IPC-2541

Generic Requirements for Electronics Manufacturing Shop-Floor Equipment Communication Messages (CAMX)

Endorsed by the National Electronics Manufacturing Initiative (NEMI)

IPC-2541
October 2001 A standard developed by IPC
In May 1995 the IPC’s Technical Activities Executive Committee adopted Principles of Standardization as a guiding principle of IPC’s standardization efforts.

**Standards Should:**
- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

**Standards Should Not:**
- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

**Notice**
IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

**IPC Position Statement on Specification Revision Change**
It is the position of IPC’s Technical Activities Executive Committee (TAEC) that the use and implementation of IPC publications is voluntary and is part of a relationship entered into by customer and supplier. When an IPC standard/guideline is updated and a new revision is published, it is the opinion of the TAEC that the use of the new revision as part of an existing relationship is not automatic unless required by the contract. The TAEC recommends the use of the latest revision. 

Adopted October 6, 1998

**Why is there a charge for this standard?**
Your purchase of this document contributes to the ongoing development of new and updated industry standards. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC’s volunteers in the standards development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC’s staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

IPC’s membership dues have been kept low in order to allow as many companies as possible to participate. Therefore, the standards revenue is necessary to complement dues revenue. The price schedule offers a 50% discount to IPC members. If your company buys IPC standards, why not take advantage of this and the many other benefits of IPC membership as well? For more information on membership in IPC, please visit www.ipc.org or call 847/597-2872.

Thank you for your continued support.
CAMX - GENERIC

Generic Requirements for Electronics Manufacturing Shop-Floor Equipment Communication Messages (CAMX)

A standard developed by the Generic Shop Floor XML Schema Formatting Task Group (2-13a) of the Shop Floor Communications Subcommittee (2-13) of IPC.

The IPC-2541 standard defines an XML encoding schema, which enables a detailed definition of electronics assembly, inspection, and test equipment messages to be encoded at a level appropriate to facilitate plug-and-play characteristics in a factory’s shop-floor information system.

This project was initiated by the NEMI Plug-and-Play Factory Project which established proof of concept. After completion, the project leaders recommended standardization by IPC under the ANSI rules and procedures.

Users of this standard are encouraged to participate in the development of future revisions.

Contact:

IPC
3000 Lakeside Drive, Suite 309S
Bannockburn, Illinois
60015-1219
Tel 847 615.7100
Fax 847 615.7105
Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Generic Shop Floor XML Schema Formatting Task Group (2-13a) of the Shop Floor Communications Subcommittee (2-13) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

<table>
<thead>
<tr>
<th>Shop Floor Communications Subcommittee</th>
<th>Generic Shop Floor XML Schema Formatting Task Group</th>
<th>Technical Liaison of the IPC Board of Directors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chair</td>
<td>Chair</td>
<td>Stan Plzak</td>
</tr>
<tr>
<td>Allan Fraser</td>
<td>Allan Fraser</td>
<td>SMTC Manufacturing Corp.</td>
</tr>
<tr>
<td>GenRad Inc.</td>
<td>GenRad Inc.</td>
<td></td>
</tr>
</tbody>
</table>

Generic Shop Floor XML Schema Formatting Task Group

Tom Baggio, Panasonic Factory Automation Company
Cord Burmeister, Siemens Dematic AG
Tom Dinnel, Universal Instruments
Andrew D. Dugenske, Georgia Institute of Technology
Allan Fraser, GenRad Inc.
Frank Gearhart, Assembleon
Yoshiyuki Hattori, Matsushita Electric Industrial Co. Ltd.
Mike Hamblin, GenRad Inc.
Nam Hoang, KIC
Dave Kerem, Camalot Division, Speedline Technologies
Miles Moreau, KIC
Dave J. Morris, Nortel Networks
Hitoshi Nakamura, Matsushita Electric Industrial Co. Ltd.
Bob Neal, Agilent Technologies
Andy Oughton, DEK Printing Machines Ltd.
Jim Perilli, MPM Division, Speedline Technologies
Jari Pirkola, JOT Automation
Mike Rogers, DEK Printing Machines Ltd.
Hannu Ronkainen, JOT Automation
Bob Voitus, Celestica Inc.
Mark Williams, Motorola

A special note of thanks goes to the following individuals for their dedication to bringing this project to fruition. We would also like to highlight those individuals who were involved with the initial NEMI program concept and made major contributions to the development of the standard.

Allan Fraser, GenRad, Incorporated
Tom Dinnel, Universal Instruments
Mark Williams, Motorola
Andy Dugenske, Georgia Institute of Technology
David Kerem, Speedline Technologies
Bob Voitus, Celestica, Inc.
Robert E. Neal, Agilent Technologies
# Table of Contents

1. **Scope** .......................................................................................................................... 1  
   1.1 Interpretation .................................................................................................................. 1  
2. **Applicable documents** .................................................................................................... 1  
3. **General Requirements** ................................................................................................... 2  
   3.1 Terms and Definitions ................................................................................................. 2  
   3.2 Date and Time Notation ............................................................................................. 3  
   3.3 CAMX Compliance ........................................................................................................ 3  
4. **Equipment State Model** ............................................................................................... 4  
5. **Multiple Zone and Multiple Lane Equipment State Prioritization** .............................. 10  
6. **Equipment Alarm, Error, Warning, and Information Messages** ................................. 10  
7. **Event Extensions** ........................................................................................................... 11  
   7.1 Equipment Heart Beat Event ........................................................................................ 11  
      7.1.1 Event: EquipmentHeartbeat ........................................................................... 11  
    7.2 Equipment State Change Event ................................................................................ 12  
      7.2.1 Event: EquipmentChangeState ....................................................................... 12  
    7.3 Item Events .............................................................................................................. 13  
      7.3.1 Event: ItemWorkStart .................................................................................... 13  
      7.3.2 Event: ItemWorkPause .................................................................................. 13  
      7.3.3 Event: ItemWorkResume ............................................................................... 14  
      7.3.4 Event: ItemWorkAbort ................................................................................... 14  
      7.3.5 Event: ItemWorkComplete ........................................................................... 15  
      7.3.6 Event: ItemTransferIn ................................................................................... 15  
      7.3.7 Event: ItemTransferOut .................................................................................. 16  
      7.3.8 Event: ItemTransferZone ............................................................................... 16  
      7.3.9 Event: ItemTransferLane ............................................................................... 17  
      7.3.10 Event: ItemIdentifierRead .......................................................................... 17  
      7.3.11 Event: ItemInformation ............................................................................... 18  
    7.4 Lane Flow Events ......................................................................................................... 19  
      7.4.1 Event: LaneStarved ......................................................................................... 19  
      7.4.2 Event: LaneUnStarved .................................................................................... 19  
      7.4.3 Event: LaneBlocked ....................................................................................... 20  
      7.4.4 Event: LaneUnBlocked ................................................................................... 20  
    7.5 Equipment Flow Events ............................................................................................. 21  
      7.5.1 Event: EquipmentStarved ................................................................................ 21  
      7.5.2 Event: EquipmentUnStarved .......................................................................... 21  
      7.5.3 Event: EquipmentBlocked ............................................................................. 22  
      7.5.4 Event: EquipmentUnBlocked ....................................................................... 22  
    7.6 Equipment Events ................................................................................................------- 23  
      7.6.1 Event: EquipmentInitializationComplete ...................................................... 23  
      7.6.2 Event: EquipmentSetupComplete .................................................................... 23  
      7.6.3 Event: EquipmentStartSelected ...................................................................... 24  
      7.6.4 Event: EquipmentSetupSelected .................................................................... 24
7.6.5 Event: EquipmentDownSelected .............................................................. 25
7.6.6 Event: EquipmentPowerOff ...................................................................... 25
7.6.7 Event: EquipmentRecipeSelected ............................................................ 26
7.6.8 Event: EquipmentRecipeReady ................................................................ 26
7.6.9 Event: EquipmentSelectedRecipeModified ................................................ 27
7.6.10 Event: EquipmentNonSelectedRecipeModified ......................................... 27
7.6.11 Event: EquipmentParameterModified ................................................... 28
7.6.12 Event: EquipmentAlarm ......................................................................... 28
7.6.13 Event: EquipmentAlarmCleared .............................................................. 29
7.6.14 Event: EquipmentAlarmsCleared ........................................................... 29
7.6.15 Event: EquipmentError .......................................................................... 30
7.6.16 Event: EquipmentErrorCleared ............................................................. 30
7.6.17 Event: EquipmentErrorsCleared .......................................................... 31
7.6.18 Event: EquipmentWarning ..................................................................... 31
7.6.19 Event: EquipmentWarningCleared ........................................................ 32
7.6.20 Event: EquipmentWarningsCleared ....................................................... 32
7.6.21 Event: EquipmentInformation ............................................................... 33
7.7 Operator Information Events ...................................................................... 34
7.7.1 Event: OperatorInformation .................................................................... 34
7.7.2 Event: OperatorActionRegistered ............................................................ 34
7.7.3 Event: WaitingForOperatorAction ............................................................ 35
8 Equipment Flow Event Scenarios – Single Lane Equipment ........................ 36
8.1 Scenario 1 – Single Working Zone, Single Item ........................................... 36
8.2 Scenario 2 – Single Working Zone, Multiple Items ....................................... 44
8.3 Scenario 3 – Single Working Zone, Multiple Items, Downstream Bottleneck ...... 56
8.4 Scenario 4 – Single Working Zone, Equipment Error ................................... 69
9 Equipment Flow Event Scenarios – Dual Lane Equipment ............................ 80
9.1 Scenario 5 – Single Working Zone, Single Item ........................................... 80
9.2 Scenario 6 – Single Working Zone, Multiple Items ....................................... 93
10 2541 XML Schema ....................................................................................... 121
10.1 EquipmentAlarm ....................................................................................... 122
10.2 EquipmentAlarmCleared ........................................................................... 123
10.3 EquipmentAlarmsCleared ........................................................................ 124
10.4 EquipmentBlocked ................................................................................... 125
10.5 EquipmentChangeState ........................................................................... 126
10.6 EquipmentDownSelected ........................................................................ 127
10.7 EquipmentError ....................................................................................... 128
10.8 EquipmentErrorCleared .......................................................................... 129
10.9 EquipmentErrorsCleared ........................................................................ 130
10.10 EquipmentHeartbeat ............................................................................. 131
10.11 EquipmentInformation .......................................................................... 132
10.12 EquipmentInitializationComplete ............................................................ 133
10.13 EquipmentNonSelectedRecipeModified .................................................. 134
10.14 EquipmentParameterModified ............................................................... 135
10.15 EquipmentPowerOff ................................................................. 136
10.16 EquipmentRecipeReady ........................................................... 137
10.17 EquipmentRecipeSelected ........................................................ 138
10.18 EquipmentSelectedRecipeModified ............................................ 139
10.19 EquipmentSetupComplete ....................................................... 140
10.20 EquipmentSetupSelected .......................................................... 141
10.21 EquipmentStartSelected ............................................................ 142
10.22 EquipmentStarved ................................................................. 143
10.23 EquipmentUnBlocked .............................................................. 144
10.24 EquipmentUnStarved ............................................................... 145
10.25 EquipmentWarning ................................................................. 146
10.26 EquipmentWarningCleared ....................................................... 147
10.27 EquipmentWarningsCleared ..................................................... 148
10.28 ItemIdentifierRead ................................................................. 149
10.29 ItemInformation ................................................................. 150
10.30 ItemTransferIn ............................................................... 151
10.31 ItemTransferLane ............................................................... 152
10.32 ItemTransferOut ................................................................. 153
10.33 ItemTransferZone ................................................................. 154
10.34 ItemWorkAbort ................................................................. 155
10.35 ItemWorkComplete ............................................................... 156
10.36 ItemWorkPause ................................................................. 157
10.37 ItemWorkResume ................................................................. 158
10.38 ItemWorkStart ................................................................. 159
10.39 LaneBlocked ............................................................... 160
10.40 LaneStarved ................................................................. 161
10.41 LaneUnBlocked ............................................................... 162
10.42 LaneUnStarved ............................................................... 163
10.43 OperatorActionRegistered .................................................... 164
10.44 OperatorInformation ............................................................ 165
10.45 WaitingForOperatorAction .................................................... 166
Generic Requirements for Electronics Manufacturing
Shop-Floor Equipment Communication Messages (CAMX)

