Operation and Maintenance Instructions
Borehole Hydrophone String BHC-Type 5

The hydrophone string BHC-5 is a string of 24 (or less) small diameter hydrophones with integrated preamplifier, designed for seismic tomographic surveys in boreholes having a diameter of approx. 50 mm (2") or larger.

In its standard version the BHC-5 has a hydrophone spacing of 1 m and can be operated up to a depth of 123 m (standard depth) or larger.

Content

1. Description of the equipment

1.1 Borehole cable equipment

A rugged seismic cable having 24 pairs of wires and a mantle of PUR (Polyurethan) is used for the hydrophone section and the following lead-in cable. The whole string is coiled on a cable drum. For depth measurement cable is marked every two meter.

Depth reference (=0m) is at lowest hydrophone.

Cable end splits in a connector to seismograph and a connector to battery box (see fig 1).

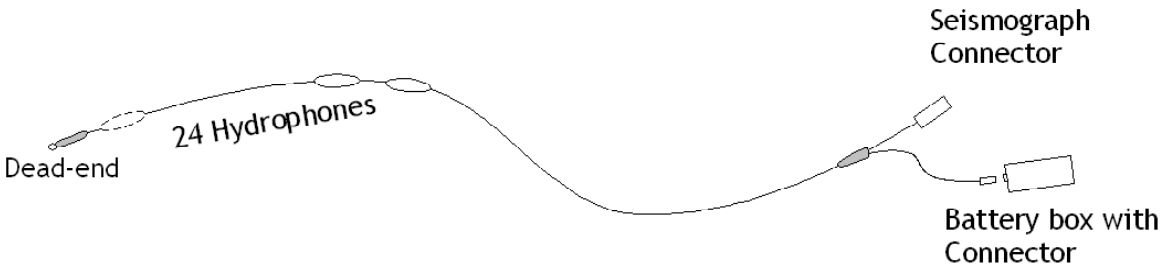

Fig. 1: Schematic diagram of the BHC5

Connect battery box first to string before connecting to seismograph. Disconnect first from seismograph before disconnecting from battery box.

Additional parts provided along with the string are:

- Spooler device to unspool cable (1)
- Clamping device to hold cable on top of borehole (2)
- Battery box with self-test function (3)

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The borehole cable and the hydrophones are coiled on a simple drum. By using the spooling device the cable can easily be unspooled (see fig 2). Cable can be clamped at the top of the casing. Please use the supplied clamping device (see fig 3).

Fig 2: Cable spooler

Fig. 3: Clamping device

Do not pull cable over sharp edges.

1.2 Hydrophones

Hydrophone sensors of type SQ54 or AQ2000 are used. Each hydrophone consists of a piezoelectric pressure sensor, a low noise preamplifier and a line driver for two-conductor signal transmission. The current consumption of a single hydrophone is about 5 mA and about 120 mA for 24 hydrophones.

A pre-amplification of 4x is pre-set. All hydrophone connections of the borehole cable junctions are completely embedded in PU compound.

1.3 Battery box and self-test function

The pre-amplification needs power from surface. A battery box is supplied which can be connected to the hydrophone cable (refer to fig 4). Operating time of fully charged batteries is about 10 hours.

You may use re-chargeable batteries or normal AA batteries.
The batteries should be placed with correct polarity (polarity is shown on a diagram at the outside of the battery housing).

Fig 4: Power supply box

The battery box and connectors are not water tight. Avoid water migrating into connector or box.

