"The Measurement Guys"

Barth Electronics, Inc.™

# Pulse Power Catalog






Since 1964

# High Voltage
# Fast Pulse
# Coaxial Components


Barth Electronics, Inc.

"The Measurement Guys"

www.BarthElectronics.com

Phone: (702) 293-1576

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# PULSE MODEL NUMBER NUMERICAL INDEX

Barth Electronics, Inc.™

## Company Background - Pulse Power Division

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" and 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 ohms ±0.5 ohms 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 100 picoseconds, 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 50 picosecond risetime pressurized reed switch pulse generator that has an output voltage that is adjustable from 100 to 2500 volts.

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 a fast as sub-nanosecond or as slow as 100 ns risetimes.

**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.**
**Call us to discuss your pulse measurement needs.**

# TECHNICAL SPECIFICATIONS

## 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 its 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 $1/\varepsilon$ notation. An exponentially decaying pulse with a $1/\varepsilon$ 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 RISETIME

The 10%-90% risetime through our attenuators is listed as $\tau$ (tau). It is calculated by taking 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 **measurements are made with a 54120A HP digital sampling system that can be normalized to as fast as 10ps.**

## ATTENUATORS ENERGY RATINGS

| Attenuator Model | Pulse Energy Rating | |
|---|---|---|
| BEI 142 | 50 mJ | Higher voltage and >12 GHz bandwidth |
| BEI 102 | 50 mJ | Higher voltage and 7 GHz bandwidth |
| BEI 202 | 200 mJ | Maximum N connector voltage 17 GHz bandwidth |
| BEI 2237A | 800 mJ | HN connector 7 GHz bandwidth |
| BEI 2239A | 2050 mJ | HN connector 3.5 GHz bandwidth |
| BEI 2536 | 400 mJ | HN connector, 200 watt average power |

# VOLTAGE COEFFICIENT OF RESISTANCE

Application Note #1

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[1P]; 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[1] 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 ohms 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.

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.

# VOLTAGE COEFFICIENT OF RESISTANCE

Application Note #1

Many different resistivity compositions are made to cover the 10 ohm to 10 megohm 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,[2P] 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. 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 I/A, where r is the resistivity of the bulk material, I 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 ohms to 200 ohms 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[3P]. 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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*This agrees within the limit of 0.02 percent per volt quoted by G.W.A. Dummer[4P]. The results quoted for 1 megohm resistors of 1/4 to 2 watt ratings by F. Langford Smith[5P] 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. l.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.

# Information on HN and Barth HNB Connectors:

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 which 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 which 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 which limits the bandwidth of this connection.

The Barth 401-HNB male HN cable connector is 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 of 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 of the dielectric overlap area, and thus creates 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 rise times are slower than 0.5ns, you probably wouldn't benefit from the advantages of the Barth HNB connectors, but if your pulse rise times are on the order of 200-300ps then you would see some benefit, and if your rise times are faster than 100ps the HNB connectors are a must.

If your application does not need the wide bandwidth of the HNB connectors, just insure that the HN 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 HN connectors.

# Information on Barth BE 40kV Connectors:

The Barth BE connector is a unisex connector with a mating bullet that was specifically designed to addresses the Pulse Power need for a connector that will take higher voltage than an HN connector, and can still pass fast sub-ns pulse rise times. 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 40kVDC, at sea level and somewhat higher pulse voltages. The BE connector provides both fast rise time performance, and high voltage pulse capability, for applications up to 40kV. These two characteristics are not both together available 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 to 25kV pulses, and some are matched better than others for rise time 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, and 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 which 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 which 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 allow us to also maintain the correct dielectric diameter to provide the correct impedance, which eliminates the discontinuity and therefore the bandwidth limitations inherent of 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 2 BE connectors are mated you have the best available match for your high voltage pulse system. If your fast pulse rise times are slower than 1ns, you may not benefit much from the advantages of the Barth BE connectors, but if your pulse rise times are faster than 500ps then you would see some benefit, and if your rise times are faster than 100ps, the BE connectors are a must.

If your application does not need the wide bandwidth of the BE connectors, just insure 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

MODEL 1400-1 Test Kit

**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

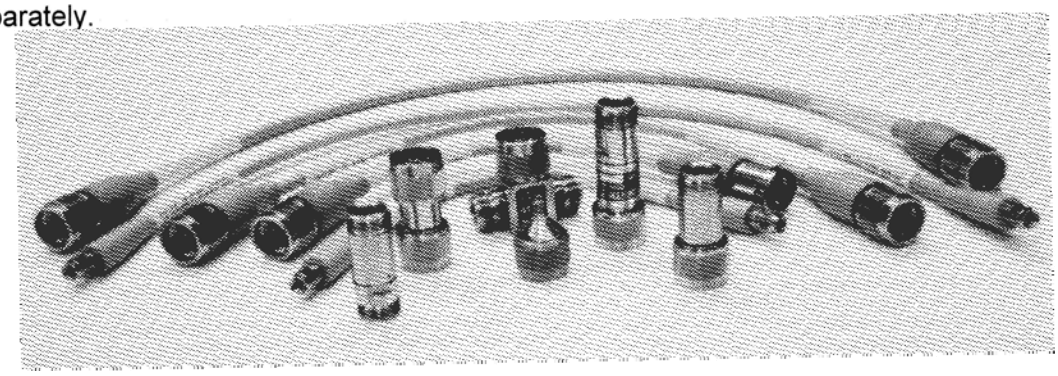
**DESCRIPTION**

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 divider 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 and all components are also available separately.



| 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 Terminator

## ADVANTAGES OVER STANDARD RF TERMINATORS

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

## DESCRIPTION

Barth High Voltage Pulse Terminators are designed to terminate 50 ohm 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 insures 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.

### TERMINATOR MODEL COMPARISON

| | | Maximum Input* | | |
|---|---|---|---|---|
| **Model** | **Peak Voltage** | **@ Pulse width ns** | **Input reflection coefficient at 100ps τ** | **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 τ | GHV male |
| 2051-GHFP | 10,000 | 100 | < 3%/100ps τ | GHV female |
| 2035-BEP | 20,000 | 200 | < 4% | Barth BE Series |
| 223-BMFP | 4,000 | 100 | < 5% | BNC male/female |

NOTE: 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



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# High Voltage Pulse Terminator
# Barth Model 101-xxx, 201A-xxx

Model 101-GLP

Model 201A-NMP

## DESCRIPTION

50 Ω High Voltage Pulse Terminator

## 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 Ω ± 0.5% |
| **Reflection-TDR:** | | < 1% 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:** | | .2 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.



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# High Voltage Pulse Terminator
# Barth Model 201-BMP


Model 201-BMP

## DESCRIPTION

50 Ω High Voltage Pulse Terminator

## SPECIFICATIONS

| | |
|---|---|
| **Maximum Input:** | 3kV, 250ns FWHM Pulse |
| **Peak Input Power:** | 200kW at rated pulse width |
| **Average Input Power:** | 1W maximum |
| **Impedance:** | 50 Ω ± 0.5% |
| **Reflection-TDR:** | < 1% to a 100ps risetime step function |
| **Voltage Coefficient:** | < 1% at rated voltage |
| **Connector:** | BNC male |
| **Dimensions:** | 1.5” long x 19/32” dia. max. |
| **Weight:** | <1 oz. |

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# High Voltage Pulse Terminator
# Barth Model 2033-HFP, 2035-HFP


Model 2033-HFP


Model 2035-BEP

## DESCRIPTION

50 Ω High Voltage PulseTerminator

## SPECIFICATIONS

| | |
|---|---|
| **Maximum Input:** | 2033 10kV, 250ns FWHM Pulse<br>2035 20kV, 200ns FWHM Pulse |
| **Peak Input Power:** | 2033 2MW at rated pulse width<br>2035 2MW at rated pulse width |
| **Average Input Power:** | 2033 4W Maximum<br>2035 8W Maximum |
| **Impedance:** | 50 Ω ± 0.5% |
| **Reflection-TDR:** | < 4% to a 100ps risetime step function |
| **Voltage Coefficient:** | < 1% at rated voltage |
| **Connector:** | HNB female<br>Barth BE Series |
| **Dimensions:** | 2033 4.8" long x 1.3" wide x 1.3" high<br>2035 10.4" long x 1.3" wide x 1.3" high |
| **Weight:** | 2033 1 lb.<br>2035 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.

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# High Voltage Pulse Terminator
# Barth Model 2051-GHMP, 2051-GHFP


Model 2051 – GHMP
(Male Version Shown)

## DESCRIPTION

50 Ω High Voltage Pulse Terminator

## SPECIFICATIONS

| | |
|---|---|
| **Maximum Input:** | 10kV, 100ns FWHM Pulse |
| **Peak Input Power:** | 2MW at rated pulse width |
| **Average Input Power:** | 2W maximum |
| **Impedance:** | 50 Ω ± 0.5% |
| **Reflection-TDR:** | < 3% to a 100ps risetime step function |
| **Voltage Coefficient:** | < 1% at rated voltage |
| **Connector:** | GHV male, or GHV female |
| **Dimensions:** | 3.2” long x 1” dia. max. |
| **Weight:** | < 1/3 lb. |

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# High Voltage Pulse Attenuator

## DESCRIPTION

Barth High Voltage Pulse Attenuators are matched impedance coaxial attenuators for use primarily in pulsed 50 ohm 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 ohms, 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 insures 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 OVER STANDARD RF ATTENUATORS

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

## MAXIMUM 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 ohm impedance. We do, however, manufacture and stock many 100 ohm impedance units. If we are unable to meet your requirements with a stock unit, call, as other types and impedance's can be designed to your specifications.

## SPECIAL USE CONSIDERATIONS

Attenuators purchased at list price can be used at higher voltages and shorter pulse width ratings but are not guaranteed.

Guaranteed pulse energy performance is available with a nominal additional cost for special testing at specified voltage & pulse width.

