

SEMI E54.24-1116 (Reapproved 0124) SPECIFICATION FOR SENSOR/ACTUATOR NETWORK SPECIFIC DEVICE MODEL OF A GENERIC EQUIPMENT NETWORKED SENSOR (GENSen)

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NOTICE: The section symbol (§) is used to reference a numbered section, paragraph, or header and all subordinate paragraphs, headers, and embedded material (i.e., EXCEPTIONs, lists) therein. The paragraph symbol (§) is used to reference a particular numbered paragraph and embedded material therein. When duplicated (i.e., §§ and §§) the symbols are used to reference more than one section or paragraph, respectively.

NOTICE: Paragraphs entitled ‘NOTE:’ are not an official part of this Standard or Safety Guideline and are not intended to modify or supersede the official Standard or Safety Guideline. These have been supplied by the global technical committee to enhance the usage of the Standard or Safety Guideline.

1 Purpose

1.1 This Specification is part of a suite of Standards which specify the implementation of SEMI Standards for the Sensor/Actuator Network. The specific purpose of this Specification is to describe a network-independent application model of a generic sensor device measuring one or more phenomena on a piece of semiconductor manufacturing equipment and communicating over a sensor/actuator communication network. Oftentimes such sensors are added onto the equipment as they might provide a capability that is not provided with the current equipment configuration.

2 Scope

2.1 This Standard describes a specific device structure and behavior of a generic equipment networked sensor. This could include a sensor added onto the equipment that communicates over a sensor/actuator communication network. It could also include a sensor that is part of the default configuration of the equipment, communicating over a sensor/actuator communication network.

2.2 This Standard is applicable to sensors which are regarded as data producers only. A configuration or control of the sensor device (e.g., described by a third entity) is outside the scope of this Standard.

2.3 This Standard does not define terms which have been defined already in other referenced Standards.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 This Standard is only applicable to sensors that are measuring analog phenomena or digital phenomena utilizing an analog method. They may report the phenomena as an analog or digital data type. Thus, for example, typical temperature sensors and residual gas analyzers are within scope.

3.2 This Standard is not applicable to sensors for which a specific device model (SDM) exists (e.g., in situ particle monitor).

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI E39 — Specification for Object Services: Concepts, Behavior, and Services

SEMI E54 — Specification for Sensor/Actuator Network

SEMI E54.1 — Specification for Sensor/Actuator Network Common Device Model

SEMI E90 — Specification for Substrate Tracking

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 *GENSen* — Generic Equipment Networked Sensor (GENSen may also be used herein to mean ‘GENSen device’.)

5.1.2 *ASM-GENSen* — Assembly GENSEn (object)

5.1.3 *CTX-GENSen* — Context-GENSen (object)

5.1.4 *SAI-GENSen* — Sensor Analog Input-GENSen (object)

5.1.5 *FDC* — fault detection and classification

5.1.6 *CDM* — Common Device Model

5.1.7 *NCS* — Network Communication Standard

5.1.8 *SDM* — Specific Device Model

5.2 Definitions

5.2.1 *context data* — data which identify a specific manufacturing process or a sub process and the substrate which is processed and its location within the manufacturing equipment.

5.2.2 *data report* — a list of attributes for a single object. Data reports may be pre-defined.

5.2.3 *generic equipment networked sensor device* — measurement device which is connected to manufacturing equipment and communicates via a sensor/actuator network. It may be connected optionally in order to measure values which represent properties of the equipment or the process running.

5.2.4 *RecipeID* — an identifier of a pre-planned and reusable portion of the set of instructions, settings, and parameters under control of a processing agent that determines the processing environment seen by the material (e.g., wafer).

5.2.5 *recipe step* — a distinct subset of process specification of the recipe that represents a significant change in the recipe execution conditions or instructions from the steps that precede or follow. A recipe step is completely contained within a single recipe component.

