ACTIVE VIBRATION ISOLATION
System TS-150/140 LP

Instruction manual

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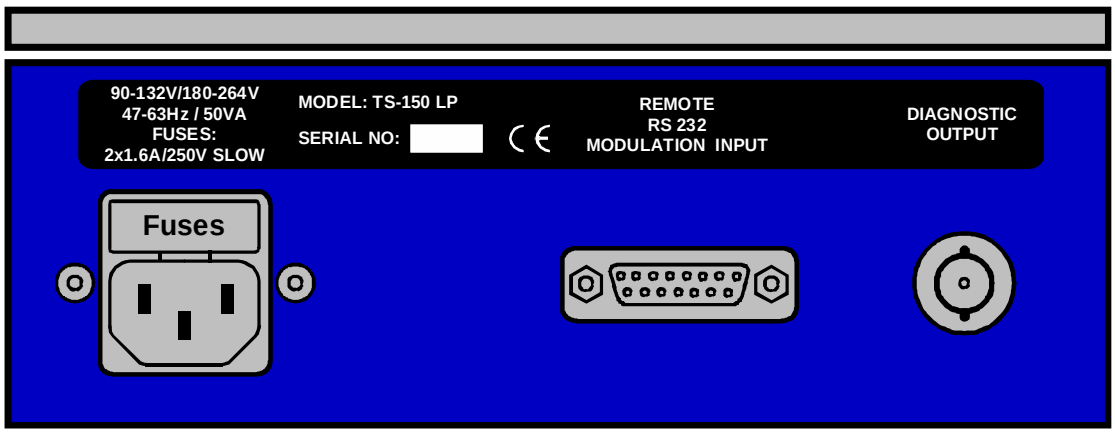
Notes on Equipment Safety

The vibration isolation systems **TS-150 LP and TS-140 LP** have been designed, manufactured and tested to conform to the safety regulations for measurement- and control-equipment DIN EN 61010-1:2001 (IEC 61010-1 second edition 2001-02) and satisfy the relevant requirements of EEC Directive 73/23. The systems conform to EEC Directive 89/336 (electro-magnetic compatibility). The operator should read this manual which contains important warnings and information.

Safety Instructions

- The system may only be plugged into a socket with separate ground. Do not disconnect this ground, either at the socket, or by using an ungrounded extension cable.
- Before switching on this apparatus make sure that it is connected to the correct mains voltage.
- Do not remove any cover or allow any metal objects to enter any openings in the unit.
- Disconnect from mains before removing any covers. Refer servicing to qualified personnel.
- Do not use in potentially explosive surroundings.
- Do not drill any holes into the top plate. This will damage the system.
- The fuses are located in the rear panel power socket. Do not attempt to change a fuse without first unplugging the power cable. Only replace a fuse with the correct type.
  Never try to bypass a fuse.



- If you suspect the system to be in any way unsafe, unplug and prevent any possible accidental usage. Contact your nearest service centre.

Accessories

1 Power Cable
1 Manual
1 Remote Control Box (optional)

General

The **TS-150 LP** and **TS-140 LP** are compact dynamic antivibration systems, which offer isolation against all six translational and rotational vibration modes.

These moderately priced dynamic vibration isolation systems achieve in a very small volume better isolation than is possible with the biggest and most expensive passive systems. Inertial feedback using piezoelectric force motors provides not only isolation from building vibrations, but also isolation from vibration sources placed on the system itself. This means, for example, that a delicate microscope isolated by the system will remain at rest despite forces being applied via the operator's hands.

The inherent stiffness of the systems, some 200 - 500 times greater than that of a 1 Hz resonance passive isolator, imparts excellent directional and positional stability.

The characteristics of an active isolation system are typified by the virtual lack of any low frequency resonance, a resonance which plagues all passive isolation systems.

The **TS-150 LP** is a complete active isolation system measuring 450 x 400 x 78,5 mm and which can support a maximum load of 150kg. The **TS-140 LP** measures 500 x 600 x 84 mm, can support a maximum load of 140kg, but has otherwise identical properties. The systems have been designed to offer excellent isolation even at frequencies as low as 2-3Hz, where many buildings show large horizontal amplitudes due to oscillation about the vertical axis. Isolation begins at about 0.7 Hz, increasing rapidly to at least 40dB beyond about10 Hz.

