

ISO 10303-28:2007-10 (E)

Industrial automation systems and integration — Product data representation and exchange — Part 28: Implementation methods: XML representations of EXPRESS schemas and data, using XML schemas

| Contents | Page |
|---|------|
| 1 Scope..... | 1 |
| 2 Normative references..... | 1 |
| 3 Terms, definitions, abbreviations, and conventions | 2 |
| 3.1 Terms defined in ISO 10303-1..... | 2 |
| 3.2 Terms defined in ISO 10303-11..... | 2 |
| 3.3 Terms defined in the XML Standards..... | 4 |
| 3.4 Other terms and definitions..... | 5 |
| 3.5 Conflicting terminology..... | 7 |
| 3.6 Abbreviations..... | 7 |
| 3.7 Conventions | 7 |
| 3.7.1 Text conventions..... | 8 |
| 3.7.2 Namespace conventions..... | 8 |
| 4 Conformance..... | 8 |
| 4.1 Conformance of an XML document | 9 |
| 4.1.1 Conformance of an iso-10303-28 document..... | 9 |
| 4.1.2 Conformance of a uos document..... | 10 |
| 4.1.3 Conformance of a configured document | 10 |
| 4.2 Conformance of a derived XML schema document | 10 |
| 4.3 Conformance of a configuration file..... | 11 |
| 4.4 Conformance of a pre-processor | 11 |
| 4.5 Conformance of a post-processor..... | 12 |
| 4.6 Conformance of an XML schema generator..... | 12 |
| 5 Document level elements..... | 12 |
| 5.1 The iso-10303-28 document | 13 |
| 5.2 Document and uos header information | 14 |
| 5.2.1 The exp:header element..... | 14 |
| 5.2.2 The name element..... | 15 |
| 5.2.3 The time_stamp element..... | 15 |
| 5.2.4 The author element | 15 |
| 5.2.5 The organization element..... | 15 |
| 5.2.6 The authorization element | 15 |
| 5.2.7 The originating_system element..... | 15 |
| 5.2.8 The preprocessor_version element | 15 |
| 5.3 The schema_population element..... | 15 |
| 5.4 The express element..... | 17 |
| 5.4.1 By-reference representation of an EXPRESS schema..... | 18 |
| 5.4.2 By-value representation of an EXPRESS schema..... | 18 |
| 5.5 The configuration element..... | 18 |
| 5.6 The unit of serialization element..... | 18 |
| 5.7 The uos document | 20 |
| 5.8 The configured document | 20 |
| 5.9 Enterprise data objects | 20 |
| 6 Derived XML Schema..... | 20 |
| 6.1 Preconditions..... | 21 |
| 6.2 Unmapped EXPRESS concepts..... | 21 |
| 6.3 Abstract entity data types..... | 21 |

