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**Barth Electronics, Inc.**



# Pulse Power Catalog

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Boulder City, NV 89005  
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**High Voltage  
Fast Pulse  
Coaxial Components**



**Barth Electronics, Inc.**

**Pulse Power Catalog** © Revised 7/1/26



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# About Us

 Barth Electronics, Inc.

## Our Beginnings

Barth Electronics, Inc., has been designing and manufacturing state-of-the-art sub-nanosecond high energy, pulse power coaxial components since 1964.

## Our Promise

Our attenuator design capability continues to evolve and has resulted in improved pulse response, voltage rating and in greatly increased average power rating. Our components remain the highest performance and most reliable voltage coaxial devices available anywhere.

We are continuously investigating new technologies that can be applied to EM measurements and are designing new products as needs arise. If we have not already designed what you need, we have other sources that may be helpful with your high voltage measurements.

Contact us to discuss your pulse measurement needs.

[www.barthelectronics.com](http://www.barthelectronics.com)

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**Worldwide Customers Relying  
on Barth High Voltage Wide  
Bandwidth Pulse Power  
Instrumentation since 1964:**

BAE – British Aerospace Systems

BNL – Brookhaven National Laboratory

CEA – The French Alternative Energies and  
Atomic Energy Commission

Diamond Light Source

Diehl Defence

DRI – Desert Research Institute

Fermi – Fermi National Accelerator  
Laboratory

FID Technology Germany

Fraunhofer Institute Germany

General Atomics

Her Majesty’s Government United Kingdom

Ioffe Physiotechinical Institute Russia

LANL – Los Alamos National Laboratory

 Barth Electronics, Inc.

LLNL – Lawrence Livermore National  
Laboratory

NAWCWD – Naval Air Warfare Center  
Weapons Division

Nevada Test Site

NSTEC – National Security Technologies,  
LLC

SARA – Scientific Applications & Research  
Associates, Inc.

SNL – Sandia National Laboratories

SLAC – Stanford Linear Accelerator Center

University of Rochester Laboratory for Laser  
Energetics

UNR – University of Nevada Reno

USAFRL – U.S. Air Force Research  
Laboratory

USARL – U.S. Army Research Laboratory

# Company Capabilities

 Barth Electronics, Inc.

Barth Electronics, Inc., has been designing and manufacturing state-of-the-art sub-nanosecond high energy, pulse power coaxial components since 1964. Our first high voltage pulse instrumentation hardware was designed for underground nuclear testing and taught us much about reliable wideband HV attenuators. These special products have become standards that are used every day for reliable pulse measurements in physics and pulse power laboratories around the world. Our instrumentation advances developed as high voltage pulse technology evolved (and has been consistently faster than pulses that could be generated). We stay at the leading edge of this technology by constantly creating innovations in component design that you require now or will need tomorrow.

The resistor used in our attenuators, terminators, and voltage probes has many capabilities designed specifically for high voltage pulse use. It has a very low voltage coefficient of resistance, which is why our components provide the same accurate measurements at millivolt or kilovolt signal levels. Their low temperature coefficient of resistance also provides minimal attenuation change with temperature, and our resistors are held to  $50 \Omega \pm 0.5 \Omega$  for accurate and repeatable attenuation measurements.

Our microwave and HV design capabilities have enabled us to put our resistors into coaxial housings that provide the best pulse response possible for their rated energy. The combination of these capabilities provides you with the fastest pulse rated components available.

Our attenuator design capability continues to evolve and has resulted in improved pulse response, voltage rating and in greatly increased average power rating. Our components remain the best high voltage coaxial devices available anywhere.

We strive to minimize your problems in interconnection of measuring instrumentation by providing many different coaxial connectors with close tolerances on our products. We offer type SMA, TNC, BNC, N, SHV, and HN connector selections on many of our standard products.

We are working on the design of new and higher voltage connectors for use with your constantly increasing pulse voltages.

Our high voltage probes are usually designed to meet specific requirements of resistance, voltage, pulse width, risetime, and physical dimensions for each application. They are presently being used in air, vacuum, and water systems, with risetimes as fast as 100ps and voltages as high as 500kV.

Our line of pulse transformer components has less loss and narrower bandwidth than resistive units for dividing, combining, or signal sampling. We make several extremely wide bandwidth reactive units that have high energy capability as well. We have developed a 50ps risetime pressurized reed switch pulse generator that has an output voltage that is adjustable from 100-2500V.

Our waveform modification capabilities include impulse, linear ramp, stairstep generators, and risetime spoilers and positive exponential generators. Units have been produced that can operate up to 10kV and are as fast as sub-nanosecond or as slow as 100ns risetimes.

# Technical Specifications

 Barth Electronics, Inc.

## TESTING FOR GUARANTEED PERFORMANCE

Components are 100% tested with 1000 pulses at their rated voltage and pulse width. The resistance of all ports is measured before and after HV testing. Each unit passes this test only if its resistance, after HV pulsing, increases less than 0.04%. Any higher increase indicates a breakdown, and that unit is rebuilt and retested. In addition to the DC resistance measurements, each unit is also tested for pulse response and reflection coefficient to be certain they meet our specifications. The pulse amplitude and width capability of a unit listed as 5kV/400ns means that it is guaranteed to withstand 5kV rectangular pulses that are 400ns long. We recommend that DC resistance tests be performed regularly on all of your resistive attenuators, of any make, as an easy detection of resistor failure. All of our products are guaranteed to perform to their specifications indefinitely when used within their specifications.

## MAXIMUM INPUT LIMITATION

The voltage specification of our products is sometimes limited by the breakdown characteristics of the connectors. The voltage limits we use for our specifications are 4kV for the N connector, 6kV for the GR 874 connector, and 13kV for the HN connector. These limitations are for DC and provide a safety factor for our pulse length ratings. The N connector, for instance, can pass 10kV at short (10ns) pulse widths.

The breakdown limitations of our film resistors are related to pulse energy. A unit that has been tested to withstand 5kV, 400ns FWHM rectangular pulses should be able to withstand 10kV, 75ns FWHM rectangular pulses. While this general rule of thumb has been found to be useful in practice, we cannot guarantee higher voltages or pulse widths unless we test the particular unit to your pulse specification.

Some units have been designed and rated to withstand exponentially decaying pulses and are listed with a 1/ notation. An exponentially decaying pulse with a 1/ time constant has half the energy of a rectangular pulse, with the same FWHM time. Therefore, our resistive units can withstand exponential pulses that have a time constant twice as long as a rectangular pulse.

Please call if your pulse measurement requirements cannot be met by the standard product specifications.

## VOLTAGE COEFFICIENT OF RESISTANCE

The voltage coefficient error of our resistive components is less than 1% at their rated voltage. It is usually significantly lower than this, but we cannot specify it any better because of present measurement limitations. See our Application Note for further information regarding the importance of voltage coefficient in pulse voltage measurement.

## PULSE RISE TIME

The 10%-90% risetime through our attenuators is listed as  $\tau$ . It is calculated by the square root of the difference between the observed risetime squared and the input risetime squared. This would be the risetime out of our attenuator with a perfect (zero risetime) input. Our risetime and reflection coefficient are made with a 54120A HP digital sampling system that can be normalized to as fast as 10ps.

## ATTENUATOR ENERGY RATINGS

Model	Pulse Energy Rating	
BEI 142	50 mJ	Higher voltage and > 12GHz bandwidth
BEI 21	10 mJ	1000v, 3550MHz bandwidth
BEI 102	50 mJ	Higher voltage and 7GHz bandwidth
BEI 202	200 mJ	Maximum N connector voltage 17GHz bandwidth
BEI 2237A	800 mJ	HN connector 7GHz bandwidth
BEI 2239A	2050 mJ	HN connector 3.5GHz bandwidth
BEI 2536	400 mJ	HN connector, 200W average power

# Voltage Coefficient of Resistance

 Barth Electronics, Inc.

**Application Note #1** *Barth Electronics, Inc.*  
©"VCADV" 5/3/88

*This is a four-page white paper.*

The purpose of this application note is to describe some important considerations in high voltage pulse measurements with resistors as dividing elements. The term "Voltage Coefficient of Resistance" has been around for a long time<sup>1</sup>; but is seldom used or well understood. As high voltage pulse measurements improve, and higher accuracy becomes available, voltage coefficient errors that could once be ignored now must be considered.

It is well known that the resistance increases with temperature rise of nearly all resistors, including the commonly encountered carbon composition resistor. The temperature coefficient of resistance (of a resistor) may be expressed as the ratio of the resistance change to the temperature rise. Such a temperature coefficient classification is useful if the resistance changes uniformly with temperature rise and fall.

Resistors undergo temperature variations not only due to changes in ambient temperature, but also due to dissipation of electrical energy when current is passed through them. It is desirable in measurements using resistors, that their temperature coefficient be small to minimize errors. One can see, for example, that when a measurement apparatus involving resistors is calibrated at low signal levels, the calibration may be invalid at higher signal levels if the resistance values change.

It has also been known for a long time<sup>1</sup> that the resistance of a resistor can change due to a change in the voltage applied to it, even though the temperature may be held constant. The voltage coefficient of resistance may be expressed as the ratio of the resistance change in  $\Omega$ s to the corresponding increase in applied voltage in volts when the temperature is held constant. Such voltage coefficient of resistance definition is useful to characterize the resistance change with an increase in applied voltage. Of course, for any useful resistor material, the resistance returns to its original value when the applied voltage is removed.

When a steady voltage is applied to a resistor, it normally undergoes resistance changes due to both applied voltage and temperature increase. The temperature increase is caused by the dissipation of electrical energy in the resistor due to current flow. At low voltages the temperature coefficient is usually larger than the voltage coefficient. This change in resistance is almost entirely due to a temperature change in the resistor.

When a short pulse is applied to a resistor, and very little average power is dissipated in the resistor, its temperature will not rise appreciably. Most of the resistance change of a low temperature coefficient resistor will be due mainly to the application of voltage, and limited to the time when the voltage is applied. When high voltage pulses are applied to low value resistors, the change in resistance can be appreciable, and can be very important in measurement applications.

Measurement of short high voltage pulses are made in investigations of the effects of lightning strikes, EMP testing on electrical equipment, instrumenting underground nuclear tests, and the pulse power industry.

Most resistors have a negative voltage coefficient, which means that at higher voltages, the resistance decreases during the pulse. If the resistance increases with voltage, the resistor has a positive voltage coefficient. This voltage dependent change of resistance happens instantaneously and can be observed to occur in less than 1 nanosecond. If the period of voltage application is too long, the temperature may rise and cause large resistance changes that can mask voltage coefficient effects.

Short pulses applied to many resistors will show voltage coefficient effects during the time the voltage is applied. Although a resistor may not burn out during extensive pulsing, or have a permanent resistance change, it can have significant voltage coefficient changes during the time of the pulse.

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# Voltage Coefficient of Resistance

⊗ Barth Electronics, Inc.

The voltage coefficient varies with different resistive materials, and seems to be greatest for materials that are composed of a granular conglomeration of resistive material held together with an insulating binder. Carbon composition and cermet film resistors use these types of resistive materials.

Nonlinear resistivity can easily be displayed by placing a small amount of finely powdered conducting or semiconducting material between two skewed small diameter wires. Graphite shaved from a pencil or from a carbon composition resistor displays this effect nicely. The effect can be observed using as little as 1 volt between the two wires. The nonlinear voltage versus current ratio can easily be seen on a simple transistor / diode curve tracer as a nonlinear slope. This nonlinear resistance occurs for both positive and negative voltages and is symmetrical if there is no rectifying contact. Of course, resistors of a few thousandths of an inch in length are not used in high voltage applications; but if you put 1,000 of these small resistors mentioned above that are three thousandths of an inch long, in series, you would have a resistor three inches long. This resistor, assembled from many low voltage nonlinear junctions, would have a nonlinear resistance when used at 1,000 volts.

The voltage coefficient of resistance of the resistor depends not only upon the length of the resistor, but also upon the conductive interfaces between the resistive particles that make up the resistor. These interfaces result in emission current (tunneling) across microscopic gaps between conductive particles such as graphite. It is complicated by many factors such as size of particles, their size distribution, and electron emission coefficients. If resistance can be obtained without resorting to high resistance contacts between granular low resistivity materials, then low voltage coefficients can be achieved.

Bulk metal resistors have almost unmeasurable voltage coefficients. However, due to the low resistivity of metals, wire wound resistors must be used to achieve reasonable resistance values.

The combined inductance and capacitance effects of wire wound resistors prevent their use either at high frequencies or with fast pulses.

Thin metal film can also be used to achieve reasonable resistance values, but these resistors have a high voltage coefficient. This may result from the extremely thin metal film deposited on a very rough ceramic substrate that allows tunneling or current flow across the ceramic valleys.

Carbon composition resistors are made with powdered or granular graphite material, which has a relatively low bulk resistivity.

Many different resistivity compositions are made to cover the 10  $\Omega$  to 10 meg $\Omega$  resistor range. The graphite/insulator compositions are held in place with a phenolic binder that also anchors the wire terminals into the carbon resistance element. This is the original construction method for carbon composition resistors and creates a robust and inexpensive resistor.

Ordinary carbon composition resistors normally are made in 1/4, 1/2, 1, and 2 watt sizes. Our measurements found the 2 watt size to have a much higher voltage coefficient than the 1 watt size, and the 1/2 watt size to have the lowest voltage coefficient over all. It was also found that the voltage coefficient of any particular wattage rating is not much different between manufacturers. This would lead us to believe that something in the basic manufacturing process of this type of resistor may be responsible for its very high voltage coefficient.

In order to increase the surface area of a carbon composition resistor and allow it to dissipate more energy, the size of the resistor is increased. Increasing the size of the resistor will usually decrease its resistance unless one increases the resistivity of the bulk material to compensate for the increase in cross sectional area. For example a typical 1/2 watt resistor has a length of 0.375 inch and a diameter of 0.140 inch. The typical 2 watt resistor has a length of 0.688 inch and a diameter of 0.318 inch.

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# Voltage Coefficient of Resistance

 Barth Electronics, Inc.

The length has been increased by a factor of 1.8, and the diameter by a factor of 2.27, so that the cross sectional area has increased by a factor of 5.2. The resistance of a cylindrical resistor would be  $R = r l/A$ , where  $r$  is the resistivity of the bulk material,  $l$  is the length, and  $A$  is the cross sectional area. The resistance would be increased by a factor of 1.8 due to the longer length, and decreased by a factor of 5.2 due to the larger cross sectional area. This example assumes parallel end terminals, although commercial carbon composition resistors have very non-uniform end terminals.

In order to maintain the same resistance, in going from 1/2 watt size to the 2 watt size, the resistivity of the bulk material must be increased by a factor of 2.9. The resistivity depends upon the ratio of graphite particles (and their size distribution) to the insulating binder material. A higher resistivity is achieved by decreasing this ratio, using more binder or less graphite in the mixture. Therefore, the resistance material of a 2 watt resistor has a smaller percentage of graphite, than a 1/2 watt resistor with the same value. Fewer contacts between granular resistor particles results in more tunneling, causing a higher voltage coefficient.

The mechanism that causes resistors to change value with the application of voltage is difficult to define with certainty. However, the evidence for such a change is real, and substantial changes in resistance can be observed. In one of our tests, the resistance of a 2 watt carbon composition resistor was observed to decrease from 390  $\Omega$ s to 200  $\Omega$ s during pulse testing. The high voltage resistance was approximately 51% of the resistance at low voltage during application of a 2kv, 100ns wide pulse. In pulse tests at 3kV with the same value resistors, a 1 watt resistor decreased approximately 15%, and a 1/2 watt resistor decreased approximately 6%.\*

An additional factor that probably contributes to a decrease in resistance upon the application of high voltage is the effect of the swaged tinned metal contacts of these resistors. They protrude into the bulk resistive material in such a way as to cause non-uniform current distribution at both ends of the resistor.

In high voltage pulse testing, inaccurate results are obtained when high voltage coefficient resistors are used for voltage division or attenuation measurements. The measurement of voltage coefficient of resistance can be accomplished at audio and radio frequencies by measuring the production of harmonic signals due to resistor nonlinear behavior.<sup>3</sup> We have developed additional measurement methods using voltage pulses and will continue resistor and attenuator testing.

We hope this information helps provide a better understanding of voltage coefficient and the causes of resistance changes at high voltage. Reduced accuracy is the result of using common resistors in high voltage pulse measurements. The effect of voltage coefficient and the importance of using resistors with a low voltage coefficient in high voltage measurements is gradually becoming more widely appreciated.

Because future designs are based on voltage measurements made today, it becomes obvious that the use of low voltage coefficient resistive instrumentation is essential for tomorrow's designs.

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# Voltage Coefficient of Resistance

Ⓟ Barth Electronics, Inc.

\* This agrees within the limit of 0.02 percent per volt quoted by G.W.A. Dummer.<sup>4</sup> The results quoted for 1 meg $\Omega$  resistors of 1/4 to 2 watt ratings by F. Langford Smiths<sup>5</sup> cannot be compared to those obtained at Barth Electronics, Inc., because there is no information on the dimensions of the resistors, and because Barth Electronics test resistors had lower resistance values.

## REFERENCES

1 "Measurements of Nonlinearity in Cracked Carbon Resistors", G.H. Millard, Proc. I.E.E. (London) Vol.106B, Jan. 1959, pp. 31-34.

2 "Electronic Designers Handbook", L.J. Giacoletto, Editor, Second Edition, McGraw-Hill Book Co. 1977, pp. 3-B.

3 "Harmonic Testing Pinpoints Passive Component Flaws", V. Peterson and P. Harris, Electronics, July 11, 1966, pp. 93-100.

4 "Materials for Conductive and Resistive Functions", G.W.A. Dummer, Hayden Book Co., 1970, p. 279.

5 "Radiotron Designer's Handbook", F. Langford Smith, Editor, Fourth Edition, Electron Tube Div. RCA, 1953, p. 188.

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# Information on HN and Barth HNB Connectors

 Barth Electronics, Inc.

The Barth HNB connector was specifically designed to provide both high voltage pulse capability and fast rise time performance in an HN compatible connector. These two characteristics are not available, both together, in any other commercially available HN connector.

While the HN connector interface is not quite as good as the precision N connector, it is still a very respectable connector and has the advantage of withstanding much higher voltages. The HN connector to connector interface will handle 15kV DC at sea level and somewhat higher pulse voltages.

