RULA The Harmony of Solutions

Setting Additional Shock Limits

Limit configuration for Shock test is responsible for the integrity of the shaker. Shock Limits stop the test if the Shock values reach a set threshold, preventing equipment failure.

To set the shock limits, use the Limits tab in the Test Settings panel. There are three main groups of options here:

- Shaker limits;
- Control limits;
- Abort and Tolerance limits.
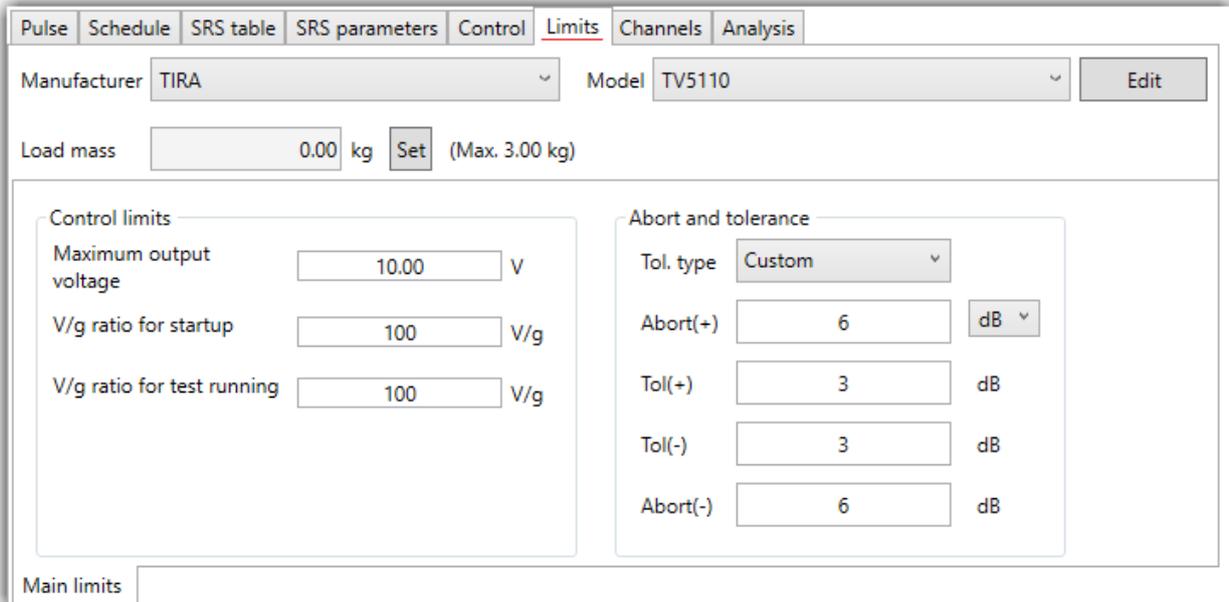
| Pulse | Schedule | SRS table | SRS parameters | Control | Limits | Channels | Analysis |

Manufacturer TIRA ⌄   Model TV5110 ⌄   Edit

Load mass [0.00] kg [Set] (Max. 3.00 kg)

Control limits

Maximum output voltage	10.00	V
V/g ratio for startup	100	V/g
V/g ratio for test running	100	V/g

Abort and tolerance

Tol. type	Custom ⌄	
Abort(+)	6	dB ⌄
Tol(+)	3	dB
Tol(-)	3	dB
Abort(-)	6	dB

Main limits

Input the mass of the test object in the "Load mass" field. To the right of this field, the maximum possible object mass for the selected shaker, considering the set profile and schedule, is specified. To set the "Load mass", click "Set" and in the "Setting masses" window set: load mass, fixture mass, table mass, other mass which attached to the object or fixture of table.

