

ALPS 3 Default SECS II Interface Requirements

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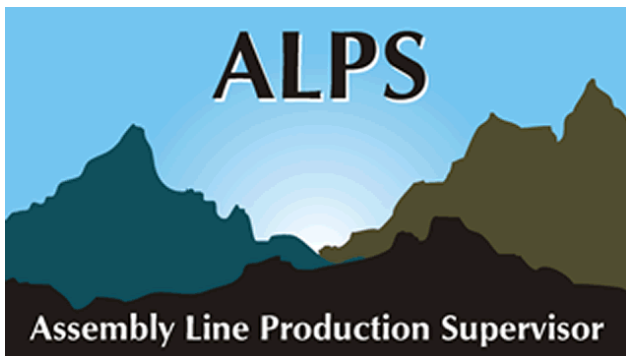
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ALPS 3 DEFAULT SECS II INTERFACE REQUIREMENTS

INTRODUCTION

This document is complementary to the ALPS Default SECS-II Die Pick Interface (Ref. [9]). It describes additional and updated SECS-II messages, data items and parameters, used for the SECS-II communication between equipment and ALPS 3. Unlike the Die Pick Interface document this document applies to a wide range of equipment type, including but not limited to; Inspection, Die Bonders, Pick and Place, Molding, Striptest, Laser Mark and Singulation.

This document describes a "Default" interface. A new implementation based on this interface should be widely applicable since it is based on the best practices to communicate the necessary data, according to the SEMI standards, at the time of writing. However, for equipment that has already implemented some form of wafer mapping, event reporting, services, these can be used as is as long as they are capable of transmitting the necessary information in a timely fashion.

This specification should be viewed as a (strong) recommendation. Provided that the interface complies with the SEMI standards mentioned, it need not comply with all details with this document. On receipt of full documentation, KINESYS will provide a machine type-specific interface for ALPS.

Not all the capabilities described are applicable to every equipment type. For example, a die bonder may not handle trays and therefore does not need tray map download and upload. Even if a capability is applicable, e.g. strip map upload from a die bonder, it need not be implemented immediately. However, all applicable capabilities add significant value to the end user of the equipment and may be available from other competitive vendors. So it is advised that the implementation of missing capabilities should at least be scheduled for inclusion in a future release of the equipment software.

As a first step the equipment vendor should complete the Compliance with Standards section.

REFERENCES

- [1] SEMI Equipment Communications Standard 2 Message Content (SECS-II), SEMI document E5-0303
- [2] Generic Model for Communications and Control of Manufacturing Equipment (GEM), SEMI document E30-0303
- [3] Object Services Standard: Concepts, Behavior, and Services), SEMI document E39-1102
- [4] Specification for Substrate Tracking, SEMI document E90-0303
- [5] Specification for Substrate Mapping, SEMI document E142
- [6] Specification for Substrate Mapping XML Schema, SEMI document E142.1
- [7] Specification for Substrate Mapping SECS II Protocol, SEMI document E142.2 (4067)
- [8] Guide for Style & Usage of XML for Semiconductor Manufacturing Applications, SEMI document E121-0303
- [9] [ALPS Default SECS-II Die Pick Interface, Revision 2.7](#)

TERMINOLOGY

Substrate – (see ref [5]) “Any carrier of a two-dimensional array of devices including, but not limited to: wafers, trays, strips, tape, panels, or boards”. In ALPS 3 a substrate is either a wafer, frame (with a wafer mounted on it), a strip or a tray.

Carrier – The definition of substrate carrier and carrier slot in ref [4] imply that a carrier has slots that contain substrates such as wafer cassettes, strip magazines, and tray stacks. It can be argued that a tray is also a substrate carrier. However, for the purposes of ALPS 3 carrier is defined according to the apparent intent of ref [4], i.e. a wafer cassette, strip magazine or tray stack with slots.

REVISION HISTORY

Revision 1 – May 12th, 2003

- ❑ Initial draft.

Revision 2 – May 13th, 2003

- ❑ Changed name to ALPS Default SECS II Interface.
- ❑ Extended Introduction.
- ❑ Added Compliance with Standards
- ❑ Added Wafer Map Download and Upload.
- ❑ Added Download Data (object attribute request) and included LayoutDownload.
- ❑ Revised examples in Status Variables.

Revision 3 – September 19th, 2003

- ❑ Renamed DeviceTrackingReport to DeviceSelectedReport
- ❑ Simplified description of equipment behavior for AtDestination event.

