FI/50 Ω		1kW	49	400
8720 1 1/8" EIA FI/50 Ω		5kW	49	630
8726 QC-LC(F)		5kW	49	600
8730 1 1/8" EIA FI Econoload®		10kW	49	750
8731 3/8" EIA FI Econoload		10kW	49	775
8738 3/8" Unfl Econoload		10kW	49	775
8745 3/8" EIA FI Econoload		20kW	49	1100
8746 3/8" Unfl Econoload		20kW	49	1100
8755 3/8" EIA FI Econoload		30kW	49	1525
8756 3/8" Unfl Econoload		30kW	49	1525
8765 3/8" EIA FI Econoload		40kW	49	1725
8766 3/8" Unfl Econoload		40kW	49	1725
8775 3/8" EIA FI Econoload		50kW	50	1950
8776 3/8" Unfl Econoload		50kW	50	1950
8790 6 1/8" EIA FI Econoload		80kW	50	3000
8791 6 1/8" Unfl Econoload		80kW	50	3000

For Econoload Resistors mounted on a Dolly with Water Flow Switch, Control Box and Bracket (for optional Wattmeter), add -677 to Model No. 52 750

## Control Box Assembly

MODEL	POWER	PAGE	PRICE
8750-100 For all Econoloads		52	\$265

## Replacement Resistors — Econoloads, etc.

8570-032 (Forced Air Loads)	15kW	52	\$ 72
8572-021 (Forced Air Loads)	25kW	52	73
8731-021	10kW	52	265
8755-027-3	30kW	52	335
8755-027-4	40kW	52	390
8755-027-5	50kW	52	400
8755-029-2	20kW	52	270
8790-035 Two Req'd.	80kW	52	475

## Water Flow Switch — Econoloads

5-898-2	20kW	52	\$125
5-898-3	30kW	52	125
5-898-4	40kW, 50kW	52	125
5-898-6	10kW	52	125
5-898-7	80kW	52	125

## Wall-mounting Brackets

6770-120	10kW	52	\$100
6770-125	20kW, 30kW, 40kW, 50kW	52	100
6770-130	80kW	52	100

## Air Cooled, Liquid Dielectric

MODEL	CONNECTOR	POWER	PAGE	PRICE
8833-300 QC-LC(F)		1kW	47	\$ 640
8860 QC-LC(F)		1500W	47	720
8861 1 1/8" Unfl		1500W	47	720
8862 1 1/8" EIA FI		1500W	47	735
8863 3/8" Unfl		1500W	47	780
8864 3/8" EIA FI		1500W	47	800
8890-300 QC-LC(F)		2 1/2 kW	48	830
8890-008 Thermoswitch		52	110	
8891-300 3/8" EIA FI/50 Ω		2 1/2 kW	48	950
8892-300 1 1/8" EIA FI/50 Ω		2 1/2 kW	48	850
8895-300 1 1/8" Unfl/50 Ω				
(Recessed Ctr Cond)		2 1/2 kW	48	865
8896-300 3/8" Unfl/51.5 Ω		2 1/2 kW	48	900
8897-300 3/8" Unfl/50 Ω				
(Flush Ctr Cond)		2 1/2 kW	48	900
8898-300 3/8" Unfl/50 Ω				
(Recessed Ctr Cond)		2 1/2 kW	48	915

## AIR COOLED, LIQUID DIELECTRIC (CONT'D)

MODEL	CONNECTOR	POWER	PAGE	PRICE
BA-300-115, -230 Blower				
Increases any 8890-330 series to		5kW	48	\$ 500
8890-315 (115V) Load/Blower/2 Thermoswitch Assy		5kW	48	1700
8890-300 (230V) Load/Blower/2 Thermoswitch Assy		5kW	48	1700
8921 QC-LC(F)		5kW	48	1830
8922 1 1/8" EIA FI		5kW	48	1855
8926 3/8" EIA FI		5kW	58	1915
8927 3/8" Unfl		5kW	48	1900
8931-115 QC-LC(F)		10kW	48	2750
8931-230 QC-LC(F)		10kW	48	2790
8932-115 1 1/8" EIA FI		10kW	48	2780
8932-230 1 1/8" EIA FI		10kW	48	3005
8936-115 3/8" EIA FI		10kW	48	2825
8936-230 3/8" EIA FI		10kW	48	2865
8937-115 3/8" Unfl		10kW	48	2825
8937-230 3/8" Unfl		10kW	48	2865