However all HN connector to cable interfaces are not created equal; some are capable of handling high voltages and others are not! The high voltage limitations of a cable connector, or any connector for that matter, are often limited by the transitions on the end of the connector opposite the connector to connector interface. This is especially true of cable connectors, where the center conductor to outer conductor air gap spacing at the cable to connector transition is often not designed for high voltage; that is, it is shorter than the connector interface air gap spacing. A real danger in this is that breakdown can be occurring inside a connector and it will most likely not be apparent at the connector interface.

The Amphenol UG-59B/U Male HN cable connectors as well as the Barth 401-HNB Male HN cable connectors have a cable to connector interface (center conductor to outer conductor) air path that is 50% longer than the HN to HN interface air path, and thus gives these connectors good high voltage capability. The easiest, and typical, design (as used in the Amphenol UG-59B) to make an HN cable connector handle high voltage is to cut the cable insulation off square and then have the connector insulator overlap the cable insulation by a length that is longer (commonly 50%) than the connector to connector interface air gap path. While this does a good job of providing high voltage capability, it causes a severe discontinuity that limits the bandwidth of this connection.

The Barth HNB and HN cable connectors are

designed to handle high voltage and provide the best possible bandwidth. The way we provide both high voltage capability and wide bandwidth is to cut down the diameter of the insulation, in the cable to connector interface area, with a special hand tool. The connector insulator will then overlap this area to provide the high voltage capability, and it is made the correct diameter to also provide the correct impedance, which eliminates the discontinuity and therefore the bandwidth limitations inherent in the typical dielectric overlap used in the typical high voltage HN connectors.

Other HN connectors such as the Kings KH-59-19 Male HN cable have an improved RF specification. This improved bandwidth typically is the result of shortening the dielectric overlap area, and thus creating a reduction in the length of mismatched impedance. This improvement for bandwidth comes at the expense of lower voltage handling capability in the cable to connector interface. In the case of the Kings KH-59-19 Male HN cable connector, the cable to connector interface (center conductor to outer conductor) air path is 50% shorter than the HN to HN interface air path, and thus makes this connector unsuitable for high voltage applications. The shorter air gap in the coax to connector interface will almost always break down before break down occurs in the connector interface (where it would be more easily detected).

The Barth HNB interface is completely compatible with the standard HNB interface and, when 2 HNB connectors are mated, you have the best available match for HN type connectors. If your fast pulse risetimes are slower than 0.5ns, you probably wouldn't benefit from the advantages of the Barth HNB connectors, but if your pulse risetimes are on the order of 200-300ps, you would see some benefit; if your risetimes are faster than 100ps, the HNB connectors are a must.

If your application does not need the wide bandwidth of the HNB connectors, just ensure that the HN connectors you are using have a cable to connector interface that will handle your highest pulse voltage pulses.

# Information on Barth BE Connectors

 Barth Electronics, Inc.

The Barth BE connector is a unisex connector with a mating bullet that was specifically designed to address the pulse power need for a connector that will take higher voltage than an HN connector and still pass fast sub-ns pulse risetimes. While the HN connector to connector interface will handle 15kV DC at sea level and somewhat higher pulse voltages, the BE connector to connector interface will handle 40kV DC at sea level and somewhat higher pulse voltages. The BE connector provides both fast risetime performance and high voltage pulse capability for applications up to 40kV. These two characteristics are not available together in any other commercially available connector at this voltage rating.

Most high voltage connectors are not designed to be wide bandwidth; likewise, most RF connectors are not designed to handle high voltage. There are a few RF connectors on the market that will handle 20-25kV pulses, and some are matched better than others for risetime performance. Most are limited to a particular cable type, and others are only found on pulse generators and are supplied with the mating connector on a piece of coax.

The high voltage limitations of a coaxial cable connector are often determined by the cable to connector transition, the end of the connector opposite the connector to connector interface. Coaxial cable connectors are typically designed for RF performance, not with high voltage in mind. Most often the center conductor to outer conductor air gap spacing at the cable to connector transition is not designed for high voltage; that is, it is shorter than the connector interface air gap spacing. A real danger in this is that breakdown can be occurring inside a connector and it will most likely not be apparent at the connector interface.

The coaxial connector, cable to connector interface air path (center conductor to outer conductor), for a well-designed high voltage connector, is made to be longer than the connector to connector interface air path, and thus gives the connectors reliable high voltage capability. The easiest, and typical, design to make a

cable connector handle high voltage is to cut the cable insulation off square and then have the connector insulator overlap the cable insulation by a length that is longer (commonly 50%) than the connector to connector interface air gap path. While this does a good job of providing high voltage capability, it causes a severe discontinuity that limits the bandwidth of these connectors.

The Barth BE connector is designed to provide the best possible bandwidth and to also reliably handle high voltage. The way we provide both is to cut down the diameter of the cable insulation in the cable to connector interface area with a special hand tool. The connector insulator will then overlap this area to provide the high voltage capability. This allows us to also maintain the correct dielectric diameter to provide the correct impedance, which eliminates the discontinuity and therefore the bandwidth limitations inherent in the typical dielectric overlap design used in most high voltage connectors.

The Barth BE interface is now standard on many of our higher voltage products, and we offer a cable version for RG-214 cable. Other versions for RG-217 will be available, other high performance low-loss cables, as will be adapters to HN, N, bulkhead feedthroughs and bulkhead flange to transmission line versions. A hermetic feedthrough for vacuum applications is also being planned.

When two BE connectors are mated you have the best available match for your high voltage pulse system. If your fast pulse risetimes are slower than 1ns, you may not benefit much from the advantages of the Barth BE connectors but, if your pulse risetimes are faster than 500ps, you would see some benefit; if your risetimes are faster than 100ps, the BE connectors are a must.

If your application does not need the wide bandwidth of the BE connectors, just ensure that the high voltage connectors you are using have a cable to connector interface that will handle your highest pulse voltage pulses. We hope this information will help you to achieve good test results using BE connectors.

# Coaxial Components

## 1400-1 Test Kit

### DESCRIPTION

The Barth Model 1400-1 test kit contains cable assemblies, adapters, attenuators, and dividers.

The cable assemblies feature minimal fast pulse distortion to provide the fastest possible risetime response for 1GHz or 3.5GHz bandwidth oscilloscopes. The cables are constructed with precision SMA or N type connectors for minimum reflection losses.

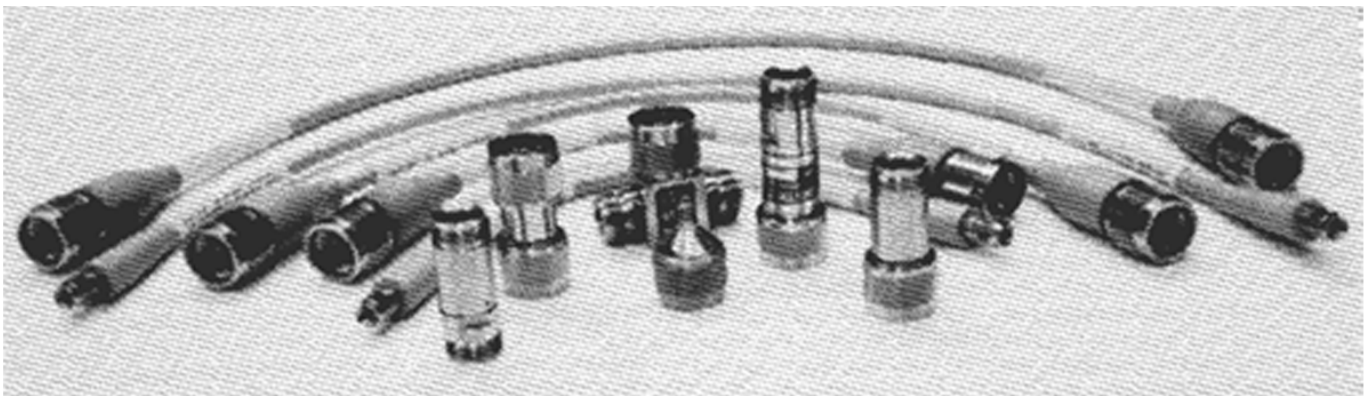
The coaxial adapters, attenuators, and dividers are used for coaxial interconnections of sub-nanosecond risetime pulse information during high performance CDM and ESD testing.

Each component is TDR tested for low reflection and pulse tested for risetime response to ensure minimal degradation of sub-nanosecond pulses.

The kit contains the cable assemblies, connector adapters, attenuators, and power dividers listed below; all components are also available separately.

### ADVANTAGES

- ⊗ Pulse tested and characterized for time domain applications
- ⊗ Wide bandwidth, triple shielded, flexible, high performance cable
- ⊗ Rugged stainless steel connector construction for long life



Quantity in kit	Description	Model
2	10" SMA plug-SMA plug picosecond cable assembly	460-MMP-10
2	15" SMA plug-SMA plug picosecond cable assembly	460-MMP-15
2	20" SMA plug-SMA plug picosecond cable assembly	460-MMP-20
2	10" N plug-N plug picosecond cable assembly	460-NMP-10
2	15" N plug-N plug picosecond cable assembly	460-NMP-15
2	20" N plug-N plug picosecond cable assembly	460-NMP-20
1	36" N plug-SMA plug picosecond cable assembly	460-NMMMP-36
2	N plug to N jack precision adapter	420-NMF
2	N plug to N plug precision adapter	421-NMM
2	N jack to N jack precision adapter	422-NFF
6	N plug to SMA jack adapter	423-NMMF
2	10/1 VR 20ps time domain attenuators - low voltage	2-20
2	2 way resistive divider - low voltage	1506A

# High Voltage Pulse Terminators

## DESCRIPTION







Barth High Voltage Pulse Terminators are designed to terminate 50  $\Omega$  systems with a very low reflection coefficient.

High voltage pulses are terminated with characteristics as good as, or better than, most instrument loads.

These units are ideal for use in nuclear and high energy experiments. Extensive testing during manufacturing ensures very high reliability for single-shot experiments.

A voltage coefficient of the resistive film of less than .0001%/V allows low voltage calibration of most systems.

## ADVANTAGES

-  Low reflection coefficient
-  Withstands high voltage pulses
-  Pulse power rated
-  Low voltage coefficient
-  High reliability
-  Impedance held very close to nominal

## TERMINATOR MODEL COMPARISON

Model	Peak Voltage	Maximum Input* @ Pulse width ns	Input reflection coefficient at 100ps $\tau$	Connectors
101-xxx	2,500	400	< 1%	**
201 A-xxx	5,000	400	< 1%	**
201-BMP	3,000	250	< 1%	BNC male
2033-HFP	10,000	250	< 4%	HNB female
2051-GHMP	10,000	100	< 3%/100ps $\tau$	GHV male
2051-GHFP	10,000	100	< 3%/100ps $\tau$	GHV female
2035-BEP	20,000	200	< 4%	Barth BE Series
223-BMFP	4,000	100	< 5%	BNC male/female

## NOTES

Our type HN (HNB) connectors are specially designed to obtain the minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or Model 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

\* Please refer to the Technical Specifications (Maximum Input Limitations) page for a full explanation of voltage and pulse width ratings.

\*\* Any male or female (GR, N, HNB) can be supplied. Units with N connectors are limited to a 4kV rating. The Model 101 is not supplied with HNB connectors to avoid voltage capability confusion. These are our most popular terminators, and are stocked for immediate delivery.

## High Voltage Pulse Terminators

# BARTH MODEL 101-XXX, 201A-XXX

50  $\Omega$  High Voltage Pulse Terminator

Pictured:  
Model 101-GLP  
Model 201A-NMP



## Specifications

**Maximum Input:** 101-xxx : 2.5kV, 400ns FWHM Pulse  
201A-xxx : 5kV, 400ns FWHM Pulse \*\*

**Peak Input Power:** 125kW at rated pulse width

**Average Input Power:** 4W maximum

**Impedance:** 50  $\Omega \pm 0.5\%$

**Reflection-TDR:** < 1% to a 100ps risetime step function  
< 3.5% to a 100ps risetime step function \*

**Voltage Coefficient:** < 1% at rated voltage

**SWR:** DC-4GHz < 1.005 +.013f GHz  
DC-6GHz < 1.005 +.013f GHz

**Connectors:** 101, 201A-GP : GR 874 non-locking  
101, 201A-GLP : GR 874 locking  
101, 201A-NMP: N Male \*\*  
101, 201A-NFP : N Female \*\*  
201A-HMP \* : HNB Male \*\* (201A only)  
201A-HFP \* : HNB Female \*\* (201A only)

**Dimensions:** 2.5" long, 1.25" dia. max.

**Weight:** 1/5 lbs.

## Note

Our type HN (HNB) connectors are only available in 201A series and are specially designed to obtain the minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or Model 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

-xxx Connector identifier, see list under connector heading for our standard (stocked) configurations. Call for connector configurations not shown.

\*\* Units with N connectors are limited to a 4kV rating.



# BARTH MODEL 201-BMP

50  $\Omega$  High Voltage Pulse Terminator

Pictured:  
Model 201-BMP



## Specifications

<b>Maximum Input:</b>	3kV, 250ns FWHM Pulse
<b>Peak Input Power:</b>	200kW at rated pulse width
<b>Average Input Power:</b>	1W maximum
<b>Impedance:</b>	50 $\Omega \pm 0.5\%$
<b>Reflection-TDR:</b>	< 1% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	BNC Male
<b>Dimensions:</b>	1.5" long x 19/32" dia. max.
<b>Weight:</b>	< 1 oz.



# BARTH MODEL 2033-HFP

50  $\Omega$  High Voltage Pulse Terminator

Pictured:  
Model 2033-HFP



## Specifications

<b>Maximum Input:</b>	10kV, 250ns FWHM Pulse
<b>Peak Input Power:</b>	2MW at rated pulse width
<b>Average Input Power:</b>	4W maximum
<b>Impedance:</b>	50 $\Omega \pm 0.5\%$
<b>Reflection-TDR:</b>	< 4% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	HNB Female Barth BE Series
<b>Dimensions:</b>	4.8" long x 1.3" wide x 1.3" high
<b>Weight:</b>	1 lb.

## Note

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection.



# BARTH MODEL 2035-HFP

50  $\Omega$  High Voltage Pulse Terminator

Pictured:  
Model 2035-BEP



## Specifications

<b>Maximum Input:</b>	20kV, 200ns FWHM Pulse
<b>Peak Input Power:</b>	2MW at rated pulse width
<b>Average Input Power:</b>	8W maximum
<b>Impedance:</b>	50 $\Omega \pm 0.5\%$
<b>Reflection-TDR:</b>	< 4% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	HNB Female Barth BE Series
<b>Dimensions:</b>	10.4" long x 1.3" wide x 1.3" high
<b>Weight:</b>	2 lb.

## Note

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection.



# BARTH MODEL 2051-GHMP, 2051-GHFP

50  $\Omega$  High Voltage Pulse Terminator

Pictured:  
Model 2051-GHMP  
(Male Version shown)



## Specifications

**Maximum Input:** 10kV, 100ns FWHM Pulse

**Peak Input Power:** 2MW at rated pulse width

**Average Input Power:** 2W maximum

**Impedance:** 50  $\Omega \pm 0.5\%$

**Reflection-TDR:** < 3% to a 100ps risetime step function

**Voltage Coefficient:** < 1% at rated voltage

**Connectors:** GHV Male, or GHV Female

**Dimensions:** 3.2" long x 1" dia. max.

**Weight:** < 1/3 lb.



# High Voltage Pulse Attenuators

## DESCRIPTION

Barth High Voltage Pulse Attenuators are matched impedance coaxial attenuators for use primarily in pulsed 50  $\Omega$  systems, or where occasional transients would damage ordinary units. The attenuator design closely matches the impedance around each resistor, to that resistor. These attenuators feature an input impedance very close to 50  $\Omega$ , with characteristics as good or better than most microwave attenuators. These units are ideal for use in nuclear and high energy experiments. Extensive testing during manufacturing ensures very high reliability for single-shot experiments. A voltage coefficient of the resistive film of less than .0001%/V allows low voltage calibration of most systems.

### Max. Input Considerations

The breakdown limitations of our film resistors are related to pulse energy. A unit that has been rated and tested to withstand 5kV, 400ns FWHM rectangular pulses should be able to withstand 10kV, 75ns FWHM rectangular pulses. While this general rule of thumb has been found useful in practice, we cannot guarantee higher voltages or pulse widths unless we test the particular unit to your pulse specification.

NOTE: We will only guarantee other voltages and pulse widths or shapes if we life test a unit for that particular pulse specification.







Our standard units are all 50  $\Omega$  impedance. We do, however, manufacture and stock many 100  $\Omega$  impedance units. If we are unable to meet your requirements with a stock unit, call us, as other types and impedances can be designed to your specifications.

### Special Use Considerations

Our Standard Attenuators can almost always be used at higher pulse voltages with shorter pulse widths, or lower pulse voltages with longer pulse widths. We will only guarantee these products for these alternate uses if they are tested by Barth at the specified voltage and pulse width.

Guaranteed pulse energy performance is available at an additional cost for special testing. Please contact us to discuss specific alternate pulse voltage derating information for any particular pulse attenuator.

