



**Equipment Data Acquisition (EDA) Change Summary: November
2005 to July 2009**

**International SEMATECH Manufacturing Initiative
Technology Transfer #09055011A-TR**

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Abstract: As a result of a “freeze” declared by International SEMATECH Manufacturing Initiative (ISMI) members, all commercial implementations of the Equipment Data Acquisition (EDA) interface (also called “Interface A”) have been based on the 1105 version of the related SEMI standards. Meanwhile, work on the EDA standards has continued. A new EDA freeze will include the improvements to the SEMI standards since the 1105 release. This document from the MFGM065M project lists and explains those changes from the 1105 to the 0709 release to help users and implementers of EDA understand the differences, learn of the benefits, and gauge the amount of work needed to update existing implementations.

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1 INTRODUCTION

1.1 Background

Equipment Data Acquisition (EDA) is a data collection interface for semiconductor manufacturing equipment. It moves data collection from the SECS link to a new connection using mainstream technologies such as XML, SOAP, and HTTP.

The SEMI standards for EDA were created in 2002–2005. The 1105 SEMI release of the EDA standards was identified as mature by ISMI, whose members declared that the 1105 release should be implemented globally until further notice. This first “freeze” of EDA remains in effect as of the first half of 2009.

In the interim, changes to the EDA standards have continued. As more implementations of EDA have been created, the industry has identified various shortcomings and corresponding improvements. With SEMI’s approval of the 4729 EDA ballot in April 2009, most known issues with the EDA standards have been resolved. As a result, ISMI members are considering a new EDA freeze.

1.2 Purpose

This document provides a technical summary of the changes made to the EDA standards between the 1105 and 0709 releases. It is intended to help users and implementers of EDA understand the differences, learn of the benefits, and gauge the amount of work needed to update existing implementations.

1.3 Scope

This document focuses on modifications made to the EDA standards set as it is represented in the 1105 release (November 2005).

It summarizes conceptual changes to the standards. Some basic maintenance of the standards is also covered, but it is not within the scope of this document to provide a complete, line-by-line explanation of all changes.

SEMI owns the copyright to all SEMI documents, both the standards and the ballot proposals. ISMI cannot provide copies of either.

1.4 References

1.4.1 ISMI Documents

Equipment Data Acquisition Guidance, ISMI Technology Transfer #0603478C-ENG, (ismi.sematech.org/docubase/abstracts/4784ceng.htm).

1.4.2 SEMI Standards

The standards listed below are available for purchase from SEMI (<http://www.semi.org/en/Standards/StandardsPublications/index.htm>). Typically, the most current version of the specification is provided, but SEMI will make older versions available upon request. Schema and WSDL files are also available from SEMI (<http://dom.semi.org/web/wstandards.nsf/supmaterials>).

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

SEMI E40 – *Standards for Processing Management*

SEMI E87 – *Specification for Carrier Management (CMS)*

SEMI E90 – *Specification for Substrate Tracking*

SEMI E94 – *Specification for Control Job Management*

SEMI E120 – *Specification for the Common Equipment Model (CEM)*

SEMI E125 – *Specification for Equipment Self-Description (EqSD)*

SEMI E128 – *Specification for XML Message Structures*

SEMI E132 – *Specification for Equipment Client Authentication and Authorization*

SEMI E134 – *Specification for Data Collection Management (DCM)*

SEMI E138 – *XML Semiconductor Common Components*

SEMI E145 – *Classification for Measurement Unit Symbols in XML*

SEMI E147 – *Guide for Equipment Data Acquisition (EDA)*

SEMI E151 – *Guide for Understanding Data Quality*

1.5 Abbreviations

CEM – Common Equipment Model

DCM – Data Collection Management

DCP – Data Collection Plan

uid – Unique Identifier – SEMI E120 identifier based on uuid

uuid – Universally Unique Identifier – Defined in ISO/IEC 11578

1.6 Definitions

EDA – Equipment Data Acquisition – The SEMI Standard specification for the Interface A data communication interface. EDA is defined by SEMI E125 and E134 and their related specifications.

Interface A – The network interface for data communication from equipment to factory system. The term refers to the interface, independent of implementation details.

Restricted Parameter – A non-transient parameter whose value is valid only during specific time periods and not valid at other times.

2 OVERVIEW

This document assumes the reader has a detailed knowledge of the EDA standards. For an overview of EDA and the EDA standards, see SEMI E147, Guide for Equipment Data Acquisition (EDA), and ISMI Technology Transfer 0603478C-ENG, *Equipment Data Acquisition Guidance*.¹

This document addresses the changes at two levels. Section 3 through Section 10 summarize the changes made to each EDA standard from the 1105 release to 0709 release. Appendix A through Appendix H provide a ballot-by-ballot history and explanation of the changes made by each.

3 GENERAL MODIFICATIONS

The most visible change to the EDA standards is a reworking of the XML representation of the messages and data. The 0709 release has reduced the XML of the messages in general and of the metadata specifically.

In the original EDA freeze, most elements in the XML that were identified as “not required” are represented as zero length strings or as specific values, such as “unknown.” In the 0709 release, most of these are omitted when not needed. This can represent a significant decrease in the bulk of the XML.

The original XML mapping also included many unneeded container structures. These containers added both size and complexity to the XML. The 0709 release has simplified the XML by removing several of these container structures and flattening the hierarchical data structures.

A number of inconsistencies were found in mapping the EDA standards to XML. The cardinalities of some relationships were incorrect. New items were sometimes added into the XML without a corresponding definition in the main specification. Naming was inconsistent in some places. All such known issues have been resolved in the 0709 release.

These changes/corrections to the XML mapping are too numerous and too detailed to effectively convey in this document.

4 SEMI E125 EQUIPMENT SELF DESCRIPTION

For more detail, see Appendix B.

4.1 Conceptual Changes

4.1.1 StateMachines and SimpleEvents

SEMI Document #4151A, Line Item #4 and #4366, Line Item #2 created the concept of SimpleEvents. SimpleEvents are an alternative to StateMachines as sources of EventReports for EquipmentNodeDescriptions and SEMI Objects. Use of SimpleEvents allows the implementer to skip defining the underlying state model.

¹ ISMI documents can be found at <http://ismi.sematech.org> by entering the TTID or title into the search field.

No guidance was included about when to use SimpleEvents versus StateMachines. ISMI recommends using SimpleEvents only for simple state models, such as those with only two states. It is intended that state models defined in other SEMI standards (E40, E87, E90, E94, etc.) be represented as StateMachines.

4.1.2 SEMI Objects

In SEMI Document #4366, Line Item #2, the SEMI Object definition was changed to allow it to contain multiple StateMachine instances.

Just as the SEMI E87 Load Port has multiple state models defined for it (Transfer, Access Mode, Reservation, Carrier Association, Clamped/Unclamped, Open/Closed), SEMI Objects may need to hold instances of multiple state models.

4.1.3 Exceptions

In SEMI Document #4729, the severity attribute of the Exception class has been changed from an optional string field to a required enumeration. The four values defined include Fatal, Error, Warning, and Informational.

Exceptions were further changed in the 4729 ballot to replace the setData/clearData attributes with a single exceptionData field. With setData/clearData, each Exception had separately defined Parameters. Typically thousands of exceptions are defined for an equipment. The new exceptionData instead references existing Parameters defined within the equipment. This compresses the metadata and provides more context for the meaning of the Parameter values, since the source is known.

Note in Figure 1 that the relationship from Exception to Parameter has an unfilled diamond, which represents aggregation. Aggregations translate to references to the associated object.

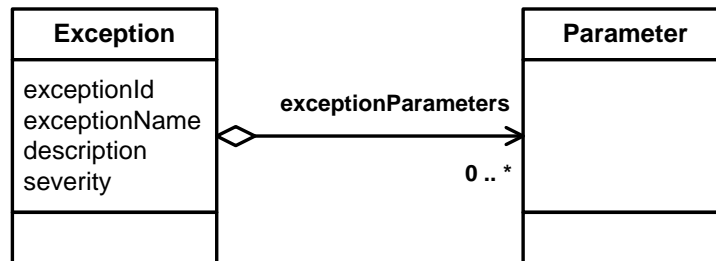


Figure 1 Exception from SEMI E125-0709

4.1.4 Restricted Parameters

In SEMI Document #4729, the isTransient attribute of the Parameter class was changed from a Boolean to a three-value enumeration. The original definitions of a Transient Parameter and a non-Transient Parameter (now called “Unrestricted”) remain essentially unchanged. The new choice, called “Restricted,” was defined to describe a Parameter that does not always report valid values, but is still traceable.

