*COMPONENT

The keyword *COMPONENT provides a way of incorporating specialized components and features. The keyword control cards in this section are defined in alphabetical order:

COMPONENT_GEBOD_*OPTION

COMPONENT_GEBOD_JOINT_*OPTION

*COMPONENT_HYBRIDIII

COMPONENT_HYBRIDIII_JOINT_*OPTION

***COMPONENT_GEBOD**_OPTION

Purpose: Generate a rigid body dummy based on dimensions and mass properties from the GEBOD database. The motion of the dummy is governed by equations integrated within LS-DYNA separately from the finite element model. Default joint characteristics (stiffnesses, stop angles, etc.) are set internally and should give reasonable results, however, they may be altered using the *COMPONENT_GEBOD_JOINT command. Contact between the segments of the dummy and the finite element model is defined using the *CONTACT_GEBOD command. The use of a positioning file is essential with this feature; see Appendix N for further details.

OPTION specifies the human subject type. The male and female types represent adults while the child is genderless.

MALE

FEMALE

CHILD

Card 1	1	2	3	4	5	6	7	8
Variable	DID	UNITS	SIZE					
Type	I	I	F					
Default	none	none	none					

Card 2	1	2	3	4	5	6	7	8
Variable	VX	VY	VZ	GX	GY	GZ		
Type	F	F	F	F	F	F		
Default	0.	0.	0.	0.	0.	0.		

VARIABLE	DESCRIPTION
DID	Dummy ID. A unique number must be specified.

VARIABLE	DESCRIPTION
UNITS	System of units used in the finite element model. EQ.1: lbf × s^2 / in - in - s EQ.2: kg - m - s EQ.3: kgf × s^2 / mm - mm - s EQ.4: metric ton - mm - s EQ.5: kg - mm – ms
SIZE	Size of the dummy. This represents a combined height and weight percentile ranging from 0 to 100 for the male and female types. For the child the number of months of age is input with an admissible range from 24 to 240.
VX, VY, VZ	Initial velocity of the dummy in the global *x*, *y* and *z* directions.
GX, GY, GZ	Global *x*, *y*, and *z* components of gravitational acceleration applied to the dummy.

Example:

```
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$$$$   *COMPONENT_GEBOD_MALE
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$  A 50th percentile male dummy with the ID number of 7 is generated in the
$  lbf*sec^2-inch-sec system of units.  The dummy is given an initial velocity of
$  616 in/sec in the negative x direction and gravity acts in the negative z
$  direction with a value 386 in/sec^2.
$
*COMPONENT_GEBOD_MALE
$
$...>....1....>....2....>....3....>....4....>....5....>....6....>....7....>....8
$       did     units      size
          7         1        50
$        vx        vy        vz        gx        gy        gz
       -616         0         0         0         0      -386
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
```

COMPONENT_GEBOD_JOINT_*OPTION

Purpose: Alter the joint characteristics of a GEBOD rigid body dummy. Setting a joint parameter value to zero retains the default value set internally. See Appendix N for further details.

The following options are available.

PELVIS	RIGHT_ELBOW
WAIST	LEFT_HIP
LOWER_NECK	RIGHT_HIP
UPPER_NECK	LEFT_KNEE
LEFT_SHOULDER	RIGHT_KNEE
RIGHT_SHOULDER	LEFT_ANKLE
LEFT_ELBOW	RIGHT_ANKLE

Card 1	1	2	3	4	5	6	7	8
Variable	DID	LC1	LC2	LC3	SCF1	SCF2	SCF3	
Type	F	I	I	I	F	F	F	

VARIABLE	DESCRIPTION
DID	Dummy ID, see *COMPONENT_GEBOD_*OPTION*.
LC*i*	Load curve ID specifying the loading torque as a function of rotation (in radians) for the i^{th} degree of freedom of the joint.
SCF*i*	Scale factor applied to the load curve of the i^{th} joint degree of freedom.

Card 2	1	2	3	4	5	6	7	8
Variable	C1	C2	C3	NEUT1	NEUT2	NEUT3		
Type	F	F	F	F	F	F		

VARIABLE	DESCRIPTION
C*i*	Linear viscous damping coefficient applied to the i^{th} DOF of the joint. Units are torque × time/radian, where the units of torque and time depend on the choice of UNITS in Card 1 of *COMPONENT_GEBOD_*OPTION*.
NEUT*i*	Neutral angle (degrees) of the joint's i^{th} DOF.

