

PRD

RF and Microwave

INSTRUMENTS

COMPONENTS

CUSTOM
INSTRUMENTATION



General Information

The goal of PRD Electronics throughout its thirty-year history has been to meet the needs of its customers for highest quality microwave and electronic products in an atmosphere of helpful and courteous service. The design of our catalog reflects this goal. Products have been presented within functional groupings that are outlined in the Table of Contents on the facing page. Special Order items are included in these groupings although there is a separate Special Order Section that begins on page 27. For your added convenience, we have provided a Model Number Index inside the back cover.

Several RF products appear in this catalog that have recently been added to PRD's product line. These new products include a Signal Generator, a Synthesizer, and a family of Power Amplifiers and Amplifier Modules. The Special Order pages also include data on several new laser-related products.

The microwave and electronic products described in this catalog represent only one aspect of PRD's capability in the electronic measurement field. PRD is also the world's major producer of computer-controlled automatic test equipment through its Versatile Avionic Shop Test (VAST) system. VAST automatically tests the avionics in carrier based U.S. Navy aircraft and at various shore installations.

PRD's extensive experience in automatic test equipment has culminated in a commercial Computerized Automatic Systems Tester (CAST) for automatic testing and data monitoring and a new Integrated Diesel Engine Analyzer (IDEA).

PRICES

For prices of items found in this catalog, refer to the latest PRD Price List or contact either PRD in Westbury or your local PRD sales representative.

SALES REPRESENTATIVES

PRD maintains a world-wide sales representative organization. A listing of authorized PRD reps has been sent to you with this catalog.

HOW TO ORDER

Always order by catalog TYPE NUMBER. If other than standard catalog specifications are desired, please be sure to include all essential details as well as calibration instructions. We have direct telegraph printer connections with Western Union for the prompt handling of messages. Our telegraph address is FAX, Westbury, N.Y. Our cable address is MICROWAVE, Westbury, N.Y. Our teletype address is TWX 510-222-4494.

WARRANTY

PRD Electronics, Inc. warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to making good at our factory any parts thereof—except tubes, fuses, batteries, or bolometers—which shall, within one year after delivery to the original purchaser, be returned to us with transportation charges prepaid and which, upon examination by the company, shall appear to have been thus defective.

PRD Electronics, Inc. neither makes nor authorizes any other person to make any other warranty or guaranty with respect to such instruments.

REPAIRS

Before returning instruments for repair, or for any other reason, please contact our customer service department for shipping instructions. To expedite repair service it is important to provide type number, serial number, calibration frequency desired if it is other than standard, and a detailed description of the reason for the return of the instrument.

CHANGES

Due to our continuous program of product improvement, specifications noted herein are necessarily subject to change without notice. The company also reserves the right to make changes in design without incurring any obligation to provide the same changes in units previously ordered or to continue the production of instruments conforming to former design.



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Model Number/Page

Number Index. inside back cover

■ Indicates product available on special order only.



PRD 7808

SIGNAL GENERATOR

- 50 kHz to 80 MHz
- 1 PART IN 10^6 /MONTH STABILITY
- 0.1 μ V TO 10 V RMS INTO 50 OHMS
- INTERNAL OR EXTERNAL AM AND FM
- MANUAL AND AUTOMATIC SWEEP
- WIDE RANGE FAST PULSED RF OUTPUT
- PROGRAMMABLE FREQUENCY, OUTPUT LEVEL, AND MODULATION
- SPURIOUS -60 dB, HARMONICS -30 dB

GENERAL

The PRD 7808 Signal Generator is a solid state frequency synthesizer which is combined with manual and automatic sweep circuits to allow use as: (1) a digital frequency synthesizer with frequency standard accuracy, (2) a conventional signal generator, and (3) a sweep generator. Operation is in the 0.05 to 80 MHz frequency range with tuning in 1-kHz steps. The vernier control can be set for frequencies between the 1-kHz steps with 1-Hz resolution.

The unit features remote programming, digital frequency selection, high signal power output, FM, AM, Pulse, manual and automatic sweep. Push button controls are used for operator convenience. Front-panel meters monitor modulation and output level.

The PRD 7808 has digital synthesizer performance, yet retains the manual and vernier tuning and modulation features of conventional signal generators.

SYNTHESIZER FEATURES

The basic frequency generation is provided by a frequency synthesizer which is phase locked to a crystal frequency standard. Phase locked loops are used in the frequency generating scheme. State-of-the-art mixer design and an advanced synthesis scheme yield an output frequency that is remarkably free of spurious signals and noise.

Stability when locked to the internal frequency standard is better than 1 part in 10^6 per month or, with the high stability option, 5 parts in 10^9 per day. The synthesized frequency is adjusted in 1-kHz steps using rotary knobs. A vernier that may be calibrated every 100 Hz has 1-Hz resolution and is used to obtain frequencies between the 1-kHz steps.

STANDARD SIGNAL GENERATOR FEATURES

The unit is entirely solid state and uses integrated circuits extensively. It provides for internal AM and FM and external AM, FM, and gated fast pulse modulation. Internal modulation frequencies of 400 and 1,000 Hz are provided for both AM and FM. External modulation up to 100 kHz may be used with good linearity — only 7 volts peak-to-peak is required for full AM and FM deviation.

Modulation level is set with a variable control using the front-panel meter readout. The AM scale reads 0 to 100% and four FM deviation scales read 5, 15, 75, and 375 kHz full scale.

The PRD 7808 has a push button attenuator on the front panel with 10-dB steps from 0.1 microvolt to 10 volts output into 50 ohms (2 watts). A vernier adjusts the output level between 10-dB steps. The output meter reads in volts and dBm, with automatic leveling provided. Output VSWR, distortion, spurious, and residual FM are all low.

SWEEPER FEATURES

Two types of sweep are provided, symmetrical and full, in two modes, manual and automatic. The type, frequency range, and mode of sweep are selected by panel push buttons. Symmetrical sweep is accomplished by unlocking oscillators which are swept through the selected sweep ranges centered about the frequency indicated on the main frequency knobs. Full sweep covers 1 to 80 MHz in the manual mode.

In the automatic sweep mode the manual sweep knob adjusts the percentage of the range to be swept. The automatic sweep may be internally synchronized with the power line, or may be set with a sweep speed adjustment. Slow and fast sweep speeds are provided for use with X-Y recorders and oscilloscopes. Triggering, either externally or by the front-panel push button, allows a single sweep at desired intervals. Penlift, blanking, and other auxiliary outputs are provided on the rear panel.

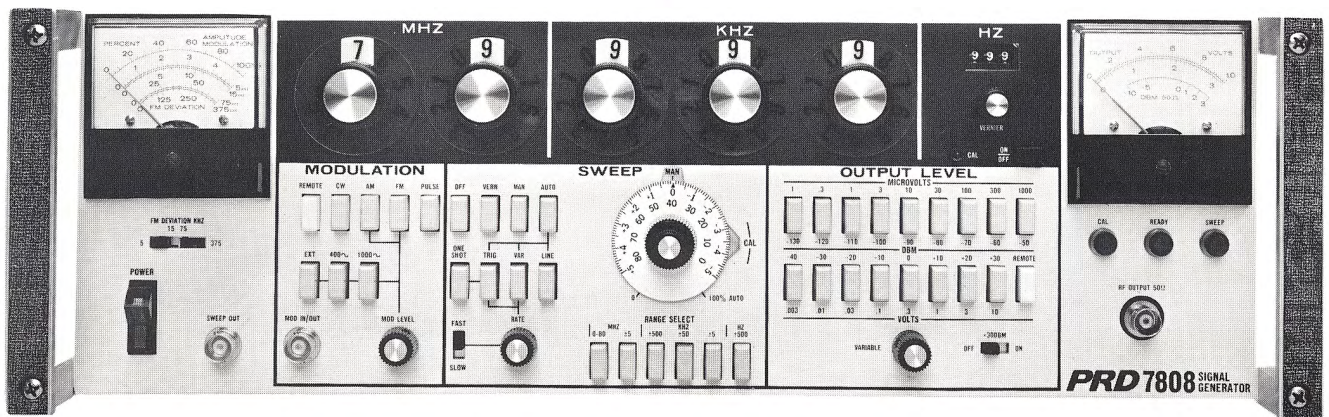
REMOTE PROGRAMMING FEATURES

Three major functions of the PRD 7808 may be remotely programmed. These are:

1. Output level
2. Frequency
3. Modulation

Remote programming is accomplished using a standard computer-compatible BCD code. Thus, the functions of the digital frequency controls and the modulation and output level push buttons can be performed remotely. These digitally controlled functions are compatible with standard positive-true RTL, DTL, or TTL computer logic circuits. In addition, analog remote signals can be applied to operate the vernier frequency control and the variable output level control. With the use of external D/A converters, these latter two functions may also be controlled in steps by digital signals.

Because BCD is the most commonly used automatic control interfacing for this type of equipment, the PRD 7808 gives the user maximum versatility at minimum cost in automatically programmed applications.



SPECIFICATIONS

FREQUENCY CHARACTERISTICS

RANGE: 50 kHz to 80 MHz
SETTABILITY: 1-kHz phase locked steps; continuous interpolation vernier with 1-Hz resolution

LONG TERM STABILITY: 1 part in 10⁶ per month with internal standard when in synthesized mode. (5 parts in 10⁹/day available as option)

SHORT TERM STABILITY: Typical RMS Fractional Frequency Deviation:

Frequency—	50 MHz	1 MHz
10 msec Avg. Time—	1 x 10 ⁻⁸	3 x 10 ⁻⁷
1 sec Avg. Time—	1 x 10 ⁻⁹	4 x 10 ⁻⁸

DIGITAL FREQUENCY SETTING: Front-panel rotary switch controls. Dial Transfer Mechanism is available as an option

SPURIOUS OUTPUTS:
Non-harmonic— < -60 dB, typically < -75 dB
Harmonic— < -30 dB, typically < -38 dB

PHASE NOISE: Typical in 10-Hz bandwidth
 -60 dB at 50 Hz from carrier
 -72 dB at 200 Hz from carrier
 < -83 dB beyond 1 kHz from carrier

OUTPUT CHARACTERISTICS

LEVEL: 0.1 μ V to 10 V rms into 50 ohms in 10-dB steps plus continuous vernier
ACCURACY: Better than ± 1 dB
IMPEDANCE: 50-ohm source below 3 volts

REMOTE PROGRAMMING

FUNCTION	CONTROL
Frequency Steps	BCD, 4 wires each digit
10-dB Output Steps	Binary, 5 wires
Modulation Mode	On/Off control lines
Modulation Level	Set by audio input level
Frequency Vernier	Analog voltage input
Variable Output Level	Analog voltage input

LOGIC LEVELS: Digitally controlled functions compatible with standard positive-true RTL, DTL, TTL logic circuits. Internal +3.6 Vdc supply available at rear remote control connector for driving control leads through simple switch closures if desired.

TYPICAL SWITCHING

SPEEDS:
Frequency— 10 msec
Output Attenuator— 10-dB steps: 1 msec
 variable control: 1 msec
Modulation— 1 msec

AMPLITUDE MODULATION

INTERNAL AM: 400 and 1,000 Hz up to 95% modulation with less than 1% envelope distortion to 30% modulation
EXTERNAL AM: DC to 100 kHz up to 95% modulation. 7 volts peak-to-peak required for full modulation

FREQUENCY MODULATION

INTERNAL FM: 400 and 1,000 Hz up to 375 kHz deviation with less than 3% distortion to 75 kHz deviation. 5, 15, 75, and 375 kHz deviation ranges
EXTERNAL FM: 30 Hz to 100 kHz rate up to 375 kHz deviation. 7 volts peak-to-peak required for full scale deviation
FM STABILITY: FM center frequency phase locked to frequency standard

PULSE MODULATION

RISE TIME: 25 nsec

FALL TIME: 25 nsec
PULSE WIDTH: Minimum—limited by rise and fall times. Maximum—infinite
ON/OFF RATIO: 60 dB typical

SWEEP CHARACTERISTICS

MANUAL: 1–80 MHz or in five symmetrical ranges from 0 to 10 MHz wide around set center frequency with single turn of knob

AUTOMATIC:
Width— In symmetrical ranges from zero to 10 MHz wide around set center frequency
Speed— Fast, typically 6 to 80 sweeps per second, variable. Slow, typically 8 to 100 seconds per sweep, variable
Trigger— Manual, line synchronized, externally triggered, or free running

AUXILIARY OUTPUTS AND INPUTS

FRONT PANEL: Internal audio modulation output/external AM/FM/Pulse modulation input. X-axis sawtooth sweep voltage in automatic sweep only
REAR PANEL: Penlift signal output, programming signal inputs, external sweep trigger input, auxiliary rf output, internal frequency standard output/external frequency standard input, blanking pulse output. X-axis voltage in manual sweep with Option 04

WEIGHT: 45 lbs (20.5 kg), Shipping Wt: 50 lbs (22.7 kg)

DIMENSIONS: 5.25" H x 17" W x 16.75" D (133 H x 432 W x 424 D MM)

POWER: 115 or 230 $\pm 10\%$ Vac; 47 to 420 Hz

OPTIONS

ALTERNATE SWEEP RATES, OPTION 01:

Includes different rates and overlapping ranges upon request

75-OHM OUTPUT IMPEDANCE, OPTION 02:

In place of 50-ohm output

AUXILIARY SWEEP, OPTION 04:

a) External Sweep Ramp Input through rear connector to externally sweep PRD 7808 at external rate through ranges set on front panel.
 b) X-axis Sweep Output while operating front-panel Manual Sweep Control — through rear sweep connector.
 c) Automatic Sweep sawtooth output remains through front-panel connector

HIGH STABILITY FREQUENCY STANDARD, OPTION 06:

Long Term Stability: 1 MHz reference frequency 5 parts in 10⁹ per day with internal standard when in synthesized mode

REMOTE SWEEP SELECT, OPTION 07:

Allows remote programming of sweep modes. PRD 7808 may be switched between CW and Manual Sweep, and may be switched between ± 500 Hz and ± 50 kHz, or between ± 5 kHz and ± 500 Hz Sweep ranges

ACCESSORIES

Rack Mount Kit—	PA 7808
Remote Programming	
Mating Connector—	P/N 7808-0348
Circuit Card Extender Board I—	P/N 7808-0170
Circuit Card Extender Board II—	P/N 7808-0370
Extender Cable Assembly—	P/N 7808-0356
Circuit Board Extractor Tool—	P/N MP 480000
Additional Manual—	HB-7808
Alignment Tool—	MP 480001

MODIFICATIONS AVAILABLE

Special modifications can be furnished to provide other features such as:

- Simultaneous pulse and amplitude modulation (PAM)
- Simultaneous multiple modulation inputs for special purpose
- Special calibration to provide improved accuracy at specific levels of modulation and output



PRD 7828

FREQUENCY SYNTHESIZER

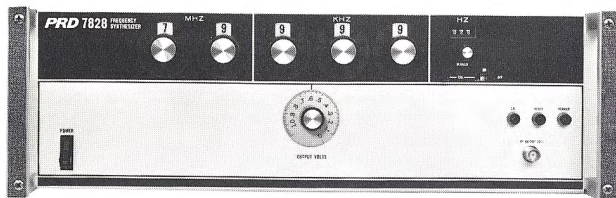
- 1 kHz to 80 MHz
- PROGRAMMABLE

The PRD 7828 is a programmable frequency synthesizer covering a frequency range of 1 kHz to 80 MHz in 1-kHz steps with an optional vernier providing resolution of 1 Hz.

Stability when locked to the internal frequency standard is 1 part in 10^6 per month. An optional 5 parts in 10^9 per day frequency standard is available. The synthesized frequency is adjusted in 1-kHz steps using rotary knobs. The optional vernier which is settable to 1-Hz resolution is used to obtain frequencies between the 1-kHz steps.

The basic frequency generation is provided by a frequency synthesizer that is locked to an internal 1-MHz crystal frequency standard. State-of-the-art mixer design and an advanced synthesis scheme yield an output frequency that is remarkably spurious and noise free. The unit is all solid state and uses integrated circuits extensively.

Remote programming is accomplished by means of a computer compatible BCD code. Thus, the functions of the digital frequency controls can be performed remotely. These digitally controlled functions are compatible with standard positive-true, RTL, DTL, or TTL computer logic circuits. In addition, analog remote signals can be applied to operate the vernier frequency control and the variable output level control to provide AM and FM modification capability. With the use of external D/A converters, these latter two functions may also be controlled in steps by digital signals.



SPECIFICATIONS

FREQUENCY COVERAGE:	1 kHz to 80 MHz
STABILITY:	1 part in 10^6 per month
SHORT TERM STABILITY:	Typical RMS Fractional Frequency Deviation:
Frequency—	50 MHz 1 MHz
10 msec. Avg. Time—	1×10^{-8} 3×10^{-7}
1 sec. Avg. Time—	1×10^{-9} 4×10^{-8}
SETTABILITY:	1-kHz steps; 1-Hz resolution (with vernier option)
OUTPUT LEVEL:	10 mV to 1.0 volt rms into 50 ohms
OUTPUT IMPEDANCE:	50-ohm source
SPURIOUS OUTPUTS: (TYPICAL)	Non-harmonic < -70 dB Harmonic < -40 dB
PHASE NOISE:	Typical in 10-Hz bandwidth -60 dB at 50 Hz from carrier -72 dB at 200 Hz from carrier < -83 dB beyond 1 kHz from carrier
REMOTE PROGRAMMING:	
Frequency Steps—	Parallel BCD, 4 wires each digit
Frequency Vernier—	Analog voltage input
Variable Output Level—	Analog voltage input
LOGIC LEVELS:	Digitally controlled functions directly compatible with standard positive-true RTL, DTL, TTL logic circuits. Internal +3.6 V DC supply available at rear remote control connector for driving control leads. Simple contact closures are sufficient for all digital remote functions
LEVELING:	± 0.25 dB over the frequency range
REAR PANEL INTERFACES:	Programming signal inputs Internal frequency standard output External frequency standard input
POWER:	115 or 230 volts $\pm 10\%$, 47 - 420 Hz
WEIGHT:	35 pounds (15.9 kg)
DIMENSIONS:	5.25" H x 17" W x 16.75" D (133 H x 432 W x 424 D mm)

OPTIONS

FREQUENCY VERNIER, OPTION 01:

Allows setting of frequency between 1-kHz synthesized steps. Accurate to 1 Hz when calibrated to nearest 100-Hz point using front-panel calibration controls. When remotely programmed, vernier may be swept ± 5 kHz of center frequency with sensitivity of 1 kHz per 1.2 V DC. Calibration indicator is operable when remotely programming vernier

HIGH STABILITY FREQUENCY STANDARD, OPTION 02:

Long Term Stability: 1 MHz reference frequency. 5 parts in 10^9 per day with internal standard when in synthesized mode

ECL DRIVER OUTPUT, OPTION 03:

Square wave output with symmetry better than 60/40%. Fully compatible with various ECL logic families. Replaces standard sine wave output

TTL DRIVER OUTPUT, OPTION 04:

Square wave output with symmetry better than 60/40%. Fully compatible with various TTL logic families. Replaces standard sine wave output

REAR RF CONNECTOR, OPTION 06:

RF output connector is placed on rear panel with hole plug on front panel

ACCESSORIES

Rack Mount Kit—	PA 7828
Remote Programming Mating Connector—	P/N 7807-0348
Circuit Card Extender Board 1—	P/N 7808-0170
Circuit Card Extender Board 2—	P/N 7808-0370
Extender Cable Assembly—	P/N 7808-0356
Circuit Board Extractor Tool—	P/N MP 480000
Additional Manual—	HB-7828
Alignment Tool—	P/N MP 480001



PRD 904-A

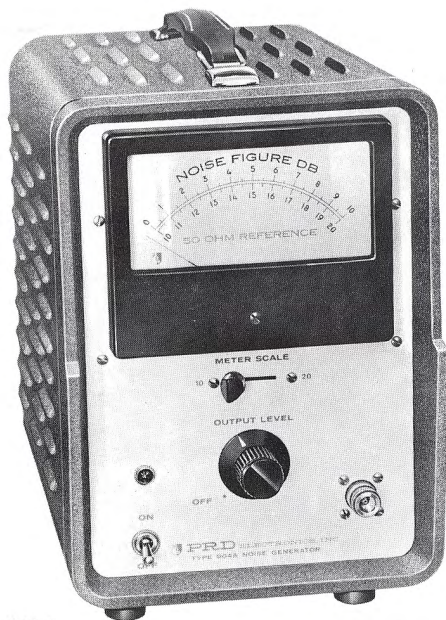
NOISE GENERATOR

- ADJUSTABLE OUTPUT
- COMPACT, EASILY PORTABLE

This broadband variable noise source permits direct measurement of the noise figures of RF amplifiers and receivers from 30 MHz to 1.0 GHz. Noise figures from zero to 20 dB or greater may be accurately determined.

A coaxial diode mounted in a well-terminated 50-ohm coaxial line generates noise power for application to the receiver or amplifier under test. Noise power output is related to the diode plate current, which may be varied by a front panel adjustment of diode filament voltage. Plate current is indicated on a front panel meter calibrated to read noise figure directly in decibels when the noise power output of the receiver under test is doubled. The output is available at a front panel Type N Jack. The 904-A operates from 115 volts ac, 60 Hz and draws approximately 60 watts.

