MBAS

Multistation Borehole Acquisition System

Operating and Maintenance Instructions

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Content

Introduction

High-resolution P-wave tomographic investigations between boreholes are routinely applied for the exploration of development sites considered for larger building projects, e.g., power stations, dams and high-rise buildings. However, the geotechnical benefits of P-wave tomography are rather limited and information about S-wave velocity distribution is additionally required to derive geotechnically relevant parameters, such as dynamic soil parameters. Up to now, only little efforts have been made to develop equipment enabling the competitive acquisition of S-wave crosshole tomographic data.

The Multistation Borehole Acquisition System (MBAS) is designed for efficient recording of S-waves in boreholes at different levels. The system is digital and no longer needs a seismograph. Each station is equipped with a 3C sensor arrangement and is pneumatically coupled to the borehole wall by two pressure cylinders. All X and Y components are aligned to each other. To orient the MBAS to an optimal recording position a rotational string hose is used. The hose is flexible to be coiled on a drum but it is stiff if one tries to rotate it. In this way one easily can turn the whole MBAS to any desired direction. Trigger can be plugged into a surface USB interface which leads directly to the laptop. New 3C stations can be added by simply connecting them to the bottom last station.

The MBAS system consists of

1. USB interface (1x, Fig 1.)
2. Trigger channel (1x, Fig. 2))
3. MBAS Rotary string on drum with surface connector and probe head (1x, Fig. 3)
4. MBAS stations (N x of 3C stations, Fig 4)
5. Software (1x)