## Forced Air-Cooled, Air Dielectric

MODEL	CONNECTOR	POWER	PAGE	PRICE
8570-115-6 3/8" EIA FI		15kW	51	\$3100
8570-230-5 3/8" EIA FI		15kW	51	3135
8571-115-6 3/8" Unfl		15kW	51	3100
8571-230-5 3/8" Unfl		15kW	51	3135
8572-115-6 3/8" EIA FI		25kW	51	3995
8572-230-5 3/8" EIA FI		25kW	51	4030
8573-115-6 3/8" Unfl		25kW	51	3995
8573-230-5 3/8" Unfl		25kW	51	4030
8574-115-6 1 1/8" EIA FI		15kW	51	3100
8574-230-5 1 1/8" EIA FI		15kW	51	3135

## TENULINE® Attenuators

MODEL	POWER	dB	PAGE	PRICE
8302 Seriesⓐ	2W	1, 2, 3, 6, 8, 10, 14 or 20	53	\$ 25
8303 Seriesⓐ	5W	3, 6, 10, 20 or 30	54	50
8304 Seriesⓐ	10W	3, 6, 10, 20 or 30	54	60
8305 Seriesⓐ	15W	3, 6, 10, 20 or 30	54	70
8306 Seriesⓐ	25W	3, 6, 10, 20 or 30	54	80
8307 Seriesⓐ	50W	3, 6, 10 or 20	55	Inq.
8308 Seriesⓐ	75W	3, 6, 10, 20 or 30	55	210
8321	50W	30	55	365
8322	200W	30	56	565
8323	100W	30	55	430
8325	500W	30	56	765
8327-300 (was 8327) 1000W 2450-056 Thermoswitch		30	56	950
8329-300 (was 8329) 2000W 8329-028 Thermoswitch		30	56	1250
BA-300-115, -230 Blower. Increases 8329-300 to 4000W			56	500
8340ⓐ	25W	3, 6, 10 or 20	54	190
8341ⓐ	*40W	3, 6, 10 or 20	54	210
8343ⓐ	100W	3, 6, 10 or 20	55	410

\*when bolted to heat sink  
ⓐ add -010, -020, -030, -060, -080, -100, -140, -200 for 1, 2, 3, 6, 8, 10, 14 or 20dB respectively  
ⓑ add -030-N, -060-N, -100-N, -200-N, -300-N for 3, 6, 10, 20 or 30dB respectively (8307: no 30dB)  
ⓒ add -030, -060, -100, -200 for 3, 6, 10 or 20dB respectively

## 50 Ω Line Sections

PART NO.	ELEMENTS SOCKETS	CONNECTOR	PAGE	PRICE
4230-006-1	One	QC*	34	\$ 79
4230-018	One	Two QC-N(F)		93
4230-053	Two	QC*	34	139
4230-059	One, w/Bracket	QC*	34	82
4501-000	One	3/8" FI	34	175
4502-000	Two	3/8" FI	34	255
4522-002-1	Two, panel mtg	Two QC-N(F)	—	123
4522-002-2	Two, panel mtg	Two QC-HN(F)	—	169
4522-002-3	Two, panel mtg	Two QC-BNC(F)	—	133
4522-002-5	Two, panel mtg	QC*	34	109
4600-000	One	3/8" FI	34	360
4610-000	Two	3/8" FI	34	415
4616-000	Hi/Reg	3/8" FI	34	445
4617-000	Hi	3/8" FI	34	390
4712-000	One	1 1/8" FI	34	220
4713-000	One	51.5 Ω 1 1/8" FI	34	170
4715-000	Two	1 1/		

