

## Operating Instructions:

**Active** vibration isolation for heavy loads  
**Duo**



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## 1. Introduction

Thank you for purchasing the duo system. By selecting the Duo system, you have acquired top-of-the-line active vibration isolation equipment. We feel confident that our system will meet your expectations and provide the best possible performance for your specific application.

Please read the operating instructions carefully to setup the Duo system correctly.

We hope you enjoy working with your Duo!

## 2. Unpacking the Duo System

After unpacking the equipment, please check whether you have received all components listed below:

Equipment supplied for the Duo system:

- 2 duo isolation elements
- 2 power cords
- 1 set of instructions for the Duo systems
- 1 allen key size 3
- 1 spanner 10 mm

Equipment supplied for the Duo add-on unit:

- 1 duo isolation element
- 1 power cord

## 3. Symbols used in these instructions



Warning symbol



Important note



Action that the user is required to take

## 4. Safety Instructions and Warnings

Please read through the following safety instructions and warnings carefully before using this equipment.

### General Warnings

Do not operate the system in a potentially explosive or humid environment. Do not switch on the system if there is any visible damage or if you think it might be damaged. In this case, turn off the power immediately and notify our distributor in your area or contact W.A.V.E's headquarters in Germany directly.

### Electrical Safety

This system may be operated only on AC power that has a protective grounding conductor ("protective earth"). Do not interrupt the protective grounding conductor under any circumstances. If you plan to use a power cable other than the standard power cord supplied with this equipment, first check that the protective grounding conductor is connected.

Before starting to operate this equipment, check the voltage rating to be sure that it matches your local line voltage (mains). For further information, please refer to the specifications on page 10. Completely set up and install the equipment before attempting to plug it into an electrical outlet (mains). Never open the equipment housing. Only authorized and qualified personnel may service or repair the equipment.

### Mechanical Safety

Be sure that the equipment rests on a stable surface that can safely support the weight of this instrument.



*Please note that you need to lock the system before you transport or move the equipment! For further instructions, please refer to the section on "Static Load Adjustment and Transportation Lock" on page 6.*

### DIN and European Standards, European Council Directives

Duo systems conform to the requirements currently valid for electrical safety according to EC Directive 2014/35/EU and for electromagnetic compatibility according to EC Directive 2014/30/EU. This equipment has been tested and found to comply with the following standards EN 61010-1:2010.

## 5. Getting Started

### Basic Requirements

The performance of every vibration isolation solution depends on the ambient conditions. We therefore recommend to install the Duo directly on the ground floor. Best isolation performance can be achieved with a rigid connection between the base plate of the Duo and the floor. Elastic interlayers, e.g. lineleum or carpet, will reduce the isolation performance! Furthermore a very plane support surface is required. For optimal isolation results the planarity should be within the limit of 0.5 mm. Often the floor has to be prepared in order to fulfill these conditions.

Duo systems may be installed on floating floor screed grounds, but it is recommended to remove any existing floating floor screed in advance. If the floor doesn't fit these requirements we recommend to use self leveling floor screed to achieve the required planarity.

### Mechanical Setup



Place the Duo isolation units to the required positions. A parallel orientation with a minimum distance of 500 mm of the units is recommended for optimal isolation performance.

Attach the mechanical structure, e.g. the top plate or the frame, on top of the units. To set up your vibration isolation equipment, select a place with a vibration level that is as low as possible. Vibration generated in this place should not exceed velocities of 350  $\mu\text{m/s}$ . Read also page 8, section "Overmodulation of the System".



*Operating the system at low temperatures (below 10° C) may cause malfunctioning. If the equipment is brought from a cold environment into a relatively warmer one, we recommend that you wait approx. 2 – 3 hours before plugging it into AC power (mains) and switching on the power*

## Static Load Adjustment and Transportation Lock

The Duo units have to be adjusted to accommodate the required loads. The top parts of the isolation elements are supported by four steel springs. These springs carry the static load, placed on top. For the initial installation or after load changes these springs have to be prestressed according to the weight of the setup. This procedure is called „static load adjustment“. The objective of the load adjustment is that the top parts of the elements can be moved in any direction.



