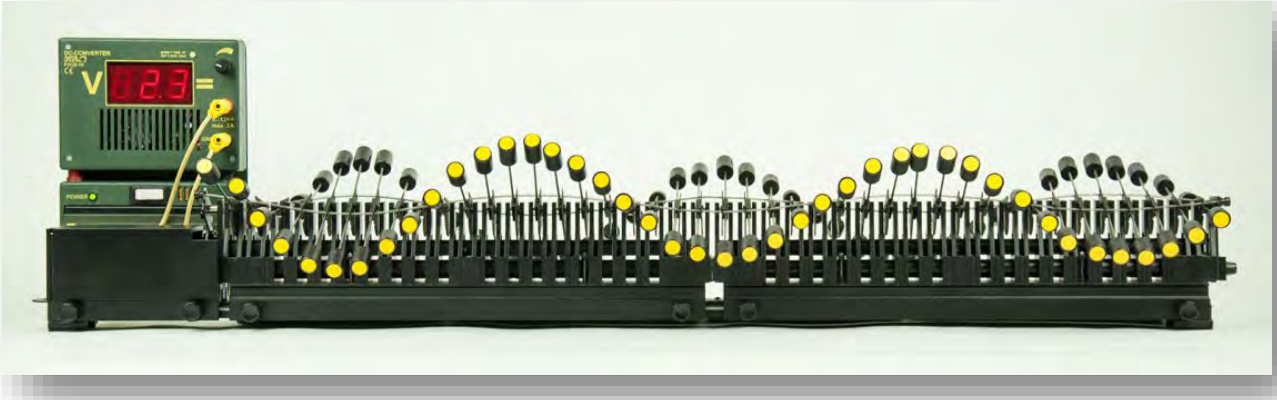
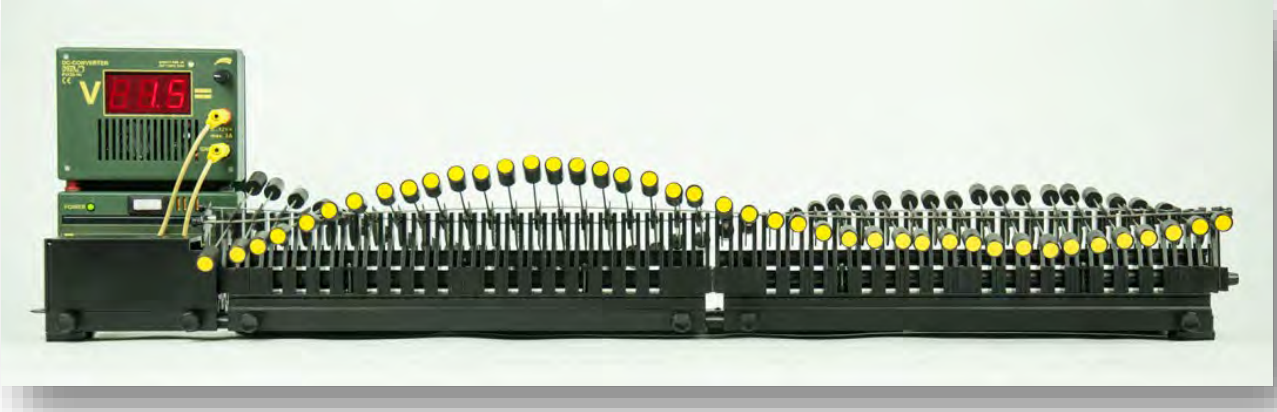
# STANDING WAVES WHEN REFLECTED AT THE FIXED END

**SWD 03.06**





***Material:***

| Item Code | Qty | Description |
|---|---|---|
| **DW405-1A** | **1** | **Oscillation module 1 – set consisting of** |
| DW405-1A1 | 1 | Oscillation module 1 with brake |
| P5312-1A | 2 | Little base with damping |
| DW405-3SK | 2 | Coupling spring 38 cm, for wave demonstrator |
| DW405-3F | 1 | Fixed end plate for wave demonstrator |
| DG205-1G | 1 | Hook metal, with handle |
| **DW405-1E** | **1** | **Wave demonstrator - Module II consisting of** |
| DW405-1E1 | 1 | Oscillation module 2b with brake |
| P5310-1S | 1 | Rail bond SE, universal |
| DW405-3SL | 2 | Coupling spring 80 cm, for wave demonstrator |
| **DW405-2A** | **1** | **Wave demonstrator - Electrical driving unit consisting of** |
| DW405-2A1 | 1 | Motor drive for wave demonstrator |
| P5310-1S | 1 | Rail bond SE, universal |
| P3120-1B | 1 | Rechargeable battery, “inno”, 6V/10 Ah |
| P3120-1K | 1 | DC Converter "inno" |
| P3120-4A | 1 | L-shaped assembly platform |
| DG507-25 | 2 | Safety connecting lead, yellow, 25 cm |