These systems are extremely convenient to use. Load compensation (auto-levelling) is performed automatically on switching on the power. If the load is changed whilst the system is isolating, it automatically readjusts and then returns to the isolation mode. Furthermore, at the push of a button the system locks itself for shipping. Apart from a single adjustable foot to allow for unevenness in the support surface, there are no manual adjustments to be made.

All the control circuitry, including the power supply, is built into the unit. Power consumption is less than 10 W. The unit has a universal input and may be connected to any AC power point from 90 to 120VAC, or 200 to 240VAC

The design has been optimized to achieve best possible isolation for delicate instruments such as the Scanning Probe Microscopes (AFM, STM), Scanning Electron Microscopes, Interferometers and other high resolution instruments, allowing the ultimate performance to be achieved from these instruments. The tables have also proved to be extremely successful for supporting sensitive experiments, such as patch clamp, micro injection or the troughs for liquids used in measurements on Langmuir-Blodgett films.

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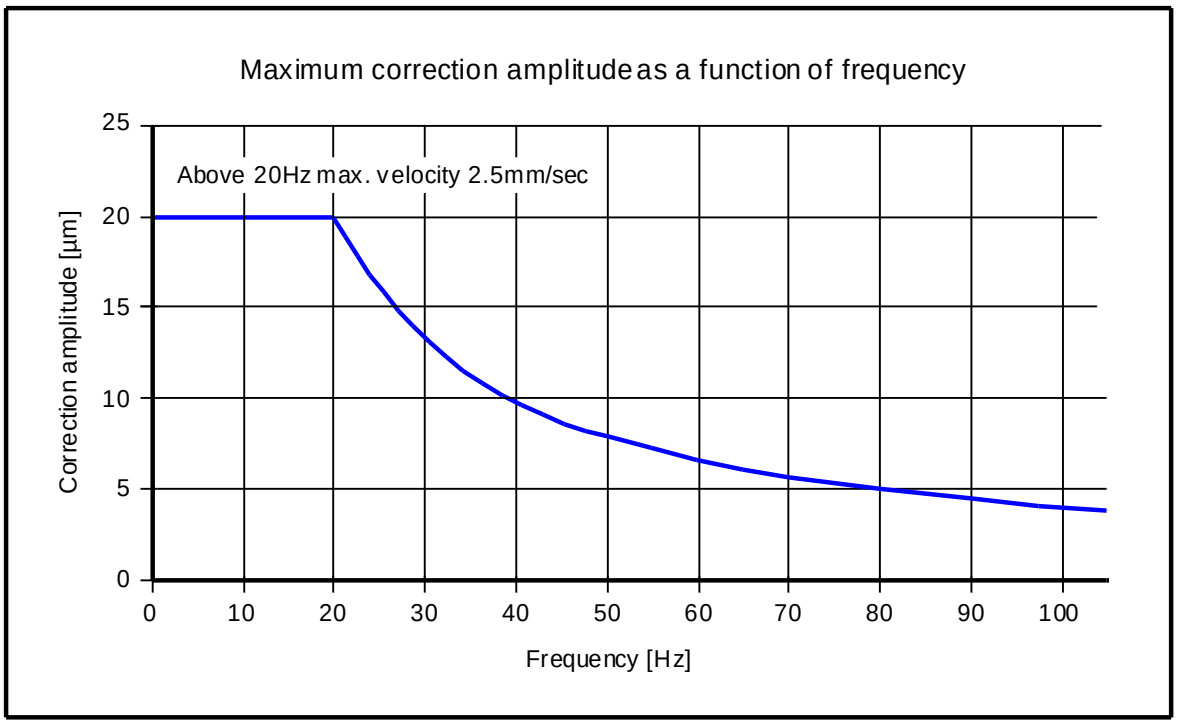
The systems offer excellent isolation in the typical laboratory environment. The maximum vibration amplitude that can be compensated is frequency dependent, reflecting the fact that in typical environments the amplitudes decrease rapidly at higher frequencies. Up to 20Hz **amplitudes** of 20µm can be compensated in all directions. At higher frequencies the maximum correction amplitude decreases inversely proportional to frequency (see diagram), corresponding to a maximum correction **velocity** of 2.5mm/sec.



Note: At frequencies around 0.5Hz, even though there is no isolation at these frequencies, the system will be driven into saturation by amplitudes of around 10µm. This will not normally be a problem unless you are working at the top of a very tall building.