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# High Voltage Pulse Attenuator
# Barth Model Comparison

| | | | Maximum Input* | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Model** | **Average input power** | **Voltage ratio dB** | **Maximum peak voltage** | **Input @ pulse width ns** | **Pulse Energy Joules** | **Risetime through unit ps** | **Effective bandwidth DC to** | **Connectors** |
| 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 | 3.5GHz | N female output |
| 2240A-BENFP | 2.5W | 26 | 25,000<br>50,000 | 160<br>40 | 2.00 | <100 | 7 GHz | Barth 454 Input<br>N Female Output |
| 2248-HFNFP | 10W | 26 | 5,000 | 4µs | 2.00 | <100 | DC to 3.5 GHz | HN Female Input<br>N Female Output |
| 2511-30F | 25W | 30 | 8,000 | 150 | 0.192 | < 1ns | 0.35 GHz | Fischer input<br>BNC output |
| | | | | | | | | |
| 2536-HFP-3 | 200W | 3 | 7,000<br>15,000 | 400<br>75 | 0.392<br>0.337 | 35 | 10 GHz | HNB female**** |
| 2536-HFP-6 | 200W | 6 | 7,000<br>15,000 | 400<br>75 | 0.392<br>0.337 | 35 | 10 GHz | HNB female**** |
| 2536-HFP-10 | 200W | 10 | 7,000<br>15,000 | 400<br>75 | 0.392<br>0.337 | 35 | 10 GHz | HNB female**** |
| 2536-HFP-20 | 200W | 20 | 7,000<br>15,000 | 400<br>75 | 0.392<br>0.337 | 35 | 10 GHz | HNB female**** |

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.

* 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.

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# High Voltage Pulse Attenuator
# Barth Model 102 Series

## ADVANTAGES

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


Model 102-NMFP-20

## DESCRIPTION

This unit utilizes a patented design, which provides for maintaining good HV capabilities and good power dissipation. While this unit has a simpler housing design than our precision attenuators, for better heat dissipation, it still provides a very respectable and clean 50 ps output risetime.

## SPECIFICATIONS

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

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

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# High Voltage Pulse Attenuator
# Barth Model 202-XXX


Model 202B-NMFP-N

## ADVANTAGES

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

## DESCRIPTION

The Model 202 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.

## SPECIFICATIONS

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

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

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

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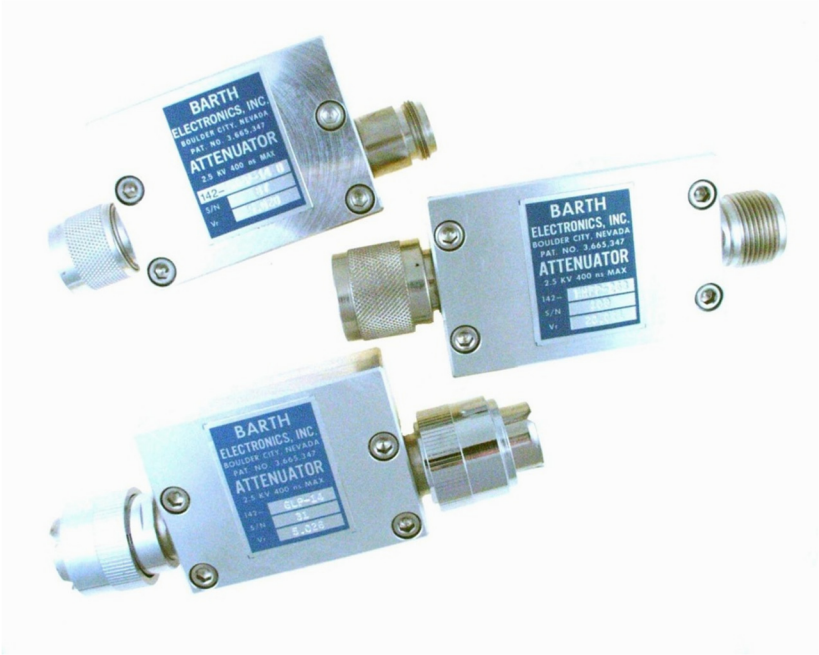
# High Voltage Pulse Attenuator
# Barth Model 142 Series

## 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.




## DESCRIPTION

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.

## SPECIFICATIONS

**Voltage Ratio - Attenuation dB:**

| | | |
|---|---|---|
| 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) |

**Maximum Input:** 2.5kV, 400ns FWHM Pulse

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

**Average Input Power:** 2W maximum

**Impedance:** 50 ± 1%

**Risetime through Unit:** < 10ps

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*Specifications are continued on the next page*



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*SPECIFICATIONS continued*

| | | |
|---|---|---|
| **Bandwidth (-3dB):** | | DC to 30GHz |
| **Reflection-TDR:** | | < 3% to a 100ps risetime step function |
| **Voltage Coefficient:** | | < 1% at rated voltage |
| **Connectors:** | 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 *** |
| **Dimensions:** | | Outline drawings available |
| **Weight:** | | 3/4 lb max. |
| **Ordering Information:** | | 142-xxx-yy |

-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.

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.

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.

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# High Voltage Pulse Attenuator
# Barth Model 2237A-HFNFP, 2239A-HFNFP

Model 2237A-HFNFP



Model 2239A-HFNFP

## DESCRIPTION

26dB attenuators with
HN female input connectors.

## SPECIFICATIONS

| | |
|---|---|
| **Voltage Ratio:** | 20/1 Vr (26dB) |
| **Maximum Input:** | 2237A 10kV/400ns FWHM Pulse<br>2239A 16kV/400ns |
| **Peak Input Power:** | 2237A 2MW at rated pulse width<br>2239A 5.12MW at rated pulse width |
| **Average Input Power:** | 2.5W maximum |
| **Impedance:** | 50 Ω ± 1% |
| **Risetime through Unit:** | 2237A < 50ps<br>2239A <100ps |
| **Bandwidth (-3dB):** | 2237A DC to 7.0GHz<br>2239A DC to 3.5GHz |
| **Reflection-TDR:** | Input < 4% to a 100ps risetime step function<br>Output < 3% to a 100ps risetime step function |
| **Voltage Coefficient:** | < 1% at rated voltage |
| **Connectors:** | HN female input<br>N female output |
| **Dimensions:** | 2237A 4.8" long x 1.250" wide x 2" high<br>2239A 10.5” long x 1.250” wide x 2” high |
| **Weight:** | 2237A 1 ¼ lbs.<br>2239A 1 ¾ 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 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.

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# High Voltage Power Pulse Attenuator
# Barth Model 2240A-BENFP


**DESCRIPTION:**

The 2240A-BENFP is an ultra wide band high voltage attenuator designed for measurement of signal rise times as fast as 100ps

## SPECIFICATIONS:

| | | |
|---|---|---|
| **Voltage Ratio:** | | 20/1 +/- 5% (26dB) |
| **Maximum Input Voltage:** | | 25kV, 160ns FWHM<br>50kV, 40ns FWHM |
| **Peak Input Energy:** | | 2.0 Joules (Watt Seconds) |
| **Average Input Power:** | | 2.5W Maximum |
| **Impedance:** | | 50 Ohm +/- 1% |
| **Risetime through Unit:** | | <100ps |
| **Bandwidth** | | DC to 3.5GHz |
| **Reflection - TDR:** | **Input**<br>**Output** | <4% to a 100ps rise time step<br><3% to a 100ps rise time step |
| **Voltage Coefficient:** | | <1% at any voltage |
| **Connectors:** | | Barth BE Series Input<br>N Female Output |
| **Available Mating Connector:** | | 454-BE Series for RG-214 Cable<br>(Call us for other configurations) |
| **Dimensions:** | | 10.5" long x 1.25" wide x 2" high |
| **Weight:** | | 1.5 lbs. |

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# Barth Model 454-BE Connector

**DESCRIPTION:**

The Barth 454-BE Connector is for use with RG-214 Coax

## SPECIFICATIONS:

| | |
|---|---|
| **Maximum Input Voltage:** | 40 kV DC<br>100 kV, 20ns FWHM |
| **Average Input Power:** | 1kw@ 1 Ghz. |
| **Impedance:** | 50 Ohm +/- 1% |
| **Risetime through Unit:** | <100ps |
| **Bandwidth:** | DC to 7.0GHz |
| **Reflection - TDR:** | <4% to a 100ps risetime step |
| **Connector:** | Barth BE<br>RG-214 pigtail unterminated |
| **Connector Dimensions:** | Approx. 1.6" Dia. x 4" long |
| **Weight:** | Approx. 1 lb. (Connector + 1M RG-214 coax) |



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# Barth Model XXX-BE Connector

**<u>*NOTE:</u>**
**Additional Connectors Coming.**

**<u>DESCRIPTION:</u>**

The Barth XXX-BE Connector is for use with TBD Coax

## SPECIFICATIONS:

| | |
|---|---|
| **Maximum Input Voltage:** | 40 kV DC<br>100 kV, 20ns FWHM |
| **Average Input Power:** | 1kw@ 1 Ghz. |
| **Impedance:** | 50 Ohm +/- 1% |
| **Risetime through Unit:** | <100ps |
| **Bandwidth:** | DC to 7.0GHz |
| **Reflection - TDR:** | <4% to a 100ps risetime step |
| **Connector:** | Barth BE<br>RG-214 pigtail unterminated |
| **Connector Dimensions:** | Approx. 1.6" Dia. x 4" long |
| **Weight:** | Approx. 1 lb. (Connector + 1M RG-214 coax) |

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# High Voltage Pulse Power Attenuator
# Barth Model 2511-30F

## ADVANTAGES

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


## DESCRIPTION

The Model 2511-30F has a medium power rating that allows for high repetition rate testing of EFT generators, at their high voltage rating.

## SPECIFICATIONS

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

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# High Voltage Pulse Power Attenuator
# Barth Model 2248


**DESCRIPTION:**

The 2248-HFNFP is an ultra wide band high voltage attenuator designed for measurement of signal rise times as fast as 100ps

## SPECIFICATIONS:

| | | |
|---|---|---|
| **Voltage Ratio:** | | 20/1 +/- 5% (26dB) |
| **Maximum Input Voltage:** | | 5kV, 4µs FWHM |
| **Peak Input Energy:** | | 2.0 Joules (Watt Seconds) |
| **Average Input Power:** | | 12W Maximum |
| **Impedance:** | | 50 Ohm +/- 1% |
| **Risetime through Unit:** | | <100ps |
| **Bandwidth** | | DC to 3.5GHz |
| **Reflection - TDR:** | **Input** | <4% to a 100ps rise time step |
| | **Output** | <3% to a 100ps rise time step |
| **Voltage Coefficient:** | | <1% at any voltage |
| **Connectors:** | | HN Female Input (Receptacle)<br>N Female Output (Receptacle) |
| **Dimensions:** | | 8.25" long x 1.50" wide x 2" high |
| **Weight:** | | 5.8 lbs. |

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# High Voltage Pulse Power Attenuator
# Barth Model 2536

**DESCRIPTION:**

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.