Introduction

Factory Information Systems (FIS) form the nervous system of an enterprise, analysing data and delivering information to the machines and people who need to make information-based decisions. These systems provide a bi-directional flow of information between the factory floor and the rest of the enterprise. The National Electronics Manufacturing Initiative’s (NEMI) Plug & Play Factory project addressed some critical problems involving factory information system deployment on the electronics manufacturing factory floor. The Plug & Play Factory project focused on the development of the standards necessary to achieve interoperability, or plug-and-play capability, on the factory floor. Activities were comprised of three areas:

- Definition of standards for a software framework that will allow interoperability between equipment produced by different vendors.
- Development of process-specific, machine communication interface standards for surface mount equipment. These standards will leverage the Generic Equipment Model (GEM) specification developed for semiconductor equipment and web-based standards for data transmission.
- Establishment of a test-bed manufacturing line to prove out the concepts developed by the project.

1 Scope

The IPC-2541 standard defines an XML encoding schema to facilitate plug-and-play characteristics in a factory’s shop-floor information system. This standard describes the generic event message content, and should be used together with the IPC-2540 series sectional documents, which define the set of messages and key attributes of specific classes of equipment used in the electronics manufacturing area.

1.1 Interpretation

"Shall", the emphatic form of the verb, is used throughout this standard whenever a requirement is intended to express a provision that is mandatory. Deviation from a shall requirement is not permitted, and compliance with the XML syntax and semantics shall be followed without ambiguity, or the insertion of superfluous information.

The words "should" and "may" are used whenever it is necessary to express non-mandatory provisions.

"Will" is used to express a declaration of purpose.

To assist the reader, the word shall is presented in bold characters.

2 Applicable documents

The following documents contain provisions that, through reference in this text, constitute provisions of this standard. All documents are subject to revision. Parties who make agreements
based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below.

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits
IPC-2501 Generic Computer Aided Manufacturing (CAMX) Framework definitions
IPC-2511 Generic Computer Aided Manufacturing (GenCAM) descriptions for Printed Circuit Boards and Printed Board Assembly
IPC-2546 Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Assembly
IPC-2547 Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Test, Inspection and Rework

3 General Requirements

The requirements of IPC-2501 are a mandatory part of this standard. That document describes the generic requirements for the CAMX format.

3.1 Terms and Definitions

Downstream equipment
A piece of equipment located after another piece of equipment in a line.

Equipment Controller Down
The equipment cannot process instructions without operator or other personnel intervention.

Equipment Controller Up
When the equipment controller is running and the equipment Web client can send messages.

Equipment State
The various possible conditions of a piece of equipment. These include states such as ready, setup, down, and off.

Initialization
A normal directed process for the equipment to reach the state for its intended production function such as homing, calibration or initialization.

Item
An individual unit that is processed. An item usually consists of a single printed circuit board or a panelized board containing multiple circuits.

Item instance identifier
Item instance identifier is an identifier for an item. An item instance identifier may be derived from the serial number. If a bar code reader is present then the item instance identifier may be the bar code label that is read. If no bar code reader is present then the item instance identifier may be generated by the piece of equipment.

Lane
A lane is an independent processing path through a piece of equipment. A single piece of equipment may have multiple lanes.
**Upstream equipment**  
A piece of equipment located before another piece of equipment in a line.

**Zone**  
A staging area or a working area within a piece of equipment. A single piece of equipment may have many zones.

### 3.2 Date and Time Notation

All 2540 standards **shall** use the World Wide Web consortium (W3C) date time standard. This standard **shall** use the Complete Date plus Hours, Minutes, Seconds, and a decimal fraction of a second and Time Zone Designator. Two decimal places will be used in order to represent time down to a hundredth of a second. For additional information on date and time, see web page:


### 3.3 CAMX Compliance

All events defined in 2541 that are applicable to a piece of equipment **shall** be implemented in order to comply with this standard. The only exception to this rule is that for a single lane piece of equipment it is not required for the equipment to send the LaneStarved, LaneUnStarved, LaneBlocked, and LaneUnBlocked events. In addition, 2541 events can be extended in the 2540 series sectional documents. All of the attribute names defined in 2541 events must also be present in the events that are extended in the sectionals. All attribute names that are used to extend events defined in the sectionals must have different names than the attribute names defined in 2541. Individual equipment suppliers can also extend any events defined in the 2540 series of standards, providing they support all attribute names defined in the 2540 series of documents.

Equipment performance data will be included in specific event definitions that are defined or extended in each of the sectionals. The CAMX reporting mechanism will be different from how GEM reporting works today. Key reporting data will be defined in the 2540 sectionals that detail the information to be sent from the equipment when certain events occur on the equipment. For example, in the 2546 sectional, a placement machine pick error may be accompanied by the nozzle that performed the mis-pick, along with counts of previously successful picks by that nozzle, each time a component mis-pick event occurs on the equipment.

