

# Instrumentation Cables

## Applications

Geokon cables are of the highest quality materials and construction. They are designed to be matched with the appropriate instrument for a variety of geotechnical and hydrological applications. Standard and specialized cables are available for...

- Typical applications
- High temperature environments
- Extra abrasion resistance
- Heavy duty use



- The Model 4500HT High Temperature Piezometer depicts a **Teflon**® cable threaded inside stainless steel tubing.



- Standard Geokon cables.

## Cable Design

**GEOKON**® cables are made from individual stranded copper conductors encased in an insulation material. Individual, insulated conductors are twisted into pairs, bundled inside a conductive Mylar-type shielding material and then covered by an outer jacket made from the most suitable material. In addition, cables may be water blocked, armored, or may contain steel or **Kevlar**® cables for additional strength, or plastic tubes for circulation fluids, or for venting to atmosphere.

## Cable Conductors

In general, the number of conductors in a cable is determined by the number of sensors to be connected to the cable, and the number of conductors required by each sensor.

The type of conductor normally used is stranded, 22 AWG tinned copper. Stranded conductors are more flexible than solid conductors, which makes the cable easier to handle during installation.

## Cable Shielding and Insulation

Shielding provides protection from electromagnetic radiation coming from nearby electrical equipment, lightning strikes and fields surrounding power lines, transformers, etc. **GEOKON** multi-conductor cables are individually shielded and twisted in pairs, which helps minimize common mode interference. Drain wires connected electrically to Mylar-type shields provide a simple means of connecting all the shields to a common ground. For applications with very high levels of EMI, such as in pumping wells, a special cable with a braided shield can be provided.

Plastic insulation is typically used on the individual copper conductors. Polyethylene or polypropylene insulation is used at normal temperatures and **Teflon**® is most often used for high temperature.

## Outer Jackets

**GEOKON** cable jackets are thicker than regular commercial types, and pressure extruded, which produces cables that are rounder, firmer and easier to grip and seal at the point of entry on the sensor. A wide variety of outer jacket materials is available depending on the end use:

**Neoprene:** A synthetic rubber compound commonly used for outdoor applications, with good resistance to gasoline, oils etc. Ordinary rubber should never be used.

**PVC:** A common choice for its good electrical properties and for being waterproof. It should not be used at low temperatures where it becomes brittle.

**Polyurethane:** This material is very resistant to cuts and abrasions making it useful for cables that are subject to repeated rough handling. It is not as water resistant as PVC but has better low temperature capabilities.

**High Density Polyethylene:** An excellent material that is highly resistant to environmental attack and exhibits excellent low temperature characteristics. Unfortunately, like **Teflon**, the material is so slippery that splicing and potting compounds will not stick to it.

**Teflon®:** This material is essential wherever sensors and cables are subject to high temperature. It has outstanding resistance to environmental attack and has excellent low temperature properties. However, splicing and potting compounds will not adhere to it.

Other compounds such as **Kevlar** or **Kapton®**, etc. may be required where there is a need for low smoke emissions, flame retardant, or resistance to nuclear radiation.

## Armor

Armored cables are most often needed for sensors installed in earth embankments or landfills where large forces are exerted on the cable by compaction equipment and earth moving vehicles, and by settlement, "weaving," and sideways spreading of the embankment as it is built. Armored cables should not be connected directly to strain gages or crackmeters because the stiffness of the cable would pull on the gage and alter the readings. Armored cable is not necessary in concrete. The armor usually takes the form of a helically laid layer of steel wire. In very severe situations, regular cable may be put inside stainless steel tubing.

## Vented Cables

Special cables are available which contain plastic tubes inside of them as well as the usual conductors. These tubes can be used to transport air or other fluids. This kind of cable is required for vented piezometers, where a single vent tube allows the inside of the pressure sensor to be connected to the ambient atmosphere to provide automatic barometric compensation.