For example, enabling a trace for an end-point detection sensor may gather critical process information. However, when no product is in the chamber, the sensor may be switched off to save power and extend the life of the sensor. At that time, no valid reading is available. In the

past, such a Parameter was often classified as “Transient”, making it available only for event reporting. This change provides a better option for such Parameters.

4.1.5 Data Types

To promote reuse of many of the data types and the tools for defining these data types, sections related to data types were removed from SEMI E125 and SEMI E134 and added to SEMI E138 (XML Semiconductor Common Components). SEMI E125 references SEMI E138 for the data types.

The data types were improved and streamlined in this process. In addition, the units were separated from the format definition to give greater flexibility in their use. The result is many fewer data types have been defined. See Section 9 on SEMI E138 changes for more detail.

4.1.6 MetadataRevised Construct Optimized

The MetadataRevised message from the equipment has been simplified by a change made by SEMI Document #4729. The MetadataRevised message contained redundant information in the form of the EquipmentElement (always equal to the Equipment instance). By removing EquipmentElement and the RevisionNotice container, the message content is simplified to contain only the MetadataRevision element with the revisionDate.

4.1.7 Nested State Machines

In SEMI Document #4151A, Line Item #2, a change was made to allow for state transitions from one “nested stateMachine” to another. Harel state models allow for “concurrent” states, in which one state is subdivided into multiple concurrent (“And”) states. EDA models these concurrent states as StateMachines. The 1105 version of SEMI E125 inadvertently prohibited transition from a State into a StateMachine, as is required with these concurrent states.

For an example, see the SEMI E87 CarrierID Read/Write state model.

Note that this change is not related to “nestedStateMachines.” The nestedStateMachines composition is a collection of StateMachineInstances that can be contained within another StateMachineInstance. This little used feature has not changed since the initial version of EDA.

4.2 Simplifications, Clarifications, and Editorial Changes

4.2.1 Provisional Status Removed

SEMI E125 was elevated from a Provisional Specification to a full SEMI Specification by SEMI Document #4366, Line Item #1. This reflects the acknowledged maturity of the standard.

4.2.2 Initial/Final States

In SEMI Document #4151, Line Item #3, a clarification was made to refer to all initial and final states in stateMachine definitions as “NoState.” These are pseudo-states before the state model is created or after the state model is destroyed. They are needed to complete certain transition definitions.

4.2.3 State Naming Convention

SEMI Document #4151A, Line Item #5 simplifies the naming convention for states:

“~~urn:semi-org:state:<standard id>:<state machine>:<state path name>~~”

This change significantly reduces the size of StateMachine definitions.

4.2.4 SEMI Objects

SEMI Objects have two elements (attributes and eventData) that each contain a list of Parameters associated with the SEMI Object. SEMI Document #4729, clarified that the two lists cannot overlap.

This was the original intent of these elements, but it had not been documented in the standard. The “attributes” list is intended to contain Parameters that map to the object’s defined attributes. The “eventData” list is intended to contain additional Parameters that provide needed information in associated event reports. Some eventData Parameters may be Transient Parameters, tied directly to Transitions of StateMachineInstances associated with the SEMI Object.

4.2.5 Exceptions

SEMI Document #4729 added a new requirement that any alarms reported to the operator must be modeled as Exceptions. This was the original intent of Exceptions, but it was not documented in the earlier versions of SEMI E125.

5 SEMI E134 DATA COLLECTION MANAGEMENT

For more detail, see Appendix C.

5.1 Conceptual Changes

5.1.1 Trace Data Collection

Trace data collection has added an “index” to each traceResult (see Figure 2). This allows the client to confirm that all trace reports are received and to order them correctly. At data rates above their capacity, some equipment have been shown to drop messages and/or to send other messages out of order. This will help the client detect such problems, should they occur.

The Trace definition has been changed to clarify the behavior for an event-triggered trace when an event occurs. When an event initiates the Trace, the first trace report will include the startTrigger and startTriggerTime. This first trace report has been clarified as occurring immediately upon a Trace start.

When the Trace is stopped by an event, the last trace report will include the stopTrigger and the stopTriggerTime. Note that this last trace report may not include any traceResults (that is, CollectedData), because the Trace stops immediately upon the event. TraceReport cardinality for the traceResults has been adjusted to a minimum of zero to reflect this.

Both changes were made by SEMI Document #4729.

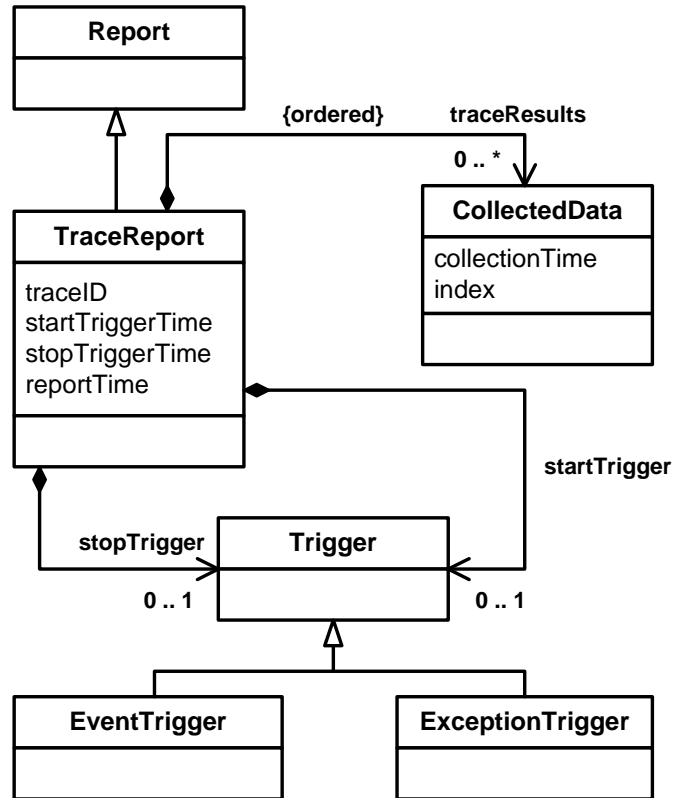


Figure 2 Trace Report from SEMI E134-0709

5.1.2 DCPDefined/DCPDeleted Notifications

SEMI Document #4729 added two new services to the **DCPConsumer** interface: `DCPDefined()` and `DCPDeleted()` (see Figure 3).

These services allow an EDA client to be notified by the equipment when a different client adds or deletes data collection plans (DCPs) to which this client has access.

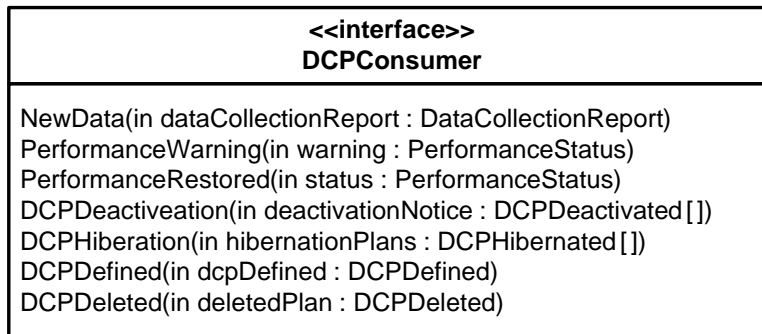


Figure 3 DCPConsumer Interface from SEMI E134-0709

5.1.3 GetCurrentDateTime Service

SEMI Document #4729 added the new service GetCurrentDateTime(). This service returns the current date and time in the same ISO 8601 format as specified for SEMI E134 timestamps.

The purpose is to allow the client to determine the difference in equipment time and client time. Of course, the accuracy of this approach is limited due to the communication delay, but it will show where significant offsets exist. Future use of time synchronization techniques such as NTP will eliminate most significant time offsets.