The IPC-2541 document defines a set of Equipment, Recipe, Item, and Operator events and related message formats. The IPC-2501 document defines a message packet structure. All shop floor equipment that complies with the IPC-2541 standards **shall** also comply with the event messages contained in the IPC-2501 standard as well as those events that are described in this document. All event messages **shall** be formatted in compliance with the IPC-2501. The following is a typical message example. The latest IPC-2501 requirements are available at [http://webstds.ipc.org/2501](http://webstds.ipc.org/2501).

```xml
<?xml version="1.0" encoding = "UTF-8"?>
<Envelope xmlns:xsi = "http://www.w3.org/2000/10/XMLSchema-instance"
    xsi:noNamespaceSchemaLocation = "http://webstds.ipc.org/2501/Envelope.xsd"
    xmlns:IPC2541 = "http://webstds.ipc.org/2541/EquipmentInitializationComplete.xsd"
    sender = "myhost.xyz.com/Line3/Machine1"
    messageId = "15.11.9.54.+2001-01-23T19:20:30.27+05:00"
    dateTime = "2001-01-23T19:20:30.27+05:00"
    messageSchema = "http://webstds.ipc.org/2541/EquipmentInitializationComplete.xsd"
</Envelope>
```
4 Equipment State Model

The objective of the equipment state model is to capture important machine status information that can be used to track machine utilization and availability. It is useful in the monitoring and control of resources in automated surface mount (SMT) lines. A processing station in the SMT line processes raw materials to produce finished or semi-finished products, as shown below in Figure 1.

The goals of the development of the CAMX equipment state model are the following:

1. Create an equipment state model and define states applicable to the electronics assembly, inspection, and test industry. This endeavor is analogous to that which resulted in the Semiconductor Equipment and Materials International (SEMI) E-10 standard for the semiconductor industry.

2. Minimize the number of states. Each state must have significance for process monitoring and control.

3. Define states so that no variations in the basic states are allowed in implementations.

The equipment model consists of three components: The state diagram, the state transition table and the events that trigger these state transitions. The state transitions are triggered by material
conditions, alarms, or operator or host inputs. In all cases the equipment shall send the appropriate message when the corresponding physical event occurs on the equipment.

The CAMX equipment state diagram is shown in Figure 2.

![CAMX Equipment State Diagram](image)

**Figure 2 CAMX Equipment State Diagram**

Some typical equipment state transitions are shown in Table 2. A complete listing of all of the event state transitions is shown in Table 3.
Table 2 Example State Transition Table for Equipment State Model

<table>
<thead>
<tr>
<th>Arrow</th>
<th>Current state</th>
<th>Typical trigger</th>
<th>Specific example</th>
<th>New state</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>OFF</td>
<td>Power On (Default entry)</td>
<td>EquipmentInitializationComplete</td>
<td>SETUP</td>
</tr>
<tr>
<td>1</td>
<td>SETUP</td>
<td>Complete Setup</td>
<td>EquipmentSetupComplete</td>
<td>Any READY sub-state or DOWN</td>
</tr>
<tr>
<td>2</td>
<td>READY</td>
<td>Start Setup</td>
<td>EquipmentSetupSelected</td>
<td>SETUP</td>
</tr>
<tr>
<td>3</td>
<td>READY-IDLE-STARVED</td>
<td>Material Received</td>
<td>EquipmentUnStarved</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>4</td>
<td>READY-PROCESSING-ACTIVE</td>
<td>Material Output Blocked</td>
<td>EquipmentBlocked</td>
<td>READY-IDLE-BLOCKED</td>
</tr>
<tr>
<td>5</td>
<td>DOWN</td>
<td>Press &quot;Start&quot;</td>
<td>EquipmentStartSelected</td>
<td>Any READY sub-state</td>
</tr>
<tr>
<td>6</td>
<td>READY</td>
<td>Out of Supply</td>
<td>EquipmentAlarm</td>
<td>DOWN</td>
</tr>
<tr>
<td>7</td>
<td>SETUP</td>
<td>Major Error</td>
<td>EquipmentError</td>
<td>DOWN</td>
</tr>
<tr>
<td>8</td>
<td>DOWN</td>
<td>Start Setup</td>
<td>EquipmentSetupSelected</td>
<td>SETUP</td>
</tr>
<tr>
<td>9</td>
<td>DOWN</td>
<td>Controlled Shutdown</td>
<td>EquipmentPowerOff</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Each piece of equipment must track its own state. Each state is mutually exclusive. Each event can cause the equipment to enter one and only one new state. At any point in time, the state of a piece of equipment is uniquely determined by the most recent event that occurred on the equipment.

The terms used to refer to the various equipment states are defined as follows:

**IDLE** means a piece of equipment is ready to process items but is not doing so. The piece of equipment may be in either the STARVED or BLOCKED sub-states.

**STARVED** is a sub-state of IDLE. This is the state of a piece of equipment when it is ready to receive an item from an upstream piece of equipment but no item is available. The equipment’s working area is available to work but it is not being given anything to build. There is no unfinished work within the equipment and there are no items available to move into the equipment. The equipment is empty and it can’t pull any items in to work on.

**BLOCKED** is a sub-state of IDLE. This is the state of a piece of equipment when it is ready to send completed items to a downstream piece of equipment but it is prevented from doing so by the downstream piece of equipment. Processing of all items in a working zone within the equipment has been completed. The equipment is unable to accept any new items into its staging or working zones. The equipment is full and it can’t push any items out.

**PROCESSING** means that a piece of equipment is productively working on an item. The piece of equipment may be in either the ACTIVE or EXECUTING sub-states.
**EXECUTING** is the sub-state of PROCESSING in which the equipment is executing a recipe and it can continue to do so without external intervention. The executing sub-state includes times like fiducial finding and board alignment for a piece of placement equipment.

**ACTIVE** is the sub-state of PROCESSING when an item is available but no recipe is being executed. This includes time intervals when items are transferring into a piece of equipment, out of a piece of equipment, or between different zones within a piece of equipment.

**READY** is a superset of the PROCESSING and IDLE states.

**SETUP** means that a piece of equipment is being configured. Set-up involves a deliberate action being taken on the equipment.

**DOWN** means that a piece of equipment can not produce items either due to a lack of components or other consumable material, an equipment malfunction, host or operator intervention, or equipment initiated events. A piece of equipment that is in the DOWN state is not in the SETUP, READY, or OFF states.