**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. 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.

The Model 2536-HFP-X is warranted to perform to its specifications for a period of 1 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.

## SPECIFICATIONS:

| | | |
|---|---|---|
| **Voltage Ratio:** | 2536-3 | 1.4/1 Vr (3 dB) |
| | 2536-6 | 2.0/1 Vr (6 dB) |
| | 2536-10 | 3.2/1 Vr (10 dB) |
| | 2536-20 | 10.0/1 Vr (20 dB) |

| | |
|---|---|
| **Maximum Input:** | 7kV/400ns, 15kV/75ns, 30kV/15ns, 60kV/2ns FWHM Pulse |
| **Peak Input Power:** | 72MW at rated pulse width |
| **Average Input Power:** | 200W Maximum |
| **Impedance:** | 50 Ω +/- 1% (output terminated with 50Ω) |
| **Risetime through Unit:** | 35ps |
| **Bandwidth (-3dB):** | DC to >10GHz |
| **Reflection - TDR:** | <5% to a 100ps risetime step function |
| **Voltage Coefficient:** | <1% at 25kV |
| **Connectors:**** | HNB Female |
| **Dimensions:** deep | ≈ 5”(12.7 cm) wide x 10”(25.4 cm) high x 12”(30.5 cm) |
| **Weight:** | ≈17 lbs. (7.8 kg) |
| **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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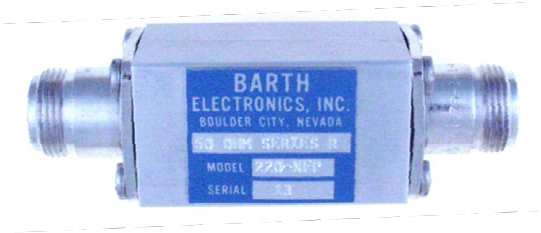
# Wide Band Impedance Matching Components
# Barth Model 220-NFP, 220 MMFP




Model 220-NFP

## DESCRIPTION

A 50 Ω series high voltage pulse resistor for a one way match of 100 Ω components, to 50 Ω components.

## SPECIFICATIONS

| | |
|---|---|
| **Input-Output Impedance:** | 100 Ω to 50 Ω (50 Ω 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 (-3 dB):** | DC-1GHz |
| **Voltage Coefficient:** | < 1% at rated voltage |
| **Connectors:** | 50 Ω N female |

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# 50 Ohm Series Resistor

**Similar Products:**

- 220-NFP 50 ohm Series Resistor
- 220a-GLP 50 ohm Series Resistor


The Barth Model 5101-MMFP-1 is a 50 Ohm Series High Voltage Pulse Resistor designed for a one way match of 100 ohm components to 50 ohm components.

**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: | < 400ps |
| 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 |



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# Wide Band Impedance Matching Components
# Barth Model 224A-GLP

## DESCRIPTION

Model 224A-GLP, 50 Ω to 100 Ω resistive matched attenuator

Model 224A-GLP

## SPECIFICATIONS

| | |
|---|---|
| **Input-Output Impedance:** | 50 Ω to 100 Ω |
| **Voltage Ratio:** | 3.035 Vr (9.64dB) 50 Ω to 100 Ω direction<br>7.07 Vr (16.99dB) 100 Ω to 50 Ω direction |
| **Maximum Input:** | 2.5kV, 250ns FWHM Pulse |
| **Peak input Power:** | 62.5kW at rated pulse width |
| **Average Input Power:** | 2W maximum |
| **Risetime:** | < 20 ps |
| **Bandwidth (-3 dB):** | DC - 18GHZ |
| **Voltage Coefficient:** | < 1 % at rated voltage |
| **Connectors:** | GR 874 locking 50 Ω - GR 874 locking 100 Ω |



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# Hand Held High Voltage High Frequency Voltage Probe
# Barth Model 2440-6GHz

**DESCRIPTION**

The Model 2440 Hand Held, High voltage, High Frequency voltage probe, is intended for passive probing of high speed, high voltage pulse circuits. The probe kit contains one 450 ohm resistive probe for a 10:1 voltage ratio (20dB), one 950 ohm resistive probe for a 20:1 voltage ratio (26dB), and one each 450 and 950 ohm replacement resistors.

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

## SPECIFICATIONS

| | | |
|---|---|---|
| **Maximum Input:** | 10:1 probe | 3kv, 500ns 1/*e* Exponential decay pulse |
| | 20:1 probe | 5kv, 500ns 1/*e* Exponential decay pulse |
| **Risetime:** | | < 60ps Typical |
| **Bandwidth:** | | DC to 6GHz Typical Risetime and bandwidth can be limited by the physical structure surrounding the measurement point. |
| **Input Resistance:** | 10:1 probe | 500 ohm - when probe is terminated |
| | 20:1 probe | 1k ohm - into nominal 50 ohm load |
| **Voltage Coefficient:** | | < 1 % at rated voltage |
| **Connectors:** | | SMA female on probe bodies<br>SMA male on both ends of 36" long low loss cable for connection of probe to measurement system. |

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.

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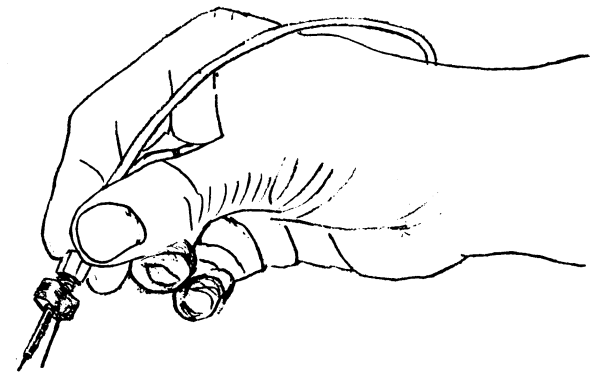
## WARNING / SAFETY

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.

## OPERATION NOTE



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 ohm system, for instance to an attenuator or directly to a 50 ohm scope input. The correct method for holding the probe when making measurements, is to hold the probe body by the SMA connector in your hand 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" long cable. Use of longer or higher loss cable will degrade the probe's response.

## 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.



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## 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 which requires that the resistor remains 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 Ω | 1 μs | ** | 8-32 female thread *** |
| VP5E2-28-8R2 | 28,000 | 500 Ω | 800 | ** | HNB female |
| VP2E3-35-1R2N | 35,000 | 2000 Ω | 100 | ** | N female |
| VP2E3-35-1R2H | 35,000 | 2000 Ω | 100 | ** | HNB female |

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.

** 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.**



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# High Voltage Pulse
# Match Resisted Power Divider

Barth High Voltage Resistive Power Dividers are matched impedance coaxial devices for use primarily in pulsed 50 ohm 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 ohms. Extensive testing during manufacturing insures 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 OVER STANDARD RF POWER DIVIDERS

- 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 |

-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.

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# High Voltage Pulse Power Matched Resistive Power Divider
# Barth Model 151-XXX


Model 151-NFP

## DESCRIPTION

High Voltage 2 Way Matched Power Divider (3 resistors)

## SPECIFICATIONS

| | | |
|---|---|---|
| **Voltage Ratio:** | | 2.0/1Vr (6dB) |
| **Maximum Input:** | | 2.5kV, 400ns FWHM Pulse |
| **Peak Input Power:** | | 125kW at rated pulse width |
| **Average Input Power:** | | 2W maximum |
| **Impedance:** | | 50 Ω ± .25 Ω |
| **Reflection-TDR:** | | < 4% to a 100ps risetime step function |
| **Risetime through Unit:** | | < 40ps |
| **Bandwidth:** | | DC to 9GHz |
| **Voltage Coefficient:** | | < 1% at rated voltage |
| **Connectors:** | 151-GP | GR 874 Non locking |
| | 151-GLP | GR 874 Locking |
| | 151-NMP | N male |
| | 151-NFP | N female |
| **Dimensions:** | | 4" long x 2.5" wide x 1" high |
| **Weight:** | | Approx. 1/2 lb. |

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

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# High Voltage Pulse Matched Resistive Power Divider
# Barth Model 251-XXX


Model 251-NFP

## DESCRIPTION

High Voltage 2 Way Matched Power Divider (3 resistors)

## SPECIFICATIONS

| | | |
|---|---|---|
| **Voltage Ratio:** | | 2.0/1 Vr (6dB) |
| **Maximum Input:** | | 5kV, 400ns FWHM Pulse ** |
| **Peak Input Power:** | | 500kW at rated pulse width |
| **Average Input Power:** | | 2W maximum |
| **Impedance:** | | 50 Ω |
| **Reflection-TDR:** | | < 4% to a loop risetime step function |
| **Risetime through Unit:** | | < 40ps |
| **Bandwidth:** | | DC to 9GHz |
| **Voltage Coefficient:** | | < 1% at rated voltage |
| **Connectors:** | 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 |
| **Dimensions:** | | 4" long x 2.5" wide x 1" high |
| **Weight:** | | Approx. 1/2 lb. |

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

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.

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

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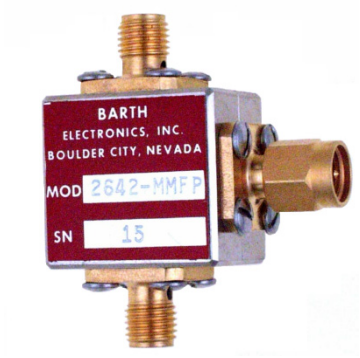
# High Voltage Pulse Match Resistive Power Divider
# Barth Model 2642-MMFP. 2642-MFP




Model 2642-MMFP

## DESCRIPTION

High Voltage 2 Way Matched Resistive Power Divider with SMA Connectors

## SPECIFICATIONS

| | |
|---|---|
| **Voltage Ratio:** | 2.0/1 Vr (6dB) |
| **Maximum Input:** | 1kV, 400ns FWHM Pulse |
| **Peak Input Power:** | 20kW at rated pulse width |
| **Average Input Power:** | 1W maximum |
| **Impedance:** | 50 Ω |
| **Reflection-TDR:** | Input < 1% to a l00ps risetime step function<br>Output < 2% to a 100ps risetime step function |
| **Risetime through Unit:** | < 35ps |
| **Bandwidth:** | DC to 10GHz |
| **Voltage Coefficient:** | < 1% at rated voltage |
| **Connectors:** | 2642-MMFP SMA male in, 2 SMA female out<br>2642-MFP SMA female |
| **Dimensions:** | 1.560" long x 1.370" wide x .640" high |
| **Weight:** | Approx. 2.3 oz. |

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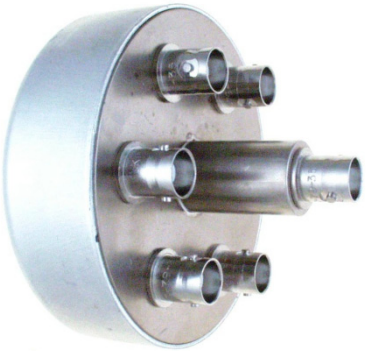
# High Voltage Pulse Matched Resistive Power Divider
# Barth Model 2700 Series



Model 2706-BFP

## DESCRIPTION

The 2700 series High Voltage Power Dividers offer 2, 3, 4, 5, or 6 output ports and are designed for use primarily in pulsed 50 ohm systems, or where occasional transients would damage ordinary units. These dividers feature input and output impedance very close to 50 ohms.