General Setup

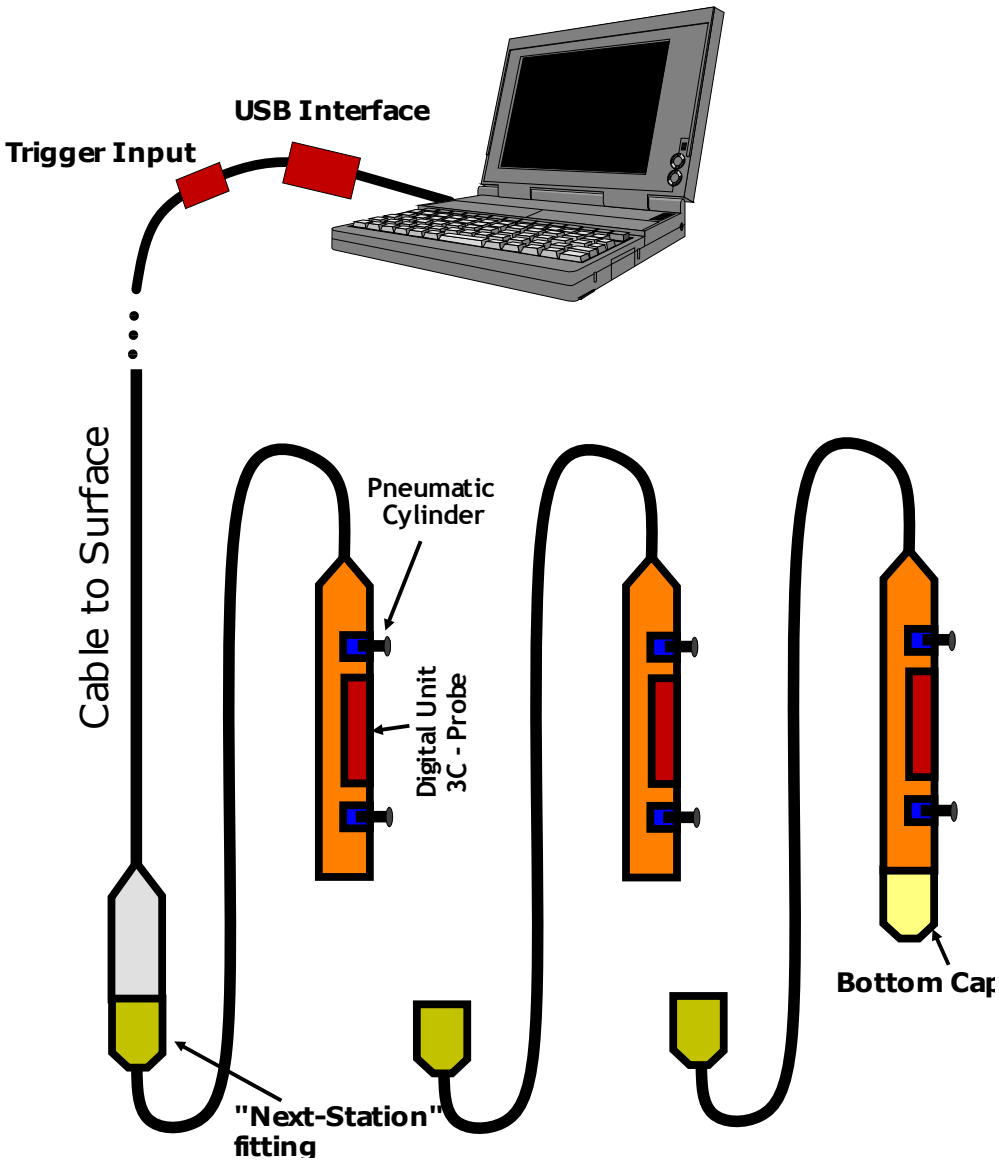

Fig. 1: USB Interface (MicroMed)

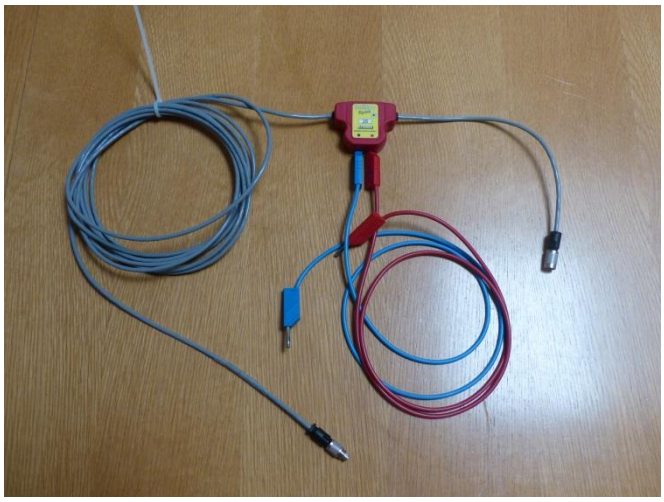

Fig. 2: Trigger channel (MicroMed)

Fig. 3: MBAS Rotary String

Fig. 4: MBAS stations

1. Software MBAS

The MBAS software is provided in cooperation with company Micromed* (www.micromed.eu). It is their proprietary versatile software *SoilSpy Rosina*. For software instructions please refer to the SoilSpy Rosina software manual.

SoilSpy Rosina is the software tool to establish communication to the MBAS stations, to acquire recordings and to store data on PC.

Note: In order for the system to work, the *SoilSpy Rosina* USB interface must be recognized by the PC operating system as a COM (communication) port. To this extent you need to install the USB interface driver. Please follow the instructions provided in the *SoilSpy Rosina* manual (see under PC Settings).

Please note that trigger channel is always numbered as channel 1. Station channels can be re-numbered in case one station is lost or shows bad signals.

Function	Channel Number
Trigger	1
1st Station	2,3,4
2nd Station	5,6,7
…	…
Nth Station	Starting with N*3+1

Anyhow, it is a must that channel numbering is continuous starting from 1.

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2. Hardware MBAS

2.1 Connection to 1st Station Probe Head

The MBAS hardware consists of the USB interface, one trigger channel, the cable connection to the MBAS stations and the MBAS stations.

Figure 5 shows the arrangement from PC to probe head.

