SEMI E125-0310
SPECIFICATION FOR EQUIPMENT SELF DESCRIPTION (EqSD)

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1 Purpose

1.1 This specification describes a method for allowing equipment suppliers to provide a description of the variables, events, exceptions, and physical equipment configuration available from their equipment. With this information available for consumption by software systems, it can be used as a tool to aid the process of integrating equipment into a factory's automation system.

2 Scope

2.1 *In-scope*

2.1.1 This document specifies the classes that suppliers are to use to describe essential data, events, and exceptions provided by their equipment. The specification only describes information that is static in nature (i.e., information that does not change dynamically while the equipment is running). This document also specifies an interface that clients can use to access this information.

2.1.2 This specification applies to all semiconductor manufacturing equipment that supports the data acquisition interface defined in the SEMI specification for Data Collection Management.

2.2 *Out of Scope*

2.2.1 This specification does not define any new behavior required of the equipment other than that necessary for retrieving information describing equipment configuration, interfaces, and available data, and keeping this information current.

2.2.2 The details of any underlying concepts and behavioral models (e.g., carrier management, process/control job, etc.) that can be described by metadata are to be separately specified in a document dedicated to those concepts. Only the ability to describe the fact that a supplier has implemented such a concept and that a client can discover this implementation and any data it can produce is in scope for this specification.

2.2.3 This specification does not require that the metadata provided by the equipment be directly human readable. It is expected that applications will be written to organize and present this information to human users in a form that is easier for end users to digest.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 *Abstract Model*

3.1.1 This specification is an abstract model only. Adjunct specifications must be developed to bind this specification to an implementation technology.

3.2 *Other Limitations*

3.2.1 This specification does not define the mechanism used for determining how to locate clients that are to receive notifications defined by this specification. It assumes that the equipment has established a communications context with any clients that can submit requests, and has provided any context necessary to send notifications to those clients.

3.2.2 This specification does not define the mechanism used for identifying or authenticating clients. It assumes that clients can be uniquely identified, and that the equipment is capable of distinguishing requests originating from different clients.

4 Referenced Standards and Documents

4.1 *SEMI Standards*

SEMI E30 — Generic Model for Communications and Control of Manufacturing Equipment (GEM)

SEMI E39 — Object Services Standard: Concept, Behavior, and Services

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SEMI E120 — Specification for the Common Equipment Model (CEM)

4.2 *ISO Standards*[1]

ISO 639:1988 — Code for the Representation of Names of Languages

ISO 3166-1:1997 — Codes for the Representation of Names of Countries and their Subdivisions – Part 1: Country Codes

ISO 8601 — Data Elements and Interchange Formats – Information Interchange – Representations of Dates and Times

4.3 *OMG Standards*[2]

OMG 01-09-67 — Unified Modeling Language, v1.4

4.4 *Other Standards*

American National Standards Institute (ANSI) X3.135-1992 — Information Systems – Database Language – SQL; http://www.ansi.org[3]

Internet Engineering Task Force (IETF) RFC 1776 – Tags for the Identification of Languages, ed. H. Alvestrand. 1995; http://www.ietf.org/rfc/rfc1766.txt

Uniform Resource Name (URN) Syntax, IETF RFC 2141, May 1997; http://www.ietf.org/rfc/rfc2141.txt

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 Descriptions of many of the abbreviations and acronyms used in this specification may be found in the SEMI Compilation of Terms, available on the SEMI Web site, http://www.semi.org/. In most cases, these terms are not included in this section.

5.1.2 *IDL* — Interface Definition Language

5.1.3 *OMG* — Object Management Group

5.1.4 *SQL* — Standard Query Language

5.1.5 *UML* — Unified Modeling Language

5.1.6 *URN* — Uniform Resource Name

5.1.7 *XML* — eXtensible Markup Language

5.2 *Definitions*

5.2.1 Definitions or descriptions of many of the terms used in this specification may be found in the SEMI Compilation of Terms, available on the SEMI Web site, http://www.semi.org/. In most cases, these terms are not included in this section.

5.2.2 § R8-1 contains useful definitions of UML terms taken directly from the UML standard. UML terms used in this document conform to these definitions. Please refer to this section as needed.

5.2.3 *metadata* — data used to describe data. For example, if a tool can report an event with several associated variables under certain conditions, the metadata for that event would provide a description of what condition will produce the event, what the type and units are of each variable, and the id of the event itself.