Maximum noise power output of the PRD 904-A is continuously variable from zero to 20 dB above thermal. Any noise figure up to 20 dB may be measured by varying the output control of the PRD 904-A until the noise power output of the device under test is doubled. Noise factors greater than 20 dB may be calculated from the increase in noise which results from application of the full output of the noise generator. Accuracy is limited principally by reduction in noise due to transit time and by residual VSWR in the output impedance.



904-A

PERFORMANCE CHARACTERISTICS

Frequency Range: 30 to 1000 MHz/sec

Noise Figure Range: 0 to 20 dB

Accuracy: 0.1 dB at full scale

Maximum VSWR: 1.30

Characteristic Impedance: 50 ohms unbalanced

Output Connector: Type N Jack

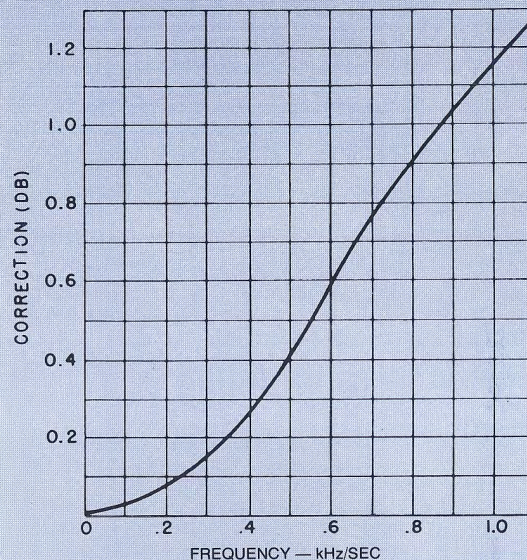
Input Power:* 115 Vac; 60 Hz; 60 watts

Weight: 25 pounds

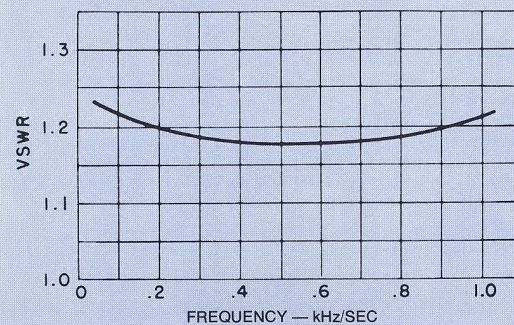
Size: 10½" high, 7¾" wide, 11" deep

*PRD 904-AS1 for 115 V, 50 Hz

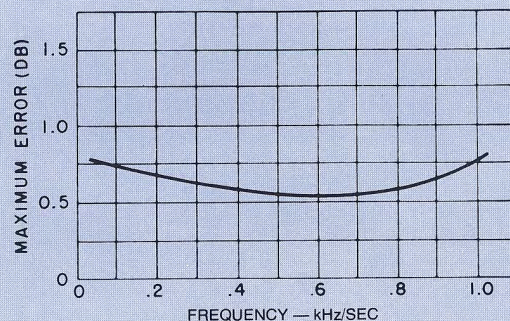
PRD 904-AS2 for 230 V, 50 Hz



Calculated Transit Time Reduction of Noise



Typical VSWR



Resulting Possible Error in Noise Measurement



PRD 7805/PRD 7806

BROADBAND LINEAR RF AMPLIFIER AND AMPLIFIER MODULE

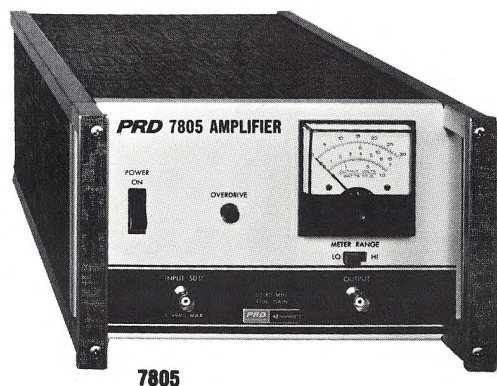
- 0.10 VOLT IN — 22.5 VOLTS OUT
- FLAT, 0.05 MHz — 80 MHz
- USABLE OUTPUT 0.02 MHz — 150 MHz
- NO BANDSWITCHING

The PRD 7805 is a ten-watt, solid state, broadband, linear amplifier with exceptionally flat gain, and low distortion. Gain of the amplifier is 47 dB minimum, constant within 1 dB, and full output is produced with less than 0.1 volt at the 50-ohm input. (Most manual and swept tuned signal generators deliver at least 0.1-volt output, -7 dBm.) The PRD 7805 will raise the power of these devices and thus extend the usefulness and versatility of available generators. Output level is accurately metered and the unit has a self-contained power supply which can operate from 115 or 230 VAC 50/60 Hz. Input and output overload protection is provided so that overdrive or operation into a short or open circuit is possible without damage to the 7805. The amplifier is packaged for bench mounting. An optional rack mounting kit is available.

The equipment is designed to raise the power level of signal sources and generators without requiring tuning or bandswitching of the amplifier. Testing and calibration work requiring high level signals can be performed with greater speed and convenience than was previously possible. AM, FM, PULSE, SSB, TV, and other modulated signals can be amplified to high power levels with minimum distortion. The flat gain characteristics allow for high power sweep testing of attenuators, antennas, power meters, etc.

The PRD 7805 has applications in the laboratory with signal generators and power splitters; and applications in other instrumentation such as exciter driver stages for transmitters, power stages in harmonic-generator chain, and for wideband power pulse devices. Receiver testing, attenuator measurements, and filter and component testing will be aided with the use of this equipment. Two or four 7805's can be paralleled using splitters or combiners to provide 20 to 40 watts of linear power.

The PRD 7806 Amplifier Module provides the basic performance of the PRD 7805, but with much smaller mounting dimensions. It is conveniently mounted as a sub-assembly in systems and thus does not have the front panel, output level meter, AC power supply, or instrument enclosure of the 7805. Although rated as flat to 80 MHz \pm 1 dB, the 3 dB points are typically at 100 MHz and 30 kHz, with usable power output available well outside these limits. Applications include use in RF Transmitters, Laser Modulators, Accelerator Drivers, RFI Testing, Ultrasonic Transducer Drivers ... and many others.



SPECIFICATIONS

FREQUENCY RANGE:

0.05 to 80 MHz in one band

OUTPUT LEVEL AND RESPONSE:

10 watts into 50-ohm load within 1 dB over the range. Typically, -1.5 dB down at 100 MHz

GAIN:

47 dB min. (0.1 volt input to 10 watts output at 50 ohms)

HARMONIC OUTPUT:

More than 30 dB down at full output

INTERMODULATION DISTORTION:

More than 30 dB down at full output, -60 dB and better at lower power levels. Typical third order intercept is +52 dBm

SPURIOUS OUTPUT:

Hum and noise level more than 70 dB down

OUTPUT METERING (7805):

3% full scale accuracy

Voltage: 2 scales 0-7 volts
0-30 volts

Watts: 2 scales 0-1 watt
(50 ohms) 0-15 watts

TYPES OF SIGNALS: AM, FM, PULSE, SWEEP, SSB, TV, etc.

Limited only by frequency, bandwidth, and power output capability

POWER REQUIREMENTS:

115 or 230 VAC \pm 10% 50/60 Hz (7805)

+28 VDC at 3.5 A (7806)

7805 SIZE:

5.25" H x 8" W x 14.25" D
(133 H x 203 W x 362 D mm)

7806 SIZE:

4¹⁵/₁₆" H x 4¹/₂" W x 10" D (125 H x 114 W x 245 D mm)

7805 WEIGHT:

20 lbs. (9.1 kg)

7806 WEIGHT:

5 lbs. (2.3 kg)

INPUT IMPEDANCE:

50 ohms (higher impedance optional)

INPUT VSWR:

1.3:1

INPUT-OUTPUT CONNECTORS:

BNC

INPUT OR OUTPUT OVERLOAD:

Lamp warning and automatic protection. 7806 has voltage for warning signal at connector pin.

OVERLOAD PROTECTION:

Input — Overdrive protected to 3 volts RMS
input (30 dB of overdrive)

Output — Short and open circuit protected at nominal
input

MOUNTING:

7805: Bench use. Rack mounting optional.

7806: Threaded holes for mounting

TEMPERATURE RANGE:

0°C to 50°C

OPTIONS:

7805-01 Extended range (to 14 kHz)

7805-03 TNC connectors

PA7805-1 Front-panel adapter for one 7805

PA7805-1R Panel adapter for 7805, rear RF connector

PA7805-2 Front-panel adapter for two 7805's



PRD 7815

TUNABLE AMPLIFIER

- 8 W (20 V) INTO 50 OHMS
- 10 to 500 MHz FREQUENCY RANGE
- >35 dB GAIN
- AUTOMATIC OVERDRIVE PROTECTION

The PRD 7815 is a tunable power amplifier designed to increase the RF power level of signal generators operating in the 10–500 MHz frequency range. It operates in six bands, and employs a two-speed vernier mechanism for fast tuning within each band. Power gain is sufficient to provide an output power of at least 4.5 watts with common signal generators. The signal may be modulated with AM, FM, SSB, CW, or Pulse Modulation. Class A stages and well regulated power supplies provide linear amplification with low distortion.

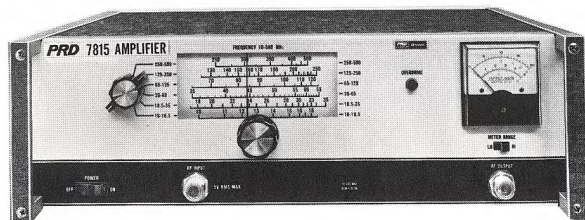
Solid state broadband circuitry is employed in the low level stages, while a single standard tube with a simple tuned circuit is used in the output stage. Because only one stage is tuned, tracking of multiple synchronously tuned stages is eliminated from the alignment procedure. Power supplies and control circuitry employ only solid state devices. RF output metering is provided in two ranges. A unique overdrive protection circuit helps prevent damage to the Amplifier for output levels exceeding approximately 120% of the selected meter range. An indicator lamp shows the status of the overdrive protection circuit.

Clean, simple lines in the exterior styling reflect similar features in the interior of the unit, from its simple, modern circuit design to its freedom from complicated alignment and maintenance procedures. This carries over into the modular simplicity of the unit and its small, lightweight size for ease of handling. The PRD 7815 is housed in an aluminum cabinet for bench use. It can also be rack mounted, with or without chassis slides. RFI filtering and tight shielding prevent stray radiation. Circulation of ambient air through the rear panel air filter by an internal fan cools the unit. Primary power is single-phase, 50/60 Hz, 115 VAC or 230 VAC as selected by a rear panel switch.

The PRD 7815 Amplifier is intended for use in 50-ohm systems. When used with a properly matched load, it will produce up to 8 watts of RF power with nominal input drive provided by signal generators such as the PRD 7808 and Hewlett-Packard models HP-606 and HP-608. Virtually any signal source within the frequency range of the Amplifier may be used; including special purpose FM and navigation aid signal generators, crystal oscillators, breadboard models or engineering projects and frequency synthesizers.

Applications for the Amplifier are almost unlimited. Some of the more common uses are testing receivers at high signal levels; calibrating voltmeters; testing antennas, feedlines, and antenna couplers; driving transmitters; driving varactor multipliers and high level mixers; checking bandpass filters and RFI devices; testing shielding and screen rooms; and use as a transmitter to make tests with radiated signals.

The bandwidth of the Amplifier is wide enough (1.5 MHz minimum) to allow use with most forms of modulation and to make tuning noncritical, but narrow enough to provide excellent harmonic rejection. By tuning to a harmonic of the signal generator frequency, signals above the frequency range of the source can be obtained and amplified to usable levels.



SPECIFICATIONS

FREQUENCY RANGE:	Band 1	10 to 18.5 MHz
	Band 2	18.5 to 35 MHz
	Band 3	35 to 65 MHz
	Band 4	65 to 125 MHz
	Band 5	125 to 250 MHz
	Band 6	250 to 500 MHz

BANDWIDTH (AT 10 VOLTS INTO 50 OHMS):	Greater than 1.5 MHz (10 to 150 MHz)
	Greater than 3.0 MHz (150 to 500 MHz)

RF GAIN (AT 10 VOLTS INTO 50 OHMS):	>40 dB from 10 to 125 MHz
	>37 dB from 125 to 250 MHz
	>35 dB from 250 to 500 MHz

INPUT IMPEDANCE:	50 ohms (VSWR less than 1.5:1)
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OUTPUT:	15 volts minimum into 50-ohm load (4.5 watts). Typically 20 V (8 W) below 250 MHz
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OUTPUT VSWR:	Typically 2:1
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RF CONNECTORS:	Type N Female
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TUNING:	Output stage is manually tuned to cover each band. Tuning dial accuracy is $\pm 10\%$, graduated at approximately 10% increments
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OUTPUT LEVEL METER:	Four scales, 5 & 20 volts rms full scale 10% accurate, 0.5 and 8 watts full scale into 50 ohms
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TYPES OF SIGNALS:	AM, FM, SSB, CW, PULSE, limited only by frequency, bandwidth, and power output capability
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AM REPRODUCTION:	Reproduces 0 to 100% modulation. Less than 10% added to distortion of driving source at up to 5 volts carrier output for up to 100% modulation
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FM REPRODUCTION:	Reproduces modulation of driving source up to bandwidth limit (see Bandwidth). Less than 10% incidental AM added to modulation of driving source at 200 kHz deviation. FM distortion is negligible for less than 200 kHz deviation and modulation frequencies.
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PROTECTION:	Automatic overdrive/over-range indicator. Internal limiting helps prevent overdrive damage.
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SIZE:	5.25 H x 17 W x 14.25 D inches (133 H x 432 W x 362 D mm)
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WEIGHT:	25 pounds (11.3 kg). Shipping wt 40 pounds (18.2 kg)
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POWER REQUIREMENTS:	115 or 230 VAC $\pm 10\%$ (selected by rear panel switch) 50/60 Hz, single-phase, 150 watts maximum
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OPTIONS AND ACCESSORIES:

Rear RF Connectors—	Option 01
Rack Mount Kit—	PA 7815
Chassis Slide Kit—	P/N 815-0115
Additional Manual—	HB 7815

For special modifications contact factory.



PRD 277-D

SWR/ATTENUATION METER

- USED FOR SWR, REFLECTION COEFFICIENT AND ATTENUATION MEASUREMENTS
- SOLID STATE, COMPACT
- BOLOMETER PROTECTION
- 70 db RANGE IN 2 db STEPS

The PRD Type 277-D SWR/Attenuation Meter is a solid-state direct reading instrument for measuring VSWR and attenuation. The instrument is essentially a high-gain low-noise tuned amplifier, incorporating its own power supply, and an indicator calibrated for signal inputs from either crystal or bolometer type square-law detectors. The SWR scales on the indicator are calibrated to provide direct VSWR readings. DB scales provide attenuation readings directly in decibels. High accuracy and resolution in measurements are obtained by expanding selected portions of the ordinary scales for full-scale presentation. The gain, bandwidth and pass frequency of the amplifier can be controlled from the front panel. A rear-panel recorder jack permits connection of a dc recorder if a permanent record of meter indications is desired.

The input signal to the PRD-277-D is obtained from either a crystal (100 and 5000 ohms, biased crystal [1 volt into 1 K ohms]), or a bolometer type (4.3 ma or 8.7 ma) detector. Bolometer bias is adjustable by means of a readily accessible rear panel screwdriver adjustment. Crystal and bolometer detectors produce low-level signal outputs that require the high-gain amplification afforded by the PRD 277-D before being applied to the indicator proper. The instrument can also be used as a high-gain tuned amplifier by making use of its amplifier output terminals on the rear panel.

The power requirements for the PRD 277-D are either 115 volts or 230 volts $\pm 10\%$, 50 to 400 cps. The selection of 115-volt operation or 230-volt operation is accomplished by means of a rear panel switch. The SWR/Attenuation Meter can also be used as a portable instrument with 36 hours of uninterrupted service available from an optional rechargeable battery pack with twice the operating time allowed for recharge.

SPECIFICATIONS:

INPUT CIRCUIT:

Input Impedance:

Crystal: 100 ohms and 5000 ohms unbiased; 1 volt into 1 K ohms biased

Bolometer: 200 ohms

Bolometer Current: 8.7 ma (high) and 4.3 ma (low); adjustable $\pm 10\%$; positive bolometer protection

Input Connector: BNC

AMPLIFIER:

Bandwidth: Continuously adjustable between 15 and 130 cps. Gain variation usually less than 0.5 db from minimum to maximum bandwidth

Center Frequency: 1000 cps*, adjustable over 7% range

Sensitivity: 0.15 μ v rms at maximum bandwidth and 25°C to 55°C; 1 μ v on high impedance.

Noise Level: 7.5 db below full scale sensitivity terminated input, better than 4 db noise figure

Attenuation Range: 70 db in 10 db and 2 db steps (for square-law response)

Accuracy:

± 0.05 db per 10 db step or ± 0.1 db maximum cumulative

± 0.05 db maximum cumulative error between 2 db steps

± 0.02 db linearity on EXP scales

DC Output: 0 to 1 v into 1000 ohms minimum at RECORDER BNC jack (rear panel)

AC Output: 0 to 0.3 v rms and 0.8 v (EXP) into 2000 ohms at AMPLIFIER OUTPUT terminals (rear panel)

METER: Taut Band, Switch to select optimum response time

Calibration: Square law

Scales: SWR: 1 to 4

3.2 to 10

1 to 1.25 (EXP)

DB: 0 to 10

0 to 2 (EXP)

Bolometer bias: 4.3 ma

8.7 ma

Battery Charge

MISCELLANEOUS:

Power Requirements: 115 v or 230 v $\pm 10\%$ 50 to 400 cps, 1 watt or optional rechargeable battery (up to 36 hours of continuous operation)

Dimensions: Width: 8 1/4 in.

Height: 7 1/4 in.

Depth: 11 1/8 in.

Weight: 12 lbs without battery; 14 lbs. with battery

*other frequencies available on special order.

Accessory: PRD 277-D1, Rechargeable Battery Pack



277-D



HARRIS

PRD ELECTRONICS, INC. 1200 PROSPECT AVE., WESTBURY, N. Y. 11590 (516) 334-7810

PRD 2020 / 2021

VECTOR VOLTMETER

- 1.5 MHz-2.4 GHz FREQ. RANGE
- 50-OHM INPUT IMPEDANCE
- 75 dB DYNAMIC RANGE

The PRD Type 2020 Vector Voltmeter provides an accurate and convenient means for measuring the amplitude and phase relationship of two RF voltages in the 1.5 MHz to 2.4 GHz frequency range. Each of the two input channels of the Type 2021 Sampling Head presents a well matched 50-ohm load to the measurement points, thereby reducing mismatch errors present in similar instruments and permitting amplitude measurements to be made directly in dBm, as well as in millivolts.

The two input signals are translated down to 20 kHz by phase-locked coherent sampling in the sampling head. These two 20 kHz IF signals retain the amplitude, waveshape, and phase of the original signals and are available at rear panel connectors. This technique results in very wide frequency coverage while limiting the measurement bandwidth to ± 1 kHz in the 20 kHz IF section.

Tuning is accomplished by simply selecting one of 22 overlapping octave ranges. Fine tuning is completely automatic and is verified by the extinguishing of the Phase Unlocked lamp. Once locked, the instrument will follow slowly drifting signals within the range selected, and will not respond to harmonics or spurious signals. Channel A (the reference channel of the instrument) requires only -50 dBm to achieve phase lock. The +10 dBm upper limit of either channel may be readily extended with conventional calibrated attenuators or with the Type 2022 Probe.

Phase ranges of $\pm 180^\circ$, $\pm 60^\circ$, $\pm 18^\circ$, and $\pm 6^\circ$ are augmented by a Phase Meter Offset switch which allows all measurements to be made on the $\pm 6^\circ$ range for high resolution. Differences in cable lengths are compensated for with the Phase Zero control.

Amplitude measurements can be made from -70 dBm (70.7 μ V) to +10 dBm (0.707 V) in 9 ranges. A front panel switch selects measurement of either channel A or B.

An optional Probe, Type 2022, is available for investigating strip-line and conventional circuits.

PRD Application Note No. 22, available on request, describes a variety of microwave measurements which can be readily made with the vector voltmeter. These include: scattering parameters, insertion loss, attenuation, gain, phase shift, harmonic content, and percent modulation. Additional application notes are available on request.

SPECIFICATIONS

GENERAL

Frequency Range: 1.5 MHz to 2.4 GHz

Tuning: Twenty-two position range switch selects overlapping bandwidths. Fine tuning is fully automatic.

