

WAVE DEMONSTRATOR - SINGLE ITEMS

SWD 03.00



Purpose and use of the wave demonstrator

The wave demonstrator is used to demonstrate experiments on the behaviour of mechanical transverse waves and their properties.

The following experiments are described in this manual:

- SWD 3.01 Propagation of transverse waves
- SWD 3.02 Reflection at the fixed end
- SWD 3.03 Reflection at the free end
- SWD 3.04 Superposition of waves
- SWD 3.05 Parameters of a transverse wave
- SWD 3.06 Standing waves when reflected at the fixed end
- SWD 3.07 Wavelengths as a function of the oscillation masses

The general setup of the wave demonstrator is based on a modular system:

DW405-1A	Oscillation module 1, with brake
DW405-1E	Wave demonstrator - Module II
DW405-2E	Wave demonstrator - Module III
DW405-2A	Wave demonstrator - Electrical driving unit
DW405-2D	Wave demonstrator - Mechanical damping unit

A few experiments can already be carried out with the Oscillation module 1.

If two oscillation modules are coupled we get a "wave machine" with a length of 80 cm.

The development and observation of the wave phenomena can be perfectly observed with the entire wave machine.

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DW405-1A Oscillation module 1 - set

21 double pendulums mounted on a special aluminum profile, each has a length of 21.5 cm. The cylindrical pendulum masses made from aluminum are rotatable mounted in horizontal position at a distance of 1.8 cm and coupled by two spiral springs - through this coupling the waves can be propagated.

Thanks to a built-in brake mechanism the pendulum movements can be stopped immediately, for example to measure the wavelengths.

At the end with the long brake spring, the self-aligning bearing or the drive unit can be attached.

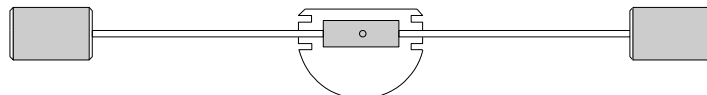
At the end with the short brake spring, the following elements can be added: .

- Plate for fixed end
- Pendulum bearings for dampening unit
- Wave demonstrator - Module II or
- Wave demonstrator - Module III



Included in the scope of delivery:

- 1 x DW405-1A1 Oscillation module 1 with brake
- 2 x P5312-1A Little base with damping
- 2 x DW405-3SK Coupling spring 38 cm, for wave demonstrator
- 1 x DW405-3F Fixed end plate for wave demonstrator
- 1 x DW405-3P Pendulum bearing for wave demonstrator
- 1 x P7230-4E Bearing pin
- 1 x DG205-1G Hook metal, with handle



The drawing shows one of the pendulums with the oscillation masses at the ends and the axis of rotation. The coupling springs with which the individual pendulums are coupled can be attached above or below the pendulum rotation axis.

The coupling springs with a length of 38 cm are used when only one module and the drive unit or the damping unit are required.

When coupling several vibration modules, the 80 cm long coupling I springs are used.

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DW405-1E Wave demonstrator - Module II

21 double pendulums mounted on a special 40 cm long aluminum profile, each has a length of 21.5 cm.

Used to extend module I -
resulting in a unit with 42 double pendulums



Included in the scope of delivery:

- 1 x DW405-1E1 Oscillation module 2a with brake
- 1 x P5310-1S Rail bond SE, universal
- 2 x DW405-3SL Coupling spring 80 cm, for wave demonstrator



DW405-2E Oscillation module 2b, Set

21 double pendulums mounted on a special 40 cm long aluminum profile, each has a length of 21.5 cm.

Used to extend module I -
resulting in a unit with 42 double pendulums

This module differs from module 2a only in the lower pendulum masses, which means that different wave propagation speeds can be achieved.