Revision 4 – June 24th, 2004

- ❑ Replaced references to Object and Event Services with SEMI G85 by SEMI 4032.1 MapData SECS II Protocol.
- ❑ Replaced references to SEMI 3754 Device Tracking Data by SEMI 4032 MapData.
- ❑ Updated examples of BinCodeMap, DeviceIdMap, TransferMap and Layout to correspond with the latest version of the SEMI 4032.2 XML Schema.
- ❑ Renamed SubstrateMap Upload, Report and Data to BinCodeMap Upload, Report and Data.
- ❑ Renamed DeviceTracking Upload, Report and Data to TransferMap Upload, Report and Data.
- ❑ Renamed DeviceId Upload, Report and Data to DeviceIdMap Upload, Report and Data
- ❑ Renamed DieColumn and DieRow to X and Y for consistency with 4032.

Revision 5 – September 15th, 2004

- ❑ Replaced references to SEMI G81 to SEMI 4032

Revision 6 – February 28th, 2005

- ❑ Replaced references to SEMI 4032 to approved standard designation SEMI E142. The E142 sub documents will be numbered as follows...
 - SEMI E142.1 XML Schema for Substrate Mapping
 - SEMI E142.2 (4067) SECS II Protocol for Substrate Mapping
 - SEMI E142.3 (4068) Web Services for Substrate Mapping
- ❑ Updated Standard Compliance Tables

COMPLIANCE WITH STANDARDS

This section provides a check list for the capabilities that equipment might support for substrate mapping (see) and traceability.

Not all the capabilities will apply to all equipment types. Where there are multiple options for one capability (e.g. bin code map download) the preferred approach is to use the SEMI E142 standard suite. New implementations should always be based on SEMI E142.

The tables below show the applicable standard document and description of each capability and a check box for equipment vendors to specify whether or not the capability is supported.

If capability is supported but is not compliant with the standard the equipment vendor should provide details of the alternative equipment interface that realizes this capability.

Table 1: Standards Compliance: Substrate Mapping

Document	Capability	Supported ¹	Description
SEMI E30-1000 Generic Equipment Model (GEM)	Establish Communications	<input type="checkbox"/>	Support bi-directional (H>E and H<E) stream 1 F1/2 or F13/14 transactions
	Device Events	<input type="checkbox"/>	Events: DeviceStarted, DevicePicked, DevicePlaced ²
SEMI E142.2 (4067) SECS II Protocol for Substrate Mapping³	BinCode Map Download	<input type="checkbox"/>	Download bin code map data
	BinCode Map Upload	<input type="checkbox"/>	Upload bin code map data
	Layout Download	<input type="checkbox"/>	Download layout map data
	Layout Upload	<input type="checkbox"/>	Upload layout map data
SEMI E5-0702 SECS II	Substrate Tracking	<input type="checkbox"/>	Substrate Location: AtSource, AtWork, AtDestination, Removed
	SECS2 wafer map Download	<input type="checkbox"/>	Stream 12 Type 2 (F3,F4,F15,F16)
	SECS2 wafer map Upload	<input type="checkbox"/>	Stream 12 Type 2 (F1,F2,F9,F10)
SEMI G84-0303	Strip Map Download	<input type="checkbox"/>	Strip Map Download
	Strip Map Upload	<input type="checkbox"/>	Strip Map Upload
Flat File⁴	Flat File Map Download	<input type="checkbox"/>	
	Flat File Map Upload	<input type="checkbox"/>	

¹ Please indicate if capability is supported but is not compliant with the standard. Please include details of how the host should interface with the equipment to realize this capability.

² Please refer to [ALPS Default SECS-II Die Pick Interface, Revision 2.7](#).

³ Exchange data compliant with the SEMI E142.1 schema via SECS II. Compliance with SEMI E142 and E142.1 also required.

⁴ Please supply detailed format specification and some representative examples. Kinesys Software will verify format against the existing format converter library for ALPS. If a suitable converter is not found then Kinesys Software will develop a new converter. The ALPS format converter name should be entered in the description column.

Table 2: Standards Compliance: Traceability

Document	Capability	Supported⁵	Description
SEMI E142.2 (4067) SECS II Protocol for Substrate Mapping⁶	Transfer Map Download	<input type="checkbox"/>	Download transfer map data
	Transfer Map Upload	<input type="checkbox"/>	Upload transfer map data
	DeviceId Map Download	<input type="checkbox"/>	Download device id map data
	DeviceId Map Upload	<input type="checkbox"/>	Upload device id map data
	Layout Download	<input type="checkbox"/>	Download layout map data
	Layout Upload	<input type="checkbox"/>	Upload layout map data
SEMI E90-0301 Substrate Tracking	Carrier Tracking	<input type="checkbox"/>	Carrier Location: Occupied, Unoccupied
	Substrate Tracking	<input type="checkbox"/>	Substrate Location: AtSource, AtWork, AtDestination, Removed
SEMI E90-0301 Substrate Tracking	Carrier Tracking	<input type="checkbox"/>	Carrier Location: Occupied, Unoccupied
	Substrate Tracking	<input type="checkbox"/>	Substrate Location: AtSource, AtWork, AtDestination, Removed

⁵ Please indicate if capability is supported but is not compliant with the standard. Please include details of how the host should interface with the equipment to realize this capability.