1 International Organization for Standardization, ISO Central Secretariat, 1 rue de Varembé, Case postale 56, CH-1211 Geneva 20, Switzerland. Telephone: 41.22.749.01.11; Fax: 41.22.733.34.30; http://www.iso.ch

2 Object Management Group, Inc., 250 First Ave. Suite 100, Needham MA 02494, USA. Telephone: 781.444.0404; Fax: 781.444.0320; http://www.omg.org/

3 American National Standards Institute, Headquarters: 1819 L Street, NW, Washington, DC 20036, USA. Telephone: 202.293.8020; Fax: 202.293.9287. New York Office: 11 West 42nd Street, New York, NY 10036, USA. Telephone: 212.642.4900; Fax: 212.398.0023; http://www.ansi.org

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6 Conventions

6.1 *Document and Notation Conventions*

6.1.1 *Unified Modeling Language (UML)* — This specification uses the UML conventions for representing all class, state, object, and sequence diagrams. Refer to the UML specification for a detailed description of these conventions.

6.1.2 *Attribute Tables* — The table below provides an example of the tables used to list and describe attributes of classes defined in this specification.

Table 1 Attribute Table Format

Attribute Name	*Definition*	*Required*	*Form*
		Y or N	See list below

6.1.2.1 *Form* — Defines the data type of the attribute. The terms used to describe data types in this column are defined in the SEMI Compilation of Terms, or are included as part of the specification. Refer to the compilation of terms for the definition of SEMI type name meanings.

6.1.3 *UML Associations* — The mechanism used for representing UML associations between classes is implementation dependent. This document is abstract in nature, and does not specify or imply any such mechanism. Any adjunct standard that provides an implementation of this specification must include a description of the mechanism used for representing the UML associations shown in this document.

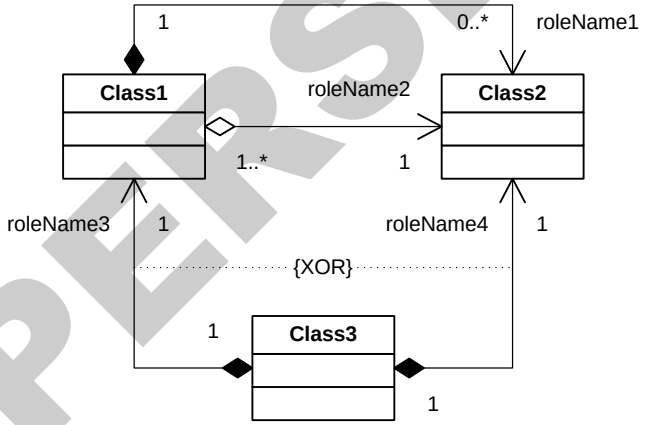

Figure 1
Association Notation

6.1.3.1 *Association Notation* — This document uses the UML aggregation diamond adornment, role names, end multiplicities, and navigability in all class diagrams specifying associations. Unadorned associations are not used, for economy of notation. See the UML 1.4 specification, § 4.3 for details. All role names are public by default; therefore the visibility symbols are not used.

6.1.3.1.1 Open diamond adornments indicate that instances of the target class may be shared among aggregate classes. Closed diamond adornments indicate that target instances belong to at most one composite class. The part-whole semantics of the aggregation/composition symbol is not significant in this specification. See the UML 1.4 specification, § 4.3 for further information.

6.1.3.1.2 Some diagrams use the UML "XOR" constraint where applicable. An "XOR" constraint indicates that only one of many possible associations can be instantiated at any one time for a given instance of the association class. See the UML 1.4 specification, § 4.3 for further information.

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6.1.4 *Association Tables* — The table below provides an example of the tables used to list and describe associations between classes defined in this specification.

Table 2 Association Table Format

Association Role Name	*Definition*	*Comments*

6.1.4.1 *Association Role Name* — The name of the association role being specified.

6.1.4.2 *Definition* — Describes the function or purpose of the association.

6.1.4.3 *Comments* — Any additional comments or notes regarding the association.

6.1.5 *Operation Definition Tables* — The table below provides an example of the tables used to list and describe the interface operations defined in this specification.

Table 3 Operation Definition

Operation	*Description*	*Type*
		See list below

6.1.5.1 *Operation* — Specifies the name of the operation.

6.1.5.2 *Type* — Specifies the messaging semantics of the operation. Only Request-Reply (RR) semantics are used in this specification. Request-Reply messages are messages that involve an initiator and a receiver. In a Request-Reply exchange, the initiator sends a single request message to the receiver, and the receiver sends a single reply message to that request back to the initiator. Fire-and-Forget messages are messages that involve a sender and a receiver. In a Fire-and-Forget exchange, the sender sends a single message to the receiver, with no associated response.

6.1.6 *Operation Argument Definition Table* — The table below provides an example of the tables used to list and describe arguments for interface operations defined in this specification.

Table 4 Operation Argument Definitions

Argument	*Description*	*Kind*	*Form*
		See list below	See list below

6.1.6.1 *Argument* — Specifies the name of the argument.