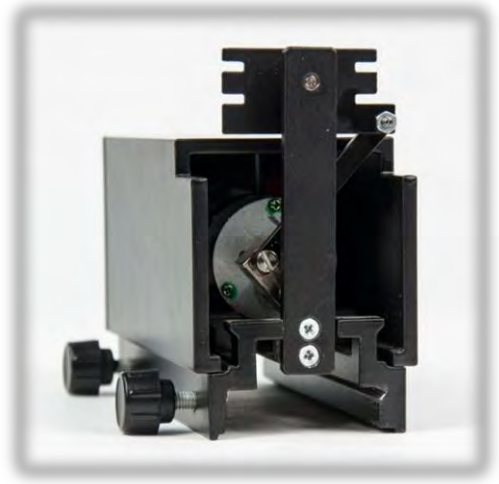
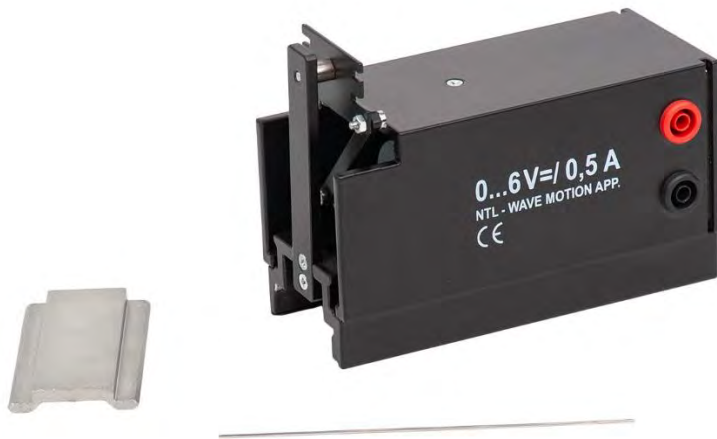
Included in the scope of delivery:

- 1 x DW405-1E1 Oscillation module 2b with brake
- 1 x P5310-1S Rail bond SE, universal
- 2 x DW405-3SL Coupling spring 80 cm, for wave demonstrator



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DW405-2A Wave demonstrator - Electrical driving unit

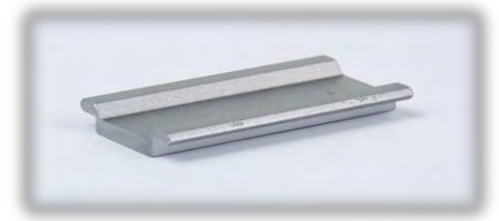
Aluminum case, 14 cm long, mounted on special aluminum profile with two 4-mm safety jacks for an adjustable DC voltage source (0 - 6 V DC / 0.5 A).

A DC motor with an attached cam and exciter plate regulates the speed of the pendulum motion. Increasing or decreasing the amount of DC input voltage likewise affects the pendulum frequency of the exciter plate.

The excitation of waves or pulses can also be done by hand, but for a standing wave for example the constant movement of the electric drive is essential.

Included in the scope of delivery:

- 1 x DW405-2A1 Motor drive for wave demonstrator
- 1 x P5310-1S Rail bond SE, universal
- 1 x DW405-2A2 Pointer for motor drive unit



DW405-2D Wave demonstrator - Mechanical damping unit

This unit is mounted at the end of the wave demonstrator and serves to prevent undesired reflection of waves by means of a damping plate submerged in water.

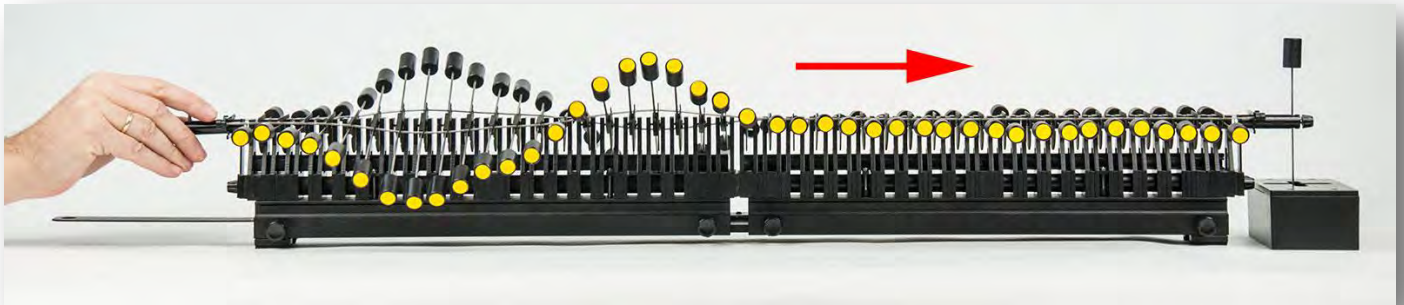
Included in the scope of delivery:

- 1 x DW405-3P Pendulum bearing for wave demonstrator
- 1 x DW405-2DP Pendulum for damping unit
- 1 x DW405-2DW Water trough for damping unit