⁶ Exchange data compliant with the SEMI E142.1 schema via SECS II. Compliance with SEMI E142 and E142.1 also required.

WAFER MAP DOWNLOAD AND UPLOAD

The [ALPS Default SECS-II Die Pick Interface, Revision 2.7](#) document has been in use for several years and many Die Pick (e.g. die bonder and pick and place) equipment have based their wafer mapping interface to ALPS on it.

To avoid unnecessary development work at the equipment vendor, this is still the default interface for wafer map download and upload and device selected events for the real-time equipment display defined in the Table 1: Standards Compliance: Substrate Mapping.

However, some equipment vendors may chose to use the **SEMI E142.2 (4067) Substrate Mapping SECS II Protocol** for wafer map download and upload, for consistency with the protocol used for strip and tray maps. This is fully supported by KINESYS. We believe that in time the old Stream 12 wafer mapping messages will be replaced by this technique.

For new equipment that supports wafer mapping, it is recommended that the **SEMI E142.2 (4067) Substrate Mapping SECS II Protocol** for wafer map download and upload are chosen.

DOWNLOAD DATA (OBJECT ATTRIBUTE REQUEST)

Equipment may download individual Status Variables using Object Services GetAttr (S14F1/F2). The variables that may be downloaded are described below.

Equipment should upload data as an attachment to a collection event⁷ (see Upload Data (events)).

SUBSTRATE MAP DOWNLOAD

BinCodeMapDownload

Equipment may download and upload bin code maps at any time. The following behaviour is expected from the equipment:

- ❑ Download the bin code map when it starts using the substrate.
- ❑ When the equipment decides to save an updated bin code map, it should send an Upload event with a report containing the updated map to ALPS.
- ❑ In the meantime, the equipment may decide to download the bin code map again for any reasons. In that case, it will receive the last bin code map version saved by ALPS:
 - The last uploaded map, in case the equipment did an upload and since then the bin code map has not been changed on the ALPS GUI
 - An edited bin code map, in case the (uploaded) bin code map was edited by an operator after the last upload
 - A saved, partially picked bin code map, in case the picked bin code map shown on the ALPS screen has been saved (by the ALPS operator or automatically after communication loss)

⁷ Existing equipment that has already implemented the SECS II wafer map messages are not required to convert to using object services and event reporting for download and upload of maps. See Wafer Map Download and Upload.

- The downloaded bin code map that has already been sent earlier, in case no upload was done by the machine and no partially picked map was saved either
- Between the initial download and the final upload the equipment can decide to do additional uploads, for instance to save the current status in the ALPS database, in case operator actions are to be expected that could destroy the bin code map information on the machine. The equipment should however be careful not to perform such additional uploads too often, because all such bin code maps are to be maintained in the ALPS database as individual versions.

LayoutDownload

Equipment that needs detailed knowledge of a substrate layout can download the LayoutData from ALPS if it is available.

See also LayoutData.

UPLOAD DATA (EVENTS)

The following events may be sent via the GEM Event Reporting services (See Ref [2]).

The events listed may be sent to upload specific data to ALPS. The data is included in Reports which contain Status Variables. Please see those sections for more details.

It may be that several of the events listed are always sent at the same time. In that case a new event may be defined, e.g. "AfterWork", to which several reports are attached. This must be carefully described in an equipment specific interface definition.

DEVICE SELECTED

These events are sent per device and are used by ALPS to provide a real-time display of the process, e.g. picking devices⁸.

These events are not essential to operation but they do provide the user with useful feedback and are also used to save a partially picked map in the case of a failure, so that the process can be restarted where it left off.

The events are the same as defined in the Real-time Substrate Map Display section of Ref. [9], but the attached report contains more information.