| | | |
|-------|--|-----|
| 7 | Default XML Schema Binding | 22 |
| 7.1 | Naming conventions | 22 |
| 7.1.1 | Schema | 22 |
| 7.1.2 | EXPRESS identifiers | 22 |
| 7.1.3 | Data types | 22 |
| 7.2 | XML Schema data types corresponding to EXPRESS data types | 22 |
| 7.2.1 | EXPRESS simple data types | 23 |
| 7.2.2 | Aggregation data types | 30 |
| 7.2.3 | Constructed data types | 44 |
| 7.2.4 | Defined data types | 45 |
| 7.2.5 | ENTITY data types | 45 |
| 7.3 | XML Schema definitions and declarations for EXPRESS defined data types | 45 |
| 7.3.1 | Simple underlying types | 46 |
| 7.3.2 | Aggregate underlying types | 47 |
| 7.3.3 | ENUMERATION underlying types | 48 |
| 7.3.4 | SELECT underlying types | 49 |
| 7.3.5 | Defined data type underlying type | 53 |
| 7.4 | Instance elements corresponding to EXPRESS data types | 54 |
| 7.4.1 | Instance elements for simple data types | 55 |
| 7.4.2 | Instance elements for anonymous aggregation data types | 59 |
| 7.4.3 | Instance elements for defined data types | 62 |
| 7.4.4 | Instance elements for entity data types | 63 |
| 7.4.5 | Instance element attributes | 63 |
| 7.4.6 | Referenceable instances | 64 |
| 7.5 | XML Schema definitions and declarations for EXPRESS entity data types | 64 |
| 7.5.1 | Type graph associated with the EXPRESS entity data type | 65 |
| 7.5.2 | Complex entity instances | 66 |
| 7.5.3 | Base XML data types and elements for EXPRESS entity data types | 66 |
| 7.5.4 | XML data type definitions for entity data types | 69 |
| 7.5.5 | Instance elements corresponding to entity data types | 71 |
| 7.5.6 | XML groups corresponding to entity data types | 72 |
| 7.5.7 | Single entity value elements corresponding to entity data types | 75 |
| 7.5.8 | Proxy elements corresponding to entity data types | 77 |
| 7.5.9 | XML Uniqueness constraints for entity data types | 78 |
| 7.6 | XML Schema declarations for EXPRESS attributes | 79 |
| 7.6.1 | Accessor element and attribute naming | 79 |
| 7.6.2 | EXPRESS attributes mapped to XML schema | 80 |
| 7.6.3 | Accessor elements | 81 |
| 7.7 | XML Schema and namespaces for EXPRESS Schema | 86 |
| 7.7.1 | Namespace prefixes | 86 |
| 7.7.2 | URI for the target namespace of the derived XML schema | 87 |
| 7.7.3 | Namespace declarations for the derived XML schema | 88 |
| 7.7.4 | Import declarations for the derived XML schema | 88 |
| 7.8 | Context-schema specific unit of serialization | 89 |
| 8 | Configured XML Schema Binding | 91 |
| 8.1 | Naming conventions | 91 |
| 8.1.1 | Schema | 91 |
| 8.1.2 | EXPRESS identifiers | 91 |
| 8.1.3 | Data types | 91 |
| 8.2 | XML Schema data types corresponding to EXPRESS data types | 92 |
| 8.2.1 | EXPRESS simple data types | 92 |
| 8.2.2 | Aggregation data types | 97 |
| 8.2.3 | Constructed data types | 108 |
| 8.2.4 | Defined data types | 108 |

| | | |
|--------|--|-----|
| 8.2.5 | ENTITY data types..... | 108 |
| 8.3 | XML Schema definitions and declarations for EXPRESS defined data types | 108 |
| 8.3.1 | Simple underlying types | 109 |
| 8.3.2 | Aggregate underlying types..... | 111 |
| 8.3.3 | ENUMERATION underlying types | 112 |
| 8.3.4 | SELECT underlying types..... | 112 |
| 8.3.5 | Defined data type underlying type..... | 115 |
| 8.3.6 | Defined data types mapped by map configuration directive..... | 116 |
| 8.4 | Instance elements corresponding to EXPRESS data types | 116 |
| 8.4.1 | Instance elements for simple data types..... | 117 |
| 8.4.2 | Instance elements for anonymous aggregation data types | 120 |
| 8.4.3 | Instance elements for defined data types | 124 |
| 8.4.4 | Instance elements for entity data types | 124 |
| 8.4.5 | Instance element attributes..... | 124 |
| 8.4.6 | XML identity-constraints for instance elements..... | 125 |
| 8.4.7 | Referenceable instances | 128 |
| 8.5 | XML Schema definitions and declarations for EXPRESS entity data types | 129 |
| 8.5.1 | Type graph associated with the EXPRESS entity data type | 131 |
| 8.5.2 | Complex entity instances..... | 131 |
| 8.5.3 | Base XML data types and elements for EXPRESS entity data types..... | 132 |
| 8.5.4 | XML data type definitions for entity data types | 134 |
| 8.5.5 | Instance elements corresponding to entity data types..... | 146 |
| 8.5.6 | XML groups corresponding to entity data types..... | 147 |
| 8.5.7 | Single entity value elements corresponding to entity data types | 149 |
| 8.5.8 | Proxy elements corresponding to entity data types..... | 150 |
| 8.5.9 | XML Identity constraints corresponding to entity data types..... | 151 |
| 8.5.10 | XML Uniqueness constraints for entity data types..... | 154 |
| 8.5.11 | Dynamic subtype elements corresponding to entity data types | 155 |
| 8.6 | XML Schema declarations for EXPRESS attributes | 156 |
| 8.6.1 | Accessor element and attribute naming | 157 |
| 8.6.2 | EXPRESS attributes mapped to XML schema..... | 157 |
| 8.6.3 | Accessor attributes..... | 159 |
| 8.6.4 | Accessor elements | 163 |
| 8.6.5 | Type-tagged attributes | 170 |
| 8.6.6 | No-tag attributes | 173 |
| 8.7 | XML Schema and namespaces for EXPRESS Schema..... | 174 |
| 8.7.1 | Namespace prefixes..... | 175 |
| 8.7.2 | URI for the target namespace of the derived XML schema | 175 |
| 8.7.3 | Namespace declarations for the derived XML schema | 175 |
| 8.7.4 | Import declarations for the derived XML schema..... | 175 |
| 8.8 | Context-schema specific unit of serialization | 176 |
| 9 | XML document creation..... | 177 |
| 9.1 | Preconditions..... | 177 |
| 9.2 | General XML document structure | 177 |
| 9.2.1 | Structure of an iso-10303-28 document..... | 178 |
| 9.2.2 | Structure of a uos document | 178 |
| 9.2.3 | Encoding of EXPRESS schemas | 179 |
| 9.2.4 | Encoding of configuration files | 179 |
| 9.2.5 | Encoding of population definitions..... | 180 |
| 9.2.6 | Encoding of data sets – the unit of serialization | 180 |
| 9.3 | Representation of EXPRESS entity instances..... | 183 |
| 9.3.1 | By-value representation of entity instances | 184 |
| 9.3.2 | External representation of EXPRESS entity instances | 187 |
| 9.3.3 | By-reference representation of EXPRESS entity instances..... | 189 |