PROPAGATION OF TRANSVERSE WAVES

SWD 03.01

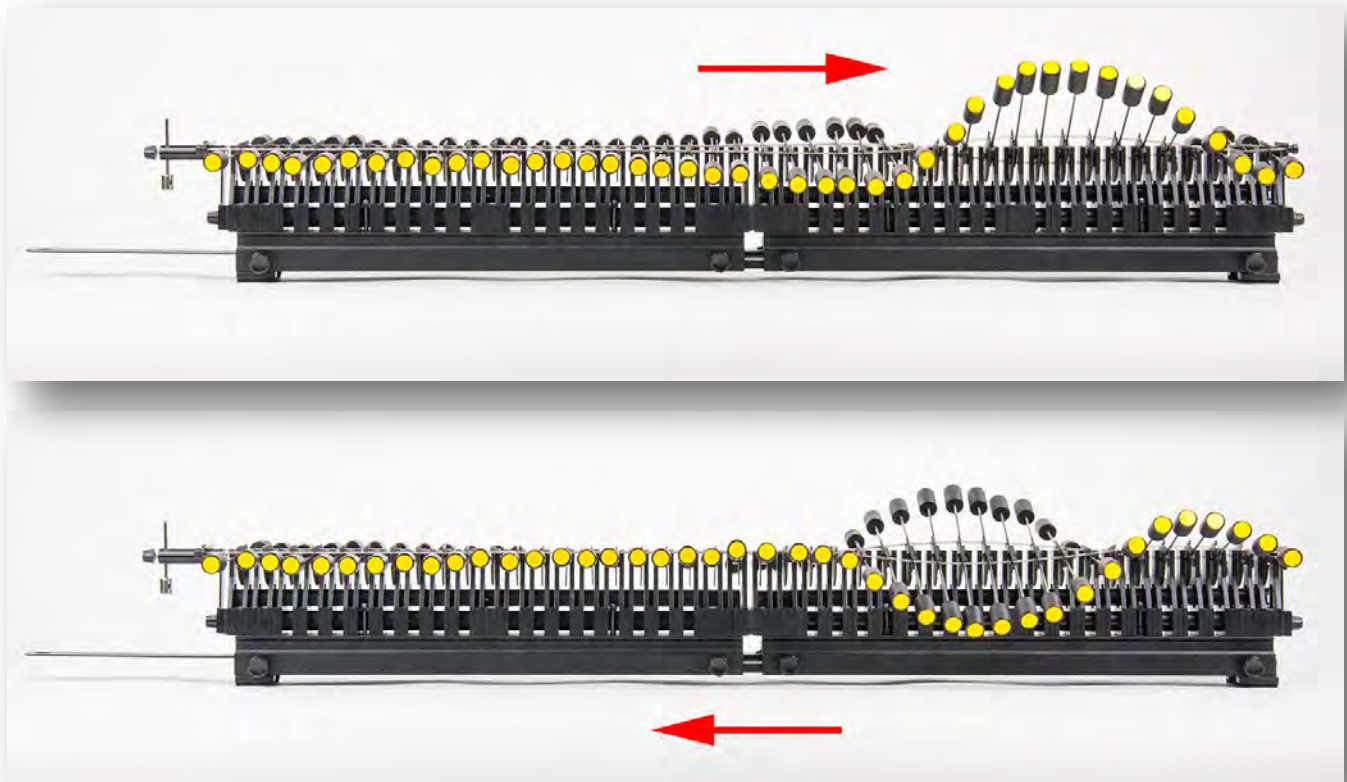


Material:

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
DW405-3P	1	Pendulum bearing for wave demonstrator
P7230-4E	1	Bearing pin
DG205-1G	1	Hook metal, with handle
DW405-1E	1	Wave demonstrator - Module II consisting of
DW405-1E1	1	Oscillation module 2a with brake
P5310-1S	1	Rail bond SE, universal
DW405-3SL	2	Coupling spring 80 cm, for wave demonstrator
DW405-2D	1	Wave demonstrator - Mechanical damping unit consisting of
DW405-3P	1	Pendulum bearing for wave demonstrator
DW405-2DP	1	Pendulum for damping unit
DW405-2DW	1	Water trough for damping unit