Optimum Support Surface

To obtain the optimum performance from the system it must be supported on a surface which is as rigid as possible. The best possible performance is obtained with the system sitting directly on the floor. However for most applications this will not be practical, and some support structure will be required to bring the system to a convenient operating height. Most simple table structures will be rigid enough vertically, but will leave much to be desired horizontally. The addition of diagonal struts between the table legs can improve the situation dramatically.

It is good to bear in mind that any support structure will follow the building vibrations exactly up to some certain cut off frequency at which point the structure goes into resonance and amplifies the vibration amplitudes. A typical structure may have its lowest horizontal resonance frequencies around 40-60 Hz.

It is an unfortunate fact of life that the amplitudes of the vertical vibrations of the building (dominantly bending modes of the floor) are largest in the centre of the floor, where for convenience most experiments are situated!

Since the system are quite small, a possible location may be on a shelf attached to a building pillar. Good braces will be required to support the shelf. This location has the advantage that the vertical vibrations of the building will be very much reduced.

Test of Support Surface

Although the systems will operate on virtually any support surface, a soft support structure resonantly amplifies certain building vibration frequencies and these will therefore be less effectively isolated.

You can obtain an idea for the suitability of your support structure by observing the diagnostic signal while pushing on the support. The isolation should be disabled for this test. If the support is rigid the signals should hardly respond to a push on the support in any direction. Now try tapping the support to excite its internal resonances. Generally the support will react more strongly to a horizontal tap than to a vertical one. A very resonant support will show long lived resonances and the isolation will be seriously affected at these frequencies. A better support will show well damped resonances.

First Time Installation

For shipping the system has been locked to prevent damage. It will automatically be unlocked when power is applied to the system. Sometimes equipment can get very cold during shipping. We recommend that if the system is cold you allow 2-3 hours for it to reach room temperature before connecting the power, otherwise a malfunction may arise due to condensation.

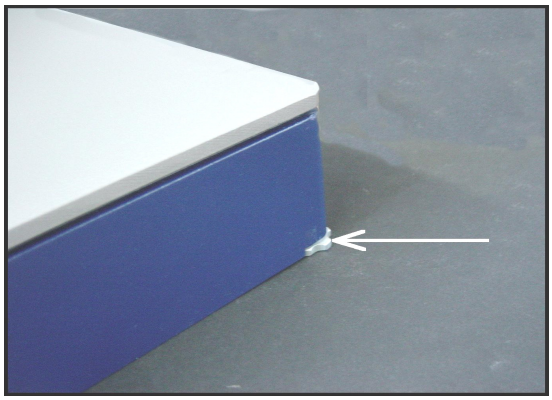
Auto-Levelling

When operating the system for the first time, place on a suitable rigid support surface and switch on the power. If the system has been locked for transport the motors will run rapidly for a few seconds until the system is floating.