Bandwidth: ± 1 kHz

VSWR: 1.5 to 100 MHz; 1.1

100 to 600 MHz; 1.15

600 MHz to 2.4 GHz; 1.25

AMPLITUDE

CHANNEL A:

Lock Range:

1.5 to 3 MHz; -40 dBm

3 MHz to 1.8 GHz; -45 dBm

1.8 to 2.4 GHz; -40 dBm

Accuracy:

1.5 to 100 MHz; ± 0.5 dB

100 MHz to 1.8 GHz; ± 0.6 dB

1.8 GHz to 2.4 GHz; ± 0.8 dB

Recorder Output: 0-1 Vdc

CHANNEL B:

Sensitivity:

1.5 MHz to 2.4 GHz; -65 dBm

Dynamic Range:

1.5 MHz to 1 GHz; 75 dB

1 GHz to 2.0 GHz; 70 dB

above 2 GHz; 65 dB

Accuracy at 0 dBm:

1.5 to 100 MHz; ± 0.5 dB

100 MHz to 1.8 GHz; ± 0.6 dB

1.8 GHz to 2.4 GHz; ± 0.8 dB

Recorder Output: 0-1 Vdc

Voltage Ratio Accuracy (-60 to -10 dBm ranges):

1.5 MHz to 1 GHz; 0.5 dB

1 to 1.8 GHz; 0.6 dB

1.8 to 2.2 GHz; 0.8 dB

2.2 to 2.4 GHz; ± 1 dB

Maximum AC Input: 2 V p-p

Isolation:

1.5 MHz to 200 MHz; 70 dB min.

200 MHz to 1.8 GHz; 65 dB min.

1.8 GHz to 2.4 GHz; 60 dB min.

PHASE

Accuracy: (With up to 30 dB level difference)

1.5 MHz to 1 GHz; $\pm 3.5^\circ$ (max)

1 to 2.4 GHz; $\pm 4.0^\circ$ (max)

Recorder Output: -0.5 to +0.5 Vdc

MISCELLANEOUS

RF Input Connector: Female Type N Stainless Steel

Input Power: 115/230 $\pm 10\%$ Vac. 50 to 400 Hz

Dimensions:

Type 2020; 16 $\frac{13}{16}$ W x 6 $\frac{31}{32}$ H x 16 $\frac{3}{4}$ D (inches)

Type 2021; 9 $\frac{1}{8}$ W x 3 $\frac{31}{32}$ H x 6 $\frac{1}{8}$ D (inches)

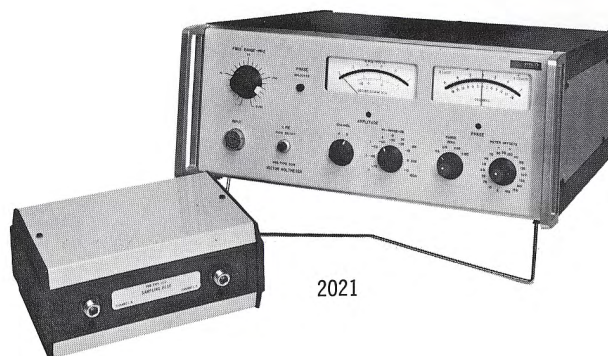
Optional Accessories:

Type 2021-01 Sampling Head with 10' long interconnecting cable

Type 2021-S2 Sampling Head with 25' long cable

Type 2022 Probe

Type PA-30 Rack Mounting Adapter



2021

2020



PRD P2020/P2021

PROGRAMMABLE VECTOR VOLTMETER

- IDEAL FOR AUTOMATIC RF AND MICROWAVE TESTING
- AUTOMATIC FREQUENCY RANGE SELECTION
- 1.5 MHz-2.4 GHz FREQUENCY RANGE
- 50-OHM INPUT IMPEDANCE
- 75 dB DYNAMIC RANGE

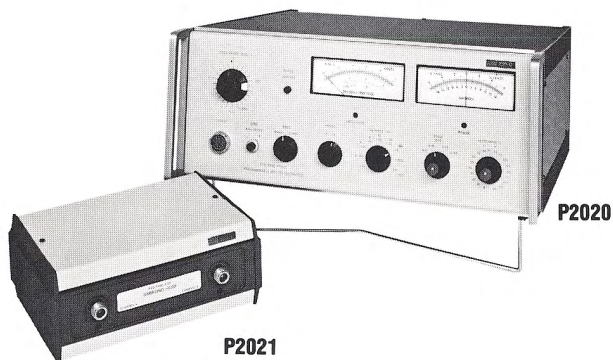
The PRD Type P2020 Programmable Vector Voltmeter provides a cost-effective means for automating RF and microwave test stations, either by hard-wire programming or computer control. All amplitude and phase control functions are programmed through a rear panel connector by standard T²L compatible logic levels. Phase locking to the input signal is accomplished automatically over the entire 1.5 MHz-2.4 GHz frequency range, thereby simplifying the programming effort and permitting more convenient operation in the manual mode.

Amplitude and phase indications are displayed on two front panel meters and are also available as analog outputs on the rear panel.

The Type P2021 sampling head presents two well matched 50-ohm terminations to the measurement points, thereby reducing mismatch errors present in similar instruments and permitting amplitude measurements to be made directly in dBm, as well as in millivolts. The two input signals are translated down to 20 kHz by phase-locked coherent sampling in the sampling head. These two 20 kHz IF signals retain the amplitude, waveshape, and phase of the original signals and are available at rear panel connectors. This technique results in very wide frequency coverage while limiting the measurement bandwidth to ± 1 kHz in the 20 kHz IF section.

An optional Probe, Type 2022, is available for testing strip-line and conventional circuits.

PRD Application Note No. 22, available on request, describes in detail a variety of microwave measurements which can be readily made with the Vector Voltmeter. These include: scattering parameters, insertion loss, attenuation, gain, phase shift, harmonic content, group delay, and percent modulation. Additional application notes are available on request.



SPECIFICATIONS

GENERAL

Frequency Range: 1.5 MHz to 2.4 GHz

Tuning:

Manual Mode:

Twenty-three position switch is used to select one of 22 frequency ranges or the automatic mode. Fine tuning within the frequency range selected is automatic.

Automatic Mode:

Internal circuitry selects correct frequency range.

Phase Lock Acquisition Time:

1 sec (typical)

Bandwidth: ± 1 kHz

VSWR: 1.5 to 100 MHz: 1.1

100 to 600 MHz: 1.15

600 MHz to 2.4 GHz: 1.25

AMPLITUDE

Channel A:

Lock Range:

1.5 to 3 MHz; -40 dBm

3 MHz to 1.8 GHz; -45 dBm

1.8 to 2.4 GHz; -40 dBm

Accuracy:

1.5 to 100 MHz; ± 0.5 dB

100 MHz to 1.8 GHz; ± 0.6 dB

1.8 GHz to 2.4 GHz; ± 0.8 dB

Recorder Output: 0-1 Vdc

Channel B:

Residual Noise:

1.5 MHz to 2.4 GHz; -70 dBm typical

Dynamic Range:

1.5 MHz to 1 GHz; 75 dB

1 GHz to 2.0 GHz; 70 dB

above 2 GHz; 65 dB

Accuracy at 0 dBm:

1.5 to 100 MHz; ± 0.5 dB

100 MHz to 1.8 GHz; ± 0.6 dB

1.8 GHz to 2.4 GHz; ± 0.8 dB

Recorder Output: 0-1 Vdc

Voltage Ratio Accuracy (-60 to -10 dBm ranges)

1.5 MHz to 1 GHz; 0.5 dB

1 to 1.8 GHz; 0.6 dB

1.8 to 2.2 GHz; 0.8 dB

2.2 to 2.4 GHz; ± 1 dB

Maximum AC Input: 2 V p-p

Isolation:

1.5 MHz to 200 MHz; 70 dB min.

200 MHz to 1.8 GHz; 65 dB min.

1.8 GHz to 2.4 GHz; 60 dB min.

PHASE

Accuracy: (With up to 30 dB level difference)

1.5 MHz to 1 GHz; $\pm 3.5^\circ$ (max)

1 to 2.4 GHz; $\pm 4.0^\circ$ (max)

Recorder Output: -0.5 to +0.5 Vdc

MISCELLANEOUS

Programming Requirements:

All control functions can be programmed by logic levels applied to a rear panel connector. Logic can be either TTL compatible or contact closures to ground.

RF Input Connector: Female Type N Stainless Steel

Input Power: 115/230 $\pm 10\%$ Vac. 50 to 400 Hz

Dimensions:

Type P2020; 16^{13/16} W x 6^{31/32} H x 16^{3/4} D

Type P2021; 9^{1/8} W x 3^{31/32} H x 6^{1/8} D

Optional Accessories:

Type P2020-S1 Rear panel connector

Type P2020-S3 Rack mounted with rear connector

Type P2021-01 Sampling Head with 10' long interconnecting cable

Type 2022 Probe

Type PA-30 Rack Mounting Adapter



PRD 915-B

ATTENUATION CALIBRATOR

ADVANTAGES:

- MEASURES 110 DB ATTENUATION IN A SINGLE STEP
- MEASUREMENT AT POWER LEVELS AS LOW AS -120 DBM
- NOISE BALANCE CONTROL
- AUTOMATIC RANGE SWITCHING FOR LOW LEVEL MEASUREMENTS
- FOR MEASUREMENTS FROM 10 MHz TO 40 GHz
- REFERENCE ATTENUATOR EASILY REMOVED FOR CALIBRATION BY NBS
- REFERENCE OSCILLATOR ADJUSTABLE

USES:

- ATTENUATION CALIBRATION
- SIGNAL GENERATOR OUTPUT ATTENUATOR CALIBRATION
- BOTH HIGH AND LOW STANDING WAVE RATIO MEASUREMENT
- NOISE MEASUREMENT
- A SENSITIVE DETECTOR IN REFLECTOMETER MEASUREMENT; PLASMA DIAGNOSTICS, ETC.

The PRD Attenuation Calibrator makes accurate measurements of attenuation, with the appropriate local oscillator and mixer, over the frequency range from 10 MHz to above 40 GHz. Attenuation measurements of 110 db can be made in a single step and relative power measurements at levels as low as -120 dbm can be made. The 915-B can be used for signal generator attenuation calibration, VSWR measurements and as an extremely sensitive detector for use in RF and microwave systems. Basically, the PRD 915-B is a 30 MHz parallel IF substitution receiver. In performing attenuation measurements, the unknown attenuator is compared to a highly accurate reference attenuator contained in the calibrator. This reference attenuator can be removed for calibration by NBS.

Application notes for the PRD 915-B Attenuation Calibrator are available upon request.

SPECIFICATIONS

Input Frequency: 30 MHz CW.

Input Impedance: 50 ohms nominal; 200 ohm matching network supplied.* (915B-1)

Reference Oscillator: Crystal Controlled: 30 MHz $\pm 0.02\%$.
30 MHz Measurement:

1. 0-110 db indication with a 4 digit in-line readout (least division indication 0.02 db).
2. "0" insertion loss approximately 16 db.
3. Accuracy ± 0.03 db per 10 db to 70 db. Maximum cumulative error ± 0.25 db to 100 db; ± 0.35 db to 110 db

Gain Variation: In excess of 100 db

- I-F AMPLIFIER:**
1. Center Frequency: 30 MHz.
 2. Input Impedance: 50 ohms nominal.
 3. Bandwidth: 3 db, approx. 2 MHz.
 4. Noise Figure: 2.5 db maximum.
 5. Video output jack, TNC female.

- AFC UNIT:**
1. Insulated 5000 volts from chassis.
 2. Output of AFC powered from floating regulated supply.
 3. AFC provides necessary correction voltage to hold L.O. to calibrator I-F.

- METERING:**
1. Positive and Negative crystal current for mixer.
 2. Positive and Negative Automatic Frequency Control Indicator.
 3. Null Indicator—center zero, two scales (a) high, (b) low. Signal differences can be resolved to better than .01 db at signal levels as low as -100 dbm.
 4. Video Signal (volts).
 5. Mixer Crystal Current Switch.
 - (a) EXT: for balanced mixers with crystal current monitoring port
 - (b) INT: for unbalanced mixers.

Signal Level at Input:	Accuracy per 10 db increment:
-10 to -80 dbm	± 0.03 db
-80 to -105 dbm	± 0.12 db
-105 to -120 dbm	± 0.20 db

Power Input: 115 $\pm 10\%$, 60 Hz **

Dimensions: Cabinet: 19 $\frac{1}{8}$ " W x 11 $\frac{1}{4}$ " H x 18 $\frac{1}{8}$ " D; Rack Mounted: 19" W x 10 $\frac{1}{2}$ " H x 17" D.

Weight: Approximately 75 lbs.

Frequency Coverage: 10 MHz to above 40 GHz depending upon mixer and L.O. used (PRD 600 Series Mixers recommended to 18 GHz)

*PRD 915-2 Matching Network (400-ohm) available

PRD 915-1, 200 ohms

PRD 915-3, 50 ohms

**PRD 915-BS1, 220 V, 50 Hz

PRD 915-BS3, 115 V, 50 Hz



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PRD ELECTRONICS, INC. 1200 PROSPECT AVE., WESTBURY, N. Y. 11590 ■ (516) 334-7810

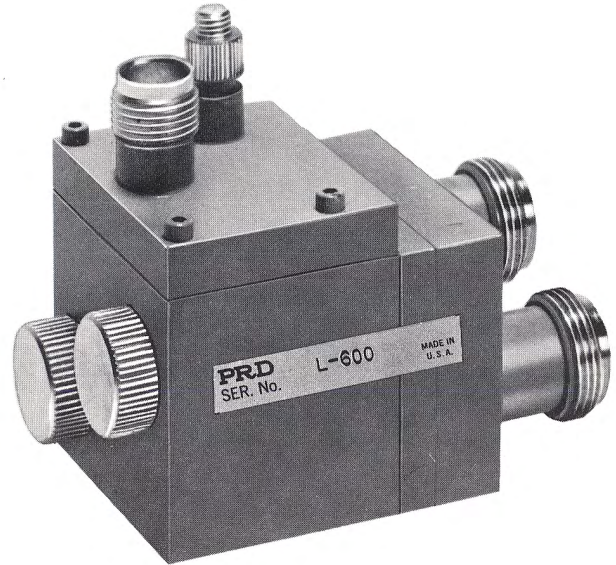
PRD 600 Series

BALANCED MIXERS

- SMALL SIZE
- LOW NOISE FIGURE
- BROADBAND

PRD 600 SERIES BALANCED MIXERS

PRD Type 600 Balanced Mixers cover frequencies from 10 MHz to 18 GHz in six models. They have been designed to extend the frequency range of the PRD 915-B Attenuation Calibrator when used with the proper signal generator and local oscillator. The 600 Series Mixers can also operate as standard single output mixers.



SPECIFICATIONS

PRD TYPE	Frequency Range	Diode Supplied	Noise Figure (dB)*	Conversion Loss (dB)	Use Match Box
UHF 600**	10 MHz-1 GHz	1N831A	8.0	6.5	915-3
L 600	1.0-2.0 GHz	1N416E	8.5	8.0	915-3
S 600	2.0-4.0 GHz	1N416E	8.5	8.0	915-3
C 600	4.0-8.0 GHz	1N23E	9.0	8.0	915-3
X 600	8.2-12.4 GHz	MA492DMR	9.5	7.0	915-1
U 600	12.4-18.0 GHz	MA490DMR	10.5	7.0	915-1

Signal & LO Inputs: Type N Female (coaxial units)

Crystal Current Monitoring: Equivalent to Microdot female (33-01)

IF Output: TNC Female

*Noise Figure: With IF noise figure of 1.5 db

**Monitoring thru IF jack)



PRD 2219

STANDING WAVE DETECTOR

- FREQUENCY RANGE: EXTENDED TO 10 MHz TO 2300 MHz
- SENSITIVITY: IMPROVED TO 5 mW AT 10 MHz — 100 MHz, 20 mW 100-2300 MHz
- ELIMINATES HEAVY COAXIAL SLOTTED LINES
- INTERCHANGEABLE CALIBRATED SUSCEPTANCES
- ADAPTERS AVAILABLE WITH KNOWN REFLECTION COEFFICIENT
- DETECTOR, SUSCEPTANCES AND GR ADAPTERS HOUSED IN ATTRACTIVE, PORTABLE CASE
- SUPPLIED WITH CALIBRATED SHORT & 50 OHM TERMINATION FOR IMPEDANCE MEASUREMENTS
- KIT ELEMENTS AVAILABLE SEPARATELY
- RESIDUAL VSWR: 1.04 (MAX.) 10-2000 MHz. NOMINALLY TUNEABLE TO 1.02. NOMINALLY 1.05, 2000-2300 MHz.

The PRD 2219 Standing Wave Detector is used to measure VSWR and angle of reflection coefficient in the frequency range from 10 MHz to 2.3 GHz in coaxial systems. The detector consists basically of a coaxial tee junction, a manually driven pickup probe assembly and a normalizing calibrated susceptance. In operation, the direct reading drum dial of the susceptance is set to the operating frequency, the input jack is connected to a signal source (PRD 712) or generator and the output connector to a SWR/Attenuation Meter (PRD 277-D). The angle of reflection coefficient is read directly on the calibrated dial at the top of the instrument.

An outstanding advantage of the 2219 is that it replaces coaxial slotted lines which at the lower frequencies may weigh several hundred pounds and be over 10 feet in length. A half wavelength (normally covered in a slotted section) at 10 MHz would be approximately 49 feet long.

A signal input of only 5 mW at 10 MHz is required to operate the 2219* which makes it suitable for use with standard laboratory signal generators. The use of a GR900® load termination provides universality since, the 2219 can mate with all standard coaxial systems through adapters with known reflection coefficients. GR900® adapters are available to BNC, C, N, TNC, OSM/BRM, SC and APC-7 connectors.

The 2219 is offered in three frequency ranges as shown in the chart. By interchanging detector heads and calibrated susceptances, the complete 10 MHz to 2.3 GHz range can be covered.

Each 2219 includes a PRD 1135 Standard 50 ohm Termination and 1136 Standard Short mounted on the base of the instrument.

An attractive, portable case, PRD 2191 houses the detector heads, susceptances and adapters.

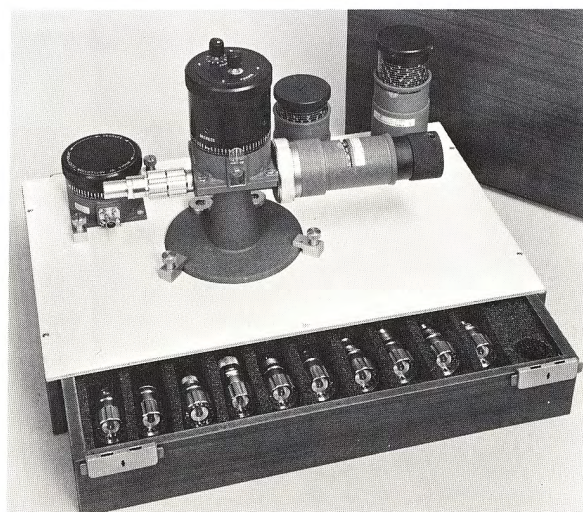
Application notes for the PRD 2219 Standing Wave Detector are available on request.

*U.S. PATENT NO. 3,019,386

PRD Type	Freq. Range MHz	Components Included
2219-L	10 to 100	2219-B, 2219-HL, 3304-L, 1135, 1136
2219-M	100 to 1000	2219-B, 2219-HH, 3304-M, 1135, 1136
2219-H	950 to 2,300	2219-B, 2219-HH, 3304-H, 1135, 1136

COMPONENTS AND ADAPTERS

Type	Description
1135	50-ohm standard termination GR 900 W50
1136	GR 900 WN (Short Circuit Termination)
2191	Carrying Case for complete kit
2219-B	Base unit for all components in the kit
2219-HL	Detector head for use in 10- to 100-MHz frequency band
2219-HH	Detector head for use in 100- to 2300-MHz frequency band
3304-L	Susceptance matching unit for use in the 10- to 100-MHz frequency band
3304-M	Susceptance matching unit for use in the 100- to 1000-MHz frequency band
3304-H	Susceptance matching unit for use in the 950- to 2300-MHz frequency band
3321	BNC Female to GR 900 adapter
3322	BNC Male to GR 900 adapter
3323	C Female to GR 900 adapter
3324	C Male to GR 900 adapter
3325	N Female to GR 900 adapter
3326	N male to GR 900 adapter
3327	TNC Female to GR 900 adapter
3328	TNC Male to GR 900 adapter
3329	OSM/BRM Female to GR 900 adapter
3330	OSM/BRM Male to GR 900 adapter
3331	SC Female to GR 900 adapter
3332	SC Male to GR 900 adapter
3333	APC-7 (Amphenol) to GR 900 adapter



PRD 6872 Series

MINIATURE MICROWAVE POWER MONITORS

- SMALL SIZE
- BROAD BAND (10 MHz-12.4 GHz)
- HIGH RELIABILITY
- USE WITH STANDARD PANEL METER
- IDEALLY SUITED TO SYSTEM APPLICATIONS
- INSENSITIVE TO RESISTANCE VARIATIONS IN LONG MONITORING CABLES

The PRD Miniature Microwave Power Monitors provide for the continuous monitoring of RF power in the 10 MHz to 12.4 GHz frequency range. Their small size and high reliability make them ideally suited to systems and OEM applications.

Basically, the power monitors consist of a thermoelectric calorimeter, which accurately converts the input RF power to a low-level dc signal, and a linear IC amplifier circuit which produces a dc current (0.1 mA) proportional to the input RF power. This output current can be used to drive metering, alarm or control circuits. Any number of power monitors can be used with a single metering circuit by providing a simple switching arrangement.