To expose the adjustment nuts, remove the end coverings by undoing the screws shown below. For this procedure please use the allen key provided.



Fig. 1: End cover Duo compact unit



Fig. 2: Indicators for load adjustment

Under load the upper and the lower gap shown in fig. 2 should be approximately equal (2 - 3 mm). It is however not essential that the gaps are equal. Either gap may be as small as 0.5 mm without affecting normal operation, but a small subsequent change of the load might cause the unit to move against the stop.



Fig. 3: Load adjustment Duo

If an adjustment is needed turn the M6 nuts using the spanner provided. Adjust all springs equally. Moving the spanner to the left raises the units and thus increases the maximum load. See figure 3.



Do not turn the nuts too far or you may damage the units. Under no circumstances should the gap indicated in fig. 3 be larger than 10 mm!

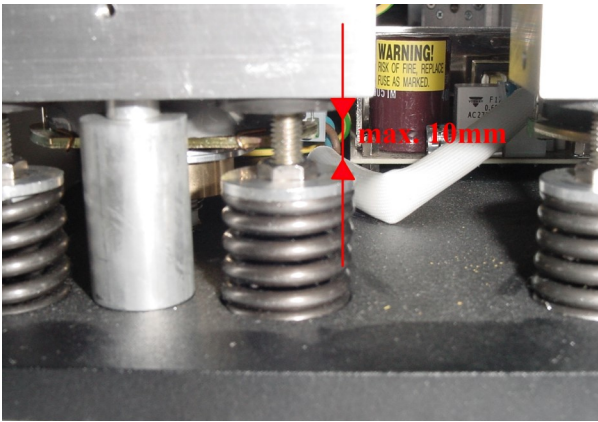


Fig. 4: Distance between spring and upper stop



For transportation the system has to be locked by turning the M6 nuts to the left till the upper stop position is reached. In the lock mode a rigid mechanical contact between the top and the bottom of the element prevents the sensitive components to get damaged. Check the lock mode by pushing gently the top of the element. There should be no relative displacement between the base and the top part of the unit since the base and the top part of the unit are mechanically connected and the internal voice coil actuators are protected against impacts.

## Operation

For the initial operation connect the power socket 1 at the rear side of the unit with the power cord and switch the power button to the on position indicated by „1“. In this mode the green power LED 4 will light up and the 8 display LEDs in the sensor array 6 will briefly flicker. If severe vibrations are present, or by exciting the table top with the finger tip, some of the LEDs will flicker as well.



Fig. 5: Rear view Duo compact unit

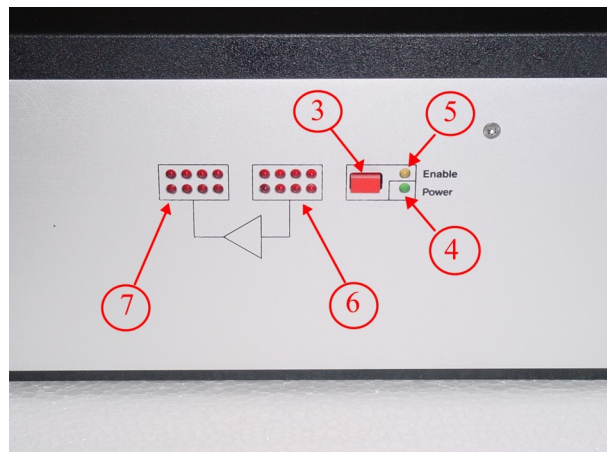


Fig. 6: Front view Duo compact unit

The active isolation mode of the Duo system can be turned on by pressing the red knob 3 on the front side. In the initial state the system needs about 30 seconds to get ready for active isolation. During this period the yellow LED 5 is briefly flickering. After the initialization the yellow LED 5 remains lit permanently, indicating that the system is in the active isolation mode. If severe vibrations are present, some of the LEDs in the actuator array 7 may flicker briefly.

## Overmodulation of the System

The Duo system has been designed to compensate vibration amplitudes up to 350  $\mu\text{m/s}$ . If vibrations significantly exceed this level the system changes to the stand-by mode, indicated by a flashing yellow LED. After the overload excitation is stopped, the isolation mode will automatically be turned on again. Some of the sensor and actuator LEDs may come on and persist for a few seconds. After a severe overload the system may take up to 30 seconds to reach full active isolation performance, but normally only a few seconds are required.