5.1.4 Timestamp for Ad Hoc Data Request

SEMI Document #4729 modified the GetParameterValues to add a “reportTime” field. This new field records the time at which a response to the ad hoc data request was created.

Including the timestamp in the response enables the client to better compare/merge this ad hoc data with other data that has been sampled at about the same time (e.g., trace data or event data).

5.1.5 DCP State Machine

SEMI Document #4729 changed the application of the DCP state model (see Figure 4).

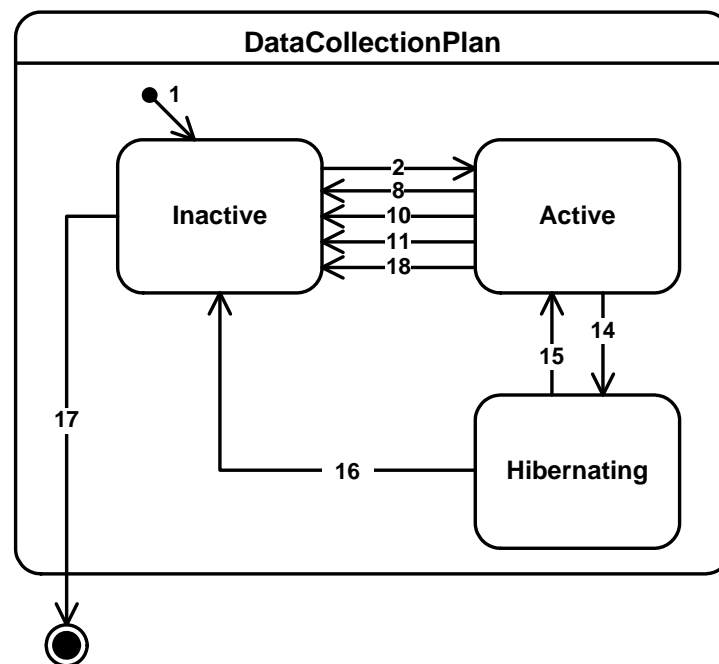


Figure 4 DCP State Model from SEMI E134-0709

Previously, a single instance of the state model represented the DCP’s state for all clients. This added significant complexity to the model but left some cases in which the model did not yield reasonable results. For example, if a DCP with a Trace had run to completion for a first client, then when a second client activated the DCP, no Trace data would be returned.

The new approach is that the DCP state model is applied independently for each client of a DCP. Thus, the client is assured that upon activation, the DCP will provide all expected data.

This change also simplified the DCP state model. Eight of the original 17 transitions were eliminated.

The DCP state model was modified for a different purpose to add one new transition from the Active to Inactive state. This transition is taken when “the equipment has determined that the DCP is invalid.”

This new transition is taken at the equipment’s discretion, which may be not at all. The change does not dictate when or if the equipment should check whether the DCP is invalid. It also does not give any criteria for declaring the DCP invalid. However, if a DCP no longer contains any valid parameters, the equipment now has the option of deactivating the DCP.

5.1.6 Description and Name Attributes

The “name” and “description” attributes have been added by SEMI Document #4729 to certain messages to make interpretation more efficient.

The name and description attributes were added to the GetDefinedPlanIds() and GetActivePlanIds() responses to help the client understand the nature of DCPs listed. Note that some DCPs in the list may not have been created by this client. This includes pre-defined (supplier-defined) DCPs and those created by other clients.

The old version of the service returned the planID, but no descriptive information. The client was forced to upload each unknown DCP to understand its purpose. Receiving a name and description may eliminate the need to upload and examine each DCP.

Because it shares a data structure with GetActivePlanIds(), the ActivatePlan() response was also affected. It now contains the name and description of the DCP that was activated.

The Exception description was added to the ExceptionReport structure, which makes the exception report more immediately understandable to a user. It is possible to get that information from the metadata using the exceptionID, but this assumes that the consumer of the exception message has instant access to the metadata.

5.1.7 Data Types

To promote the reuse of many of the data types and the tools for defining these data types, sections relating to data types were removed from SEMI E125 and SEMI E134 and added to SEMI E138. SEMI E134 references SEMI E138 for the data types.

The data types were improved and streamlined in this process. See Section 9 on SEMI E138 changes for more detail.

5.2 Clarifications and Editorial Changes

5.2.1 Provisional Status Removed

SEMI E134 was elevated from a Provisional Specification to a full SEMI Specification by SEMI Document #4362, Line Item #1. This reflects the acknowledged maturity of the standard.

5.2.2 DeactivatePlan Behavior

The behavior of the DeactivatePlan() request was covered more completely. Several cases are based on combinations of the following:

- Whether planID = a single ID or “allDCPs”
- Whether terminate = true or false
- Whether the specified DCP was active or not (or whether any were active in the case of allDCPs)
- Whether the requesting client has the ManageAnyDCP privilege

Behavior for each case is clarified.

5.2.3 NoValue and Null Usage

The implementer can choose whether to use NoValue or a null value as needed. Note that because XML specifies how a null value is represented, it is not given a separate class. The definition of NoValue is now a part of SEMI E138.

6 SEMI E120 COMMON EQUIPMENT MODEL

For more detail, see Appendix D.

6.1 Conceptual Changes

6.1.1 MaterialLocations for Consumables and Others

The MaterialLocation class was expanded to cover consumables and other types of locations in SEMI Document #4160A, Line Item #1. This was done by adding the new values “Consumable” and “Other” to the materialType enumeration definition.

In addition, a new materialSubType attribute was added to the MaterialLocation class. This is a free-form text field that allows the implementer to give more specific information. For instance, a Carrier type of Location might have a materialSubType = “FOUP.” Substrate location might have materialSubType = “300 mm wafer.”

6.1.2 Nameable uid Value

SEMI Document #4160A, Line Item #3 removed the requirement that the Nameable uid attribute always contain a properly generated ISO/IEC 11578:1996 uuid value. Suppliers have reported that creating and maintaining these universally unique values is too difficult. This is especially true in the field as parts are periodically replaced. The uid of the Equipment class is still required to be a valid uuid value. All other elements of the equipment structure no longer require a uuid.

The change to SEMI E120 still allows the use of the uuid value. When a uuid is assigned, the uuid form is used (e.g., 9F5FBC24-EFE2-4f90-B498-EC0FB7D47D15). However, if a properly generated uuid value is not used for the uid, then the free-form string must not take the uuid format. In this way, the client can identify which is provided.

6.1.3 EquipmentElement

The EquipmentElement has an attribute called elementType that was intended to identify the type of each equipment component. The attribute is a free-form string format. User feedback requested a more limited set of choices for elementType that could be recognized in an automated fashion.

SEMI Document #4597, Line Item #2 establishes a set of predefined strings to be used for elementType. The set includes values from many common instances of Equipment, Modules, etc.

Creating an exhaustive set of values was not possible. Retaining the string format for elementType allows the implementer to extend the list by creating additional elementType values, but only if the component does not fit any of the predefined values.

A second change to EquipmentElement was made in SEMI Document #4597, Line Item #3. The attributes supplier, make, model, modelRevision, function, and immutableId were changed from required to conditional. The new text says,

“Each attribute is required when a value corresponding to that attribute has been associated with the EquipmentElement. For example, immutableId is a required attribute when the supplier has assigned a serial number (or equivalent) to that component of the equipment.”

The older version required that all attributes be included in the metadata, but contain “unknown” when no value is available. Note that the text specifying the use of “unknown” was inadvertently left in the standard. This will be removed in a later ballot and should be ignored for now.

6.2 Clarifications and Editorial Changes

6.2.1 AbstractModule

The AbstractModule class was renamed to ExecutionElement by SEMI Document #4081, Line Item #2. This change was made to help implementers better understand its purpose. Its definition was expanded from “capable of processing material” to include measuring and testing of material as well.

6.2.2 Locator

The Locator definition and XML data type were used by SEMI E134. However, the Locator was defined in a Related Information section of SEMI E120. Thus, it could not be considered a required element. In SEMI Document #4081, Line Item #5, the Locator definition was moved to the main part of the specification.

