



*Bender Element Interface Unit (with Leads and Cables)*

# Bender Scope System

## Bender Test

The Bender Element test is a non-destructive test for determination of the small strain shear modulus ( $G_{Max}$ ). The test basically consists of sending a wave from a transmitting element, through a soil sample to a receiving element and comparing the transmitted and received waveforms using VJ Tech (csBENDER) software. The software will automatically filter and display the data, but raw data can be viewed if required.

## Bender Setup

The transmission and reception is undertaken using piezoelectric elements mounted in the Top Cap and Base Pedestal which protrude into the sample assembled in an adapted Triaxial Cell or a Dynamic Triaxial Cell. Both S-Wave and P-Wave testing can be performed, i.e. from the Top Cap element to the Base Pedestal element and vice-versa.

The cables from the Transmit and Receive elements are sealed as they exit the Triaxial Cell Base using cable bungs and are connected via Lemo connectors to the VJ Tech Bender Scope, which in turn is connected to a USB port on the PC (or Laptop) using a standard USB-USB cable.

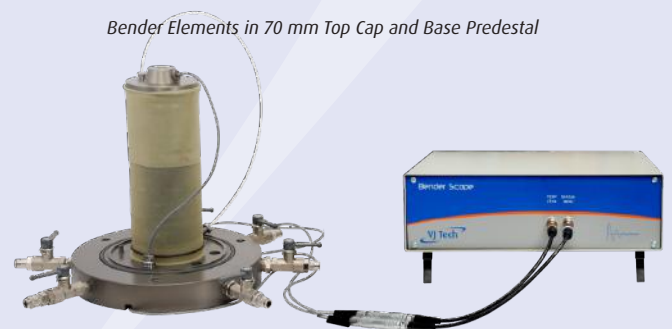
Alternatively, S and P waves can be transmitted horizontally through the sample. Splits are made in the membrane on opposing sides of the sample and the horizontal bender elements are inserted and sealed with the specially adapted sealing 'O' Rings. The cables are then passed through bungs in the Cell Base and connected to the Bender Scope.

## VJ Tech Bender System Setup Features:

- Piezoelectric elements encapsulated in titanium for minimal weight
- Either Vertical or Horizontal S and P Wave capabilities (using the interchangeable sockets)
- Built-in signal generator with Sine, Square or Triangular waveforms
- Single or multiple pulse generation with defined interval between pulses
- Maximum A/D resolution 16 bit
- Sampling frequency up to 50 kHz
- USB interface to PC



*Bender Elements in 70 mm Top Cap and Base Pedestal*



*Bender System Setup*

# VJT CLISP Studio csBENDER software

The wave generation and capture performed by Bender Scope is controlled by the VJ Tech csBENDER software

## Features

- User friendly Test setup on an individual client, job, borehole and sample basis
- Selectable Pulse Frequency values from 0.1 kHz to 50 kHz
- Selectable Amplitude values from 1 to 12 volts
- Sinusoidal, Triangular, Square & User Defined waveforms available
- Single or automated multiple pulse generation with defined interval between pulses
- Burst Count facility to send between 1 and 10 continuous Bender captures though the sample
- Low Pass Filter setup capability
- Display of wave capture data in Graphical format (single & stacked)
- Easily viewed results with common data export options
- User selection of captured signal for stacking
- On-screen cursors for travel time measurement
- Calculation of Gmax

## Ordering Information

- VJT1020** Bender Element Interface Unit
- VJT0400-BE** 100 mm Triaxial Cell for On-Sample Transducer, Bender Element or On-Sample testing

The following Top Caps and Base Pedestal sets are for 100 mm Cell Sizes – sets for other Cell sizes available on request:

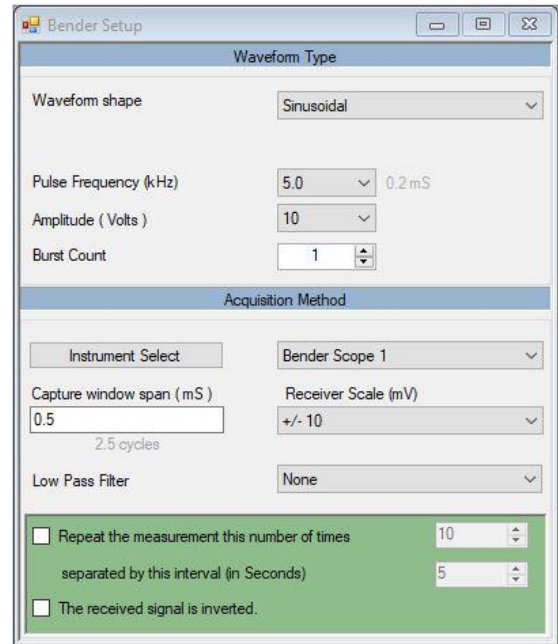
- VJT0262A** Bender Elements in 38 mm Top Cap & Base Pedestal (Set)
- VJT0262** Bender Elements in 50 mm Top Cap & Base Pedestal (Set)
- VJT0263** Bender Elements in 70 mm Top Cap & Base Pedestal (Set)
- VJT0264** Bender Elements in 100 mm Top Cap & Base Pedestal (Set)
- VJT0264B** Bender Elements in 100 mm Top Cap & Base Pedestal (Set) for 100 mm Dynamic Cell

## The number for a horizontal set is:

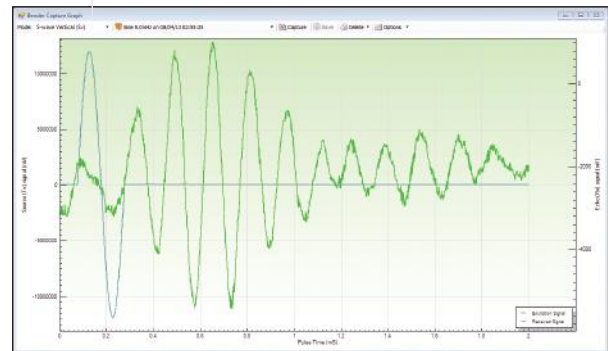
- VJT0265-HRZ** Bender Element Horizontal Set (supplied with rubber grommets, sealing O-rings & leads for connection to Interface Unit)

## Clisp Studio Bender Software:

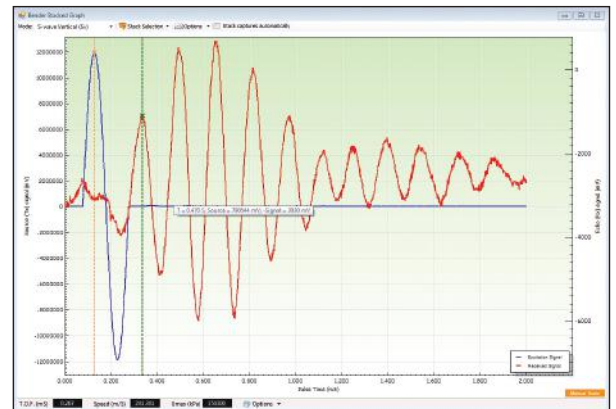
- VJT-csBEND** Clisp Studio Software for controlling Bender Tests



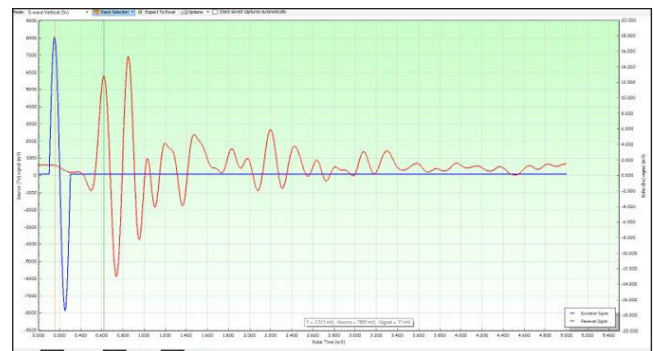
Bender Setup Screen



Example Bender Capture Graph



Example of Stacked Bender Graphs



Example of Multiple Capture Bender Graph