## Cable Splices

Cable splicing is best done using commercially available splicing kits containing butt splice connectors and epoxy potting compounds. These help provide a waterproof and mechanically strong splice. Armored cables are difficult to splice if the mechanical strength is to be maintained; special mechanical connections need to be fabricated which will grip the armor firmly.

## Technical Specifications

Model	Conductors	Conductor Insulation	Drain Wire	Cable Jacket <sup>1</sup>	Nominal O.D.	Temp. Range
02-187P6	4-conductor, 2 twisted pairs, 22 AWG 7/30	8 mil HDPP	24 AWG	Blue PU	4.75 mm (±0.25 mm)	-20°C to +80°C
02-187V3	4-conductor, 2 twisted pairs, 22 AWG 7/30	8 mil HDPP	24 AWG	Red PVC	4.75 mm (±0.25 mm)	-20°C to +80°C
02-250P4	4-conductor, 2 twisted pairs, 22 AWG 7/30	8 mil HDPP	24 AWG	Green PU	6.35 mm (±0.25 mm)	-20°C to +80°C
02-250T	4-conductor, 2 twisted pairs, 22 AWG 19/34	10 mil FEP	24 AWG	White <b>Teflon®</b> with aluminum polyester foil shielding	5.20 mm (±0.25 mm)	-80°C to +200°C
02-250V6	4-conductor, 2 twisted pairs, 22 AWG 7/30	10 mil HDPP	24 AWG	Blue PVC	6.35 mm (±0.25 mm)	-20°C to +80°C
02-313PI	4-conductor, 2 twisted pairs, 22 AWG 7/30	10 mil HDPP	24 AWG	Black PU with integral stranded steel wire	7.95 mm (±0.38 mm)	-20°C to +80°C
02-335VT8	4-conductor, 2 twisted pairs, 24 AWG 7/32	10 mil HDPP	24 AWG	Yellow PU with integral 0.125" Ø PE vent tube	8.50 mm (±0.38 mm)	-20°C to +80°C
02-500PE1	4-conductor, 2 twisted pairs, 22 AWG 7/30	10 mil HDPP	24 AWG	Black PVC Inner; Black MDPE outer, with served armor	12.70 mm (±0.38 mm)	-20°C to +80°C
03-250V0	6-conductor, 3 twisted pairs, 24 AWG 7/32	10 mil HDPP	24 AWG	Black PVC	6.35 mm (±0.38 mm)	-20°C to +80°C
04-375V9	8-conductor, 4 twisted pairs, 22 AWG 7/30	10 mil HDPP	22 AWG	Violet PVC	9.50 mm (±0.38 mm)	-20°C to +80°C
04-500VT10	8-conductor, 4 twisted pairs, 22 AWG 7/30	10 mil HDPP	22 AWG	Gray PVC with integral 0.125" Ø PE vent tube	12.70 mm (±0.38 mm)	-20°C to +80°C
05-375V12	10-conductor, 5 twisted pairs, 22 AWG 7/30	10 mil HDPP	22 AWG	Tan PVC	9.50 mm (±0.38 mm)	-20°C to +80°C
06-312V0	12-conductor, 6 twisted pairs, 24 AWG 7/32	10 mil HDPP	24 AWG	Black PVC	7.95 mm (±0.38 mm)	-20°C to +80°C
06-500V7	12-conductor, 6 twisted pairs, 22 AWG 7/30	10 mil HDPP	22 AWG	Orange PVC	12.70 mm (±0.38 mm)	-20°C to +80°C
12-625V5	24-conductor, 12 twisted pairs, 22 AWG 7/30	10 mil HDPP	22 AWG	Brown PVC	15.90 mm (±0.38 mm)	-20°C to +80°C

<sup>1</sup>All outer cable jackets are pressure extruded. In addition, other cable jackets are available for special applications.

FEP = Fluorinated Ethylene Propylene (**Teflon®**) | HDPP = High Density Polypropylene | MDPE = Medium Density Polyethylene | PE = Polyethylene | PP = Polypropylene | PU = Polyurethane | PVC = Polyvinylchloride