Next Die To Be Processed	
CEID	t.b.s.
Attached report:	DeviceSelectedReport
Equipment behaviour:	See Ref. [9]
ALPS behaviour:	See Ref. [9]

Die Has Been Picked	
CEID	t.b.s.
Attached report:	DeviceSelectedReport
Equipment behaviour:	See Ref. [9]
ALPS behaviour:	See Ref. [9]

Die Has Been Placed	
CEID	t.b.s.
Attached report:	DeviceSelectedReport
Equipment behaviour:	See Ref. [9]
ALPS behaviour:	See Ref. [9]

⁸ It is only appropriate to send these events if they occur once every three seconds or more. This is the case with most die bonders and pick and place equipment.

SUBSTRATE TRACKING UPLOAD

The equipment should implement the Substrate Transport part of the SEMI E90 Substrate Object State Model (see ref [4]), in particular the Substrate Transport States AT SOURCE, AT WORK and AT DESTINATION with corresponding collection events for the state transitions.

It is assumed that each substrate is assigned to the equipment for a certain period of time. This period starts when the equipment sends an AtSource event (see ref [5]), meaning that the substrate has been taken into use. That event could for instance be issued after the substrate is unloaded for the first time from the carrier and the substrate ID has been read. The period ends when a CarrierUnoccupied event is sent for a carrier containing the substrate, or a

Removed event is sent to indicate that an individual substrate has been manually removed from the equipment.

While assigned to the equipment the substrate the substrate is either in the AT SOURCE, AT WORK or AT DESTINATION states (according to the state model in ref [5]). Changes of the physical location of the substrate are reported by successive AtWork collection events. ALPS assumes that the equipment reports all substrate movements to all physical locations (so there should be no "undefined" locations). Note that if a substrate is put back in the carrier for some time, with the intention to take it out again during the same run, the substrate stays AT WORK.

This interface specification takes into account that a substrate may be taken out of use for exceptional reasons. This will for instance be the case when an operator manually removes a substrate from the equipment, without the intention to put it back (at the same location, or back into the carrier, etc.). When the equipment notices such actions it should report them by sending a

Removed event.

When a substrate is removed from a location and placed back in the carrier or perhaps another process location, the equipment should send the appropriate AtSource or AtWork event, specifying the location where the substrate is.

The Removed event may also be used when an individual substrate leaves the equipment not in a carrier, for example if the equipment is part of an integrated single substrate line.

When any of the substrate tracking events are received and the location is unknown to ALPS, an error message is produced and ALPS resynchronizes the list of locations and substrates being processed by requesting the SubstrateTrackingData.

When AtSource, AtWork or AtDestination events are received and the substrate is not yet assigned to the equipment, an error message is produced and ALPS resynchronizes its information about substrates being processed on the machine by requesting the SubstrateTrackingData.

AtSource

AtSource	
CEID	t.b.s.
Attached report:	SubstrateTrackingReport
Equipment behaviour:	This event is sent by the equipment when it a new substrate is detected that needs to be processed. The substrate location and identifier must be reported with the event. If the substrate is in a carrier location, the SubstrateTrackingReport should specify the carrier and slot number. This may only be possible be when the substrate is first unloaded from a carrier, and identified ⁹ .
ALPS behaviour:	ALPS will (re)assign the substrate to the equipment, record its current location and transport state (AT SOURCE) and update the substrate tracking history. The substrate will be available on the ALPS Equipment screen.

AtWork

AtWork	
CEID	t.b.s.
Attached report:	SubstrateTrackingReport
Equipment behaviour:	The equipment send this event when a substrate arrives at a location. This should only be done for substrates for which an AtSource or an AtWork event has been sent, not having yet been followed by a AtDestination event.
ALPS behaviour:	ALPS will record the new current location and transport state (AT WORK) and update the substrate tracking history. The substrate will be available on the ALPS Equipment screen.

⁹ In this case the AtSource event will be immediately followed by an AtWork event for the same substrate, specifying the new location.

AtDestination

AtDestination	
CEID	t.b.s.
Attached report:	SubstrateTrackingReport
Equipment behaviour:	The equipment sends this event when the substrate processing is complete and it has been returned to its final destination in the equipment, typically a slot in the carrier.
ALPS behaviour:	ALPS will record the new current location and transport state (AT DESTINATION) and update the substrate tracking history. The substrate will be available on the ALPS Equipment screen.

Removed

Removed	
CEID	t.b.s.
Attached report:	SubstrateTrackingReport
Equipment behaviour:	The equipment sends this event when a substrate has been manually removed from a process location. This only needs to be done for substrates AtSource or AtWork.
ALPS behaviour:	ALPS will unassign the substrate from the equipment, record that its current location and transport state are unknown and update the substrate tracking history. The substrate will no longer be available on the ALPS Equipment screen.

CARRIER TRACKING UPLOAD

Collection events are provided both for the entry and removal of carriers from (one of the) carrier location(s). The equipment should base such events on high-level status information about the carriers¹⁰.