6.1.6.2 *Kind* — Specifies whether the argument is an ‘in’, ‘out’, or ‘error’ argument for the operation. ‘Error’ arguments always function as ‘out’ arguments, but indicate that the operation did not complete successfully.

6.1.6.3 *Form* — Defines the data type of the argument. The terms used to describe data types in this column are defined in the SEMI Compilation of Terms, or are included as part of the specification. Refer to the compilation of terms for the definition of SEMI type name meanings.

6.2 *Terms*

6.2.1 *Class, type* — This specification uses the terms “class” and “type”, interchangeably to refer to a UML class.

7 Background

7.1 *Motivation*

7.1.1 This specification is designed to help address the problem of integrating semiconductor equipment from a variety of suppliers into an automated factory environment, and to provide a standard mechanism for describing

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information and data that the equipment can provide for a wide variety of uses. See ¶ R1-3.1 for an overview of some example use cases.

7.1.2 This specification defines the information that is needed to communicate essential features of the equipment to software applications, and provides extensibility features to allow suppliers to communicate information unique to their equipment or that may not be specified in a SEMI Standard.

7.1.3 Equipment metadata is designed to be useful to applications that provide an interface to human end users for the purposes of understanding and browsing equipment configuration, available data items, events, exceptions, etc. In many cases, these users will be referring to equipment metadata so they can perform data collection for a variety of objectives (diagnostics, troubleshooting, process control, etc.).

7.1.4 Equipment metadata is also designed to be useful to applications written to take advantage of standardized state models and other data so that discovery and usage of this information can be automated, without requiring human intervention. Diagnostics, health monitoring, or other supplier-provided applications that understand the details of specific equipment types, for example, can also discover and use common equipment-specific configuration and data without requiring manual assistance.

8 Overview

8.1 *Equipment Metadata Organization*

8.1.1 Figure 2 shows the concepts that are included in this specification and their relationship to the SEMI E120 Common Equipment Model. A brief description of the purpose of each metadata concept is provided in this section only as an overview. For the detailed specification of the corresponding classes, refer to § 10.

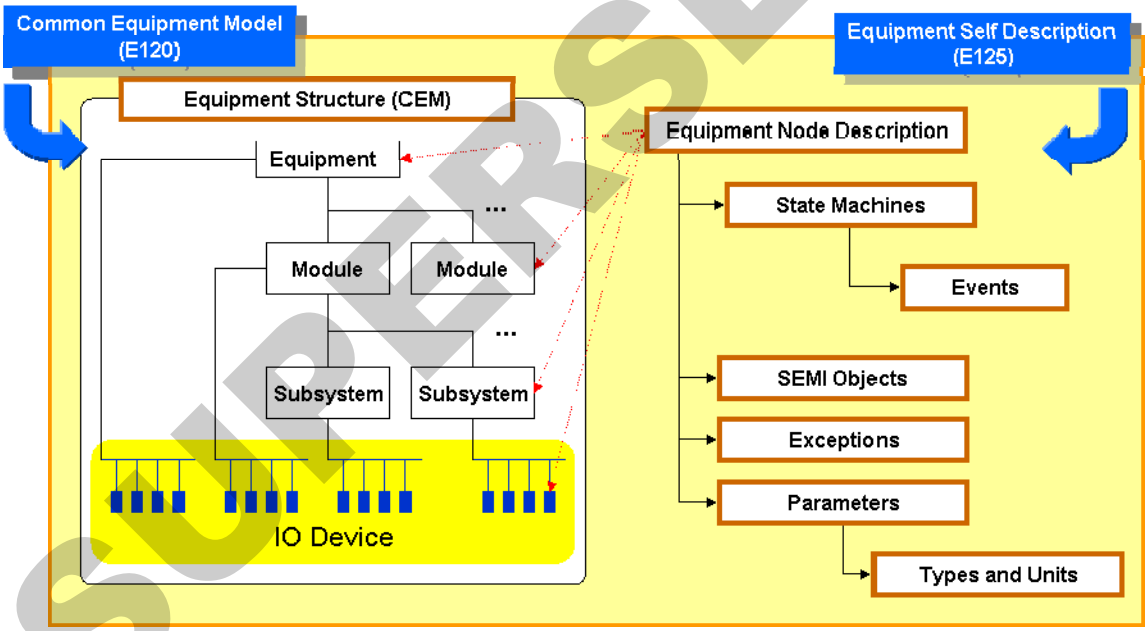

Figure 2
Organization of Metadata Concept

8.1.2 *Equipment Node Description*

8.1.2.1 This specification defines classes that provide a way to associate events, exceptions, parameters, and SEMI E39 ObjTypes with any node in the equipment hierarchy. SEMI E120 defines the classes that are used to describe the physical equipment structure and related elements; this specification defines the classes that link SEMI E120 equipment nodes (that is, any derivative of the SEMI E120 Nameable class) with the events, exceptions, parameters, and ObjTypes that they produce. Equipment node description classes are defined in § 10.3.