## 50 Ω LINE SECTIONS (CONT'D)

PART NO.	ELEMENTS SOCKETS	CONNECTOR	PAGE	PRICE
4720-025	One	1½ Unfl	34	\$160
4723-000	Two	1½ Unfl	34	245
4800-000	One	51.5 Ω 3¼ Unfl	34	170
4801-000	One	Special 3¼ Unfl	34	225
4801-100	Two	Special 3¼ Unfl	34	265
4802-000	Two	3¼ Unfl	34	285
4808-000	Hi	3¼ Unfl	34	235
4808-010	Hi/Reg	3¼ Unfl	34	325
4808-020	Hi	3¼ Unfl	34	220
4810-000	Two	51.5 Ω 3¼ Unfl	34	395
4805-000	One	3¼ Unfl	34	210
4902-000	**One	6¼ FI	34	785
4905-000	**Two	6¼ FI	34	890
4907-000	**One	6¼ Unfl	34	450
4909-000	**Two	6¼ Unfl	34	560

\*QC connectors not included \*\*DC cable(s) included

## Meters

PART NO.	TYPE	SCALES	PAGE	PRICE
2000-030	4½" round	5/10/25kW	37	\$108
2000-059	4½" round	15/30/60kW	37	108
2000-068	4½" round	8/80kW	37	108
2080-002	3½" round	25/50/100W	37	53
2080-005	3½" square	25/50/100W	37	54
2150-015	3½" rect.	25/50/100W	37	120
2150-088	4½" rect.	5/10/25kW	37	98
3127-035	4½" rect. on panel*	5/10/25kW	16,37	220
3127-040	two 4½" rect. on panel*	5/10/25kW	16,37	360
3127-055	4½" rect. + switch on panel*	5/10/25kW	16,37	245
3127-070	4½" rect. on panel*	15/30/60kW	16,37	235
3127-075	two 4½" rect. on panel*	15/30/60kW	16,37	360
3127-080	4½" rect. + switch on panel*	15/30/60kW	16,37	245
6810-005	**in housing	8/80kW	37	240
6810-007	**in housing	15/30/60kW	37	240
6810-009-7	**in housing	5/10/25kW	37	240
6810-020	**in housing, w/FWD & RFL switch	5/10/25kW	37	290
6810-030	**in housing, w/FWD & RFL switch	15/30/60kW	37	290
8-000	Kit w/cable	25/50/100kW	37	65

① 30µA ② 100µA  
\*25' DC cable(s) included \*\*10' DC cable(s) included

## Power Sensors Filter Couplers and Coaxial RF Filters

Models listed in our Power Sensor and Filter Catalog pages are representative of our design capabilities in the three product categories. All have been built for quantity customers, to individual specification. Request quotation on your requirements. Ask for special Power Sensor or Filter Catalog.

MODEL	PAGE	PRICE
Standard Units for 4A-4E Series	—	\$185
4H Series	—	225

## Coaxwitch® Coaxial Selector Switches

MODEL	FUNCTION	PAGE	PRICE
72-R	2P Reversing	57	\$280
72-2	2P2T	57	295
74	1P6T	57	300
718	1P8T	57	325
7181	1P10T	57	375
7422	1P2T	57	235
7431	1P4T	57	265
7441	1P3T	57	255

## Accessories

### QUICK CHANGE CONNECTORS — QC

PART NO.	TYPE	PAGE	PRICE
4240-002	¼ Swivel FI EIA 50 Ω	35	\$105
4240-012	LT(M)	35	82
4240-018	LT(F)	35	62
4240-025	LC(M)	35	65
4240-031	LC(F)	35	49
4240-050	UHF(F)	35	7
4240-062	N(F)	35	7
4240-063	N(M)	35	12
4240-075	LC(F) Bulkhead	35	95