6.2.3 Regular Expressions

The formats of the LocatorType and the NameType were controlled by regular expressions in the XML schema file. These were found to be faulty and corrected in SEMI Document #4729.

7 SEMI E132 EQUIPMENT CLIENT AUTHENTICATION AND AUTHORIZATION

For more detail, see Appendix E.

7.1 Conceptual Changes

7.1.1 EnhancedEstablishSession

As other new standards (e.g., SEMI E139 and E142) began to adopt EDA-style messaging based on SEMI E132, it was clear that an EDA client might gain unwanted services (e.g., Recipe Management) when it connected to the equipment for data collection. SEMI Document #4409 created a way to request specific services for a session, while excluding others.

The new EnhancedEstablishSession() service allows the requestor to choose the desired services for the session. The naming of capabilities is specified and includes both the standard number and version. Thus, an equipment could, in theory, offer a connection to either SEMI E134-1105 or E134-0709 on the same equipment.

For backward compatibility, the original EstablishSession() service has been retained.

7.1.2 InterfaceDiscovery Interface

The initial connection from an EDA client to an equipment requires entering multiple long internet address strings (URNs), usually by hand, along with some other information. Data entry errors in URNs are difficult to diagnose. An incorrectly addressed message never arrives at its intended destination. This might occur for several reasons, but no error message is sent to indicate the reason.

SEMI Document #4533, Line Item #1 adds the new InterfaceDiscovery interface. This interface responds to queries with all the information needed to establish a session with an equipment. The returned information includes the list of capabilities that can be specified with the EnhancedEstablishCommunication() service.

To connect, a potential client need know only the Ethernet address or name of the equipment's EDA computer.

7.1.3 All Sessions Persistent

Session persistence was an added feature to EDA before the 1105 freeze. Subsequently, it was decided that all sessions should be persistent by default. SEMI Document #4219 made this change in SEMI E132. It also deleted the PersistSession() service and removed the now unneeded "isPersistent" attribute from the ActiveSession class.

7.1.4 Disabling Session Pings

The original SEMI E132 suggests a way to disable periodic pings by setting the ping interval to zero. SEMI Document #4533, Line Item #5 made this the standard method for disabling session pings.

7.1.5 Number of Sessions Per ACL Principal

The SEMI E132 access control list (ACL) defines identities for the EDA clients called "principals." In the past, a client could connect to the equipment multiple times while identifying itself as the same principal for each connection. This leads to problems, since the

connections look the same. SEMI Document #4533, Line Item #6 limits a client to one active session per ACL principal.

7.1.6 SessionClosed Notification

This line item removes the requirement for the equipment to send the SessionClosed notification to a client if that client initiated the session close.

7.2 Clarifications and Editorial Changes

7.2.1 SEMI E128 Messaging Support

SEMI E128 was originally created to define how asynchronous messaging should be done using SOAP. SEMI Document #4034A added synchronous messaging support to SEMI E128. EDA uses synchronous messaging.

SEMI Document #4409 changed SEMI E132 to remove the portion that duplicates the SEMI E128 definitions and to reference SEMI E128. While some of the terminology changed (e.g., E32Header became SynchHeader), no conceptual change was involved.

7.2.2 GetDefinedPrivileges

SEMI Document #4533, Line Item #2 clarifies that when a client with “SecurityAdmin” rights requests the equipment for a list of all defined privileges, the GetDefinedPrivileges response should include all the defined privileges, including the “allPrivileges” and “SecurityAdmin” privileges.

8 SEMI E128 XML MESSAGE STRUCTURES

For more detail, see Appendix F.

SEMI E128 was not originally part of the EDA standards set. It was created to support asynchronous messaging using SOAP.

SEMI Document #4034A added support for synchronous SOAP messaging as used for EDA.

Changes were subsequently made to SEMI E125, E132, and E134 to remove the now duplicate definitions and reference those in SEMI E128.

9 SEMI E138 XML SEMICONDUCTOR COMMON COMPONENTS

For more detail, see Appendix G.

The Error used by the 1105 release of EDA is the same as that defined in SEMI E138. However, SEMI E138 was not included in the original EDA standards set because it was not ready in time. Subsequent changes to the EDA standards added references to SEMI E138 while removing the now duplicate definitions of the Error class.

9.1 Conceptual Changes

SEMI Document #4595A added the equivalent of SEMI E125 Parameter Types and SEMI E134 Parameter Values. These are intended to provide a common definition of those data format concepts that could be reused by other standards in the future.

The implementer should note that several detailed improvements were made to the definitions when transferring them to SEMI E132. See Appendix G for the more notable of these improvements. While the main concepts have not changed, many details are affected. Implementers should study the new definitions closely.

9.2 Clarifications and Editorial Changes

SEMI Document #4729 corrects an XML error brought about by the changes in SEMI Document #4595A.

10 SEMI E145 UNIT SYMBOLS IN XML

For more detail, see Appendix H.

SEMI E145 did not exist when the 1105 version of EDA was released. SEMI E125-1105 included the Unit class, which had a text attributed called “symbol.” It did not place any limitations on the content of the symbol string.

SEMI E145 specifies symbols for the most common base units and defines how to build more complex units from the base units. While only some implementations of the 1105 release conform to SEMI E145, the 0709 release requires conformance.

SEMI E145 has not been modified since its initial approval by SEMI.

Appendix A – SEMI Ballots for EDA Since the 1105 Release

Table A-1 lists all the SEMI ballots that were proposed after the approval of the 1105 release through the 0709 release. The list includes those that were approved and those that failed.

The table includes the following columns:

- **Cycle** – SEMI provides seven voting cycles during the year in which ballots can be proposed. In North American, three cycles are generally used: Cycle 1 (January–March), Cycle 4 (May–July), and Cycle 6 (August–October). This column contains text in the form YYYY-C, where YYYY is the year and C is the cycle number.
- **Doc#** – Each ballot submitted to SEMI is assigned a unique four-digit SEMI document number. If the document is submitted for balloting more than once, a letter is appended to the new submission. Therefore, SEMI document 4151 is labeled “4151” for its first submission, then “4151A” if it is resubmitted and “4151B” if it is ballot a third time, etc. The document number for an approved ballot is retired. If even one line item fails, it may be resubmitted. In this column, a document that was completely approved with no changes is shown in **green**. A document that failed all line items is shown in **red**. Where some line items failed or editorial changes were necessary, the document number is shown in **blue**.
- **Stds** – The standards affected by the ballot proposal are listed. Where all proposals for a standard were approved with no changes, the standard is shown in **green**. Where all proposed changes failed, ~~red with strikeouts is used~~. Where some changes were approved or editorial changes were necessary, the standard is shown in **blue**.
- **Status** – This column shows whether the ballot proposal was approved or failed. Ballot proposals may be broken into Line Items, which are voted on separately. These are coded similarly to the other columns with **green for approved**, **red for failed**, and **blue for approved with editorial changes**.
- **Content** – Each ballot is briefly explained. Typically, the title of the line item from the ballot proposal is shown.

Further details on these ballots are in the following appendices.