| | | |
|---------|--|-----|
| 9.3.4 | Complex entity representation of EXPRESS entity instances | 190 |
| 9.4 | Representation of an EXPRESS attribute | 192 |
| 9.4.1 | Determining by-reference or by-value representation | 192 |
| 9.4.2 | Representation of EXPRESS attribute value as accessor attribute | 193 |
| 9.4.3 | Attribute-tag representation of EXPRESS attribute value | 194 |
| 9.4.4 | Double-tag representation of EXPRESS attribute value | 196 |
| 9.4.5 | Type tag representation of EXPRESS attribute value | 197 |
| 9.4.6 | No-tag representation of entity instance as EXPRESS attribute value | 198 |
| 9.4.7 | No-tag-simple representation of entity instance as EXPRESS attribute value | 198 |
| 9.5 | Representation of simple values | 198 |
| 9.5.1 | Representation of BINARY values | 199 |
| 9.5.2 | Representation of BOOLEAN values | 199 |
| 9.5.3 | Representation of INTEGER values | 199 |
| 9.5.4 | Representation of LOGICAL values | 200 |
| 9.5.5 | Representation of NUMBER values | 201 |
| 9.5.6 | Representation of REAL values | 201 |
| 9.5.7 | Representation of STRING values | 202 |
| 9.6 | Representation of enumeration items | 203 |
| 9.7 | Representation of values of SELECT types | 204 |
| 9.8 | Representation of aggregate values | 206 |
| 9.8.1 | List-of-values representation of aggregate values | 207 |
| 9.8.2 | Sequence-of-elements representation of aggregate values | 209 |
| 9.8.3 | Indexed representation of aggregate values | 210 |
| 9.8.4 | List-of-references representation of aggregate values | 211 |
| 9.8.5 | Aggregates of aggregate values | 212 |
| 9.8.6 | Aggregates of values of defined data types | 219 |
| 9.8.7 | Instance elements for component values | 219 |
| 9.9 | Representation of values of defined data types | 220 |
| 9.10 | Representation of values in instance elements | 221 |
| 9.10.1 | By-value instance elements for non-entity data types | 222 |
| 9.10.2 | By-reference instance elements for non-entity data types | 223 |
| 10 | Configuration Language | 223 |
| 10.1 | The configuration element | 225 |
| 10.1.1 | By-reference representation of a configuration file | 226 |
| 10.1.2 | By-value representation of a configuration file | 226 |
| 10.2 | Configuration options | 226 |
| 10.2.1 | name | 227 |
| 10.2.2 | exp-type | 227 |
| 10.2.3 | content | 227 |
| 10.2.4 | aggregate-content | 228 |
| 10.2.5 | exp-attribute | 228 |
| 10.2.6 | entity-attribute | 229 |
| 10.2.7 | concrete-attribute | 229 |
| 10.2.8 | tagless | 229 |
| 10.2.9 | flatten | 230 |
| 10.2.10 | use-id | 230 |
| 10.2.11 | keep | 231 |
| 10.2.12 | keep-all | 231 |
| 10.2.13 | map | 232 |
| 10.2.14 | naming-convention | 234 |
| 10.2.15 | inheritance | 234 |
| 10.2.16 | notation | 234 |
| 10.2.17 | tag-source and tag-value | 234 |
| 10.2.18 | namespace | 235 |

