

SEMI E131-0304

SPECIFICATION FOR THE PHYSICAL INTERFACE OF AN INTEGRATED MEASUREMENT MODULE (IMM) INTO 300 mm TOOLS USING BOLTS-M

This specification was technically approved by the Global Physical Interfaces & Carriers Committee and is the direct responsibility of the North American Physical Interfaces & Carriers Committee. Current edition approved by the North American Regional Standards Committee on December 4, 2003. Initially available at www.semi.org February 2004; to be published March 2004.

1 Purpose

1.1 This document establishes the specification for the interface requirements between an integrated measurement module (IMM) and 300 mm tools using an interface as defined by SEMI E63 (BOLTS-M).

NOTE 1: The 1997 and 2000 SIA roadmaps call for the implementation of metrology integrated with process tools. Such technology is important as specifications tighten the cost of monitor substrates at larger size increases, and as materials and processing steps become more complex.

NOTE 2: The 300 mm equipment generation offers an opportunity for integration of measurement equipment modules in a configuration that could be standard across different tools.

1.2 The standard will permit the tool suppliers, robotics suppliers, and measurement module suppliers, to provide plug and play integrated measurement solutions on a mechanical level.

1.3 It is the purpose of this standard to facilitate process monitoring through rapid access to measurement data, to reduce material handling between process and measurement equipment, and to provide the opportunity to increase process monitoring with a minimum or no decrease in throughput.

2 Scope

2.1 This standard is intended to set an appropriate level of specification that places minimal limits on innovation while ensuring modularity and interoperability at all mechanical interfaces. It establishes the mechanical interface specifications for integration of measurement modules intended for, but not limited to, 300 mm process tools using a BOLTS-M interface, while utilizing existing SEMI Standards as much as possible.

2.2 This standard specifies that SEMI E63 is utilized for the tool side of the interface.

2.3 This standard covers the following topics:

- General physical requirements for integration of the IMM,

- Nominal wafer-seating plane within the IMM,
- Maximum outer dimensions of the IMM, in case it is located at the front of a tool.

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 This standard does not specify the location of the IMM relative to the tool.

3.2 This standard does not specify facility or communication interfaces.

3.3 No materials requirements or micro-contamination limits are given.

3.4 Substrate input and retrieval will be the obligation of the tool.

4 Referenced Standards

4.1 SEMI Standards

SEMI E1.9 — Mechanical Specification for Cassettes Used to Transport and Store 300 mm Wafers

SEMI E15 — Specification for Tool Load Port

SEMI E15.1 — Specification for 300 mm Tool Load Port

SEMI E47.1 — Provisional Mechanical Specification for Boxes and Pods Used to Transport and Store 300 mm Wafers

SEMI E57 — Mechanical Specification for Kinematic Couplings Used to Align and Support 300 mm Carriers

SEMI E63 — Mechanical Specification for 300 mm Box Opener/Loader to Tool Standard (BOLTS-M) Interface

SEMI E64 — Specification for 300 mm Cart to SEMI E15.1 Docking Interface Port

SEMI E127 — Specification for Integrated Measurement Module Communications: Concepts, Behavior, and Services (IMMC)

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 IMM — Integrated Measurement Module

5.2 Definitions

5.2.1 *bilateral datum plane* — a vertical plane that bisects the substrates and that is perpendicular to both the horizontal and facial datum planes. (As defined in SEMI E57.)

5.2.2 *BOLTS plane* — a plane parallel to the facial datum plane near the front of the tool where the box/opener loader is attached. (As defined in SEMI E63.)

5.2.3 *facial datum plane* — a vertical plane that bisects the wafers and that is parallel to the front side of the carrier (where wafers are removed or inserted). On tool load ports, it is also parallel to the load face plane specified in SEMI E15 on the side of the tool where the carrier is loaded and unloaded. (As defined in SEMI E57.)

5.2.4 *horizontal datum plane* — a horizontal plane from which projects the kinematic-coupling pins on which the carrier sits. On tool load ports, it is at the load height specified in SEMI E15 and might not be physically realized as a surface. (As defined in SEMI E57.)

5.2.5 *integrated measurement module (IMM)* — a measurement module intended to be integrated into manufacturing equipment, and with the capability of receiving substrates from the equipment, measuring those substrates, and returning the substrates and the measurement results to the equipment and other concerned clients. (As defined in SEMI E127.)

5.2.6 *measurement module* — an equipment module whose intended function is to measure or inspect the product and to report the results. Measurement of the product is the factory's means of gaining feedback on the manufacturing process. (As defined in SEMI E127.)

5.2.7 *nominal wafer-seating plane* — horizontal plane that bisects the wafer pick-up volume. (As defined in SEMI E1.9.)

6 Requirements

6.1 The IMM is required to mate with an interface as defined by SEMI E63. This includes meeting the requirements for the hole opening, bolt hole pattern, and other relevant requirements. Note that certain requirements in SEMI E63, such as y76 (facial datum plane when carrier is undocked), do not have relevance for the IMM but will not be in conflict.

6.2 *Use of Datum Planes* — The location in space where a substrate is delivered to an IMM is the intersection of three orthogonal datum planes defined in other standards: the facial datum plane, the nominal wafer-seating plane and the bilateral datum plane. The BOLTS plane, as in SEMI E63, is defined to be parallel to, and at a distance of y70 from the facial datum plane.

6.2.1 *Bilateral Datum Plane* — All bilateral dimensions of the interface are symmetric about the bilateral datum plane as shown in Figure 1.

6.2.2 *Facial Datum Plane* — This is the vertical plane, parallel to the BOLTS plane, which bisects the substrate at the insertion and removal position of the substrate inside of the IMM. The distance from the BOLTS plane to the facial datum plane in the IMM is determined by y70 of SEMI E63.

6.2.3 *Nominal Wafer-Seating Plane* — The nominal wafer-seating plane is the horizontal plane within the IMM where a substrate is to be loaded to or unloaded from by the tool. It can be anywhere between the given minimum and maximum values that follow. This range is not defined by a single standard, rather it results from a combination of dimensions of SEMI E1.9, SEMI E15.1 and SEMI E47.1. (See Figure 1.)

6.2.3.1 The minimum value for a nominal wafer-seating plane is the sum of $(H + z44 + z8)$, measured from the floor.

6.2.3.2 The maximum value for a nominal wafer-seating plane is calculated by $(H + z44 + z8 + (25-1) * z12)$, measured from the floor.

6.2.3.3 For both calculations, H is from SEMI E15.1, z44 is from SEMI E47.1, and z8 and z12 are from SEMI E1.9.

6.3 *Internal Clearances* — There are requirements relating to clearances inside the IMM. These relate to robot arm requirements for substrate handoff, and can be referenced from SEMI E1.9 and SEMI E47.1 as the same restrictions apply.

6.3.1 This includes clearance in front of the wafer set-down location of radius r3, and heights bounded by z11 and z10 relative to the nominal wafer-seating plane. All clearance requirements above the highest and below the lowest slot from SEMI E1.9 and SEMI E47.1 must