**OFF** means that a piece of equipment has been powered down and is not available for production.

### Table 3 Complete State Transition Table for Equipment State Model

<table>
<thead>
<tr>
<th>EVENT NAME</th>
<th>SEE PARA</th>
<th>TYPICAL TRIGGER</th>
<th>CURRENT STATE</th>
<th>NEXT STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EquipmentAlarm</td>
<td>7.6.12</td>
<td>Unsafe condition for operator or machine has occurred.</td>
<td>Any</td>
<td>DOWN</td>
</tr>
<tr>
<td>EquipmentAlarmCleared</td>
<td>7.6.13</td>
<td>Alarm condition has been removed.</td>
<td>DOWN</td>
<td>DOWN</td>
</tr>
<tr>
<td>EquipmentAlarmsCleared</td>
<td>7.6.14</td>
<td>All alarm conditions have been removed.</td>
<td>DOWN</td>
<td>DOWN</td>
</tr>
<tr>
<td>EquipmentBlocked</td>
<td>7.5.3</td>
<td>Item work is complete but output queue is not available.</td>
<td>READY-</td>
<td>READY-IDLE-BLOCKED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROCESSING-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACTIVE</td>
<td></td>
</tr>
<tr>
<td>EquipmentChangeState</td>
<td>7.2.1</td>
<td>An event caused an equipment State Change</td>
<td>Any</td>
<td>Any Other</td>
</tr>
<tr>
<td>EquipmentDownSelected</td>
<td>7.6.5</td>
<td>The operator or host has selected the equipment down mode.</td>
<td>Any Other</td>
<td>DOWN</td>
</tr>
<tr>
<td>EquipmentError</td>
<td>7.6.15</td>
<td>Trapped equipment error.</td>
<td>Any</td>
<td>DOWN</td>
</tr>
<tr>
<td>EquipmentErrorCleared</td>
<td>7.6.16</td>
<td>Operator or other interaction has removed the error condition.</td>
<td>DOWN</td>
<td>DOWN</td>
</tr>
<tr>
<td>EquipmentErrorsCleared</td>
<td>7.6.17</td>
<td>All error conditions have been removed.</td>
<td>DOWN</td>
<td>DOWN</td>
</tr>
<tr>
<td>EquipmentHeartbeat</td>
<td>7.1.1</td>
<td>Equipment sends a keep alive message.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentInformation</td>
<td>7.6.21</td>
<td>Informational message emitted.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentInitializationComplete</td>
<td>7.6.1</td>
<td>Boot process has completed and the equipment is ready for recipe and material.</td>
<td>OFF</td>
<td>SETUP</td>
</tr>
<tr>
<td>EquipmentNonSelectedRecipe-Modified</td>
<td>7.6.10</td>
<td>A non-selected recipe has been modified by the operator or host computer</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EVENT NAME</td>
<td>SEE PARA</td>
<td>TYPICAL TRIGGER</td>
<td>CURRENT STATE</td>
<td>NEXT STATE</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------</td>
<td>----------------------------------------------------------------------------------</td>
<td>---------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>EquipmentParameterModified</td>
<td>7.6.11</td>
<td>Equipment parameter has been changed, either by the operator or by the host.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentPowerOff</td>
<td>7.6.6</td>
<td>Equipment is being powered down via a controlled shutdown procedure.</td>
<td>DOWN</td>
<td>OFF</td>
</tr>
<tr>
<td>EquipmentRecipeReady</td>
<td>7.6.8</td>
<td>The recipe file is loaded.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentRecipeSelected</td>
<td>7.6.7</td>
<td>Recipe file has been selected</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentSelectedRecipe-Modified</td>
<td>7.6.9</td>
<td>Selected recipe has been modified by the operator or host computer.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentSetupComplete</td>
<td>7.6.2</td>
<td>Equipment has completed setup.</td>
<td>SETUP</td>
<td>Any READY sub-state or DOWN</td>
</tr>
<tr>
<td>EquipmentSetupSelected</td>
<td>7.6.4</td>
<td>The operator or host has selected the equipment setup mode.</td>
<td>Any Other</td>
<td>SETUP</td>
</tr>
<tr>
<td>EquipmentStartSelected</td>
<td>7.6.3</td>
<td>The equipment itself, an operator, or host has selected the equipment start mode.</td>
<td>Any Other</td>
<td>Any READY sub-state</td>
</tr>
<tr>
<td>EquipmentStarved</td>
<td>7.5.1</td>
<td>Equipment is ready but there is no product item available.</td>
<td>Any Other</td>
<td>READY-IDLSTARVED</td>
</tr>
<tr>
<td>EquipmentUnBlocked</td>
<td>7.5.4</td>
<td>Equipment has been blocked and output queue becomes available.</td>
<td>READY-IDLE-BLOCKED</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>EquipmentUnStarved</td>
<td>7.5.2</td>
<td>Equipment has been starved and now there is new product available.</td>
<td>READY-IDLE-STARVED</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>EquipmentWarning</td>
<td>7.6.18</td>
<td>Warning message emitted</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentWarningCleared</td>
<td>7.6.19</td>
<td>Warning condition cleared</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>EquipmentWarningsCleared</td>
<td>7.6.20</td>
<td>All warning conditions cleared</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>ItemIdentifierRead</td>
<td>7.3.10</td>
<td>An item is available and its Identification label has been read successfully.</td>
<td>READY-PROCESSING-ACTIVE</td>
<td>Same</td>
</tr>
<tr>
<td>ItemInformation</td>
<td>7.3.11</td>
<td>Non-threatening item information is emitted.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>ItemTransferIn</td>
<td>7.3.6</td>
<td>An item has entered the equipment.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>ItemTransferLane</td>
<td>7.3.9</td>
<td>An item has transferred from one equipment lane to another.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>ItemTransferOut</td>
<td>7.3.7</td>
<td>An item has transferred out of the equipment.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>ItemTransferZone</td>
<td>7.3.8</td>
<td>An item has transferred from one equipment zone to another.</td>
<td>Any</td>
<td>Same</td>
</tr>
<tr>
<td>ItemWorkAbort</td>
<td>7.3.4</td>
<td>Process work that has been paused on an item is aborted.</td>
<td>READY-PROCESSING-ACTIVE</td>
<td>Same</td>
</tr>
<tr>
<td>ItemWorkComplete</td>
<td>7.3.5</td>
<td>Process work on an item is complete.</td>
<td>READY-PROCESSING-EXECUTING</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>EVENT NAME</td>
<td>SEE PARA</td>
<td>TYPICAL TRIGGER</td>
<td>CURRENT STATE</td>
<td>NEXT STATE</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------</td>
<td>--------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>ItemWorkPause</td>
<td>7.3.2</td>
<td>Process execution on an item has been paused.</td>
<td>READY-PROCESSING-EXECUTING</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>ItemWorkResume</td>
<td>7.3.3</td>
<td>Process work on an item has been restarted.</td>
<td>READY-PROCESSING-ACTIVE</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>ItemWorkStart</td>
<td>7.3.1</td>
<td>The equipment begins executing its process on a product item.</td>
<td>Any READY-Sub-state</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>LaneBlocked</td>
<td>7.4.3</td>
<td>Item work is complete but output queue is not available for that lane.</td>
<td>Any Same</td>
<td></td>
</tr>
<tr>
<td>LaneStarved</td>
<td>7.4.1</td>
<td>Equipment lane is ready but there is no item to process.</td>
<td>Any Same</td>
<td></td>
</tr>
<tr>
<td>LaneUnBlocked</td>
<td>7.4.4</td>
<td>Equipment lane has been blocked and output queue becomes available.</td>
<td>Any Same</td>
<td></td>
</tr>
<tr>
<td>LaneUnStarved</td>
<td>7.4.2</td>
<td>Equipment lane has been starved and now there is a new item available to process.</td>
<td>Any Same</td>
<td></td>
</tr>
<tr>
<td>OperatorActionRegistered</td>
<td>7.7.2</td>
<td>An operator intervention has taken place.</td>
<td>Any Same</td>
<td></td>
</tr>
<tr>
<td>OperatorInformation</td>
<td>7.7.1</td>
<td>Operator instigated information message is emitted.</td>
<td>Any Same</td>
<td></td>
</tr>
<tr>
<td>WaitingForOperatorAction</td>
<td>7.7.3</td>
<td>The process is halted for a reason other than a starved or blocked piece of equipment and human intervention is required before processing can resume.</td>
<td>Any Down</td>
<td></td>
</tr>
</tbody>
</table>
5 Multiple Zone and Multiple Lane Equipment State Prioritization

In order to give further clarification to the state of a piece of equipment containing multiple lanes or zones the following rule will be used. When any of the lanes of a piece of equipment, or any of the zones within a lane, is in one of the following states, the equipment will assume the state of the lane or the zone that has the highest priority according to the priorities shown in Table 4.

<table>
<thead>
<tr>
<th>PRIORITY (1= Highest)</th>
<th>STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>2</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>3</td>
<td>READY-IDLE-STARVED</td>
</tr>
<tr>
<td>4</td>
<td>READY-IDLE-BLOCKED</td>
</tr>
<tr>
<td>5</td>
<td>SETUP</td>
</tr>
<tr>
<td>6</td>
<td>DOWN</td>
</tr>
<tr>
<td>7</td>
<td>OFF</td>
</tr>
</tbody>
</table>

6 Equipment Alarm, Error, Warning, and Information Messages

Equipment alarms are events which are sent when dangerous conditions occur that can cause danger to either people or equipment if not addressed immediately.

Equipment errors are events which cause the equipment to malfunction and not operate correctly.

Equipment warnings are events which do not cause any immediate problems. Equipment warnings may escalate into either equipment error conditions or equipment alarm conditions if not addressed.

Equipment information messages are generated by the equipment when an interesting event occurs on the equipment.

The difference between equipment warnings and equipment error messages is that warnings do not change the state of the machine, whereas equipment errors do change the state of the machine.

The difference between equipment warnings and equipment information messages is that equipment warnings do need to be cleared whereas equipment information messages do not need to be cleared.

Table 5 illustrates the differences between Equipment Alarm, Error, Warning, and Information messages.

EquipmentAlarm, EquipmentError, and EquipmentWarning events must maintained when the equipment is powered down and back up again.
If a piece of equipment determines that it cannot communicate then it must be able to spool all events locally.

Table 5 – Equipment Alarms, Errors, Warning, and Information Events Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Tracked by Equipment</th>
<th>Cleared by Equipment or Host</th>
<th>State Change</th>
<th>Dangerous Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarms</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Errors</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Warnings</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Information</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

7 Event Extensions

All 2541, 2546, and 2547 messages can be extended. An element called Extensions will be included in each event. See the 2541 XML Schema section for a complete listing of the XML schema used in the 2541 standard. The following sections show the name for each event, along with any state changes associated with the event, the description of the event, all attributes and their type for each event, as well as an illustrative example of how that event could be used in an actual production situation. The right-most column indicates the expected number of occurrences (cardinality) of each attribute or element. In this standard all attributes or elements are mandatory as is indicated by 1-1. The IPC-2546 and IPC-2547 use 0-1 to indicate an optional field. 1-1 to indicate a single mandatory field. 0-n to indicate any number, including zero. 1-n indicates at least one.