## QUICK CHANGE CONNECTORS (CONT'D)

PART NO.	TYPE	PAGE	PRICE
4240-080	Open Terminal, 10-32 post	35	\$ 42
4240-090	SC(F)	35	29
4240-096	1½ Fixed FI EIA 50 Ω	35	96
4240-100	C(F)	35	18
4240-110	C(M)	35	48
4240-125	BNC(F)	35	12
4240-132	BNC(M)	35	35
4240-138	LC(M) UG156A/U	35	132
4240-149	LC(F) UG157B/U	35	85
4240-156	TNC(F)	35	10
4240-160	TNC(M)	35	15
4240-179	UHF(M)	35	19
4240-208	1½ Swivel FI EIA 50 Ω	35	112
4240-254	GR 874	35	51
4240-261	N(F) 75 Ω	—	22
4240-268	HN(F)	35	27
4240-278	HN(M)	35	30
4240-334	SMA(M)	35	54
4240-336	SMA(F)	35	36
4240-346	UHF Miniature (Mini-UHF)(F)	35	22
4100-014	SQC Small Pattern N(F)	36	10
4100-017	SQC Small Pattern UHF(F)	36	12
4100-015	SQC Small Pattern N(M)	36	15
4100-055	SQC Small Pattern TNC(F)	36	15
4110-014	SQC Small Pattern BNC(F)	36	15

## MISCELLANEOUS ADAPTORS, CONNECTORS

PART NO.	DESCRIPTION	PAGE	PRICE
5-793-2	N(M) to UHF(F), UG-146A/U	41	\$ 15
4240-165	QC(F) to QC(F)	34, 36	20
4240-180	Copl. (M) to QC(F)	36	45
4240-187	3¼ Unfl/51.5 Ω to QC(F)	36, 52	85
4240-194	3¼ FI to QC(F)	36, 52	150
4240-201	¾ FI to QC(F)	36, 52	86
4240-244	Rt. Angle QC	36, 52	75
4240-260	1½ FI to QC(F)	36, 52	79
4240-400	Interseries Adaptor Kit [N, N, UHF, BNC, TNC, (M, F)]	37	79
4240-401	Interseries Adaptor Kit [N, UHF, BNC, TNC, SMA, (M, F)]	—	105
4600-025	3¼ FI to 1½ FI EIA 50 Ω	36, 52	142
4712-015	1½ FI to ¾ FI EIA 50 Ω	36, 52	115
4902-025	3¼ FI to 6¼ FI EIA 50 Ω	36, 52	275
7500-076	DC Conn. Plug	36, 52	6
8110-186	Copl. (M) to N(F)	36	40

## COUPLING KITS

PART NO.	LINE TYPE	PAGE	PRICE
4240-220	¾ EIA FI/50 Ω	36, 52	\$ 57
4600-020	3¼ EIA FI/50 Ω	36, 52	72
4712-020	1½ EIA FI/50 Ω	36, 52	45
4902-020	6¼ EAI FI/50 Ω	36, 52	320
5-289	3¼ Unfl/51.5 Ω*	36, 52	100
5-726	3¼ Unfl/50 Ω	36, 52	105
5-1322	6¼ Unfl/50 Ω	36, 52	240

\*with adapter to 50 Ω

## CABLE ASSEMBLIES

**RG-58/U with DC Plug 7500-076 on one end for connecting Line Sections to Instruments**

PART NO.	LGTH	OUTPUT CONNECTOR	PAGE	PRICE
3170-058-1	14"	BNC(M)	36	\$ 17
3170-058-6	6'	BNC(M)	36	20
3170-058-2	15'	BNC(M)	36	22
3170-058-3	25'	BNC(M)	36	28
3171-010	25'	BNC(M)*	36	49
3170-058-4	40'	BNC(M)	36	36
3170-058-5	50'	BNC(M)	36	38
3170-058-7	80'	BNC(M)	36	72
3170-058-8	90'	BNC(M)	36	78
3170-058-9	100'	BNC(M)	36	85
4220-097-4	9"	Spade Lug	36	16
4220-097-8	12"	Spade Lug	36	16
4220-097-5	16"	Spade Lug	36	16
4220-097-21	25"	Spade Lug	36	24
4220-097-1	33"	Spade Lug	36	24
4220-097-2	39.5"	Spade Lug	36	25