A unique feature of these units is their ability to maintain stated accuracy with variations in metering circuit resistance. This capability is especially desirable in remote monitoring applications when long lengths of cable are subjected to changing environmental conditions, or when these cables are fed through slip rings from rotating antenna mounts.

Other applications of these versatile devices are in power leveling circuits, portable power measuring equipment, power level alarm systems and remote, VSWR monitoring systems.

The only ancillary equipment required to complete the power monitoring system is a panel meter, power supply, zero-set potentiometer and, if two ranges are desired, a SPST range switch. An attenuator or directional coupler can be used if higher power ranges are to be monitored.

The sensor (calorimeter) and amplifier portions of the Power Monitors are also available in separate packages if required. MIL type versions operating over a temperature range of -55°C to $+125^{\circ}\text{C}$ are available on a special order basis.

Application notes for the PRD 6872 Series are available upon request.

SPECIFICATIONS

Frequency Range: 10 MHz to 12.4 GHz

VSWR: 1.5 max.

Power Ranges:

6872-1: 1mW full scale

6872-2: 10 mW full scale

6872-3; 100 mW full scale

Accuracy:

±1% of full scale excluding RF calibration and external meter error

Temperature Range: 0 to 70°C

Output: 0 to 1 mA

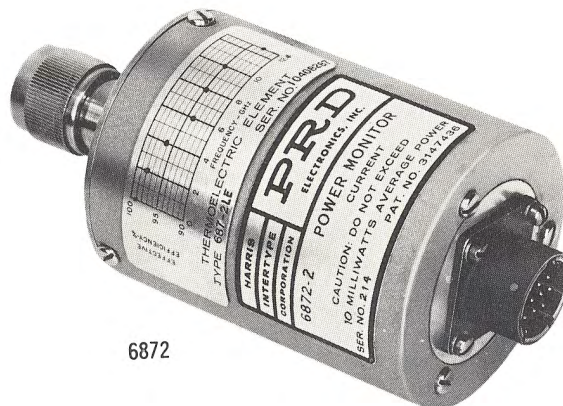
Recommended Meter:

- DVM with either 100 ohms or 1 k ohms precision shunt resistor for 20 dB range.
- 100 μ A meter and a switchable shunt to obtain two 10 dB ranges.
- 1 mA meter to obtain 20 dB range (accuracy of lower 10 dB limited by meter resolution).

Power Requirements: +12 \pm 3 Vdc and -12 \pm 3 Vdc @ 20 mA, 0.1% reg.

Dimensions: 3 $\frac{3}{8}$ " long, 2 $\frac{1}{4}$ " diameter

Weight: 10 oz.



HARRIS

PRD ELECTRONICS, INC. 1200 PROSPECT AVE., WESTBURY, N. Y. 11590 ■ (516) 334-7810

PRD 685/6685

THERMOELECTRIC CALORIMETER & POWER METER

- ALL SOLID STATE DESIGN
- ACCURACY $\pm 1\%$ FULL SCALE
- NEGLIGIBLE ZERO DRIFT
- 65 DB OPERATING RANGE
- LOWEST RANGE $0.3 \mu\text{W}$ F.S.
- OPTIONAL BATTERY OPERATION
- DVM OR RECORDER OUTPUT

The PRD 6685 Thermoelectric Power Meter provides accurate and stable measurements of the average power of cw, pulse, AM and FM signals. It operates with any of the PRD Series 685* Thermoelectric Calorimeters as its sensing element. This combination is capable of RF power measurements over thirteen ranges from 30 nW to 100 mW** and at frequencies up to 18 GHz. Instrumentation accuracy of $\pm 1\%$ of full scale is achieved by a solid state chopper-stabilized amplifier utilizing 100 dB of feedback. Power level indications are displayed on a 0.5% taut band meter. An analog output voltage is available at a rear panel connector for application to an external DVM (for increased accuracy) or to a recorder. Accurate recalibration of the instrument is readily attainable using an accessory calibration cable (PRD 6685-03) in conjunction with commonly available test equipment.

The PRD Calorimeters utilize thin film thermoelectric elements as the power sensing device. Replacement of this element is readily accomplished using an available field service kit (PRD 685-K). All calorimeters are temperature compensated and exhibit negligible

zero drift. Momentary overloads of several hundred percent can be applied without damaging the element. An efficiency control on each unit compensates for frequency-varying RF losses encountered in the calorimeter. The setting of this control for a particular frequency is determined directly from a calibration chart attached to the calorimeter. Coaxial calorimeters operate from 10 MHz to 12.4 GHz and waveguide units operate to 18 GHz.

The 6685 Power Meter automatically indicates the proper sensitivity scale in accordance with the calorimeter being used.

As supplied the instrument can be both bench and panel mounted.

SPECIFICATIONS

Power Range: $0.03 \mu\text{W}$ to 100^{**} mW in 13 ranges
(see table below)

Accuracy:

Instrumentation: $\pm 1\%$ of full scale from 0 to 55°C

Calorimeter: ± 1 to 2% depending on frequency and connector

Noise and Drift: At constant temperature, long term/day; from $\pm 0.0006\%$ to $\pm 0.2\%$ of full scale (depending on range).

Temperature Range: 0 to 55°C

Temperature Coefficient: $< 0.1\%/^\circ\text{C}$

Response Time: 0.1 second typical

DVM or Recorder Output:

Amplitude:

300 mV corresponds to full scale in 0.3, 3, & $300 \mu\text{W}$ and 3, 30, & 300 mW ranges

1.0 V corresponds to full scale in 1, 10, & $100 \mu\text{W}$, and 1, 10 & 100 mW ranges.

Impedance:

into $> 100 \text{ K ohm load}$

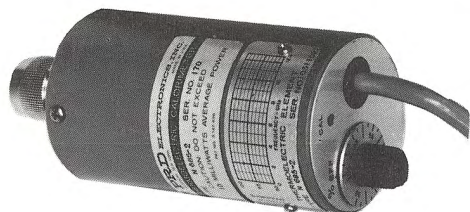
Calorimeter VSWR: 1.5 max

Input Power: 115/230 Vac $\pm 10\%$, 50 to 120 Hz, 5.5 W

Dimensions: W $8\frac{1}{2}"$, H $7\frac{1}{4}"$, D $11\frac{1}{8}"$

Weight: 11 lbs.

Application notes available on request.



SERIES 685

CALORIMETERS

PRD Type	Frequency Range	Connector/Flange Type	Dynamic Range**	Sensitivity ($\mu\text{V}/\text{mW}$)	Replacement Element
N685-1	10 MHz to 12.4 GHz	Type N	$0.03 \mu\text{W}$ to 1 mW -45 to 0 dBm	2500	685-1LE
N685-2	10 MHz to 12.4 GHz	Type N	$0.3 \mu\text{W}$ to 10 mW -35 to +10 dBm	500	685-2LE
N685-3	10 MHz to 12.4 GHz	Type N	$3 \mu\text{W}$ to 100 mW -25 to +20 dBm	50	685-3LE
*** X685-2	8.2 to 12.4 GHz	UG-39/U	$0.3 \mu\text{W}$ to 10 mW -35 to +10 dBm	500	685-2XLE
*** U685-2	12.4 to 18 GHz	UG-419	$0.3 \mu\text{W}$ to 10 mW -35 to +10 dBm	500	685-2ULE

*Patent No. 3,147,436

**Does not include +5 dBm (300%) overrange capability.

***Available on special order only.

6685



PRD 686-A/6284-A

POWER METER & THERMISTOR MOUNTS

- USES COMPENSATED THERMISTOR MOUNTS
- COMPLETE SOLID STATE DESIGN
- ACCURACY TO $\pm 1\%$ OF FULL SCALE
- OPTIONAL RECHARGEABLE BATTERY PACK

The PRD 686-A Power Meter is an extremely stable, solid-state instrument for power measurements. This unit can be used with temperature compensated mounts such as the PRD 6284 Series. Full scale readings from 10 microwatts to 10 mw are covered in seven steps, with a bridge accuracy to $\pm 1\%$ of full scale. Because of the extremely high stability of the PRD 686-A, continuous zero setting is unnecessary—even on the most sensitive range.

The instrument is drift-free due to a unique design using two self-balancing bridges. One arm of each bridge contains a matched thermistor element housed in an external mount. This mount is coupled to the input connector of the PRD 686-A Power Meter. The two matched thermistors are mounted so that one is in the r-f field controlling the oscillator ac feedback loop, while the other is isolated from it and connected to the metering bridge controlling the dc feedback loop. Both elements react to changes in ambient temperature simultaneously and are automatically balanced by the two self-balanced bridges—eliminating thermal drift errors.

A dc calibration input jack for precise dc substitution power measurements and a Recorder/Voltmeter output jack are provided.

A 13 position calibration factor switch on the front panel normalizes the instrument meter to assure optimum operation with the 6284 Mount. The switch is set to read the efficiency indicated on the "calibration factor and efficiency vs. frequency" chart supplied on each mount.

The self-contained PRD 686-A Power Meter weighs only 12 pounds and is, therefore, ideally suited as a portable instrument. A rechargeable battery pack which gives up to 24 hours of uninterrupted service is available as an optional accessory. A front panel control selects ac operation and trickle charge, battery operation, or battery charge.

The PRD 6284 Series or other commercially available thermistor mounts with negative coefficient elements and operating resistances of 100 or 200 ohms can be used with the PRD 686-A. An interconnection cable (PRD 6862-A) for temperature compensated mounts is supplied. Application notes for these PRD products are available on request.



N6284-A

SPECIFICATIONS

Power Range: .01 to 10 milliwatts full scale in 7 steps (.01, .03, 0.3, 1, 3, 10 milliwatts)

DBM Scale: 7 ranges full scale from -20 dbm to +10 dbm.

Accuracy:

$\pm 1\%$ of full scale from $+20^{\circ}\text{C}$ to $+35^{\circ}\text{C}$;
 $\pm 2.5\%$ of full scale from 0°C to $+55^{\circ}\text{C}$.

Efficiency Control: 13 positions, 88% to 100%, in 1% steps calibration factor compensation

Zero Carry Over: Less than 0.5% of full scale when set on .01 mw scale

Thermistor Mount:

External Temperature-compensated thermistor (100 to 200 ohms)

Zero Balance: At least 3% of full scale.

Voltmeter Output: 1 vdc $\pm 0.3\%$ into 500 K ohms or more. Connector located on rear of unit.

Recorder Leveler Output: 1 volt (at full scale) into 600 ohms or more. Connector located at rear of unit.

DC Calibration Input: Terminals are available to the power measuring thermistor bridge for precision voltage measurements required in dc substitution techniques.

RFI: MIL-I-6181D

Power: 115 v/230 v $\pm 10\%$ 50 to 400 cps 2.5 watts

Battery: Optional (up to 24 hours operation)

Weight: 12 lbs.

Dimensions: 8¼" wide, 11½" deep, 7¼" high

Cable Supplied: PRD 6862-A Interconnection Cable

TYPE N6284-A COMPENSATED THERMISTOR MOUNTS

Frequency Range: 10 MHz to 10 GHz.

Maximum VSWR: 1.6, 10 to 25 MHz. 1.3, 25 MHz to 7 GHz.
 1.5, 7 to 10 GHz.

Transmission Line: Type N

Operating Resistance: 200 ohms

Accessories:

PRD 6861-A Rechargeable Battery pack

PRD 6862-A Interconnection cable for compensated thermistor mounts (supplied)

PRD 6863-A Interconnection cable for uncompensated thermistor mounts

PRD 6284-A1 Replacement element for N6284-A only

686-A



PRD 6690-A

PEAK POWER METER & BOLOMETERS

- DESIGNED FOR USE IN HIGH RF ENVIRONMENTS
- SENSITIVITY ADJUSTMENT MATCHES WIDE RANGE OF BOLOMETERS
- MEASURES TO 300 MW PEAK POWER

The PRD 6690-A Peak Power Meter is an extremely stable, solid state instrument designed to measure peak power in high RF environments. The measuring circuitry is encased in a shielded module to permit measurements in high peak RF environments a feature not offered in other instruments of this type.

This newly designed unit consists of a bank of highly stable amplifiers which processes the ramp function generated by the bolometer sensor and then reconstructs the pulse to its original form. A tunnel diode peak detector controlled by an electronic servo loop detects the signal which is then converted to analog form and read on a meter.

A calibration adjust potentiometer is provided on the front of the instrument to match the bolometer sensitivity. The potentiometer dial is set to the sensitivity number supplied with each PRD series-HC Bolometer.

SPECIFICATIONS

Frequency Range: Depends on bolometer mount used

Repetition Frequency: 50 pps to 10,000 pps**

Pulse Width: 0.35 to 10 μ sec**

Power Ranges: 30, 100, 300 mW (full scale)

Accuracy: Better than ± 0.2 dB, excluding RF calibration

Video Output: (Reconstructed Pulse) At front panel, 50 ohm impedance

Dimensions: 8 1/4" W, 11 1/8" D, 7 1/4" H

Cable Supplied: Interconnection cable with TNC connectors

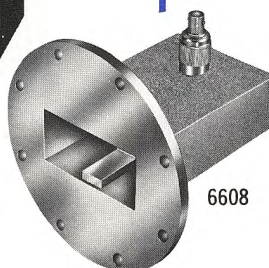
Power Requirements: 115/230 V $\pm 10\%$, 50 to 1000 cps

*Battery pack optional (PRD 6691-A)

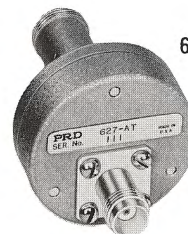
**Useable to 0.2 μ sec and 50,000 pps



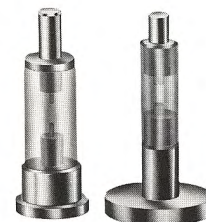
6690-A



6608



627-AT



6301

6302

WAVEGUIDE BOLOMETER MOUNTS

The PRD 6608-T series of fixed tuned waveguide bolometer mounts are designed for use with the PRD 6690 Peak Power Meter. Each consists of a shortened section of single-ridged guide containing a bolometer holder mounted between the center of the ridge and the broad face of the guide. Bolometer elements are easily replaced by unscrewing the TNC jack cap.

Type	Frequency (GHz)	Equivalent Waveguide Type	Equivalent Flange Type	Recommended Detector
X6608-T	8.2 -12.4	RG-52/U	UG-39/U	PRD 6302-HC
U6608-T	12.4-18	RG-107/U	UG-419/U	PRD 6302-HC

COAXIAL BOLOMETER MOUNTS

THE PRD 627 series of fixed tuned mounts consist of a length of 3/8 inch coaxial line and a bolometer housing. The bolometer is a flat disc structure that is clamped between the round flanges at the end of the mount. Fixed matching structures are provided in the form of inductive undercuts in the coaxial line of the mount and by the proper shaping of the electrode of the bolometer disc.

Type	Input Connector	Output Connector	Recommended Detector
627-AT	N-Female	TNC Female	631-HC
627-AMT	N-Male	TNC Female	631-HC

Frequency range: 0.5—10 GHz

BOLOMETERS

The 6301HC and 6302HC series bolometers are specifically designed for broadband waveguide detectors such as the PRD 6608 series. They use Wollaston wire elements which permit impedance matching in waveguides over the complete frequency range without additional tuning. Both types are calibrated for peak power measurements with the PRD Model 6690 Peak Power Meter.

PRD 631HC Bolometers are used with PRD 627 Broadband Coaxial Bolometer Mounts for accurate r-f power measurements in the frequency range from 0.5 to 10 GHz. They provide a VSWR of less than 1.5 over the specified frequency range without tuning. Each bolometer has a nominal resistance of 200 ohms for bias operation and an r-f resistance of 50 ohms to match the coaxial line impedance.

Type	Frequency Range (GHz)	PRD Mount Recommended
631HC	0.5-10	627 Series
6301HC	2.6-5.85	S, G6608
6302HC	5.3-18	C, H, X, U6608

Bias Current @ 200 ohms
Max. RF Power rating
Temperature Coefficient

8.75 mA.
10 mW.
positive



BOLOMETERS

PRD 631 SERIES

PRD 631 Bolometers are used with PRD 627-A and 628-A, B Broadband Coaxial Bolometer Mounts for accurate RF power measurements in the frequency range from 0.5 to 10 GHz. They provide a VSWR of less than 1.5 over the specified frequency range without tuning. Each bolometer has a nominal resistance of 200 ohms for bias operation and an RF resistance of 50 ohms to match the coaxial line impedance. Bolometer elements are either short lengths of Wollaston wire or metallic film on a thin mica disc.

Type	PRD Mount	Type	Temp. Coeff.	Bias Current @ 200 ohms (mA)	Max. RF Power Rating (mW)
631C	627	wire	+	4.5	1
631D	628A	film	+	35.0	100
631-F	628-B	film	+	35.0	100
631G	628A	therm.	-	12.0	10
631H	627	wire	+	8.75	10
631-HC	627	wire	+	8.75	10

PRD 610, 614, 617 SERIES

These bolometers, because of their inherently accurate square law characteristics, replace crystals for precise microwave power measurements. Applications include accurate slotted line measurements, power monitoring, and attenuation and insertion loss measurements. They are suitable for AM power detection when used with a suitable standing wave amplifier (PRD 277-D) or CW detection when used with a power meter (PRD 650 C or 686). Each bolometer employs a short length of very fine platinum wire as detector element. Small size is a major factor contributing to a short time constant and high sensitivity. Bolometers are mechanically interchangeable with the crystals as follows: 610-A with 1N23; 614 with 1N26. The 617 bolometer employs a platinum wire mounted on a flat strip of mica which is shaped to fit over the alignment pins of Types UG-381/U and UG-424/U waveguide connectors.

Type	Frequency Range GHz	Type	Bias Current @ 200 ohms (mA)	Max. RF Power Rating (mW)
610A	0 to 12.4	wire	4.5	1
614	12.4 to 26.5	wire	4.5	1
617	18 to 40	wire	4.5	1

PRD 6301, 6302, 6303

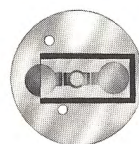
The 6301 and 6302 series bolometers are specifically designed for broadband waveguide detectors such as the PRD 6608 series. They use Wollaston wire elements which permit impedance matching in waveguides over the complete frequency range without additional tuning. The 6303 is a general purpose bolometer of the cartridge type and can be used in mounts from dc to 18 GHz.

Type	Frequency Range GHz	Type	Bias Power @ 200 ohms (mA)	Max. RF Power Rating (mW)
6301L**	2.6 to 5.85	wire	4.5	4
6301H*	2.6 to 5.85	wire	8.75	10
6302L	5.3 to 18	wire	4.5	4
6302H*	5.3 to 18	wire	8.75	10
6303**	.01 to 18	wire	8.75	16

*6301HC same as 6301H but calibrated for peak power measurements.
6302HC same as 6302H

Type	PRD Mount Recommended	Temp. Coeff.
6301L**	S, G 6608	+
6301H	S, G 6608	+
6301HC	S, G 6608	+
6302L	C, H, X, U 6608	+
6302H	C, H, X, U 6608	+
6302HC	C, H, X, U 6608	+
6303**	—	+

**Available on special order only.



631



6301



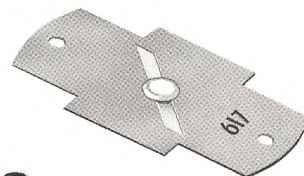
6302



614



610



617



PRD 101 SERIES

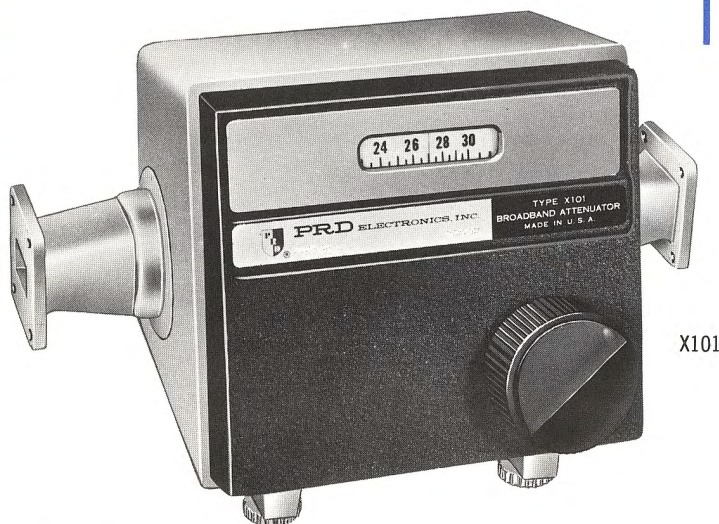
BROADBAND DIRECT READING ATTENUATORS

- 60 DB RANGE
- SHORT INSERTION LENGTH
- DIRECT READING
- MINIMAL PHASE SHIFT

These broadband direct-reading precision waveguide attenuators are designed for applications requiring a highly accurate and stable control of attenuation over a wide frequency range. They serve as versatile and dependable attenuation standards for a variety of attenuation and relative power-level measurements and can be used as repeatable isolation and level-set devices.

The attenuation of these rotary-vane units is determined by the angular position of a resistive film with respect to the waveguide, and is therefore independent of frequency. They cover from 3.95 to 40.0 GHz in seven sizes. The readout scale is two feet long printed on a stabilene (stabilized mylar) tape by a photographic process.

