

# ISO 10303-108:2005-02 (E)

## Industrial automation systems and integration - Product data representation and exchange - Part 108: Integrated application resource: Parameterization and constraints for explicit geometric product models

---

### Contents

Page

1	Scope .....	1
1.1	Parameterization schema .....	2
1.2	Explicit constraint schema .....	3
1.3	Variational representation schema .....	3
1.4	Explicit geometric constraint schema .....	4
1.5	Sketch schema .....	4
2	Normative references .....	4
3	Terms, definitions and abbreviations .....	5
3.6	Terms defined in ISO 13584-20 .....	7
3.7	Other terms and definitions .....	7
3.8	Abbreviations .....	14
4	Parameterization .....	15
4.1	Introduction .....	15
4.2	Fundamental concepts and assumptions .....	15
4.2.1	Model parameters .....	16
4.2.2	Parameter binding to an instance attribute .....	17
4.3	Parameterization type definitions .....	18
4.3.1	attribute identifier .....	18
4.4	Parameterization entity definitions .....	19
4.4.1	model parameter .....	19
4.4.2	bound model parameter .....	20
4.4.3	unbound model parameter .....	22
4.4.4	bound parameter environment .....	23
4.4.5	unbound parameter environment .....	23
4.4.6	instance attribute reference .....	24
4.4.7	unbound model parameter semantics .....	25
4.4.8	fixed instance attribute set .....	25
4.4.9	generated finite numeric space .....	26
4.5	Parameterization function definitions .....	27
4.5.1	make numeric set .....	27
4.5.2	validate attribute id .....	28
5	Explicit constraint .....	30
5.1	Introduction .....	30
5.2	Fundamental concepts and assumptions .....	31
5.2.1	Free-form and defined constraints .....	32
5.2.2	Simultaneous groups of constraints .....	32
5.2.3	Use of the current result in the resolution of ambiguities .....	32
5.2.4	Directed and undirected constraints .....	33
5.2.5	Roles of model parameters in free-form constraints .....	33
5.2.6	Accuracy of constraint satisfaction .....	34
5.3	Explicit constraint type definitions .....	34
5.3.1	constraint group member .....	34
5.4	Explicit constraint entity definitions .....	34
5.4.1	explicit constraint .....	34
5.4.2	defined constraint .....	35

5.4.3	equal parameter constraint .....	36
5.4.4	free form constraint .....	37
5.4.5	free form assignment .....	38
5.4.6	free form relation .....	39
5.4.7	simultaneous constraint group .....	40
6	Variational representation .....	43
6.1	Introduction .....	43
6.2	Fundamental concepts and assumptions .....	43
6.3	Variational representation entity definitions .....	45
6.3.1	variational representation item .....	45
6.3.2	auxiliary geometric representation item .....	46
6.3.3	variational representation .....	46
6.3.4	variational current representation relationship .....	48
6.4	Variational representation function definitions .....	49
6.4.1	invalidate vrep item .....	49
7	Explicit geometric constraint .....	52
7.1	Introduction .....	52
7.2	Fundamental concepts and assumptions .....	52
7.2.1	Dimensional constraints .....	54
7.2.2	Semantics of dimensional constraints .....	55
7.2.3	Constraints on procedurally defined model elements .....	56
7.3	Explicit geometric constraint type definitions .....	56
7.3.1	geometric constraint element .....	56
7.3.2	point curve or surface constraint element .....	57
7.3.3	curve or surface constraint element .....	57
7.3.4	linear geometry constraint element .....	57
7.3.5	radial geometry constraint element .....	57
7.3.6	axial geometry constraint element .....	58
7.3.7	swept surface or solid .....	59
7.3.8	tangent contact type .....	59
7.3.9	parallel offset type .....	59
7.3.10	non negative length measure .....	60
7.4	Explicit geometric constraint entity definitions .....	60
7.4.1	explicit geometric constraint .....	60
7.4.2	fixed element geometric constraint .....	61
7.4.3	parallel geometric constraint .....	62
7.4.4	pgc with dimension .....	63
7.4.5	point distance geometric constraint .....	64
7.4.6	pdgc with dimension .....	65
7.4.7	skew line distance geometric constraint .....	65
7.4.8	near point relationship .....	66
7.4.9	curve distance geometric constraint .....	67
7.4.10	cdgc with dimension .....	69
7.4.11	surface distance geometric constraint .....	69
7.4.12	sdgc with dimension .....	71
7.4.13	radius geometric constraint .....	72
7.4.14	rgc with dimension .....	72
7.4.15	curve length geometric constraint .....	73
7.4.16	clgc with dimension .....	74
7.4.17	parallel offset geometric constraint .....	74
7.4.18	pogc with dimension .....	76
7.4.19	angle geometric constraint .....	77
7.4.20	agc with dimension .....	78
7.4.21	perpendicular geometric constraint .....	79
7.4.22	incidence geometric constraint .....	80
7.4.23	coaxial geometric constraint .....	82
7.4.24	tangent geometric constraint .....	82
7.4.25	symmetry geometric constraint .....	84
7.4.26	swept point curve geometric constraint .....	86
7.4.27	swept curve surface geometric constraint .....	87