## CABLE ASSEMBLIES (CONT'D)

PART NO.	LGTH	OUTPUT CONNECTOR	PAGE	PRICE
4220-097-22	48"	Spade Lug	36	\$ 27
4220-097-6	56"	Spade Lug	36	28
4220-097-23	64"	Spade Lug	35	29
4220-097-7	10'	Spade Lug	36	35
6810-041-1	10'	Spade Lug*	36	38
4220-097-9	15'	Spade Lug	36	39
4220-097-10	25'	Spade Lug	36	40
4220-077-1	25'	Spade Lug*	36	44
4220-097-19	40'	Spade Lug	36	45
4220-097-17	50'	Spade Lug	36	50
4220-097-15	60'	Spade Lug	36	55
4220-097-14	65'	Spade Lug	36	60
4220-097-18	70'	Spade Lug	36	65
4220-097-13	75'	Spade Lug	36	70
4220-097-16	100'	Spade Lug	36	80
4220-097-20	225'	Spade Lug	36	100
7500-072-1	39"	DC Plug	36	25
7500-072-3	10'	DC Plug	36	30
7500-072-4	10'	DC Plug	36	30
6810-036-1	10'	DC Plug*	36	36
7500-072-2	25'	DC Plug	36	36
6810-036-2	25'	DC Plug*	36	42

\*Use this cable if your Line Section is 6¼"  
For all other applications use the cable listed immediately preceding it.

## CARRYING CASES

MODEL	FOR STORAGE OF	PAGE	PRICE
CC-1	43-size Wm. + 6 Elmts.	36	\$ 30
CC-2	Mini-Monitor	36	17
CC-3	43-size Wm. + 3 El. + Load	36	30
EC-1	12 Elements	36	22
4300-061	43-size Wattmeters + access.	36	40
4300-070	43-size Wm. + acc. ("Zero" case)	36	118
4300-080	4381/2/3/4 + access.	36	95
4300-085	4391 + access.	36	95

## DOLLIES

PART NO.	DESCRIPTION	PAGE	PRICE
6771-011	For 10 & 25kW Moduloads	52	\$255
6772-011	For 50kW Moduloads	52	290

## COOLANTS (in 1 gallon can)

PART NO.	DESCRIPTION	PAGE	PRICE
5-030-3	Refined Mineral Oil	52	\$ 21
5-1070-2	DC-200 Silicon	52	78
5-1134-3	Ethylene Glycol, Industrial Grade	52	28

## THERMOSWITCHES

PART NO.	ACTION	PAGE	PRICE
2450-056	Opens @ 155°C	56	\$110
2450-085	Closes @ 155°C	52	110
8329-028	Opens @ 200°C	56	110
8630-013	Opens @ 86°C	52	110
8640-066	Opens @ 77°C	52	110
8890-008	Opens @ 236°C	52	110
8890-017	Opens @ 226°C	52	110
8896-012	Closes @ 100°C	52	110

## BATTERIES

PART NO.	VOLTS	TYPE	PAGE	PRICE
5-733-1	6	NiCd	36	\$34
5-733-2	12	NiCd	36	58
5-1230	1.25	NiCd	36	9
5-1375	9	Alkaline	36	4
5-1444	9	Lithium	36	87
5-1475	3	Li-Mn	36	3
5-1576	9	Lithium	36	48
5-1587	9	NiCd	36	14
5-1588	7.5	NiCd	36	Inq.

## MISCELLANEOUS

PART NO.	DESCRIPTION	PAGE	PRICE
5-1242	4381/2/3/4 Power Supply-120V	36	\$ 8
5-1257	4381/2/3/4 Power Supply-230V	36	19
3610-031	Dummy Plug	36	3

**U.S.A. Regional Offices:** Our east and west coast offices will provide complete technical and sales service and visits at your facility as may be desired. Call these offices, or the factory for referral to a close-by distributor - for quick deliveries.

<b>Eastern</b> Bird Electronic Corp. 30303 Aurora Road Cleveland, OH 44139 Phone: 216-248-1200 TLX: 706898	<b>Western</b> Bird Electronic Corp. 621 W. Ojai Ave., Suite F P.O. Box 28 Ojai, CA 93023 Phone: 805-646-7255
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 The President of the United States  
Award for Excellence in Exports

# BIRD

## Electronic Corporation

30303 Aurora Road, Cleveland (Solon) Ohio 44139

Litho in U.S.A.