The instruments are housed in an attractive compact casting with height-adjustable feet. They provide broadband operation over a full 60 db range, featuring frequency independent attenuation, negligible phase-shift variations (less than 3°) and excellent stability with time or changes in atmospheric conditions. The drive mechanism and materials have been chosen for minimum wear, maximum resistance to corrosion, smooth operation, and negligible backlash. The low insertion loss and the VSWR below 1.15 provide an instrument of highest versatility.



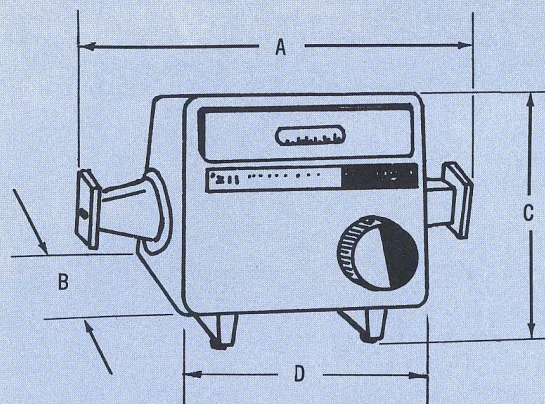
X101

Type	Frequency GHz	Max. Insert. Loss (db)	Max. Pwr. (watts)
G101	3.95-5.85	0.5	15
C101	5.30-8.20	0.5	10
H101	7.05-10.0	0.5	10
X101	8.20-12.4	0.5	10
U101	12.4-18.0	0.7	5

Type *	Waveguide Size (inches)	Equivalent Flange Type	Recommended Panel Adapter
G101	2x1	UG-407/U	
C101	1½x¾	UG-441/U	PA-IL
H101	1¼x⅝	UG-138/U	PA-IL
X101	1x½	UG-39/U	PA-IL
U101	.702x.391	UG-419/U	PA-IH

Accuracy: ± 0.1 dB or $\pm 2\%$, whichever is greater, from 0 to 50 dB; $\pm 3\%$ from 50 to 60 dB.

Panel mounting of the series 101 attenuators can be easily accomplished through the use of optional adapters Type PA-IL and Type PA-IH. See special order pages for a complete description of these adapters.



Type	Inches			
	A	B	C	D
G101	19	7	6⅜	7⅞
C101	14½	7	6⅜	7⅞
H101	11⅜	7	6⅜	7⅞
X101	9	6⅜	6⅞	5⅞
U101	7⅞	6	5	3⅞

* Units with special waveguide orientations for panel mounting are available at additional cost.



PRD 1110 SERIES

VARIABLE COAXIAL ATTENUATORS

■ PRECISION MICROMETER ADJUSTMENT

■ HIGH POWER CAPACITY

The PRD 1110 Variable Coaxial Attenuators are used in the laboratory and field (from 0.3 to 8.2 GHz) for the adjustment and regulation of microwave power in coaxial systems.

These precision micrometer-driven variable coaxial attenuators by PRD are of the volumetric type. A lossy material gradually inserted into the electromagnetic field absorbs energy proportional to the amount of coupling. VSWR and insertion loss are kept low across the frequency band.

Continuous and accurate attenuation adjustment settings are provided by the micrometer readout. Exceedingly fine increments of attenuation are attainable (hundredths of a db). This characteristic is extremely useful when the output of two or more circuits must be set to a desired level.

The PRD 1110 Series can dissipate 10 watts, has a maximum insertion loss of 0.2 db, and a resetability of 0.1 db. A calibration curve, supplied on special order, provides accuracy to 0.2 db per frequency.

Non-translating drives are available for the PRD 1110 attenuators on special order. These are ideally suited for use as microwave system components.

Type	Frequency (GHz)	Attenuation Range (min.)	VSWR (max.)
UHF1110	0.3-1.0	13db	1.7
L1110	.95-2.0	27db	1.4
S1110	1.9-4.0	30db	1.3
C1110	3.95-8.2*	40db	1.4

Calibration curve (± 0.2 db accuracy) supplied on special order.
*Usable to 10.5 GHz



1110

PRD 369 SERIES

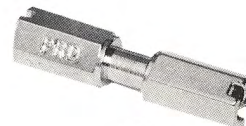
FLANGE NUT AND BOLT ASSEMBLY

These bolt and nut assemblies are designed specifically for simultaneous coupling and alignment of flanged waveguide components. They can be used to assemble permanent waveguide transmission systems and in production test and laboratory bench setups.

The assembly consists of a nickel plated brass nut and bolt. They are available in five sizes for use with the AN flange types listed in the accompanying table.

Each bolt and nut is provided with a slotted hexagonal head — convenient for tightening by hand, wrench or screwdriver. Small clearances between the bolt diameter and the appropriate flange hole automatically align the adjacent waveguide components in the system.

Type	Used With Flange Type	Used With Waveguide Size (Inches)	Length (Inches)
369-A	UG-53/U	3 x 1 1/2	1 3/16
369-B	UG-149/U	2 x 1	1 3/16
	UG-344/U	1 1/2 x 3/4	1 3/16
369-C	UG-51/U	1 1/4 x 5/8	1 3/16
369-D	UG-39/U	1 x 1/2	1
369-E	UG-419/U	0.702 x 0.391	15/16



369



PRECISION COAXIAL ATTENUATORS

PRD SERIES 1600

- SMALL SIZE
- LOW VSWR
- LOW FREQUENCY DEVIATION
- 2 WATTS AVG. POWER
- RUGGED STAINLESS STEEL CONSTRUCTION
- MIL TYPE N or APC-7 CONNECTORS

The PRD 1600 Series Precision Coaxial Attenuators provide accurate, repeatable and stable values of insertion loss in coaxial systems. They employ deposited metal thin film elements to achieve exceptional electrical and mechanical characteristics. An attached chart conveniently indicates calibrated values of attenuation measured at specific frequencies. Swept frequency tests assure the validity of interpolation between these frequencies.

Low VSWR and frequency sensitivity qualify these attenuators for use in swept frequency systems and as range extenders for power meters, vector voltmeter and other RF and microwave instrumentation. Their accuracy and stability also permits employing them as pads and/or reference attenuators in substitution type attenuation measurements and other setups which require precise values of attenuation.

These precision devices are available in a wide selection of attenuation values and frequency ranges to meet your specific requirements.

PRD SERIES 1700

- EXTREMELY SMALL SIZE AND LIGHT WEIGHT
- RUGGED STAINLESS STEEL CONSTRUCTION WITH MIL CONNECTORS

The combination of small size and weight and excellent performance characteristics make these rugged devices well suited to systems and OEM applications, as well as standards lab and bench use. They feature low frequency deviation and VSWR in a cylindrical package less than 1 1/4 inch long. Rugged stainless steel construction and high temperature stability allow operation over a wide range of environmental conditions.

An attached calibration chart conveniently indicates the calibration frequencies and the attenuation values measured at these frequencies. Swept frequency testing assures the validity of interpolation between these points.

These miniature precision devices are available in a wide selection of attenuation values and frequency ranges to meet your specific requirements.



1600



1700

SERIES 1600 PRECISION COAXIAL ATTENUATORS

Model	1612	1613	1614	1622	1623
Frequency Range (GHz)	DC-18	DC-12.4	DC-6	DC-18	DC-12.4
Connectors: (Male/Female)	Type "N"	Type "N"	Type "N"	APC-7	APC-7
Max. Frequency Deviation:					
3db	±0.3db	±0.3db	±0.5db	±0.3db	±0.3db
6db	±0.4db	±0.3db	±0.5db	±0.4db	±0.3db
10db	±0.5db	±0.5db	±0.5db	±0.5db	±0.5db
20db	±1.0db	±0.5db	±0.5db	±1.0db	±0.5db
30db	±1.0db	±1.0db	±1.0db	±1.0db	±1.0db
40db	±1.5db	±1.5db	±1.0db	±1.5db	±1.5db
50db	±1.5db	±1.5db	±1.0db	±1.5db	±1.5db
60db	±2.0db	±2.0db	±1.0db	±2.0db	±2.0db
Max. VSWR:					
DC — 6 GHz	—	—	1.25	—	—
DC — 8 GHz	1.25	1.25	—	1.20	1.20
8 — 12.4 GHz	1.35	1.35	—	1.30	1.30
12.4 — 18 GHz	1.50	—	—	1.50	—
Calibration: Frequencies (GHz)	DC, 4, 8, 12, 18	DC, 4, 8, 12	DC, 2, 4, 6	DC, 4, 8, 12, 18	DC, 4, 8, 12
Maximum Input Power:					
Average: 2W	Length: 2 3/4 inches				
Peak: 100W	Diameter: 1 3/8 inch				
	Weight: 4 oz.				
Impedance: 50 Ohms					
Tem. Coefficient: 0.001 dB/dB/°C					

Type	Frequency	Attenuation (dB)
1612	DC-18 GHz	3, 6, 10, 20 30, 40, 50, 60
1613	DC-12.4 GHz	3, 6, 10, 20 30, 40, 50, 60
1614	DC-6 GHz	3, 6, 10, 20 30, 40, 50, 60
1622	DC-18 GHz	3, 6, 10, 20 30, 40, 50, 60
1623	DC-12.4 GHz	3, 6, 10, 20 30, 40, 50, 60

SERIES 1700 MINIATURE PRECISION COAXIAL ATTENUATORS

Model	1752	1753	1754
Frequency Range (GHz)	DC-18	DC-12.4	DC-6
Max. Frequency Deviation:			
3dB	±0.3dB	±0.3dB	±0.3dB
6dB	±0.4dB	±0.3dB	±0.3dB
10dB	±0.5dB	±0.5dB	±0.5dB
20dB	±1.0dB	±0.5dB	±0.5dB
30dB	±1.0dB	±1.0dB	±1.0dB
40dB	±1.5dB	±1.5dB	±1.5dB
50dB	±1.5dB	±1.5dB	±1.5dB
60dB	±2.0dB	±2.0dB	±2.0dB
Max. VSWR	1.50	1.35	1.30
Calibration Frequencies (GHz):	DC, 4, 8, 12, 18	DC, 4, 8, 12	DC, 2, 4, 6
Connectors: SMA Male/Female	Length:		
Max. Input Power:	3-40 dB; 1 1/4 inches		
Average: 2W	50-60 dB; 1 3/8 inches		
Peak: 100W	Weight:		
Impedance: 50 ohms	3-40 dB; 1 oz.		
Temp. Coefficient: 0.001 dB/dB/°C	50-60 dB; 1 1/4 oz.		

Type	Frequency	Attenuation (dB)
1752	DC-18 GHz	3, 6, 10, 20 30, 40, 50, 60
1753	DC-12.4 GHz	3, 6, 10, 20 30, 40, 50, 60
1754	DC-6 GHz	3, 6, 10, 20 30, 40, 50, 60



PRD 1203-1206, 1208, 1209, 1213

WAVEGUIDE FERRITE ISOLATORS

- PROVIDES LOAD ISOLATION
- ELIMINATES FREQUENCY PULLING
- HIGH POWER HANDLING CAPACITY

These waveguide isolators are nonreciprocal attenuators which isolate generators from variable or unmatched loads, thus reducing effects of load characteristics on the signal source. They provide low attenuation for input signals and high attenuation for reflected signals. Thus, maximum power is available for measurement purposes while the generator match is preserved. The isolators contain a specially designed, low reflection ferrite which permits transmission of electromagnetic energy in one direction only. The magnetic field required to achieve this condition is supplied by a permanent magnet, which is protected from shock and accidental degaussing by a non-ferrous shield. Insertion loss and VSWR are low over the entire frequency range (models are available from 3.95 to 40 GHz). The power rating of 10 watts can be exceeded by a factor of 5 without damage, but this may temporarily degrade the electrical characteristics.

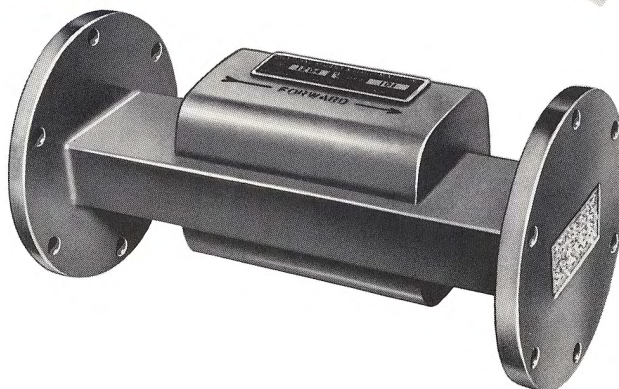
Type	Frequency (GHz)	Minimum Isolation (db)	Maximum VSWR (either end)
1205	3.95-5.85	25	1.20
1204	5.85-8.20	20	1.20
1203	8.20-12.4	30	1.20
1208	12.4-18.0	25	1.15
1209-F1	18.0-26.5	24	1.15
1213-BF1	26.5-40.0	20	1.15

Type	Waveguide Size (inches)	Equivalent Flange Type	Length (inches)
1205	2 x 1	UG-149A/U	7 1/2
1204	1 1/2 x 3/4	UG-344/U	6 1/8
1203	1 x 1/2	UG-39/U	6 1/4
1208	.702 x .391	UG-419/U	5 1/4
1209-F1	.500 x .250	UG-595/U	4 1/2
1213-BF1	.360 x .220	UG-599/U	4

Max. Insertion Loss: 1 db; Average Power: 10 W; Peak Power: 2 kW.

1213 — Insertion Loss: 2 db; Average Power: 5 W.

1204



PRD 1210-C, 1211-C, 1212-C

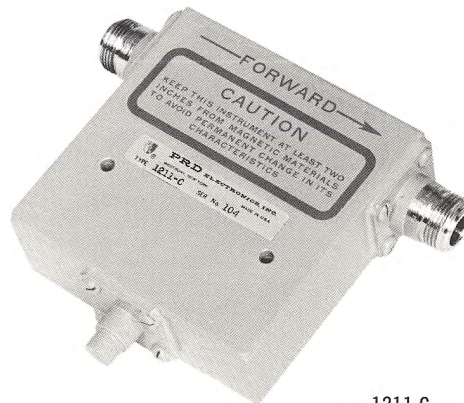
MAGNETICALLY SHIELDED MINIATURE COAXIAL ISOLATORS

These miniature coaxial isolators offer 20 dB of isolation over frequency bands of 1 to 2, 2 to 4 and 4 to 8 GHz. PRD miniature isolators are magnetically shielded and are not affected by close proximity to magnetic materials when used in microwave systems. Their short length, high isolation and universality of mounting position make them ideally suited to laboratory or system applications.

Type	Frequency (GHz)	Minimum Isolation (db)	Maximum VSWR
1210-C	1 to 2	20	1.25
1211-C	2 to 4	20	1.25
1212-C	4 to 8	20	1.25

Peak Power	Type	Maximum Insertion Loss (dB)	Length (inches)	Operating Temperature (C)
400 W	1210-C	0.5	4 13/16	10 to 40°
1 kW	1211-C	0.5	3 1/2	0 to 55°
1 kW	1212-C	0.5	3	0 to 55°

Connectors: Equivalent to UG-23/U at both ends
Forward Power: 100 W
Reverse Power: 2 W



1211-C



PRD 518

BROADBAND COAXIAL FREQUENCY METER

The PRD 518 Coaxial Frequency Meters are precision, broadband, direct reading units operating over the frequency ranges of 960 MHz to 4 GHz, and 3.7 to 12.4 GHz.

High resolution over the entire frequency range is attainable through the use of an extended spiral scale with 1 MHz increments between 960 MHz and 4 GHz, 5 MHz increments between 4 and 6 GHz, and 10 MHz increments between 6 and 12.4 GHz.



PRD 587-A

UHF FREQUENCY METER

This direct reading frequency meter is used for measurements in the UHF band (250-1000 MHz). It is recommended wherever quick determination of frequency and ease of reading are required. The resonator is an end-loaded coaxial cavity. A drum dial with a spiral calibration has an effective scale length of 60 inches. The coupling system consists of two loops connected to type N jacks, providing either transmission or absorption operation. As a transmission device, nominal insertion loss is 6 dB, and as an absorption device, it produces a dip greater than 20%. When the 587-A is used as a reaction device, a UG-107B/C tee connector (not supplied) should be connected to either end of the frequency meter.

Meter accuracy is $\pm 0.2\%$ above 400 MHz and $\pm 0.5\%$ below 400 MHz. A specially designed spring-loaded drive system eliminates backlash and wear problems. All internal parts of the resonator are high conducting materials insuring the highest Q.

TYPE 587-A

Frequency: .25 to 1.0 GHz
Accuracy: $\pm 0.2\%$ above 400 MHz; $\pm 0.5\%$ below 400 MHz
Nominal Insertion Loss: 8 dB (17 dB max at .25 GHz)
Minimum Dip: 20%
Dial Markings: 5 MHz, 250 to 350 MHz
 1 MHz, 350 to 1,000 MHz

Type	Frequency (GHz)	Accuracy		Resonance Dip
		Dial	Overall*	
LS-518	0.96-4.0	0.96-1.0 GHz $\pm 0.15\%$	0.96-1.0 GHz $\pm 0.22\%$	0.96-1.0 GHz 0.6 dB min.
		1.0 -4.0 GHz $\pm 0.10\%$	1.0 -4.0 GHz $\pm 0.17\%$	1.0 -4.0 GHz 1.0 dB min. 0.96-4.0 GHz 3.5 dB max.
CX-518	3.7-12.4	$\pm 0.10\%$	$\pm 0.17\%$	1.0 dB min.

Connectors: Type N female, UG-50A/U

Cavity Q: Typically greater than 1500

*Includes temperature variation over a 20°C range, relative humidity and backlash.

Effective scale length: LS-518, 180 inches CX-518, 73 inches



PRD 819-A

SOLID STATE KLYSTRON POWER SUPPLY

- SHORT CIRCUIT PROOF
- VARIABLE DC FILAMENTS
- SOLID STATE
- LIGHTWEIGHT
- 3600-VOLT BEAM SUPPLY
- DIGITAL READOUT OF BEAM AND REFLECTOR VOLTAGE
- LOW REFLECTOR IMPEDANCE FOR USE WITH MILLIMETER KLYSTRONS

The PRD 819-A Universal Klystron Power Supply is an all solid state primary power source for laboratory and field operation. The use of silicon controlled rectifiers and other solid state devices provides this unit with a state of the art capability unmatched in the industry.

The PRD 819-A is capable of supplying from 250 to 3600 volts at 200 watts maximum on the beam line. The beam circuit is protected against short circuit currents by a fast acting unijunction-SCR circuit which turns off the beam voltage before internal or external components can be damaged by current overload transients. Also included are extremely well-regulated low ripple, reflector, grid and filament supplies which are referenced to the high voltage. A modulator for use with internal square, sawtooth, or sine wave or external signal can apply up to 175 volts peak-to-peak on the reflector supply. Included is a continuously variable current limit setting on the beam supply. Front panel controls are functionally grouped to provide ease of operation and minimize operator error. The use of counters and single range tuning for the beam and reflector voltages provide a high degree of accuracy.



