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## Bare Probe Manual

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## Safety

**High Voltage Safety is important. Always ground the probe to a reliable ground point near the measurement point. Do not touch the probe during high voltage operation. Stay away from malfunctioning high voltage equipment and ground it carefully if it must be touched. Failure to ground the probe near the device under test can also destroy the probe.**

## General

North Star High Voltage “Bare” probes are high voltage RC dividers designed to produce precisely attenuated signals over a very wide bandwidth. “Bare” probes do not have shields and so they are more subject to effects due to stray capacitance than our standard VD series probes. The electrodes that reduce stray capacitance in our standard probes are also not present in these probes.

The circuit diagram is shown below. The divider network consists of a high voltage network represented by a parallel capacitor and resistor, and a low voltage network which consists of a parallel RC network and a compensation circuit. The high voltage section of the voltage divider is in the blue epoxy “potted” section (or bare board for PVM-series or VD-series bare probes). The low voltage section is in the small blue rectangular box supplied with the probe (there is no blue box required for the PVM series bare probes).

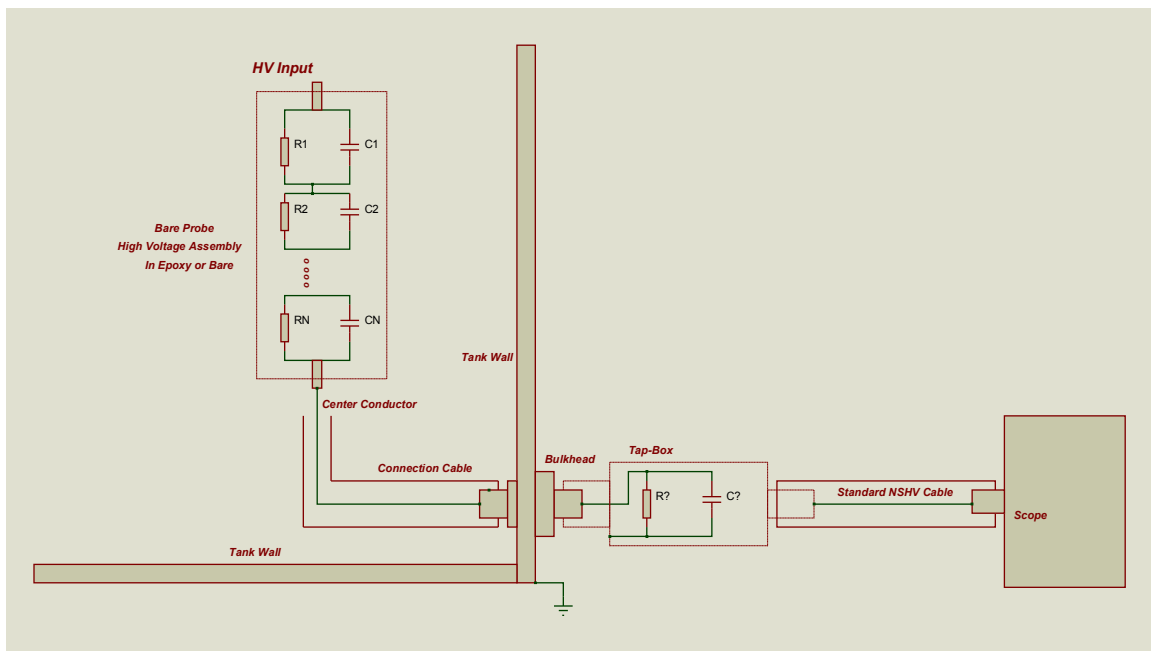


Figure 1 Arrangement of the Bare probe in the tank.

## **Connection and Installation**

The items Included with this shipment are:

High Voltage Assembly  
Cable inside tank (may be attached)  
Bulkhead  
Tap-Box (not required for PVM series bare probes)  
Standard Cable  
Manual

Figure 1 illustrates the connection of the probe to the high voltage and oscilloscope. If possible the base of the probe should be close to a ground plane with it's axis perpendicular to the ground plane. Walls parallel to the probe should be at least half the probe height away to avoid stray capacitance effects. If equipment is near the probe, please send a sketch of nearby grounds and high voltage conductors. We will perform a calibration by simulating a customer's geometry (at no extra charge) if we have the necessary information.