Shaker settings

| Manufacturer | TIRA | | Add | Delete | | List of manufacturers |

| Model | TV5110 | | Change the shaker name |

Frequency range 5.00 - 10000.00 Hz

Limit values
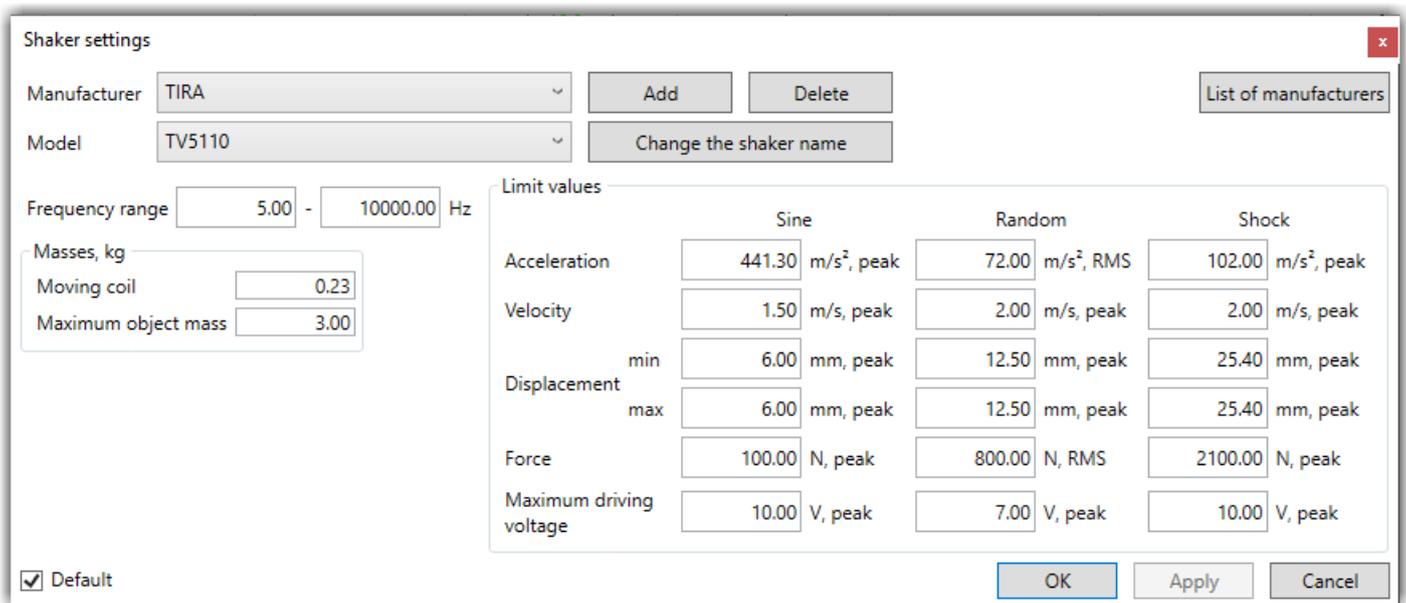
	Sine	Random	Shock
Acceleration	441.30 m/s², peak	72.00 m/s², RMS	102.00 m/s², peak
Velocity	1.50 m/s, peak	2.00 m/s, peak	2.00 m/s, peak
Displacement min	6.00 mm, peak	12.50 mm, peak	25.40 mm, peak
Displacement max	6.00 mm, peak	12.50 mm, peak	25.40 mm, peak
Force	100.00 N, peak	800.00 N, RMS	2100.00 N, peak
Maximum driving voltage	10.00 V, peak	7.00 V, peak	10.00 V, peak

Masses, kg

| Moving coil | 0.23 |
| Maximum object mass | 3.00 |

☑ Default   OK   Apply   Cancel

The Shaker limits category includes three elements: shaker Manufacturer, shaker Model and object mass field. The drop-down lists of Manufacturer and Model allow you to specify the shaker used for tests. When you choose a Manufacturer, all added shaker models will be shown in the Model drop-down list.