7.1 Equipment Heart Beat Event

7.1.1 Event: EquipmentHeartbeat

StateChange: This event does not cause any state changes.

Description: This event sends a heart beat at a regular time interval from a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>Interval</td>
<td>Non-negative integer</td>
<td>Time interval between heart beat events being sent by the piece of equipment. A value of 0 means that the equipment will send no further heart beat events.</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<EquipmentHeartbeat
datetime="2000-02-02T10:33:00.00-05:00"
interval=60/>
```
7.2 Equipment State Change Event

7.2.1 Event: EquipmentChangeState

StateChange: This event reports a state change, it does not cause any state changes.

Description: This event occurs only when a piece of equipment changes state. This event uniquely identifies the event that caused the equipment to change state. Even though there may be many events occurring at the same time on a piece of equipment, the event identifier listed here is the name of the event that caused the equipment to change state.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>currentState</td>
<td>string (enumerated)</td>
<td>READY-IDLE-BLOCKED</td>
<td>READY-IDLE-STARVED</td>
</tr>
<tr>
<td>previousState</td>
<td>string (enumerated)</td>
<td>READY-IDLE-BLOCKED</td>
<td>READY-IDLE-STARVED</td>
</tr>
<tr>
<td>eventId</td>
<td>string</td>
<td>Event identifier which caused the state change</td>
<td>1-1</td>
</tr>
</tbody>
</table>

<EquipmentChangeState
dateTime="2000-02-02T10:35:00.00-05:00"
ccurrentState="READY-PROCESSING-ACTIVE"
previousState="READY-IDLE-STARVED"
eventId="EquipmentUnStarved"
/>
7.3 Item Events

7.3.1 Event: ItemWorkStart

**StateChange:** Any READY Sub-state

**Description:** This event occurs when an item is starting to be worked on by a piece of equipment. This event must be the first processing event for a specific item. This event must be sent for every individual working zone. The ItemWorkComplete, ItemWorkAbort, or ItemWorkPause events may follow this event.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane number</td>
<td>1-n</td>
</tr>
<tr>
<td>zoneId</td>
<td>string</td>
<td>Area segment number</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<ItemWorkStart
datetime="2000-02-02T10:35:12.00-05:00"
itemInstanceId="001"
laneId="1"
zoneId="2"/>
```

7.3.2 Event: ItemWorkPause

**StateChange:** Ready-Processing-Executing->Ready-Processing-Active

**Description:** This event occurs when an item is paused. A pause may be caused either by the equipment itself, by an operator, or by a host computer. Either an ItemWorkResume event or an ItemWorkAbort event must follow this event.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>zoneId</td>
<td>string</td>
<td>Area segment identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>pauseId</td>
<td>string</td>
<td>Pause identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<ItemWorkPause
datetime="2000-02-02T10:37:12.00-05:00"
itemInstanceId="001"
laneId="1"
zoneId="2"
pauseId="Paused waiting for parts"/>
```
7.3.3 Event: ItemWorkResume

StateChange: Ready-Processing-Active->Ready-Processing-Executing

Description: This event occurs when work on an item is resumed. This event may be triggered either by an operator or by a host computer.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>zoneId</td>
<td>string</td>
<td>Area segment identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<ItemWorkResume
datetime="2000-02-02T10:39:12.00-05:00"
itemInstanceId="001"
laneId="Left"
zoneId="Curing"
/>
```

7.3.4 Event: ItemWorkAbort

StateChange: No state change.

Description: This event occurs when work on an item is aborted.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>zoneId</td>
<td>string</td>
<td>Area segment identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>abortId</td>
<td>string</td>
<td>Abort identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<ItemWorkAbort
datetime="2000-02-02T10:41:12.00-05:00"
itemInstanceId="001"
laneId="1"
zoneId="2"
abortId="Aborted due to bad material"
/>
```
7.3.5 Event: ItemWorkComplete

StateChange: Ready-Processing-Executing->Ready-Processing-Active

Description: This event indicates the completion of the processing of an item. This event must be sent for every individual working zone. This event does not indicate anything about the quality of the processing, it is merely indicating that the processing of that item is complete. This event must be preceded by an ItemWorkStart message.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>zoneId</td>
<td>string</td>
<td>Area segment identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```
<ItemWorkComplete
datetime="2000-02-02T10:43:12.00-05:00"
itemInstanceId="001"
laneId="1"
zoneId="2"
/>
```

7.3.6 Event: ItemTransferIn

StateChange: No State Change

Description: The item has finished transferring into the first zone of a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```
<ItemTransferIn
datetime="2000-02-02T10:45:12.00-05:00"
itemInstanceId="001"
laneId="1"
/>
```
7.3.7 Event: ItemTransferOut

**StateChange:** No State Change

**Description:** The item has finished transferring out of the last zone of a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<ItemTransferOut
dateTime="2000-02-02T10:47:12.00-05:00"
itemInstanceId="001"
laneId="1"
/>
```

7.3.8 Event: ItemTransferZone

**StateChange:** No State Change

**Description:** The equipment sends this event when an item has finished transferring between any two zones within a piece of equipment. This event must not be sent when an item enters the first zone of a piece of equipment nor when it leaves the last zone of a piece of equipment. See the ItemTransferIn and ItemTransferOut events for these two cases. The first zone inside a machine must have a Zone identifier of 1.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>fromZoneId</td>
<td>string</td>
<td>From area segment identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>toZoneId</td>
<td>string</td>
<td>To area segment identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<ItemTransferZone
dateTime="2000-02-02T10:49:12.00-05:00"
itemInstanceId="001"
fromZoneId="2"
toZoneId="3"
laneId="1"
/>
7.3.9 Event: ItemTransferLane

**StateChange:** No State Change

**Description:** The equipment sends this event when an item has finished transferring between any two lanes within a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>fromLaneId</td>
<td>string</td>
<td>From lane segment identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>toLaneId</td>
<td>string</td>
<td>To lane segment identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>zoneId</td>
<td>string</td>
<td>Equipment zone identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<ItemTransferLane
dateTime="2000-02-02T10:51:12.00-05:00"
itemInstanceId="001"
fromLaneId="2"
toLaneId="3"
zoneId="1"
/>
```

7.3.10 Event: ItemIdentifierRead

**StateChange:** No State Change

**Description:** This event is sent when an item's label containing an identifier has been read by a piece of equipment (e.g., barcode label, RF tag). If the equipment has label readers on the top and bottom side of one lane, the scannerId must contain the location of the label readers.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Item instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>zoneId</td>
<td>string</td>
<td>Zone identifier</td>
<td>1-n</td>
</tr>
<tr>
<td>scannerId</td>
<td>string</td>
<td>Unique scanner identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<ItemIdentifierRead
dateTime="2000-02-02T10:53:12.00-05:00"
itemInstanceId="001"
laneId="2"
zoneId="2"
scannerId="Input Conveyor, Placer 1-IC"
/>
```
7.3.11 Event: ItemInformation

StateChange: No State Change

Description: Item information messages that are directly related to the assembly process, and are not associated with a specific machine subsystem. These indicate a no problem condition without a recovery screen.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Current date and time</td>
<td>1-1</td>
</tr>
<tr>
<td>itemInstanceId</td>
<td>string</td>
<td>Serial number, Product type, Lot Id</td>
<td>1-1</td>
</tr>
<tr>
<td>informationId</td>
<td>string</td>
<td>Information identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```
<ItemInformation
dateTime="2000-02-02T10:55:12.00-05:00"
itemInstanceId="001"
informationId="EquipmentMessage56"
/>
```
7.4 Lane Flow Events

Lane flow events are used to track the events occurring on an individual lane of a multi-lane piece of equipment. The state of the equipment is determined solely by the equipment flow events as shown in Table 4 "Prioritization of Multiple Lane and Multiple Working Zone Equipment States". For a single lane piece of equipment it is not required for the equipment to send the LaneStarved, LaneUnStarved, LaneBlocked, and LaneUnBlocked events.

7.4.1 Event: LaneStarved

StateChange: No State Change

Description: This event is triggered when a lane is ready to receive an item from an upstream piece of equipment but no item is available. All zones in the lane are empty. There is no unfinished work within the lane and there are no items available to move into the lane. All zones in the lane are empty and it can't pull any items in to work on.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```
<LaneStarved
dateTime="2000-02-02T10:57:12.00-05:00"
laneId="001"
/>
```