| | | |
|---|--|-----|
| 10.2.19 | ref..... | 236 |
| 10.2.20 | use..... | 236 |
| 10.2.21 | implementation..... | 236 |
| 10.2.22 | facet..... | 237 |
| 10.2.23 | generate-keys..... | 237 |
| 10.2.24 | embed-schema-items..... | 238 |
| 10.2.25 | alias and prefix..... | 238 |
| 10.2.26 | select..... | 238 |
| 10.3 | Scoping elements..... | 239 |
| 10.3.1 | Option element..... | 240 |
| 10.3.2 | Type element..... | 240 |
| 10.3.3 | Entity element..... | 241 |
| 10.3.4 | Attribute element..... | 246 |
| 10.3.5 | Inverse element..... | 248 |
| 10.3.6 | Aggregate element..... | 250 |
| 10.3.7 | Schema element..... | 251 |
| 10.3.8 | UosElement element..... | 255 |
| 10.3.9 | UosEntity element..... | 255 |
| 10.3.10 | RootEntity element..... | 255 |
| 10.4 | Configuration attributes..... | 256 |
| 10.5 | Applicability of configuration directives..... | 257 |
| 10.5.1 | exp-attribute..... | 257 |
| 10.5.2 | content and use-id..... | 259 |
| 10.5.3 | exp-type..... | 260 |
| 10.5.4 | map..... | 260 |
| 10.5.5 | tagless..... | 261 |
| 10.5.6 | flatten..... | 261 |
| 10.5.7 | inheritance..... | 262 |
| 10.5.8 | notation..... | 262 |
| 10.5.9 | keep..... | 262 |
| 10.5.10 | ref..... | 262 |
| 10.5.11 | use..... | 262 |
| 10.5.12 | implementation..... | 263 |
| 10.5.13 | facet..... | 263 |
| Annex A (normative) Universal Resource Names for bindings of EXPRESS schemas..... | | 264 |
| Annex B (normative) XML Schema for the configuration language..... | | 265 |
| Annex C (normative) Base XML Schema..... | | 272 |
| Annex D (normative) Document Schema..... | | 280 |
| Annex E (normative) Valid populations of EXPRESS entity instances..... | | 291 |
| Annex F (normative) Information object registration..... | | 302 |
| Annex G (informative) Configuration language examples..... | | 303 |
| Bibliography..... | | 307 |
| Index..... | | 308 |

Figures

| | | |
|------------|--|-----|
| Figure 1 - | Choice group..... | 73 |
| Figure 2 - | Choice group for inheritance mapping | 148 |

Tables

| | | |
|---------|---|-----|
| Table 1 | — Namespace prefixes..... | 8 |
| Table 2 | — Subclause governing aggregation data type correspondence | 30 |
| Table 3 | — Subclause governing aggregation data type correspondence | 99 |
| Table 4 | — Instance elements for <code>STRING</code> data types mapped to XML data types..... | 120 |
| Table 5 | — XML key names for anonymous <code>EXPRESS</code> data types..... | 127 |
| Table 6 | — Representation of <code>EXPRESS</code> characters invalid in XML <code>normalizedString</code> | 203 |
| Table 7 | — Subclause governing XML representation of aggregate value | 207 |
| Table 8 | — Subclause governing XML representation of aggregates of aggregate values . | 213 |
| Table 9 | — Pattern strings for select | 239 |