Table A-1 EDA Ballots Since the 1105 Release

Cycle	Doc#	Stds	Status	Content
2005-1	4081	E120 E120.1	LI# 1 - Failed LI# 2 - 0705 LI# 3 - Failed LI# 4 - Failed LI# 5 - 0705	LI#1 Add Consumable Location LI#2 Rename AbstractModule LI#3 Remove uid Persistence Requirement LI#4 Relax uid Uniqueness Requirement LI#5 Locator Definition
2005-4	4160	E420 E420.1	Failed	<ul style="list-style-type: none"> o Resubmit a corrected version of 4081 Line Item 1 - “Add a Consumable Location,” including the omitted schema change o Make changes to the equipment component identifiers “locator” and “uid” that have evolved from the original 4081 Line Items 3 & 4 o Update the E120.1 XML schema for CEM according to SEMI XML Task Force advice

Cycle	Doc#	Stds	Status	Content
2005-6	4151A	E125 E125.1	LI# 1 - 0306 LI# 2 - 0306 LI# 3 - 0306 LI# 4 - 0306 LI# 5 - 0306	LI#1 Errata and Clarifications LI#2 Permit Transitions between Nested State Machines LI#3 Clarify Initial/Final states LI#4 Events without state machines LI#5 Simplify SEMI state naming convention
2005-6	4219	E132 E132.1	0306 with editorial changes	Removed support for non-persistent sessions
2005-7	3851C	E145	0306 with editorial changes	New standard (Units)
2006-1	4034A	E128	LI#1 - 0706 LI#2 - 0706 with editorial changes LI#3 - 0706 with editorial changes LI#4 - 0706	LI#1 Correct Namespace Description LI#2 Add Synchronous Header Elements LI#3 Correct description and usage of Fault header LI#4 Clarify usage of Action Header
2006-1	4160A	E120 E120.1	LI#1 - 0706 LI#2 - 0706 LI#3 - 0706 LI#4 - Failed	LI#1 Changes to MaterialLocation class LI#2 Errata on published 0705 version LI#3 Relaxing requirement for "uid" attribute LI#4 Adding "Locators" attribute to Nameable Class
2006-4	3571B	E147	Failed	EDA Guide
2006-6	3571C	E147	0307 with editorial changes	EDA Guide
2006-6	4362	E134	LI#1 - 0307 with editorial changes LI#2 - 0307 LI#3 - 0307 LI#4 - 0307	LI#1 Removal of provisional status LI#2 Correction of reference to SEMI E120 LI#3 Correction of Namespace references LI#4 Remove Redundant References to Dated Information
2006-6	4363	E132	0307	Remove Redundant References to Dated Information
2006-6	4366	E125	LI#1 - 0307 LI#2 - 0307 LI#3 - 0307 LI#4 - Failed LI#5 - 0307	LI#1 Removal of provisional status LI#2 Changes to NodeEvent and SEMIObjType Classes LI#3 Remove Redundant References to Dated Information LI#4 Transition Naming Convention Clarification LI#5 Schema file errata correction
2007-1	4409	E132	1107 with editorial changes	Adding E128 XML Messaging Support and the new EnhancedEstablishSession Request Service
2007-4	4452	E125 E125.1 E134 E134.1	LI#1 - Failed LI#2 - Failed LI#3 - 1107 LI#4 - Failed LI#5 - Failed	LI#1 E125.1 - Correct File Names, Headers, and Versions for all Files LI#2 Changes to Correct Problem with Choice Construct LI#3 E125 - Editorial Correction LI#4 Correct File Names, Headers, and Versions for all E134.1 Files LI#5 Changes to Correct Problem with Choice Construct
2007-6	4452A	E125 E125.1 E134 E134.1	LI#1 - 0308 LI#2 - 0308 with editorial changes	LI#1 E125.1 Correct File Names and Versions for all Files LI#2 Correct File Names and Versions for all E134.1 Files

Cycle	Doc#	Stds	Status	Content
2008-4	4533	E132 E132.1	LI#1 - 1108 LI#2 - 1108 LI#3 - 1108 with editorial changes LI#4 - 1108 LI#5 - 1108 LI#6 - 1108 with editorial changes LI#7 - 1108	LI#1 Interface Discovery LI#2 Equipment Defined Privilege Usage Clarification LI#3 Multiple Addition of Error Text and Error Codes LI#4 Editorial Corrections LI#5 Disabling Session Pings LI#6 Clarification for ACLEntry Session Allowance LI#7 CloseSession Notification Requirement
2008-4	4534	E134 E134.1	LI#1 - Failed LI#2 - Failed LI#3 - Failed LI#4 - Failed	LI#1 DCPDefined and DCPDeleted operations added to DCPCConsumer interface LI#2 Addition of index in CollectedData for TraceResults LI#3 Addition of timestamp in GetParameterValues LI#4 Changes to Clarify the Acceptance of Transient Parameters in Data Collection Plans
2008-4	4595	E138 E138.1	Failed	Revision to SEMI E138, XML Semiconductor Common Components
2008-4	4597	E120 E120.1	LI#1 - Failed LI#2 - 1108 LI#3 - 1108 LI#4 - 1108	LI#1 Simplification of ExecutionElement attributes LI#2 Equipment component type attributes LI#3 Equipment component identity attributes LI#4 Regular Expression changes in the E120 schema
2008-6	4595A	E138 E138.1	0309 with editorial changes	Revision to SEMI E138, XML Semiconductor Common Components

Appendix B – SEMI E125 Changes from SEMI E125-1105 to E125-0709

SEMI E125-1105 was included in the EDA freeze

Each SEMI E125-related ballot document, the resulting standard version, and a summary of the conceptual changes made by that ballot document are listed below. This document does not contain all technical details or a line-by-line compilation of the changes. The ballot proposals are SEMI copyright documents that are not publicly available from SEMI after the voting period.

1. Ballot Doc# 4151A → SEMI E125-0306 (LI#2–4 only, all schema/WSDL files)

- LI#1 – Errata and Clarifications
 - As the title implies, this corrected a number of conflicts: data item content, association cardinality, typographical errors, etc. There is no conceptual change in this line item.
- LI#2 – Permit Transitions between Nested State Machines
 - The title above is a reuse of the term “Nested State Machines,” which causes confusion. A “nestedStateMachine” is a StateMachineInstance contained within another StateMachineInstance. This line item adds the term “nested state machine” (note the spaces) to refer to a StateMachine that refers to another StateMachine.
 - Within a Harel state model, a state can contain substates. These substates may be “And” substates or “Or” substates. With “Or” substates, only one substate is occupied at any one time. With “And” substates, each substate is occupied in parallel with the others.
 - With SEMI E125 StateMachines, “Or” substates are modeled as a State containing other States. When a State contains “And” substates, it is modeled as the State containing StateMachines – one for each substate in the model for that State.
 - To move into a State with “And” substates, the transition must be to a State within a StateMachine contained within the target State. However, SEMI E125-1105 did not allow a transition from a State to a State within another StateMachine. This line item allowed that transition.
- LI#3 – Clarify Initial/Final States
 - This line item named and described the initial states (black dots on a Harel diagram) and final states (black dots with a circle around them in Harel) in the StateMachines.
 - Both initial and final states are to be described within a StateMachine with a single instance of the State object named “NoState.”
 - Transitions to/from “NoState” are treated like any other transition and are identified (numbered). Note that some related standards that need to be represented in the metadata do not number these transitions (e.g., see the SEMI E30 Processing State Diagram).

- LI#4 – Events Without State Machines
 - This line item provided for a collection of “NodeEvents” (later called “SimpleEvents”) to be contained within the EquipmentNodeDescription. This allows the equipment to report events without defining the underlying StateMachine that initiates the events.

Note that this change allows even defined standard state models to be represented as simple events. There are some two-state models where this is appropriate.

- LI#5 – SEMI State Naming Convention
 - This line item simplified State names by removing the urn qualifier:
~~“urn:semi-org:state:<standard id>:<state machine>:<state path name>”~~

2. Ballot Doc# 4366 → SEMI E125-0307 (LI#1-3 and 5 only, all new schema/WSDL files)

- LI#1 – Removal of provisional status
 - All references to “Provisional” for SEMI E125.1-0306 were removed. The marked sections were originally marked as provisional pending approval of SEMI E132.1 and E138.
- LI#2 – Changes to NodeEvent and SEMIObjType Classes
 - Adds SimpleEvents to SemiObjType class
 - Both SEMI E87 (Carrier Management) and E40 (Process Job Management) define non-state machine events as part of the standard.
 - Changed NodeEvent → SimpleEvent (see 4151A, LI#4)
 - The concept now applies to SEMI Objects as well as equipment nodes.
 - SEMI Objects changed to allow multiple state models for a SEMI Object instance
- LI#3 – Remove Redundant References to Dated Information
 - This line item makes no conceptual changes.
 - It removes some unneeded references and converts other references to exclude version numbers that had to be changed any time the document they referred to was updated.
- **Failed** LI#4 – Transition Naming Convention Clarification
 - This line item required that all transitions be named by concatenating the “From” state and the “To” state names: <FromState>-<ToState>.
- LI#5 – Schema file errata correction
 - This line item made no conceptual changes. The schema was modified to better match the main document.