## SPECIFICATIONS

| | | |
|---|---|---|
| **Voltage Ratio:** | 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 Ω |
| **Input Reflection-TDR:** | | < 5% to a 100ps risetime step function |
| **Risetime through Unit:** | | < 65ps |
| **Bandwidth:** | | DC to 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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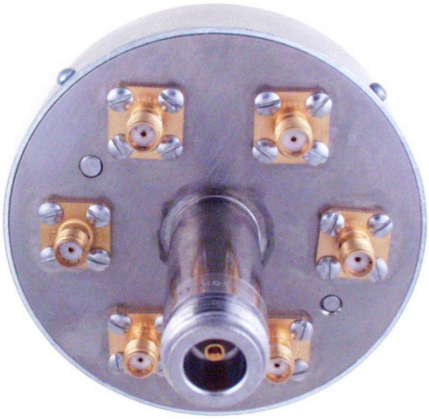
# High Voltage Pulse Matched Resistive Power Divider
# Barth Model 2746-NFMFP



Model 2746-NFMFP

## DESCRIPTION

High Voltage 6 Way Matched Resistive Power Divider

## SPECIFICATIONS

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

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# High Voltage Pulse Matched Resistive Power Divider
# Barth Model 2810 Series

## DESCRIPTION

The 2810 series 50 ohm matched resistive power divider equally divides and distributes signals in high voltage pulse applications.

## SPECIFICATIONS

**Voltage Ratio:**

| | |
|---|---|
| 2812-NFP/NMFP<br>2812-HFNFP<br>2812-BENFP | 2 WAY DIVIDER<br>2.0/1 Vr ± 2% (6.02dB) |
| 2813-NFP/NMFP<br>2813-HFNFP<br>2813-BENFP | 3 WAY DIVIDER<br>3.0/1 Vr ± 2% (9.54dB) |
| 2814-NFP/NMFP<br>2814-HFNFP<br>2814-BENFP | 4 WAY DIVIDER<br>4.0/1 Vr ± 2% (12.04dB) |
| 2815-NFP/NMFP<br>2815-HFNFP<br>2815-BENFP | 5 WAY DIVIDER<br>5.0/1 Vr ± 2% (13.98dB) |
| 2816-NFP/NMFP<br>2816-HFNFP | 6 WAY DIVIDER<br>6.0/1 Vr ± 2% (15.56dB) |

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**SPECIFICATIONS continued**

| | | |
|---|---|---|
| **Maximum input:** | 281x-NFP/NMFP | 2.5kV, 250ns FWHM Pulse |
| | 281x-HFNFP | 5.0kV, 100ns FWHM Pulse |
| | 281x-BENFP | 10.0kV, 25ns FWHM Pulse |
| **Peak Input Power:** | 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 Ω ± 1% | |
| **Reflection-TDR:** | 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 to 7GHz | |
| **Maximum Precursor:** | < ± 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:** | ±10ps maximum time difference between any/all output ports | |
| **Attenuation Matching:** | ± 1.0% between ports from DC to 300MHz minimum | |
| **Voltage Coefficient:** | < 1% at rated voltage | |
| **Connectors:** | 281x-NFP | N female (standard stocked 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 |
| | Note: Inputs are labeled, outputs are numbered. | |
| **Dimensions:** | Outline drawings available | |
| **Weight:** | 2812-NFP | approx. ½ lb. |
| | 2813-NFP | approx. ¾ lb. |
| | 2814-NFP | approx. 7/8 lb. |
| | 2815-NFP | approx. 1 lb. |
| | 2816-NFP | approx. 1 ¼ lb. |

X = number of outputs (2, 3, 4, 5 or 6)



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# High Voltage Pulse Matched Resistive Power Divider
# Barth Model 2825-NFP, 2828-NFP, 2830-NFP, 2832-NFP

Model 2820/2830 Series

## DESCRIPTION

The 2820/2830 Series Power Dividers are designed to equally divide and distribute signals in high voltage pulse applications.

## SPECIFICATIONS

| | | |
|---|---|---|
| **Voltage Ratio:** | 2825-NFP | 5.0/1Vr (13.98dB) |
| | 2828-NFP | 8.0/1Vr (18.06dB) |
| | 2830-NFP | 10.0/1Vr (20.00dB) |
| | 2832-NFP | 12.0/1Vr (21.58dB) |
| **Maximum Input:** | 4kV, 100ns FWHM Pulse | |
| **Peak Input Power:** | 320kW at rated pulse width | |
| **Average Input Power:** | 10W maximum | |
| **Impedance:** | 50 Ω | |
| **Reflection-TDR:** | < 2% to a 100ps risetime step function | |
| **Risetime through Unit:** | 2825-NFP | < 75ps |
| | 2828-NFP | < 65ps |
| | 2830-NFP | < 70ps |
| | 2832-NFP | < 75ps |
| **Bandwidth:** | 2825-NFP | DC to 4.5GHz |
| | 2828-NFP | DC to 5.4GHz |
| | 2830-NFP | DC to 5.0GHz |
| | 2832-NFP | DC to 4.5GHz |
| **Voltage Coefficient:** | < 1% at rated voltage | |
| **Connectors:** | N female | |
| **Dimensions:** | Outline drawing available | |
| **Weight:** | 2825-NFP | 1 1/8 lbs. |
| | 2828-NFP | 2 1/4 lbs. |
| | 2830-NFP | 3 lbs. |
| | 2832-NFP | 3 3/4 lbs. |

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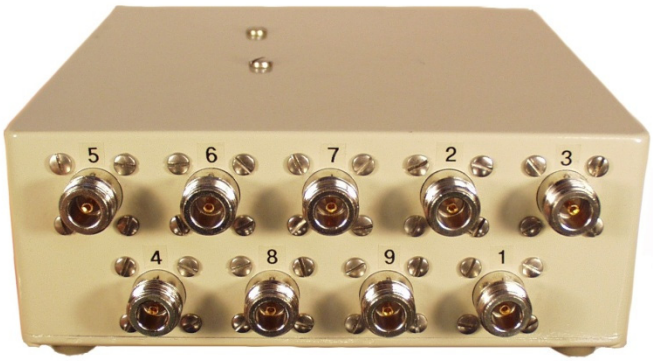
# High Voltage Pulse 9 Port Power Divider
# Barth Model 6419-MFP

## 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 customers requirements.




## DESCRIPTION

9 Output High Voltage Pulse divider specifically designed for use with 10 kV, 250 ps risetime high voltage pulses.

### SPECIFICATIONS

| | |
|---|---|
| **Number of Outputs:** | 9 Outputs |
| **Input-Output Voltage Ratio:** | 2.94:1 / 3.21:1 (9.75dB +/- 0.38 dB) |
| **Output Pulse Risetime:** | 280 ps for a 250ps Input Risetime |
| **Maximum Input Pulse Amplitude:** | 10 kV/10 ns, Rectangular Pulse |
| **Input Reflection Coefficient:** | + 1.6%, - 3.0%, to a 250 ps Risetime Step Function |
| **Maximum Pulse Droop:** | 6% @ 16 ns |
| **Connectors:** | Type "N" Receptacle (female) on Input and Outputs |
| **Dimensions:** | Approx. 7.3" x 7.3" x 3" Height |
| **Weight** | 4.5 lbs. |

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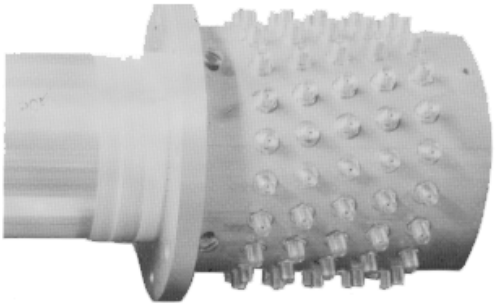
# High Voltage Pulse 100 Port Power Divider
# Barth Model 9201-GMF

## 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 waveshape, risetime, amplitude, and delay.
- Similar dividers with different number of outputs, pulse width, voltage, or risetime specifications can be designed to a meet a customers requirements.



## DESCRIPTION

100 Output High Voltage Pulse Divider specifically designed for use with a fast rise high voltage pulse generator such as Barth Model 731, (2KV output with < 50ps rise time).

## SPECIFICATIONS

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

Note: Other High Voltage Pulse Dividers are available; call us with your needs.

