

Multi-Component Borehole Geophone BGK5



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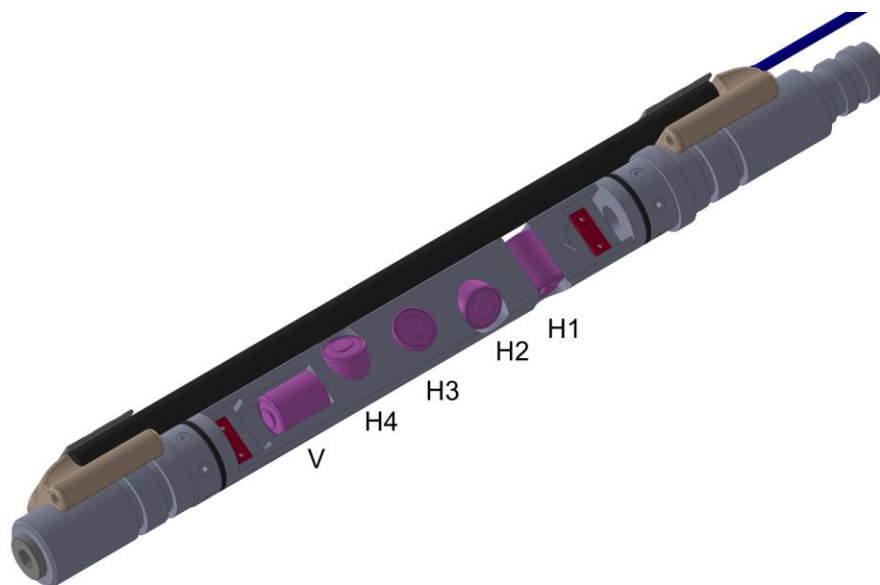
1. Description

The borehole geophone BGK5 is used to receive P- and S-waves in dry or water-filled boreholes. The borehole geophone BGK5 consists of four horizontal sensors, separated by 45° intervals, and one vertical sensor. The geophone is coupled to the borehole wall by a pneumatic clamping system (inflatable bladder). Air is supplied to the BGK5 through an electro-pneumatic hybrid cable with a Kevlar tension string. The cable is terminated by a connector to the seismograph. It is a robust tool with a body diameter of 50 mm, which can be used for seismic measurements in boreholes of a diameter of 75mm (or larger if spacers are used) to a depth of a maximum of 200 m. The receiver weighs about 5 kg, and the 100m cable approx. 18,3 kg (in air).

It consists of two main parts, the geophone unit, which is connected directly to the borehole cable, and the pneumatic clamping unit.

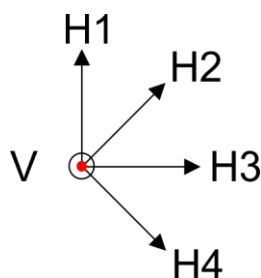
1.1 Geophone Unit BGK5

Four BGK5 horizontal geophone sensors (H1, H2, H3, H4) and a single vertical geophone (V) are placed inside a stainless steel tube, acting as a multi-component seismic receiver.



Horizontal components are placed clockwise in 45° steps (see Figure 1).

- **H1:** X
- **H2:** X+45°
- **H3:** X+90°=Y
- **H4:** X+135°
- **H5:** Z



H1 = Ch1
 H2 = Ch2
 H3 = Ch3
 H4 = Ch4
 V = Ch5

The reference direction of the geophone unit is the axis of the H1 element. Two markings (N) in a line on the outside of the geophone housing indicate the reference direction.

The sensors will give a positive rising signal in the direction of the sensor array (see Figure 1, a seismic impulse in the direction of the marker line will provide a positive rising signal). All other H components can be tested in the same way. A small pressure tube is routed inside the geophone unit from the quick connector on the probe head to the clamping unit to supply the pneumatic clamping device.