REFLECTION AT THE FIXED END

SWD 03.02

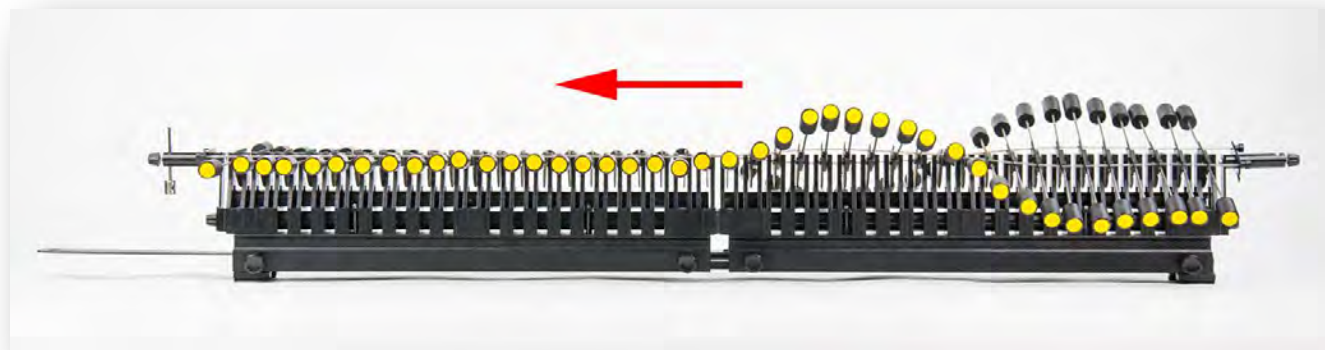
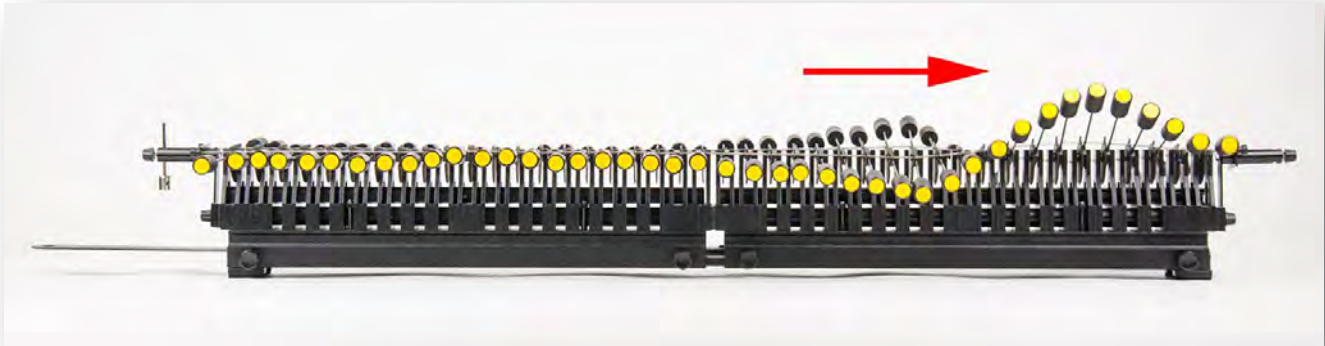


Material:

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
DW405-3F	1	Fixed end plate for wave demonstrator
DW405-3P	1	Pendulum bearing for wave demonstrator
P7230-4E	1	Bearing pin
DG205-1G	1	Hook metal, with handle
DW405-1E	1	Wave demonstrator - Module II consisting of
DW405-1E1	1	Oscillation module 2a with brake
P5310-1S	1	Rail bond SE, universal
DW405-3SL	2	Coupling spring 80 cm, for wave demonstrator