Fig 5: Changing batteries

Fig 6: Connection to box

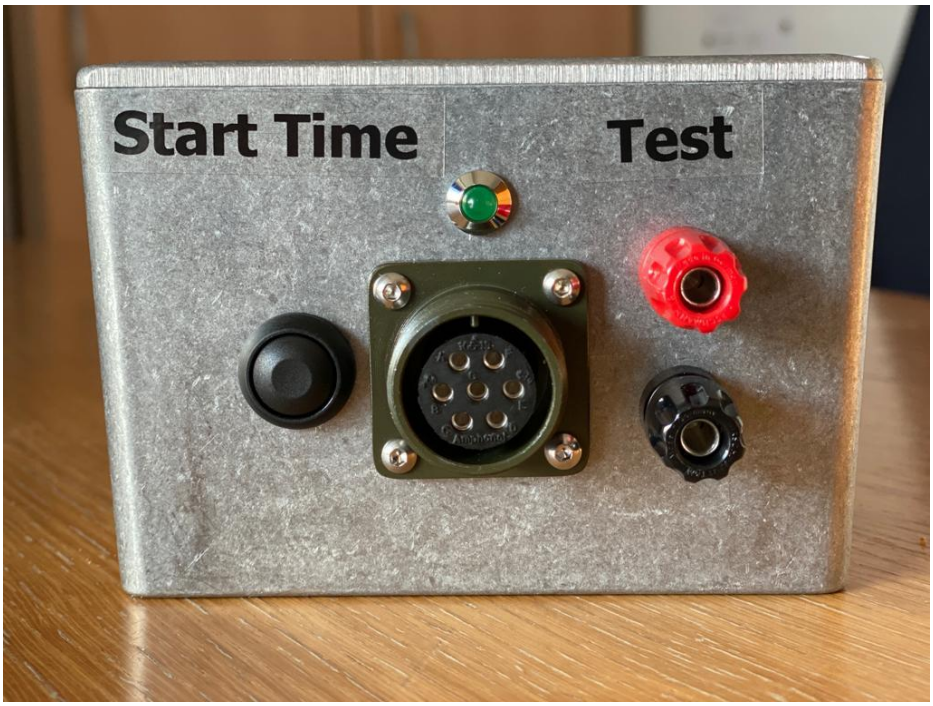

Fig 7: Controls at battery box

A self-test function is provided to test the operational state and amplification of the amplifiers. To carry out the self-test a seismograph needs to be connected to the string.

Use the two (red/black) banana plugs and connect a trigger line to your seismograph. Once the seismograph is ready and the hydrophone string is connected press the “Start Time” push button to start the self-test.

The internal self-test generates a 1 kHz test signal. Set a sample rate of minimum 8 kHz or higher at the seismograph and a recording time of min. 250 ms.

To start press the push button at the battery inlet side of the battery box and record. To analyse the data you may use software provided by Geotomographie (pls contact us).