Card 3	1	2	3	4	5	6	7	8
Variable	LOSA1	HISA1	LOSA2	HISA2	LOSA3	HISA3		
Type	F	F	F	F	F	F		

VARIABLE	DESCRIPTION
LOSA*i*	Value of the low stop angle (degrees) for the i^{th} DOF of this joint.
HISA*i*	Value of the high stop angle (degrees) for the i^{th} DOF of this joint.

Card 4	1	2	3	4	5	6	7	8
Variable	UNK1	UNK2	UNK3					
Type	F	F	F					
Default	0.	0.	0.					

VARIABLE	DESCRIPTION
UNK*i*	Unloading stiffness (torque/radian) for the i^{th} degree of freedom of the joint. This must be a positive number. Units of torque depend on the choice of UNITS in Card 1 of *COMPONENT_GEBOD_*OPTION*.

Example 1:

```
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
```

```
$$$$  *COMPONENT_GEBOD_JOINT_LEFT_SHOULDER
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$  The damping coefficients applied to all three degrees of freedom of the left
$  shoulder of dummy 7 are set to 2.5.  All other characteristics of this joint
$  remain set to the default value.
$
*COMPONENT_GEBOD_JOINT_LEFT_SHOULDER
$
$...>....1....>....2....>....3....>....4....>....5....>....6....>....7....>....8
$      did       lc1       lc2       lc3      scf1      scf2      scf3
         7         0         0         0         0         0         0
$       c1        c2        c3     neut1     neut2     neut3
       2.5       2.5       2.5         0         0         0
$    losa1     hisa1     losa2     hisa2     losa3     hisa3
         0         0         0         0         0         0
$     unk1      unk2      unk3
         0         0         0
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
```

Example 2:

```
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$$$$  *COMPONENT_GEBOD_JOINT_WAIST
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$  Load curve 8 gives the torque versus rotation relationship for the 2nd DOF
$  (lateral flexion) of the waist of dummy 7.  Also, the high stop angle of the
$  1st DOF (forward flexion) is set to 45 degrees.  All other characteristics
$  of this joint remain set to the default value.
$
*COMPONENT_GEBOD_JOINT_WAIST
$
$...>....1....>....2....>....3....>....4....>....5....>....6....>....7....>....8
$      did       lc1       lc2       lc3      scf1      scf2      scf3
         7         0         8         0         0         0         0
$       c1        c2        c3     neut1     neut2     neut3
         0         0         0         0         0         0
$    losa1     hisa1     losa2     hisa2     losa3     hisa3
         0        45         0         0         0         0
$     unk1      unk2      unk3
         0         0         0
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
```

*COMPONENT_HYBRIDIII

Purpose: Define a HYBRID III dummy. The motion of the dummy is governed by equations integrated within LS-DYNA separately from the finite element model. The dummy interacts with the finite element structure through contact interfaces. Joint characteristics (stiffnesses, damping, friction, etc.) are set internally and should give reasonable results, however, they may be altered using the *COMPONENT_HYBRIDIII_JOINT command. Joint force and moments can be written to an ASCII file (see *DATABASE_H3OUT).

Card 1	1	2	3	4	5	6	7	8
Variable	DID	SIZE	UNITS	DEFRM	VX	VY	VZ	
Type	I	I	I	I	F	F	F	
Default	none	none	none	1	0.	0.	0.	

Card 2	1	2	3	4	5	6	7	8
Variable	HX	HY	HZ	RX	RY	RZ		
Type	F	F	F	F	F	F		
Default	0.	0.	0.	0.	0.	0.		

VARIABLE	DESCRIPTION
DID	Dummy ID. A unique number must be specified.
SIZE	Size of dummy. EQ.1: 5th percentile adult EQ.2: 50th percentile adult EQ.3: 95th percentile adult

NOTE: If negative, then the best of currently available joint properties is applied.

VARIABLE	DESCRIPTION
UNITS	System of units used in the finite element model. EQ.1: lbf × s^2 / in - in - s EQ.2: kg - m - s EQ.3: kgf × s^2 / mm - mm - s EQ.4: metric ton - mm - s EQ.5: kg - mm – ms
DEFRM	Deformability type: EQ.1: all dummy segments entirely rigid EQ.2: deformable abdomen (low density foam, mat #57) EQ.3: deformable jacket (low density foam, mat #57) EQ.4: deformable headskin (viscoelastic, mat #6) EQ.5: deformable abdomen/jacket EQ.6: deformable jacket/headskin EQ.7: deformable abdomen/headskin EQ.8: deformable abdomen/jacket/headskin
VX, VY, VZ	Initial velocity of the dummy in the global *x*, *y* and *z* directions.
HX, HY, HZ	Initial global *x*, *y*, and *z* coordinate values of the H-point.
RX, RY, RZ	Initial rotation of dummy about the H-point with respect to the global *x*, *y*, and *z* axes (degrees).

