MUSEN file format (as text)

Each line of a text file describes a single object or specific scene property and can have the following format:

IDENTIFIER | OBJ_ID | OBJ_TYPE_IDENT OBJ_TYPE | OBJ_GEOM_IDENT OBJ_GEOM | OBJ_MATERIAL_IDENT LOCAL_MATERIAL_ID | OBJ_ACTIVITY_IDENT OBJECT_ACTIVITY| OBJ_TIME_IDENT OBJECT_TIME | OBJ_COORD_IDENT OBJECT_COORD …

Each line starts with one of the following indicators, which define the type of information stored in this line. There exist eight possible types of *main identifiers*:

Table 1. List of main identifiers.

IDENTIFIER	Description
0	Information in this line describes one of the physical objects (Particle, Wall, Solid bond, etc.)
22	Information in this line describes computational domain (more information about computational domain is given in the user's guide)
25	Main description of the geometrical object (union of triangular walls)
26	Time-dependent properties of specific geometrical object
27	Indexes of walls included into this geometry
28	Information about selected periodic boundary conditions
29	A flag indicating whether anisotropy of particles is taken into account during the simulation
30	A flag indicating whether particles have increased contact radius
32	Compounds
33	Interactions
34	Mixtures
38	Analysis volume
39	Package generator
40	Overall settings for all package generators
41	Bonds generator

Each line starting with the main identifier equal to **0** contains complete information about a particular physical object. This information is separated by internal identifiers (marked as blue) and for all objects have a similar format:

Information about a sphere:

0 | **OBJ_ID |** **1** 1 | **5** RADIUS CONTACT-RADIUS **|** **23** LOCAL_MATERIAL_ID **|** **24** INIT_ACTIV END_ACTIV **|** …

… **2** TP_1 **|** **12** COORD **|** **15** VEL **|** **16** ANGL_VEL **|** **18** TOT_FORCE **|** **20** FORCE **|** **31** QUATERNION **|** **36** STRESS_TENSOR **|**

Information about a triangular wall:

0 | **OBJ_ID |** **1** 14 | **5** _ **|** **23** LOCAL_MATERIAL_ID **|24** INIT_ACTIV END_ACTIV **|** …

… **2** TP_1 **|** **12** COORD_V1 **|** **15** VEL **|** **16** COORD_V3 **|** **18** TOT_FORCE **|** **20** FORCE **|** **31** COORD_V2 **|**

Information about a solid bond:

0 | **OBJ_ID |** **1** 9 | **5** ID1 ID2 DIAMETER INIT_LENGTH **|** **23** LOCAL_MATERIAL_ID **|** **24** INIT_ACTIV END_ACTIV **|** …

… **2** TP_1 **|** **12** TOT_TORQUE 0 0 **|** **15** 0 0 0 **|** **16** TANG_OVERLAP **|** **18** TOT_FORCE **|** **20** FORCE **|** **31** 0 0 0 0 **|**

Lines that do not start from **0** describe specific properties of the scene and have the following format:

Information about the computational domain:

22 | coordMin coordMax

Information about a geometrical object:

25 | geometry_name mass freeMotionX freeMotionY freeMotionZ

26 | motion_type motion_intervals_number [time_interval_begin time_interval_end velocity_x velocity_y velocity_z rot_velocity_x rot_velocity_y rot_velocity_z rot_center_x rot_center_y rot_center_z […]] **|** [force_limit limit_type velocity_x velocity_y velocity_z rot_velocity_x rot_velocity_y rot_velocity_z rot_center_x rot_center_y rot_center_z […]]