7.4.2 Event: LaneUnStarved

StateChange: No State Change

Description: This event denotes the removal of a LaneStarved condition. This event may only be sent after a LaneStarved event. This means that an item is available for the equipment to work on.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```
<LaneUnStarved
dateTime="2000-02-02T10:59:12.00-05:00"
laneId="001"
/>
```
7.4.3 Event: LaneBlocked

**StateChange:** No State Change

**Description:** The event is triggered when a lane is ready to send completed items to a downstream piece of equipment but is prevented from doing so by the downstream piece of equipment. Processing of all items in all working zones within the lane has been completed. There is no room available within any of the equipment’s zones. The lane is unable to accept any new items into its staging or working zones. The lane is full and it can’t push any items out.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>date_time</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<LaneBlocked
dateTime="2000-02-02T11:01:12.00-05:00"
laneId="001"/>
```

7.4.4 Event: LaneUnBlocked

**StateChange:** No State Change

**Description:** This event denotes the removal of a LaneBlocked condition. This event may only be sent after a LaneBlocked event. This means that an item can be transferred out of a lane. The downstream equipment blockage has been removed.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>date_time</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>laneId</td>
<td>string</td>
<td>Line lane identifier</td>
<td>1-n</td>
</tr>
</tbody>
</table>

```xml
<LaneUnBlocked
dateTime="2000-02-02T11:03:12.00-05:00"
laneId="001"/>
```
7.5 Equipment Flow Events

7.5.1 Event: EquipmentStarved

**StateChange:** Current State -> READY-IDLE-STARVED

**Description:** This event is triggered when a piece of equipment is ready to receive an item from an upstream piece of equipment but no item is available. The equipment's working area is available to work but it is not being given anything to build. There is no unfinished work within the piece of equipment and there are no items available to move into the equipment. The equipment is empty and it can't pull any items in to work on.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentStarved
datetime="2000-02-02T11:05:12.00-05:00"/>
```

7.5.2 Event: EquipmentUnStarved

**StateChange:** Ready-Idle-Starved -> READY-PROCESSING-ACTIVE

**Description:** This event denotes the removal of an EquipmentStarved condition. This event may only be sent after an EquipmentStarved event. This means that an item is available for the equipment to work on.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentUnStarved
datetime="2000-02-02T11:07:12.00-05:00"/>
```
7.5.3 Event: EquipmentBlocked

**StateChange:** Current State -> READY-IDLE-BLOCKED

**Description:** The event is triggered when a piece of equipment is ready to send completed items to a downstream piece of equipment but is prevented from doing so by the downstream piece of equipment. Processing of all items in a working zone within the equipment has been completed. The equipment is unable to accept any new items into its staging or working zones. The equipment is full and it can’t push any items out.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```
<EquipmentBlocked
datetime="2000-02-02T11:09:12.00-05:00"
/>
```

7.5.4 Event: EquipmentUnBlocked

**StateChange:** READY-IDLE-BLOCKED - /> READY-PROCESSING-ACTIVE

**Description:** This event denotes the removal of an EquipmentBlocked condition. This event may only be sent after an EquipmentBlocked event. This means that an item can be transferred out of a piece of equipment. The downstream equipment blockage has been removed.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```
<EquipmentUnBlocked
datetime="2000-02-02T11:12:00-05:00"
/>
```
7.6 Equipment Events

7.6.1 Event: EquipmentInitializationComplete

StateChange: Off -> SETUP

Description: This event is sent when power is applied to the piece of equipment and the piece of equipment has entered the Setup state.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>softwareRev</td>
<td>string</td>
<td>Software or Firmware revision code</td>
<td>1-1</td>
</tr>
<tr>
<td>hardwareRev</td>
<td>string</td>
<td>Hardware revision code</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentInitializationComplete
datetime="2000-02-02T11:13:12.00-05:00"
softwareRev="Rev 3.2.0"
hardwareRev="Rev 7-B"
/>
```

7.6.2 Event: EquipmentSetupComplete

StateChange: SETUP -> Any READY Sub-state or DOWN

Description: This event is sent when setup is complete and the equipment is ready to process items.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentSetupComplete
datetime="2000-02-02T11:12:12.00-05:00"
/>
7.6.3 Event: EquipmentStartSelected

**StateChange:** Current State -> Any READY Sub-state

**Description:** This event is sent when Setup is complete and the equipment has entered the Ready state. Either the equipment itself, an operator, or a host computer can initiate the transition into the any READY sub-state. The eventInitiator attribute may have the default value of "Operator" if tracking of personal data is not possible.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>eventInitiator</td>
<td>string</td>
<td>Identifier of person or host who initiated event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentStartSelected
datetime="2000-02-02T11:15:12.00-05:00"
eventInitiator="Operator 10650"
/>```

7.6.4 Event: EquipmentSetupSelected

**StateChange:** Current State -> SETUP

**Description:** This event is sent when the equipment has completed its transition into the SETUP state. This event typically occurs in response to an equipment operator or host computer-initiated command.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>eventInitiator</td>
<td>string</td>
<td>Identifier of person or host who initiated event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentSetupSelected
datetime="2000-02-02T11:17:12.00-05:00"
eventInitiator="SMT Line 2 Host"
/>```
7.6.5 Event: EquipmentDownSelected

StateChange: Current State -> DOWN

Description: This event is sent when the equipment has completed its transition into the DOWN state. This event typically occurs in response to an equipment operator or host computer-initiated command.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>eventInitiator</td>
<td>string</td>
<td>Identifier of person or host who initiated event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentDownSelected
datetime="2000-02-02T11:21:12.00-05:00"
eventInitiator="SMT Line 2 Host"
/>```

7.6.6 Event: EquipmentPowerOff

StateChange: DOWN -> OFF

Description: This event is sent when the equipment is powered down during a controlled shutdown procedure. This event is not sent during an emergency shutdown.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>eventInitiator</td>
<td>string</td>
<td>Identifier of person or host who initiated event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentPowerOff
datetime="2000-02-02T11:22:12.00-05:00"
eventInitiator="Joe Smith"
/>```
7.6.7 Event: EquipmentRecipeSelected

StateChange: No State Change

Description: This event is sent when a recipe is selected for use on a piece of equipment. A recipe must be selected before it can become the active recipe for a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>recipeId</td>
<td>string</td>
<td>Identifier of the new program</td>
<td>1-1</td>
</tr>
<tr>
<td>laneList</td>
<td>stringList</td>
<td>List of affected lanes (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>zoneList</td>
<td>stringList</td>
<td>List of affected zones (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
</tbody>
</table>

```xml
<EquipmentRecipeSelected
datetime="2000-02-02T11:23:12.00-05:00"
recipeId="12345.A"
laneList="1-3,4,5"
zoneList="1"/>
```

7.6.8 Event: EquipmentRecipeReady

StateChange: No state change

Description: This event is sent when a recipe is ready to run on a piece of equipment. The selected recipe has become the active recipe for the piece of equipment. This event must be sent after an EquipmentRecipeSelected event.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>recipeId</td>
<td>string</td>
<td>Identifier of the new program</td>
<td>1-1</td>
</tr>
<tr>
<td>laneList</td>
<td>stringList</td>
<td>List of affected lanes (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>zoneList</td>
<td>stringList</td>
<td>List of affected zones (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
</tbody>
</table>

```xml
<EquipmentRecipeReady
datetime="2000-02-02T11:25:12.00-05:00"
recipeId="12345.B"
laneList="1-3,4,5"
zoneList="1-7"/>
```
7.6.9 Event: EquipmentSelectedRecipeModified

StateChange: No State Change

Description: This event is sent whenever a selected recipe on a piece of equipment has been modified. This event occurs whenever a selected recipe has been edited and saved.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>recipeId</td>
<td>string</td>
<td>Identifier of the modified program</td>
<td>1-1</td>
</tr>
<tr>
<td>laneList</td>
<td>stringList</td>
<td>List of affected lanes (eg: 1,3-5 means 1,3,4 and 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>zoneList</td>
<td>stringList</td>
<td>List of affected zones (eg: 1,3-5 means 1,3,4, and 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>action</td>
<td>string (enumerated)</td>
<td>DELETE</td>
<td>MODIFY</td>
</tr>
</tbody>
</table>

```xml
<EquipmentSelectedRecipeModified
datetime="2000-02-02T11:27:12.00-05:00"
recipeId="12345 Rev C"
laneList="1-3,5"
zoneList="1"
action="MODIFY"
/>
```

7.6.10 Event: EquipmentNonSelectedRecipeModified

StateChange: No State Change

Description: This event is sent whenever a non-selected recipe on a piece of equipment has been modified. This event occurs whenever an existing recipe has been edited and saved.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>recipeId</td>
<td>string</td>
<td>Identifier of the modified program</td>
<td>1-1</td>
</tr>
<tr>
<td>action</td>
<td>string (enumerated)</td>
<td>CREATE</td>
<td>DELETE</td>
</tr>
</tbody>
</table>