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8.1.3 *Parameters*

8.1.3.1 This specification defines classes that can be used to describe any variables that are provided by the equipment, and refers to all such variables as "Parameters". Parameters can be used to model any concept that can be represented as a data type. For example, the SEMI E30 concepts of equipment constants, data variables, and status variables can all be represented by a parameter. Any type of data that the equipment can produce (e.g., measurement results on metrology equipment) can be represented by a Parameter. Parameters can only be defined by an equipment node, an SEMI E39 ObjType, or an exception. Parameter description is defined in § 10.4.

8.1.4 *State Machine and Events*

8.1.4.1 This specification defines classes that can be used to describe the state machines (and the corresponding transitions and events) that are implemented by the equipment. These classes can be used to describe any SEMI-defined state machine or any supplier-defined state machine. This specification also defines classes that can be used to describe the Parameters that are available for reporting when a specific event occurs. State machine description is defined in § 10.6.

8.1.5 *SEMI Objects*

8.1.5.1 This specification defines classes that can be used to describe any SEMI E39 ObjTypes that are implemented by the equipment. SEMI ObjType state machines and events are described using the same classes that are used to describe state machines. ObjType attributes are described using the same classes that are used to describe Parameters and types. Description of ObjType services is not supported. SEMI ObjType description is defined in § 10.6.

8.1.6 *Exceptions*

8.1.6.1 This specification defines classes that can be used to describe the existence of error conditions that the equipment can detect and report as exceptions. An exception can represent any SEMI E30 alarm or equipment-supplier-defined exception that can be reported to clients. Exception description is defined in § 10.5.

8.2 *Accessing Equipment Metadata*

8.2.1 Equipment metadata is directly associated with each unique equipment installation within a factory. Access to metadata is provided by a collection of operations available from a specific equipment installation. This interface is described in § 9.1.

9 Interfaces for Managing Equipment Metadata

9.1 *Equipment Metadata Manager*

9.1.1 Figure 3 shows the interface used to access equipment metadata descriptions.

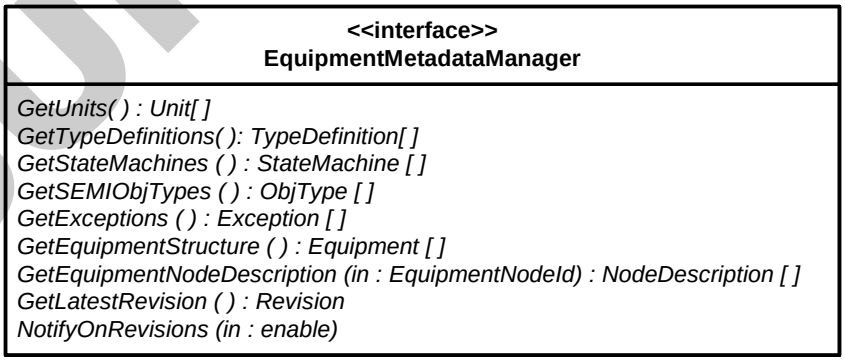

Figure 3
Interface for Accessing Equipment Metadata

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9.1.2 *EquipmentMetadataManager Operations*

Table 5 EquipmentMetadataManager Operation Definition

Operation	*Description*	*Type*
GetUnits	Retrieves all unit metadata provided by the equipment.	RR
GetTypeDefinitions	Retrieves all type definitions provided by the equipment.	RR
GetStateMachines	Retrieves all state machine metadata provided by the equipment.	RR
GetSEMIObjTypes	Retrieves all SEMI ObjTypes metadata provided by the equipment.	RR
GetExceptions	Retrieves all exception metadata provided by the equipment.	RR
GetEquipmentStructure	Retrieves all equipment structural metadata provided by the equipment.	RR
GetEquipmentNodeDescriptions	Retrieves all requested equipment node description metadata.	RR
GetLatestRevision	Retrieve the last date and time at which the equipment metadata was revised.	RR
NotifyOnRevisions	Request that the equipment notify the requestor when changes to the metadata are made.	RR

9.1.2.1 *GetUnits* — Upon receiving this request, the equipment shall return all units metadata provided by the equipment.