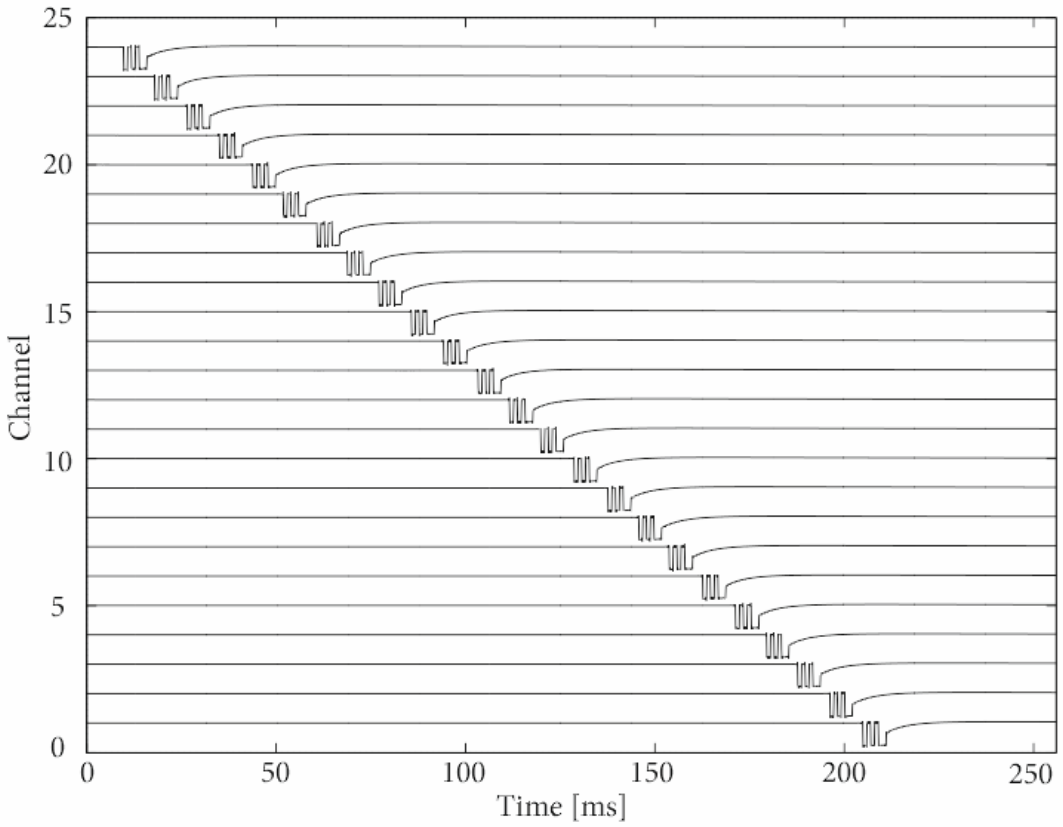

Fig 8: Self-test record

2. Operation

Lower hydrophone string to desired depth and clamp with clamping device.

- Connect to battery box first and then to seismograph. LED lights.
- Disconnect from seismograph first and then disconnect battery box.

During lowering of the string pay attention to the cable tension. Make sure the string runs down smoothly. Check frequently if you can lift cable.

Do not pull or lower cable over sharp edges. If cable mantle gets damaged water might migrate into it and sooner or later the string will stop working.

3. Technical data

3.1 Hydrophone

SPECIFICATIONS

Voltage sensitivity (individual phones):	-201.0 ± 1.0 dBV re 1 mPa @ 20°C, 8.4 V/mbar
Charge sensitivity:	40 nC/bar
Capacitance:	4.5 nF ± 10% @ 20°C
Capacitance variation with temperature:	0.4% increase per °C
Capacitance variation with pressure:	8% loss per 1,000 m (3,300 ft)
Operating depth:	down to 2,000 m
Frequency response:	flat from 1 Hz to 10,000 Hz
Acceleration sensitiviy:	< 0.2 mbar/g when properly mounted
Diameter:	13.5 mm (0.5")
Length:	46.0 mm (1.8")
Electrical leads:	two, 28 AWG stranded,
Electrical insulation:	> 500 mW
Water blocked leads:	yes

3.2. Cable specifications

SPECIFICATIONS

- Main cable with 25 X 2 X 28 AWG, Cores twisted in pairs & 4 X 2 X 24 AWG:
- Elements laid up together in concentric layers around LPC fiber strength member of 500 Kg breaking strength
- Hydrolysis UV resistant matt PUR outer sheath, nominal thickness 2,80 mm
- Nominal overall diameter 13,50 +/- 0,5mm
- Weight in air nom. : 200 kg/km
- Weight in fresh water nom. : 57 kg/km

4. Maintenance

Before and after a survey check visually the BHC equipment if damages are visible.

Charge batteries after long use or after long times of no use.

Be carefully when transporting and handling the hydrophone string it is a sensitive tool.

5. Accessories

Cable can be equipped with towing points. Towing points can be used to fix the cable to a boats railing while moving along the sea. Towing points are to protect cable mantle from uncontrolled fixation.

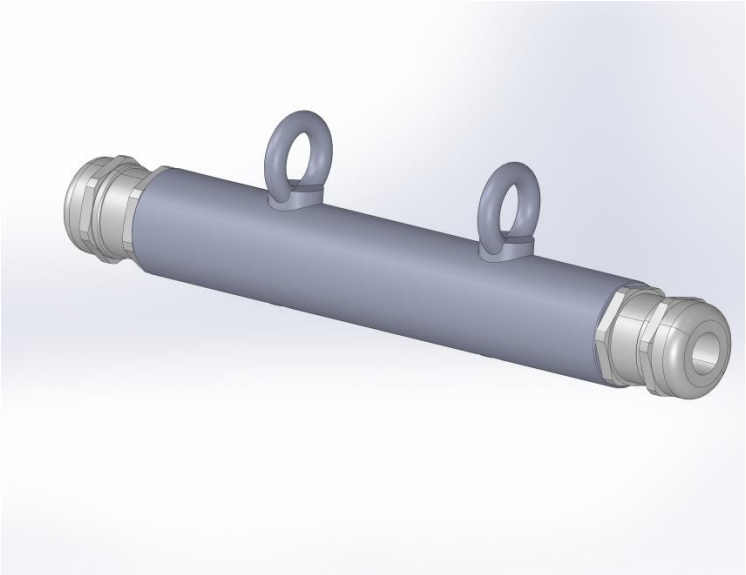

Fig 9: Towing point