SPECIFICATIONS

BEAM SUPPLY

RANGE:	250 to 3600 VDC (1 Range) at 100 mA (200 W max.)
LINE REGULATION:	$\pm 0.015\%$, $\pm 10\%$ of 115 VAC
LOAD REGULATION:	$\pm 0.05\%$, No load to full load
MAX. RIPPLE PLUS NOISE:	20 mV rms (typical: 10 mV*)
READABILITY:	1 volt
READING ACCURACY:	2% meter

METERING

VOLTAGE:	0 to 3600 V
CURRENT:	0 to 30 mA; 0 to 100 mA
CURRENT LIMIT:	continuously variable pot calibrated 0 to 100 mA

REFLECTOR SUPPLY (referenced to beam)

RANGE:	0 to 1000 V
CURRENT:	0 to 0.5 mA max.
DYNAMIC IMPEDANCE:	< 50 k ohms
REGULATION:	$\pm 0.005\%$, $\pm 10\%$ of 115 VAC
MAX. RIPPLE PLUS NOISE:	20 mV rms
READABILITY:	1 V
METERING:	Calibration voltage

+GRID SUPPLY (referenced to beam)

RANGE:	0 to 150 VDC
CURRENT:	0 to 5 mA max.
INTERNAL IMPEDANCE:	0 to 14.7 k ohms
REGULATION:	$\pm 0.005\%$, $\pm 10\%$ of 115 VAC
MAX. RIPPLE PLUS NOISE:	30 mV rms
METERING:	Calibration voltage

-GRID SUPPLY (referenced to beam)

RANGE:	0 to 300 VDC
CURRENT:	0 to 1 mA max.
INTERNAL IMPEDANCE:	0 to 14.7 k ohms
REGULATION:	$\pm 0.005\%$, $\pm 10\%$ of 115 VDC
MAX. RIPPLE PLUS NOISE:	30 mV rms

FILAMENT SUPPLY (DC filament (+) or (-) may be connected to the klystron cathode)

RANGE: REGULATED	
VOLTAGE:	2.4 to 6.5 VDC at 2 amps
LINE REGULATION:	$\pm 1\%$, $\pm 10\%$ of 115 VAC

MODULATION (reflector)

1. INTERNAL:
 - (a) Amplitude— 0 to 175 V p-p
 - (b) Frequency— square wave 200 to 2000 Hz
sawtooth 40 to 400 Hz
sine wave line frequency
 - (c) Input Impedance— > 100 k ohms
2. EXTERNAL (DIRECT):
 - (a) Amplitude— 0 to 175 V p-p
 - (b) Frequency— to 60 kHz
 - (c) Input Impedance— > 100 k ohms
3. EXTERNAL (AMPLIFIED):
 - (a) Input Amplitude— 0 to 10 V p-p max.
 - (b) Frequency— dc to 20 kHz
 - (c) Input Impedance— > 10 k ohms
 - (d) Output Amplitude— 0 to 175 V p-p
4. EXTERNAL SYNCHRONIZATION
5. INTERNAL MODULATION OUT

GENERAL

INPUT POWER:	115 $\pm 10\%$, 60 Hz, approx. 1400 watts max.
DIMENSIONS:	17" W x 7" H x 15½" D
RACK MOUNTING:	Side walls of cabinet readily convert this unit for 19" rack mounting
WEIGHT:	60 pounds

*Measured at 2500 volts, 30 mA



PRD 8300 SERIES

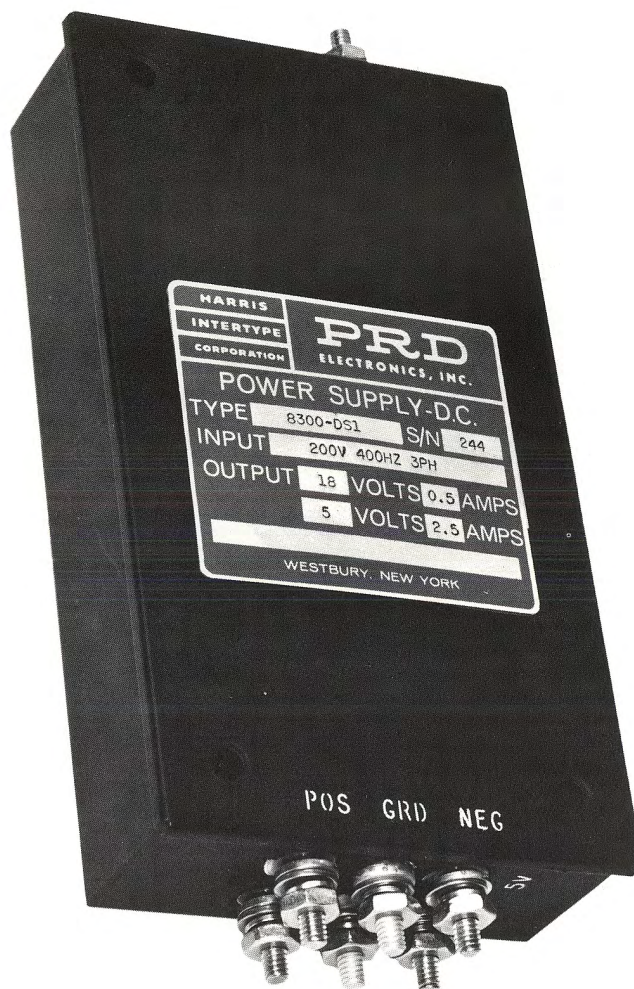
MODULAR POWER SUPPLIES

- SMALL SIZE
- SERIES PASS REGULATOR
- FLOATING OUTPUT
- OVERLOAD PROTECTED
- OVERVOLTAGE PROTECTED
- MEET MIL-T-21200

The PRD 8300 Series Power Supplies are designed to power operational amplifiers, linear and digital integrated circuits and discrete transistor circuits from 200 Vac (line-to-line), 400 Hz, 3-phase line power. They are available with outputs of 5 to 28 Vdc at 0.25 to 20 A, and with dual or adjustable outputs on special order.

All units are equipped with overload protection circuitry which limits short circuit currents to values which will not damage the supply. In addition, the supplies are protected against overvoltage, transients and loss of any input power phase.

Floating output terminals provide for either positive or negative output voltages.



	OUTPUT VOLTAGE	OUTPUT VOLTAGE ACCURACY	CURRENT RATING	REGULATION NO LOAD TO FULL LOAD	P-P MAX RIPPLE AND NOISE	STABILITY (8 HOURS)	DIMENSIONS (INCHES)			FED. STOCK NO.
							L**	W	H	
8300-DS1	5	±1%	2.5 A	1%	5 mV	±0.5%	5½	3	1¼	1*
	18	±1%	0.5 A		15 mV					
8300-VS1	4-6 adj.	—	6 A	0.5%	200 mV	—	5½	3¾	1¼	—
8300-VS2	115-135 adj.	—	0.35 A	0.5%	5 mV	—	5½	3	1	—
8305-150	5	±1%	15 A	1%	15 mV	±0.5%	7⅞	5⅞	1¼	2*
8305-060	18	±1%	5 A	1%	10 mV	±0.5%	7¾	5¾	1¼	—
8305-200	5	±1%	20 A	1%	15 mV	±0.5%	7⅞	5⅞	1¼	3*
8312-060	12	±1%	6 A	1%	5 mV	±0.5%	7⅞	5⅞	1¼	4*
8315-020	15	±1%	2 A	1%	5 mV	±0.5%	5⅞	3⅞	1¼	5*
8318-050	5	±1%	6 A	1%	5 mV	±0.5%	6	4	1¼	—
8328-020	28	±5%	2 A	1%	500 mV	±2.5%	5½	3	1¼	6*
8328-040	28	±1%	4 A	1%	5 mV	±0.5%	7⅞	5⅞	1¼	7*

*1-RH6130-068-8190BY 2-RH6130-163-6241BY 3-RH6130-461-5131BY 4-RH6130-163-1803BY
5-RH6130-165-3748BY 6-RH6130-165-3749BY 7-RH6130-163-6230BY

**Add 35/64" at each end for terminals.



PRD PA-SERIES

RACK MOUNTING PANEL ADAPTERS

The PRD Rack Mounting Panel Adapters are designed to adapt PRD bench and modular type instrument cabinets to a standard 19-inch equipment rack. Adapters are available that allow combinations of the two basic PRD cabinet sizes. All kits come with necessary hardware and instructions.

PA7808, PA7815, PA7828

Using this kit permits the mounting of either the PRD 7808, PRD 7815, or PRD 7828 in a standard 19-inch rack. Connections are made at front panel.

PA7805-1

Using this kit, the PRD 7805 may be mounted in a standard 19-inch rack, and connections are made at the front panel.

PA7805-1R

A similar rack mount kit is available with feedthrough type BNC connectors mounted in the rack panel adapters. This option allows short jumper cables to be connected from the PRD 7805 input and output connectors to the feedthrough connectors, so that cables can be attached from the rear of the rack.

PA7805-2

Using this kit, two PRD 7805's may be mounted in a standard 19-inch rack. Connections are made at the front panel.

PA-27

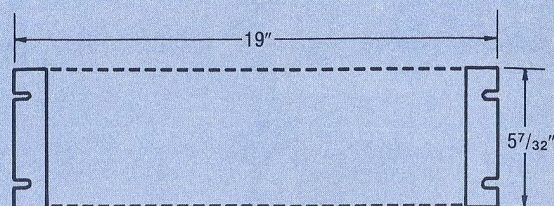
Adapts two PRD cabinets of modular type instruments to 19-inch rack panel. Includes PRD instrument types 277-D, 686-A, 6685 and 6690.

PA-28

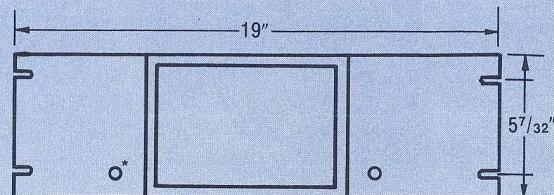
Adapts one PRD cabinet of modular type instrument to 19-inch rack panel. Includes PRD instrument types 277-D, 686-A, 6685 and 6690.

PA-30

Adapts PRD 2020 and P2020 for 19-inch rack mounting.

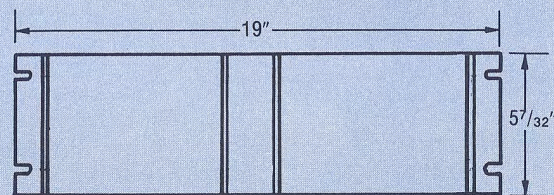


PA7808, PA7815, PA7828

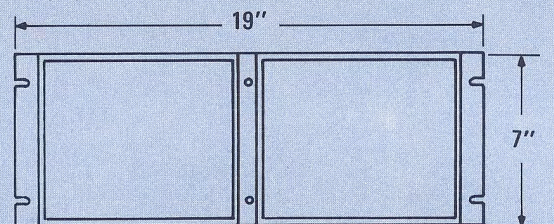


PA7805-1, PA7805-1R

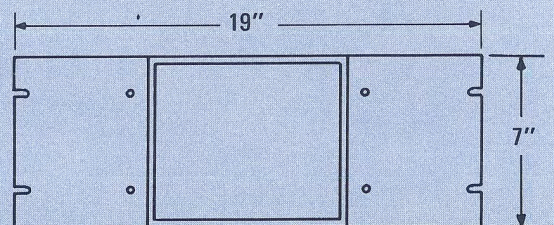
*BNC feedthrough for PA7805-1R only.



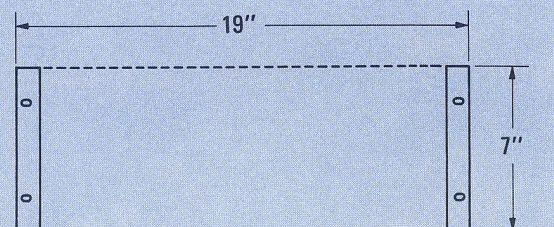
PA7805-2



PA-27 2 Modular Type Instruments



PA-28 1 Modular Type Instrument



PA-30 for Vector Voltmeter



PRD

CUSTOM INSTRUMENTATION

**—a special order
capability**

The PRD products described on the following pages are available on a special order basis only. Some are former standard catalog items, others are products that were conceived and developed for a project that has been completed. Engineering notes and manufacturing drawings are available that will enable us to reproduce and deliver the exact item outlined within a reasonable period of time. Variations of electrical specifications or mechanical features can be economically accomplished to meet your specific requirements.

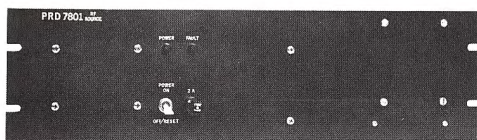


SPECIAL ORDER CAPABILITY FOR:

TYPE 7801 RF SOURCE

The PRD 7801 RF Source is an all solid state, 50-watt signal source capable of being pulsed on and off by means of a logic (TTL) input.

The PRD 7801 has applications as a Q-switch driver for pulsed laser systems and as an excitation source for low powered CW gas lasers. It is also a brute force Class C amplifier and it can provide a continuous RF output if desired. Other current applications are in acousto-optic research, filter, antenna, and pulse testing, and as a CW transmitter or RF amplifier for CW or FM transmitters. The PRD 7801 can be modified to provide center frequencies from 10 to 60 MHz and it has many other applications wherever a 50- to 100-watt RF signal is required.



7801

SPECIFICATIONS

OUTPUT FREQUENCY:

26 MHz ± 2.0 MHz with trimmer adjustment

OUTPUT POWER:

50 watts minimum

OUTPUT LOAD:

50 ohms

DUTY:

Continuous operation

MODULATING SIGNAL:

TTL logic input. Low logic level — RF on. Low to high level transition turns RF off for 10 microseconds

RF FALL TIME:

0.2 microsecond max.

RF RISE TIME:

0.7 microsecond max.

RF ON/OFF RATIO:

20 dB minimum

OUTPUT PROTECTION:

The unit is capable of operation into all types of passive loads without damage. A front-panel display indicates a fault condition.

THERMAL PROTECTION:

Thermostat on heat sink will protect unit if cooling air fails.

POWER REQUIRED:

115 $\pm 10\%$ Vac, 50/60 Hz

COOLING:

Heat sink fins exposed on rear of unit require 75 CFM of air flow at an ambient temperature of 50°C or less.

OPERATING AMBIENT:

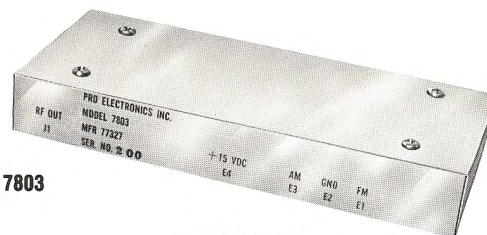
0 to 50°C

SPECIAL ORDER CAPABILITY FOR:

TYPE 7803 ACOUSTO-OPTICAL MODULATOR DRIVER

The PRD 7803 Driver is used for the control of coherent light beams. It provides the complex modulation of RF signals for control of He-Ne, Argon, He-Cd, NdYag, Krypton Yag and other LASERS. Application of the required signals to the AM and FM modulators in the PRD 7803 provides the driving signals for amplitude modulation and deflection of a LASER beam through an acousto-optic modulator. The PRD 7803, with an acousto-optic modulator, such as the Harris H200, provides an inexpensive, easily assembled LASER modulation system.

The PRD 7803 AOM driver is a solid state device that consists of an oscillator, FM modulator, AM modulator and power amplifier in one integrated module.



7803

SPECIFICATIONS

INPUT POWER:

+15 Vdc regulated $\pm 1\%$

INPUT CURRENT:

600 mA maximum

OUTPUT POWER:

1.5 W minimum

CENTER FREQUENCY:

70 MHz ± 1.0 MHz (other frequencies available)

FM DEVIATION:

± 10 MHz

FM SPECTRUM SYMMETRY:

Within 2 dB in amplitude

FM MODULATION RATE:

Up to 150 kHz

FM SENSITIVITY:

Less than 7 volts rms for ± 10 MHz deviation

AMPLITUDE RANGE:

1.5 W to 27 dB below 1.5 W minimum range

AMPLITUDE LINEARITY:

The power output of the amplifier will be linearly related to the modulating voltage ± 2 dB over the 27 dB range

AMPLITUDE SENSITIVITY:

0.75 W/volt nominal

SPURIOUS AND HARMONIC OUTPUTS:

More than -15 dB below fundamental

AMPLITUDE CONTROL INPUT RANGE:

± 5 volts max., 10 mA max

MOUNTING:

Four 6/32 blind captive nuts on 3" x 7" surface in a 2" x 5" pattern

CONNECTORS:

Solder pin for AM Modulation, FM Modulation, and power input. RF Output uses Amphenol type 27 female (UG-1619/U)

OPERATING TEMPERATURES:

+10 to +55°C

HUMIDITY:

0 - 100% without condensation

STORAGE TEMPERATURE:

-55 to +85°C



SPECIAL ORDER CAPABILITY FOR:

WIDEBAND LINEAR AMPLIFIER MODULES

The PRD 7807 Wideband Linear Amplifier Module Series covers a frequency range of 10 kHz to 500 MHz with a flat 30-dB minimum gain. Although gain flatness limits are specified at ± 1 dB from 10 kHz to 500 MHz, the 3-dB points are typically found at 5 kHz and 600 MHz with usable amplification available over even wider limits. Similarly, although temperature limits are specified as 0 to 50°C, the unit is usable over environmental extremes of -40 to +85°C with slightly reduced performance. The unit may be operated into a 75-ohm impedance load, but with reduced performance such as flatness (± 1.5 dB typical).

Output level of the amplifier is +20 dBm with low harmonic and intermodulation distortion. Noise figure is typically 6 dB. Phase ripple is extremely good, and gain ripple is typically ± 0.5 dB. AM, FM, pulse, SSB, and video signals can be amplified by the PRD 7807 series.

The two units of the series have the same specifications except for the connectors; PRD 7807-56-3 has SMA connectors, and PRD 7807-56-4 has BNC connectors.

SPECIFICATIONS

FREQUENCY RANGE:

10kHz to 500 MHz
5 kHz to 600 MHz, 3 dB bandwidth

OUTPUT LEVEL:

+20 dBm minimum at 1 dB gain compression

GAIN:

30 dB minimum

GAIN FLATNESS:

± 1 dB

NOISE FIGURE:

6 dB typical

HARMONIC DISTORTION:

-30 dB at rated output

IM DISTORTION:

35 dB typical at rated output

THIRD ORDER INTERCEPT:

+33 dBm typical

INPUT/OUTPUT IMPEDANCE AND VSWR:

50 ohms; VSWR 2:1 max to 500 MHz

GROUP DELAY:

Constant to within 0.1 nsec

POWER SUPPLY:

+28 Vdc at 190 mA

SIGNAL CONNECTORS:

SMA or BNC female available

MIL SPECS:

Designed to meet:

MIL-STD-202

MIL-I-6181

MIL-STD-130

OPERATING TEMPERATURE:

0° to 50°C

WEIGHT:

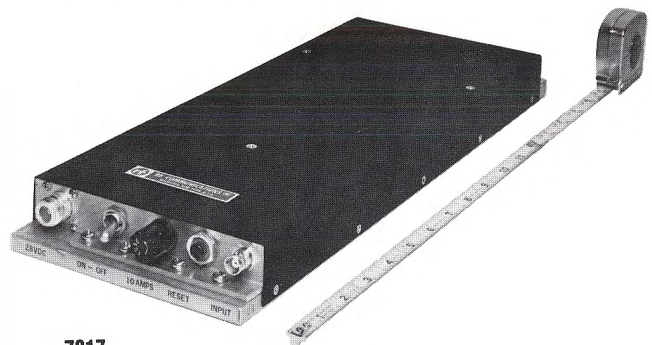
355 grams; 12.5 oz

SPECIAL ORDER CAPABILITY FOR:

WIDEBAND BOOSTER AMPLIFIERS TYPE 7817

This Amplifier Series is designed to boost low level RF signals from signal sources or intermediate low power amplifiers.

Applications for the PRD 7817 Series include amplification of test signals, RF transmitters, laser excitation, laser modulation, particle accelerator systems, NMR spectrometers, and wideband power pulse amplification.



7817

Typical frequency/power combinations available:

50 to 110 MHz / 100 W ± 1.0 dB
100 to 225 MHz / 50 W ± 1.0 dB
20 to 40 MHz / 200 W ± 1.0 dB
30 to 76 MHz / 150 W ± 1.0 dB



7807



SPECIAL ORDER CAPABILITY FOR:

ANTENNA TEST SET TYPE 10013

Designed to measure VSWR performance of a large quantity of quick disconnect antennas. System is basically a fully militarized reflectometer that can make field measurements, rapidly and simply.

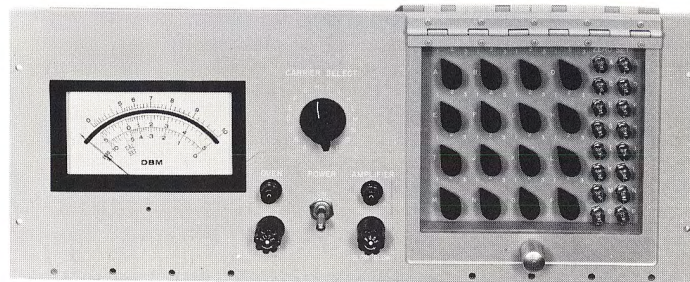
The Test Set is adaptable to any frequency range from VHF through microwave. Features include single scale read-out, wide dynamic range, and simplicity of operation.

Antenna Test Set shown consists of Indicator-Amplifier Unit and two octave frequency band Coupler Units. A standard 1-kHz modulated signal generator can supply the required power and frequency input.

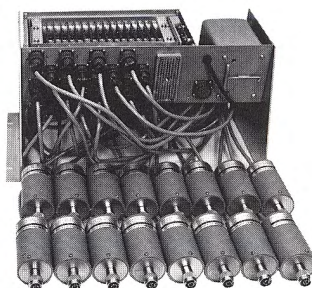


SPECIAL ORDER CAPABILITY FOR:

CUSTOMIZED POWER MEASURING EQUIPMENT



Custom designed power measuring system for COMSAT simultaneously monitors 16 individual RF ports. The control panel can be located 1000 feet from the calorimeter sensors. Amplifiers are temperature stabilized from 5 to 55°C.



Frequency Range: 5.9 to 6.5 GHz
Power Ranges: +10 dBm (full scale), +5 dBm, 0 dBm
VSWR: 1.2 (max.)
Full Scale: 4 volts
Power Readout: Available at remote station



This 2-channel digital power meter was developed for use in long haul microwave links. It features a 3½ digit auto-ranging readout and occupies only 3½" of rack space.

Power measurements at either of two points within the microwave system (the IF and RF outputs) are obtained by simply rotating a selector switch. An auxiliary edge-reading panel meter facilitates zeroing the instrument and "peaking" power levels.

A dual range voltmeter is incorporated in the unit for other system support requirements.

Frequency Range:
 IF; 40-300 MHz
 RF; 10 MHz-12.4 GHz

Power Range: -20 to +10 dBm

Input Impedance:
 IF; 50 or 75 ohms
 RF; 50 ohms

Voltage Range: 0 to 1,000 Vdc



SPECIAL ORDER CAPABILITY FOR:

POWER MEASUREMENTS

THREE-CHANNEL REMOTE POWER MEASURING SYSTEM



- LOCAL & REMOTE SELECTION OF THREE REMOTE CALORIMETERS
- LOCAL & REMOTE READOUTS
- AUTOMATIC ZEROING

A-BAND MICROWAVE POWER MONITOR TYPE 20068



THERMOELECTRIC CALORIMETER & DIGITAL POWER METER TYPE D6685-B

The PRD D6685-B Digital Thermoelectric Power Meter provides accurate readouts of the average power of cw, pulse, AM or FM signals. It operates with any of the PRD Series 685* Calorimeters as its sensing element. This combination is capable of RF power measurements from $0.01 \mu\text{W}$ to 100 mW^{**} at frequencies up to 18 GHz.