9.1.2.1.1 *GetUnits Operation Arguments*

Table 6 GetUnits Argument Definitions

Argument	*Description*	*Kind*	*Form*
units	All units defined for the equipment.	out	Unordered list of elements of type Unit, described in § 10.4.8

9.1.2.2 *GetTypeDefinitions* — Upon receiving this request, the equipment shall return all type definition metadata provided by the equipment.

9.1.2.2.1 *GetTypeDefinitions Operation Arguments*

Table 7 GetTypeDefinitions Argument Definitions

Argument	*Description*	*Kind*	*Form*
typeDefinitions	All type definitions provided by the equipment.	out	Unordered list of elements of type ParameterTypeDefinition, described in SEMI E138.

9.1.2.3 *GetStateMachines* — Upon receiving this request, the equipment shall return all state machine metadata provided by the equipment.

9.1.2.3.1 *GetStateMachines Operation Arguments*

Table 8 GetStateMachines Argument Definitions

Argument	*Description*	*Kind*	*Form*
stateMachines	All state machine metadata provided by the equipment.	out	Unordered list of elements of type StateMachine, described in § 10.6.

9.1.2.4 *GetSEMIObjTypes* — Upon receiving this request, the equipment shall return all OSS ObjType metadata provided by the equipment.

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9.1.2.4.1 *GetSEMIObjTypes Operation Arguments*

Table 9 GetSEMIObjTypes Argument Definitions

Argument	*Description*	*Kind*	*Form*
objTypes	All SEMI ObjType metadata provided by the equipment.	out	Unordered list of elements of type SEMIObjType, described in ¶ 10.7.1.1. If no SEMI ObjTypes are provided, this list shall be empty.

9.1.2.5 *GetExceptions* — Upon receiving this request, the equipment shall return all exception metadata provided the equipment.

9.1.2.5.1 *GetExceptions Operation Arguments*

Table 10 GetExceptions Argument Definitions

Argument	*Description*	*Kind*	*Form*
exceptions	All exception metadata provided by the equipment.	out	Unordered list of elements of type Exception, described in § 10.5.

9.1.2.6 *GetEquipmentStructure* — Upon receiving this request, the equipment shall return all equipment structural metadata provided by the equipment.

9.1.2.6.1 *GetEquipmentStructure Operation Arguments*

Table 11 GetEquipmentStructure Argument Definitions

Argument	*Description*	*Kind*	*Form*
equipmentStructure	All equipment structural metadata provided by the equipment.	out	Structured data, of a type derived from the SEMI E120 type Link or EquipmentElement, that represents the equipment as a whole.

9.1.2.7 *GetEquipmentNodeDescriptions* — Upon receiving this request, the equipment shall return all requested equipment node description metadata defined for the equipment. If the request includes unrecognized equipment node identifiers, the equipment shall return only node descriptions for recognized identifiers. All unrecognized identifiers shall be returned with the response.

9.1.2.7.1 *GetEquipmentNodeDescriptions Operation Arguments*

Table 12 GetEquipmentNodeDescriptions Argument Definitions

Argument	*Description*	*Kind*	*Form*
equipmentNodeIds	The id's of the requested equipment node descriptions.	in	List of text, each entry equal to a valid SEMI E120 Locator value (see SEMI E120, Related Information 2). If an empty list is provided, the equipment shall return node descriptions for all equipment nodes.
equipmentNodeDescriptions	All equipment node description metadata.	out	Structured data of type NodeDescriptionResult.

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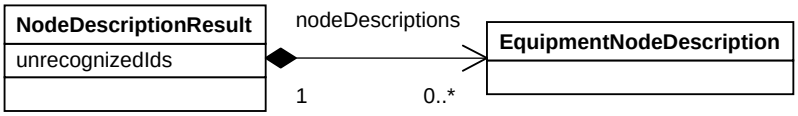

Figure 4
Interface for Accessing Equipment Metadata

9.1.2.8 *NodeDescriptionResult* — This class provides the list of requested EquipmentNodeDescription elements and any unrecognized equipment node id's that may have been provided with the request.

9.1.2.8.1 *NodeDescriptionResult Attribute Definition Table*

Table 13 NodeDescriptionResult Attribute Definition

Attribute Name	*Definition*	*Form*
unrecognizedIds	Any unrecognized equipment node identifiers provided in the original request.	List of text, each entry equal to an unrecognized equipment node identifier provided in the GetEquipmentNodeDescriptions request.

9.1.2.8.2 *NodeDescriptionResult Association Definition Table*

Table 14 NodeDescriptionResult Association Definition

Association Role Name	*Definition*	*Comments*
nodeDescriptions	The requested equipment node description metadata.	Zero or more elements of type EquipmentNodeDescription. The equipment shall return node description metadata for all recognized equipment node identifiers. If the same node identifier appears more than once in the request, the equipment shall return only one corresponding node description.

