General Description

The NexTek PTRONxONFxxS is a Coaxial Lightning and Surge Protector. This device has N-type coaxial connectors on each end, one of which is a bulkhead connector. There is a replaceable protective component in the center of the part. The frequency capability is from dc to 3.2 GHz and the voltage rating varies from 90V up to 1000V. This device can protect from multiple 20 kA discharges, or a single 50kA discharge.

Theory of Operation

The outer conductor of the cable is grounded by the bulkhead mount. This ground connection drains or discharges the high current to earth. The center conductor passes through the unit, so there is dc continuity through the protector. The protective component is called a gas discharge tube (GDT) and is triggered by high voltage on the center conductor, and shunts the center conductor to the shield when a high voltage is sensed. For the PTRONFONF23S (or any 230V model), the trigger voltage is 230V +/- 20% (184V to 276V) for dc or slow transients. The trigger voltage increases when the pulse rise time is faster. For example, the trigger voltage is about 650V for 5kV/microsecond. When the device is triggered a shunt response will occur between the center conductor and the shield. Therefore the shield ground connection drains any lightning current on the shield and on the center conductor. The shunt action of the GDT ceases when a lower or normal voltage returns on the center conductor (when there is very low current through the GDT). The GDT can typically shunt 10 pulses of 20 kA with a waveform of 8us rise time and 20us pulse width. It can also protect against one 50 kA pulse.

The GDT's that NexTek uses are popular industry standard format 8mm diameter devices, and they are chosen to provide high transient current capability, good protection levels, and long life multi-strike capability. These are simple and well-proven devices that are constructed similar to a fuse; with two conductive end caps and a glass or ceramic cylindrical body between these two end caps. (A glass unit is shown here so you can see the inside of the component; normally a ceramic body would be opaque and prevent this inside view.)

Gas Discharge Tube

Instead of a fuse's wire conducting current and melting when the current is exceeded, the GDT has a gas inside, somewhat like a neon sign, which arcs brilliantly in the small gap when a high voltage exists between the two end caps. While these gas discharge tubes are rugged components, they can be damaged by *extreme* exposure to lightning. The typical failure mode is an increase in voltage at which the GDT conducts (or protects), or complete catastrophic failure for *severe* exposures. The vast majority of GDTs in service provide satisfactory protection for many years without replacement. Therefore, for extremely exposed conditions, the need for maintenance can arise.

Failure Modes

The failure modes for this product are associated with transient current exposure and general connector failure. *Please refer to the troubleshooting table on Page 4.*

Protective Component Replacement Techniques

CAUTION: *NexTek lightning protectors are high capacity devices for coaxial lines. The high energy and current associated with the operation of these devices should have expert installation and maintenance.*

A. DO NOT install or repair while there is a threat of thunderstorm activity.
B. DO NOT replace protective Gas Discharge Tubes while transmitting high RF power.
C. Consult a protection professional for a complete protection design, including protection of personnel and all wiring interfaces, and ground system qualification
D. Follow electrical, grounding, building, and lightning protection codes and practices.
E. Follow RF power handling practices appropriate to the application.

Replacing a protective component (aka GDT or Gas Discharge Tube)

1. Remove RF power sources, particularly those over 1 W. (Turn transmitters off.)
2. Unscrew the hex cap from the protector. (Use a wrench or large screwdriver.)
3. Carefully withdraw the hex cap from the protector.
4. Remove the protective GDT component from the cap.
5. If the old GDT remains in the protector, remove or retrieve this component.
6. Inspect the old GDT component. If you see a cracked GDT, severe welding or melting of either end of the GDT, also see the severe damage steps below.
7. You can either test the minimum and maximum GDT trigger voltage with a low current power supply or just replace the protective component if you wish.
8. Replace the protective component in the cap with a new or verified component, by inserting the protective component into the cap. (NexTek P/N 400-0001-01 for a 90 Volt protector.)
9. Reinstall the cap into the protector and screw in snugly (50 – 100 Inch pounds). (Make sure the component is in position against the pin.)

Checking a device where Severe Damage is suspected

1. Remove the mating cable connectors from the protector.
2. Verify that there is no arcing or melting of the center pin.
3. If the connector center pin is damaged, it is likely that all connectors and cables on that side of the protector need replacing.
4. Check that the cap and center pin are not excessively damaged from arcing.
5. If there is significant damage internal to the protector, the protector will need replacing.

Additional Tips

- You can periodically replace the GDT component according to a 1 to 3 year cycle, depending on exposure to lightning (height of antennas and frequency of thunderstorms).
- If periodic inspection reveals no damage, consider extending the cycle time.
- If protected equipment is being damaged, but the surge protector and GDT appear functional and undamaged: You may need to improve grounding.

Gas Discharge Tube Replacement Part Numbers

Listed by Protection Voltage

Protection Voltage	Voltage Code[1]	RF Power (W)[2]	Let-through (V_{pk} / mJ)[3]	NexTek Part Number
90	09	37	600 / 0.3	400-0001-01
150	15	95	600 / 0.3	400-0001-02
230	23	240	650 / 0.5	400-0001-03
350	35	550	800 / 0.7	400-0001-04
470	47	1000	1200 / 2.2	400-0001-05
600	60	1600	1500 / 4.4	400-0001-06
800	80	2900	1900 / 9.0	400-0001-07
1000	99	4500	2200 / 14	400-0001-08

[1] Use the voltage code in the part number
[2] For multiple carriers, sum of peak voltages should not exceed 60% of the protection voltage
[3] Input is 6kV @ 1.2x50μs/ 3kA @ 8x20μs

NexTek PTR Troubleshooting Guide

Cause	Symptom	Corrective Action
Lifetime of protective component exceeded	• Damage to protected equipment • Trigger voltage out of tolerance • Cracked or damaged protective component	Replace Protective Component
Protector not grounded sufficiently	• Damage to protected equipment	Use 10 AWG (minimum) ground bonds. Suppress power and data lines to same ground point/plane. Use multiple ground rods.
Gross Transient Current Pulse Overload	• Cable Failure • Antenna Failure Protective Component Cracked or Fractured • Connector center pins burned or charred or missing • Protective component welded to pin or removable cap	Inspect and consider replacement of protector and connectors and wire
General Damage	• Physical Damage and Abuse • High RF Insertion Loss • Moisture Damage	Replace Protector Use waterproof connectors Inspect connector pins for damage
Transmission problems but receive is O.K.	• Protector voltage is too low for RF power (Watts) • High VSWR	Use higher voltage protector