## ADVANTAGES

-  Low reflection coefficient
-  Withstands high voltage pulses
-  Pulse power rated
-  Low voltage coefficient
-  High reliability
-  Input/output impedance held very close to nominal

# High Voltage Pulse Attenuators

Barth Model Comparison Chart

Model	Average input power	Voltage ratio dB	Maximum Input*		Pulse Energy Joules	Risettime through unit ps	Effective bandwidth DC to	Connectors
			Maximum peak voltage	Input @ pulse width ns				
21-BMFP-20	2W	10	1,000	500	10	< 1ns	350 MHz	BNC Male/Female
21-BMFP-26	2W	20	1,000	500	10	< 1ns	350 MHz	3" Lg. X 0.660" Dia
102-GP-20	5W	20	2,500	400	0.05	< 50	7 GHz	GR 874 non-locking
102-GLP-20	5W	20	2,500	400	0.05	< 50	7 GHz	GR 874 locking
102-NMFP-20	5W	20	2,500	400	0.05	< 50	7 GHz	N Male/Female**
102 with CF Option	10W	20	2,500	400	0.05	< 50	7 GHz	See available configurations above
142-xxx-3	2W	3	2,500	400	0.05	< 10	30 GHz	***
142-xxx-4	2W	4	2,500	400	0.05	< 10	30 GHz	***
142-xxx-6B	2W	6	2,500	400	0.05	< 10	30 GHz	**
142-xxx-8B	2W	8	2,500	400	0.05	< 10	30 GHz	***
142-xxx-10B	2W	10	2,500	400	0.05	< 10	30 GHz	***
142-xxx-14B	2W	14	2,500	400	0.05	< 10	30 GHz	***
142-xxx-20B	2W	20	2,500	400	0.05	< 10	30 GHz	***
142-xxx-26B	2W	26	2,500	400	0.05	< 10	30 GHz	***
202B-GLP-N	2W	8	5,000	400	0.20	< 20	17 GHz	GR 874 locking
202A-GLP-T	2W	14	5,000	400	0.20	< 20	17 GHz	GR 874 locking
202A-GLP-X	2W	20	5,000	400	0.20	< 20	17 GHz	GR 874 locking
202B-NMFP-N	2W	8	4,000	400	0.128	< 20	17 GHz	N Female/Male
202-NMFP-T	2W	14	4,000	400	0.128	< 20	17 GHz	N Female/Male
202-NMFP-X	2W	20	4,000	400	0.128	< 20	17 GHz	N Female/Male
2237A-HFNFP	2.5W	26	10,000	400	0.80	< 50	7 GHz	HNB Female input
2239A-HFNFP	2.5W	26	16,000	400	2.05	< 100	3.5 GHz	N Female output
2240A-BENFP	2.5W	26	20,000	200	1.60	< 100	3.5 GHz	Barth 454 Input N Female Output
2248-HFNFP	10W	26	5,000	4µs	2.00	<100	DC to 3.5 GHz	HN Female Input N Female Output
2511-30F	25W	30	8,000	150	0.192	< 1ns	0.35 GHz	Fischer input BNC output
2536-HFP-3	200W	3	7,000 15,000	400 75	0.392 0.337	35	10 GHz	HNB Female****
2536-HFP-6	200W	6	7,000 15,000	400 75	0.392 0.337	35	10 GHz	HNB Female****
2536-HFP-10	200W	10	7,000 15,000	400 75	0.392 0.337	35	10 GHz	HNB Female****
2536-HFP-20	200W	20	7,000 15,000	400 75	0.392 0.337	35	10 GHz	HNB Female****

## NOTES

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

\* Please refer to the Technical Specifications (Maximum Input Limitations) page for a full explanation of voltage and pulse width ratings.

\*\* Units with N connectors are limited to a 4kV rating.

\*\*\* Any male or female (GR, N, HNB, GHV) can be supplied.

\*\*\*\* Unit is supplied with a Barth Model 404-HMM low reflection HNB Male to Male adapter, so that either the input or output can be adapted to a male connection.

# BARTH MODEL 102 SERIES

The 102 series have a patented design that provides for maintaining good HV capabilities and good power dissipation. While this series has a simpler housing design than our precision attenuators, for better heat dissipation, it still provides a very respectable and clean 50ps output risetime.





Pictured:  
Model 102-NMFP-20



## Specifications

<b>Voltage Ratio:</b>	10.0/1 Vr (20dB)
<b>Maximum Input:</b>	5.0kV, 80ns FWHM Pulse, 500kW Peak Power** 2.5kV, 400ns FWHM Pulse, 125kW Peak Power 1.25kV, 1600ns FWHM Pulse, 31kW Peak Power
<b>Average Input Power:</b>	5W maximum 10W with optional fins (Model CF) for ext. cooling
<b>Impedance:</b>	50 Ω ± 1%
<b>Risetime Through Unit:</b>	< 50ps
<b>Bandwidth (-3dB):</b>	DC-7GHz
<b>Reflection-TDR:</b>	< 4% to a 100ps risetime step function
<b>SWR:</b>	< 1.05 to 1GHz < 1.30 to 4GHz
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	102-NMFP-20 : N Male/Female** 102-GLP-20 : GR 874 locking 102-GP-20 : GR 874 non-locking
<b>Dimensions:</b>	102-NMFP-20 : 5" long x .8" dia. 102-GP-20 : 4.5" long x 0.625" dia. 102-GLP-20 : 4.5" long x 1.01" dia.
<b>Weight:</b>	3/8 lb.

## Advantages

-  High voltage pulse rated
-  Least expensive high voltage coaxial attenuator available
-  Small dimensions
-  Higher average power than 142 series

## Note

\*\* Units with N connectors are limited to a 4kV rating.

Model CF (Cooling Fins) can be sold separately, or affixed to the 102 attenuator; please state your preference when ordering.

Actual measured voltage ratio is recorded on each unit.



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# BARTH MODEL 202 SERIES

This unit utilizes our original patented design, which still provides the best high voltage attenuator available. This unit withstands 5kV, 400ns FWHM pulses into either end and has a 20ps risetime.




Pictured:  
Model 202B-NMFP-N



## Specifications

<b>Voltage Ratio:</b>	202-xxx-N	: 2.5/1 Vr (8dB)
	202-xxx-T	: 5.0/1 Vr (14dB)
	202-xxx-X	: 10.0/1 Vr (20dB)
<b>Maximum Input:</b>	5.0kV, 400ns FWHM Pulse **	
<b>Peak Input Power:</b>	500kW at rated pulse width	
<b>Average Input Power:</b>	2W maximum	
<b>Impedance:</b>	50 Ω ± 1%	
<b>Risetime Through Unit:</b>	< 20ps	
<b>Bandwidth (-3dB):</b>	DC-17GHz	
<b>Reflection-TDR:</b>	< 5% to a 100ps risetime step function	
<b>SWR:</b>	< 1.05 to 1GHz	
	< 1.30 to 4GHz	
<b>Voltage Coefficient:</b>	< 1% at rated voltage	
<b>Connectors:</b>	202-NMFP-y	: N Male/Female
	202-GLP-y	: GR 874 locking
<b>Dimensions:</b>	4.1" to 3.3" long x 1.2" wide x 1" high depending on value	
<b>Weight:</b>	< 1/2 lb.	

## Advantages

-  High voltage pulse rated
-  High voltage precision coaxial attenuator
-  Small dimensions

## Note

-xxx Connector identifier; see list under Connectors heading for our standard (stocked) configurations. Call for connector configurations not shown.

-y Attenuation value identifier.

\*\* Units with N connectors are limited to a 4kV rating.

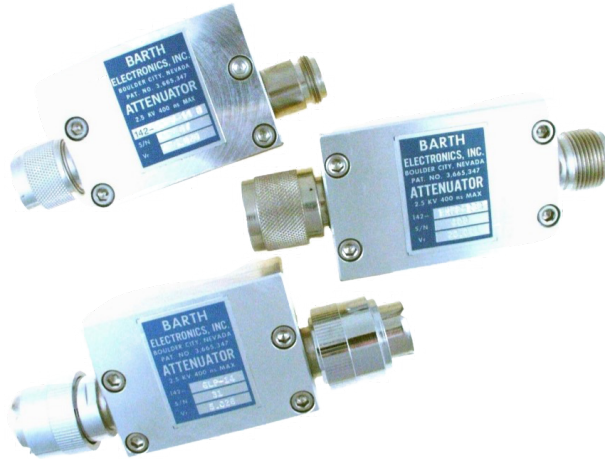
Actual measured voltage ratio is recorded on each unit.



# BARTH MODEL 142 SERIES



The 142 series attenuators are available in 8 standard attenuator values and are rated for 2.5kV/400ns wide rectangular pulse. Any non-standard value between 1.2 and 20dB can be manufactured.







Pictured:  
Samples

## Specifications

<b>Voltage Ratio:</b>	<b>Attenuation dB</b>
	142-xxx-3 : 1.4/1 Vr (3dB)
	142-xxx-4 : 1.5/1 Vr (4dB)
	142-xxx-6B : 2.0/1 Vr (6dB)
	142-xxx-8B : 2.5/1 Vr (8dB)
	142-xxx-10B : 3.16/1 Vr (10dB)
	142-xxx-14B : 5.0/1 Vr (14dB)
	142-xxx-20B : 10.0/1 Vr (20dB)
	142-xxx-26B : 20.0/1 Vr (26dB)
<b>Maximum Input:</b>	2.5kV, 400ns FWHM Pulse
<b>Peak Input Power:</b>	125kW at rated pulse width
<b>Average Input Power:</b>	2W maximum
<b>Impedance:</b>	50 ± 1%
<b>Risetime Through Unit:</b>	< 10ps
<b>Bandwidth (-3dB):</b>	DC-30GHz
<b>Reflection-TDR:</b>	< 3% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at rated voltage

## Advantages

-  High voltage pulse rated
-  Wide range of standard attenuation values; custom values available
-  Units with standard connector combinations are available from stock
-  Custom connector combinations can be manufactured from standard parts



# BARTH MODEL 142 SERIES ~ cont.



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<b>Connectors:</b>	142-NMFP-yy	: N Male/Female *
	142-GLP-yy	: GR 874 locking
	142-HMFP-yy	: HNB Male/Female
	142-GHMFP-yy	: GHV Male/Female ***
	142-SPJP-yy	: SHV Male/Female ***

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**Weight:** 3/4 lb max.

## Ordering Information

-xxx Connector identifier; see list under Connectors heading for our standard (stocked) configurations. Call for connector configurations not shown.

-yy Attenuation value in dB; see list of standard values under Voltage Ratio heading, or call for nonstandard values.

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

Actual measured voltage ratio is recorded on each nameplate.

\* Most popular general purpose lab items; in stock for immediate delivery.

\*\*\* Connector has risetime limitations; please specify test pulse risetime.



# BARTH MODEL 2237A-HFNFP



26dB Attenuator with HN Female Input Connectors

Pictured:  
Model 2237A-HFNFP



## Specifications

<b>Voltage Ratio:</b>	20/1 Vr (26dB)
<b>Maximum Input:</b>	10kV/400ns FWHM Pulse
<b>Peak Input Power:</b>	2MW at rated pulse width
<b>Average Input Power:</b>	2.5W maximum
<b>Impedance:</b>	50 $\Omega$ $\pm$ 1%
<b>Risetime Through Unit:</b>	< 50ps
<b>Bandwidth (-3dB):</b>	DC-7.0GHz
<b>Reflection-TDR:</b>	Input < 4% to a 100ps risetime step function Output < 3% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	HN Female input N Female output
<b>Dimensions:</b>	4.8" long x 1.250" wide x 2" high
<b>Weight:</b>	1.25 lbs.

## Note

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection. A RG214/U coax "pigtail" input is also available and can be supplied with a HNB Male connector on the coax.

We have found that the best Commercial Off The Shelf (COTS) HN Connector pair cannot withstand 25kV at 10ns pulse width for more than 1000 shots. We have to limit the maximum pulse voltage of any attenuator with HN connectors. They can withstand 25 or 30kV at much shorter pulses, but we cannot specify what that pulse width limit may be.



# BARTH MODEL 2239A-HFNFP

26dB Attenuator with HN Female Input Connectors

Pictured:  
Model 2239A-HFNFP



## Specifications

<b>Voltage Ratio:</b>	20/1 Vr (26dB)
<b>Maximum Input:</b>	16kV/400ns
<b>Peak Input Power:</b>	5.12MW at rated pulse width
<b>Average Input Power:</b>	2.5W maximum
<b>Impedance:</b>	50 Ω ± 1%
<b>Risetime Through Unit:</b>	< 100ps
<b>Bandwidth (-3dB):</b>	DC-3.5GHz
<b>Reflection-TDR:</b>	Input < 4% to a 100ps risetime step function Output < 3% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	HN Female input N Female output
<b>Dimensions:</b>	10.5" long x 1.250" wide x 2" high
<b>Weight:</b>	1.75 lbs.

## Note

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection. A RG214/U coax "pigtail" input is also available and can be supplied with a HNB Male connector on the coax.

We have found that the best HN Commercial Off the Shelf (COTS) Connector pair cannot withstand 25kV at 10ns pulse width for more than 1000 shots. We have to limit the maximum pulse voltage of any attenuator with HN connectors. They can withstand 25 or 30kV at much shorter pulses, but we cannot specify what that pulse width limit may be.



# BARTH MODEL 2240A-BENFP

An ultra wide band high voltage attenuator designed for measurement of signal risetimes as fast as 100ps.



Pictured:  
2240A-BENFP

## Specifications

<b>Voltage Ratio:</b>	20/1 $\pm$ 3.5% (26dB)
<b>Maximum Input:</b>	20kV, 200ns FWHM 25kV, 125ns FWHM
<b>Peak Input Energy:</b>	1.6 J (watt seconds)
<b>Average Input Power:</b>	2.5W maximum
<b>Impedance:</b>	50 $\Omega$ $\pm$ 1%
<b>Risetime Through Unit:</b>	< 100ps
<b>Bandwidth:</b>	DC-3.5GHz
<b>Reflection-TDR:</b>	Input < 4% to a 100ps risetime step function Output < 3% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at any voltage
<b>Connectors:</b>	Barth BE Series input N Female output
<b>Supplied Mating Cable:</b>	454-BE Series on 1 meter * RG-214 open
<b>Dimensions:</b>	10.5" long x 1.25" wide x 2" high
<b>Weight:</b>	1.5 lbs.



## **BARTH MODEL 2240A-BENFP ~ cont.**

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\* Other lengths are available.

Also available is an HNB Male connector assembled onto the open end of the 454-BE cable. The HNB connector will limit the useable voltage to 15kV maximum.



## High Voltage Pulse Attenuators

# BARTH MODEL 21-BMFP-20, 21-BMFP-26

The Model 21 was designed to meet the need for a low cost high voltage pulse attenuator for applications that have moderate high voltage requirements and more relaxed bandwidth requirements.

Pictured:  
Model 21-BMFP-20  
Model 21-BMFP-26



### Advantages

- ⊕ High voltage pulse rated
- ⊕ Low cost – high voltage coaxial attenuator
- ⊕ Small dimensions
- ⊕ For lower bandwidth – high voltage pulse applications

### Specifications

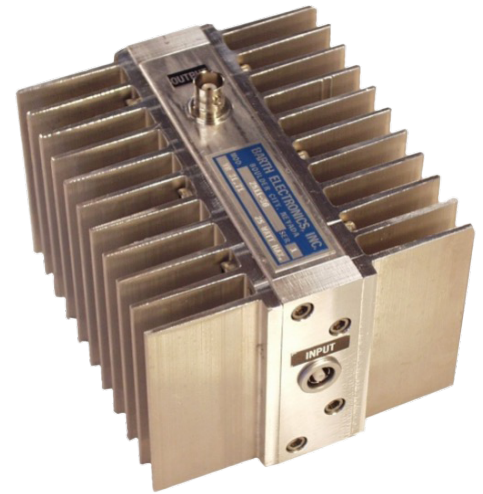
<b>Voltage Ratio:</b>	21-BMFP-20	10/1 Vr (20dB)
	21-BMFP-26	20/1 Vr (26dB)
<b>Maximum Input:</b>	1.0kV, 500ns FWHM Pulse, 20kW Peak Power	
<b>Average Input Power:</b>	2W maximum	
<b>Impedance:</b>	50 $\Omega$ $\pm$ 1%	
<b>Risetime Through Unit:</b>	< 1ns	
<b>Bandwidth (-3dB):</b>	DC to 350MHz	
<b>Reflection-TDR:</b>	< 4% to a 1ns rise time step function	
<b>Voltage Coefficient:</b>	< TBD % at rated voltage	
<b>Connectors:</b>	21-BMFP-xx	BNC Male/Female
<b>Dimensions:</b>	21-BMFP-xx	3" long x 0.660" dia.
<b>Weight:</b>	$\approx$ 3 oz.	



# BARTH MODEL 2511-30F

This model has a medium power rating that allows for high repetition rate testing of EFT generators at their high voltage rating.



Pictured:  
Model 2511-30F



## Specifications

<b>Voltage Ratio:</b>	30dB 31.6/1 Vr
<b>Maximum Input:</b>	8kV @ 50ns FWHM Pulse, 100ns 1/e Exponential decay
<b>Peak Input Energy:</b>	64 mJ @ 50ns Pulse Width
<b>Average Input Power:</b>	25W
<b>Impedance:</b>	50 Ω
<b>Risetime Through Unit:</b>	1ns
<b>Bandwidth (-3dB):</b>	350MHz
<b>Reflection-TDR:</b>	< 5% @ 1ns
<b>Voltage Coefficient:</b>	< 1% at 10kV
<b>Connectors:</b>	Fischer 103 receptacle input; BNC receptacle output
<b>Dimensions:</b>	5.5" long x 4.2" wide x 3.5" high
<b>Weight:</b>	2.8 lbs.

## Advantages

-  Used for high voltage, high repetition rate testing of sources
-  Electrical Fast Transients pulse sources

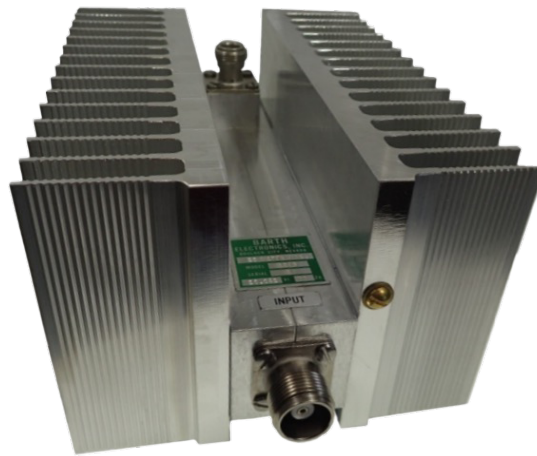


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# BARTH MODEL 2248-HFNFP

An ultra wide band high voltage attenuator designed for measurement of signal risetimes as fast as 100ps.