The CarrierOccupied event should be sent when the carrier has been placed on the equipment and any information necessary to process that carrier has been entered (e.g. the carrier ID which corresponds with the ALPS Run ID).

The CarrierUnoccupied event, should be sent when the logical state of the carrier (as far as the equipment is concerned) has been changed to “finished processing”. This may be before or after the carrier is physically removed.

CarrierOccupied

CarrierOccupied	
CEID	t.b.s.
Attached report:	CarrierTrackingReport
Equipment behaviour:	The equipment sends this event when a carrier has arrived at a carrier location and is taken into use by the equipment.
ALPS behaviour:	<p>ALPS will record that the carrier location is now OCCUPIED.</p> <p>If a RunId is supplied then the slots in the carrier will be populated by triggering AtSource events for all the substrates in the run.</p> <p>If there is no RunId then the first AtSource event received for this carrier will populate the carrier by triggering AtSource events for the other substrates in the same run. The time recorded for the AtSource events will match the CarrierOccupied event time.</p> <p>If slot number information is not available then the substrates will be assigned to sequential slots but the slot number field will be empty.</p>

¹⁰ One reason for this is to avoid erroneous reports from a faulty carrier presence sensor from triggering multiple events.

CarrierUnoccupied

CarrierUnoccupied	
CEID	t.b.s.
Attached report:	CarrierTrackingReport
Equipment behaviour:	The equipment sends this event when a carrier has been put out of use by the equipment and has been removed from a carrier location.
ALPS behaviour:	ALPS will record that the carrier location is now UNOCCUPIED. The carrier will be de-populated by triggering Removed events for all the substrates in the run.

SUBSTATE MAP UPLOAD

BinCodeMapUpload

BinCodeMapUpload	
CEID	t.b.s.
Attached report:	Error! Reference source not found.
Equipment behaviour:	The equipment sends this event when it has a substrate map ready for upload to ALPS.
ALPS behaviour:	ALPS will read the uploaded Error! Reference source not found. and update the database.

TransferMapUpload

TransferMapUpload	
CEID	t.b.s.
Attached report:	Error! Reference source not found.
Equipment behaviour:	The equipment sends this event when it has collected the device tracking data for a substrate ready for upload to ALPS.
ALPS behaviour:	ALPS will read the uploaded Error! Reference source not found. and update the database.

DeviceIdMapUpload

DeviceIdMapUpload	
CEID	t.b.s.
Attached report:	DeviceIdMapReport
Equipment behaviour:	The equipment sends this event when it has completed marking the devices on a substrate and is ready to upload the traceability codes to ALPS.
ALPS behaviour:	ALPS will read the uploaded DeviceIdMapData and update the database.

LayoutUpload

Equipment that must make accurate measurements of a substrate layout, e.g. a prober, in order to perform its process can upload the Layout data to ALPS

LayoutUpload	
CEID	t.b.s.
Attached report:	LayoutReport
Equipment behaviour:	The equipment sends this event when it has measured the dimensions of the features on a substrate and is ready to upload the layout to ALPS.
ALPS behaviour:	ALPS will read the uploaded LayoutData and update the database.

REPORTS

These reports will be attached to the collection events as described in the section on Upload Data (event).

Dependent on the equipment implementation of the SECS-II interface, the reports and their links to collection events can either be hard-coded ("canned" reports), or they will be defined and linked by ALPS using the GEM Dynamic Event Report Configuration capability (see Ref. [2] and [9]).

DeviceSelectedReport

DeviceSelectedReport	
RPTID	t.b.s.
X	Substrate column (X-) position of die selected, picked or placed (in coordinate system used by the equipment)
Y	Substrate row (Y-) position of die selected, picked or placed (in coordinate system used by the equipment)
SubstrateId	Text string that uniquely identifies substrate
SubstrateType	Substrate type; "Wafer", "Frame", "Strip" or "Tray"
LocationId	Identification text string of location where the substrate is being processed. This should be one of the locations specified by the status variable SubstrateTrackingData.
LocationType	"Carrier" or "Equipment", as defined for the specific location in the status variable SubstrateTrackingData.

SubstrateTrackingReport

SubstrateTrackingReport	
RPTID	t.b.s.
SubstrateId	Text string that uniquely identifies substrate
SubstrateType	Substrate type; "Wafer", "Frame", "Strip" or "Tray"
LocationId	Identification text string of location where the substrate has arrived. This should be one of the locations specified by the status variable SubstrateTrackingData.
LocationType	"Carrier" or "Equipment", as defined for the specific location in the status variable SubstrateTrackingData.
SlotNumber	Only relevant for LocationType "Carrier". Specifies the carrier slot number in which the substrate has been placed or has been taken from.