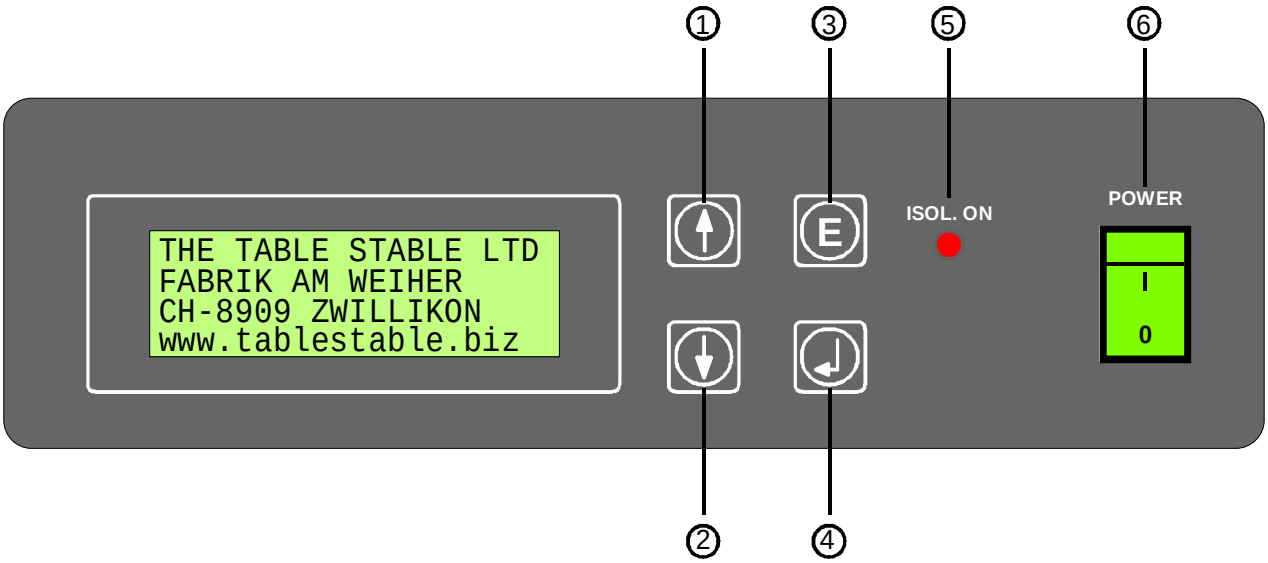
Adjustable Foot

Before proceeding further check first that the system is sitting properly on the support surface. The rear right foot is adjustable – turn until the system is sitting well balanced on all four feet.

Important: make sure that the system is unlocked before adjusting the foot



Operation



1 Scroll Up
2 Scroll Down
3 Enable / Disable Isolation
4 Enter
5 Isolation Indicator
6 Power Switch

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Display Overview

Push ⓘ or ⓘ to toggle between display pages:

```
****** TS-150 ******
HEIGHT ADJUSTMENT
```

System is setting the correct height.

```
****** TS-150 ******
HEIGHT ADJUST ERROR
```

System is unable to set the correct height. The load may be badly distributed.

```
****** TS-150 ******
ISOLATION DISABLED
```

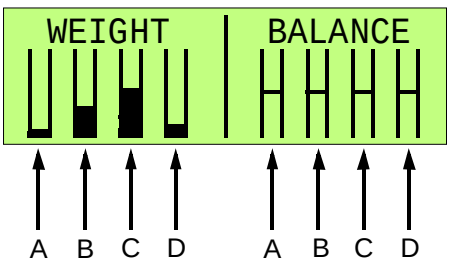
Isolation off, push Ⓔ to activate isolation.

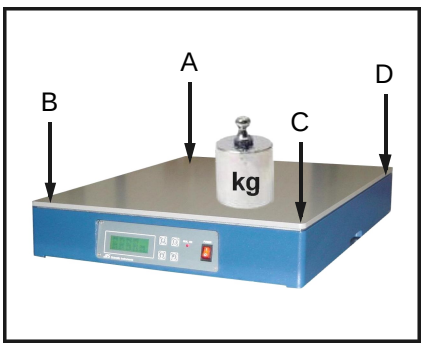
```
****** TS-150 ******
ISOLATION ENABLED
```

System is Isolating, push Ⓔ to deactivate isolation.

```
SYSTEM UNLOCKED
PUSH ↵ TO LOCK
```

Push ↵ to lock the system for transport.
System will automatically unlock when the power is switched on.





Weight shows the load on each corner. A flashing bar means an overload or bad load distribution, the system will not isolate.

Balance shows the centre of the height adjustment. Under normal circumstances the bars should be approximately in the middle. A flashing bar means the system is not balanced and will not isolate.

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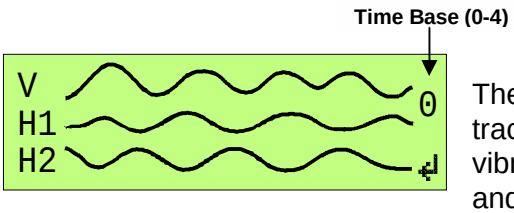
Observing Mode



The traces show velocity, but are not calibrated – the top trace is vertical and the lower 2 traces show the horizontal vibrations. H1 is parallel to the cables attached to the unit, and H2 perpendicular to this axis. The time axis can be changed by pushing the Enter button.
A higher index number N gives a slower display.
The approximate time per scan is 160 x 2^N milliseconds.

Note: This function is not intended for measurement purposes and is not calibrated.

On using the system for the first time it is strongly recommended that you observe this signal, with the isolation both Enabled and Off - it gives a good impression of how well the system is operating.

Function Menu

```
FUNCTION ↵
```

Push ↵ to gain access to the function menu.

```
Display B.-Light On
PwrOnIsolEn On
EXIT
EXIT AND SAVE
```

The backlight may be turned off if desired. Scroll display to the appropriate function and push ↵ to toggle between backlight on and off.

```
Display B.-Light On
PwrOnIsolEn On
EXIT
EXIT AND SAVE
```

Power-on Isolation enable
If this function is on, the isolation will start automatically after the system is switched on. This function is useful when a remote control-box is connected on the rear (Optional).

```
Display B.-Light On
PwrOnIsolEn On
EXIT
EXIT AND SAVE
```

Push ↵ to exit the function menu without saving the changes. When you switch the system off, all settings will be lost.

```
Display B.-Light On
PwrOnIsolEn On
EXIT
EXIT AND SAVE
```

Push ↵ to exit the function menu and save all the settings. All settings will be present after switching the system off.