```xml
<EquipmentNonSelectedRecipeModified
datetime="2000-02-02T11:29:12.00-05:00"
recipeId="Product A Top Side Line 1"
action="CREATE"
/>
```
7.6.11 Event: EquipmentParameterModified

**StateChange:** No State Change

**Description:** This event is sent whenever a parameter on a piece of equipment has been modified. This event occurs whenever an existing equipment parameter has been edited and saved.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>parameter</td>
<td>string</td>
<td>Identifier of the modified parameter or group of parameters.</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentParameterModified
datetime="2000-02-02T11:31:12.00-05:00"
parameter="Vision System"/>
```

7.6.12 Event: EquipmentAlarm

**StateChange:** Current State -> DOWN

**Description:** This event is sent whenever an alarm condition is encountered on a piece of equipment. An alarm indicates a dangerous situation for people, equipment, or items. Alarms are distinguished from errors in that they must be acted on immediately.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>alarmId</td>
<td>string</td>
<td>Alarm identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>alarmInstanceId</td>
<td>string</td>
<td>Specific alarm instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>alarmType</td>
<td>string (enumerated)</td>
<td>PERSONALSafety</td>
<td>EQUIPMENTSafety</td>
</tr>
<tr>
<td>laneList</td>
<td>stringList</td>
<td>List of affected lanes (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>zoneList</td>
<td>stringList</td>
<td>List of affected zones (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
</tbody>
</table>

```xml
<EquipmentAlarm
datetime="2000-02-02T11:33:22.00-05:00"
alarmId="MotorOilLow"
alarmInstanceId="30465"
alarmType="EQUIPMENTSafety"
laneList="1,2"
zoneList="3"/>
```
7.6.13 Event: EquipmentAlarmCleared

**State Change:** No State Change

**Description:** This event is sent when an individual alarm is cleared on a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>alarmInstanceId</td>
<td>string</td>
<td>Specific alarm instance identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentAlarmCleared
datetime="2000-02-02T11:35:22.00-05:00"
alarmInstanceId="30465"/>
```

7.6.14 Event: EquipmentAlarmsCleared

**State Change:** No State Change

**Description:** This event is sent when all alarm conditions have been cleared on a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentAlarmsCleared
datetime="2000-02-02T11:37:22.00-05:00"/>
```
7.6.15 Event: EquipmentError

StateChange: Current State -> DOWN

Description: This event is sent by a piece of equipment when a piece of equipment encounters a situation where it can no longer process an item. The equipment requires either operator or host assistance to remedy the error situation.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>errorId</td>
<td>string</td>
<td>Error identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>errorInstanceId</td>
<td>string</td>
<td>Specific error instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneList</td>
<td>stringList</td>
<td>List of affected lanes (eg: 1,3-5 means 1, 3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>zoneList</td>
<td>stringList</td>
<td>List of affected zones (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
</tbody>
</table>

```xml
<EquipmentError
datetime="2000-02-02T11:39:22.00-05:00"
errorId="45"
errorInstanceId="321-001"
laneList="1"
zoneList="1-3,5"
/>
```

7.6.16 Event: EquipmentErrorCleared

StateChange: No State Change

Description: This event is sent when an individual error condition has been cleared on a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>errorInstanceId</td>
<td>string</td>
<td>Specific error instance identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentErrorCleared
datetime="2000-02-02T11:41:22.00-05:00"
errorInstanceId="321-001"
/>
```
7.6.17 Event: EquipmentErrorsCleared

StateChange: No State Change

Description: This event is sent whenever all error conditions have been cleared on a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```
<EquipmentErrorsCleared
dateTime="2000-02-02T11:43:22.00-05:00"/>
```

7.6.18 Event: EquipmentWarning

StateChange: No State Change

Description: This event is sent by a piece of equipment when a piece of equipment encounters a situation that does not cause an error but will cause problems if not attended to in a timely manner. An example of a warning would be an event, which if not addressed, would degrade the performance of the equipment. The equipment will not stop and it will continue to process items.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>warningId</td>
<td>string</td>
<td>Warning identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>warningInstanceId</td>
<td>string</td>
<td>Specific warning instance identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>laneList</td>
<td>stringList</td>
<td>List of affected lanes (eg: 1,3-5 means 1, 3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>zoneList</td>
<td>stringList</td>
<td>List of affected zones (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
</tbody>
</table>

```
<EquipmentWarning
dateTime="2000-02-02T11:45:22.00-05:00"
warningId="PreventiveMaintenanceRequired–Change Oil Filter"
warningInstanceId="1828494"
laneList="1"
zoneList="1-3"
/>
```
7.6.19 Event: EquipmentWarningCleared

**StateChange:** No State Change

**Description:** This event is sent when an individual warning condition has been cleared on a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>warningInstanceId</td>
<td>string</td>
<td>Specific warning instance identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentWarningCleared
dateTime="2000-02-02T11:47:22.00-05:00"
warningInstanceId="1828494"
/>
```

7.6.20 Event: EquipmentWarningsCleared

**StateChange:** No State Change

**Description:** This event is sent when all warning conditions have been cleared on a piece of equipment.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>warningInstanceId</td>
<td>string</td>
<td>Specific warning instance identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<EquipmentWarningsCleared
dateTime="2000-02-02T11:49:22.00-05:00"
warningInstanceId="1828494"
/>
```
7.6.21 Event: EquipmentInformation

**StateChange:** No State Change

**Description:** This event is sent by a piece of equipment when an interesting event occurs on the equipment. This event will not result in either an error or a warning. EquipmentInformation events are different from EquipmentWarning events because they are not tracked on an individual basis nor do they need to be cleared. No direct operator or host action is required.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>informationId</td>
<td>string</td>
<td>Information identifier</td>
<td></td>
</tr>
<tr>
<td>laneList</td>
<td>stringList</td>
<td>List of affected lanes (eg: 1,3-5 means 1, 3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
<tr>
<td>zoneList</td>
<td>stringList</td>
<td>List of affected zones (eg: 1,3-5 means 1,3,4 &amp; 5)</td>
<td>1-n, 1-m</td>
</tr>
</tbody>
</table>

```xml
<EquipmentInformation
dateTime="2000-02-02T11:51:22.00-05:00"
informationId="All systems operating normally"
laneList="1"
zoneList="1-5"
/>
```
7.7 Operator Information Events

7.7.1 Event: OperatorInformation

StateChange: No State Change

Description: Operator information messages are generated as the result of an operator action. These indicate a no problem condition and so do not require recovery mechanism.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>operatorId</td>
<td>string</td>
<td>Operator identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>informationId</td>
<td>string</td>
<td>Information identifier</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```xml
<OperatorInformation
datetime="2000-02-02T11:53:22.00-05:00"
operatorId="Operator 1"
informationId="New tooling working fine"
/>
```

7.7.2 Event: OperatorActionRegistered

StateChange: No State Change

Description: The equipment is indicating that an operator action has been performed.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>operatorId</td>
<td>string</td>
<td>Operator identifier</td>
<td>1-1</td>
</tr>
<tr>
<td>description</td>
<td>string</td>
<td>Description of operator action</td>
<td></td>
</tr>
</tbody>
</table>

```xml
<OperatorActionRegistered
datetime="2000-02-02T11:55:22.00-05:00"
operatorId="Operator 1"
description="Machine Calibration Complete"
/>
```
7.7.3 Event: WaitingforOperatorAction

StateChange: Current State -> DOWN

Description: The equipment is indicating that it is waiting for an operator action to be performed.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Attribute Type</th>
<th>Description</th>
<th>Occ</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>dateTime</td>
<td>Date and time of the event</td>
<td>1-1</td>
</tr>
<tr>
<td>description</td>
<td>string</td>
<td>Description of operator action required</td>
<td>1-1</td>
</tr>
</tbody>
</table>