Example 1:

```
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$$$$  *COMPONENT_HYBRIDIII
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$  A 50th percentile adult rigid HYBRID III dummy with an ID number of 7 is defined
$  in the lbf*sec^2-inch-sec system of units.  The dummy is assigned an initial
$  velocity of 616 in/sec in the negative x direction.  The H-point is initially
$  situated at (x,y,z)=(38,20,0) and the dummy is rotated 18 degrees about the
$  global x-axis.
$
*COMPONENT_HYBRIDIII
$
$...>....1....>....2....>....3....>....4....>....5....>....6....>....7....>....8
$      did    . size     units     defrm        vx        vy        vz
         7         2         1         1     -616.        0.        0.
```

```
$       hx        hy        hz        rx        ry        rz
       38.       20.        0.       18.        0.        0.
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
```

***COMPONENT_HYBRIDIII_JOINT**_OPTION

Purpose: Alter the joint characteristics of a HYBRID III dummy. Setting a joint parameter value to zero retains the default value set internally. Joint force and moments can be written to an ASCII file (see *DATABASE_H3OUT). Further details pertaining to the joints are found in the Hybrid III Dummies section of Appendix N.

The following options are available:

LUMBAR	RIGHT_ELBOW	RIGHT_KNEE
LOWER_NECK	LEFT_WRIST	LEFT_ANKLE
UPPER_NECK	RIGHT_WRIST	RIGHT_ANKLE
LEFT_SHOULDER	LEFT_HIP	STERNUM
RIGHT_SHOULDER	RIGHT_HIP	LEFT_KNEE_SLIDER
LEFT_ELBOW	LEFT_KNEE	RIGHT_KNEE_SLIDER

Card 1	1	2	3	4	5	6	7	8
Variable	DID	Q1	Q2	Q3	FRIC			
Type	F	F	F	F	F			

Card 2	1	2	3	4	5	6	7	8
Variable	C1	ALO1	BLO1	AHI1	BHI1	QLO1	QHI1	SCLK1
Type	F	F	F	F	F	F	F	F

Leave blank if joint has only one degree of freedom.

Card 3	1	2	3	4	5	6	7	8
Variable	C2	ALO2	BLO2	AHI2	BHI2	QLO2	QHI2	SCLK2
Type	F	F	F	F	F	F	F	F

Leave blank if the joint has only two degrees of freedom.

Card 4	1	2	3	4	5	6	7	8
Variable	C3	ALO3	BLO3	AHI3	BHI3	QLO3	QHI3	SCLK3
Type	F	F	F	F	F	F	F	F

VARIABLE	DESCRIPTION
DID	Dummy ID, see *COMPONENT_HYBRIDIII
Q*i*	Initial value of the joint's i^{th} degree of freedom. Units of degrees are defined for rotational DOF. See Appendix N for a listing of the applicable DOF.
FRIC	Friction load on the joint.
C*i*	Linear viscous damping coefficient applied to the i^{th} DOF of the joint.
ALO*i*	Linear coefficient for the low regime spring of the joint's i^{th} DOF.
BLO*i*	Cubic coefficient for the low regime spring of the joint's i^{th} DOF.
AHI*i*	Linear coefficient for the high regime spring of the joint's i^{th} DOF.
BHI*i*	Cubic coefficient for the high regime spring of the joint's i^{th} DOF.
QLO*i*	Value at which the low regime spring definition becomes active.
QHI*i*	Value at which the high regime spring definition becomes active.
SCLK*i*	Scale value applied to the stiffness of the joint's i^{th} DOF (default = 1.0).

Example:

```
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$$$$   *COMPONENT_HYBRIDIII_JOINT_LEFT_ANKLE
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$  The damping coefficients applied to all three degrees of freedom of the left
$  ankle of dummy 7 are set to 2.5.  All other characteristics of this joint
$  remain set to the default value.  The dorsi-plantar flexion angle is set to
$  20 degrees.
```

```
$
*COMPONENT_HYBRIDIII_JOINT_LEFT_ANKLE
$
$...>....1....>....2....>....3....>....4....>....5....>....6....>....7....>....8
$      did        q1        q2        q3      fric
         7         0       20.         0         0         0
$       c1      alo1      blo1      ahi1      bhi1      qlo1      qhi1
       2.5         0         0         0         0         0         0
$       c2      alo2      blo2      ahi2      bhi2      qlo2      qhi2
       2.5         0         0         0         0         0         0
$      2.5      alo3      blo3      ahi3      bhi3      qlo3      qhi3
```