3. Ballot Doc# 4452 → SEMI E125-1107 (LI#3 only)

- **Failed** LI#1 – SEMI E125.1 – Correct File Names, Headers, and Versions for all Files
 - LI#1 and #2 reballoted and approved as 4452A LI#1.

- This line item referenced updated versions of SEMI E120 and E132 and reflected the changes in them.
- **Failed** LI#2 – Changes to Correct Problem with Choice Construct
 - LI#1 and #2 reballoted and approved as 4452A LI#1.
 - This line item attempted to address XML mapping issues in the schema and to correct the application of the choice construct.
 - There were no proposed conceptual changes in this line item.
- LI#3 – SEMI E125 – Editorial Correction
 - This line item made no conceptual changes. It is a minor editorial correction.
- **Failed** LI#4 – Correct File Names, Headers, and Versions for all SEMI E134.1 Files
 - **This was a SEMI E134.1 line item.**
- **Failed** LI#5 – Changes to Correct Problem with Choice Construct
 - **This was a SEMI E134.1 line item.**

4. Ballot Doc# 4452A → SEMI E125-0308 (two line items, schema change)

- Line item #1 – SEMI E125.1 Correct File Names and Versions for all Files
 - Re-ballot of 4452 LI#1 and 2 combined
 - This line item references updated versions of SEMI E120 and E132 and reflects the changes in them. This included movement of portions of SEMI E132 into E128.
 - This line item addresses XML mapping issues in the schema and corrects the application of the choice construct.
 - There were no proposed conceptual changes in this line item.
- Line item #2 – Correct File Names and Versions for all SEMI E134.1 Files
 - **This was a SEMI E134.1 line item.**

5. Ballot Doc# 4729 → SEMI E125-0709 (single line item)

- Line item #1 – This was a large proposal that addressed several issues, the most important of which are summarized:
 - Removed the data type definitions and replaced them with references to SEMI E138
 - Note that some improvements were made to the data type definitions. The primary change was the separation of data type and units.
 - Exception severity is now a required enumeration
 - A list of four values (Fatal, Error, Warning, Informational) are defined.

- Changed isTransient Parameter attribute to enumeration with “Restricted”
 - The enumeration has three choices: Transient, Restricted, and Unrestricted (the latter two are considered Non-transient). Restricted means “valid under certain conditions” to be documented by the implementer.
 - Restricted Parameters are not always valid, but can be traced. For example, this is useful for a parameter that is valid only during processing (beam intensity) and is turned off at other times.
- Any alarms reported to the operator must be modeled as Exceptions
- Exception setData/clearData is replaced by exceptionData
 - The exceptionData field is a list of Parameter references. The setData and clearData constructs defined unique Parameter for each Exception. This allows for reuse of existing parameters and less overall bulk.
- Simplified naming conventions (removing bulky urn text)
 - For example:
urn:semi-org:transition:<standard id>:<state machine>:<transitionId>:<transition name>
becomes simply <transition name>
- Required no overlap of SEMIObj attributes and eventData parameter lists
 - Misunderstanding has resulted in duplicate Parameters being defined in these two lists of Parameters within a SEMI Object. This clarifies that “attributes” should hold the object attributes (as defined in the referenced standard) and the “eventData” should hold Parameters that correspond to data items defined for reporting in events related to the object.
- MetadataRevised construct changed/optimized
 - The MetadataRevised contained redundant information (EquipmentElement) and unneeded structure (RevisionNotice class). Removing these items has simplified the construct.

Appendix C – SEMI E134 Changes from SEMI E134-1105 to E134-0709

SEMI E134-1105 was included in the EDA freeze

The following show each SEMI E134-related ballot document, the resulting standard version, and a summary of the conceptual changes made by that ballot document. This document does not contain all technical details or contain a line-by-line compilation of the changes. The ballot proposals are SEMI copyright documents and are not publicly available from SEMI after the voting period.

1. Ballot Doc#4362 → SEMI E134-0307 (four line items)

- LI#1 – Removal of provisional status
 - All references to “Provisional” for SEMI E134.1-1105 were removed. The marked sections were originally marked as provisional pending approval of SEMI E120.1, SEMI E125.1, and SEMI E132.1.
 - This line item makes no conceptual changes.
- LI#2 – Correction of reference to SEMI E120
 - Corrected the reference to the SEMI E120 Locator from Related Information to the main SEMI E120 document where it had been moved.
 - This line item makes no conceptual changes.
- LI#3 – Correction of Namespace references
 - Corrected references to point to the latest SEMI E120, E132, and E138.
 - This line item makes no conceptual changes.
- LI#4 – Remove Redundant References to Dated Information
 - Some unneeded references were removed and other references converted to exclude version numbers that had to be changed any time the document they referred to was updated.
 - This line item makes no conceptual changes.

2. Ballot Doc# 4452 → SEMI E134-1107 (LI#3 Only; no approved changes to SEMI E134)

- **Failed** LI#1 – SEMI E125.1 – Correct File Names, Headers, and Versions for all Files
 - This was a SEMI E125 line item.
- **Failed** LI#2 – Changes to Correct Problem with Choice Construct
 - This was a SEMI E125 line item.
- LI#3 – SEMI E125 – Editorial Correction
 - This was a SEMI E125 line item.
- **Failed** LI#4 – Correct File Names, Headers, and Versions for all SEMI E134.1 Files
 - LI#4 and #5 reballoted and approved as 4452A LI#2.

- This line item referenced updated versions of SEMI E120 and E132 and reflect the changes in them.
- **Failed** LI#5 – Changes to Correct Problem with Choice Construct
 - LI#4 and #5 reballoted and approved as 4452A LI#2.
 - This line item addressed XML mapping issues in the schema and correct the application of the choice construct.
 - There were no proposed conceptual changes in this line item.

3. Ballot Doc#4452A → SEMI E134-0308 (two line items, schema change)

- Line item #1 – SEMI E125.1 Correct File Names and Versions for all Files
 - **This was a SEMI E125 line item.**
- Line item #2 – Correct File Names and Versions for all SEMI E134.1 Files
 - Reballot of 4452 LI#4 and #5 combined
 - This line item corrected references to the latest versions of E120 and E132 to take advantage of updates to these specifications.
 - This line item addressed XML mapping issues in the schema and corrected the application of the “choice” construct.
 - There were no proposed conceptual changes in this line item.

4. Ballot Doc# 4729 → E134-0709 (single line item)

- Line Item #1 – This was a large proposal that addressed several issues, the most important of which are summarized:
 - Clarified DeactivatePlan behavior in all cases
 - This DeactivatePlan message has four cases that are a combination of values for “Terminate” (true/false), planID (specific plan or “allDCPs”). These are addressed individually in the text.
 - Clarified use of NoValue and null
 - NoValue and the reporting of null values are now specified in SEMI E138. It states that NoValue is for unanticipated situations, leaving null for “anticipated” times a parameter might be invalid, such as when a module is off-line for maintenance or a Restricted Parameter in its specified time is invalid. In SEMI E134, this proposal allows the implementer to choose whether to use NoValue.
 - Clarified TraceReport cardinality in all situations
 - The existing version of SEMI E134 required that a TraceReport contain at least two CollectedData. This is true for most cases, but there are exceptions where one or none might be included. This was corrected to allow for these cases.

- Added DCPDefined/DCPDeleted notifications
 - This new service notifies a client when a DCP is created or deleted by another client.
- Added new GetCurrentDateTime() service
 - This service returns the current date and time. It helps the client determine whether the equipment clock is accurate. This is a temporary substitute until time synchronization using NTP is available.
- Added timestamp for ad hoc parameter requests
 - Adding a timestamp to ad hoc parameter requests allows for proper alignment when comparing the results with those received by event reports or traces.
- Added DCP description to GetDefinedPlanIds and DCPActivated
 - These messages reported on DCPs that might not be known to the client, including built-in DCPs and DCPs created by other clients. The description field helps understand the list of DCPs returned.
- Added TraceReport sequenceID
 - The sequenceID counts from 1 to n for each trace activation. This helps the client know if all trace reports have been received and the correct order.
- Added description to the ExceptionReport
 - Including the description allows the ExceptionReport to be understood more quickly by a human by avoiding having to access the metadata to retrieve it.
- Required a separate instance of the DCP StateMachine for each activating client of a DCP
 - The old approach used a single StateMachine instance to represent the DCP state for all clients. Some conflicts were found when multiple clients activated a DCP. A client could activate the DCP, but received no trace reports. This change makes the behavior more predictable.
- Added an optional transition for when equipment detects an invalid DCP
 - The new transition allows the equipment to deactivate a DCP if it finds it to be invalid. The decision is left to the equipment.
- Modified/clarified trace behavior for event-triggered start/stop
 - Several minor corrections are included. The most important is a change that says a stop trigger may be reported in a traceReport that contains no selected data, which is necessary in some normal cases.
- Removed the data type definitions and replaced them with references to SEMI E138
 - Note that some improvements were made to the data type definitions. The primary change was the separation of data type and units.