CarrierTrackingReport

CarrierTrackingReport	
RPTID	t.b.s.
RunId	Identification text string
SubstrateType	Identifies the type of substrate in the carrier.
LocationId	Identification text string of the carrier location where the carrier has arrived or has been removed from. This should be one of the locations specified by the status variable SubstrateTrackingData.
LocationType	"Carrier".

BinCodeMapReport

BinCodeMapReport	
RPTID	t.b.s.
BinCodeMapData	A report in E142.1 format of a substrate map.

TransferMapReport

TransferMapReport	
RPTID	t.b.s.
TransferMapData	A report in E142.1 format of where all the devices on the current substrate came from.

DeviceIdMapReport

DeviceIdMapReport	
RPTID	t.b.s.
DeviceIdMapData	A report in E142.1 format of the traceability codes marked on the devices on a substrate.

LayoutReport

LayoutReport	
RPTID	t.b.s.
LayoutData	A report in E142.1 format that describes the layout of the devices and other elements on a substrate.

STATUS VARIABLES

These variables are Status Variables, as defined in the SECS-II standard (Ref. [1]).

ALPS should be able at any time to request the value of these status variables, using the SECS-II S14F1/F2 Transaction¹¹ (see Ref [3]).

BinCodeMapData

A map of the bin codes for the devices on a substrate in SEMI E142.1 format. The example shown is taken from the SEMI E142 standard. See Ref [6] for more details of SEMI E142.1 format.

SVID: t.b.s.

Table 3: BinCodeMap Status Variable Example

```
<?xml version="1.0" encoding="utf-8" ?>
<MapData xmlns="urn:semi-org:xsd.E142-1.V0105.SubstrateMap">
  <SubstrateMaps>
    <SubstrateMap SubstrateType="Wafer" SubstrateId="Wafer1"
      LayoutSpecifier="WaferLayout/Devices" >
      <Overlay MapName="SortGrade" MapVersion="1" >
        <ReferenceDevices>
          <ReferenceDevice Name="FirstDevice" >
            <Coordinates X="1" Y="2" />
          </ReferenceDevice>
        </ReferenceDevices>
        <BinCodeMap BinType="Ascii" NullBin="." >
          <BinDefinitions>
            <BinDefinition BinCode="1" BinDescription="3.5GHz Ok" />
            <BinDefinition BinCode="2" BinDescription="2.7GHz Ok" />
            <BinDefinition BinCode="8" BinDescription="Inspection Failed" />
            <BinDefinition BinCode="9" BinDescription="Test Failed" />
          </BinDefinitions>
          <BinCode>...112111...</BinCode>
          <BinCode>..18111111..</BinCode>
          <BinCode>.9111111811.</BinCode>
          <BinCode>111111111111</BinCode>
          <BinCode>111111111111</BinCode>
          <BinCode>121111111211</BinCode>
          <BinCode>111111111111</BinCode>
          <BinCode>911111111119</BinCode>
          <BinCode>..1111811221.</BinCode>
          <BinCode>..11111111..</BinCode>
          <BinCode>...111111...</BinCode>
        </BinCodeMap>
      </Overlay>
    </SubstrateMap>
  </SubstrateMaps>
</MapData>
```

SubstrateTrackingData

Used by ALPS to synchronize its list of locations and substrates being processed with the equipment. The information is requested when

- ❑ Communication is re-established after having been lost

¹¹ Existing equipment that has already implemented the SECS/GEM Equipment Status messages, i.e. Stream 1 (see ref [2]) may use that mechanism instead of object services (i.e. Stream 14) to support ALPS status variable requests.

- ❑ Information is received from the equipment that conflicts with the corresponding ALPS information

The status variable is a single SECS-II Format: 20 (ASCII) item. An example is shown below. See Table 5 for more details of SEMI E142.1 format.

SVID: t.b.s.