7.4.28	curve segment set .....	88
7.4.29	curve smoothness geometric constraint .....	89
7.4.30	surface patch set .....	90
7.4.31	surface smoothness geometric constraint .....	90
<b>8</b>	<b>Sketch .....</b>	<b>92</b>
8.1	Introduction .....	92
8.2	Fundamental concepts and assumptions .....	92
8.3	Sketch type definitions .....	93
8.3.1	surface or solid model .....	93
8.3.2	planar curve select .....	94
8.3.3	sketch element select .....	95
8.3.4	sketch basis select .....	95
8.3.5	sketch type select .....	95
8.3.6	curves or area .....	96
8.4	Sketch entity definitions .....	96
8.4.1	implicit point on plane .....	96
8.4.2	implicit planar intersection point .....	98
8.4.3	implicit planar projection point .....	98
8.4.4	implicit planar curve .....	99
8.4.5	implicit intersection curve .....	100
8.4.6	implicit projected curve .....	100
8.4.7	implicit model intersection curve .....	101
8.4.8	implicit silhouette curve .....	101
8.4.9	neutral sketch representation .....	102
8.4.10	positioned sketch .....	103
8.4.11	repositioned neutral sketch .....	105
8.4.12	implicit explicit positioned sketch relationship .....	106
8.4.13	subsketch .....	107
8.4.14	rigid subsketch .....	108
8.5	Sketch function definitions .....	108
8.5.1	get relative direction 2points .....	108
8.5.2	check curve planarity .....	109
8.5.3	get plane of implicit geometry .....	110
<b>Annex A (normative) Short names of entities .....</b>		<b>113</b>
<b>Annex B (normative) Information object registration .....</b>		<b>115</b>
B.1	Document identification .....	115
B.2	Schema identification .....	115
B.2.1	parameterization schema identification .....	115
B.2.2	explicit constraint schema identification .....	115
B.2.3	variational representation schema identification .....	115
B.2.4	explicit geometric constraint schema identification .....	116
B.2.5	sketch schema identification .....	116
<b>Annex C (informative) Computer interpretable listings .....</b>		<b>117</b>
<b>Annex D (informative) EXPRESS-G diagrams .....</b>		<b>118</b>
<b>Annex E (informative) Technical discussions .....</b>		<b>137</b>
E.1	Role of parameterization and constraints in procedural and hybrid representations .....	137
E.2.1	Non-binary constraints .....	139
E.2.2	The modelling of variational representations .....	140
E.3	Application-related sketches with specific geometric forms .....	141
<b>Annex F (informative) Examples .....</b>		<b>142</b>
eters with attributes of entity instances .....		142

F.1.1	Example 1 .....	142
F.1.2	Example 2 .....	144
F.2	Example of a two-dimensional sketch .....	147
Bibliography .....		151
Index .....		152
Figures box) and other resource schemas .....		xi
Figure 3 Embedding of a current result representation in a variational representation .....		45
Figure D.1 EXPRESS-G diagram of the parameterization schema (1 of 2) .....		119
Figure D.2 EXPRESS-G diagram of the parameterization schema (2 of 2) .....		120
Figure D.3 EXPRESS-G diagram of the explicit constraint schema (1 of 1) .....		121
Figure D.4 EXPRESS-G diagram of the variational representation schema (1 of 1) .....		122
Figure D.5 EXPRESS-G diagram of the explicit geometric constraint schema (1 of 10) .....		123
Figure D.6 EXPRESS-G diagram of the explicit geometric constraint schema (2 of 10) .....		124
Figure D.7 EXPRESS-G diagram of the explicit geometric constraint schema (3 of 10) .....		125
Figure D.8 EXPRESS-G diagram of the explicit geometric constraint schema (4 of 10) .....		126
Figure D.9 EXPRESS-G diagram of the explicit geometric constraint schema (5 of 10) .....		127
Figure D.10 EXPRESS-G diagram of the explicit geometric constraint schema (6 of 10) .....		128
Figure D.11 EXPRESS-G diagram of the explicit geometric constraint schema (7 of 10) .....		129
Figure D.12 EXPRESS-G diagram of the explicit geometric constraint schema (8 of 10) .....		130
Figure D.13 EXPRESS-G diagram of the explicit geometric constraint schema (9 of 10) .....		131
Figure D.14 EXPRESS-G diagram of the explicit geometric constraint schema (10 of 10) .....		132
Figure D.15 EXPRESS-G diagram of the sketch schema (1 of 4) .....		133
Figure D.16 EXPRESS-G diagram of the sketch schema (2 of 4) .....		134
Figure D.17 EXPRESS-G diagram of the sketch schema (3 of 4) .....		135
Figure D.18 EXPRESS-G diagram of the sketch schema (4 of 4) .....		136
13548	generic expressions schema .....	146
Figure F.2 A simple sketch composed of line segments and circular arcs .....		147
Tables A.1 Short names of entities .....		113