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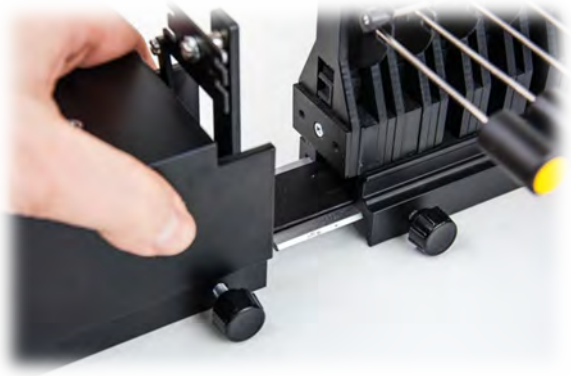
**Purpose**

A special type of vibration is a “standing wave”. The aim is to find out how such a wave can arise.

**Setup**

The two oscillation modules are coupled with the rail connector, thus we get a "wave machine" with a length of 80 cm

It should be noted that the two brake springs must also be coupled.
The pin of one spring must snap into the hole in the second spring.



The driving unit is mounted at the end with the long brake spring with the help of the rail connector.

At the end with the short brake spring, the fixed end plate for wave demonstrator is mounted.
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The two 80 cm long coupling springs are hooked into the upper slit of the pendulum.

The fixed end plate for wave demonstrator and the driving unit are also included.

The feet are inserted and screwed tight at the outer ends of the wave machine.

The drive unit is supplied with an infinitely variable DC voltage (at least 0 - 6 V).

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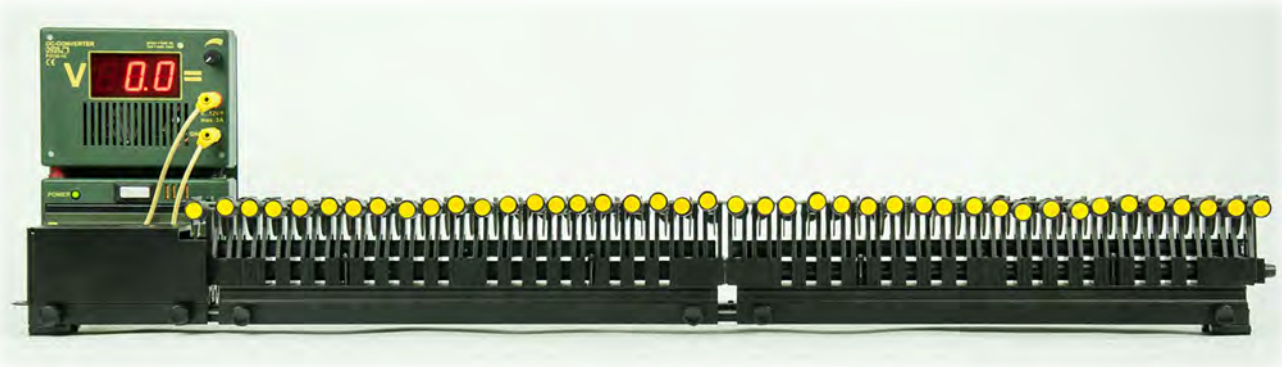

**Series of Experiments a:**

The voltage is raised very slowly, thus stimulating regular oscillation.
The period must be chosen so that there are nodes in the wave that are almost at rest.

First an attempt is made to create only one wave crest or “valley” of wave.
But since the wave machine is too long for “half a wave”, we hold a pendulum in the middle.

$f_1 = \frac{\lambda}{2}$

The voltage is now increased further very slowly.
As soon as a node develops in the middle of the wave machine, this frequency is retained.
You should be able to see the knot and two bellies.

$f_2 = \lambda$

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Afterwards the frequency is increased further.
An attempt is made to create two or more nodes

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**Result:**

If waves that are excited with certain frequencies are reflected at a fixed end, then the incoming and reflected waves overlap and a standing wave is formed.
A higher voltage results in a higher frequency and thus a shorter period of oscillation.
The higher the frequency the more nodes and antinodes are formed, this results in a smaller wavelength.

***Notes:***

A moment observation is possible by manually pulling the brake spring.

For this purpose, the hook with the handle is hooked into the hole on the long brake spring.

At the desired moment, the spring must be pulled out briefly and forcefully with the handle, the drive unit and wave machine are held with the other hand so that it does not slip.

If available, you can record the process with a camera or a mobile phone in slow motion mode. This locomotion is more visible when playing.

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**Series of Experiments b:**

For a clear demonstration of half a wave or a whole wave, it is advisable to do the test series with only one vibration module.