*Patent No. 3,147,436

**When used with D6685-B Power Meter; does not include +5 dBm (300%) overrange capability.

MICROWAVE POWER MONITOR WITH TYPE SMA CONNECTOR TYPE 6874-2



SPECIAL ORDER CAPABILITY FOR:

BROADBAND DIRECT READING FREQUENCY METERS

■ EIGHT-FOOT SCALE LENGTH

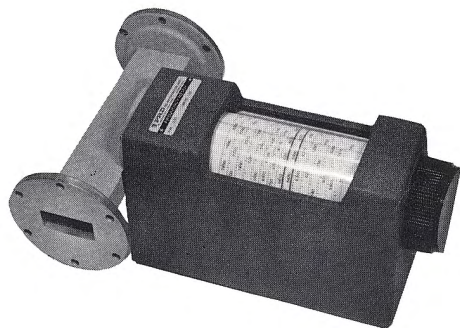
These direct-reading TE₁₁₁ mode frequency meters are used for measurements in waveguide systems from 3.95 to 40.0 GHz. Rugged, all metal construction and expanded dial features provide long, trouble-free use in laboratory or field. These meters employ a TE₁₁₁ mode cavity resonator tuned by a non-contacting plunger. The cavity is coupled to a waveguide section and fitted with flanges at both ends enabling the units to be inserted directly into any matching line. A drum-type dial with a scale length of more than 100 inches provides maximum readability, resolution, and accuracy. The plunger drive mechanism is specially designed and treated for long life and minimum backlash. Each of the meters in this series covers a full waveguide bandwidth.

Panel mounted versions of these frequency meters are also available on special order.

Type	Frequency (GHz)	Waveguide Size (Inches)	Equivalent Flange Type*
535	8.2 to 12.4	1 x 1/2	UG-39/U
536	12.4 to 18.0	0.702 x 0.391	UG-419/U
537-F1	18.0 to 26.5	0.500 x 0.250	UG-595/U
538-F1	26.5 to 40.0	0.360 x 0.220	UG-559/U

Type	Accuracy (%)	Description
535	±0.08	Absorption
536	±0.1	Absorption
537-F1	±0.1	Absorption
538-F1	±0.2	Absorption

*UG-149/U, UG-344/U, UG-51/U type flanges are also available on special order.

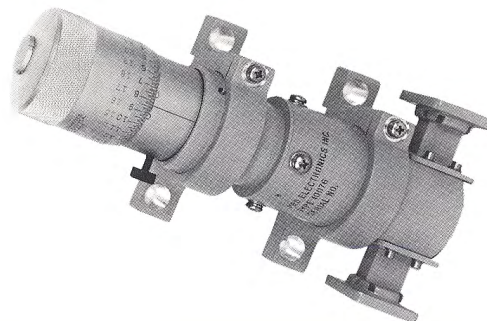


535

SPECIAL ORDER CAPABILITY FOR:

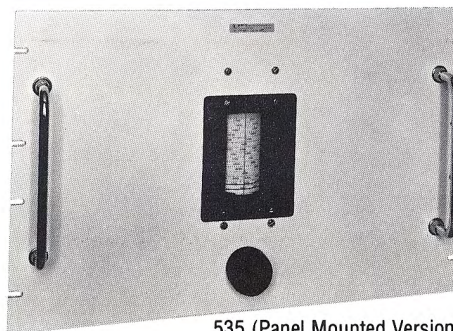
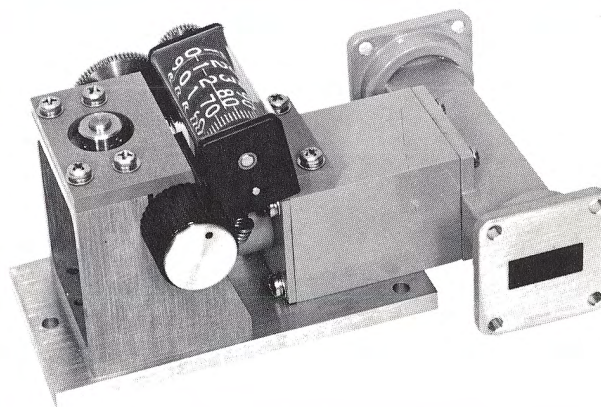
RUGGED PRECISION WAVE METERS

The PRD Type 10076 wave meters are ideal for OEM and systems applications.



SPECIAL ORDER CAPABILITY FOR:

TYPE 535DS1 DIGITAL WAVEGUIDE FREQUENCY METERS



535 (Panel Mounted Version)



SPECIAL ORDER CAPABILITY FOR:

VSWR MEASURING SET TYPE AN/USM-37

This VSWR measuring set is a complete laboratory-quality test set for making standing wave ratio measurements in waveguide and coaxial transmission systems over the frequency range of 3.0 to 12.4 GHz. It consists of:

1. An SWR/Attenuation Meter (similar to the PRD type 277-D) which is a high gain, tuned audio frequency voltmeter calibrated to read VSWR either directly or in dB. This instrument has a maximum sensitivity of $0.15\mu\text{V}$ full scale, permitting accuracies to ± 0.02 dB over a range of 70 dB.
2. An adjustable probe carriage (PRD type 230) with three interchangeable slotted lines (PRD Series 231) and an untuned probe (PRD type 253). The three slotted lines cover the frequency ranges of 3 to 12 GHz in coaxial systems, 7.05 to 12.4 GHz in waveguide.
3. Selected cables and adapters for making VSWR measurements on the most commonly encountered waveguide sizes.
4. A complete operation and maintenance manual.
5. A drip-proof fiberglass combination case which provides safe transit and storage of the measuring set.

SPECIFICATIONS

Frequency Range:

Coaxial; 3 to 12 GHz

Waveguide; 7.05 to 12.4 GHz

Range: 70 dB in 10 and 2 dB steps

VSWR Accuracy: 1.005

Meter Sensitivity: $0.15\mu\text{Vrms}$ f.s.

Noise Level: 7.5 dB below f.s. sensitivity ($0.15\mu\text{V}$)

Residual VSWR:

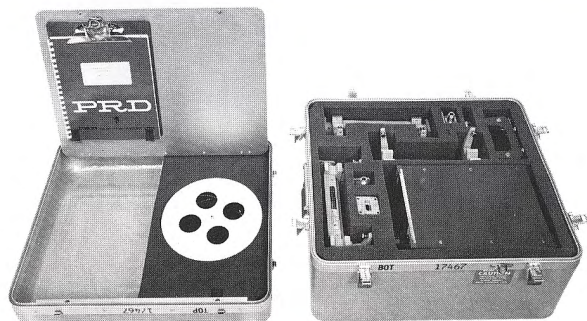
Coaxial; 1.04 to 1.1 max.

Waveguide; 1.01 max.

Power Requirements: 115 Vac or 230 Vac $\pm 10\%$, 50 to 1000 Hz, 2 watts (rechargeable battery pack available)

Combination Case Dimensions: 22"L x 19"W x 9 $\frac{1}{4}$ "H

Test Set Weight: 60 lbs. (approx.)



SPECIAL ORDER CAPABILITY FOR:

PANEL-MOUNTED, DIRECT READING ATTENUATORS

■ 60 dB RANGE

■ SHORT INSERTION LENGTH

■ MINIMAL PHASE SHIFT

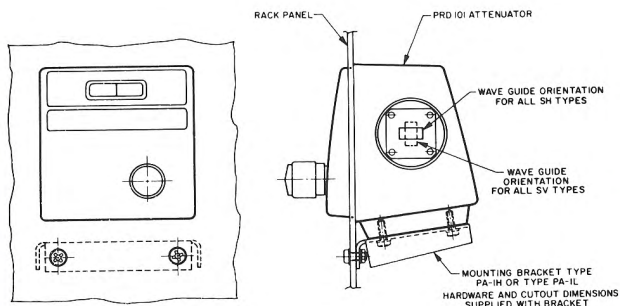
■ HIGH RESOLUTION TAPE READOUT

The PRD 101 Series Direct Reading Rotary Vane Attenuators are the only such devices that are readily adaptable to panel mounting. A simple bracket is all that's required to transform the standard bench unit to a panel-mounted, direct reading attenuator. This feature makes them ideally suited for OEM, production test, and permanent standards applications.

Rotating the unit's end transitions results in obtaining any desired flange orientation with reference to the front panel of a rack or test fixture. The most commonly requested orientation is for the waveguide wide dimension to be either parallel or perpendicular to the front panel. Part numbers have been pre-assigned to these types for ease of ordering.

TYPE ATTENUATOR *		MOUNTING BRACKET	PANEL CUTOUT (W x H)
AI01 - FI - SV	AI01 - FI - SH	PA - IH	3 $\frac{15}{16}$ x 4 $\frac{3}{32}$
CI01 - SV	CI01 - SH	PA - IL	7 $\frac{5}{32}$ x 5 $\frac{3}{8}$
HI01 - SV	HI01 - SH	PA - IL	7 $\frac{5}{32}$ x 5 $\frac{3}{8}$
KI01 - FI - SV	KI01 - FI - SH	PA - IH	3 $\frac{15}{16}$ x 4 $\frac{3}{32}$
UI01 - SV	UI01 - SH	PA - IH	3 $\frac{15}{16}$ x 4 $\frac{3}{32}$
XI01 - SV	XI01 - SH	PA - IL	5 $\frac{15}{32}$ x 4 $\frac{7}{8}$

* SUFFIX SV DESIGNATES W.G. LARGE DIMENSION PARALLEL TO PANEL.
SUFFIX SH DESIGNATES W.G. LARGE DIMENSION PERPENDICULAR TO PANEL.



Variations of electrical specifications or mechanical features can be readily and economically accomplished to meet your specific requirements.



SPECIAL ORDER CAPABILITY FOR:

PRECISION WAVEGUIDE VARIABLE ATTENUATORS TYPES 196 C, D

- SINGLE KNOB ADJUSTMENT
- FULL BANDWIDTH COVERAGE
- DIAL OR GAUGE READOUTS

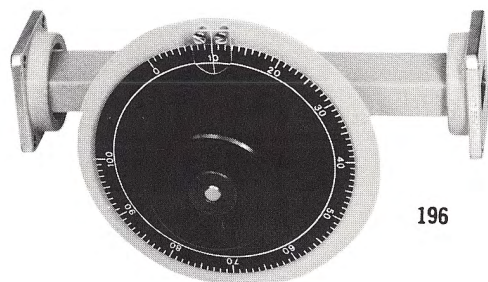
These precision variable waveguide attenuators are designed for applications requiring accurate, stable and reliable control or read-out of attenuation levels.

The attenuating element is a stable metalized glass vane whose degree of insertion in the waveguide can be varied. Excellent stability with time and atmospheric variations are inherent in these metalized plates. The drive design and its materials have been chosen for minimum wear and maximum resistance to corrosion.

196-C & D DIAL ATTENUATORS

These feature the ease of adjustment of a single turn knob-dial combination. The dial, which is coupled directly to the drive screw, is calibrated from zero to one hundred for convenient resetting. On special order, they can be calibrated at any frequency in the band to provide a highly accurate direct reading attenuation standard.

Leakage is extremely low, permitting operation with the most sensitive instruments. Attenuators for special applications such as panel mounting, or special flanges are available on special order. Units with metalized high impact ceramic plates to provide greater shock resistance are also available.



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SPECIAL ORDER CAPABILITY FOR:

FIXED WAVEGUIDE ATTENUATOR TYPE 140

- FIXED ATTENUATION
- FLAT RESPONSE
- ACCURATE CALIBRATION

Type	Attenuation at Maximum Total		
	Calibration Frequency (dB)	Frequency Sensitivity (dB)	Maximum VSWR
140-A	3	1.0	1.10
140-B	6	1.0	1.10
140-C	10	1.5	1.10
140-D	20	1.5	1.15
140-E	30	2.0	1.15
140-F	40	4.0	1.15

Note: Any attenuation between 0-40db is available on special order. Other frequency bands also available.

SPECIFICATIONS

Type: 140

Waveguide Size: 1" × 1½"

Frequency: 8.2 GHz to 12.4 GHz

Calibration Frequency: 9.6 GHz

Calibration Accuracy: ±0.2 dB

Equivalent Waveguide Type: RG-52/U

Maximum Average Power: 1 watt

Length: 6½"

Flange Type: UG-39/U

Type	Frequency (GHz)	Waveguide Size (inches)	Equivalent Waveguide Type	Equivalent Flange Type	Attenuation Freq. (dB)	Calibration Freq. (GHz)	Calibration Accuracy (dB)		Readout	Length (inches)
							With Curve	Engraved Dial		
196-C	8.2-12.4	1 × ½	RG-52/U	UG-39/U	45	—	0.3	0.5	Dial Dial	6½ 6½
196-D	8.5-9.6*	1 × ½	RG-52/U	UG-39/U	70	—	±0.6 to 50 dB ±1.0 above 50 dB	±1.0 to 50 dB ±1.5 above 50 dB		

*Frequency range may be extended with possible sacrifice in maximum attenuation.

Maximum average power dissipation: 1 Watt; Maximum insertion loss: 0.5 dB except 196-D, 1.0 dB; Maximum VSWR: 1.15

NOTE: Calibration at other than standard frequency on request. Dial readout attenuators calibration is engraved directly on the dial and a curve and chart are also supplied.

Other frequency bands available on special order.



SPECIAL ORDER CAPABILITY FOR:

VARIABLE CUTOFF ATTENUATORS TYPE 180, 198 SERIES

Type	Frequency Range (GHz)	Waveguide Size (inches)	Equivalent Waveguide Type	Flange Type
180-A	8.2 to 10	1 x 1/2	RG-52/U	UG-39/U
198	1 to 4	—	—	—

Type	Overall Closed Length (inches)	Travel (inches)	Coaxial Line Size (inches)	Coaxial Connector	Attenuation Range (dB)
180-A	6 11/32	1 1/8	3/8	Type N Jack	100
198	5 1/32	1 1/16	3/8	Two Type N Jacks	100

Type	Insertion Loss* (dB)	Linear Slope	Cutoff Tube Diameter (inches)	f _c (GHz)
180-A	3 at 9 (GHz)	1 db per division	0.338	20.45
198	16 at 3 (GHz)	0.36 db per degree	0.500	13.83

*Factory adjustment.

SPECIAL ORDER CAPABILITY FOR:

SHIELDED UNCALIBRATED VARIABLE ATTENUATORS TYPE 154-A

Type	Equivalent Waveguide Type	Waveguide Size (inches)	Frequency (GHz)	Maximum Attenuation (dB)
154-A	RG-52/U	1 x 1/2	8.2 to 12.4	20

Type	Insertion Loss (dB)	Maximum VSWR	Equivalent Flange Type	Length (inches)
154-A	0.5	1.25	UG-39/U	2 1/4

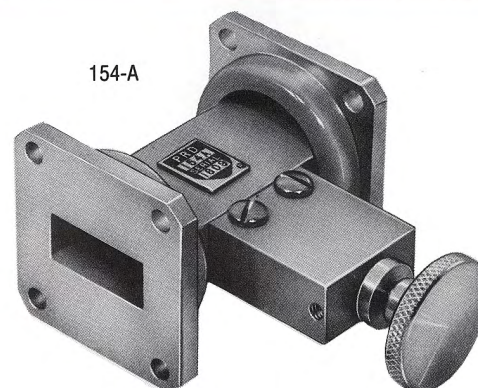
SPECIAL ORDER CAPABILITY FOR:

LEVEL SET ATTENUATORS TYPE 158-B, 159-A,-B

Type	Frequency* (GHz)	Equivalent Waveguide Type	Waveguide Size (inches)	Equivalent Flange Type
159-A	8.2 to 12.4	RG-52/U	1 x 1/2	UG-39/U
159-B	8.2 to 12.4	RG-52/U	1 x 1/2	UG-39/U
158-B	12.4 to 18	RG-91/U	.702 x .391	UG-419/U

Type	Maximum Attenuation (dB)	Maximum VSWR	Average Power Dissipation (watts)	Length (inches)
159-A	20	1.15	1	3 21/32
159-B	40	1.15	1	5
158-B	40	1.15	1	3 27/32

*Other frequency bands are available on special order.



SPECIAL ORDER CAPABILITY FOR:

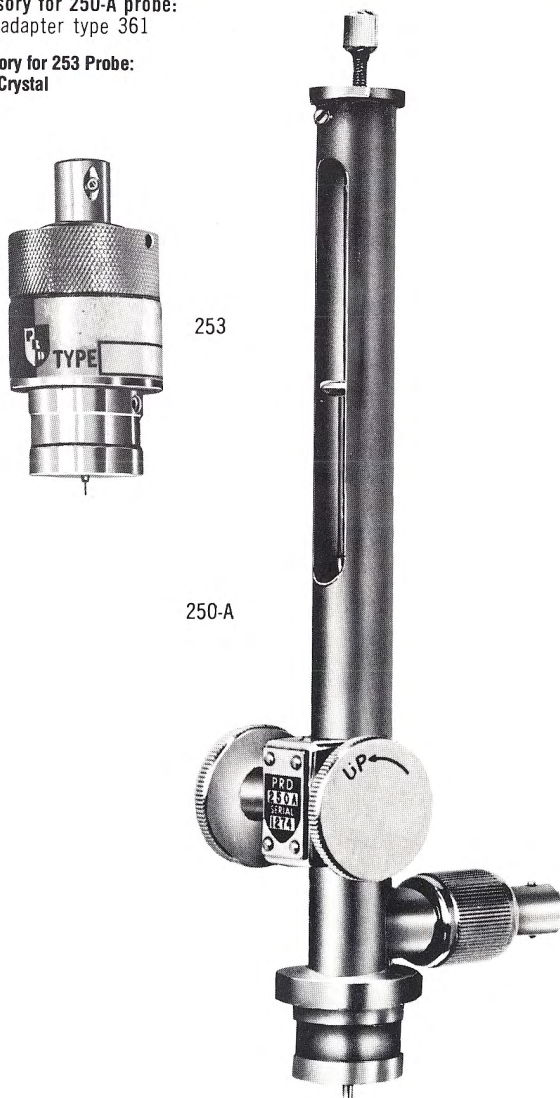
BROADBAND PROBES

(SPECIFICATIONS)

Type	Frequency Range (GHz)	Detector Required	Used with Slotted Sections
250-A	1.00 to 12.4	1N21, 1N23 Crystals or Type 610-A Bolometer	Types 215-A, N231 and X231
253	12.4 to 40.0	Type 608 Crystal or Type 609 Bolometer	Types U231 through A231

Accessory for 250-A probe:
RF adapter type 361

Accessory for 253 Probe:
608 Crystal



SPECIAL ORDER CAPABILITY FOR:

PRECISION CUTOFF ATTENUATORS TYPE 1904, 1903-B

TYPE 1904 — SPECIFICATIONS

Frequency: 30 MHz

Readout: Digital to 0.001 dB (interpolation to 0.0005 dB).

Attenuation Range: 0 to 100 dB (with 25 dB insertion loss).

Direct reading accuracy: .005 dB/10 dB (at insertion loss setting of 30 dB or greater at total losses of less than 100 dB).

Backlash: Less than 0.001 dB with proper mechanical adjustment.

Insertion loss: 10 to 35 dB (per customer request).

Stationary tuned connector: Type N Female or GR900

Movable loop connector: GR874 or GR900

Power requirements: 115 Vac, 60 Hz, approximately 250 mA.

TYPE 1903-B — SPECIFICATIONS

Operating Frequency: 30 MHz

Power: 0.5 Watt

Accuracy: $\pm .03$ dB per 10 dB to 70 dB
Maximum cumulative error
 ± 0.25 dB to 100 dB
 ± 0.35 dB to 110 dB

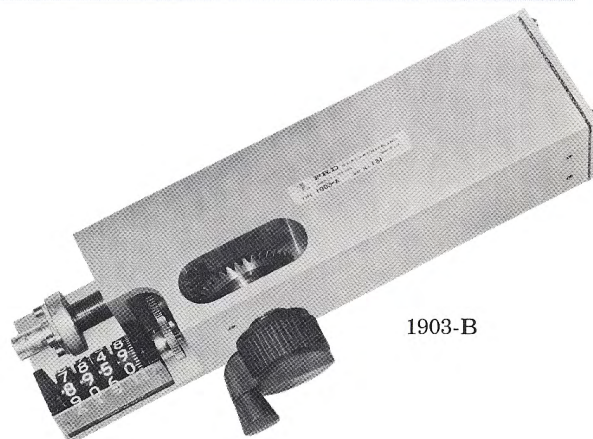
Readout: Digital, least count 0.02 dB (Interpolation to .01 dB)

Range: Greater than 100 dB above insertion loss

Insertion Loss: Approximately 16 dB

Cut-off Frequency: 13.38 GHz

Connectors: TNC



SPECIAL ORDER CAPABILITY FOR:

COAXIAL CRYSTAL & BOLOMETER MOUNTS TYPES 613, 613M

The 613 is an untuned detector mount for $\frac{3}{8}$ -inch coaxial lines. The 613-M is identical except that it includes a built-in dc return path.