*The active vibration isolation will be automatically switched off during overmodulation of the system. Once this interference has subsided, the system will re-initialize and, after a few seconds, automatically resume to the active isolation mode. This procedure does not require any action from the user.*

## BNC Output Socket

The BNC socket 2 at the rear side of the unit offers a multiplexed output showing the signals from all 8 sensors. To display this signal on an oscilloscope, set the time base to 20msec and the sensitivity to 1V. Do not use BNC cable longer than 2 meters.

The Signal on your oscilloscope should look like this:

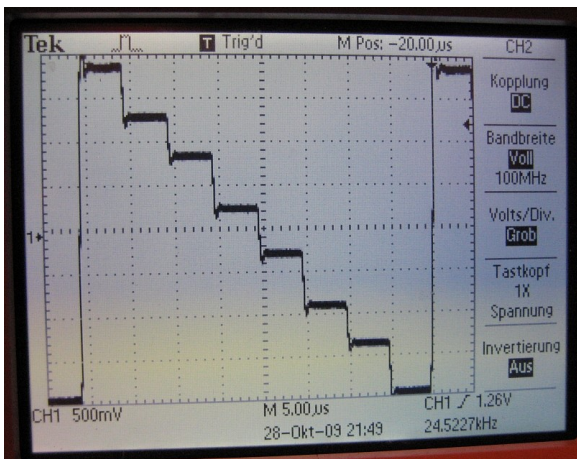


Fig. 7: good oscilloscope signal

Something is wrong if it looks like this:

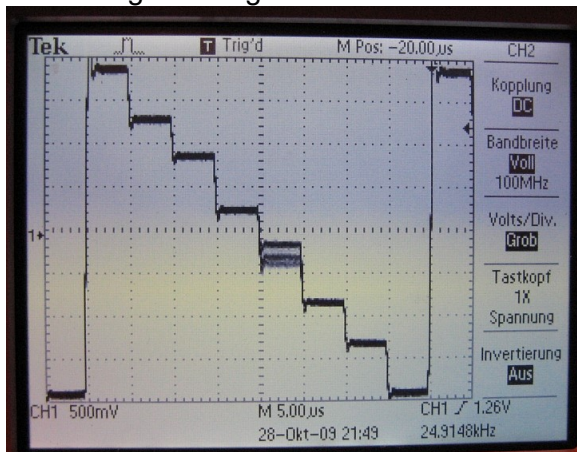


Fig. 8: bad oscilloscope signal



## 7. Appendix

### Care and Maintenance

To maintain this equipment and the validity of your warranty, you should observe the following recommendations:

- Store the system in a dry place. Never expose it to rain, liquids or dampness. The minerals contained in these liquids may lead to short-circuits or corrosion of the electronic circuits.
- Where possible, avoid operating and storing the system in dirty or dusty environments as this may otherwise damage the electronic or mechanical components.
- Do not store the system in hot environments. Operating the system at high temperatures may compromise its performance and reduce its lifetime.
- Do not store the system in cold environments. When the temperature rises to normal room temperature, moisture condenses inside the system and causes a circuit failure. If you need to transport the system from a cold environment to a warmer one, wait approx. 2 – 3 hours before plugging it into AC power and switching on the power.
- Do not drop the system or shake it, and never expose it to impact or blows. Improper handling can damage the integrated electronics and mechanical components in the system.
- To clean, wipe off dust from the exterior surfaces of the system using a lint-free cloth. For cleaning, do not use any aggressive cleaning agents.