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Locking System for Transport

```
SYSTEM UNLOCKED
PUSH ↵ TO LOCK
```

In order to prevent damage during shipping it is essential to lock the system. With the system switched on, scroll the display until the message “to lock push ↵ “ appears. Push ↵ and the motors will run, gradually slow down and then stop. The message “system locked“ will appear.
Switch off.
The next time the system is powered up it will automatically unlock.

Isolation Mode

After switching on the power, and once the motors have stopped running, the table top will be floating and the display will show “Isolation Disabled”. To enable the isolation merely push the button marked E. The system is now operating and the red LED will light up.

BNC Output Jack

The rear panel BNC socket gives a multiplexed output showing the signals from all 8 accelerometers.
To view this signal on an oscilloscope, set the time base to **20msec** and the sensitivity to **0.2V**.

The signals are for diagnostic purposes only and are not calibrated.

Remote Output

A remote control box (optional) can be connected to the D-Sub socket and allows you to switch the Isolation on and off externally.

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Specifications TS-150 LP and TS-140 LP

Isolation: dynamic 0.7 Hz to 200 Hz, mainly passive at higher frequencies, although for good stability the feedback is active to at least 2 KHz

Transmissibility: see curves below. Above about 10 Hz transmissibility <0.01 (-40dB)

Correction Forces: ±8N vertical, ±4N horizontal

System Noise: less than 20nG/√Hz from 1-200Hz in any direction

Maximum Load: TS-150: 150 kg
TS-140: 140 kg

Resonant frequency, isolation OFF, no load: TS-150: approx. 27 Hz vertical, 20 Hz horizontal
TS-140: approx. 20 Hz vertical, 15 Hz horizontal

Size: TS-150 LP: 450 x 400 x 78.5 mm
TS-140 LP: 500 x 600 x 84 mm

Weight: TS-150: 17.5 kg
TS-140: 28.5 kg

Electrical

Safety class: 1

Power Consumption: maximum 10 W when isolating,
maximum 20W during load adjustment

Input Voltage: 90 – 120V AC, 47 – 63 Hz
200 – 240V AC, 47 – 63 Hz

Fuses: 2 x 1.6A/250V slow, located in the power socket on the rear side of the unit.

Normal Environmental Conditions

Protection class: IP 20

Temperature range: 5°C - 40°C

Relative humidity: 10 – 90% (5 – 30°C)
10 – 60% (30 – 40°C)

Application: Indoor

Altitude: up to 2000m (6500ft)

Table Top

Material: Damped aluminium sandwich construction. Also available with stainless steel top, tapped M6 on 25mm centres.