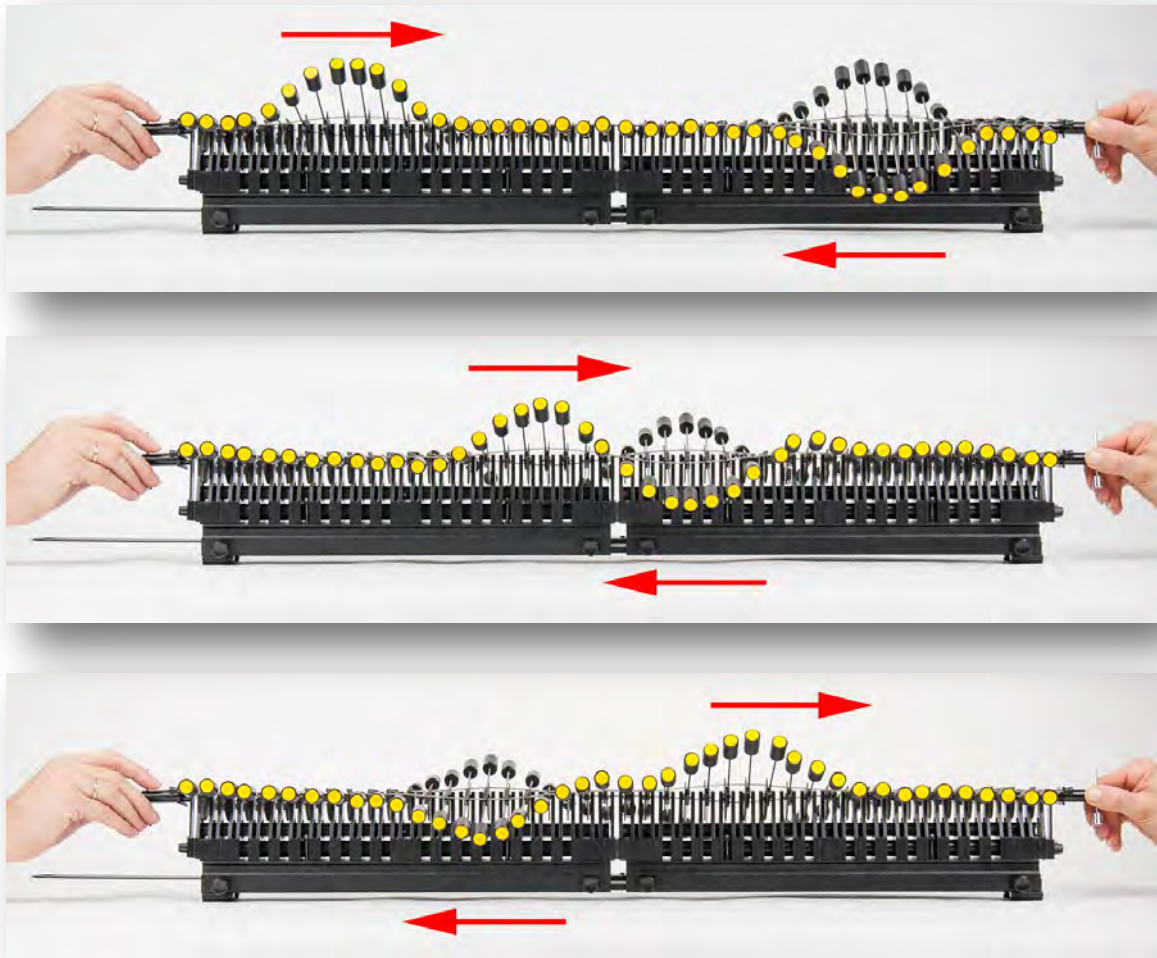
REFLECTION AT THE FREE END

SWD 03.03



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
DW405-3P	1	Pendulum bearing for wave demonstrator
P7230-4E	1	Bearing pin
DG205-1G	1	Hook metal, with handle
DW405-1E	1	Wave demonstrator - Module II consisting of
DW405-1E1	1	Oscillation module 2a with brake
P5310-1S	1	Rail bond SE, universal
DW405-3SL	2	Coupling spring 80 cm, for wave demonstrator
DW405-2D	1	Wave demonstrator - Mechanical damping unit consisting of
DW405-3P	1	Pendulum bearing for wave demonstrator



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
DW405-3P	1	Pendulum bearing for wave demonstrator
P7230-4E	1	Bearing pin
DG205-1G	1	Hook metal, with handle
DW405-1E	1	Wave demonstrator - Module II consisting of
DW405-1E1	1	Oscillation module 2a with brake
P5310-1S	1	Rail bond SE, universal
DW405-3SL	2	Coupling spring 80 cm, for wave demonstrator
DW405-2D	1	Wave demonstrator - Mechanical damping unit consisting of
DW405-3P	1	Pendulum bearing for wave demonstrator
P7230-4E	1	Bearing pin