## Specifications Duo\_73

Available Standard Versions	
Duo_73	Minimum configuration, consists of two isolation elements
Duo Add-on	Additional isolation element for combinations of three and more isolators.
Performance Specifications	
Isolation technology:	The active vibration isolation technology is based on piezoelectric type acceleration pickup, fast signal processing and electro-dynamic force transducers.
Force directions:	Active compensation in all six degrees of freedom
Isolation performance:	> 5 Hz = 25 dB (94.4%); >10 Hz = 35 dB (98.2%)
Active bandwidth:	1.0 – 200 Hz*
Settling time:	300 ms
Max. correction forces:	Vertical $\pm$ 16 N; horizontal $\pm$ 8 N (for Duo - 2 isolator configuration)
Load capacity:	0 – 400 kg (0 - 880 lbs) per element
Other Specifications	
Dimensions:	See figure 10
Weight:	26 kg (57.3 lbs) per isolation element
Maximum compensation level:	350 $\mu$ m/s at 9 Hz and 300 kg (661 lbs)**
Interface:	BNC analog diagnostic output – 50 Ohms
Environmental and Operational Requirements	
Electrical voltage:	100 - 250 V/47 – 63 Hz
Power consumption:	10 - max. 50 W per element
Operating temperature:	10 - 40°C (50 – 104 F)
Relative humidity:	0 - 60%
Operating altitude:	< 2500 m (8100 ft)
Certification	
Electrical Safety:	CE certificated according to directive 2014/35/EU
EMC:	CE certificated according to directive 2014/30/EU
<p>* Floating table top is supported by steel springs; low-pass characteristics of spring-mass combination dominates the dynamic behaviour above 200 Hz.</p> <p>** The maximum compensation level depends on several conditions, such as payload, frequency, load distribution and height of the payload as well as the distance between the isolation elements. For that reason this value should be considered as an estimation.</p>	

## Specifications Duo\_100

<b>Available Standard Versions</b>	
Duo_100	Minimum configuration, consists of two isolation elements
Duo Add-on	Additional isolation element for combinations of three and more isolators.
<b>Performance Specifications</b>	
Isolation technology:	The active vibration isolation technology is based on piezoelectric type acceleration pickup, fast signal processing and electro-dynamic force transducers.
Force directions:	Active compensation in all six degrees of freedom
Isolation performance:	> 5 Hz = 25 dB (94.4%); >10 Hz = 35 dB (98.2%)
Active bandwidth:	1.0 – 200 Hz*
Settling time:	300 ms
Max. correction forces:	Vertical $\pm 16$ N; horizontal $\pm 8$ N (for Duo - 2 isolator configuration)
Load capacity:	0 – 400 kg (0 - 880 lbs) per element
<b>Other Specifications</b>	
Dimensions:	See figure 9
Weight:	35 kg (57.3 lbs) per isolation element
Maximum compensation level:	350 $\mu\text{m/s}$ at 9 Hz and 300 kg (661 lbs)**
Interface:	BNC analog diagnostic output – 50 Ohms
<b>Environmental and Operational Requirements</b>	
Electrical voltage:	100 - 250 V/47 – 63 Hz
Power consumption:	10 - max. 50 W per element
Operating temperature:	10 - 40°C (50 – 104 F)
Relative humidity:	0 - 60%
Operating altitude:	< 2500 m (8100 ft)
<b>Certification</b>	
Electrical Safety:	CE certificated according to directive 2014/35/EU
EMC:	CE certificated according to directive 2014/30/EU
<p>* Floating table top is supported by steel springs; low-pass characteristics of spring-mass combination dominates the dynamic behaviour above 200 Hz.</p> <p>** The maximum compensation level depends on several conditions, such as payload, frequency, load distribution and height of the payload as well as the distance between the isolation elements. For that reason this value should be considered as an estimation.</p>	