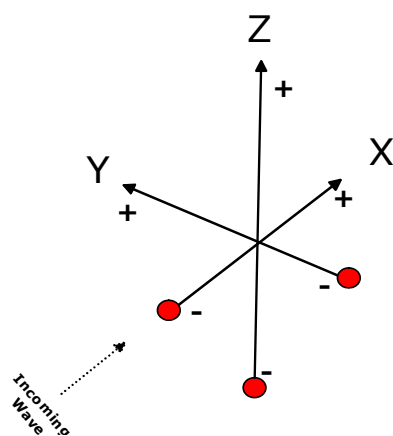


Figure 1: Sensor orientation and signal polarity

1.2 Geophone wiring

Following five channels are active:

Channel 1	Geophone H1	Pin A	Signal +
		Pin B	Signal -
Channel 2	Geophone H2	Pin C	Signal +
		Pin D	Signal -
Channel 3	Geophone H3	Pin E	Signal +
		Pin F	Signal -
Channel 4	Geophone H4	Pin G	Signal +
		Pin H	Signal -
Channel 5	Geophone V	Pin J	Signal +
		Pin K	Signal -

1.3 Pneumatic clamping unit

The pneumatic clamping unit is used to anchor the geophone inside the borehole for seismic recording. If air is injected into the clamping unit, the rubber housing expands in the direction opposite to the reference direction. After reaching the borehole wall, the geophone probe is pressed against the wall. By further increasing the pressure, the probe can be anchored in the borehole for seismic recording. If the rubber hose is damaged, the clamping unit can be replaced as described in chapter 3 Maintenance.

1.4 Drum Instrumentation

The air pressure can be checked using the pressure gauge (see Figure 2).



Figure 2: Connectors on orange drum

- The OPEN valve (turn counter-clockwise) allows air to be supplied.
- The CLOSE valve (clockwise) allows the air to be released and the pressure to be maintained for clamping.
- **RELEASE allows the air to be released while the pump is connected.**

The air pump connection is supplied with a special adapter. The outer ring must be pulled back to release the pump from the "AIR IN" socket. The pump can be permanently connected and does not need to be disconnected to release the air.

2. Operation

2.1 Preparation

2.1.1 Clamping steps

The maximum diameter of the borehole for anchoring the geophone is approximately 90 mm (without extension).

Please follow these steps to clamp the borehole geophone to the borehole wall:

Air in for Clamping	<ul style="list-style-type: none">• Lower the geophone to the desired depth• Connect the air pump to the valve• Apply pressure while lifting the cable slightly up and down• Stop applying pressure when BGK starts to clamp (lifting up and down is no longer possible)• Gently close the valve (turn to the right)• The geophone is now fixed. Slightly lower the cable by 5-10 cm and clamp it with the clamping device. This will release the tension in the cable.
Air out for release	<ul style="list-style-type: none">• Disconnect the air pump from the valve• Open the valve (turn to the left) and release the pressure until the geophone is released.• Move the geophone to the next position

Apply gentle pressure to the packer. Stop if the system clamps. Check pressure frequently to see if the BGK still clamps.