Click Edit to enter the Shaker settings window. Here you can set the limit values for Acceleration, Velocity, Displacement, Power and Maximum driving voltage specified by the shaker manufacturer.
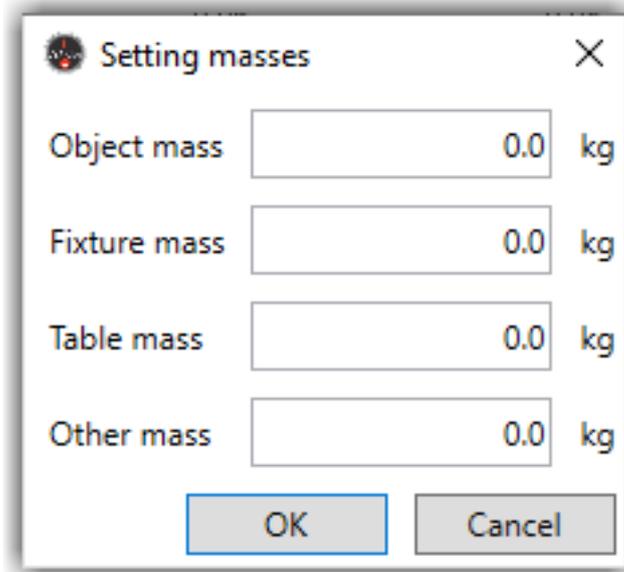
The "Maximum output voltage" is a maximum voltage value delivered to the output channel. With this parameter you can forcefully limit the output channel voltage, based on the maximum possible input voltage value of the power amplifier.

The settings of the selected shaker must correspond to the vibration shaker in use. If the settings do not correspond to the assembled shaker, the drive voltage values delivered to the shaker may be too great. Equipment damage in this case will not covered by warranty.

The parameters "V/g ratio for startup" and "V/g ratio for test running" allow setting the maximum acceptable value of this ratio at startup and during the test. V - drive shock pulse power in $\sqrt{\dfrac{V}{s}}$, g – response shock pulse power in $\sqrt{\dfrac{g}{s}}$. These parameters enable easily detecting the sensors that are incorrectly connected or installed.

For example, the "V/g ratio for test running" parameter is set as $100\sqrt{\dfrac{V}{g}}$, and the shock with the power of $1\sqrt{\dfrac{V}{s}}$ is delivered to the output. The disconnection of the sensor connected to the RULA controller's control input takes place. If during the shock its power falls below $\dfrac{1\sqrt{\dfrac{V}{s}}}{100\sqrt{\dfrac{V}{g}}} = 0.01\sqrt{\dfrac{g}{s}}$, an emergency stop of the test will happen.
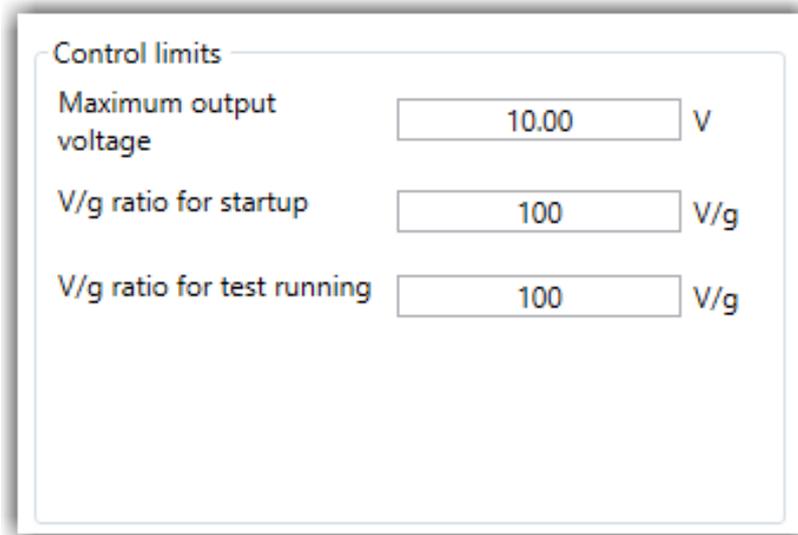
The "Abort and tolerance" group on "Limits" tab allows you to specify the abort and tolerance levels. The levels are specified relative to task shock pulse power, the parameters of which are specified in the "Pulse" tab. For control, the function is the square root of the shock pulse. This parameter is called "Shock pulse power" in RULA Software. It is calculated according

using the formula: $N = \sqrt{\int_{Tb}^{Te} A(t)\,dt}$,

where:

N – shock pulse power;

Tb and Te – the time of start and end of the main shock pulse;

A(t) – the dependence of shock acceleration from time.

- If the response shock pulse power gets bigger or smaller than the tolerance level, the message of excess or going below or above the tolerance level will appear on the test log.
- If the response shock pulse power gets bigger or smaller than the abort level, the message of emergency stop will appear on the test log and the test will be stopped if the stop is allowed for that reason.