27 | Indexes of all planes in this geometry

38 analysis_volume_name unique_key shape_type color_r color_g color_b color_a size_width size_depth size_height size_radius size_inner_radius scaling_factor rotation_matrix_00 rotation_matrix_01 rotation_matrix_02 rotation_matrix_10 rotation_matrix_11 rotation_matrix_12 rotation_matrix_20 rotation_matrix_21 rotation_matrix_22 motion_type motion_intervals_number [time_interval_begin time_interval_end velocity_x velocity_y velocity_z rot_velocity_x rot_velocity_y rot_velocity_z rot_center_x rot_center_y rot_center_z […]] **|** [force_limit limit_type velocity_x velocity_y velocity_z rot_velocity_x rot_velocity_y rot_velocity_z rot_center_x rot_center_y rot_center_z […]] mesh_name mesh_triangles_number [tri1_p1_x tri1_p1_y tri1_p1_z tri1_p2_x tri1_p2_y tri1_p2_z tri1_p3_x tri1_p3_y tri1_p3_z […]]

Information about boundary conditions:

28 | Boundary conditions

Information about anisotropy:

29 | Flag

Information about contact radius:

30 | Flag

Information about materials:

32 | compound_key compound_name | 0 density | 2 dynamic_viscosity | 7 young_modulus | …

… 8 normal_strength | 9 tangential_strength | 10 poisson_ratio | 11 surface_energy | 12 atomic_volume | …

… 13 surface_tension | 14 time_therm_exp_coeff | 15 yield_strength |

33 | compound_key_1 compound_key_2 | 200 restitution_coefficient | 201 static_friction | …

… 202 rolling_friction |

34 mixture_key mixture_name fraction_number compound diameter contact_ diameter fraction [fraction_number compound diameter contact_ diameter fraction […]]

Information about generators:

38 package_generator_name activity volume_key mixture_key target_porosity target_max_overlap max_iterations init_velocity is_inside_geometry_allowed

39 package_generator_simulator_type package_generator_verlet_coeff

40 bonds_generator_name activity compound_key min_distance max_distance diameter is_overlay_allowed is_compound_specific / list_of_materials_1 / list_of_materials_2 /

Table 2. Description of properties.

ID	Name	Value	Description
Time-independent data:			
-	**OBJ_ID**	**ID**	Unique identifier of this object
1	**OBJ_TYPE**	**1**	Sphere
		9	Solid bond
		13	Liquid bond
		14	Triangular wall
5	**OBJ_GEOM**	**RADIUS, CONTACT-R**	Radius and contact radius of a Sphere
		ID1, ID2, DIAMETER, INIT_LENGTH	Unique identifiers of connected particles and diameter of a Solid bond
		ID1, ID2, DIAMETER, INIT_LENGTH	Unique identifiers of connected particles and diameter of a Liquid bond
		-	Triangular wall
23	**LOCAL_MATERIAL_ID**	**Material-ID**	Material Identifier of an Object
24	**INIT_ACTIV END_ACTIV**	**t1 t2**	Two time points which define activity interval of an object
Time-dependent data:			
2	TP_1, TP_2	**t**	New time point
12	COORD	**X Y Z**	Object coordinates
	COORD_V1	**X Y Z**	Coordinates of the first vertex of a triangular wall
	TOT_TORQUE	**T**	Total torque
15	VEL	**X Y Z**	Velocity
16	ANGL_VEL	**X Y Z**	Angular velocity
	COORD_V3	**X Y Z**	Coordinates of the second vertex of a triangular wall
	TANG_OVERLAP	**X Y Z**	Vector of tangential overlap
18	TOT_FORCE	**F**	Magnitude of force (for bonds can be negative)
20	FORCE	**X Y Z**	Vector of force
31	QUATERNION	**q0 q1 q2 q3**	Quaternion
	COORD_V2	**X Y Z 0**	Coordinates of the third vertex of a triangular wall
36	STRESS_TENSOR	**t[0][0] t[0][1] t[0][2] t[1][0] t[1][1] t[1][2] t[2][0] t[2][1] t[2][2]**	Stress tensor of particles
37	TEMPERATURE	**T**	Temperature of particles or solid bonds

Examples:

Several examples of text files are given in the MUSEN installation folder at

<PathToMUSEN\Examples\InitScenes\>.