- ExceptionRequest attributes can be left out (instead of empty)
 - To eliminate some empty fields in messages, this change says that an unneeded field need not be included in the message. XML messaging accommodates this approach, whereas SECS usually does not.

Appendix D – SEMI E120 Changes from SEMI E120-1104 to E120-1108

SEMI E120-1104 was included in the EDA freeze

1. **Ballot Doc# 4081 → SEMI E120-0705 (LI#2 and #5 only, schema change)**

- **Failed** LI#1 – Add Consumable Location
 - Reballoted as 4160, which failed, and then was approved as 4160A, Line Item #1.
- LI#2 – Rename AbstractModule
 - Renames AbstractModule to ExecutionElement in SEMI E120.
 - Renames AbstractModuleType to ExecutionElementType in SEMI E120.1.
 - Changes the SEMI E120.1 schema file to rename AbstractModuleType to ExecutionElementType.
 - Expands the definition of ExecutionElement from “capable of processing material” to “capable of processing, measuring, or testing material.”
- **Failed** LI#3 – Remove uid Persistence Requirement
 - Reballoted as 4160, which failed, and then was approved as 4160A, Line Item #3.
- **Failed** LI#4 – Relax uid Uniqueness Requirement
 - Reballoted as 4160, which failed, and then was approved as 4160A, Line Item #3.
- LI#5 – Locator Definition
 - Moved the Locator definition to the main body of the SEMI E120 standard to make it a formal definition. SEMI E134 referenced the Locator construct in SEMI E120 and needed a formal definition of Locator.
 - Defined “positional reference” as used in SEMI E134.

2. **Failed** Ballot Doc# 4160 (remains SEMI E120-0705; one line item, schema change)

- The purpose of this ballot was to make the following changes to E120 and E120.1:
 - Resubmit a corrected version of 4081, Line Item 1 – “Add a Consumable Location,” including the omitted schema change.
 - Make changes to the equipment component identifiers “locator” and “uid” that have evolved from the original 4081 Line Items 3 and 4
 - Proposed adding “locator” attribute to Nameable class.
 - Proposed moving uid attribute to EquipmentElement class (has never been reballoted).
 - Update the SEMI E120.1 and the XML schema for CEM according to XML TF advice
 - Update the description of the XML diagram notation.
 - Restructure the E120 schema to remove containers and match XML TF recommendations.

3. Ballot Doc# 4160A → SEMI E120-0706 (LI#1–#3 only, schema change)

- LI#1 – Add Consumable Location to MaterialLocation class
 - Expands the materialType enumeration to add “Consumable” and “Other.” “Other” is to be used only when none of the other choices apply.
 - Adds a new materialSubType, a free-form text field so that, for example, a Substrate materialType could be clarified with “300 mm wafer” in the materialSubType.
 - The schema is updated with these changes.
- LI#2 – Errata list of references to figures and changes not included in the previous ballot
 - The changes are all editorial.
 - Schema changes are included.
- LI#3 – Relaxation of the requirement for uniqueness of the uid value
 - This line item was first proposed as 4081, LI#3 and #4 and again as part of 4160.
 - Removes the requirement that the uid always contain a properly generated uuid value.
 - Requires uid to be a properly generated ISO/IEC 11578:1996 uuid value **if** a string of uuid form is used (for example: 9F5FBC24-EFE2-4f90-B498-EC0FB7D47D15); otherwise, requires uid to be a string that is unique within the scope of the equipment.
 - SEMI E120.1 and the XML schema are changed accordingly. Primarily, the UuidType is replaced with xs:string as the data type for the uid type and any references using a uid value.
 - Some text was also added to clarify situations when an Equipment may contain another Equipment.
- **Failed** LI#4 – Addition of a “Locator” attribute to the Nameable class
 - Resubmitted from the 4160 ballot.
 - Proposed to add a Locators attribute to the Nameable class.
 - Corresponding SEMI E120.1 and XML schema changes were also proposed.
 - This line item has never been resubmitted.

4. Ballot Doc# 4597 → SEMI E120-1108 (LI#2–#4 only, schema changes)

- **Failed** LI#1 – Simplification of ExecutionElement attributes
 - Proposed the removal of the ExecutionElement attributes processName and processType.
 - This included changes to SEMI E120, E120.1 and the XML schema.
 - This line item has not been resubmitted, but it may be resubmitted in the future.

- LI#2 – Equipment component type attributes
 - Clarifies the EquipmentElement elementType attribute definition
 - Adds pre-defined elementType string values for various instances of Equipment, Module, and Subsystem. These values must be used wherever their definitions match the nature of the modeled components.
 - This approach also allows for the addition of new elementTypes without changing the schema.
- LI#3 – Equipment component identity attributes
 - Modifies the “Reqd” field for attributes to include “C” for conditional. When conditional, the criteria for being required are defined in the specification.
 - The EquipmentElement attributes supplier, make, model, modelRevision, function, and immutableId are changed to Reqd = “C” for conditional.
 - New text says “Each attribute is required when a value corresponding to that attribute has been associated with the EquipmentElement. For example, immutableId is a required attribute when the supplier has assigned a serial number (or equivalent) to that component of the equipment.”
 - When not required, the attributes can now be left out entirely. Note that the text in the attribute table still says that “Where this information cannot be determined or configured, it shall have the value ‘unknown’.” This was inadvertently left in the document and may be removed in future. Thus, one of these attributes that has no known value may be represented by either the string “unknown” or by excluding the attribute. The latter is preferred.
- LI#4 –Regular Expression changes in the SEMI E120 schema
 - The regular expressions in the “pattern” field for LocatorType and NameType give inconsistent results in Java and C#. These have been modified to simplify them and give correct and consistent results with these two commonly used programming languages.
 - The “pattern” that controls the contents of the LocatorType string is changed:
 - From: "`((([a-zA-Z])|([a-zA-Z][a-zA-Z\-. 0-9]*[a-zA-Z\-. 0-9])))/((([a-zA-Z])|([a-zA-Z][a-zA-Z\-. 0-9]*[a-zA-Z\-. 0-9])))`"
 - To: "`[a-zA-Z]([a-zA-Z\-. 0-9]*[a-zA-Z\-. 0-9])?(/[a-zA-Z]([a-zA-Z\-. 0-9]*[a-zA-Z\-. 0-9])?)`"
 - The “pattern” that controls the contents of the NameType string is changed:
 - From: "`([a-zA-Z])|([a-zA-Z][a-zA-Z\-. 0-9]*[a-zA-Z\-. 0-9])`"
 - To: "`[a-zA-Z]([a-zA-Z\-. 0-9]*[a-zA-Z\-. 0-9])?`"

Appendix E – SEMI E132 Changes from SEMI E132-1105 to E132-0709

SEMI E132-1105 was included in the EDA freeze

1. Ballot Doc# 4219 → SEMI E132-0306 (one line item, schema change)

- Removes non-persistent sessions
 - Removes the isPersistent attribute from the ActiveSession class.
 - Deletes the PersistSession() service from the SessionManager interface.
 - Changes affect SEMI E132, E132.1, and the XML schema.
- Minor editorial corrections
- Changes most schema and wsdl file references in SEMI E132.1 to be more indirect. Thus, when the file names change (e.g., version information), the references do not have to be updated as well.