Pictured:  
Model 2248-HFNFP

## Specifications

<b>Voltage Ratio:</b>	20/1 $\pm$ 5% (26dB)
<b>Maximum Input:</b>	5kV, 4 $\mu$ s FWHM
<b>Peak Input Energy:</b>	2.0 J (watt seconds)
<b>Average Input Power:</b>	12W maximum
<b>Impedance:</b>	50 $\Omega$ $\pm$ 1%
<b>Risetime Through Unit:</b>	< 100ps
<b>Bandwidth:</b>	DC-3.5GHz
<b>Reflection-TDR:</b>	Input < 4% to a 100ps risetime step function Output < 3% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at any voltage
<b>Connectors:</b>	HN Female input (receptacle) N Female output (receptacle)
<b>Dimensions:</b>	8.25" long x 5.5" wide x 4.25" high
<b>Weight:</b>	5.8 lbs.



## High Voltage Pulse Power Attenuators

# BARTH MODEL 2536

A high voltage pulse/high power microwave (HPM) attenuator that contains a liquid dielectric coolant. It has an integral coolant pump, heat exchanger, and fan, which enables this unit to dissipate high average power.

Pictured:  
Model 2536 Sample



## Specifications

<b>Voltage Ratio:</b>	2536-HFP-3 : 1.4/1 Vr (3dB) 2536-HFP-6 : 2.0/1 Vr (6dB) 2536-HFP-10 : 3.2/1 Vr (10dB) 2536-HFP-20 : 10.0/1 Vr (20dB)
<b>Maximum Input:</b>	7kV/400ns, 15kV/75ns, 30kV/15ns, 60kV/2ns FWHM Pulse
<b>Peak Input Power:</b>	72MW at rated pulse width
<b>Average Input Power:</b>	200W maximum
<b>Impedance:</b>	50 $\Omega$ $\pm$ 1% (output terminated with 50 $\Omega$ )
<b>Risetime Through Unit:</b>	35ps
<b>Bandwidth (-3dB):</b>	DC-> 10GHz
<b>Reflection-TDR:</b>	< 5% to a 100ps risetime step function
<b>Voltage Coefficient:</b>	< 1% at 25kV
<b>Connectors:</b>	HNB Female **
<b>Dimensions:</b>	$\approx$ 6 1/2"(16.5 cm) wide, 10"(25.4 cm) high, 12"(30.5 cm) long
<b>Weight:</b>	$\approx$ 17 lbs. (7.8 kg)



## BARTH MODEL 2536 ~ cont.

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**Power Requirements:** 115V/60Hz, 4 Amp to power cooling pump, fan and highly visible "power on" light (240V/50-60Hz model available for export)

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\*\* Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection. The unit is supplied with a Model 404-HMM low reflection Male to Male adapter, so that either the input or output can be a male connector.

Power requirements: 115V/60Hz, 4 Amp to power cooling pump, fan and highly visible "power on" light (240V/50-60Hz model available for export).

The Model 2536-HFP-X is warranted to perform to its specifications for a period of one year. This warranty does not apply to units subjected to input power higher than a 200W average or being used without the cooling pump being in operation for the minimum time as specified on the operations tag. A unit determined to have failed under normal operating conditions without excess power or voltage will be repaired under warranty.



# BARTH MODEL 220-NFP, 220-MMFP

A 50  $\Omega$  series high voltage pulse resistor for a one way match of 100  $\Omega$  components to 50  $\Omega$  components.



Pictured:  
Model 220-NFP

## Specifications

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**Input Output Impedance:** 100  $\Omega$  to 50  $\Omega$  (50  $\Omega$  series resistor)

---

**Input Output Voltage Ratio:** 2/1 (6.02dB)

---

**Maximum Input:** 2.5kV, 250ns FWHM Pulse

---

**Peak Input Power:** 62.5kW at rated pulse width

---

**Average Input Power:** 2W maximum

---

**Risetime:** < 400ps

---

**Bandwidth (-3dB):** DC-1GHz

---

**Voltage Coefficient:** < 1% at rated voltage

---

**Connectors:** 50  $\Omega$  N Female



# BARTH MODEL 5101-MMFP

A 50  $\Omega$  series high voltage pulse resistor designed for a one way match of 100  $\Omega$  components to 50  $\Omega$  components.



Pictured:  
Model 5101-MMFP-1

## Specifications

---

**Input Output Resistance:** 100 ohm to 50 ohm (50 ohm Series Resistor)

---

**Maximum Peak Input Voltage:** 1.5kV/100ns FWHM rectangular pulse

---

**Input-Output (VR):** 2/1 (-6.02 dB)

---

**Input-Output 10-90% Risetime:** 10-90%

---

**Bandwidth (-3dB):** DC-1GHz

---

**Maximum Peak Power (kW):** 22.5kW at rated pulse width

---

**Maximum Average Input Power:** 1 Watt Maximum

---

**Voltage Coefficient:** < 1% at rated voltage

---

**Connector Configuration:** SMA male / SMA female - bidirectional

### Similar Products:

220-NFP 50 ohm Series Resistor

220a-GLP 50 ohm Series Resistor



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# BARTH MODEL 224A-GLP

50  $\Omega$  to 100  $\Omega$  Resistive Matched Attenuator



Pictured:  
Model 224A-GLP

## Specifications

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**Input Output Impedance:** 50  $\Omega$  to 100  $\Omega$

---

**Voltage Ratio:** 3.035 Vr (9.64dB) 50  $\Omega$  to 100  $\Omega$  direction  
7.07 Vr (16.99dB) 100  $\Omega$  to 50  $\Omega$  direction

---

**Maximum Input:** 2.5kV, 250ns FWHM Pulse

---

**Peak Input Power:** 62.5kW at rated pulse width

---

**Average Input Power:** 2W maximum

---

**Risetime:** < 20ps

---

**Bandwidth (-3dB):** DC-18GHz

---

**Voltage Coefficient:** < 1% at rated voltage

---

**Connectors:** GR 874 locking 50  $\Omega$  - GR 874 locking 100  $\Omega$

---



## Hand Held High Voltage High Frequency Voltage Probe

# BARTH MODEL 2440-6GHz

This probe is intended for passive probing of high speed, high voltage pulse circuits. The probe kit contains one 450  $\Omega$  resistive probe for a 10:1 voltage ratio (20dB), one 950  $\Omega$  resistive probe for a 20:1 voltage ratio (26dB), and one each 450 and 950  $\Omega$  replacement resistors.

The probe is designed to have the output terminated into a 50  $\Omega$  system. It is intended for output into an attenuator or 50  $\Omega$  scope input. The probe's specified response is for the probe connected with the included low loss coaxial cable.

**Note** The probe ratings are for use with the supplied 36" long low loss cable. Use of longer or higher loss cable will degrade the risetime of the measured pulse.

Pictured:  
Model 2240



## Specifications

**Maximum Input:** 10:1 probe : 3kV, 500ns 1/e exponential decay pulse  
20:1 probe : 5kV, 500ns 1/e exponential decay pulse

**Input Resistance:** 10:1 probe : 500  $\Omega$  when probe is terminated  
20:1 probe : 1k  $\Omega$  into nominal 50  $\Omega$  load

**Risetime:** < 60ps typical

**Bandwidth:** DC-6GHz typical risetime and bandwidth can be limited by the physical structure surrounding the measurement point.

**Voltage Coefficient:** < 1% at rated voltage

**Connectors:** SMA Female on probe bodies  
SMA Male on both ends of 36" long low loss cable for connection of probe to measurement system

## Operation Notes



## BARTH MODEL 2440-6GHz ~ cont.

Appropriate precautions must be taken to discharge the probe and connecting cable when the probe is being connected to sensitive sampling scope inputs because they are very susceptible to electrostatic damage. Any Teflon dielectric coaxial cable can easily become statically charged and can hold a charge for a long period of time. Failure to discharge a piece of coax before connecting it to the sensitive scope inputs can easily damage the expensive front end electronics of these sensitive instruments.

The coax cable included with the probe can easily be discharged from either end by connecting a short or providing a resistive connection from the center conductor to the ground conductor.

Touching your finger between the center conductor and outer (ground) conductor on the SMA cable connector is a simple, effective method to remove any charge on the probe cable.

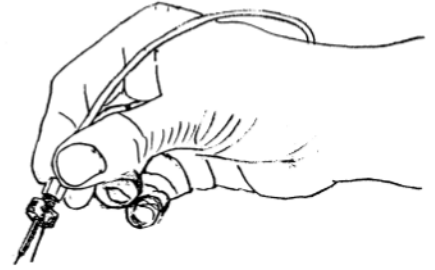
The output of the probe must be connected with the included low loss coaxial cable to a 50  $\Omega$  system, for instance to an attenuator or directly to a 50  $\Omega$  scope input. The correct method for holding the probe when making measurements is to hold the probe body by the SMA connector between your thumb and fingers in the same manner that you would hold a pencil. Placing your hand or fingers closer to the probe tip will add capacitance to the probe and will degrade the risetime of the probe output. The probe risetime specification includes the use of the supplied low loss 36" cable. Use of longer or higher loss cable will degrade the probe's response.

### Warning

The Model 2440 Voltage Probe is designed for the measurement of short high voltage pulses on open transmission structures in a laboratory environment. General laboratory safety procedures for working on active high voltage systems should be followed. Only personnel experienced in the safe operation of high voltage research and development laboratory type equipment should use this probe.

### Average Power Rating Warning

The peak, or average power rating, only applies to a well terminated load. Any reflection greater than 10% will significantly add to the power the DC-20GHz bandwidth resistor will have to absorb.



# Custom High Voltage Probes for Dedicated Pulse Location Instruments

## DESCRIPTION

Output risetime depends on housing construction around these resistors.

When used in the proper/optimum housing, the assembly has < 100ps risetime ( $\tau$ ).

The resistors listed here are examples made specifically for fast HV pulse measurement application. They were designed and tested inside a specific metal housing that accurately simulates their final application use. They are located in special gas insulation, HV dielectric material, or were potted in place to provide the required pulse amplitude and risetime response characteristics. They were constructed to produce repeatable sub-nanosecond response that requires the resistor to remain attached to the pulse voltage terminal being measured. We welcome requests for specific pulse voltage measurement applications.

If you have a need for a high voltage probe, we can design a specific resistor and housing to fit your requirements.

## Examples:

Model	Maximum peak voltage	Resistance	@ pulse width ns	Risetime of resistive output ps	Terminals
VP1E3-20-1E3	20,000	1000 $\Omega$	1 $\mu$ s	**	8-32 female thread ***
VP5E2-28-8R2	28,000	500 $\Omega$	800	**	HNB female
VP2E3-35-1R2N	35,000	2000 $\Omega$	100	**	N female
VP2E3-35-1R2H	35,000	2000 $\Omega$	100	**	HNB female

## NOTES

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or Model 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

\*\* The output risetime will be dependent on the housing.

\*\*\* Consult factory for optimum installation assistance for your application. Custom connector mounted probes can usually be designed for specific measurement requirements.




DISCLAIMER: These resistors were designed for special uses in special housings; **these resistors are not hand-held voltage probes.**

# High Voltage Pulse Matched Resistive Power Dividers

## DESCRIPTION

Barth High Voltage Resistive Power Dividers are matched impedance coaxial devices for use primarily in pulsed 50 Ω systems, or where occasional transients would damage ordinary units. These units are ideal for use in nuclear and high energy experiments. These dividers feature input and output impedance very close to 50 Ω. Extensive testing during manufacturing ensures very high reliability for single-shot experiments. A voltage coefficient of the resistive film of less than .0001%/V allows low voltage calibration of most systems.

## ADVANTAGES

-  Withstands high voltage pulses, low voltage coefficient, as well as a low reflection coefficient
-  Input/output impedance held very close to nominal
-  High reliability and pulse power rated

### MATCHED RESISTIVE POWER DIVIDER MODEL COMPARISON

Model	# of output ports	Voltage ratio dB	Maximum peak voltage	@ pulse width ns	Input reflection coefficient at 100ps τ	Risetime through unit ps	Connectors
151-xxx	2	6.0	2,500	400	< 4%	< 40	**
251-xxx	2	6.0	5,000	400	< 4%	< 40	**
2642-MMFP	2	6.0	1,000	400	< 1%	< 35	SMA female/SMA male
2642-MFP	2	6.0	1,000	400	< 1%	< 35	SMA female
2702-BFP	2	6.0	2,500	250	< 5%	< 65	BNC female
2703-BFP	3	9.5	2,500	250	< 5%	< 65	BNC female
2704-BFP	4	12.0	2,500	250	< 5%	< 65	BNC female
2705-BFP	5	14.0	2,500	250	< 5%	< 65	BNC female
2706-BFP	6	15.6	2,500	250	< 5%	< 65	BNC female
2746-NFMF	6	15.6	4,000	100	< 4%	< 45	N female/SMA female
2812-NFP	2	6.0	2,500	250	< 2%	< 50	N female
2813-NFP	3	9.5	2,500	250	< 2%	< 50	N female
2814-NFP	4	12.0	2,500	250	< 2%	< 50	N female
2815-NFP	5	14.0	2,500	250	< 2%	< 50	N female
2816-NFP	6	15.6	2,500	250	< 2%	< 50	N female
281x-NMFP	***	***	2,500	250	< 2%	< 50	N male/N female
281x-HFNFP	***	***	5,000	100	< 2%	< 50	HN female/N female
281x-BENFP	***	***	10,000	25	< 3%	< 50	UHLC/N female
2825-NFP	5	14.0	4,000	100	< 2%	< 75	N female
2828-NFP	8	18.1	4,000	100	< 2%	< 65	N female
2830-NFP	10	20.0	4,000	100	< 2%	< 70	N female
2832-NFP	12	21.6	4,000	100	< 2%	< 75	N female

## NOTES

- xxx Connector identifier, see connector list heading above for our standard (stocked) configurations; call for connector configurations not shown.
- \*\* Any Male or Female (GR, N, HNB) can be supplied. Units with N connectors are limited to 4kV.
- \*\*\* Refer to similar – NFP model above for # of output ports and voltage ratio.

## High Voltage Pulse Matched Resistive Power Dividers

# BARTH MODEL 151-XXX

High Voltage 2 Way Matched Power Divider (3 resistors)

Pictured:  
Model 151-NFP



## Specifications

<b>Voltage Ratio:</b>	2.0/1Vr (6dB)	
<b>Maximum Input:</b>	2.5kV, 400ns FWHM Pulse	
<b>Peak Input Power:</b>	125kW at rated pulse width	
<b>Average Input Power:</b>	2W maximum	
<b>Impedance:</b>	50 $\Omega$ $\pm$ .25 $\Omega$	
<b>Input Reflection TDR:</b>	< 4% to a 100ps risetime step function	
<b>Risetime Through Unit:</b>	< 40ps	
<b>Bandwidth:</b>	DC-9GHz	
<b>Voltage Coefficient:</b>	< 1% at rated voltage	
<b>Connectors:</b>	151-GP	: GR 874 non-locking
	151-GLP	: GR 874 locking
	151-NMP	: N Male
	151-NFP	: N Female
	151-NMFP	: N Male-N Female
<b>Dimensions:</b>	4" long x 2.5" wide x 1" high	
<b>Weight:</b>	$\approx$ 1/2 lb.	

## Note

-xxx Connector identifier; see Connectors heading above for our standard (stocked) configurations.

Call for connector configurations not shown.



# BARTH MODEL 251-XXX

High Voltage 2 Way Matched Power Divider (3 resistors)

Pictured:  
Model 251-NFP



## Specifications

<b>Voltage Ratio:</b>	2.0/1 Vr (6dB)
<b>Maximum Input:</b>	5kV, 400ns FWHM Pulse **
<b>Peak Input Power:</b>	500kW at rated pulse width
<b>Average Input Power:</b>	2W maximum
<b>Impedance:</b>	50 Ω
<b>Reflection-TDR:</b>	< 4% to a loop risetime step function
<b>Risetime Through Unit:</b>	< 40ps
<b>Bandwidth:</b>	DC-9GHz
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	251- GP : GR 874 non-locking 251- GLP : GR 874 locking 251- NMP : N Male ** 251- NFP : N Female ** 251- HMP : HNB Male 251- HFP : HNB Female
<b>Dimensions:</b>	4" long x 2.5" wide x 1" high
<b>Weight:</b>	≈ 1/2 lb.

## Note

Type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

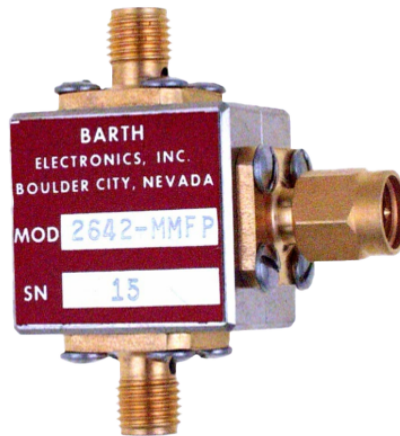
-xxx: Connector identifier; see connector list heading above for our standard (stocked) configurations. Call for connector configurations not shown.

\*\* Units with N connectors are limited to 4kV rating.



# BARTH MODEL 2642-MMFP, 2642-MFP

High Voltage 2 Way Matched Resistive Power Divider with SMA Connectors



Pictured:  
Model 2642-MMFP

## Specifications

<b>Voltage Ratio:</b>	2.0/1 Vr (6dB)
<b>Maximum Input:</b>	1kV, 400ns FWHM Pulse
<b>Peak Input Power:</b>	20kW at rated pulse width
<b>Average Input Power:</b>	1W maximum
<b>Impedance:</b>	50 $\Omega$
<b>Reflection-TDR:</b>	Input < 1% to a 100ps risetime step function Output < 2% to a 100ps risetime step function
<b>Risetime Through Unit:</b>	< 35ps
<b>Bandwidth:</b>	DC-10GHz
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	2642-MMFP : SMA Male in, 2 SMA Female out 2642-MFP : SMA Female
<b>Dimensions:</b>	1.560" long x 1.370" wide x .640" high
<b>Weight:</b>	$\approx$ 2.3 oz.

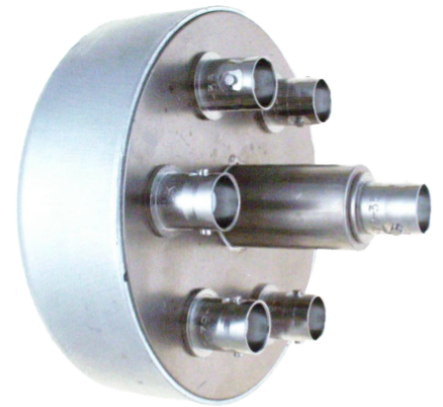


# BARTH MODEL 2700 SERIES

These models offer 2, 3, 4, 5, or 6 output ports and are designed for use primarily in pulsed 50  $\Omega$  systems, or where occasional transients would damage ordinary units.