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# Balanced Probe Combiner
# Barth 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.**

**DESCRIPTION:**

**Barth Model 691 balanced probe combiner is designed for making fast risetime pulse differential measurements. This combiner provides wide bandwidth with high Common Mode Rejection (CMR). Features include 50 Ohm "+" and "-" SMA Jack inputs with a BNC Plug output for direct attachment to an oscilloscope.**

**SPECIFICATIONS:**

| | |
|---|---|
| **Input/Output Voltage Ratio:** | 2.0:1, -6.0 dB<br>(When used as a differential combiner) |
| **Impedance:** | 50 +/- 1/2 ohm |
| **Risetime:** | 350ps |
| **Droop:** | 7% at 1µs |
| **Frequency Range:** | 15kHZ to 1GHz |
| **CMR:** | > 40 dB 100kHz to >1GHz<br>> 30 dB 20kHz to >1GHz |
| **Input Connectors:** | SMA Jacks |
| **Output Connector:** | BNC Plug |
| **Dimensions:** | 4.75"l x 1.25"dia. |
| **Weight:** | 8 oz., 225 g. |

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# High Voltage Pulse Matched Resistive Power Combiner
# Barth Model 2921-HFP


## DESCRIPTION
2 Input 4 Output Combiner

## 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. |

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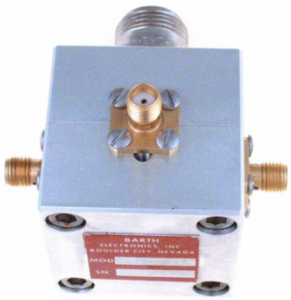
# High Voltage Pulse Matched Resistive Power Combiner
# Barth Model 2934-MFNF



## DESCRIPTION
4 Way Broadband High Peak Resistive Combiner

## SPECIFICATIONS

| | |
|---|---|
| **Voltage Ratio**: | 1.0/1 Vr |
| **Maximum Input:** | 2kV, 10ns FWHM Pulse |
| **Average Input Power:** | 1W Maximum |
| **Impedance:** | 50 Ω |
| **Risetime through Unit:** | < 30ps |
| **Connectors:** | SMA female inputs - N female output |
| **Dimensions:** | 2.2" long x 2.2" wide x 2.2" high |
| **Weight:** | 1/2 lb. |



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# Wide Band High Voltage Transformer
# Transformer Component Model Comparison

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

* Input Reflection Coefficient rated at 500psτ.



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# High Voltage Wide Band Pulse Inverter
# Barth Model 6115-BMFP


Model 6115-BMFP

## DESCRIPTION

50 Ω High Voltage Pulse Inverter

## SPECIFICATIONS

| | |
|---|---|
| **Voltage Ratio:** | 1/(-1) |
| **Maximum Input:** | 1kV, 45Vxμs Pulse |
| **Impedance:** | 50 Ω |
| **Risetime:** | < 400ps, inverted pulse >98% at 1μs |
| **Bandwidth (-3dB):** | 700MHz |
| **Droop:** | <10% at 1μs |
| **Reflection-TDR:** | < 4% to a 500ps risetime step function |
| **Connectors:** | BNC male/female |
| **Dimensions:** | 2.8" long x 0.725" diameter |
| **Weight:** | 2 oz. |

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# Wide Band High Voltage Pulse Inverter
# Barth Model 621A-GLP, 621A-MFP, 621-NFP


Model 621A-GLP

## DESCRIPTION

50 Ω High Voltage Pulse Inverter

## SPECIFICATIONS

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

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# Wide Band High Voltage Balun
# Barth Model 650A-NFT, 651-NFP, 652-NFP


Model 652-NFP

## DESCRIPTION

50 Ω Balun with (+) and (-) N female inputs

## SPECIFICATIONS

| | | |
|---|---|---|
| **Voltage Ratio:** | | 1.0 when used as a differential combiner |
| **Maximum Input:** | 650A-NFT | ± 300V, 100ns (30Vxμs) |
| | 651-NFP | ±1kV, 500ns (500Vxμs) |
| | 652-NFP | ±1kV, l00ns (100Vxμs) |
| **Impedance:** | | 50 Ω |
| **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 |
| **Connector:** | | N female |
| **Dimensions:** | | 7.12" x 2.25" dia. |
| **Weight:** | | 1.8 lbs. |

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# Bias-T (10 kV), 45355 (5 kV)
# Barth Model 45350

## APPLICATION

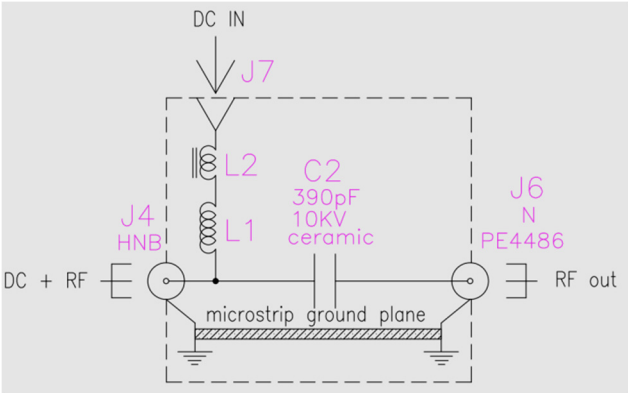
Electron Lenses in RHIC are designed with a series of biased drift tubes through which the electron beam propagates in the opposite direction of the RHIC ion beams. The image currents inducted on the drift tubes are detrimental to the electron & ion beams. The Barth Bias-T is a custom HV RF system that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

## Production Design

To produce a final design to pass greater than 90% of RF energy from 50 to 1000 MHz through a Bias T 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.

**Bias-T Design**

While Bias tees rated for 100 V 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 10 kV of DC bias while simultaneously passing up to 20 W of RF power in the frequency range of 50-500 MHz. (A simplified circuit is shown to the right.)




**45355 (5 kV)**

**45350 (10 kV)**

## Specifications:

| | | |
|---|---|---|
| Impedance: | | 50 Ohm |
| Risetime: | | <100PS |
| Droop: | 45355: | 1/ε decay = 88ns |
| Connectors: | 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. Call or email us for additional information or to discuss your application.

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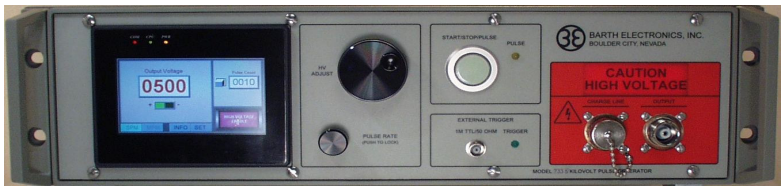
# High Voltage Pulse Generator
# Barth Model 731




## DESCRIPTION

The Model 731 high voltage pulse generator provides pulses of < 200ps risetime, 500 volts through 3kV amplitude, to drive into any load impedance through 50 ohm 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 10ns charge line, and (1) additional charge line up to 100ns of customer's choice.

## PRELIMINARY SPECIFICATIONS

**Output Pulse:** < 200ps risetime at all output voltages

**Output Amplitude:** Continuously adjustable from < 500 volts output to > 3kV output

**Output Pulse Width:** 1.5ns to 400ns

**Output Pulse Rep Rate:** Single pulse / internal repetitions / external trigger modes
Internal mode adjustable from >20 sec between pulses to 10Hz repetition

**Trigger Input:** 5V at 1mA through a grounding switch, or a 1V, 1μs input trigger pulse

**Mechanical Switch Life:** > 3,000,000 pulses at 2kV/400ns pulse width
(switch life is energy dependent)

**Connectors:** HN female output and charge line connectors

**Input Power:** Standard 120 volt/60Hz line power at 10 amps
(50Hz model available for export)

**Dimensions:** 19" wide (rack mount) x 5 1/4" high x 15" deep

**Weight:** 24 lbs.

**Accessories:**

| 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-200ns | 200ns charge line |
| 464-HMP-400ns | 400ns charge line |

Any Value from 1.5ns to 400ns available

Contact us for additional information or to discuss your application.

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# High Voltage Pulse Generator
# Barth Model 733


## DESCRIPTION

The Model 733 high voltage pulse generator provides pulses of < 200ps risetime, 500 volts through 5kV amplitude, to drive into any load impedance through 50 ohm 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 10ns charge line, and (1) additional charge line up to 100ns of customer's choice.

## PRELIMINARY SPECIFICATIONS

**Output Pulse:** < 200ps risetime at all output voltages

**Output Amplitude:** Continuously adjustable from < 500 volts output to > 5kV output

**Output Pulse Width:** 1.5ns to 400ns

**Output Pulse Rep Rate:** Single pulse / internal repetitions / external trigger modes
Internal mode adjustable from >20 sec between pulses to 10Hz repetition rate

**Trigger Input:** 5V at 1mA through a grounding switch, or a 1V, 1μs input trigger pulse

**Mechanical Switch Life:** > 3,000,000 pulses at 2kV/400ns pulse width
(switch life is energy dependent)

**Connectors:** HN female output and charge line connectors

**Input Power:** Standard 120 volt/60Hz line power at 10 amps
(50Hz model available for export)

**Dimensions:** 19" wide (rack mount)

**Weight:** 24 lbs.

**Accessories:**

| 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-200ns | 200ns charge line |
| 464-HMP-400ns | 400ns charge line |

Any Value from 1.5ns to 400ns available

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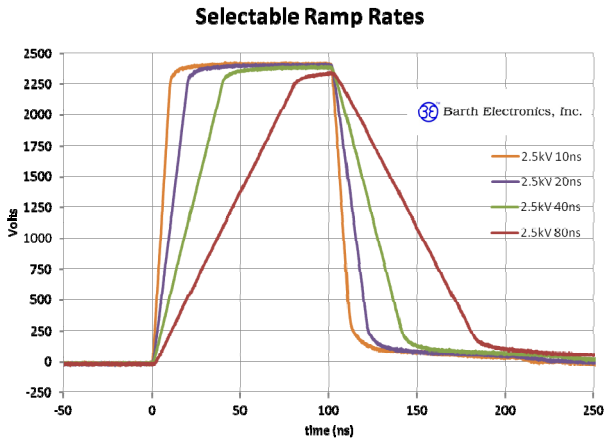
# Extremely Linear kV Ramps
# Any Ramp Time, Any Voltage (mV to kV)
# 1 Volt to kV

**SELECTABLE RAMP RATES**

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




Barth Electronics latest invention turns step functions into ramp functions

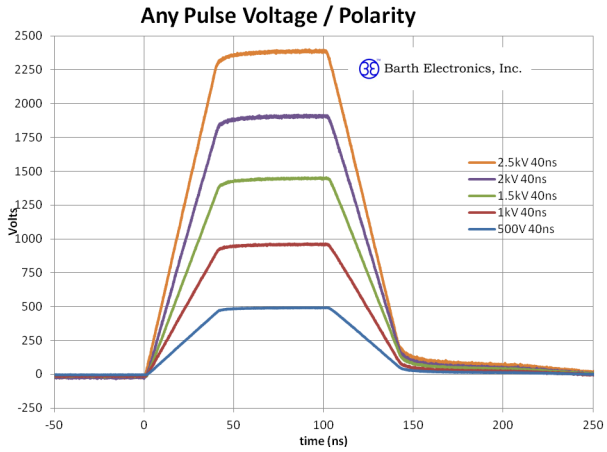
These ramps are generated by special circuits we have developed that convert a rectangular pulse into a ramp. This is accomplished with 50 ohm impedance circuits which allow ordinary cables and connectors to deliver the ramp with minimal distortion.