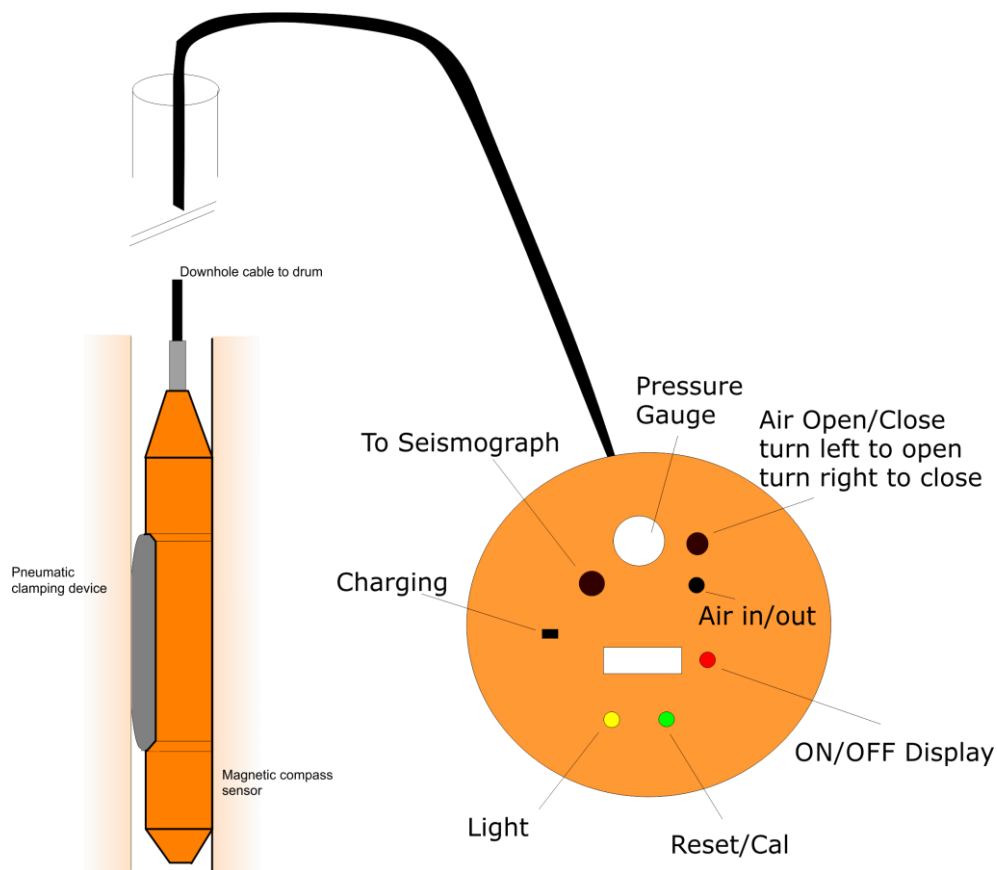


Figure 4: Clamping and release of the borehole geophone

2.1.2 Cable handling

To ensure a quality measurement, please note the following when handling the cable

- Please unwind the cable before starting the measurement
- Place the cable in loops and avoid kinking the cable.

2.2 Moving the Geophone

- The cable is clamped in place!
- Disconnect the air pump from the valve
- Open the valve (turn to the left) and release the pressure until the geophone is released.
- Move the geophone to the next position

3. Maintenance



3.1 Exchange of the clamping unit for older type of BGK5

If the rubber hose is damaged, the clamping unit can be replaced as follows:

- Unscrew the screw connection of the housing tube of the clamping unit on the compass side and open the cable connection. Remove the compass unit.
- Unscrew the housing tube on the geophone unit side and unscrew the clamping unit.
- Place a new rubber hose on the plastic tube and secure (or take a new clamp) and reassemble all parts in reverse order as described above.

New clamping units can be supplied as spares on request. Please contact us!

To dismantle the rubber clamping part please do the following:

1		<ul style="list-style-type: none"> • Remove all 6 screws from the lower part of the 3C geophone (1,2) • Pull out carefully the lower part of the compass (attention Short Compass Line) • Disconnect compass part carefully
2		<ul style="list-style-type: none"> • Remove the upper 6 screws (4) • Remove stainless steel clamping window (5) • Remove carefully rubber tube by counter-clock wise turnings (6) • Clean windings (7) and pour new HYLOMAR on winding • Screw the new rubber tube clockwise • Attach stainless steel clamping window (Keo NORTH direction marked with "N" • Connect the compass cable and grease the O-Ring at the lower compass part • Attach the lower compass part by keeping "N" marking in the correct position

3.2 Exchange of the clamping unit for new type of BGK



1. Open the hose connection
(push in outer ring to pull out the
PUR hose)



2. Cut the four cable ties and remove
damaged packer



3. Put new cable ties on



4. Fix cables ties and cut close
to cable lock



5. Connect air hose