Table 4: SubstrateTrackingData Status Variable Example

```

=<SubstrateTrackingData>
  =<CarrierLocationList>
    =<CarrierLocation>
      <SubstrateType>Strip</SubstrateType>
      <LocationType>Carrier</LocationType>
      <LocationId>Magazine</LocationId>
      <Slots>25</Slots>
    </CarrierLocation>
  </CarrierLocationList>
  =<SubstrateLocationList>
    =<SubstrateLocation>
      <SubstrateType>Strip</SubstrateType>
      <LocationType>Equipment</LocationType>
      <LocationId>Laser Mark</LocationId>
    </SubstrateLocation>
    =<SubstrateLocation>
      <SubstrateType>Tray</SubstrateType>
      <LocationType>Equipment</LocationType>
      <LocationId>Ok</LocationId>
    </SubstrateLocation>
  </SubstrateLocationList>
  =<SubstrateList>
    =<Substrate>
      <SubstrateType>Strip</SubstrateType>
      <SubstrateId>Strip5</SubstrateId>
      <LocationType>Carrier</LocationType>
      <LocationId>Magazine</LocationId>
      <SlotNumber>5</SlotNumber>
      <TransportState>AT SOURCE</TransportState>
    </Substrate>
    =<Substrate>
      <SubstrateType>Strip</SubstrateType>
      <SubstrateId>Strip3</SubstrateId>
      <TransportState>AT WORK</TransportState>
    </Substrate>
    =<Substrate>
      <SubstrateType>Strip</SubstrateType>
      <SubstrateId>Strip2</SubstrateId>
      <LocationType>Equipment</LocationType>
      <LocationId>Laser Mark</LocationId>
      <TransportState>AT WORK</TransportState>
    </Substrate>
  </SubstrateList>
</SubstrateTrackingData>

```

Table 5: SubstrateTrackingData XML elements and attributes

Name	Type	Location	Freq.	Comments
SubstrateTracking Data	Element	--	1	All locations and substrates currently in the equipment
CarrierLocation List	Element	SubstrateTrackingData	1	List of CarrierLocation elements for each carrier location in the equipment.
CarrierLocation	Element	CarrierLocationList	1+	Defines a carrier location.
SubstrateLocation List	Element	SubstrateTrackingData	1	List of SubstrateLocation elements for each substrate location in the equipment ¹² .
SubstrateLocation	Element	SubstrateLocationList	1+	Defines an equipment substrate location.
SubstrateList	Element	SubstrateTrackingData	1	List of Substrate elements for each substrate currently in the equipment.
Substrate	Element	SubstrateList	0+	Defines a substrate.
LocationType	Element	CarrierLocation SubstrateLocation Substrate	1	Defines the location type. Must be "Carrier" or "Equipment".
LocationId	Element	CarrierLocation SubstrateLocation Substrate	1	Defines the location ID for each location. All LocationId values should be unique in the same equipment
Slots	Element	CarrierLocation	1	Defines the (maximum) number of slots in the carrier. If the number is N, then the slots will be identified by the numbers 1 to N (see attribute SlotNumber)
SubstrateType	Element	Substrate	1	Values allowed: "Wafer", "Frame", "Strip", "Tray".
SubstrateId	Element	Substrate	1	Free text. Should be the same text as provided by ALPS.
SlotNumber	Element	Substrate	0-1	The slot number within a carrier. Only applies if LocationType="Carrier". If LocationType="Equipment" it may be "" or omitted altogether.
TransportState	Element	Substrate	1	Three values allowed: "AT SOURCE", "AT WORK", "AT DESTINATION"

¹² Does not include slots in the carrier locations.

TransferMapData

A map of the transfers of devices from one or more substrates to this substrate in SEMI E142.1 format. The example shown is taken from the SEMI E142 standard. See Ref [6] for more details of SEMI E142.1 format.

SVID: t.b.s.

Table 6: TransferMapData Status Variable Example

```
<?xml version="1.0" encoding="utf-8" ?>
<MapData xmlns="urn:semi-org:xsd:E142-1.V0105.SubstrateMap">
  <SubstrateMaps>
    <SubstrateMap SubstrateType="Strip" SubstrateId="Strip1"
      LayoutSpecifier="StripLayout/SRAM" >
      <Overlay MapName="WaferToStrip" MapVersion="1" >
        <TransferMap FromSubstrateType="Wafer"
          FromSubstrateId="Wafer1" >
          <T FX="40" FY="6" TX="2" TY="3"/>
          <T FX="41" FY="6" TX="2" TY="2"/>
        </TransferMap>
        <TransferMap FromSubstrateType="Wafer"
          FromSubstrateId="Wafer2" >
          <T FX="40" FY="6" TX="2" TY="3"/>
          <T FX="41" FY="6" TX="2" TY="2"/>
        </TransferMap>
      </Overlay>
    </SubstrateMap>
  </SubstrateMaps>
</MapData>
```

DeviceIdMapData

A map of the device identifier marked on each device on the substrate in SEMI E142.1 format. The example shown is taken from the SEMI E142 standard. See Ref [6] for more details of SEMI E142.1 format.

SVID: t.b.s.