These dividers feature input and output impedance very close to 50  $\Omega$ .

Pictured:  
Model 2706-BFP



## Specifications

<b>Voltage Ratio:</b>	2702-BFP	: 2.0/1 Vr (6.02dB)
	2703-BFP	: 3.0/1 Vr (9.54dB)
	2704-BFP	: 4.0/1 Vr (12.04dB)
	2705-BFP	: 5.0/1 Vr (13.98dB)
	2706-BFP	: 6.0/1 Vr (15.56dB)
	2710-BFP	: 10.0/1 Vr (20.0 dB)

**Maximum Input:** 2.5kV, 250ns FWHM Pulse

**Peak Input Power:** 125kW at rated pulse width

**Average Input Power:** 8W maximum

**Impedance:** 50  $\Omega$

**Input Reflection-TDR:** < 5% to a 100ps risetime step function

**Risetime Through Unit:** < 65ps

**Bandwidth:** DC-6GHz

**Voltage Coefficient:** < 1% at rated voltage

**Connectors:** BNC Female

**Dimensions:** 2.9' x 3" dia. + (2) 8-32 mounting studs

**Weight:** 1 lb.

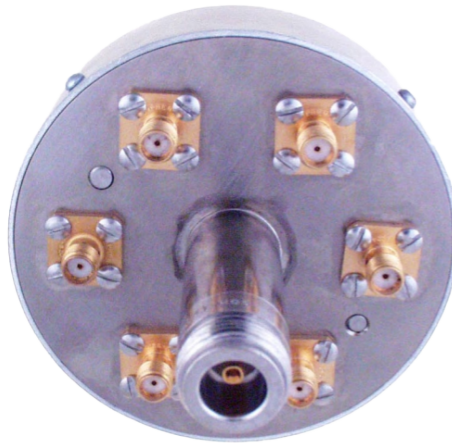


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# BARTH MODEL 2746-NFMFP

High Voltage 6-Way Matched Resistive Power Divider



Pictured:  
Model 2746-NFMFP

## Specifications

<b>Voltage Ratio:</b>	6.0/1 Vr (15.56dB)
<b>Maximum Input:</b>	4kV, 100ns FWHM Pulse
<b>Peak Input Power:</b>	125kW at rated pulse width
<b>Average Input Power:</b>	4W maximum
<b>Impedance:</b>	50 $\Omega$
<b>Reflection-TDR:</b>	< 4% to a 100ps risetime step function
<b>Risetime Through Unit:</b>	< 45ps
<b>Bandwidth:</b>	DC-8GHz
<b>Voltage Coefficient:</b>	< 1% at rated voltage
<b>Connectors:</b>	N Female input, SMA Female output
<b>Dimensions:</b>	2.9" x 3" dia. + (2) 8-32 mounting studs on 2" centers
<b>Weight:</b>	1 lb.



## High Voltage Pulse Matched Resistive Power Dividers

# BARTH MODEL 2810 SERIES

These 50  $\Omega$  matched resistive power dividers equally divide and distribute signals in high voltage pulse applications.



Pictured:  
2810 Series

## Specifications

<b>Voltage Ratio:</b>	2812-NFP/NMFP	2 WAY DIVIDER
	2812-HFNFP	} 2.0/1 $V_r \pm 2\%$ (6.02dB)
	2812-BENFP	
	2813-NFP/NMFP	3 WAY DIVIDER
	2813-HFNFP	} 3.0/1 $V_r \pm 2\%$ (9.54dB)
	2813-BENFP	
	2814-NFP/NMFP	4 WAY DIVIDER
	2814-HFNFP	} 4.0/1 $V_r \pm 2\%$ (12.04dB)
	2814-BENFP	
	2815-NFP/NMFP	5 WAY DIVIDER
	2815-HFNFP	} 5.0/1 $V_r \pm 2\%$ (13.98dB)
	2815-BENFP	

<b>Maximum Input:</b>	281x-NFP/NMFP	: 2.5kV, 250ns FWHM Pulse
	281x-HFNFP	: 5.0kV, 100ns FWHM Pulse
	281x-BENFP	: 10.0kV, 25ns FWHM Pulse

<b>Peak Input Power:</b>	281x-NFP/NMFP	: 125kW at rated pulse width
	281x-HFNFP	: 500kW at rated pulse width
	281x-BENFP	: 1.0MW at rated pulse width

**Average Input Power:** 8W maximum

**Impedance:** 50  $\Omega \pm 1\%$



# BARTH MODEL 2810 SERIES ~ cont.

---

<b>Reflection-TDR:</b>	281x-NFP
	Input < 2% to a 100ps risetime step function
	Output < 6% to a 100ps risetime step function
	281x-BENFP
	Input < 3%

---

**Risetime Through Unit:** < 50ps

---

**Bandwidth:** DC-7GHz

---

**Maximum Precursor:** <  $\pm 0.1\%$  for a 100ps risetime pulse

---

**Time Domain Overshoot:** < 2% overshoot for a 100ps risetime input pulse with no ringing

---

**Time Match Between Ports:**  $\pm 10$ ps maximum time difference between any/all output ports

---

**Attenuation Matching:**  $\pm 1.0\%$  between ports from DC-300MHz minimum

---

**Voltage Coefficient:** < 1% at rated voltage

---

**Connectors:**

281x-NFP	: N Female (standard configuration)
281x-NMFP	: N Male input, N Female output
281x-HFNFP	: HN Female input, N Female output
281x-BENFP	: Ultra fast BE100 input, N Female output

---

**Dimensions:** Outline drawings available

---

**Weight:**

2812-NFP	: approx. 1/2 lb.
2813-NFP	: approx. 3/4 lb.
2814-NFP	: approx. 7/8 lb.
2815-NFP	: approx. 1 lb.
2816-NFP	: approx. 1 1/4 lb.

---

x = Number of outputs (2, 3, 4, 5 or 6)

Inputs are labeled, outputs are numbered.



## High Voltage Pulse Matched Resistive Power Dividers

# BARTH MODEL 2820/2830 SERIES

These are designed to equally divide and distribute signals in high voltage pulse applications.

Pictured:  
Model 2820/2830 Series

## Specifications

<b>Voltage Ratio:</b>	2825-NFP	5.0/1 Vr (13.98dB)
	2828-NFP	8.0/1 Vr (18.06dB)
	2830-NFP	10.0/1 Vr (20.00dB)
	2832-NFP	12.0/1 Vr (21.58dB)

**Maximum Input:** 4kV, 100ns FWHM Pulse

**Peak Input Power:** 320kW at rated pulse width

**Average Input Power:** 10W maximum

**Impedance:** 50  $\Omega$

**Reflection-TDR:** < 2% to a 100ps risetime step function

<b>Risetime Through Unit:</b>	2825-NFP	< 75ps
	2828-NFP	< 65ps
	2830-NFP	< 70ps
	2832-NFP	< 75ps

<b>Bandwidth:</b>	2825-NFP	DC-4.5GHz
	2828-NFP	DC-5.4GHz
	2830-NFP	DC-5.0GHz
	2832-NFP	DC-4.5GHz

**Voltage Coefficient:** < 1% at rated voltage

**Connectors:** N Female

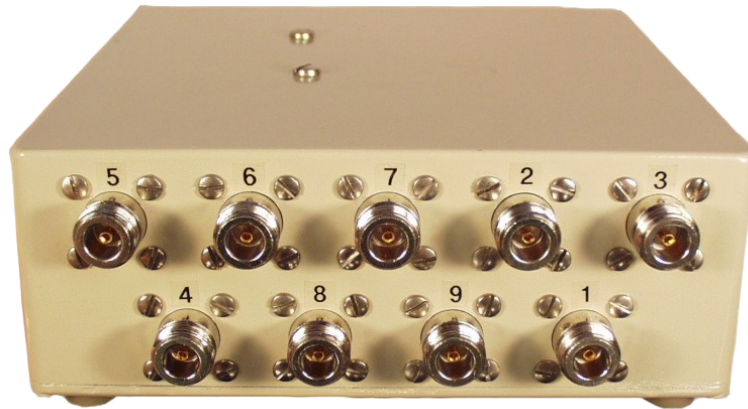
**Dimensions:** Outline drawing available

<b>Weight:</b>	2825-NFP	1 1/8 lbs.
	2828-NFP	2 1/4 lbs.
	2830-NFP	3 lbs.
	2832-NFP	3 3/4 lbs.



# BARTH MODEL 6419-MFP

This 9 Output high voltage pulse divider is specifically designed for use with 10kV, 250ps risetime high voltage pulses.



Pictured:  
Model 6419-MFP

## Specifications

<b>Number of Outputs:</b>	9
<b>Input Output Voltage Ratio:</b>	2.94:1 / 3.21:1 (9.75dB $\pm$ 0.38dB)
<b>Output Pulse Risetime:</b>	280ps for a 250ps input risetime
<b>Maximum Input Pulse Amplitude:</b>	10kV / 10ns, rectangular pulse
<b>Input Reflection Coefficient:</b>	+ 1.6%, - 3.0%, to a 250ps risetime step function
<b>Maximum Pulse Droop:</b>	6% @ 16ns
<b>Connectors:</b>	Type N Receptacle (Female) on input and outputs
<b>Dimensions:</b>	$\approx$ 7.3" x 7.3" x 3" height
<b>Weight:</b>	4.5 lbs.

## Advantages

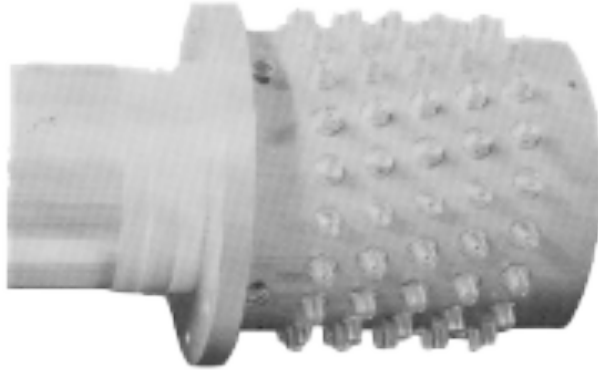
- ⊕ Specifically designed for maximum amplitude output with fixed duration flat top, while maintaining a fast clean risetime.
- ⊕ Outputs are very consistent from port to port, with respect to risetime, amplitude, and delay.
- ⊕ Similar dividers with different number of outputs, other input voltages, pulse widths, or risetime specifications can be designed to meet a customer's requirements.



# BARTH MODEL 9201-GMF

This pulse divider is specifically designed for use with a fast rise high voltage pulse generator such as Barth Model 731, (2kV output with < 50ps risetime).

Pictured:  
Model 9201-GMF



## Specifications

<b>Number of Outputs:</b>	100
<b>Input-Output Voltage Ratio:</b>	> 14:1
<b>Output Voltage Example:</b>	> 138V x 2ns flat top for a 2kV x 2ns, 50ps risetime input
<b>Input-Output Risetime:</b>	< 60 ps
<b>Output Risetime Example:</b>	< 74ps for 2ns wide, 50ps risetime input
<b>Maximum Input Voltage:</b>	2.5kV, 0.75ns to 2ns pulse width
<b>Output Time Variation between ports:</b>	< 5ps, typically < 2ps
<b>Output Amplitude Variation between ports:</b>	< 15%
<b>Connectors:</b>	Input : General Radio Type 874 Output : SMA Female
<b>Dimensions:</b>	≈ 7.64' (2.33m) long x 6" (15.3 cm) outer diameter 12" tapered input section - 8" long 100 way output section
<b>Weight:</b>	45 lbs./20.4 kg

## Advantages

- ③ Specifically designed for maximum amplitude output with fixed duration flat top, while maintaining a fast clean risetime.
- ③ Outputs are very consistent from port to port, with respect to waveshape, risetime, amplitude, and delay.
- ③ Similar dividers with different number of outputs, pulse width, voltage, or risetime specifications can be designed to meet a customer's requirements.

For other high voltage pulse dividers, call us with your needs.



# BARTH MODEL 691-MFBM

Our balanced probe combiner is designed for making fast risetime pulse differential measurements. It provides wide bandwidth with high common mode rejection (CMR). Features include 50  $\Omega$  (+) and (-) SMA jack inputs with a BNC plug output for direct attachment to an oscilloscope.

Pictured:  
Model 691-MFBM



## Advantages

- ⊕ High sensitivity for accurate differential measurements in the presence of high common mode noise levels
- ⊕ Very wide bandwidth for fast risetime measurements of power supplies to the fastest digital systems

## Specifications

**Input Output Voltage Ratio:** 2.0:1, -6.0dB (when used as a differential combiner)

**Impedance:** 50  $\pm$  1/2  $\Omega$

**Risetime:** 350ps

**Droop:** 7% at 1 $\mu$ s

**Frequency Range:** 15kHz-1GHz

**CMR:**  
> 40dB 100kHz to > 1GHz  
> 30dB 20kHz to > 1GHz

**Connectors:**  
Input : SMA Jacks  
Output : BNC Plug

**Dimensions:** 4.75" long x 1.25" dia.

**Weight:** 8 oz., 225 g



# HV PULSE MATCHED RESISTIVE POWER COMBINER

## Barth Model 2921-HFP

2 Input 4 Output Combiner



Pictured:  
Model 2921-HFP

### Specifications

**Voltage Ratio:** 2.0/1 Vr

**Maximum Input:** 2kV, 500ns FWHM Pulse

**Connectors:** HNB Female

**Dimensions:** 4 3/8" long x 4 5/8" wide x 1 1/4" high

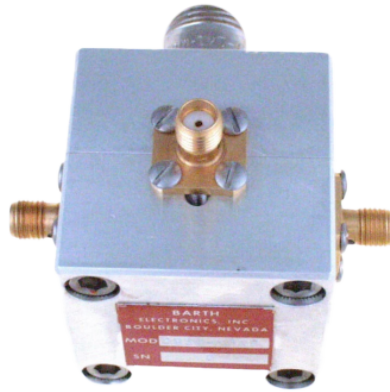
**Weight:** 1.5 lbs.



# HV PULSE MATCHED RESISTIVE POWER COMBINER

## Barth Model 2934-MFNF

4 Way Broadband High Peak Resistive Combiner



Pictured:  
Model 2934-MFNF

### Specifications

<b>Voltage Ratio:</b>	1.0/1 Vr
<b>Maximum Input:</b>	2kV, 10ns FWHM Pulse
<b>Average Input Power:</b>	1W maximum
<b>Impedance:</b>	50 $\Omega$
<b>Risetime Through Unit:</b>	< 30ps
<b>Connectors:</b>	SMA Female inputs - N Female output
<b>Dimensions:</b>	2.2" long x 2.2" wide x 2.2" high
<b>Weight:</b>	1/2 lb.



## Bias-T

# BARTH MODEL 45350, MODEL 45355

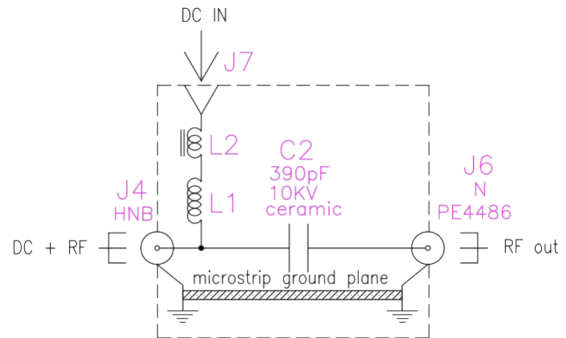
While bias tees rated for 100V are common, HV bias tees rated up to 10kV have not been available until now. The Barth Bias-T is designed to handle up to 10kV of DC bias while simultaneously passing up to 20W of RF power in the frequency range of 50-500MHz. (A simplified circuit is shown below.)

### Application

Electron lenses in RHIC are designed with a series of biased drift tubes through which the electron beam propagates in the opposite direction of the RHIC ion beams. The image currents induced on the drift tubes are detrimental to the electron & ion beams. The Barth Bias-T is a custom HV RF system that was developed to measure beam loss signals.

### Production Design

To produce a final design to pass greater than 90% of RF energy from 50-1000MHz through a bias tee requires a special inductor and capacitor design. Moreover, each of the elements of the Barth Bias-T is designed to withstand 10kV or 5kV bias voltage, depending upon model.



## Specifications

<b>Impedance:</b>	50 $\Omega$
<b>Risetime:</b>	< 100ps
<b>Droop:</b>	45355 : 1/ $\epsilon$ decay = 88ns
<b>Connectors:</b>	DC+ RF/Pulse : HN Female RF/Pulse : N Female DC Bias : AMP-LGH*

\* Unit supplied with mating HV connector; HV flying lead of customer specified length can also be provided.

Barth Electronics has been the worldwide leader in high voltage pulse instrumentation since 1964. All of our products are unconditionally guaranteed to perform exactly to our listed specifications. Contact us for additional information or to discuss your application.



# Transformer Components

## DESCRIPTION

### Wide Band High Voltage Transformer Transformer Component Model Comparison

Transformer Type Model #	Maximum peak voltage	Maximum energy without saturation	Input reflection coefficient @ 100ps $\tau$	Risetime through unit mainline ps	Risetime of coupled output ps	Connectors
<b>PULSE INVERTERS</b>						
6115-BMFP	1,000	45 V $\times$ $\mu$ s	< 4%	< 400 *	n/a	BNC male/female
621A-GLP	2,000	250 V $\times$ $\mu$ s	< 5%	< 70	n/a	GR 874 locking
621A-MFP	2,000	250 V $\times$ $\mu$ s	< 5%	< 70	n/a	SMA female
621-NFP	2,000	250 V $\times$ $\mu$ s	< 5%	< 70	n/a	N female
<b>BALUNS</b>						
650A-NFT	300	30 V $\times$ $\mu$ s	< 1%	n/a	< 60	N female input- N female output
651-NFP	1,000	500 V $\times$ $\mu$ s	< 1%	n/a	< 90	N female input- N female output
652-NFP	1,000	100 V $\times$ $\mu$ s	< 1%	n/a	< 50	N female input- N female output

## NOTES

\* Input Reflection Coefficient rated at 500ps $\tau$

# BARTH MODEL 6115-BMFP

50  $\Omega$  High Voltage Wide Band Pulse Inverter



Pictured:  
Model 6115-BMFP

## Specifications

<b>Voltage Ratio:</b>	1/(-1)
<b>Maximum Input:</b>	1kV, 45V $\times$ $\mu$ s Pulse
<b>Impedance:</b>	50 $\Omega$
<b>Risetime:</b>	< 400ps, inverted pulse > 98% at 1 $\mu$ s
<b>Bandwidth (-3dB):</b>	700MHz
<b>Droop:</b>	<10% at 1 $\mu$ s
<b>Reflection-TDR:</b>	< 4% to a 500ps risetime step function
<b>Connectors:</b>	BNC Male/Female
<b>Dimensions:</b>	2.8" long x 0.725" diameter
<b>Weight:</b>	2 oz.