## Dimensions of the System

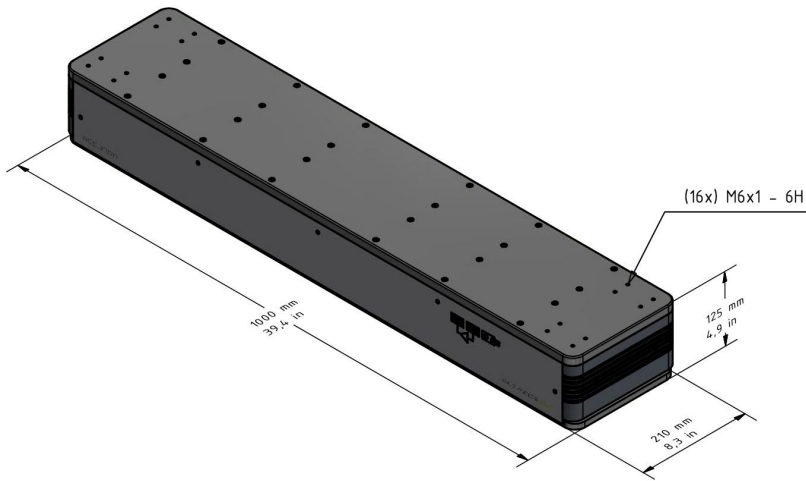


Fig. 9: Dimensions of the Duo 100 element

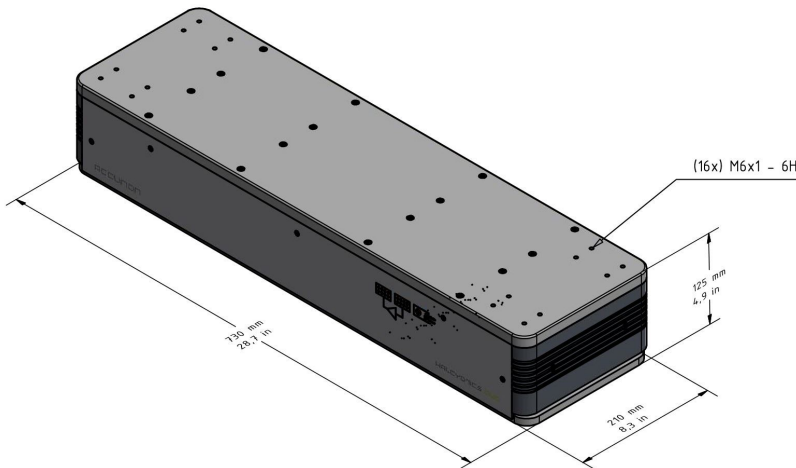


Fig. 10: Dimensions of the Duo 73 element

## Transmissibility of the Duo System

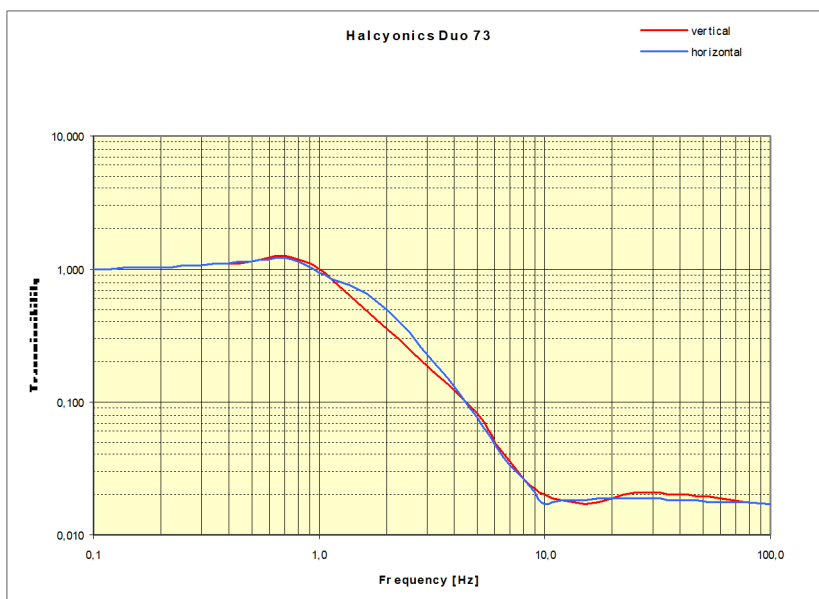


Fig. 11: Transmission Graph of Duo - measured at a velocity of 100  $\mu\text{m/s}$ , with a payload of 60 kg (132 lbs)

**W.A.V.E Office**

W.A.V.E.  
Ingenieurbüro Dr. Stöbener  
Ebereschenring 45  
34346 Hann. Münden (Germany)  
Phone: + 49 (0) 5541 799919 0  
Fax: + 49 (0) 5541 799918 0  
Mail: [info@w-ave.de](mailto:info@w-ave.de)