## **Input Impedance for Standard Operation**

Standard probes are designed to operate into a 1 megohm oscilloscope. Operation into higher impedance devices such as multi-meters requires a parallel resistance for accurate measurement. For example, a 1.111 Megohm resistance can be placed in parallel with an Agilent meter (10 Megohm input) to produce a 1 Megohm input impedance. Operation into lower impedance equipment requires factory changes. Read the manual of your measuring instrument to determine it's input impedance since many meter manufacturers use different input impedances on different meter scales. Erroneous readings will result with all probes (not just our probes) in that case. For example, an Agilent high voltage probe will not give correct readings with some Agilent meters on higher voltage (>30 V) scales.

## **Proximity Effect and Exclusion Zone**

The proximity effect (change in calibration when the probe is near ground or near a high voltage node) has been eliminated in all standard NS probes. Bare probes do not have shields and cannot be shielded from electrostatic coupling. Good practice and high voltage safety still dictate that the probe should be spaced away from other conductors by a distance of at least 3 mm/kV in air (15 cm if the DC voltage is 50 kV). A high frequency ( $f > 50$  Hz) calibration shift of about 0.5 - 1 % is possible if conductors are closer.

## Specifications

Model Number	VD-60B	VD-120B	VD-180B	VD-240B	VD-300B
Max DC/Pulsed V (kV)	60/80	120/160	180/240	240/300	300/360
Max Frequency (Mhz.)	15	15	10	8	6
Cable Impedance (ohms)	50 ohm standard or customer specified				
DC - 2 Hz accuracy	<1%	<1%	<1%	<1%	<1%
2 Hz - 200 Hz. accuracy	<2 %	<2 %	<2 %	<2 %	<3 %
200 Hz. - 1 Mhz. accuracy	<2.5 %	<2.5 %	<3 %	<3 %	<3.5 %
> 1 Mhz. Accuracy	<3 %	<3 %	<4 %	<4 %	<5 %
Input R/C (Megohm/pf)	800/38	1600/19	2400/13	3200/9	4000/8
Cable Length (ft./m)	30/9	30/9	30/9	30/9	30/9
Standard Divider Ratio	10,000:1	10,000:1	10,000:1	10,000:1	10,000:1
Length (inches/cm.)	6.9/17.5	12.9/32.8	19.8/60.3	25.8/65.6	32.7/83.1

*Part Numbers are VD-xxxB-yy. yy = 10 is the standard 10,000:1 ratio -5 is 5,000:1 -20 is 20,000:1 High frequency accuracy improves if the geometry is well understood or conductors are far away.*

## Changing the Cable

We recommend that if a different cable than originally supplied is to be used, it should be made from RG-223 cable (except for 93 ohm cable probes) and kept to the same length as the original cable. Connectors can be placed in this cable (for example for penetrating screen room walls). Our double shielded cables reduce spurious noise, leading to better performance. We usually use RG-223 (double shielded) which has a capacitance of 29 – 31 pf/ft. A 10 ft. increase in cable length will typically change the high frequency calibration by 5 % (the range is 3 - 10 % depending on probe).

## Troubleshooting

The repair of most problems with the probe will lead to a requirement for re-calibration. Except in unusual situations, North Star will repair the probe without question if it is under warranty. It is much easier for us to ascertain the problem if the probe has not been modified by the user when it is returned to us.

If the probe has no signal output, but is not shorted to ground, the problem may be a poor connection in the tap-off box. The tap-off box can be inspected, and if wires are loose they should be reconnected. Do not adjust the potentiometers in the tap-off box, or re-calibration will be required.

### **Warranty**

The probe is warranted against defects in parts and workmanship for one (1) year after the ship date from North Star. We will repair the probe if an electrical failure occurs during the first six (6) months after shipping irrespective of the cause of the fault. Shipping from the customer site to North Star will be paid by the customer, and shipping from North Star to the customer will be paid by North Star. North Star will judge whether expedited means of shipping are required.

Mechanical damage due to dropping the probe and extreme thermal damage (melting the probe) may not be covered and should be discussed with North Star before returning the probe. Shipping damage should be reported to North Star immediately.