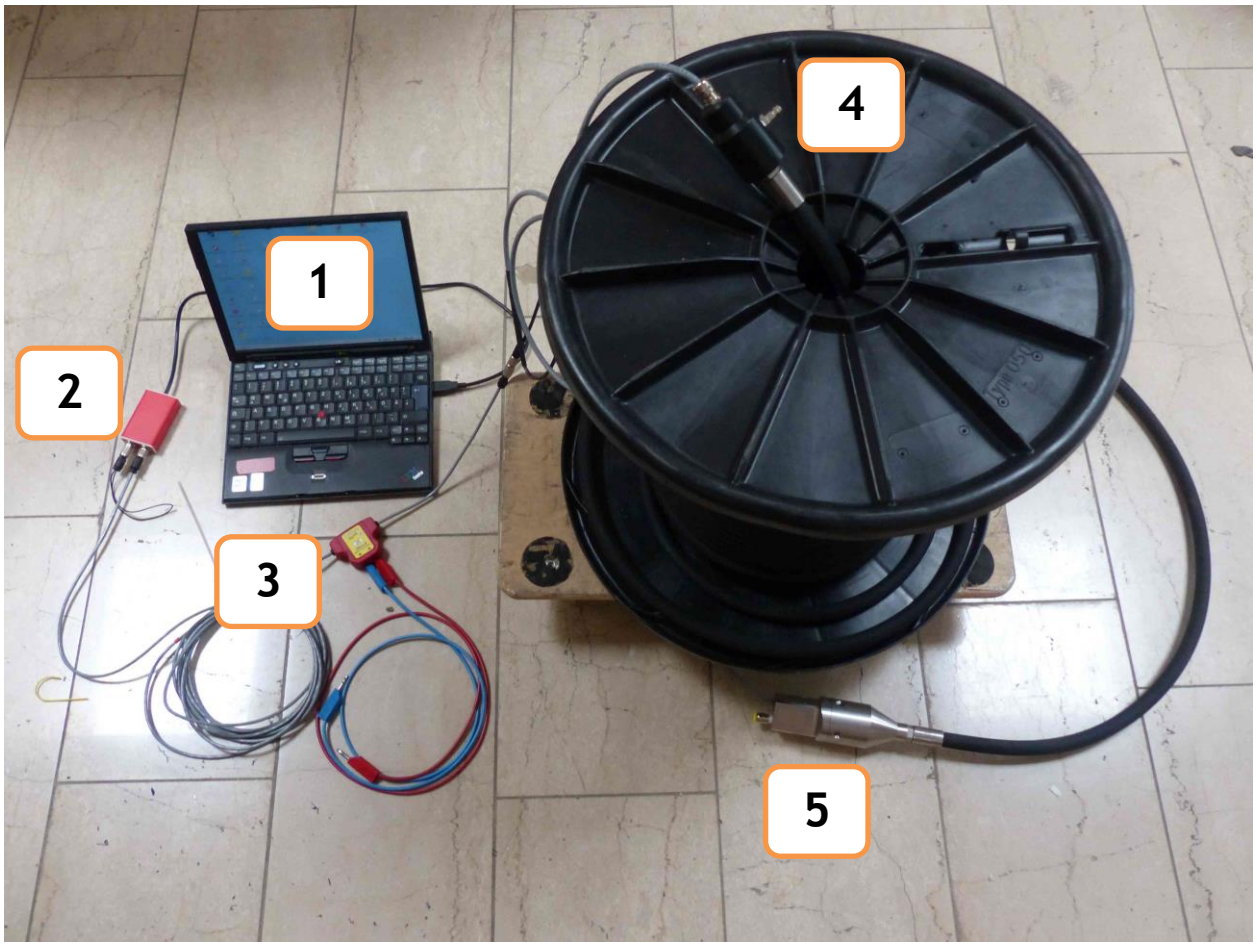

Fig.5: MBAS arrangement up to probe head

Arrangement:

1: Laptop with USB Port
2: USB Interface with USB cable and connector to trigger
3: Trigger with connection to USB interface and surface connector
4: Surface connector with cable take out to trigger and air take out
5: Probe head with LEMO 4 pin socket and air connector

Depth reference is the middle of the upper 3C station.

Connect first station to probe head (see fig. 6) and connect data cable and air hose (see fig. 7).