**ANY VOLTAGE / POLARITY**

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

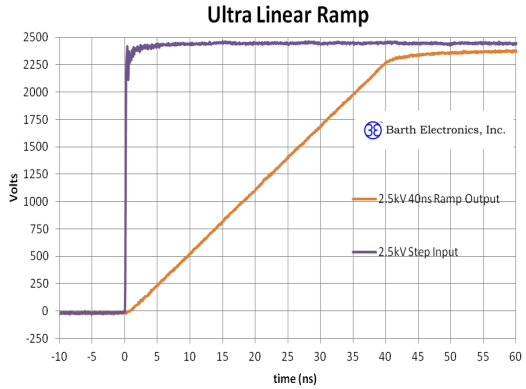
Ramp times from picoseconds to microseconds can be built for step function input.

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 10 ns 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.

Contact us for additional information or to discuss your application.

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# Common Mode Transient (CMT) Generator
# Model 731 Pulse Generator + 5081-P Ramp Module

## 3.12 To 1600 kV/µs Into 50 Ω Loads

**Features:**

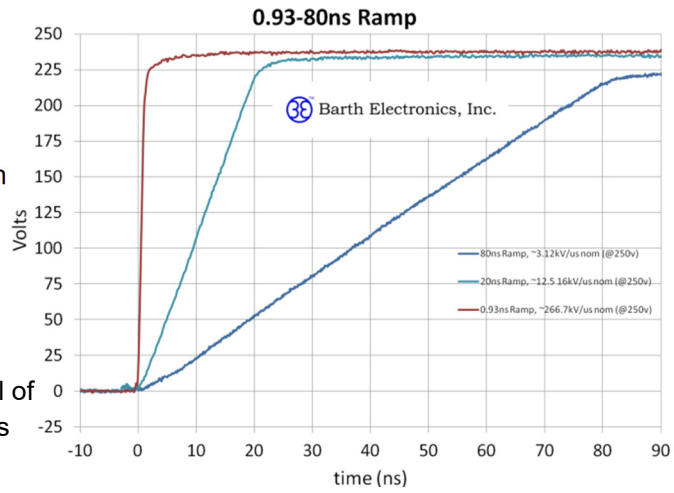
- Interactive control allows the user to gradually increase, or decrease the dV/dt rate applied to a DUT
- Stepped mode features user adjustable constant voltage and 14 stepped dV/dt selections
- Variable dV/dt mode features a more continuously variable dV/dt selectable by the user.
- 3.12 to 1600kV/µs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

### Description:

The Barth Common Mode Transient (CMT) Generator was developed for CMTI (CMT Immunity) characterization testing. The test system combines our Model 731 3kV Pulse Generator + 5081-P Ramp Generator Module, our high voltage fast rise time pulse generator with a multi ramp module to produce a selectable fixed rate linear rise ramp pulse.

### How It Works

The Barth Model 731 3kV High Voltage Pulse Generator produces a fast rise time high voltage rectangular pulse. This pulse is then passed through the Barth 5081-P Multi Ramp generator module to create a linear ramp.

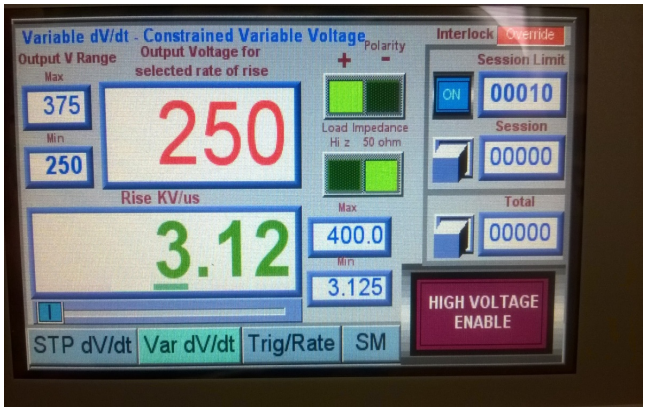



**Samples of 0.93ns, 20ns, and 80ns ramp output showing Leading edge of pulse into matched 50 ohm load**

### 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/us rate pulses. The control also allows the user to interactively increase, or decrease the dV/dt rate which is applied to the DUT.

The 2 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.




**"VAR" variable dV/dt mode shown features a continuously variable dV/dt selectable by the user.**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# Common Mode Transient (CMT) Generator
# Model 731 Pulse Generator + 5081-P Ramp Module

## System Components:

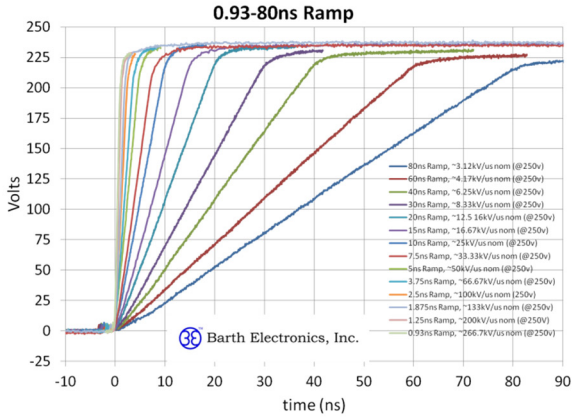
- Barth 731 High Voltage Fast Rise Time Pulse Generator
- Barth 5081-P Multi-100ns Pulse Charge line
- Output cable and control box to ramp module interconnect cables
- Optional Exponential decay Pulse shape module with 50 ohm termination

## Specifications:

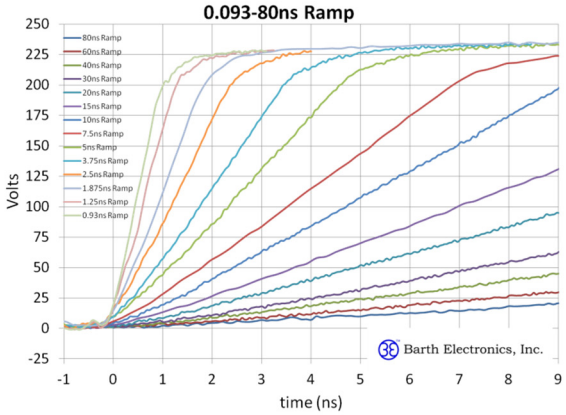
- 3.12 to 1600kV/µs can be delivered into 50 ohm loads
- 6.25 to 3200kV/µs can be realized into high impedance loads.
- 'N' Female output Connector.
- 90V-230V, A Input Power.

## Size/Weight:

- Approximately 19" w x 13" h x 15". Total weight is approximately 55 lbs.
- Output compliant with IEC….specifications.




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

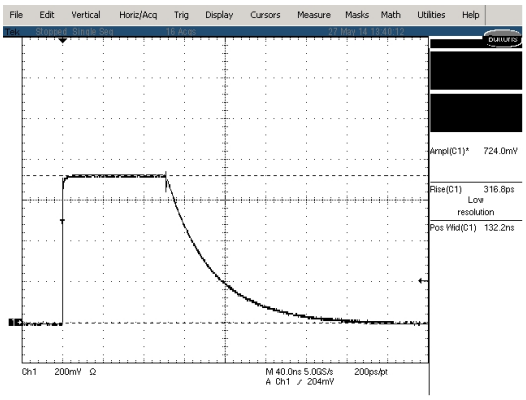



**Same Sample Pulse Outputs with expanded time scale.**

## Operation (cont.)

Specific kV/µs rate pulses between 3.12 and 1600kV/µs can be achieved into 50 ohm loads. Rates between 6.25 and 3200kV/µs can be realized into high impedance loads.

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



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

**This Product Features Barth Designed ZAPLESS ® High Speed Measurement Components**

## Pulse Rate and Triggering:

The pulse rate and triggering is similar to the 731/733 modes 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.

## Stand alone operation:

Stand alone operation of the 731 pulse generator is also supported.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# 0 to +/- 200 Volt Transient Pulse Generator
# Barth Model 790


## DESCRIPTION

**The Model 790 Transient Pulse Generator 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 ohms and 10 ohms to allow observation of supply recovery parameters.**



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# 1 GHz Risetime Filter
# Barth Model 1090-350NF


## 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.

## DESCRIPTION

Barth Model 1090-350NF Risetime Filter 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.

## SPECIFICATIONS

| | |
|---|---|
| **Input Impedance:** | 50.0 Ohms +/- 5% |
| **Output Impedance:** | 50.0 Ohms +/- 5% |
| **Input/Output Risetime:** | 90ps Input / 350ps Output |
| **Input Connection:** | Type “N” Female (jack) connector |
| **Output Connector:** | Type “N” Female (jack) connector* |
| ***Dimensions:*** | *Length: 3.625”* |
| | *Width: 1.5” body* |
| | *3-3/8" across connectors w/ Male to Male adapters)* |
| | *Height: 1.25”* |
| **Weight:** | < 0.50 lb., 226 g. |

*Supplied with “N” Male (Plug) to “N” Male (Plug) adapter for direct connection to the SCD 5000 input connector.

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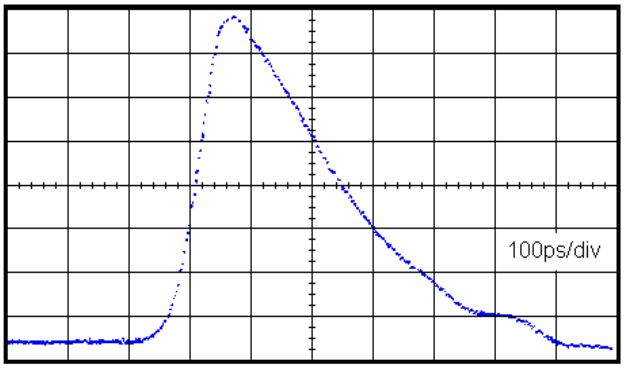
# TEM Time Domain Antenna
# Barth Model 3004




The Model 3004 is a 50 ohm 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 ohms construction to allow maximum bandwidth and minimum reflection, fed with an integral 50 ohm 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 75.6 PS. risetime followed by a slow decay. One antenna was fed with a 50 PS risetime step function of 5 ns. 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 3004 receiving antenna was fed directly into to a HP 54120A digital sampling oscilloscope through low loss coax. A pulse response through two antennas was 75.6 ps, or for each antenna an individual risetime of about 53.5 PS. The pulse decay through the pair of antennas to 50% amplitude was about 242 Ps. 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.