2. Ballot Doc# 4363 → SEMI E132-0307 (one line item, schema change)

- Editorial changes only
 - Removes all instances of the binding target namespace name used in association with the SOAP Action.
 - Removes the names of the Port Type and Binding files included in each of the defined web service sections.

3. Ballot Doc# 4409 → SEMI E132-1107 (one line item, schema change)

- Note that this ballot passed committee review in April 2007 and would ordinarily have become SEMI E132-0707. However, the patent issue with EDA delayed final approval, pushing its release to 1107.
- Adds SEMI E128 XML Messaging Support based on SEMI E128-0706
 - SessionID attribute for ActiveSession now becomes an association to sessionID from SEMI E128.
 - The E132Header is replaced with the E128 xms:SyncHeader (Sync stands for “synchronous messaging”).
 - Various sections defining the old E132Header are removed.
 - This change affects SEMI E132, E132.1, and the schema and wsdl files.
- Adds the new EnhancedEstablishSession capability
 - Add the EnhancedEstablishSession service to the SessionManager interface.
 - This is an alternative to the existing EstablishSession service.
 - This capability allows the requestor to connect to selected services available from the EDA service provider. For example, the client might choose to connect to Metadata and DataCollection services, but not to a non-EDA capability, such as RecipeManagement.

- The naming of capabilities is specified and includes both the standard number and version. Thus, an equipment could, in theory, offer a connection to either E134-1105 or E134-0709 on the same equipment.
- Some editorial corrections are made in this ballot.

4. Ballot Doc# 4533 → SEMI E132-1108 (Line Items #1–#7, schema change)

- LI#1 – SEMI E132 and E132.1 – InterfaceDiscovery
 - A new InterfaceDiscovery interface is added to E132.
 - This interface allows a potential client to request the interface capabilities supported by the equipment. The requestor needs to know only the computer name or Ethernet address of the equipment. This eliminates the need for error-prone configuration of the client based on the equipment specification.
 - The new service is named “GetInterfaces().”
- LI#2 – SEMI E132 – Equipment Defined Privilege Usage Clarification
 - This line item clarifies that when a client with “SecurityAdmin” rights requests the equipment for a list of all defined privileges, the GetDefinedPrivileges response should include all the defined privileges, i.e., “allPrivileges” and “SecurityAdmin” privileges as well as those defined in another specification or by the implementer.
- LI#3 – SEMI E132 and E132.1 – Multiple Addition of Error Text and Error Codes
 - Line Item #3 was approved with editorial changes
 - This line item addresses the proper error reporting for the following:
 - A client attempts to create a second Administrator Principal
 - A client attempts to delete a Role that is currently assigned to a Principal
 - A client attempts to establish a session when the equipment is shutting down
- LI#4 – SEMI E132 – Editorial Corrections
 - These changes are editorial.
 - It includes correcting the data type of the Session Secret and the Client Id Proof of the Client Authenticate parameter definitions.
- LI#5 – SEMI E132 – Disabling Session Pings
 - SEMI E132 suggests a way to disable periodic pings by setting the ping interval to zero. This line item turns that suggestion into a standard method for disabling session pings.
- LI#6 – SEMI E132 – Clarification for ACLEntry Session
 - Line Item #6 was approved with editorial changes.
 - This line item limits a client to one active session per ACL Principal.
 - A client can still open multiple sessions, but each must be opened as a different Principal (i.e., with a different identity).

- LI#7 – SEMI E132 – CloseSession Notification Requirement
 - This line item removes the requirement for the equipment to send the SessionClosed Notification to a client closing its own session.

Appendix F – SEMI E128 Changes from Creation to SEMI E128-0706E

SEMI E128 was not part of the 1105 EDA Freeze

Note that SEMI E128 was originally created to define the XML structures required to encode message header or “envelope” information for asynchronous messages. The corresponding structures for synchronous messaging were originally defined in SEMI E132. The two definitions were merged in SEMI E128-0706, and later SEMI E132 was modified to remove the definition there and reference SEMI E128 instead.

The following show each SEMI E128-related ballot document, the resulting standard version, and a summary of the conceptual changes made by that ballot document. This document does not contain all technical details or a line-by-line compilation of the changes. The ballot proposals are SEMI copyright documents that are not publicly available from SEMI after the voting period.

1. Ballot Doc# 4034A → SEMI E128-0706 (Line Items #1–#4, schema change)

- LI#1 – Correct Namespace Description
 - As the title suggests, this is a simple change of the XML namespace.
 - This is not a conceptual change.
- LI#2 – Add Synchronous Header Elements
 - Adds “SyncHeader” to replace the “E132Header” formerly in SEMI E132.
 - Similarly, SynchHashHeader replaces E132HashHeader.
 - Rephrases the old header construct as “AsynchHeader.” Note that SEMI E128 was previously focused on asynchronous messaging. EDA uses synchronous messaging; this is added in the 4034A ballot.
- LI#3 – Correct description and usage of Fault header
 - Changed mention of “SOAP Faults” to a more general discussion of Faults.
 - The original SEMI E128 specified SOAP Faults, but EDA has never used them.
- LI#4 – Clarify usage of Action Header
 - The line items adds explanatory text:
 - “In a simple web service binding, the Action value will be the operation name for the web service (i.e., ActivatePlan or GetSEMIObjType as defined in SEMI E134 and E125).”

Appendix G – SEMI E138 Changes from Creation to SEMI E138-0709

SEMI E138 was not part of the 1105 EDA Freeze

SEMI E138 originally contained the definition of the “Error” construct used by EDA. The 1105 release did not directly reference SEMI E138. Each of the specifications (SEMI E125, E132, and E134) contained its own copy of the common components schema. The EDA standards were later updated to reference SEMI E138 directly.

More recently, SEMI E138 was updated to include the data type/format definitions from SEMI E125 and E134. These specifications were subsequently updated to remove those definitions and reference them in SEMI E138.

1. **Failed** Ballot Doc# 4595 (remains SEMI E138-0305; one line item, schema change)

- This ballot proposed to add to SEMI E138 data format definitions equivalent to the Parameter value formats from SEMI E125 and from SEMI E134.
 - This was reballoted and approved as 4595A.

2. **Ballot Doc# 4595A → SEMI E138-0309 (one line item, schema change)**

- This ballot adds to SEMI E138 a set of data format definitions equivalent to the Parameter types/formats from SEMI E125 and from SEMI E134.
 - The design of the formats changed in this process to correct some shortcomings and to align some of the differences in the two standards.
 - Note that this ballot and the subsequent changes to SEMI E125 and E134 decoupled units from the data type to provide a new flexibility and greater reusability of data types. This also reduces the total number of data types that must be defined.
 - Some of the changes to data formats include the following:
 - For the metadata, the simple data types are described using a single enumeration. Notice that for String type, the description no longer includes attributes for *language* and *maxCharacters*.
 - The VariableType, which was defined only in SEMI E125.1, is shown more clearly in SEMI E138.
 - The EnumerationType, which could contain either an EnumeratedInteger or EnumeratedString, is replaced with two separate types: EnumeratedInteger and EnumeratedString.
 - The ParameterValue is redesigned (and renamed to PV), adding more detailed simple data types and reflecting the other changes to SEMI E138.

3. Ballot Doc# 4729 → SEMI E125-0709 (single line item)

- Line Item #1 – This ballot corrects an XML error left in SEMI E138-0309. The details of that error are not included here. Some other minor issues are also addressed.
 - The Value Type (PV) was modified to reduce the number of times the SEMI E138 namespace would have to be repeated in data reports.
 - The “null” type was removed, because XML already handles null values.
 - The TypeDef class was removed to ensure that Structures use only defined types. This reduces the overall complexity of the metadata.

Appendix H – SEMI E145 Changes from Creation to SEMI E128-0306

SEMI E145 was not part of the 1105 EDA freeze

SEMI E145 was created to provide a common way to define units within the context of XML-formatted communications. This specification was created after the 1105 release of EDA and thus was not a part of the first EDA freeze. Subsequent updates to the EDA standards added references to SEMI E145.

1. Ballot Doc# 3851C → SEMI E145-0306 (new standard, includes schema file)

- A new specification was approved that contains the Unit object definition, references to common basic unit definitions, and methods for building complex unit definitions from the basic units.

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