PARAMETERS OF A TRANSVERSE WAVE

SWD 03.05

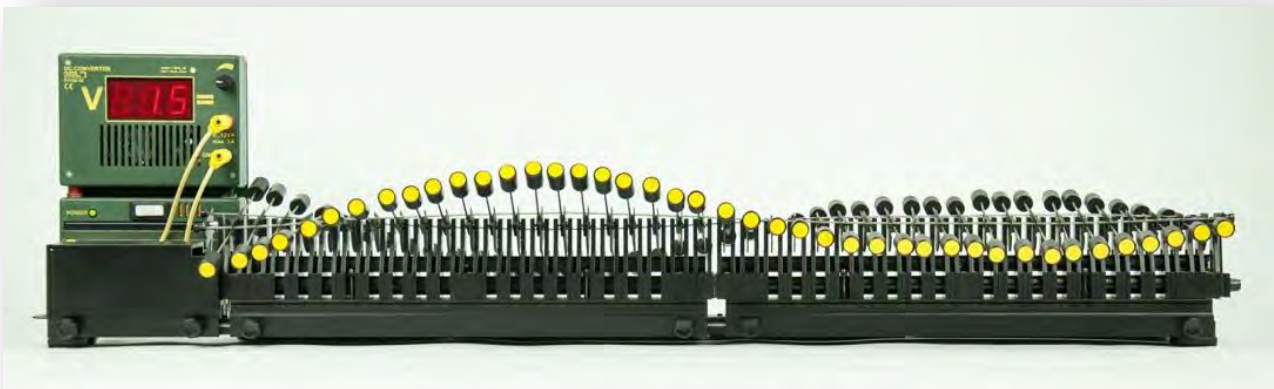


Material:

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
DG205-1G	1	Hook metal, with handle
DW405-1E	1	Wave demonstrator - Module II consisting of
DW405-1E1	1	Oscillation module 2a 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
DW405-2A2	1	Pointer for motor drive unit
DW405-2D	1	Wave demonstrator - Mechanical damping unit consisting of
DW405-3P	1	Pendulum bearing for wave demonstrator
DW405-2DP	1	Pendulum for damping unit
DW405-2DW	1	Water trough for damping unit
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, 25 cm, yellow
P1100-1E	1	Measuring tape, L=300 cm
DS090-3K	1	Claw base "Sepp", 260 x 220 mm
DS201-10	2	Support rod, round, L=1000 mm, D=12 mm
DS095-3K	1	Boss head cross-pattern, demo 03
P1320-4A	1	Light gate "demo" 04
P3120-2Z	1	Universal timer "inno"
P3120-5B	1	S-shaped assembly platform

STANDING WAVES WHEN REFLECTED AT THE FIXED END

SWD 03.06

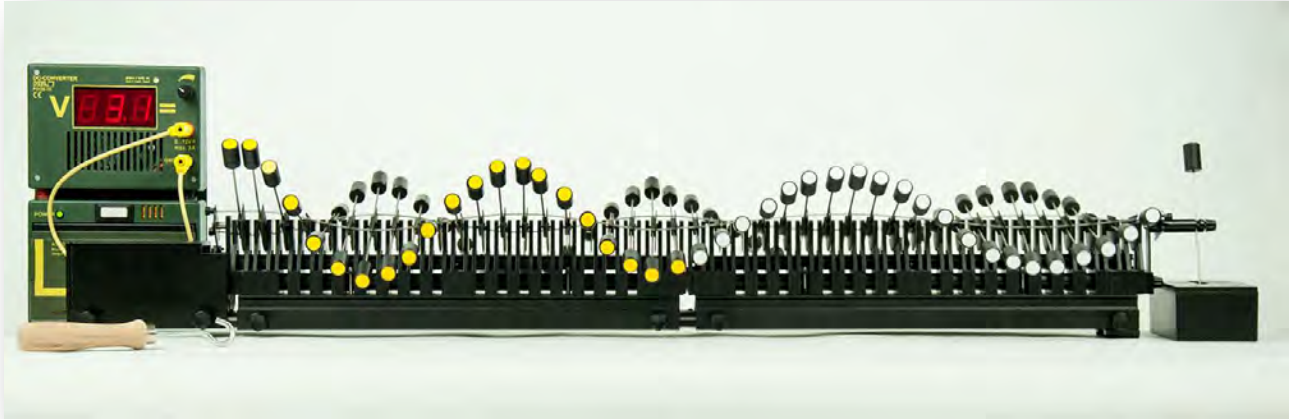


Material:

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

WAVELENGTHS AS A FUNCTION OF THE OSCILLATION MASSES

SWD 03.07



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
DW405-2E	1	Oscillation module 2b, Set consisting of
DW405-2E1	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
DW405-2D	1	Wave demonstrator - Mechanical damping unit consisting of
DW405-3P	1	Pendulum bearing for wave demonstrator
DW405-2DP	1	Pendulum for damping unit
DW405-2DW	1	Water trough for damping unit
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