## Limited Warranty

### BIRD ELECTRONIC CORPORATION

30303 Aurora Road, Solon, Ohio

We are proud of the high quality of our product and we warrant it to the original purchaser that each new instrument of our manufacture will for a period of one year after original shipment be free from defects in material and workmanship under normal and proper operating conditions and that properly used during such period it will perform in accordance with our applicable specifications.

Our obligation and the purchaser's exclusive remedy for any defect or failure to meet specifications shall be limited, at our option, to repair or replacement or, if we determine said defect or failure to be so defective as to preclude remedying by repair or replacement, the

purchaser's sole and exclusive remedy shall be limited to refund of the purchase price. We shall have no obligation if defects result from improper use, operation above rated capacities, repairs not made by us, or misapplication of the equipment. Our warranty does not extend to the failure of semiconductor devices and batteries, or to equipment and parts made by others except to the extent of the original manufacturer's warranty to us. No other warranty is expressed or implied. Bird Electronic Corporation is not liable for consequential damages.

Warranty returns must first be authorized by the factory office and are to be shipped prepaid.

## General Terms, Conditions of Sale

### TELEPHONE, TELEGRAPH AND CABLE ORDERS

Factory telephone: (216) 248-1200

Telex: 706898

Cable address: BIRDELEC

D-U-N-S Number: 00-418-9957

Bird Electronic Corporation

30303 Aurora Road

Cleveland (Solon), Ohio 44139

Eastern Sales Office

Telephone: (216) 248-1200

Western Sales Office (California)

Telephone: (805) 646-7255

### ADDRESS

All communications except when otherwise advised should be sent to the Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon), Ohio 44139, or to the appropriate regional sales office.

### ORDER BY NUMBER

Please order by model number or part number. Whenever possible, include name of the item, ranges or other significant specifications. Be sure to include in your order any accessories or special calibration required.

When modifications are desired to adapt an instrument for your special requirements, contact our Sales Department.

### SHIPPING INSTRUCTIONS

Unless specific instructions accompany the order, we shall use our judgement and select the best method for your shipment. If requested, repair parts or other items needed quickly will be shipped by air.

Export shipments via air-freight save time, and in many cases are less expensive than surface modes.

### MINIMUM BILLING

The minimum billing per order is \$25.00.

### CONDITIONS OF SALE

Determination of price, terms and conditions of sale and final acceptance of orders are made only at our factory in Cleveland (Solon), Ohio. Change orders subject to \$20 administrative charge.

### PRICE CHANGES

All prices are subject to change without notice. Formal price quotations remain valid for 60 days.

### TAXES

Applicable Federal, State or Local taxes that are in effect at the time of shipment will be added unless Certificate of Exemption is furnished by the purchaser.

### SPECIFICATIONS

We reserve the right to discontinue any item without notice and to change physical and electrical specifications at any time without incurring any obligation to incorporate new features in instrument or parts previously sold. For instruments offered with the "QC" Connector feature, maximum VSWR values listed in the specifications are obtained with the connector type shown as "normally supplied."

Listed power ratings for aircooled terminations are valid to 5000 ft. For operation at higher elevations, please contact us for applicable derating factor.

### SPECIAL DATA

Individual special performance data can be provided for most Bird products at a minimum charge of \$40 per unit.

### TERMS

All prices are F.O.B. Cleveland (Solon), Ohio. Terms net 30 days for established accounts.

Export Terms: Please request Overseas Representatives listing.

### QUANTITY DISCOUNTS

Available on most equipment when 25 pieces or more of the same model are ordered. Please inquire.

### CUSTOMER SERVICE

Bird maintains a complete repair and recalibration department at Solon. This department is set up to provide the best possible service of Bird equipment. Repairs will proceed as soon as the instrument is received with your authorization. Repair charges are kept at a minimum. If you require a firm quotation before repairs proceed, please advise and a quotation will be sent promptly. All instruments returned for repair-recalibration must be shipped prepaid and to the attention of the Customer Service Group.

Each instrument repaired is thoroughly checked and recalibrated to original specifications. The material used and work performed are warranted for 90 days with the exception of semiconductor devices and batteries.

### DISTRIBUTORS

Bird equipment is stocked throughout the United States and overseas. Inquire at Solon or the West Coast Sales Office for distributor located closest to you.