RF bypassing and leakage protection is provided by a coaxial capacitor for all coaxial mounts.

Type	Freq. (GHz)	Equivalent Transmission Line	Input Connector	Recommended Detector
613	1-12	$\frac{3}{8}$ " Coax.	UG-21()/U	PRD 610-A 1N23, 1N21
613-M*	*1-12	$\frac{3}{8}$ " Coax.	UG-21()/U	PRD 610-A 1N23, 1N21

*Has built-in dc return

SPECIAL ORDER CAPABILITY FOR:

WAVEGUIDE TO COAXIAL ADAPTERS TYPE 354-357

These adapters couple waveguide transmission lines to $\frac{3}{8}$ -in. (Type N) coaxial lines from 4.0 to 12.4 GHz in four standard waveguide sizes. Each adapter consists of a short length of coaxial line perpendicular to the broad face of a shorted waveguide section. The center conductor of the coaxial line extends as a probe into the waveguide. The waveguide section input is fitted with a standard flange and the coaxial connector (UG-23()/U) mates with standard UG-21()/U connectors. Careful design of waveguide and coaxial section coupling provides very low VSWR over the entire frequency range. High conductivity plating and minimum use of dielectric material result in negligible insertion loss.

Type	Equivalent Waveguide Type	Waveguide Size (inches)	Frequency Range (GHz)	Maximum VSWR	Flange Type	Waveguide Length
357	RG-49/U	2 x 1	3.95 to 5.85	1.25	UG-149/U	$3\frac{3}{32}$ "
356-A	RG-50/U	$1\frac{1}{2}$ x $\frac{3}{4}$	5.4 to 8.2	1.25	UG-344/U	$2\frac{1}{2}$ "
355-A	RG-51/U	$1\frac{1}{4}$ x $\frac{5}{8}$	7.05 to 10.0	1.30	UG-51/U	$2\frac{3}{32}$ "
354-C	RG-52/U	1 x $\frac{1}{2}$	8.2 to 12.4	1.25	UG-135/U	$1\frac{11}{32}$ "

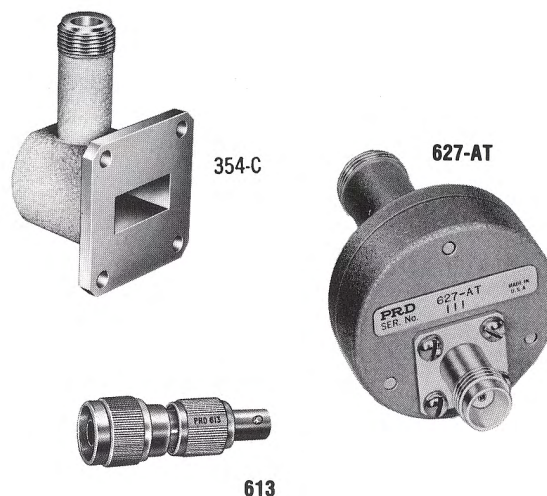
SPECIAL ORDER CAPABILITY FOR:

COAXIAL BOLOMETER THERMISTOR MOUNTS TYPE 627, 628 SERIES

These fixed tuned mounts consist of a length of $\frac{3}{8}$ -inch coaxial line and a bolometer or thermistor housing. The bolometer and thermistor are flat disc structures that are clamped between the round flanges at the end of the mount. Fixed matching structures are provided in the form of inductive undercuts in the coaxial line of the mount and by the proper shaping of the electrode of the bolometer disc.

Type	Input Connector	Output Connector	Recommended Detector
627-A	N-Female	BNC Female	PRD 631-C, H, HC
627-AM	N-Male	BNC Female	PRD 631-C, H, HC
627-AT	N-Female	TNC Female	PRD 631-C, H, HC
627AMT	N-Male	TNC Female	PRD 631-C, H, HC
628-A	N-Female	BNC Female	PRD 631-D, G
628-B*	N-Female	Solder Lugs	PRD 631-F

*PRD 631-F bolometer supplied



SPECIAL ORDER CAPABILITY FOR:

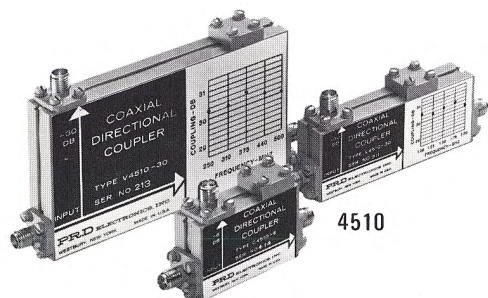
DIRECTIONAL COUPLERS

SERIES 4410 GENERAL SPECIFICATIONS

Coupling: Nominal ± 1.0 dB*
(including frequency sensitivity)
Max. Insertion Loss: 0.2 dB (excluding coupled power)
Impedance: 50 ohms
Absolute Calibration Accuracy: ± 0.1 dB/10 dB of coupling
Relative Calibration Accuracy: ± 0.05 dB
Temperature Range: -55 to $+120^{\circ}\text{C}$
Connectors: Type N female (stainless steel)
Designed to meet MIL-C-39012
Peak Power: 10 kW
*model CX4410 Series ± 1.2 dB

SERIES 4420 GENERAL SPECIFICATIONS

Coupling: Nominal ± 0.5 dB
Maximum Ripple: ± 0.2 dB
Max. Insertion Loss: 0.2 dB (excluding coupled power)
Impedance: 50 ohms
Temperature Range: -50 to $+120^{\circ}\text{C}$
Connectors: Type N female (stainless steel)
Designed to meet MIL-C-39012
Absolute Calibration Accuracy: ± 0.1 dB/10 dB coupling
Relative Calibration Accuracy: ± 0.05 dB



SERIES 4510 GENERAL SPECIFICATIONS

Coupling Deviation:
6 dB couplers; ± 0.75 dB
10, 20 & 30 dB couplers; ± 1 dB
Impedance: 50 ohms
Absolute Calibration Accuracy:
 ± 0.1 dB/10 dB
Power Rating:
6 dB couplers; 50 watts
10, 20 & 30 dB couplers; 100 watts
Connectors: 3 mm stainless steel

SERIES 4410: OCTAVE BAND COAXIAL DIRECTIONAL COUPLERS SERIES 4420: MAXIMALLY FLAT COAXIAL DIRECTIONAL COUPLERS

PRD TYPE	FREQ. RANGE (MHz)	MINIMUM DIRECTIVITY	MAX. VSWR		POWER FORWARD (WATTS)	RATING* REVERSE (WATTS)	CALIBRATION FREQUENCIES (MHz)
			PRIMARY	SECONDARY			
P4410-10 P4410-20 P4410-30	460 to 950	30 dB 30 dB 30 dB	1.15 1.15 1.15	1.15 1.15 1.15	200 500 500	50 500 500	460 580 700 825 950
L4410-10 L4410-20 L4410-30	950 to 2,000	30 dB 30 dB 30 dB	1.15 1.15 1.15	1.15 1.15 1.15	200 500 500	50 500 500	950 1,210 1,470 1,730 2,000
S4410-10 S4410-20 S4410-30	2,000 to 4,000	25 dB 27 dB 27 dB	1.15 1.15 1.15	1.20 1.20 1.20	200 500 500	50 500 500	2,000 2,500 3,000 3,500 4,000
CX4410-10 CX4410-20 CX4410-30	4,000 to 10,000	20 dB from 4-8 GHz 17 dB from 8-10 GHz	1.20 1.20 1.20	1.30 1.30 1.30	200 500 500	50 500 500	4,000 5,500 7,000 8,500 10,000
V4420-20	240 to 500	20 dB	1.10	1.2	500	500	240 305 370 435 500
P4420-10 P4420-20 P4420-30	500 to 1,000	20 dB 20 dB 20 dB	1.10 1.10 1.10	1.2 1.2 1.2	200 500 500	50 500 500	500 625 750 875 1,000
L4420-10 L4420-20 L4420-30	950 to 2,000	20 dB 20 dB 20 dB	1.10 1.10 1.10	1.2 1.2 1.2	200 500 500	50 500 500	950 1,210 1,470 1,730 2,000
S4420-10 S4420-20 S4420-30	2,000 to 4,000	20 dB 20 dB 20 dB	1.15 1.15 1.15	1.2 1.2 1.2	200 500 500	50 500 500	2,000 2,500 3,000 3,500 4,000
C4420-10 C4420-20 C4420-30	4,000 to 8,000	17 dB 17 dB 17 dB	1.2 1.2 1.2	1.25 1.25 1.25	200 500 500	50 500 500	4,000 5,000 6,000 7,000 8,000
X4420-A-10 X4420-A-20	7,000 to 12,400	15 dB 15 dB	1.25 1.25	1.3 1.3	100 100	50 100	7,000 8,000 9,000 10,000 11,000 12,400

SERIES 4510: MINIATURE COAXIAL DIRECTIONAL COUPLERS

PRD TYPE	FREQUENCY RANGE (GHz)	MEAN COUPLING (dB)	MINIMUM DIRECTIVITY (dB)	MAXIMUM VSWR	CALIBRATION FREQUENCIES (GHz)	
V4510-6 V4510-10 V4510-20 V4510-30	0.25 to 0.5	6 10 20 30	25	1.1	0.25 0.312 0.350 0.437 5.0	
P4510-6 P4510-10 P4510-20 P4510-30	0.5 to 1.0	6 10 20 30	25	1.1	0.5 0.625 0.750 0.875 1.0	
L4510-6 L4510-10 L4510-20 L4510-30	1.0 to 2.0	6 10 20 30	20	1.15	1.0 1.25 1.5 1.75 2.0	
S4510-6 S4510-10 S4510-20 S4510-30	2.0 to 4.0	6 10 20 30	20	1.20	2.0b 2.5 3.0 3.5 4.0	
C4510-6 C4510-10 C4510-20 C4510-30	4.0 to 8.0	6 10 20 30	20	1.20	4.0 5.0 6.0 7.0 8.0	
X4510-6 X4510-10 X4510-20 X4510-30	8.0 to 12.4	6 10 20 30	17	1.30	8.0 9.1 10.2 11.3 12.4	
U4510-6 U4510-10 U4510-20 U4510-30	12.4 to 18.0	6 10 20 30	14	1.50	12.4 13.8 15.2 16.6 18.0	



RIGID RECTANGULAR WAVEGUIDE STANDARDS

EIA Designation WR ()	Material Alloy	JAN Designation RG ()/U	Jan Flange Designation Choke UG()/U Cover UG()/U	Theoretical cw power rating lowest to highest frequency megawatts	Theoretical attenuation lowest to highest frequency (db/100 ft.)	Recommended Operating Range for TE ₁₀ Mode		Cut-off for TE ₁₀ Mode		Range in $\frac{2\lambda}{\lambda_c}$	Range in $\frac{\lambda_g}{\lambda}$	DIMENSIONS (inches)				Wall Thickness Nominal
						Frequency (Gc)	Wavelength (cm)	Frequency (Gc)	Wavelength (cm)			Inside	Tol.	Outside	Tol.	
2300	Alum.			153.0-212.0	.051-.031	0.32-0.49	93.68-61.18	0.256	116.84	1.60-1.05	1.68-1.17	23.000-11.500	± .020	23.250-11.750	± .020	0.125
2100	Alum.			120.0-173.0	.054-.034	0.35-0.53	85.65-56.56	0.281	106.68	1.62-1.06	1.68-1.18	21.000-10.500	± .020	21.250-10.750	± .020	0.125
1800	Alum.	201		93.4-131.9	.056-.038	0.41-0.625	73.11-47.96	0.328	91.44	1.60-1.05	1.67-1.18	18.000-9.000	± .020	18.250-9.250	± .020	0.125
1500	Alum.	202		67.6-93.3	.069-.050	0.49-0.75	61.18-39.97	0.393	76.20	1.61-1.05	1.62-1.17	15.000-7.500	± .015	15.250-7.750	± .015	0.125
1150	Alum.	203		35.0-53.8	.128-.075	0.64-0.96	46.84-31.23	0.513	58.42	1.60-1.07	1.82-1.18	11.500-5.750	± .015	11.750-6.000	± .015	0.125
975	Alum.	204		27.0-38.5	.137-.095	0.75-1.12	39.95-26.76	0.605	49.53	1.61-1.08	1.70-1.19	9.750-4.875	± .010	10.000-5.125	± .010	0.125
770	Alum.	205		17.2-24.1	.201-.136	0.96-1.45	31.23-20.67	0.766	39.12	1.60-1.06	1.66-1.18	7.700-3.850	± .005	7.950-4.100	± .005	0.125
650	Brass Alum.	69 103	417A 418A	11.9-17.2	.317-.212 .269-.178	1.12-1.70	26.76-17.63	0.908	33.02	1.62-1.07	1.70-1.18	6.500-3.250	± .005	6.660-3.410	± .005	0.080
510				7.5-10.7		1.45-2.20	20.67-13.62	1.157	25.91	1.60-1.05	1.67-1.18	5.100-2.550	± .005	5.260-2.710	± .005	0.080
430	Brass Alum.	104 105	435A 437A	5.2-7.5	.588-.385 .501-.330	1.70-2.60	17.63-11.53	1.372	21.84	1.61-1.06	1.70-1.18	4.300-2.150	± .005	4.460-2.310	± .005	0.080
340	Brass Alum.	112 113	553 554	3.1-4.5	.877-.572 .751-.492	2.20-3.30	13.63-9.08	1.736	17.27	1.58-1.05	1.78-1.22	3.400-1.700	± .005	3.560-1.860	± .005	0.080
284	Brass Alum.	48 75	54A 585	2.2-3.2	1.102-.752 .940-.641	2.60-3.95	11.53-7.59	2.078	14.43	1.60-1.05	1.67-1.17	2.840-1.340	± .005	3.000-1.500	± .005	0.080
229				1.6-2.2		3.30-4.90	9.08-6.12	2.577	11.63	1.56-1.05	1.62-1.17	2.290-1.145	± .005	2.418-1.273	± .005	0.064
187	Brass Alum.	49 95	148B 406A	1.4-2.0	2.08-1.44 1.77-1.12	3.95-5.85	7.59-5.12	3.152	9.510	1.60-1.08	1.67-1.19	1.872-0.872	± .005	2.000-1.000	± .005	0.064
159				0.79-1.0		4.90-7.05	6.12-4.25	3.711	8.078	1.51-1.05	1.52-1.19	1.590-0.795	± .004	1.718-0.923	± .004	0.064
137	Brass Alum.	50 106	343A 440A	0.56-0.71	2.87-2.30 2.45-1.94	5.85-8.20	5.12-3.66	4.301	6.970	1.47-1.05	1.48-1.17	1.372-0.622	± .004	1.500-0.750	± .004	0.064
112	Brass Alum.	51 68	52A 137A	0.35-0.46	4.12-3.21 3.50-2.74	7.05-10.00	4.25-2.99	5.259	5.700	1.49-1.05	1.51-1.17	1.122-0.497	± .004	1.250-0.625	± .004	0.064
90	Brass Alum.	52 67	40A 136A	0.20-0.29	6.45-4.48 5.49-3.83	8.20-12.40	3.66-2.42	6.557	4.572	1.60-1.06	1.68-1.18	0.900-0.400	± .003	1.000-0.500	± .003	0.050
75				0.17-0.23		10.00-15.00	2.99-2.00	7.868	3.810	1.57-1.05	1.64-1.17	0.750-0.375	± .003	0.850-0.475	± .003	0.050
62	Brass Alum. Silver	91 107	541 —	0.12-0.16	9.51-8.31 — 6.14-5.36	12.4-18.00	2.42-1.66	9.486	3.160	1.53-1.05	1.55-1.18	0.622-0.311	± .0025	0.702-0.391	± .003	0.040
51				0.080-0.107		15.00-22.00	2.00-1.36	11.574	2.590	1.54-1.05	1.58-1.18	0.510-0.255	± .0025	0.590-0.335	± .003	0.040
42	Brass Alum. Silver	53 121 66	596 598 —	0.043-0.058	20.7-14.8 17.6-12.6 13.3-9.5	18.00-26.50	1.66-1.13	14.047	2.134	1.56-1.06	1.60-1.18	0.420-0.170	± .0020	0.500-0.250	± .003	0.040
34				0.034-0.048		22.00-33.00	1.36-0.91	17.328	1.730	1.57-1.05	1.62-1.18	0.340-0.170	± .0020	0.420-0.250	± .003	0.040
28	Brass Alum. Silver	— 96	600 —	0.022-0.031	— 21.9-15.0	26.50-40.00	1.13-0.75	21.081	1.422	1.59-1.05	1.65-1.17	0.280-0.140	± .0015	0.360-0.220	± .002	0.040
22	Brass Silver	— 97	383 —	0.014-0.020	— 31.0-20.9	33.00-50.00	0.91-0.60	26.342	1.138	1.60-1.05	1.67-1.17	0.224-0.112	± .0010	0.304-0.192	± .002	0.040
19				0.011-0.015		40.00-60.00	0.75-0.50	31.357	0.956	1.57-1.05	1.63-1.16	0.188-0.094	± .0010	0.268-0.174	± .002	0.040
15	Brass Silver	— 98	385 —	0.0063-0.0090	— 52.9-39.1	50.00-75.00	0.60-0.40	39.863	0.752	1.60-1.06	1.67-1.17	0.148-0.074	± .0010	0.228-0.154	± .002	0.040
12	Brass Silver	— 99	387 —	0.0042-0.0060	— 93.3-52.2	60.00-90.00	0.50-0.33	48.350	0.620	1.61-1.06	1.68-1.18	0.122-0.061	± .0005	0.202-0.141	± .002	0.040
10				0.0030-0.0041		75.00-110.00	0.40-0.27	59.010	0.508	1.57-1.06	1.61-1.18	0.100-0.050	± .0005	0.180-0.130	± .002	0.040
8	Silver	138	—	0.0018-0.0026	152-99	90.00-140.00	0.333-0.214	73.840	.406	1.64-1.05	1.75-1.17	0.080-0.040	± 0.0003	0.156 DIA	± .001	—
7	Silver	136	—	0.0012-0.0017	163-137	110.00-170.00	0.272-0.176	90.840	.330	1.64-1.06	1.77-1.18	0.065-0.0325	± 0.00025	0.156 DIA	± .001	—
5	Silver	135	—	0.00071-0.00107	308-193	140.00-220.00	0.214-0.136	115.750	.259	1.65-1.05	1.78-1.17	0.051-0.0255	± 0.00025	0.156 DIA	± .001	—
4	Silver	137	—	0.00052-0.00075	384-254	170.00-260.00	0.176-0.115	137.520	.218	1.61-1.05	1.69-1.17	0.043-0.0215	± 0.00020	0.156 DIA	± .001	—
3	Silver	139	—	0.00035-0.00047	512-348	220.00-325.00	0.136-0.092	173.280	.173	1.57-1.06	1.62-1.18	0.034-0.0170	± 0.00020	0.156 DIA	± .001	—



RETURN LOSS VS. STANDING WAVE RATIO AND REFLECTION COEFFICIENT

REFLECTION COEFFICIENT	RETURN LOSS (dB)	SWR
1.000	0.0	∞
0.9441	0.5	34.78
0.8913	1.0	17.40
0.8414	1.5	11.61
0.7943	2.0	8.723
0.7499	2.5	6.997
0.7079	3.0	5.847
0.6683	3.5	5.030
0.6310	4.0	4.420
0.5957	4.5	3.947
0.5623	5.0	3.569
0.5309	5.5	3.263
0.5012	6.0	3.010
0.4732	6.5	2.796
0.4467	7.0	2.615
0.4217	7.5	2.458
0.3981	8.0	2.323
0.3758	8.5	2.204
0.3548	9.0	2.100
0.3350	9.5	2.008
0.3162	10.0	1.925
0.2985	10.5	1.851
0.2818	11.0	1.785
0.2661	11.5	1.725
0.2512	12.0	1.671
0.2371	12.5	1.622
0.2239	13.0	1.577
0.2113	13.5	1.536
0.1995	14.0	1.498
0.1884	14.5	1.464

REFLECTION COEFFICIENT	RETURN LOSS (dB)	SWR
0.1778	15.0	1.432
0.1679	15.5	1.404
0.1585	16.0	1.377
0.1496	16.5	1.352
0.1413	17.0	1.329
0.1334	17.5	1.308
0.1259	18.0	1.288
0.1189	18.5	1.270
0.1122	19.0	1.253
0.1059	19.5	1.237
0.1000	20.0	1.222
0.0891	21.0	1.196
0.0794	22.0	1.172
0.0708	23.0	1.152
0.0631	24.0	1.135
0.0562	25.0	1.119
0.0501	26.0	1.105
0.0447	27.0	1.094
0.0398	28.0	1.083
0.0355	29.0	1.074
0.0316	30.0	1.065
0.0282	31.0	1.058
0.0251	32.0	1.051
0.0224	33.0	1.046
0.0200	34.0	1.041
0.0178	35.0	1.036
0.0159	36.0	1.032
0.0141	37.0	1.029
0.0126	38.0	1.026
0.0112	39.0	1.023
0.0100	40.0	1.020

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