9.1.2.9 *GetLatestRevision* — Upon receiving this request, the equipment shall return the most recent date and time at which the metadata contents were changed. The equipment shall store the date and time of the most recent change in non-volatile memory. The equipment shall not generate false revision dates, in which there is no change in the available metadata, but the latest revision date/time is changed.

9.1.2.9.1 *GetLatestRevision Operation Arguments*

Table 15 GetLatestRevision Argument Definitions

Argument	*Description*	*Kind*	*Form*
revision	The most recent date and time at which the metadata was changed.	out	Text, formatted according to ISO 8601. Implementations may specify additional formatting restrictions within the ISO 8601 specification.

9.1.2.10 *NotifyOnRevisions* — Upon receiving this request, the equipment shall either enable or disable metadata revision notices to the requesting client, based on the operation arguments provided by the client. The equipment shall store the client's preference in non-volatile memory.

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9.1.2.10.1 *NotifyOnRevisions Operation Arguments*

Table 16 NotifyOnRevisions Argument Definitions

Argument	*Description*	*Kind*	*Form*
enable	Specifies the client's notification preference.	in	Boolean. If true, the client's preference is to be notified of metadata revisions. If false, the preference is to not be notified of metadata revisions.

9.1.2.10.2 Clients must invoke this operation with the 'enable' argument set to 'true' in order to receive notifications. The default behavior for revision notifications for a given client is disabled. The equipment shall automatically disable notification for a client if the equipment is in an enabled communications state and determines that the client is no longer accessible to receive such notifications. In this case, the client must invoke this operation in order to re-enable notifications.

9.1.2.10.3 If the 'enable' argument provided is 'true', the equipment shall begin notifying the client (if it is not already doing so) whenever a change in the metadata is detected, starting with the first detected change after the client invokes the operation. If the change is detected while the equipment is in a disabled communications state, the equipment shall notify the interested clients at the first opportunity when its communication status permits.

9.1.2.10.4 If the 'enable' argument provided is 'false', the equipment shall cease sending revision notifications to the client, if it is currently doing so. The equipment shall ignore duplicate enable/disable requests from the same client (see Limitations, § 3).

9.2 *Metadata Client*

9.2.1 Figure 5 shows the interface and argument data types that clients must support in order to receive metadata revision notifications.

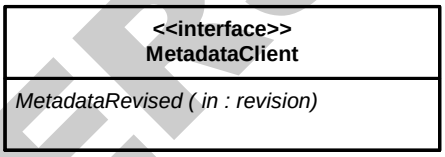

Figure 5
Metadata Client Interface

9.2.2 *MetadataClient Operations*

Table 17 MetadataClient Operation Definition

Operation	*Description*	*Type*
MetadataRevised	Notifies the client that the metadata has recently changed.	FF

9.2.2.1 *MetadataRevised* — The equipment shall send this notification whenever it detects a change in the metadata, if the client has requested to be notified through a prior invocation of the "NotifyOnRevisions" operation of the EquipmentMetadataManager interface.

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9.2.2.1.1 *MetadataRevised Operation Arguments*

Table 18 MetadataRevised Argument Definitions

Argument	*Description*	*Kind*	*Form*
revision	The date and time at which the metadata change was detected by the equipment.	in	Text, formatted according to ISO 8601. Implementations may specify additional formatting restrictions within the ISO 8601 specification.

10 Equipment Metadata

10.1 *Management of Equipment Metadata*

10.1.1 When equipment configuration changes result in a change to any information described using the classes in § 10 of this document or by the SEMI Common Equipment Model, the equipment shall update the metadata description accordingly at the time of the change. If clients have requested revision notification (see ¶ 9.1.2.9 and ¶ 9.1.2.10), the equipment shall notify each interested client at the time of the change, or at the first opportunity when its communication status permits. This includes reconfiguration of the equipment after its introduction into the factory. Ensuring that all aspects of equipment metadata are kept up-to-date and available to the factory is a critical aspect of maintaining equipment metadata.

10.2 *Equipment Structure*

10.2.1 The physical equipment structure shall be described according to the SEMI Common Equipment Model. Suppliers shall provide a model of those elements of their equipment for which it is necessary and practical to facilitate (at least) utilization tracking, process control, and technical support objectives.

10.3 *Equipment Nodes*

10.3.1 *Equipment Node Description*

10.3.1.1 Figure 6 shows how to describe the parameters, events, objTypes, and exceptions available from an element (or node) of the equipment hierarchy. Providing these descriptions indicates that the specified node acts as the source of all Events, Exceptions, ObjTypes, and Parameters that are included in the description. All Parameters, Exceptions, ObjTypes, and Events associated with a given equipment node are independent of the Events, Exceptions, ObjTypes, and Parameters associated with other equipment nodes.