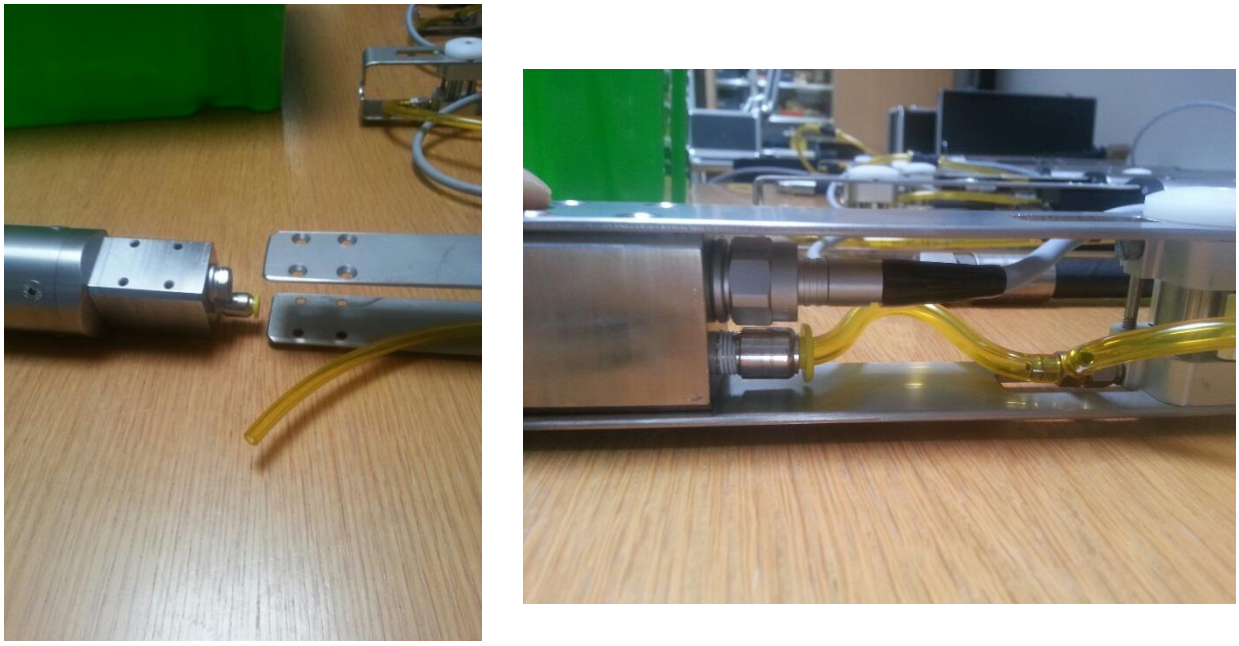

Fig. 6: Screw first station to probe head

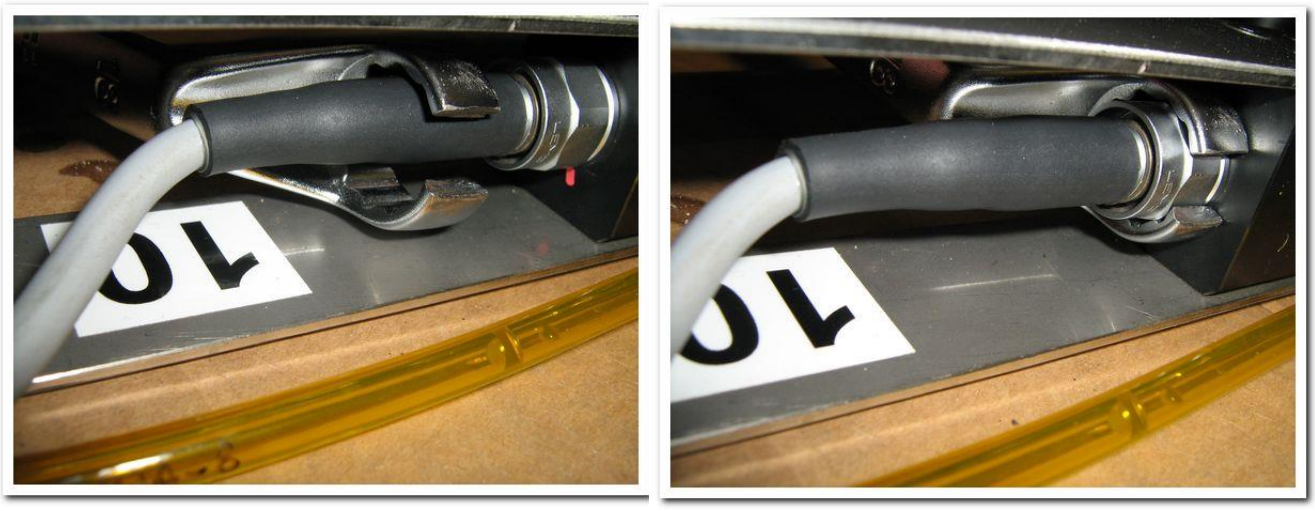

Fig. 7: Connect data cable (tighly) and air hose

2.2 Connecting Probes

To connect stations use the connecting cable and the procedure displayed in figure 8 to figure 13. **Make sure all probe are aligned in same direction.**