The shock pulse power and tolerance or abort values going compare by absolute values.

The "Abort and tolerance" group has a drop-down list where you can select various types of limitations:

1. User-defined – the abort and tolerance levels of the "Shock pulse power" deviation from the task, taking into account the level specified in the schedule. The values in the "Abort (-)" and "Abort (+)" fields must be greater than or equal to the values in the "Tol (-)" and "Tol (+)" fields correspondingly. By default, the tolerance level is set at 3dB, abort levels – at 6dB.

2. MILSTD 810 – the levels of shock pulse power deviation in reference to the task level are specified as per MILSTD 810 (US Ministry of Defense standard). The abort levels are user-defined
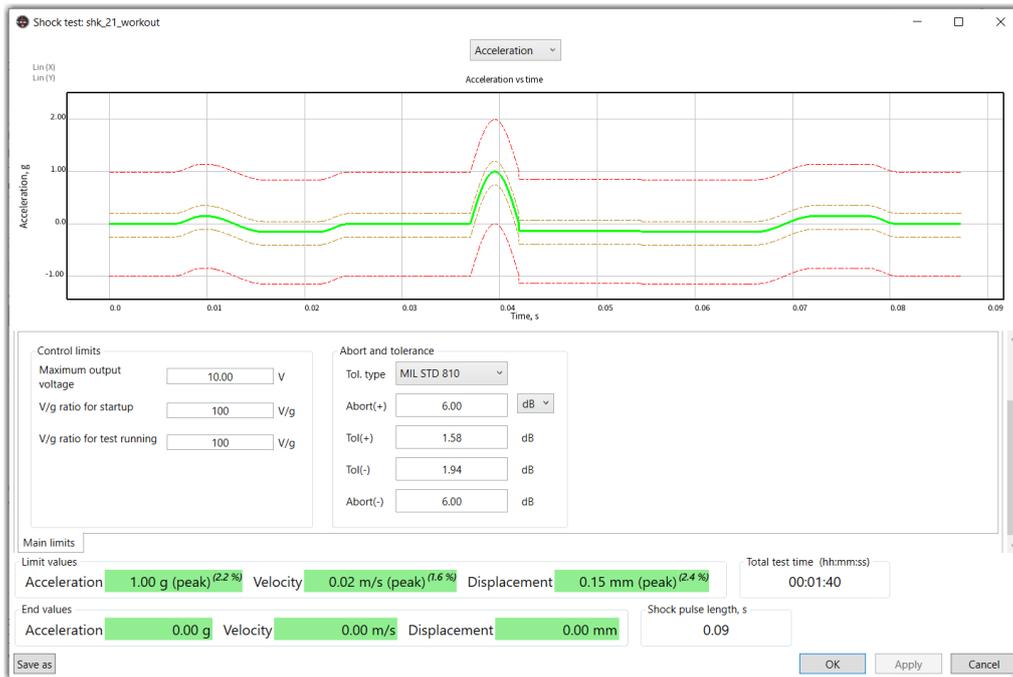
3. DO-160 – the tolerance levels of the "Shock pulse power" deviation from task, taking into account the level specified in the schedule are specified according to DO-160. The abort levels are user-defined

4. SEN 60068-2-27 – the tolerance levels of the "Shock pulse power" deviation from task, taking into account the level specified in the schedule, are specified according to BSEN 60068-2-27 (BSI. British Standards. Environmental testing. Tests. Test Ea. and guidance. Shock. 2009). The abort levels are user-defined.