Table 7: DeviceIdMapData Status Variable Example

```
<?xml version="1.0" encoding="utf-8" ?>
<MapData xmlns="urn:semi-org:xsd.E142-1.V0105.SubstrateMap">
  <SubstrateMaps>
    <SubstrateMap SubstrateType="Strip" SubstrateId="Strip1"
      LayoutSpecifier="StripLayout/SRAM" >
      <Overlay MapName="2D Matrix Mark" MapVersion="1" >
        <DeviceIdMap>
          <Id X="1" Y="1">LOT0011675</Id>
          <Id X="1" Y="2">LOT0011676</Id>
        </DeviceIdMap>
      </Overlay>
    </SubstrateMap>
  </SubstrateMaps>
</MapData>
```


LayoutData

The layout of devices on the substrate in SEMI E142.1 format. The example shown is taken from the SEMI E142 standard. See Ref [6] for more details of SEMI E142.1 format.

SVID: t.b.s.

Table 8: LayoutData Status Variable Example

```
<?xml version="1.0" encoding="utf-8" ?>
<MapData xmlns="urn:semi-org:xsd:E142-1.V0105.SubstrateMap">
  <Layouts>
    <Layout LayoutId="WaferLayout" DefaultUnits="mm" TopLevel="true" >
      <DeviceSize X="300" Y="300" />
      <Dimension X="1" Y="1" />
      <ChildLayouts>
        <ChildLayout LayoutId="FDI Target" />
        <ChildLayout LayoutId="Devices" />
      </ChildLayouts>
    </Layout>
    <Layout LayoutId="FDI Target" DefaultUnits="microns" >
      <Dimension X="1" Y="1" />
      <LowerLeft X="0" Y="0" />
      <DeviceSize X="0" Y="0" />
    </Layout>
    <Layout LayoutId="Devices" DefaultUnits="microns" >
      <Dimension X="4" Y="3" />
      <LowerLeft X="0" Y="0" />
      <DeviceSize X="0" Y="0" />
      <ProductId>Product1</ProductId>
    </Layout>
  </Layouts>
</MapData>
```

SECS-II TRANSACTIONS

The collection events should be sent to ALPS with the S6F11/F12 Transaction. This is standard SECS-II (Ref. [1]) and should need no further explanation.

Object Services GetAttr (S14F1/F2)

Message definitions as in the Object Services Standard (Ref. [3]).

The S14F1/F2 Transaction is used by ALPS to request the value of selected Status Variables, as described elsewhere in this document.

Data items in the S14F1 and S14F2 messages will be used as follows:

Item	Format	Description
OBJSPEC	20 (ASCII)	Empty string
OBJTYPE	20 (ASCII)	Fixed string, corresponding with Substrate Type ("Wafer", "Frame", "Strip" or "Tray")
OBJID	20 (ASCII)	String corresponding with SubstrateId (i.e WaferId, FrameId, StripId, TrayId)
ATTRID	20 (ASCII)	Fixed string: e.g. "SubstrateTrackingData"
ATTRDATA	20 (ASCII)	The XML structure with substrate location and substrate data, as described elsewhere in this document

Note: Object filters will not be used, therefore the data item ATTRDATA will only be used in the S14F2 message and ATTRRELN will not occur.

DATA ITEMS AND EQUIPMENT VARIABLES

Name	Type	VID	Format	Values
CEID	Data Item		52 (2-byte unsigned integer)	See Collection Event descriptions in Upload Data (event).
RPTID	Data Item		52 (2-byte unsigned integer)	See the individual Report descriptions in Reports.
X	DVVAL	t.b.s .	32 (2-byte signed integer)	Full range
Y	DVVAL	t.b.s .	32 (2-byte signed integer)	Full range
SubstrateId	DVVAL	t.b.s .	20 (ASCII)	1-32 characters
SubstrateType	DVVAL	t.b.s .	20 (ASCII)	"Wafer", or "Frame", or "Strip", or "Tray"
LocationId	DVVAL	t.b.s .	20 (ASCII)	0-32 characters
LocationType	DVVAL	t.b.s .	20 (ASCII)	"Equipment", or "Carrier"
Transport State	DVVAL	t.b.s .	20 (ASCII)	"AT SOURCE", or "AT WORK", or "AT DESTINATION"
SlotNumber	DVVAL	t.b.s .	52 (2-byte unsigned integer)	0=Unknown 1-Slots in Carrier
Slots	DVVAL	t.b.s .	52 (2-byte unsigned integer)	Number of slots in a carrier (e.g. 25 for a standard wafer cassette)
RunId	DVVAL	t.b.s .	20 (ASCII)	1-32 characters