# BARTH MODEL 621A-GLP, 621A-MFP, 621-NFP

50 Ω High Voltage Wide Band Pulse Inverter



Pictured:  
Model 621A-GLP

## Specifications

<b>Voltage Ratio:</b>	1/(-1)
<b>Maximum Input:</b>	2kV, 250Vxμs Pulse
<b>Impedance:</b>	50 Ω
<b>Risetime:</b>	< 70ps, inverted pulse > 94% at .5ns
<b>Bandwidth (-3dB):</b>	5GHz
<b>Droop:</b>	2% at100ns
<b>Reflection-TDR:</b>	< 5% to a 100ps risetime step function
<b>Connectors:</b>	621A-GLP : GR 874 locking 621A-MFP : SMA Female 621-NFP : N Female
<b>Dimensions:</b>	621A-GLP : 7.12" x 1.5" dia. 621A-MFP : 7.12" x 1.5" dia. 621-NFP : 6" x 1.5" dia.
<b>Weight:</b>	1 lb.



# BARTH MODEL 652-NFP HIGH VOLTAGE WIDE BAND BALUN

50  $\Omega$  Balun with (+) and (-) N Female Inputs



Pictured:  
Model 652-NFP

## Specifications

**Voltage Ratio:** 1.0 when used as a differential combiner

**Maximum Input:**  
 650A-NFT :  $\pm 300V$ , 100ns (30Vx $\mu$ s)  
 651-NFP :  $\pm 1kV$ , 500ns (500Vx $\mu$ s)  
 652-NFP :  $\pm 100V$ , 100ns (100Vx $\mu$ s)

**Impedance:** 50  $\Omega$

**Risetime:**  
 650A-NFT < 60ps  
 651-NFP < 90ps  
 652-NFP < 50ps

**Bandwidth (-3dB):**  
 650A-NFT : 8.75GHz  
 651-NFP : 3.8GHz  
 652-NFP : 3.5GHz

**Droop:**  
 650A-NFT : 5.0% at 100ns  
 651-NFP : 0.5% at 100ns  
 652-NFP : 1.5% at 100ns

**Voltage Coefficient:** < 1% at rated voltage

**Connectors:** N Female

**Dimensions:** 7.12" x 2.25" dia.

**Weight:** 1.8 lbs.



## High Voltage Pulse Generators

# BARTH MODEL 731

The Model 731 high voltage pulse generator provides pulses of < 200ps risetime, 500V through 3kV amplitude, to drive into any load impedance through 50  $\Omega$  coax.

The generator is capable of a minimum pulse width of 1.5ns and a maximum of 400ns. The rectangular output pulse width is determined by charge line length. HPM, impulse driven antennas, dry run simulation, and HV pulse testing are just a few of the uses for this HV pulse generator. The unit comes standard with one 10ns charge line, and one additional charge line up to 100ns of customer's choice.

Pictured:  
Model 731



## Specifications

<b>Output Pulse:</b>	<200ps risetime at all output voltages
<b>Output Amplitude:</b>	Continuously adjustable from 500 volts output to 3kV output
<b>Output Pulse Rep Rate:</b>	Single pulse / internal repetitions / external trigger modes, Internal mode adjustable from >20 sec between pulses to 10Hz repetition rate
<b>Trigger Input:</b>	5V at 1mA through a grounding switch, or a 1V, 1 $\mu$ s input trigger pulse
<b>Mechanical Switch Life:</b>	Average life is 3,000,000 pulses at 2kV/400ns pulse width
<b>Connectors:</b>	HN Female for output and charge line
<b>Input Power:</b>	90-135 VAC 2.5A, 175-264 VAC 1.8A, 50-60Hz Input selection is automatic; no manual change is required Input power supply is approved to the latest version of the following safety standards: UL/CSA 60950-1, EN 62368-1; and IEC 62368-1
<b>Dimensions:</b>	19" wide (rack mount) x 5.25" high x 15" deep
<b>Weight:</b>	24 lbs.
<b>Accessories:</b>	464-HMP-5ns                      5ns charge line 464-HMP-10ns                    10ns charge line 464-HMP-20ns                    20ns charge line 464-HMP-50ns                    50ns charge line 464-HMP-100ns                   100ns charge line 464-HMP-200ns                   200ns charge line 464-HMP-400ns                   400ns charge line Any value from 1.5ns to 400ns available
<b>Note:</b>	Contact us for additional information or to discuss your application.



# BARTH MODEL 733

The Model 733 high voltage pulse generator provides pulses of < 200ps risetime, 500V through 5kV amplitude, to drive into any load impedance through 50 Ω coax.

The generator is capable of a minimum pulse width of 1.5ns and a maximum of 400ns. The rectangular output pulse width is determined by charge line length. HPM, impulse driven antennas, dry run simulation, and HV pulse testing are just a few of the uses for this HV pulse generator. Unit comes standard with one 10ns charge line, and one additional charge line up to 100ns of customer's choice.

Pictured:  
Model 733



## Specifications

<b>Output Pulse:</b>	< 200ps risetime at all output voltages																
<b>Output Amplitude:</b>	Continuously adjustable from < 500 output to 5kV output																
<b>Output Pulse Rep Rate:</b>	Single pulse / internal repetitions / external trigger modes; Internal mode adjustable from > 20 sec between pulses to 10Hz repetition																
<b>Trigger Input:</b>	5V at 1mA through a grounding switch, or a 1V, 1μs input trigger pulse																
<b>Mechanical Switch Life:</b>	3,000,000 pulses at 2kV/400ns pulse width (switch life is energy dependent)																
<b>Connectors:</b>	HN Female for output and charge line																
<b>Input Power:</b>	90-135 VAC 2.5A, 175-264 VAC 1.8A, 50-60Hz Input selection is automatic; no manual change is required Input power supply is approved to the latest version of the following safety standards: UL/CSA 60950-1, EN 62368-1; and IEC 62368-1																
<b>Dimensions:</b>	19" wide (rack mount) x 5.25" high x 15" deep																
<b>Weight:</b>	24 lbs.																
<b>Accessories:</b>	<table><thead><tr><th>Model:</th><th>Description:</th></tr></thead><tbody><tr><td>464-HMP-5ns</td><td>5ns charge line</td></tr><tr><td>464-HMP-10ns</td><td>10ns charge line</td></tr><tr><td>464-HMP-20ns</td><td>20ns charge line</td></tr><tr><td>464-HMP-50ns</td><td>50ns charge line</td></tr><tr><td>464-HMP-100ns</td><td>100ns charge line</td></tr><tr><td>464-HMP-400ns</td><td>400ns charge line</td></tr><tr><td>Any Value from 1.5ns to 400ns available</td><td></td></tr></tbody></table>	Model:	Description:	464-HMP-5ns	5ns charge line	464-HMP-10ns	10ns charge line	464-HMP-20ns	20ns charge line	464-HMP-50ns	50ns charge line	464-HMP-100ns	100ns charge line	464-HMP-400ns	400ns charge line	Any Value from 1.5ns to 400ns available	
Model:	Description:																
464-HMP-5ns	5ns charge line																
464-HMP-10ns	10ns charge line																
464-HMP-20ns	20ns charge line																
464-HMP-50ns	50ns charge line																
464-HMP-100ns	100ns charge line																
464-HMP-400ns	400ns charge line																
Any Value from 1.5ns to 400ns available																	



# BARTH MODEL 781

## 3.12 To 1600 kV/μs Into 50 Ω Loads

### Features:

- ③ Interactive control allows the user to gradually increase or decrease the dV/dt rate applied to a DUT
- ③ Stepped mode features user adjustable constant voltage and 14 stepped dV/dt selections
- ③ Variable dV/dt mode features a more continuously variable dV/dt selectable by the user
- ③ 3.12-1600kV/μs can be delivered into 50 Ω loads
- ③ 6.25-3200kV/μs can be realized into high impedance loads
- ③ Touch screen interface allows quick interactive and intuitive control
- ③ Internal rate and external triggering capability
- ③ Designed for Common-Mode Transient Immunity (CMTI) testing
- ③ Optional exponential decay pulse shape module with 50 Ω termination
- ③ Provision for external switch interlock
- ③ One year warranty on the entire system



### Description:

The Barth Common Mode Transient (CMT) Generator was developed for CMTI (CMT immunity) characterization testing. The generator test system combines our 3kV Pulse Generator and Barth Multi Ramp Generator to produce high voltage, selectable fixed rate linear rise ramp pulses.

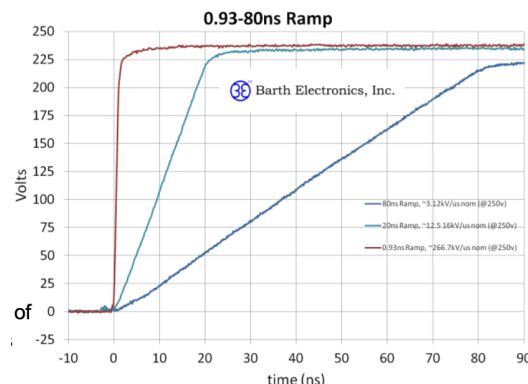
### How It Works

The Barth Model 781 CMT Generator produces a fast rise time high voltage rectangular pulse, which is then passed through an internal Barth Multi Ramp generator module to create a linear ramp.

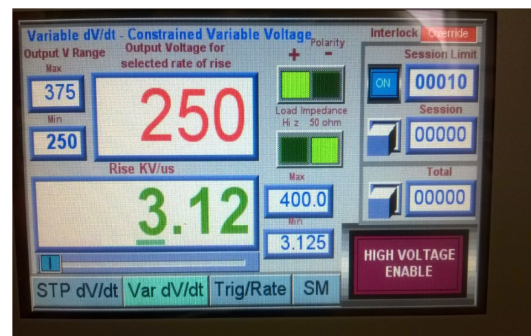
### Operation

Quick interactive and intuitive control of the generator operational parameters is provided via a touch screen interface. The test system provides interactive control of the two variables that define the dV/dt rate, the pulse voltage and ramp rate, to achieve specific kV/μs rate pulses. The control also allows the user to interactively increase or decrease the dV/dt rate that is applied to the DUT.

The two basic operational modes are the “STP” stepped mode, which features user adjustable voltage and 14 stepped dV/dt selections based on the 14 fixed ramp rates, and the “VAR” variable dV/dt mode, which features a more continuously variable dV/dt selectable by the user. This mode is accomplished by varying the output voltage within an output voltage range and jumping to the next ramp selection as required automatically.



Samples of 0.93ns, 20ns, and 80ns ramp output showing Leading edge of pulse into matched 50 ohm load



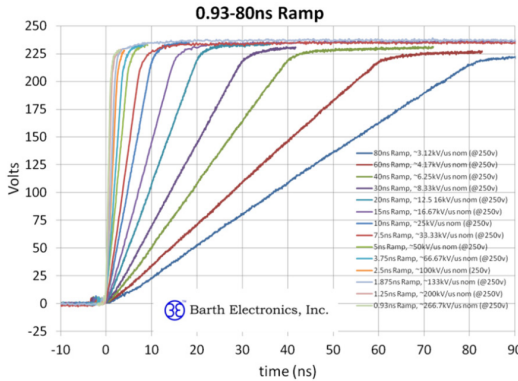
“VAR” variable dV/dt mode shown features a continuously variable dV/dt selectable by the user.



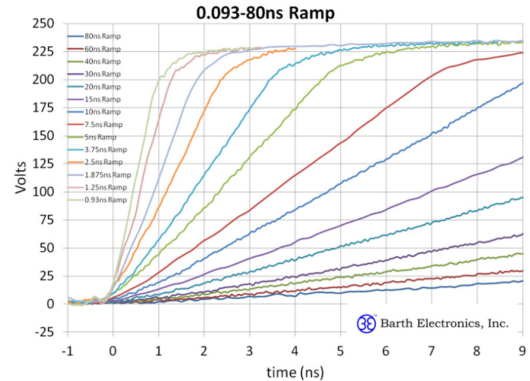
# BARTH MODEL 781 ~ cont.

## System Components:

- ⊗ Barth 781 High Voltage Fast Rise Time Pulse Generator
- ⊗ Internal 100ns Pulse Charge line
- ⊗ Output cable trigger tap off interconnect cables
- ⊗ Optional Exponential decay Pulse shape module with integrated 50 ohm termination



Sample pulse outputs showing Leading edge of pulse into matched 50 ohm load for all 14 ramp selections.



Same Sample Pulse Outputs with expanded time scale.

## Specifications:

- ⊗ 3.12-1600kV/μs delivered into 50 Ω loads
- ⊗ 6.25 to 3200kV/μs can be realized into high impedance loads.
- ⊗ 'N' Female output Connector.
- ⊗ 90V-230V, Input Power.

## Operation (cont.)

Specific kV/μs rate pulses between 3.12 and 1600kV/μs can be achieved into 50 Ω loads. Rates between 6.25 and 1600kV/μs can be realized into high impedance loads.

The fall time mirrors the risetime and, with optional pulse shape module, a long exponential decay fall time is also available.

## Pulse Rate and Triggering

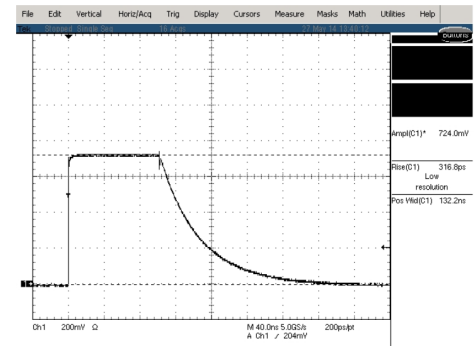
The pulse rate and triggering is similar to the 731/733 pulse generator, including internal triggering for single shot or repetitive pulsing. Repetition rates to 10Hz are selectable. External triggering capability is also included.

## Interlock

The interlock provision provides a means to prevent pulsing when a test fixture with a lid or other movable safety is employed. This requires a switch on the fixture that will close to indicate the closed lid position.

## Size/Weight

- ⊗ ≈ 19" wide x 11" high x 21" deep
- ⊗ ≈ 55 lbs.
- ⊗ Output compliant with IEC....specifications.



Fast Ramp with Pulse Shape module (adds Exponential decay on falling edge) into matched 50 ohm load.



# BARTH MODEL 781 ~ cont.

Model	Description
	<b>781 CMT Pulse Generator Includes:</b>
	CMT Pulse Generator with 100ns Charge Line (Internal to CMT Box)
SF126-A/11N/11N -1M	Output Pulse Cable, N Male-N Male 1M Low Loss Cable
CA223BM-BM-30	Trigger Output Cable, BNC Male-BNC Male 30" RG-223
326-ILC-3	Interlock Cable 3 pin DIN plugs
TB3M	DIN Interlock Receptacle -for Customer Interlock Circuit
BITSB	Barth Interlock Test - Switch Box - for Interlock Function Test
n/a	Power Cord
n/a	781 User's Manual
	<b>781 CMT Options:</b>
<b>781-PS</b>	<b>Pulse Shaper Option Includes:</b>
5150A	Pulse Shaper Module with Integrated 50 $\Omega$ HV Pulse Terminator
CA401-NM-NM-420	50ns Delay Line for High Impedance Measurement
<b>IE</b>	<b>Interlock Enclosure Options:</b>
781-IES	Interlock Enclosure Box, Small (holds up to 6" x 9" test boards)
CA223-BM-NM-10	IE Input to DUT board cable BNC Male-N Male 10" RG-223
781-IEL	Interlock Enclosure Box, Small (holds up to 10" x 13" test boards)
CA223-BM-NM-10	IE Input to DUT board cable BNC Male-N Male 10" RG-223
<b>781-DM</b>	<b>Direct Monitor Option Includes:</b>
CA223-NM-BM-15	DUT to Attenuator Cable N Male-BNC Male 15" RG-223
422-NFF	N Female-N Female Adapter
142-NMFP-20B	(Qty. 2) 20dB (10:1VR) High Voltage Pulse Attenuators
NMBF	N Male-BNC F Adapter
FMAT7437-20	BNC 20dB Attenuator
CA223BM-BM-15	Attenuator to scope cable BNC Male-BNC Male 15" RG-223
<b>781-RC</b>	<b>Remote Control Capability</b>
n/a	USB Interface Remote Control Software
CSMUAB-5M	USB A-B Cable
<b>781-2:1</b>	<b>2:1 Option – Provides 125V-750V Operation Capability</b>
142-NMFP-6B	6dB (2:1VR) High Voltage Pulse Attenuator
<b>781-10:1</b>	<b>10:1 Option - Provides 25V-150V Operation Capability</b>
142-NMFP-20B	20dB (10:1VR) High Voltage Pulse Attenuator



# BARTH MODEL 790

## 0 TO $\pm 200V$ Transient Pulse Generator

This is a combined latch up sensitivity tester and a power supply load response tester. The generator uses a mechanical reed switch and a custom network to create the single clean fast risetime transient pulses. The power supply test alternates a resistive load on a power supply between 510  $\Omega$  and 10  $\Omega$  to allow observation of supply recovery parameters.



Pictured:  
Model 790



# ULTRA LINEAR RAMPS

## Extremely Linear kV Ramps Any Ramp Time, Any Voltage (mV to kV)

Barth Electronics's latest invention turns step functions into ramp functions

These ramps are generated by special circuits we have developed that convert a rectangular pulse into a ramp. This is accomplished with 50  $\Omega$  impedance circuits that allow ordinary cables and connectors to deliver the ramp with minimal distortion.

### SELECTABLE RAMP RATES

Rates are selectable in 2:1 steps. Steps can be made very small or very large to fit the application.