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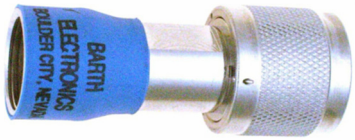
# Connectors/Adapters High Voltage Pulse
# Barth Model 401-HNB. 402-HNB. 401-371




## DESCRIPTION

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

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

## SPECIFICATIONS

| | |
|---|---|
| **Maximum Input:** | 15kV, 1μs FWHM Pulse |
| **Impedance:** | 50Ω |
| **Reflection-TDR:** | < 4% at 100ps risetime |
| **Risetime:** | < 20ps |

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

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


## DESCRIPTION

The Model 401-371 HNB trim tool is used for preparing RG214/U coax for installation of a 401-HNB / 402-HNB cable connector.

## SPECIFICATIONS

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.



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# Connectors Adapters High Voltage Pulse
# Barth Model 404-HFF. 404-HMM. 404-HFNF. 404-HMNM


## DESCRIPTION

**404-HFF** HNB female to female adapter specifically designed to maintain high voltage hold off and provide a low reflection coefficient.

**404-HMM** HNB male to male adapter specifically designed to maintain high voltage hold off and provide a low reflection coefficient.

## SPECIFICATIONS


| | | |
|---|---|---|
| **Maximum Input:** | | 15kV, 1μs FWHM Pulse |
| **Impedance:** | | 50 Ω |
| **Reflection-TDR:** | | < 2% at 100ps risetime when mated with Barth HNB connector |
| **Risetime:** | | < 20ps |
| **Connectors:** | 404-HFF | HNB Female, HNB Female |
| | 404-HMM | HNB Male, HNB Male |

## DESCRIPTION

**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


| | | |
|---|---|---|
| **Maximum Input:** | | 4kV, 1μ FWHM Pulse |
| **Impedance:** | | 50 Ω |
| **Reflection-TDR:** | | < 2% at 100ps risetime when mated with Barth HNB connector |
| **Risetime:** | | < 20ps |
| **Connectors:** | 404-HFNF | HNB Female, N Female |
| | 404-HMNM | HNB male, N male |

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# Connectors/Adapters High Voltage Pulse: Barth Model 421-NMM, 422-NFF, 423-NFMMM, NFBM, NMBF 444-HMSP, 472-HMNF

**MODEL 444-HMSP,** HN male to SHV plug adapter

| | |
|---|---|
| **Maximum Input:** | 10kV |
| **Impedance:** | 50Ω |
| **Reflection-TDR:** | ± 5% at 100ps |
| **Connectors:** | HN male and SHV plug |

**MODEL 472-HMNF,** HN male to N female adapter

| | |
|---|---|
| **Maximum Input:** | 4kV, 1μs FWHM Pulse |
| **Impedance:** | 50 Ω |
| **Connectors:** | HN male, N female |

## MODELS

**421-NMM**
N male to N male adapter; 3kV dc

**422-NFF**
N female to N female adapter; 3kV dc

**423-NFMM**
N female to SMA male adapter; 1.5kV dc

**423-NMMM**
N male to SMA male adapter; 1.5kV dc

**423-NFMF**
N male to SMA female adapter; 1.5kV dc

**423-NMMF**
N male to SMA female adapter; 1.5kV dc

**NFBM**
N female to BNC male adapter; 3kV dc

**NMBF**
N male to BNC female adapter; 3kV dc

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# Connectors/Adaptors High Voltage Pulse
# Barth Model HNL, HNT, EL-L, QHPB


**DESCRIPTION**
**HNL:** HNB right angle adapter

**SPECIFICATIONS**

| | |
|---|---|
| **Maximum Input:** | 15kV, 1μs FWHM Pulse |
| **Impedance:** | 50 Ω |
| **Connectors:** | HNB male/female |


**DESCRIPTION**
**HNT:** HNB unmatched "T"

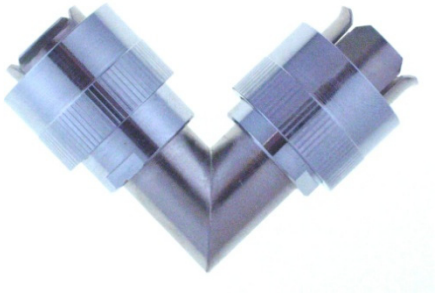
**SPECIFICATIONS**

| | |
|---|---|
| **Maximum Input:** | 15kV, 1μs FWHM Pulse |
| **Impedance:** | 50 Ω |
| **Connectors:** | HNB female |

**DESCRIPTION**
**EL-L:** 50 Ω 90 deg. Elbow (Gilbert/GR part #0874-9527)

**SPECIFICATIONS**

| | |
|---|---|
| **Maximum Input**: | 5kV, 1μs FWHM Pulse |
| **Impedance:** | 50 Ω |
| **Reflection-TDR:** | < 1% at l00ps risetime |
| **Risetime:** | < 30ps |
| **Connectors:** | GR 874 locking |



**DESCRIPTION**
**QHPB:** HNB male to GR 874 locking adapter (Gilbert/GR part #0874-9804 w/added locking nut)

**SPECIFICATIONS**

| | |
|---|---|
| **Maximum Input:** | 5kV, 1μs FWHM Pulse |
| **Impedance:** | 50 Ω |
| **Reflection-TDR:** | < 4% at l00ps risetime |
| **Risetime:** | < 20ps |

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## GR to N ADAPTERS

| Model | Connectors |
|---|---|
| 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

| Model | Connectors |
|---|---|
| 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

| Model | Connectors |
|---|---|
| 0874-QMMP | GR 874 to SMA male |
| 0874-QMMJ | GR 874 to SMA female |




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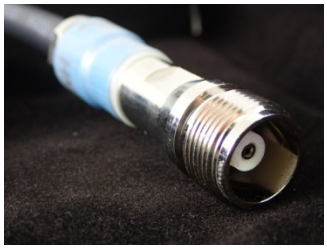
# Cable Assemblies - RG214U
# Barth Model 463 Series

**RG214/U:** Low loss coaxial cable with double shield. 5O Ω Impedance. Available configurations shown below. NOTE: Base price assemblies include up to one meter in length of RG214/U coax. Longer length assemblies are available.

**463-GLP** One (1) GR Type 874 Locking connector assembled on RG214/U coax; max voltage specification is 5kV DC.



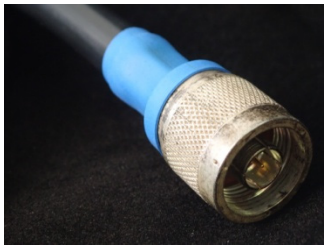
**463-HFP** One (1) 402-HNB Female connector assembled on RG214/U coax; max voltage specification is 15kV DC.

**463-HMP** One (1) 401-HNB Male connector assembled on RG214/U coax; max voltage specification is 15kV DC.

**463-HMFP** One (1) 401-HNB Male connector <u>and</u> one (1) 402-HNB Female connector assembled on RG214/U coax; max voltage specification is 15kV DC.

**463-HMMP** One (1) HN Male connector assembled on each end of RG214/U coax; max voltage specification is 15kV DC.

(x2)



**463-NMMP** One (1) N Male connector assembled on <u>each</u> end of RG214/U coax; Maximum voltage specification is 3kV DC.

(x2)

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# High Voltage Resistive Signal/Trigger Tap off

## 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 COMPARSION***

| | Maximum Input* | | | | | |
|---|---|---|---|---|---|---|
| **Model** | **Maximum Peak Voltage** | **@ Pulse width ns** | **Risetime through mainline ps** | **Voltage Ratio Tap Off** | **Risetime of Resistive Output** | **Connectors** |
| 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 | 2µS | < 30 | 100:1 | <1.5ns | HNB male/female |

NOTE: Our type HN (HNB) connectors are specially designed to obtain minimum reflection coefficient for fast rise times. 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.



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# High Voltage Resistive Signal/Trigger Tap Off
# Barth Model 241-NMFFP-11, Model 245-NMFFP-100


Model 241-NMFFP-11

## ADVANTAGES

- High Voltage Pulse rated
- N mainline and tap off connectors
- Wide bandwidth

## DESCRIPTION

A High Voltage resistive signal tap off useful for signal monitoring or device triggering.

## SPECIFICATION

| | | |
|---|---|---|
| **Voltage Ratio:** | 241-xxx-11 | 1:1 mainline into a 50 Ω load<br>11:1 tap off into a 50 Ω load |
| | 245-xxx-100 | 1:1 mainline into a 50 Ω load<br>100:1 tap off into a 50 Ω load |
| **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 |
| **Tap Off Risetime:** | 241-xxx-11 | < 60ps |
| | 245-xxx-100 | < 60ps |
| **Bandwidth (-3dB):** | 241-xxx-11 | Tap off 5GHz, mainline 10GHz |
| | 245-xxx-100 | Tap off 5GHz, mainline 10GHz |
| **Impedance:** | 241-xxx-11 | 50Ω with 450 Ω tap off |
| | 245-xxx-100 | 50Ω with 4950 Ω tap off |
| **Voltage Coefficient:** | | < 1% at rated voltage |
| **Connectors:** | 245-NMFFP-xxx | Mainline N male/female |
| | 241-NMFFP-xxx | Tap off output N female |
| | 241-GLNFP-xxx | Mainline GR 874 Locking Tap off Output N female |
| **Dimensions:** | | Approx. 3 9/16" wide (9.1 cm) x 2 3/8" high (6.0 cm) x ¾" deep (1.9 cm) |
| **Weight:** | | 1/2 lb. |

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 Ω.

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# High Voltage Resistive Trigger Tap Off
# Barth Model 242-SPJBFP-25, 50, 100, Model 242-GLBFP-25, 50, 100


Model 242-SPJBFP-50


Model 242-GLBFP-100

## DESCRIPTION

A High Voltage resistive signal tap off useful for signal monitoring or device triggering on a coaxial cable system.