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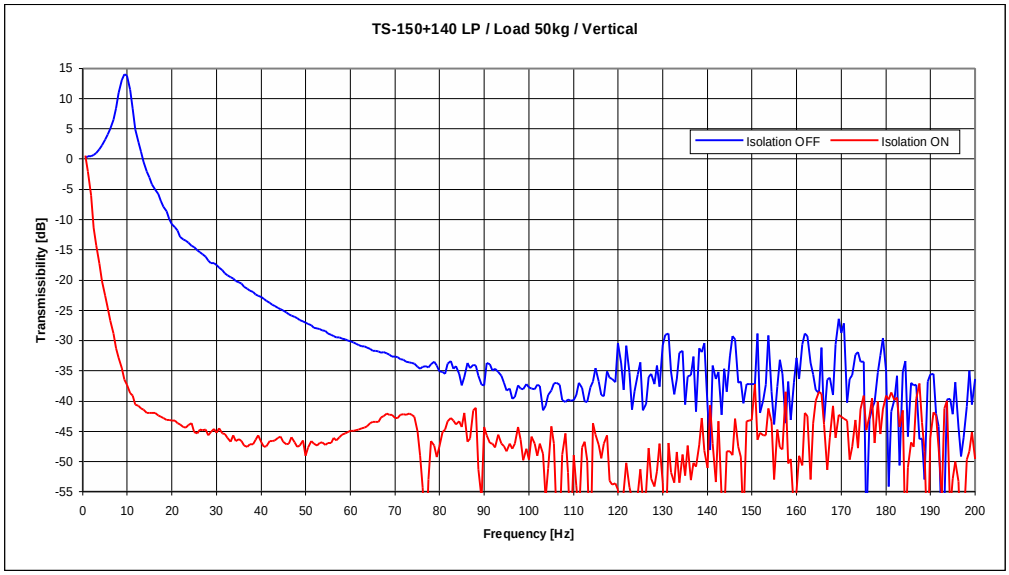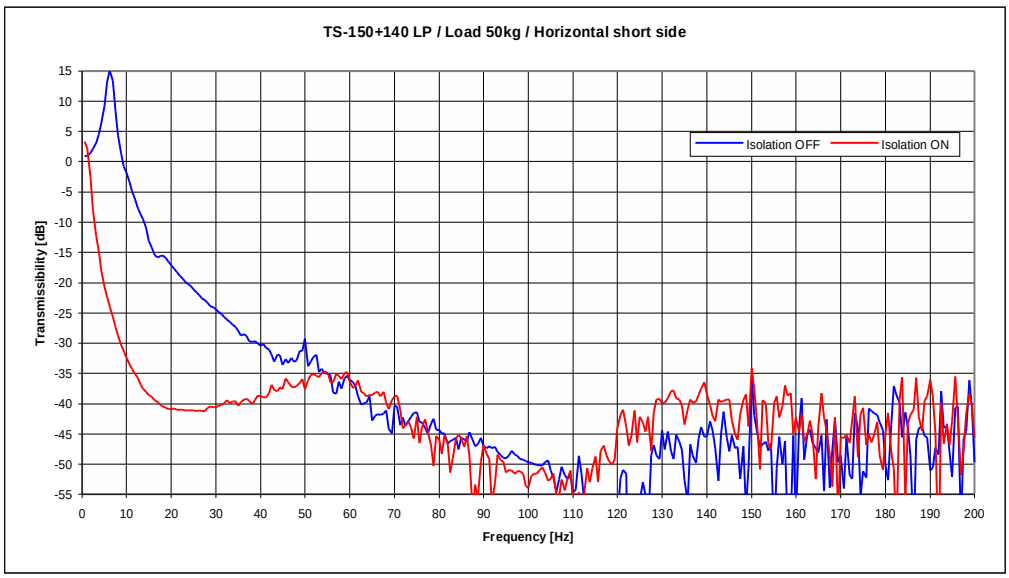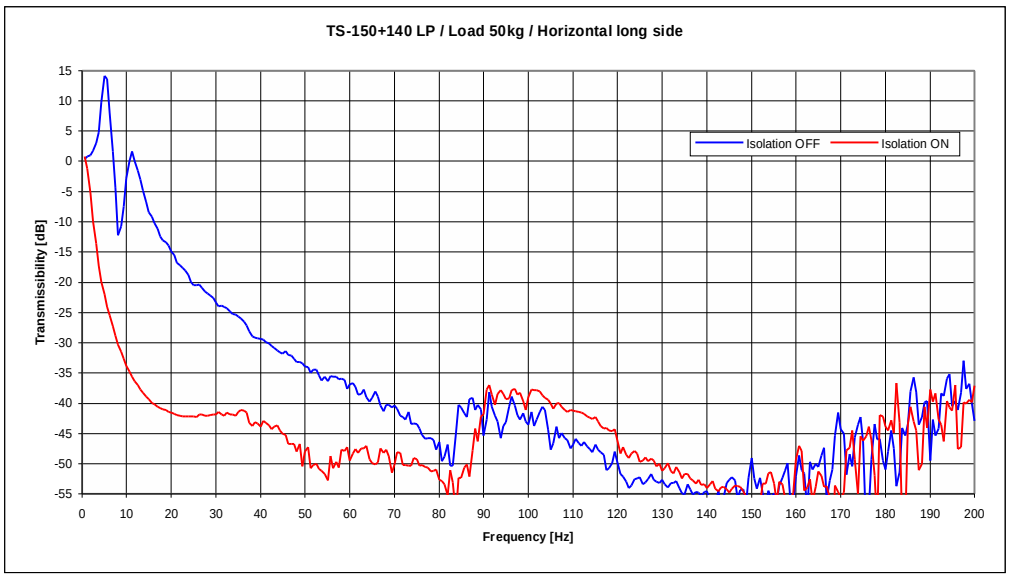
Transmissibility