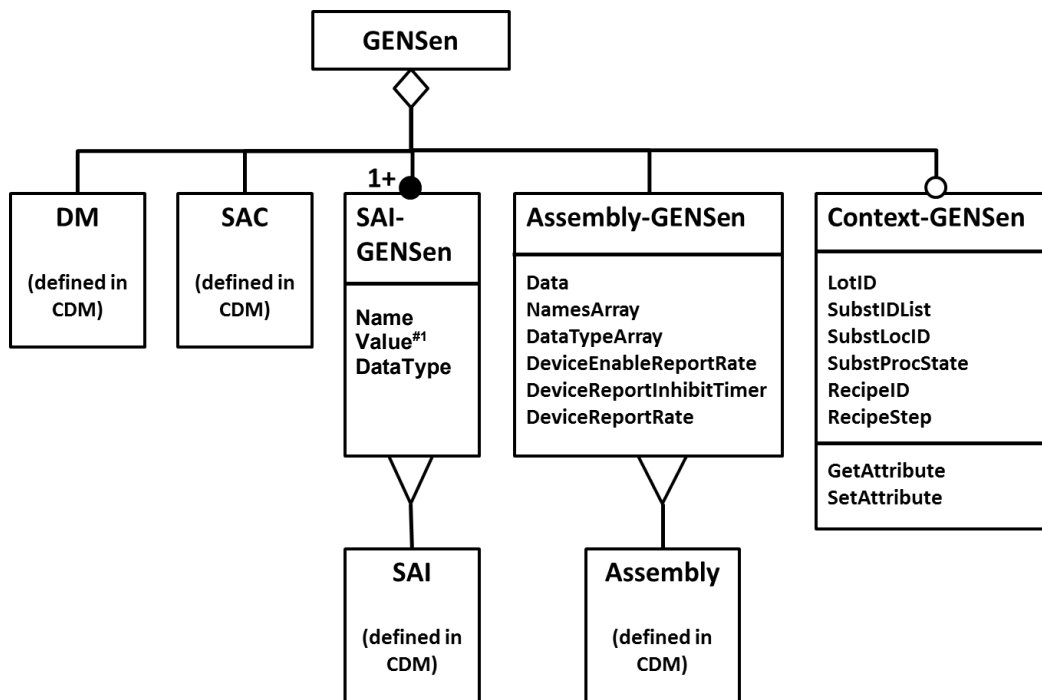
6 Device High Level Structure

6.1 *Background* — Every networked equipment sensor, especially those added to the equipment, can benefit from even a very basic specific device model. Control data usually provided from the equipment such as rf-power and chamber pressure does often not allow a sufficient characterization of the process in terms of Advanced Process Control, e-diagnostic, or Enhanced Equipment Quality Assurance. Legacy equipment is often limited in its capability to deliver the required amount of data. Sensors added onto the equipment can sometimes overcome this lack of capability in many instances by providing data directly into the Fault Detection and Classification (FDC) system using a unified interface. This SDM could be used to provide a model that would facilitate providing sensor data with appropriate context (e.g., RecipeID) to support its use in these applications. This basic model can establish a level of interoperability and interchangeability that represents an enhancement over the Common Device Model (CDM); for example, by specifying the communication of certain context or other characterization data.

6.2 *General Description* — A generic equipment networked sensor (GENSen) device is made up of a Device Manager Object, a Sensor Actuator Controller Object, one or more Sensor Analog Input-GENSen Objects, an Assembly-GENSen Object, and optionally a Context-GENSen object. The values which a GENSEn device delivers are represented respectively by instances of its Sensor Analog Input-GENSen Object. A data structure as an attribute of the Assembly-GENSen Object is defined which contains all available values, i.e. the sensor data, together with a data time stamp and the exception status. Additionally, the Assembly-GENSen object of the GENSEn device has the attribute *DataTypeArray* of each value of a Sensor Analog Input-GENSen Object instance. A data consumer connected to the SAN may read the data structure as an attribute of the Assembly-GENSen Object to get all of the data of the sensor. The consumer may also read the *NamesArray* of the Assembly-GENSen Object which describes the sensor

data and the DataTypeArray which gives all information to convert the data bytes to the appropriate format. That means the data consumer; that is, the client, can generally get, over the communication network, most or all of the required information to determine how to interact with the sensor. The GENSen sensor may identify itself by its descriptors of the data values and its data types. The GENSen sensor measures values relevant for processing; for example, from the manufacturing equipment. It is a data producer only; any need or mechanism for control or configuration is outside the scope of this Document. The GENSen sensor has a Context-GENSen Object optionally. The attributes of the Context-GENSen Object can be written by a client to transfer context data to the sensor device. The sensor device may use the context data; for example, algorithms selected based on the process recipe used.

6.2.1 *Generic Equipment Networked Sensor (GENSen) Device Description* — The high-level object view of a GENSen is shown in Figure 1. The GENSen is built up of objects as described in Figure 1 which include those defined in the CDM and an optional Context Object.



#1 Value attribute specification in SAI-GENSen object is inherited from SAI object with no additional specification; included here for clarity.

Figure 1
High-Level Object View of a Generic Equipment Networked Sensor Device (GENSen)

6.2.1.1 Each data value delivered by the GENSen is referred to as an attribute ‘Value’ of an instance of the Sensor Analog Input-GENSen object. If the GENSen delivers n values – n instances of the SAI-GENSen have to be established. The Assembly Object of the GENSen contains a data attribute which is a structure that includes the values of all instances of the SAI-GENSen, along with a single data time stamp and the exception status both of which are attributes of the DM. Additionally it contains arrays of descriptors and of data types referring to the values the GENSen delivers. All relevant information about the sensor parameters is concentrated in the Assembly-GENSen Object (ASM-GENSen).

6.2.2 General Requirements

6.2.2.1 *Device Objects* — All objects are defined in terms of their object name and instance identifier. Identifiers for all objects described in this Document are summarized in Table 1.