Fig. 8: Station Connecting Cable

Fig. 9: Put data cable trough side opening

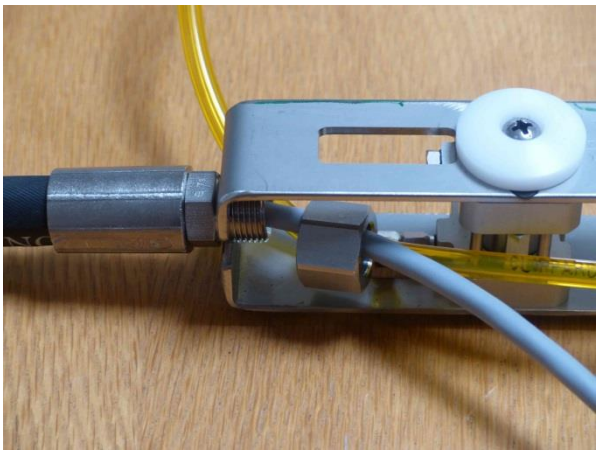

Fig. 10: Screw nut

Fig. 11: Use box wrench and spanner

Fig. 12: Fit tightly

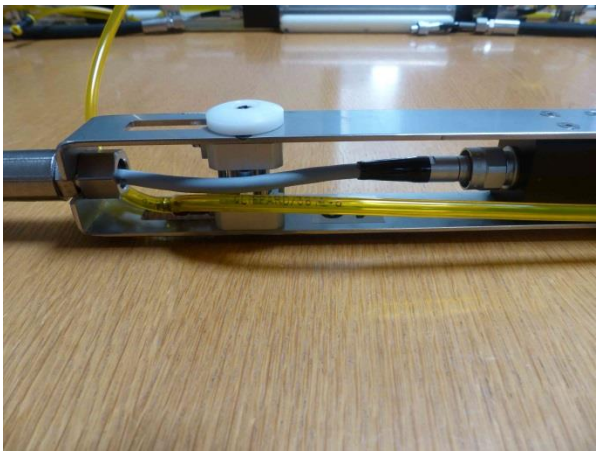

Fig. 13: Connect data cable to probe

Finger-tight fastening the data cable to 3C probe. Push connector in and screw … push in again and screw further until the connector cannot be pushed in further. Screw as tight as possible.

2.3 End connector

Put the end connector (see figure 15) at the lowest 3C station as tight as possible to terminate the data connection. Finger-tight fastening the data cable to 3C probe. Push connector in and screw … push in again and screw further until the connector cannot be pushed in further. Screw connector as tight as possible.

Fig. 15: End connector

Fig. 16: End connector attached

2.4 Air Supply and Pressure Scheme

Stations need to be clamped to the borehole wall to work properly. Surface air supply is through the surface connector (see figure 17).

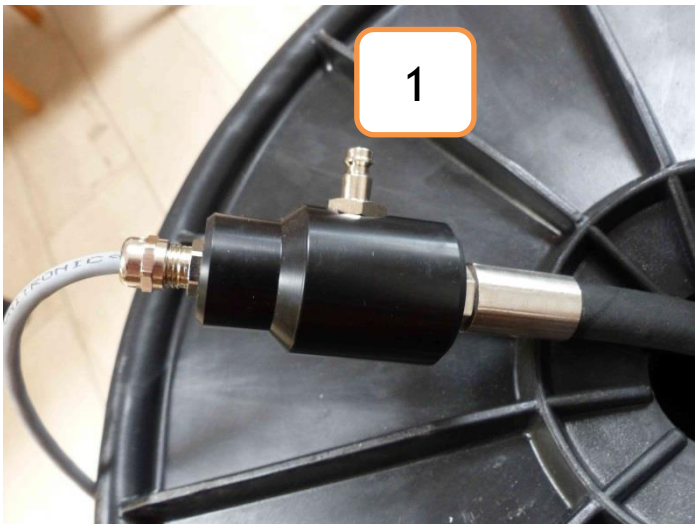

Fig. 17: Surface Air Supply

Function:

1: Air supply by pump or pressurized gas

Each station is equipped with two air cylinders type (Clippard AF-FSR-10-5/8), see fig. 18.