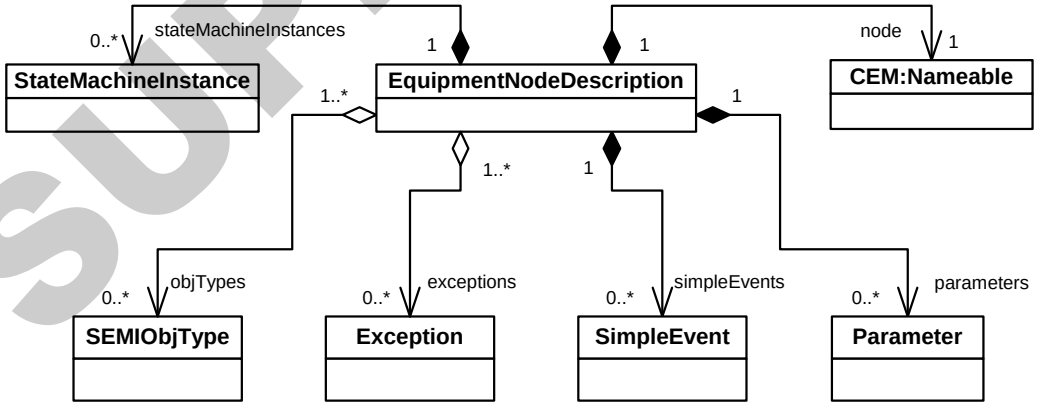

Figure 6
Describing Equipment Nodes

10.3.1.2 *EquipmentNodeDescription* — This class is used to identify a specific element of the equipment hierarchy, and to describe the StateMachineInstances, Parameters, Exceptions, ObjTypes, and SimpleEvents for which this node is the source. This is achieved through the StateMachineInstance (¶ 10.6.6), SEMIObjType (¶ 10.7.1.1),

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Exception (§ 10.5), Parameter (§ 10.4) and SimpleEvent (§ 10.8) classes. Only one EquipmentNodeDescription shall be provided for a given equipment node. Equipment elements may be any concrete class derived from Nameable, as defined in the SEMI E120 specification, Common Equipment Model.

10.3.1.3 *EquipmentNodeDescription Association Definition Table*

Table 19 EquipmentNodeDescription Association Definition

Association Role Name	*Definition*	*Comments*
stateMachineInstances	An unordered list of state machine instances that are supported by this equipment node.	List of elements of type StateMachineInstance, described in ¶ 10.6.6. There shall be one map provided for each event that the node can generate, including events for which no Parameters are available.
objTypes	An unordered list of the SEMIObjTypes that are associated with this equipment node.	List of elements of type SEMIObjType, describe in ¶ 10.7.1.1.
exceptions	An unordered list of exceptions that can be reported by this equipment node.	List of elements of type Exception described in § 10.5.
parameters	An unordered list of typed parameters provided by this equipment node.	List of elements of type Parameter, described in § 10.4. Any parameters that represent variables from SEMI standards shall be typed and named according to ¶ 10.6.3.2.1 and ¶ 10.4.11. Each parameter name for this node shall be unique. Parameter names need not be unique across equipment nodes.
node	The equipment node being described.	Element of a type derived from the SEMI E120 Nameable class.
simpleEvents	An unordered list of simpleEvents (without statemachines) that can be reported by the equipment node.	List of elements of type SimpleEvent, described in § 10.8.

10.4 *Parameters*

10.4.1 Parameters can represent any concept that can be described by any of the primitive or composite types described in SEMI E138. A parameter can generally be thought of as a named, typed field that has a specific meaning, utility or other information value. Examples are process control variables, equipment configuration settings, measurement results, wafer maps, data variables, etc. Parameters can only be defined by an equipment node (§ 10.3), a SEMI ObjType (§ 10.7), or an exception (§ 10.5).

10.4.2 Figure 7 shows how to describe named, typed parameters with units, constraints, and associations with other parameters. Type and units information is provided through the ParameterTypeDefinition referred to by the DefinedType class. ParameterTypeDefinition is described in SEMI E138.