5. Table – the tolerance levels of the "Shock pulse power" deviation from task, taking into account the level specified in the schedule, are specified according to the table entered by the user. The abort levels are user defined.
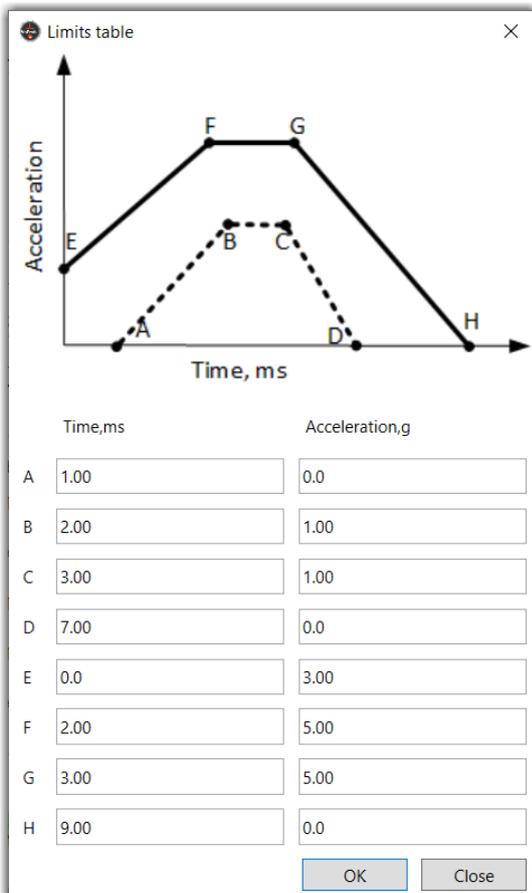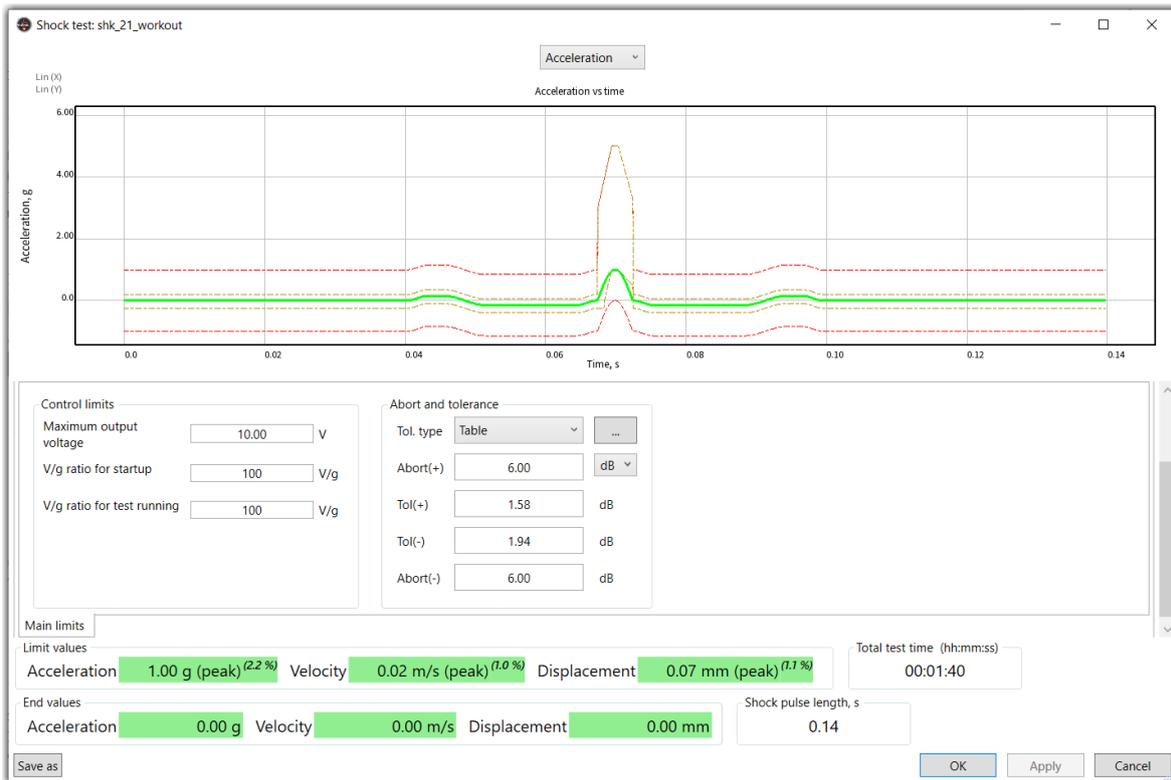
The "Table" specifies the graph of exceeded acceleration from time with four points on the graph and the graph of lower acceleration from time with four points on the graph. If you want to enter the data of acceleration and time into the "Limits table" you need press the "Table" button to the right of then table.