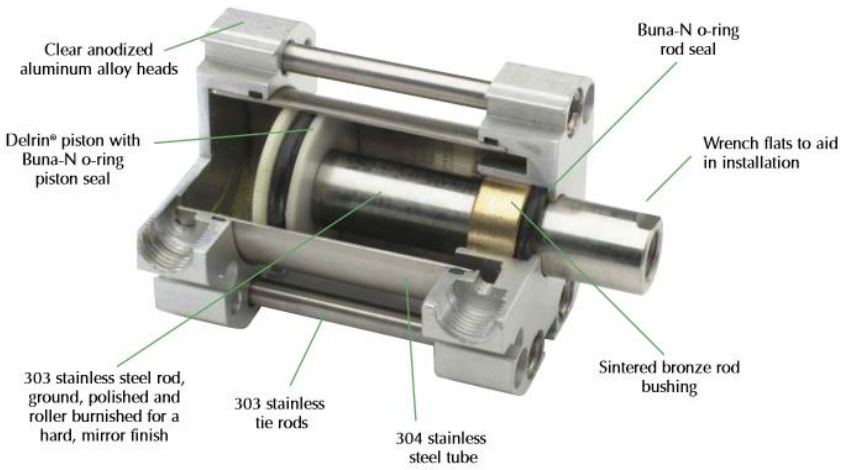

Fig. 18: Clippard Air Cylinder (picture is courtesy of from Clippard, USA)

The air cylinder is allowed to be pressurized by max 17 bar. The air hose type URH1-0804-YLT-050 has a working range from 0..7 bar and a burst pressure of about 19 bar.

Do not pressure above the burst pressure.

To clamp the stations properly to the borehole wall an over-pressure of about 3..4 bar above hydrostatic water pressure is recommended. Anyhow, it is recommended to check this once all stations are inside the borehole by testing different pressure regimes. Use the pressure where it clamps tightly.

Due to the mode of operation the clamping force of the cylinder is enhanced by about 3 times the applied pressure.

The MBAS is designed to work in 3 inch boreholes. The air cylinder piston length is about 0,5 inch (~12mm). If spacers are used make sure the piston stroke is sufficient to clamp the stations to the borehole wall.

Note: In case the piston stroke is not returning to its original position one needs to open the dead-end screw at the air cylinder to release pressure.

2.5 Re-Number Stations

Station numbering needs to be in continuous order. In case a station is damaged and not working the following station numbers need to be decreased by 3 (=number of

channels). For example, if station 5 is broken … channels 16, 17 and 18 are missing. All channels above 18 needs to be re-numbered by -3 then.

To do so, connect the USB interface directly to the surface connector (without the trigger channel). Next, connect all station to be re-numbered together, i.e. 6, 7, 8… to the probe head.

Fig. 19: Connection scheme for Re-Numbering of stations

Finally, establish data connection via *SoilSpy Rosina* software and follow the instructions for re-numbering in the software manual (check for "Shift Numbers" in the manual).

2.6 Some Technical Parameters

Weight:	~ 3 kg per station
Voltage:	min. 3.3 V (PC USB interface)
Geophones:	SM11 (30Hz)
Seismic Channels:	3 Geophones per station
A/D CONVERSION:	24 bit @ 128 Hz
Sample Frequency:	256, 512, 1024, 2048, 4096, 8192, 16384, 32768 Hz
Stacking:	plus/minus option on every stack
Dynamic Range:	142 dB
CROSS-TALK:	non-existent (digital transmission)
MAX CHANNEL:	255
TRIGGER:	TTL
PRE-TRIGGER:	up to 1 s
Noise Monitor:	Continuous