## SPECIFICATIONS

| | | | |
|---|---|---|---|
| **Voltage Ratio:** | | 1:1 mainline, into a 50 Ω load 242-XXXXX-25<br>25/1 (27.96dB) into a 50 Ω load | |
| | 242-XXXXX-50 | 50/1 (33.98dB) into a 50 Ω load | |
| | 242-XXXXX-100 | 100/1 (40dB) into a 50 Ω load | |
| **Maximum input:** | | 5kV, 400ns FWHM Pulse* | |
| **Peak/Average Input Power:** | | 500kW at rated pulse width, 1W maximum* | |
| **Impedance:** | 242-XXXXX-25 | 50Ω with 1200 Ω tap off | |
| | 242-XXXXX-50 | 50Ω with 2450 Ω tap off | |
| | 242-XXXXX-100 | 50Ω with 4950 Ω tap off | |
| **Mainline Risetime:** | | < 30ps | |
| **Tap Off Risetime/ Bandwidth (-3db):** | 242-XXXXX-25 | < 215ps | 1.6GHz |
| | 242-XXXXX-50 | < 400ps | 870 MHz |
| | 242-XXXXX-100 | < 900ps | 450MHz |
| **Voltage Coefficient:** | | < 1% at rated voltage | |
| **Reflection-TDR:** | | < 3% to a 100ps rise time step function | |
| **Connectors:** | 242-GLBFP-XX | Mainline GR 874 locking, N male/female,<br>HN male/female - BNC Tap Off | |
| | 242-SPJBFP-XX | Mainline SHV Plug/SHV Jack,<br>GHV male/female - BNC Tap Off | |
| **Dimensions:** | 242-GLBFP-XX | Approx. 3.6 long x 2.2" wide x 1" high | |
| | 242-SPJBFP-XX | Approx. 5.6” long x 2.25” wide x .78” high | |
| **Weight:** | 242-GLBFP-XX | Approx. 5 oz. 242- | |
| | SPJBFP-XX | Approx. 8 oz. | |

* Maximum rating requires mainline be terminated into 50 Ω.

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# High Voltage Resistive Signal/Trigger Tap Off
# Barth Model 243-HMFNFP-100

## ADVANTAGES

- High Voltage Pulse Rated
- HN Mainline Connectors

Model 243-HMFNFP-100

## DESCRIPTION

A High Voltage resistive signal tap off useful for signal monitoring or device triggering.

## SPECIFICATIONS

| | |
|---|---|
| **Voltage Ratio:** | 1:1 mainline, into a 50 Ω load<br>100:1 (40dB) tap off, into a 50 Ω load |
| **Maximum Input:** | 15kV, 2us FWHM Pulse * |
| **Peak Input Power:** | 4.5MW at rated pulse width * |
| **Average Input Power:** | 1W maximum * |
| **Mainline Risetime:** | < 30ps |
| **Tap Off risetime:** | < 1.5ns |
| **Bandwidth (-3dB):** | Tap off 250 MHz, Mainline 10 GHz |
| **Impedance:** | 50 Ω with 5k Ω tap off |

(This provides 1/100 of the amplitude of the main line voltage on the sampled signal output connector)

| | |
|---|---|
| **Voltage Coefficient:** | < 1% at rated voltage |
| **Connectors:** | Mainline HN male/female, Tap off output N female* |
| **Dimensions:** | Approx. 3 3/4" (9.5 cm) wide x 3" (7.6 cm) high x 3/4" (1.9 cm) deep |
| **Weight:** | Approx. 5/8 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 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 Ω.

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***SIGNAL PICKOFFS***

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

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 connector or Model 402-HNB female cable for RG214/U coax should be used for interconnection; available in our Pulse Catalog.

* 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 psτ



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# Wide Band High Voltage Transformer
# Barth Model CT5-GLP, CT5-GLBFIP

Model CT5-GLBFIP

## DESCRIPTION

High Voltage 50 Ohm Transformer Coupled Signal Pickoff

## SPECIFICATIONS

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

Barth Electronics, Inc.
1589 Foothill Drive
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Phone 702.293-1576
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# Wide Band High Voltage Current Transformer
# Barth Model CT6-NFP-8


Model CT6-NFP-8

## DESCRIPTION

Transformer Coupled Signal Pickoff without direct connection to main transmission line

## SPECIFICATIONS

| | |
|---|---|
| **Voltage Ratio:** | 8.0 + 10%, 2ns after 50% amplitude |
| **Maximum Input:** | 4kV, 135Vxμs Pulse |
| **Impedance:** | 50 Ω |
| **Mainline Risetime:** | < 70ps |
| **Tap Oft Risetime:** | < 300ps |
| **Bandwidth (-3dB):** | Mainline 5GHz, tap off 1.2GHz |
| **Reflection-TDR:** | < 5% to a 100ps risetime step function |
| **Connectors:** | N female |
| **Dimensions:** | 2.8" long x 2.5" wide x 1" high |
| **Weight:** | 1/2 lb. |

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# Wide Band High Voltage Current Transformer
# Barth Model CT20B-HFNFP-20. Model CT20B-HFNFP-8


Model CT20B-HFMNFP-20

## DESCRIPTION

High Voltage Transformer Coupled Signal Pickoff without direct connection to main transmission line.

## SPECIFICATIONS

| | | |
|---|---|---|
| **Voltage Ratio:** | CT20B-HFNFP-20<br>CT20B-HFNFP-8 | 20.0/1 Vr<br>8.0/1 Vr |
| **Maximum Input:** | CT20B-HFNFP-20<br>CT20B-HFNFP-8 | 15kV, 1300Vxμs Pulse<br>15kV, 135Vxμs Pulse |
| **Impedance:** | | 50 Ω |
| **Mainline Risetime:** | | < 70ps |
| **Tap Off Risetime:** | CT20B-HFNFP-20<br>CT20B-HFNFP-8 | < l70ps<br>< 300ps |
| **Bandwidth (-3dB):** | CT20B-HFNFP-20<br>CT20B-HFNFP-8 | Mainline 5GHZ, tap off 2GHz<br>Mainline 5GHz, tap off 1.2GHz |
| **Reflection-TDR:** | | < 5% to a 100ps risetime step function |
| **Connectors:** | | HN female mainline, N female tap oft output ** |
| **Dimensions:** | | 3" long x 3.3" wide x 1.5" high |
| **Weight:** | | 1 lb. |

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

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. 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.

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# Wide Band High Voltage Resistive Voltage Tap Off And Resistive Current Monitor – Barth Model CV1A


Model CV1A Current and Voltage Probe

## ADVANTAGES

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

## DESCRIPTION

Precision Coaxial Current Sensor, a completely new patented design providing precise current measurements from sub-nanosecond to microseconds. This complementary voltage and current probe can provide precise measurements of incident and reflected energy for time domain pulses as fast as 30 picoseconds. The CV1A is a combination voltage, tap off, and current monitor. This product presently covers the tremendously wide measurement range of $3X10^5$, which can be extended.

## SPECIFICATIONS

| | |
|---|---|
| **Voltage Sensor Ratio:** | 100:1 tap off, into 50Ω load |
| **Maximum Input:** | 2.5kV @ 400ns rectangular pulse on mainline* |
| **Peak Input Power:** | 125kW at rated pulse width |
| **Average Input Power**: | 100W maximum* |

* Maximum rating requires mainline be terminated into 50 Ω.

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## SPECIFICATIONS Continued

**Mainline Risetime:** < 20ps

***Voltage Tap Off Risetime:*** *30ps*

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

**Current Sensitivity Volts/Amp:** 0.5V/A

**Current Sensitivity Droop:** 1% in 1□s

***Maximum Current:*** *300A*

**Average power:** 100 watts

Mainline N male/female Tap off N female
**Dimensions:** Approx. 6.8" w (17.3cm) x 2.9" h (7 .3cm) x 1.5" d (3.8cm)

**Weight:** 1.6lb. (.72kg)

NOTE: 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.

* Maximum rating requires mainline be terminated into 50 Ω.



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## World Wide 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

DRI – Desert Research Institute

Fermi – Fermi National Accelerator Laboratory

FID Technology Germany

Fraunhofer Institute Germany

General Atomics

Her Majesty's Government United Kingdom

Ioffe Physiotechnical Institute Russia

LANL- Los Alamos National Laboratory

LLNL -Lawrence Livermore National Laboratory

NAWCWD- Naval Air Warfare Center Weapons Division

Nevada Test Site

NSTEC- National Security Technologies, LLC

SLAC -Stanford Linear Accelerator Center

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

# Worldwide Sales Representatives

## DOMESTIC

**UNITED STATES**
www.barthelectronics.com
**Barth Electronics, Inc.**
1589 Foothill Drive
Boulder City, NV 89005
**Sue Smith, Sales Manager**
Phone: 1-702-293-1576
Fax: 1-702-293-7024
beisales@barthelectronics.com

## INTERNATIONAL

**FRANCE**
www.pulsemc2.fr
**Pulse MC2**
Z.I. de la Petite Montagne Nord
7 allee du Brevent
91019 EVRY Cedex France
**Michel Chaillou**
Phone: 011 33 1 60 86 21 26
Fax: 011 33 1 64 97 54 98
michel.chaillou@pulsemc2.fr

**UNITED KINGDOM**
www.ppmpower.co.uk
**PPM (Pulse Power & Measurement LTD)**
65 Shrivenham Hundred Bus. Park
Watchfield, Swindon, Wiltshire
SN6 8TY UK

**Phil Surman, Sam Whitaker**
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## INTERNATIONAL

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Nei Hu, 114 Taipei, TAIWAN R.O.C. 11493
**Allen Chou** Tel (02) 2797-3357 ext 275
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achou@quatek.com.tw

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www.general-bussan.co.jp
(Pulse Only)
**Keita Kanno**
**General Bussan Co., Ltd.**
2-18-2 Nakano
Nakano-ku
Tokyo 164-0001 Japan
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Fax: +81-3-3383-1719
info@general-bussan.co.jp

# ORDERING INFORMATION

**BUSINESS HOURS**

We are located in Boulder City, NV, USA in the Pacific Time Zone. Our business hours are 8:00 a.m. to 4:00 p.m. Monday through Friday.

**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.

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 prices are F.O.B. Boulder City, Nevada. We provide commercial packaging for shipment.

**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 confirming purchase orders. Export orders may require a letter of credit or pre-payment, before order is shipped. If an export license is required; order processing and shipping may be delayed.

**CREDIT CARDS**

Barth Electronics, Inc. accepts VISA, Discover and MasterCard. Maximum credit card charge is $10,000.00 USD, per transaction. There will be a 4% processing fee 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 of 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, or visit our website for the most complete and up to date sales representative information at www.BarthElectronics.com

**TECHNICAL QUESTIONS**

For technical support email beitechsupport@barthelectronics.com , or call 1-702-293-1576

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