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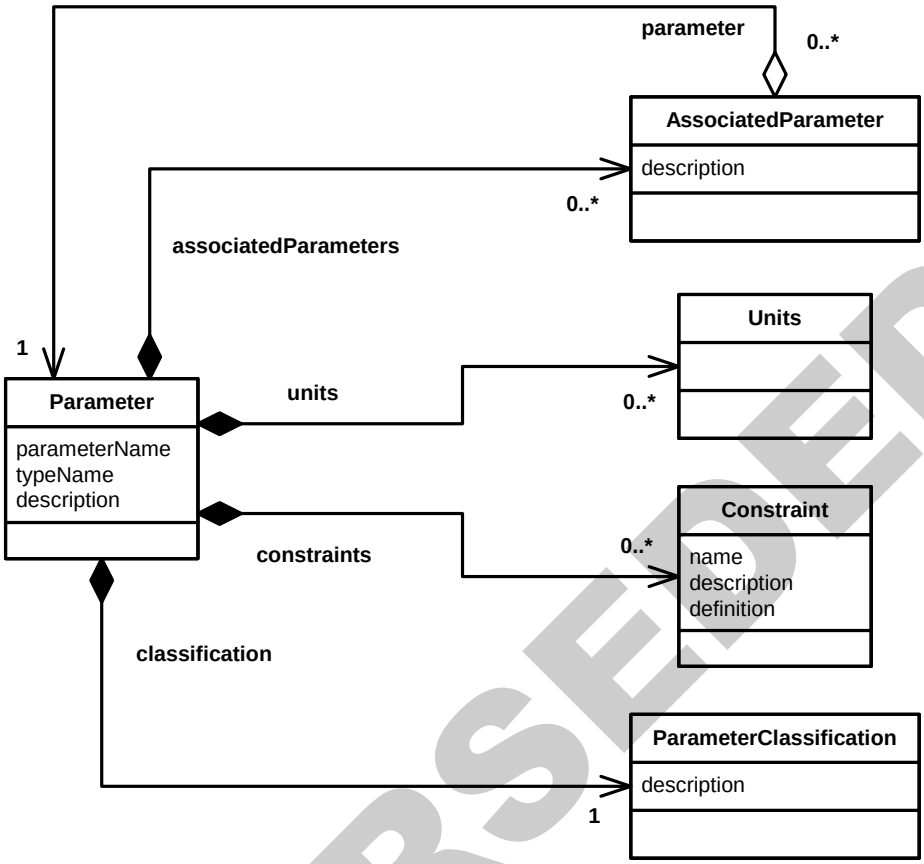

Figure 7
Describing Typed Parameters

10.4.3 Suppliers shall provide a model of those Parameters for which it is necessary and practical to facilitate (at least) utilization tracking, process control, and technical support objectives.

10.4.4 *Parameter Attribute Definition Table*

Table 20 Parameter Attribute Definition

Attribute Name	*Definition*	*Required*	*Form*
parameterName	The name of the parameter.	Y	Text.
typeName	Refers to the typeName attribute of the TypeDefinition used for this Parameter. TypeDefinition is defined in SEMI E138.	Y	Text.
description	A human-readable description of the purpose or usage of the Parameter.	Y	Text.

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10.4.5 *Parameter Association Definition Table*

Table 21 Parameter Association Definition

Association Role Name	*Definition*	*Comments*
constraints	A description of any restrictions associated with this parameter.	List of structured data, of type Constraint, described in Table 28. Logic AND semantics apply between constraints if more than one is described.
associatedParameters	List of other parameters in the system that are related to this parameter.	List of structured data, of type AssociatedParameter, described in ¶ 10.4.7.
classification	Describes the nature of the Parameter.	One and only one element of any type derived from ParameterClassification, described in ¶ 10.4.12.2.
units	Specifies the units for the parameter.	This will contain either a single fixed units specification or a set of available units from which the reported units is selected (see the definition of the Units class below).

10.4.6 Each parameter can provide a list of zero or more associated parameters, and a human-readable description of the meaning of the relationship.

10.4.7 *AssociatedParameter* — This class can be used to describe a generic association with another parameter anywhere in the equipment hierarchy. If such an association is created, this indicates that the Parameter being defined is related in some way to the parameter referenced by this class. The meaning of the relationship is documented in the description attribute of the AssociatedParameter class. More specific meaning can be attributed to an associated Parameter via the classification types described in § 10.4.12.

10.4.7.1 *AssociatedParameter Attribute Definition Table*

Table 22 AssociatedParameter Attribute Definition

Attribute Name	*Definition*	*Required*	*Form*
description	Description of the relationship between the defined parameter and the parameter identified by this association.	Y	Text.

10.4.7.2 *AssociatedParameter Association Definition Table*

Table 23 AssociatedParameter Association Definition

Association Role Name	*Definition*	*Comments*
parameter	The parameter that is the subject of the AssociatedParameter class.	Exactly one instance of type Parameter.

10.4.8 *Units* — This class is used to describe the units for the parameter. Some parameters have a single fixed units specification. Other parameters have a selection of units in which the value may be reported. The Units class specifies either a single Unit or a set of available units with a means to select. See Figure 8 and Table 24.

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