These ramps are generated by special circuits we have developed that convert a rectangular pulse into a ramp. This is accomplished with 50 ohm impedance circuits which allow ordinary cables and connectors to deliver the ramp with minimal distortion.

### ANY VOLTAGE / POLARITY

The maximum voltage we have used in our ramp circuits has typically been 5kV. Higher voltage ramps to 100kV or above can be built. HN connectors will allow peak voltages to about 15kV, while our BE 100 connector will allow peak voltages reaching 100kV.

Ramp times from picoseconds to microseconds can be built for step function input. Note that the ramp time is independent of the pulse voltage, so various dV/dt rates can easily be generated by varying the pulse voltage.

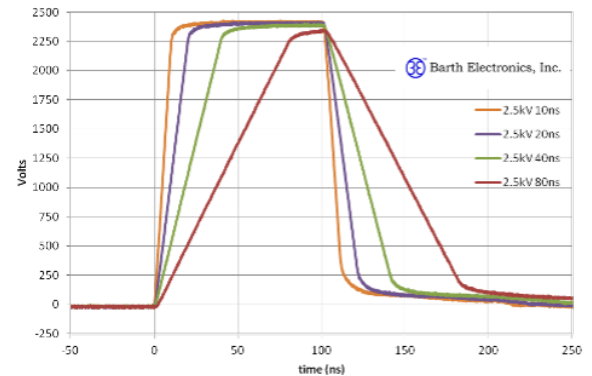
### EXTREMELY LINEAR

Linearity is only limited near the top by whatever rounding of the step function is present. The 10ns flat top of the pulses shown have the same rounding as the pulse source. Better than 1% linearity is possible with this invention.

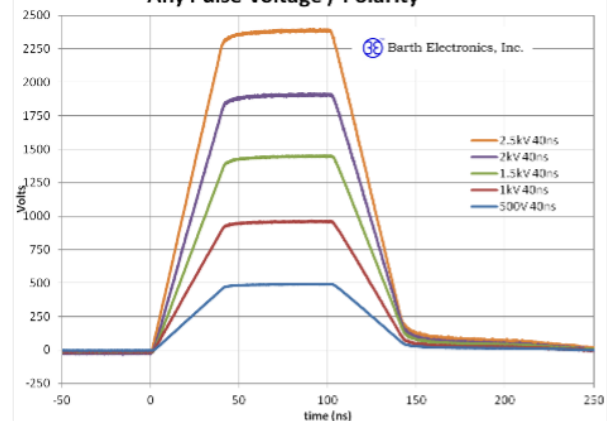
This ramp generator design is very scalable, allowing fast to slow ramp rates in 2:1 steps, and outputs from very low voltages to very high voltages, positive and negative polarity, limited only by the connector and cable capabilities.

*The waveforms shown were produced using our prototype ramp generator system which was driven by our Model 731 pulse generator. Measurements were made on a Tektronix TDS-6604 6GHz scope.*

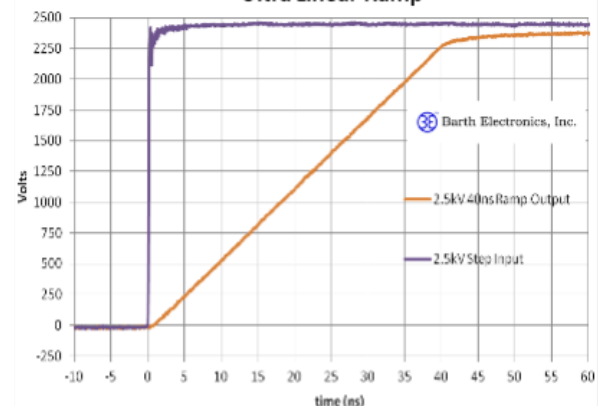
Selectable Ramp Rates



Any Pulse Voltage / Polarity



Ultra Linear Ramp



## 1GHz Risetime Filter

# BARTH MODEL 1090-350NF

This model is designed to be connected in series with the input of a TEK SCD 5000 digitizer to spoil the waveform to what would be observed on a TEK 7104 oscilloscope. This filter enables the SCD 5000 user to obtain directly comparable waveforms on the SCD 5000 without need of a 7104, thus enabling supplier and user to obtain comparable results for various testing scenarios.

Special Barth construction techniques utilized in this risetime filter have been developed over the past 31 years designing products for government laboratories in time domain applications.

Pictured:  
Model 1090-350NF



## Specifications

<b>Impedance:</b>	Input	50.0 $\Omega$ $\pm$ 5%
	Output	50.0 $\Omega$ $\pm$ 5%
<b>Risetime:</b>	Input	90ps
	Output	350ps
<b>Connectors:</b>	Input	Type N Female (jack) connector
	Output	Type N Female (jack) connector*
<b>Dimensions:</b>	Length:	3.625"
	Width:	1.5" body, 3-3/8" across connectors w/Male to Male adapters
	Height:	1.25
<b>Weight:</b>	< 1/2 lb., 226 g.	

## Advantages

- ⊕ Get 7104 comparable data from your SCD 5000
- ⊕ Easily connects to the SCD 5000 input, in series with the input signal
- ⊕ Get instant waveform data without mathematical or software waveform conversions

## Note

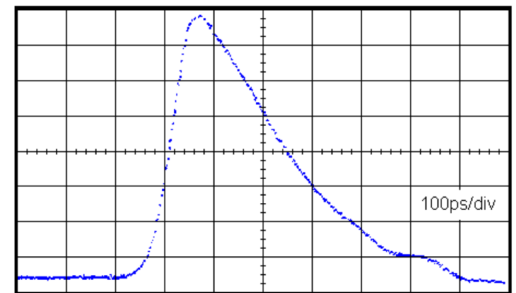
\*Supplied with N Male (plug) to N Male (plug) adapter for direct connection to the SCD 5000 input connector.



## BARTH MODEL 3004A

The Model 3004A is a 50  $\Omega$  impedance time domain antenna used to make measurements directly in the time domain. Use of this antenna for transmitting and receiving allows simple calculations of impulse amplitudes and risetimes. This direct method of measurement avoids the transformation between the frequency and time domains and minimizes the errors that can arise when basic assumptions are made about a radiating source. We have found time domain measurements to be much more reliable when made with this time domain antenna to eliminate frequency domain conversions.

The antenna has a balanced 50  $\Omega$  construction to allow maximum bandwidth and minimum reflection, fed with an integral 50  $\Omega$  wide band balun to allow the direct connection between the balanced antenna structure and ordinary coaxial line.



The good balun prevents off-axis radiation errors from unbalanced currents when used either for transmitting or receiving. The pulse response between two identical antennas is included below and shows a 75.6ps risetime followed by a slow decay. One antenna was fed with a 50ps risetime step function of 5ns. The pulse length generated by our Model 731 reed switch pulse generator fed through low loss BFT4 coax for minimal pulse distortion. The very flat top from this pulse generator minimizes additional distortion of the antenna pulse decay after the initial rise.

The Model 3004A receiving antenna was fed directly into to a HP 54120A digital sampling oscilloscope through low loss coax. A pulse response through two antennas was 75.6ps or, for each antenna, an individual risetime of about 53.5ps. The pulse decay through the pair of antennas to 50% amplitude was about 242ps. The antennas were spaced 20 feet apart for this measurement, and the pulse response would be slightly better at wider separations.

The antenna framework is 48 inches long by 39 inches wide by 15 inches high. The complete antenna weighs 22 pounds. We are designing some smaller time domain antennas for smaller aperture use at closer spacings. We are also designing some larger time domain antennas with higher directivity/gain for use with air propagation or ground penetrating radar. If you require time domain pulse radiation measurements, our commercial time domain antenna hardware, high voltage pulse generators, and high voltage pulse experience is available for you.



## Connectors/Adapters

### BARTH MODEL 404-HFF

HNB Female to Female adapter specifically designed to maintain high voltage hold off and provide a low reflection coefficient.



#### Specifications

<b>Maximum Input</b>	15kV, 1 $\mu$ s FWHM Pulse
<b>Impedance</b>	50 $\Omega$
<b>Risetime</b>	< 20ps
<b>Reflection-TDR</b>	< 2% at 100ps risetime when mated with Barth HNB connector
<b>Connectors</b>	HNB Female, HNB Female

### BARTH MODEL 404-HMM

HNB Male to Male adapter specifically designed to maintain high voltage hold off and provide a low reflection coefficient.



#### Specifications

<b>Maximum Input</b>	15kV, 1 $\mu$ s FWHM Pulse
<b>Impedance</b>	50 $\Omega$
<b>Risetime</b>	< 20ps
<b>Reflection-TDR</b>	< 2% at 100ps risetime when mated with Barth HNB connector
<b>Connectors</b>	HNB Male, HNB Male

### BARTH MODEL 404-HFNF, 404-HMNM

404-HFNF: HNB Female to N Female adapter specifically designed to maintain high voltage hold off and provide a low reflection coefficient.



404-HMNM: HNB Male to N Male adapter specifically designed to maintain high voltage hold off and provide a low reflection coefficient.

#### Specifications

<b>Maximum Input</b>	4kV, 1 $\mu$ s FWHM Pulse
<b>Impedance</b>	50 $\Omega$
<b>Risetime</b>	< 20ps
<b>Reflection-TDR</b>	< 2% at 100ps risetime when mated with Barth HNB connector
<b>Connectors</b>	404-HFNF HNB Female, N Female 404-HMNM HNB Male, N Male

### BARTH MODEL 444-HMSP

HN Male to SHV Plug Adapter



#### Specifications

<b>Maximum Input</b>	10kV
<b>Impedance</b>	50 $\Omega$
<b>Reflection-TDR</b>	$\pm$ 5% at 100ps
<b>Connectors</b>	HN Male to SHV Plug



## Connectors/Adapters

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### BARTH MODEL 472-HMNF

HN Male to N Female Adapter

Specifications

**Maximum Input** 4kV, 1 $\mu$ s FWHM Pulse

**Impedance** 50  $\Omega$

**Connectors** HN Male, N Female

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### BARTH MODEL 423-NMMF

N Male to SMA Female Adapter  
1.5kV DC



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### BARTH MODEL 423-NMMM

N Male to SMA Male Adapter  
1.5kV DC



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### BARTH MODEL 421-NMM

N Male to N Male Adapter 3kV  
DC



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### BARTH MODEL NFBM

N Female to BNC Male Adapter  
3kV DC



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### BARTH MODEL 422-NFF

N Female to N Female Adapter  
3kV DC



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### BARTH MODEL NMBF

N Male to BNC Female Adapter  
3kV DC



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### BARTH MODEL 423-NFMM

N Female to SMA Male Adapter  
1.5kV DC



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### BARTH MODEL 423-NFMF

N Male to SMA Female Adapter  
1.5kV DC





## Connectors/Adapters 0874 Series

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### GR TO N ADAPTERS

0874-9710

GR 874 non-locking/N Female

0874-9711

GR 874 locking/N Female

0874-9810

GR 874 non-locking/N Male

0874-9811

GR 874 locking/N Male



### GR TO BNC ADAPTERS

0874-9700

GR 874 non-locking/BNC Female

0874-9701

GR 874 locking/BNC Female

0874-9800

GR 874 non-locking/BNC Male

0874-9801

GR 874 locking/BNC Male



### GR TO SMA ADAPTERS

0874-QMMP

GR 874 to SMA Male

0874-QMMJ

GR 874 to SMA Female

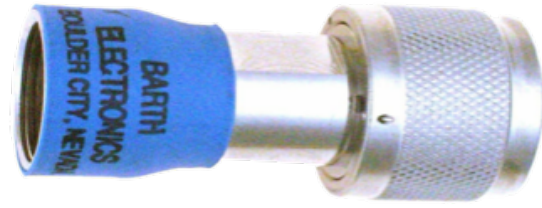


## Connector/Adapters High Voltage Pulse

# BARTH MODEL 401-HNB, 402-HNB, 401-371

Model 401-HNB Male cable connector for RG214/U coax;  
designed for low reflection coefficient

Model 402-HNB Female cable connector for RG214/U coax;  
designed for low reflection coefficient



Pictured: Model 401-HNB

## Specifications

**Maximum Input:** 15kV, 1 $\mu$ s FWHM Pulse

**Impedance:** 50  $\Omega$

**Reflection-TDR:** < 4% at 100ps risetime

**Risetime:** < 20ps

For optimum reflection, the use of Model 401-371 connector installation tool is suggested.

Model 401-HNB or 402-HNB cable connectors are also available assembled onto a user specified length of RG214/U coax (standard length is 1 meter).

## Barth Model 401-371 Trim Tool



This kit is used for preparing RG214/U coax for installation of a 401-HNB / 402-HNB cable connector.

For best pulse response, Barth Model 401-HNB Male or 402-HNB Female cable connector for RG214/U coax should be used for interconnection.



# MODEL 454-381 HNB TRIM TOOL

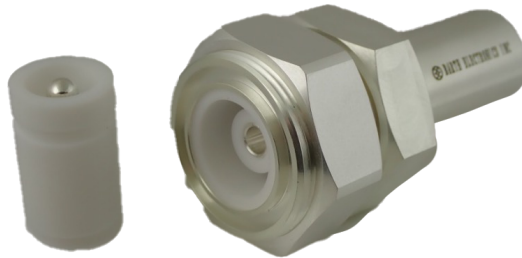
The Model 454-381 HNB trim tool is used for preparing RG214/U coax for installation of the Barth 454-BE cable connector.

Our type 454-BE connectors are specially designed to obtain minimum reflection coefficient for fast risetimes and best pulse response.



# BARTH MODEL 454-BE CONNECTOR

This connector is for use with RG214 coax.



Pictured:  
Model 454-BE Connector

## Specifications

<b>Maximum Input:</b>	30 kV DC, 100 kV, 20ns FWHM
<b>Average Input Power:</b>	1kW @ 1GHz
<b>Impedance:</b>	50 $\Omega$ $\pm$ 1%
<b>Risetime Through Unit:</b>	< 100ps
<b>Bandwidth:</b>	DC-7.0GHz
<b>Reflection-TDR:</b>	< 4% to a 100ps risetime step
<b>Connectors:</b>	Barth BE, RG-214 pigtail unterminated
<b>Dimensions:</b>	(Connector) approx. 1.6" dia. x 4" long
<b>Weight:</b>	$\approx$ 1 lb. (connector + 1M RG-214 coax)



# BARTH MODEL XXX-BE CONNECTOR

The Barth XXX-BE Connector is for use with TBD coax.



Pictured:  
Model XXX-BE Connector

## Specifications

<b>Maximum Input:</b>	40 kV DC, 100 kV, 20ns FWHM
<b>Average Input Power:</b>	1kW @ 1GHz
<b>Impedance:</b>	50 $\Omega$ $\pm$ 1%
<b>Risetime Through Unit:</b>	< 100ps
<b>Bandwidth (-3dB):</b>	DC-7.0GHz
<b>Reflection-TDR:</b>	< 4% to a 100ps risetime step
<b>Connectors:</b>	Barth BE, RG-214 pigtail unterminated
<b>Connector Dimensions:</b>	$\approx$ 1.6" dia. x 4" long
<b>Weight:</b>	$\approx$ 1 lb. (connector + 1M RG-214 coax)

Additional connectors coming.



# Cable Assemblies - RG214/U Barth Model 463 Series

## DESCRIPTION

Low loss coaxial cable with double shield. 50  $\Omega$  Impedance. Available configurations shown

NOTE: Base price assemblies include up to one meter in length of RG214/U coax.

Longer length assemblies are available.

*(Continued on next page)*

## Cable Assemblies

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### **RG214/U**

Low loss coaxial cable with double shield. 50  $\Omega$  impedance. Available configurations shown (Barth Model 463 Series).

NOTE: Base price assemblies include 1 meter in length of RG214/U coax. Longer length assemblies are available.

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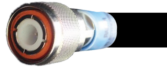
### **BARTH MODEL 463-HFP**

One 402-HNB Female connector assembled on RG214/U coax; maximum voltage specification is 15kV DC.



### **BARTH MODEL 463-HMP**

One 401-HNB Male connector assembled on RG214/U coax; maximum voltage specification is 15kV DC.



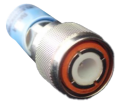
### **BARTH MODEL 463-HMFP**

One 401-HNB Male connector and one 402-HNB Female connector assembled on RG214/U coax; maximum voltage specification is 15kV DC.



### **BARTH MODEL 463-HMMP**

One HN Male connector assembled on each end of RG214/U coax; maximum voltage specification is 3kV DC.



### **BARTH MODEL 463-NMMP**

One N Male connector assembled on each end of RG214/U coax; maximum voltage specification is 3kV DC.



# High Voltage Signal/Trigger Tap Offs

## DESCRIPTION

Barth High Voltage Resistive Signal Tap Offs are useful for signal monitoring or device triggering. They are constructed using our voltage probes incorporated into a unit with connectors to allow easy insertion into a coaxial system. This arrangement is very useful in a laboratory setup, and for system monitoring.

### High Voltage Resistive Signal / Trigger Tap Off Model Comparison

Model	Maximum Input*		Risetime through mainline ps	Voltage Ratio Tap Off	Risetime of Resistive Output	Connectors
	Maximum Peak Voltage	@ Pulse width ns				
241-NMFFP-11	2,500	400	< 30	11:1	<60ps	N male/female mainline
245-NMFFP-100	2,500	400	< 30	100:1	<60ps	N female tap off
242-GLBFP-100	5,000	400	< 30	100:1	<900ps	GR874 locking mainline/BNC female tap off
242-GLBFP-50	5,000	400	< 30	50:1	<400ps	GR874 locking mainline/BNC female tap off
242-GLBFP-25	5,000	400	< 30	25:1	<215ps	GR874 locking mainline/BNC female tap off
243-HMFNFP-100	15,000	2 $\mu$ S	< 30	100:1	<1.5ns	HNB male/female

## NOTES

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or Model 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

\* Please refer to the Technical Specifications (Maximum Input Limitations) page for a full explanation of voltage and pulse width ratings.

## High Voltage Signal/Trigger Tap Offs

# BARTH MODEL 241-NMFFP-11, 245-NMFFP-100

This high voltage resistive signal tap off is useful for signal monitoring or device triggering.

Pictured:  
Model 241-NMFFP-11



## Specifications

<b>Voltage Ratio:</b>	241-xxx-11 :	
	Mainline	1:1 into a 50 $\Omega$ load
	Tap Off	11:1 into a 50 $\Omega$ load
	245-xxx-100 :	
	Mainline	1:1 into a 50 $\Omega$ load
	Tap Off	100:1 into a 50 $\Omega$ load
<b>Maximum Input:</b>	2.5kV @ 400ns rectangular pulse on mainline*	
<b>Peak Input Power:</b>	125kW at rated pulse width	
<b>Average Input Power:</b>	1W maximum	
<b>Mainline Risetime:</b>	< 30ps	
<b>Tap Off Risetime:</b>	241-xxx-11	< 60ps
	245-xxx-100	< 60ps
<b>Bandwidth (-3dB):</b>	241-xxx-11	Tap off 5GHz, mainline 10GHz
	245-xxx-100	Tap off 5GHz, mainline 10GHz
<b>Impedance:</b>	241-xxx-11	50 $\Omega$ with 450 $\Omega$ tap off
	241-xxx-100	50 $\Omega$ with 4950 $\Omega$ tap off
<b>Voltage Coefficient:</b>	< 1% at rated voltage	
<b>Connectors:</b>	241-NMFFP-xxx	Tap off output N Female
	245-NMFFP-xxx	Mainline N Male/Female
	241-GLNFP-xxx	Mainline GR 874 locking tap off Output N Female
<b>Dimensions:</b>	$\approx$ 3 9/16" wide (9.1 cm) x 2 3/8" high (6.0 cm) x 3/4" deep (1.9 cm)	
<b>Weight:</b>	1/2 lb.	

## Advantages

- ⊗ High voltage pulse rated
- ⊗ N mainline and tap off connectors
- ⊗ Wide bandwidth

## Note

Other configurations-voltage ratio/tap off can be obtained.

User must specify desired tap off voltage ratio or resistance value, voltage, and risetime requirements.

BNC Female is optionally available for tap off connector.

The risetime and voltage specifications are dependent on, and in some cases limited by, the resistance value selected.

\* Maximum rating requires mainline be terminated into 50  $\Omega$ .



## High Voltage Signal/Trigger Tap Offs

### BARTH MODEL 242-SPJBFP-25, 50, 100 & BARTH MODEL 242-GLBFP-25, 50, 100

This high voltage resistive signal tap off is useful for signal monitoring or device triggering on a coaxial cable system.

Pictured:  
Model 242-SPJBFP-50  
Model 242-GLBFP-100



## Specifications

**Voltage Ratio:** 1:1 mainline, into a 50  $\Omega$  load  
242-xxxxx-25 : 25/1 (27.96dB) into a 50  $\Omega$  load  
242-xxxxx-50 : 50/1 (33.98dB) into a 50  $\Omega$  load  
242-xxxxx-100 : 100/1(40dB) into a 50  $\Omega$  load

**Maximum Input:** 5kV, 400ns FWHM Pulse\*

**Peak/Average Input Power:** 500kW at rated pulse width, 1W maximum\*  
\* Maximum rating requires mainline be terminated into 50  $\Omega$ .

**Impedance:** 242-xxxxx-25 : 50  $\Omega$  with 1200  $\Omega$  tap off  
242-xxxxx-50 : 50  $\Omega$  with 2450  $\Omega$  tap off  
242-xxxxx-100 : 50  $\Omega$  with 4950  $\Omega$  tap off

**Tap Off Risetime:** < 30ps

**Bandwidth (-3dB):** 242-xxxxx-25 < 215ps 1.6GHz  
242-xxxxx-50 < 400ps 870MHz  
242-xxxxx-100 < 900ps 450MHz

**Voltage Coefficient:** < 1% at rated voltage

**Reflection-TDR:** < 3% to a 100ps risetime step function

**Connectors:** 242-SPJBFP-xx :  
Mainline SHV Plug/SHV Jack,  
GHV Male/Female - BNC Tap Off  
242-GLBFP-xx :  
Mainline GR 874 locking, N Male/Female,  
HN Male/Female - BNC Tap Off

**Dimensions:** 242-SPJBFP-xx :  
 $\approx$  5.6" long x 2.25" wide x 0.78" high  
242-GLBFP-xx :  
 $\approx$  3.6 long x 2.2" wide x 1" high

**Weight:** 242-SPJBFP-xx :  $\approx$  8 oz.  
242-GLBFP-xx :  $\approx$  5 oz.



## High Voltage Signal/Trigger Tap Offs

# BARTH MODEL 243-HMFNFP-100

A high voltage resistive signal tap off is useful for signal monitoring or device triggering.

Pictured:  
Model 243-HMFNFP-100

## Specifications

<b>Voltage Ratio:</b>	Mainline	1:1, into a 50 $\Omega$ load
	Tap Off	100:1(40dB), into a 50 $\Omega$ load
<b>Maximum Input:</b>	15kV, 2 $\mu$ s FWHM Pulse *	
<b>Peak Input Power:</b>	4.5MW at rated pulse width *	
<b>Average Input Power:</b>	1W maximum	
<b>Risetime:</b>	Mainline	< 30ps
	Tap Off	< 1.5ns
<b>Bandwidth (-3dB):</b>	Tap off 250MHz, Mainline 10GHz	
<b>Impedance:</b>	50 $\Omega$ with 5k $\Omega$ tapoff **	
<b>Voltage Coefficient:</b>	< 1% at rated voltage	
<b>Connectors:</b>	Mainline HN Male/Female, Tap off output N Female *	
<b>Dimensions:</b>	$\approx$ 3 3/4" (9.5 cm) wide x 3" (7.6 cm) high x 3/4" (1.9 cm) deep	
<b>Weight:</b>	$\approx$ 5/8 lb.	



## Advantages

- ⊕ High Voltage pulse rated
- ⊕ HN Mainline Connectors

## Note

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or Model 402-HNB Female cable connector for RG214/U coax should be used for interconnection; available in our Pulse Catalog.

Other configurations-voltage ratio/tap off can be obtained. User must specify desired tap off voltage ratio or resistance value, voltage and risetime requirements, and desired sampled signal output connector. N Female and BNC Female are currently available.

The risetime and voltage specifications are dependent on, and in some cases limited by, the resistance value selected.

\* Maximum rating requires mainline be terminated into 50  $\Omega$ .

\*\* This provides 1/100 of the amplitude of the mainline voltage on the sampled signal output connector.



# Wide Band High Voltage Transformers

## DESCRIPTION

### *Transformer Component Model Comparison*

#### Signal Pickoffs

Model	Maximum Peak Voltage	Maximum Input*		Risetime through unit mainline ps	Risetime of coupled Output ps	Connectors
		Energy without saturation	Reflection coefficient at 100ps $\tau$			
CT5-GLP	5,000	800V $\times\mu$ s	< 5%	< 70	350	GR 874 locking
CT5-GLBFIP	5,000	800V $\times\mu$ s	< 5%	< 70	350	GR 874 locking Mainline/BNC female isolated
CT6-NFP-8	4,000	135V $\times\mu$ s	< 5%	< 70	< 300	N female
CT20B-HFNFP-20	15,000	1,300V $\times\mu$ s	< 5%	< 70	<170	HN female mainline/N female output
CT20B-HFNFP-8	15,000	135V $\times\mu$ s	< 5%	< 70	300	HN female mainline/N female output**

## NOTES

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB connector or Model 402-HNB female cable for RG214/U coax should be used for interconnection.

\* Please refer to the Technical Specifications (Maximum Input Limitations) page for a full explanation of voltage and pulse width ratings.

\*\* Input Reflection Coefficient rated at 500 ps $\tau$

# BARTH MODEL CT5-GLP, CT5-GLBFIP

High Voltage 50 Ω Transformer Coupled Signal Pickoff

Pictured:  
Model CT5-GLBFIP



## Specifications

<b>Voltage Ratio:</b>	10.0/1	
<b>Maximum Input:</b>	5kV, 800Vxμs Pulse	
<b>Impedance:</b>	50 Ω	
<b>Risetime:</b>	Mainline	< 70ps
	Tap Off	< 350ps
<b>Droop:</b>	< 5% at 1μs	
<b>Bandwidth (-3dB):</b>	Mainline	5GHz
	Tap Off	1GHz
<b>Reflection-TDR:</b>	< 5% to a 100ps risetime step function	
<b>Connectors:</b>	CT5-GLP	GR 874 locking
	CT5-GLBFIP	GR874 locking mainline, BNC Female isolated output
<b>Dimensions:</b>	4" long x 3.150" wide x 1" high	
<b>Weight:</b>	5/8 lb.	



## Wide Band High Voltage Transformers

# BARTH MODEL CT6-NFP-8

This is a transformer coupled signal pickoff without direct connection to main transmission line.

Pictured:  
Model CT6-NFP-8

## Specifications

<b>Voltage Ratio:</b>	8.0 + 10%, 2ns after 50% amplitude	
<b>Maximum Input:</b>	4kV, 135V $\times$ $\mu$ s Pulse	
<b>Impedance:</b>	50 $\Omega$	
<b>Risetime:</b>	Mainline	< 70ps
	Tap Off	< 300ps
<b>Bandwidth (-3dB):</b>	Mainline 5GHz, tap off 1.2GHz	
<b>Reflection-TDR:</b>	< 5% to a 100ps risetime step function	
<b>Connectors:</b>	N Female	
<b>Dimensions:</b>	2.8" long x 2.5" wide x 1" high	
<b>Weight:</b>	1/2 lb.	



## Wide Band High Voltage Transformers

# MODEL CT20B-HFNFP-20, CT20B-HFNFP-8

This is a high voltage transformer coupled signal pickoff without direct connection to main transmission line.

Pictured:  
Model CT20B-HFNFP-20

## Specifications

<b>Voltage Ratio:</b>	CT20B-HFNFP-20	20.0/1 Vr
	CT20B-HFNFP-8	8.0/1 Vr
<b>Maximum Input:</b>	CT20B-HFNFP-20	15kV, 1300Vx $\mu$ s Pulse
	CT20B-HFNFP-8	15kV, 135Vx $\mu$ s Pulse
<b>Impedance:</b>	50 $\Omega$	
<b>Risetime:</b>	CT20B-HFNFP-20	Mainline < 70ps, tap off < 170ps
	CT20B-HFNFP-8	Mainline < 70ps, tap off < 300ps
<b>Bandwidth (-3dB):</b>	CT20B-HFNFP-20	Mainline 5GHZ, tap off 2GHz
	CT20B-HFNFP-8	Mainline 5GHZ, tap off 1.2GHz
<b>Reflection-TDR:</b>	< 5% to a 100ps risetime step function	
<b>Connectors:</b>	HN Female mainline, N Female tap off output **	
<b>Dimensions:</b>	3" long x 3.3" wide x 1.5" high	
<b>Weight:</b>	1 lb.	



## Note

The response is fairly flat from 40kHz to 950MHz with the -3dB point at 16kHz.

Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast risetimes. For best pulse response, our Model 401-HNB Male or Model 402-HNB Female cable connector for RG214/U coax should be used for interconnection.

Unit is supplied with a Barth Model 404-HMM low reflection Male to Male adapter, so that either the input or output can be adapted to a male connection.

\*\* BNC Female tap off output is optionally available.



# BARTH MODEL CV1A

This precision coaxial current sensor has a completely new patented design providing precise current measurements from sub-nanosecond to microseconds. The complementary voltage and current probe can provide precise measurements of incident and reflected energy for time domain pulses as fast as 30ps. The CV1A is a combination voltage, tap off, and current monitor. This product presently covers the tremendously wide measurement range of 3X10<sup>5</sup>, which can be extended.

Pictured:  
Model CV1A



## Advantages

- ⊕ Highest speed coaxial current sensor available for time domain measurements
- ⊕ Flat pulse response extending to microseconds
- ⊕ Clean response

## Specifications

**Maximum Input:** 2.5kV @ 400ns rectangular pulse on mainline\*

**Peak Input Power:** 125kW at rated pulse width

**Average Input Power:** 1W maximum

**Mainline Risetime:** < 30ps

### VOLTAGE SENSOR

**Voltage Ratio:** 1:1 mainline, into 50 Ω load  
100:1 tapoff, into 50 Ω load

**Tap Off Risetime:** < 60ps

**Bandwidth (-3dB):** Tap Off 5 GHz, mainline 10 GHz

**Impedence:** 50 Ω with 4950 tap off

### CURRENT SENSOR

**Current Sensitivity:** Volts/Amp 0.5V/A  
Droop 1% in 1μs

**Risetime** < 60ps

**Bandwidth** Tap off 5 GHZ, mainline 10GHZ



## BARTH MODEL CV1A ~ cont.

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### GENERAL

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<b>Voltage Coefficient</b>	< 1% at rated voltage and current
<b>Connectors</b>	Mainline N Female/Female Tap offs N Female
<b>Dimensions</b>	≈ 6.8" w (17.3cm) x 2.9" h (7.3cm) x 1.5" d (3.8cm)
<b>Weight</b>	1.6 lb. (.72kg)

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\* Maximum rating requires mainline be terminated into 50 Ω

Other configurations-voltage ratio/tap off can be supplied. User must specify voltage ratio, current ratio, voltage, and risetime requirements. The risetime and voltage specifications are dependent on, and in some cases limited by, the resistance sensitivities selected.



# Worldwide Sales Representatives for Barth Electronics, Inc.

## DOMESTIC

### UNITED STATES

#### **Barth Electronics, Inc.**

www.barthelectronics.com

1589 Foothill Drive

Boulder City, NV 89005

**Contact:** Sue Smith, Sales Manager

Tel 1-(702) 293-1576 | Fax 1-(702) 293-7024

beisales@barthelectronics.com

## INTERNATIONAL EUROPE

### FRANCE

#### **Pulse MC2**

www.pulsemc2.fr

Z.I. de la Petite Montagne Nord

7 allée du Brevet

91019 EVRY Cedex, France

**Contact:** Michel Chaillou

Tel 011 33 1 60 86 21 26 | Fax 011 33 1 64 97 54 98

michel.chaillou@pulsemc2.fr

### UNITED KINGDOM

#### **PPM (Pulse Power & Measurement LTD)**

www.pppmpower.co.uk

65 Shrivenham Hundred Bus. Park

Watchfield, Swindon, Wiltshire

SN6 8TY UK

**Contact:** Sam Whitaker

Tel +44 (0) 1793 784389

sales@ppm.co.uk

## INTERNATIONAL ASIA

### CHINA

#### **Qatek Company Limited**

www.quatek.com.cn

Room 2112, 21 Floor, Yong Sheng Tower

2025 West Zhong Shan Road

Shanghai, P.R.C. 200235

Contact: Kidd Shen

Tel (86) 21-64813366 ext. 819 | Fax (86) 21-64813369

kshen@quatek.com.cn

### TAIWAN

#### **Qatek International Limited**

www.quatek.com.tw

4th Fl., 308, Sec. 1 Nei-Hu Road

Nei Hu, 114 Taipei, TAIWAN R.O.C. 11493

Contact: Allen Chou

Tel (02) 2797-3357 ext. 275 | Fax (02) 2797-3957

achou@quatek.com.tw

### JAPAN and KOREA

#### **TET (Tokyo Electronics Trading Co.)**

www.tet.co.jp

5-16-30, Shibasaki-cho, Tachikawa-Shi

Tokyo 190-0023 Japan

Contact: Hideki Sadohara

Tel 011 81 42 548 8011 | Fax 011 81 42 548 8013

sadohara@tetjp.onmicrosoft.com

#### **General Bussan Co., Ltd.**

www.generl-bussan.co.jp (Pulse Only)

2-18-2 Nakano, Nakano-ku

Tokyo 164-0001 Japan

Contact: Keita Kanno

Tel +81-3-3383-1711 | Fax +81-3-3383-1719

info@general-bussan.co.jp

# Ordering Information

## Business Hours

We are located in Boulder City, Nevada, USA in the Pacific time zone.

Our business hours are:

8:00 a.m.–4:00 p.m., Monday–Friday.

## Terms & Conditions

### TERMS

Prices and discounts are subject to change without notice. Specifications for any product may be improved at any time without notice. Major improvements in a specification usually add a letter to the original part number.

Payment Terms are net 30 days. Accounts over 30 days are considered past due and will receive a finance charge of 0.05% per day (18% per annum).

All orders shipped F.O.B. Origin (Boulder City, Nevada). Titles pass to buyer as soon as the order is shipped. We recommend insuring all shipments for loss and damage.

### CONDITIONS OF SALE

Determination of price, terms, conditions of sale, and final acceptance of orders are made at the factory in Boulder City, Nevada.

### DOMESTIC SHIPPING / RUSH ORDERS

Products in stock are available for immediate delivery. Every effort is made to stock the most popular items. Delivery for a product not in stock is dependent upon our production schedule.

### EXPORT TERMS / SHIPPING

The “end-use” and “customer name” for exported products must be included with all Requests For Quotes and Confirming Purchase Orders. Export orders may require a letter of credit or pre-payment before an order is shipped. If an export license is required, order processing and shipping will be delayed. These items are controlled by the U.S. Government and authorized for export only to the

country of ultimate destination for use by the ultimate consignee or end user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any country other than the authorized ultimate consignee or end user(s), either in their original form or after being incorporated into other items, without first obtaining the approval from the U.S. Government or as otherwise authorized by U.S. laws and regulations.

### CREDIT CARDS

Barth Electronics, Inc., accepts VISA, Discover, and MasterCard. Maximum credit card charge is \$10,000.00 USD per transaction. A 4% processing fee is added to all credit card orders.

### DISCOUNTS

Discounts for quantities are available. Call factory for quantity discount pricing.

### WARRANTY INFORMATION

We stand behind every high quality product we manufacture. Our commitment to quality and workmanship are among the highest in the world. Quality does cost, and all high voltage pulse power items produced by Barth Electronics Inc., are “buy it once use it forever,” when used within catalog specifications. **Note:** Tampering with any Barth pulse product in any way will void the warranty.

### Domestic & International Sales

Contact the Barth sales team:

beisales@barthelectronics.com

1-(702) 293-1576

Visit our website for the most complete and up to date sales representative information, at:

[www.BarthElectronics.com](http://www.BarthElectronics.com)

### Technical Questions

For technical support, contact:

beitechsupport@barthelectronics.com

1-(702) 293-1576

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