```
<WaitingforOperatorAction
dateTime="2000-02-02T11:57:22.00-05:00"
description="Waiting for parts replenishment"
/>
```
8 Equipment Flow Event Scenarios – Single Lane Equipment

8.1 Scenario 1 – Single Working Zone, Single Item
Scenario - Equipment idle; single item enters system and is processed. Equipment has single lane, single working zone.
Note: LR is a label reader.

LR

<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------PIECE OF EQUIPMENT--------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -
State: READY-IDLE-STARVED
Action: Single item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.

Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event: ItemIdentifierRead
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
itemId: 001
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:
datetime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
datetime: 2000-02-02T10:35:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved
<table>
<thead>
<tr>
<th>LR</th>
<th>001</th>
<th>Lane 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT CONVEYOR</td>
<td>INPUT ZONE-1</td>
<td>WORKING ZONE-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INPUT CONVEYOR</td>
<td>INPUT ZONE-1</td>
<td>WORKING ZONE-2</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Action:</td>
<td>Transfer of item to Working Zone completes.</td>
<td></td>
</tr>
<tr>
<td>Event:</td>
<td>ItemTransferZone</td>
<td></td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-ACTIVE</td>
<td></td>
</tr>
<tr>
<td>Message:</td>
<td>dateTime: 2000-02-02T10:35:10.00-05:00</td>
<td></td>
</tr>
<tr>
<td>itemInstanceId: 001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fromZoneId: 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>toZoneId: 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>laneId: 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INPUT CONVEYOR</td>
<td>INPUT ZONE-1</td>
<td>WORKING ZONE-2</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong><strong><strong><strong><strong>001</strong></strong></strong></strong></strong></em>______________</td>
<td></td>
<td>-------PIECE OF EQUIPMENT--------</td>
</tr>
</tbody>
</table>

**Action:** Processing of item begins.

**Event:** ItemWorkStart  
**State:** READY-PROCESSING-EXECUTING  
**Message:** 
**dateTime:** 2000-02-02T10:35:12.00-05:00  
**itemInstanceId:** 001  
**laneId:** 1  
**zoneId:** 2  

**Event:** EquipmentChangeState  
**State:** READY-PROCESSING-EXECUTING  
**Message:** 
**dateTime:** 2000-02-02T10:35:12.00-05:00  
**previousState:** READY-PROCESSING-ACTIVE  
**currentState:** READY-PROCESSING-EXECUTING  
**eventId:** ItemWorkStart
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------\PIECE OF EQUIPMENT---------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Processing of item completes.

**Event:** ItemWorkComplete

**State:** READY-PROCESSING-ACTIVE

**Event:** EquipmentChangeState

**State:** READY-PROCESSING-ACTIVE

---

**dateTime:** 2000-02-02T10:35:32.00-05:00

**itemInstanceId:** 001

**laneId:** 1

**zoneId:** 2

---

**Event:** ItemWorkComplete

**State:** READY-PROCESSING-ACTIVE

**Message:** READY-PROCESSING-EXECUTING

**eventId:** ItemWorkComplete
LR_________________________001________________ Lane 1

<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

------PIECE OF EQUIPMENT------

Action: Transfer of item to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:

dateTime: 2000-02-02T10:35:33.00-05:00
itemId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><strong><strong><strong><strong>PIECE OF EQUIPMENT</strong></strong></strong></strong></strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Transfer of item to Output Conveyor completes. Equipment becomes starved as no items are available.

**Event:** ItemTransferOut  
**State:** READY-PROCESSING-ACTIVE  
**Message:**  
**dateTime:** 2000-02-02T10:35:38.00-05:00  
**itemInstanceId:** 001  
**laneId:** 1  

**Event:** EquipmentStarved  
**State:** READY-IDLE-STARVED  
**Message:**  
**dateTime:** 2000-02-02T10:35:38.00-05:00  

**Event:** EquipmentChangeState  
**State:** READY-IDLE-STARVED  
**Message:**  
**dateTime:** 2000-02-02T10:35:38.00-05:00  
**previousState:** READY-PROCESSING-ACTIVE  
**currentState:** READY-IDLE-STARVED  
**eventId:** EquipmentStarved
8.2 Scenario 2 – Single Working Zone, Multiple Items

Scenario - Equipment idle; two items enter system and are processed. Equipment has single lane, single working zone.

Action: Stable state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -

State: READY-IDLE-STARVED
Action: First item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.

Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event: ItemIdentifierRead
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
itemId: 001
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
prevState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved
Action: Transfer of first item to Input Zone completes. Label of second item read.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:05.00-05:00
itemId: 001
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:06.00-05:00
itemId: 002
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC
Action: Transfer of first item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

Action: Second item enters equipment.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:11.00-05:00
itemInstanceId: 002
laneId: 1
Action: Processing of first item begins.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:12.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:12.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
</table>

| Action: | Processing of first item completes. |
| Event:  | ItemWorkComplete |
| State:  | READY-PROCESSING-ACTIVE |
| Message: | ItemInstanceId: 001 |
| dateTime: | 2000-02-02T10:35:32.00-05:00 |
| laneId: | 1 |
| zoneId: | 2 |

<p>| Event:  | EquipmentChangeState |
| State:  | READY-PROCESSING-ACTIVE |
| Message: | previousState: READY-PROCESSING-EXECUTING |
| dateTime: | 2000-02-02T10:35:32.00-05:00 |
| currentState: | READY-PROCESSING-ACTIVE |
| eventId: | ItemWorkComplete |</p>
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

--- PIECE OF EQUIPMENT ---

**Action:** Transfer of first item to Output Zone completes.

**Event:** ItemTransferZone

**State:** READY-PROCESSING-ACTIVE

**Message:**
- **dateTime:** 2000-02-02T10:35:33.00-05:00
- **itemInstanceId:** 001
- **fromZoneId:** 2
- **toZoneId:** 3
- **laneId:** 1

**Action:** Transfer of second item to Working Zone completes.

**Event:** ItemTransferZone

**State:** READY-PROCESSING-ACTIVE

**Message:**
- **dateTime:** 2000-02-02T10:35:37.00-05:00
- **itemInstanceId:** 002
- **fromZoneId:** 1
- **toZoneId:** 2
- **laneId:** 1
<table>
<thead>
<tr>
<th>Action:</th>
<th>Transfer of first item to Output Conveyor completes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event:</td>
<td>ItemTransferOut</td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>Message:</td>
<td>dateTime: 2000-02-02T10:35:38.00-05:00</td>
</tr>
<tr>
<td></td>
<td>itemInstanceId: 001</td>
</tr>
<tr>
<td></td>
<td>laneId: 1</td>
</tr>
</tbody>
</table>
Action: Processing of second item begins.

Event: ItemWorkStart
State: Ready-Processing-Executing
Message: dateTime: 2000-02-02T10:35:39.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T10:35:39.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart
**Action:** Processing of second item completes.

**Event:** ItemWorkComplete

**State:** READY-PROCESSING-ACTIVE

**Message:**

<table>
<thead>
<tr>
<th>dateTime</th>
<th>2000-02-02T10:35:59.00-05:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>itemInstanceId</td>
<td>002</td>
</tr>
<tr>
<td>laneId</td>
<td>1</td>
</tr>
<tr>
<td>zoneId</td>
<td>2</td>
</tr>
</tbody>
</table>

**Event:** EquipmentChangeState

**State:** READY-PROCESSING-ACTIVE

**Message:**

<table>
<thead>
<tr>
<th>dateTime</th>
<th>2000-02-02T10:35:59.00-05:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>previousState</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>currentState</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>eventId</td>
<td>ItemWorkComplete</td>
</tr>
<tr>
<td>INPUT CONVEYOR</td>
<td>INPUT ZONE-1</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Action:</td>
<td>Transfer of second item to Output Zone completes.</td>
</tr>
<tr>
<td>Event:</td>
<td>ItemTransferZone</td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-ACTIVE</td>
</tr>
<tr>
<td>Message:</td>
<td>dateTime: 2000-02-02T10:36:00.00-05:00</td>
</tr>
<tr>
<td>itemInstanceId: 002</td>
<td></td>
</tr>
<tr>
<td>fromZoneId: 2</td>
<td></td>
</tr>
<tr>
<td>toZoneId: 3</td>
<td></td>
</tr>
<tr>
<td>laneId: 1</td>
<td></td>
</tr>
</tbody>
</table>
Action: Transfer of second item to Output Conveyor completes. Equipment becomes starved as no items are available.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T10:36:05.00-05:00
itemInstanceId: 002
laneId: 1

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message: dateTime: 2000-02-02T10:36:05.00-05:00
laneId: 1

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message: dateTime: 2000-02-02T10:36:05.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved
8.3 Scenario 3 – Single Working Zone, Multiple Items, Downstream Bottleneck

Scenario - Equipment idle; unspecified number of items enter the system and are processed. A gap in the entry of items results in an equipment starved condition. Subsequently a downstream bottleneck results in an equipment blocked condition. Equipment has single lane, single working zone.

<p>| LR |
|----------------------|----------------------|----------------------|----------------------|----------------------|</p>
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>------PIECE OF EQUIPMENT------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

**Event:**

**State:** READY-IDLE-STARVED
Action: First item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.

Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event: ItemIdentifierRead
State: READY-IDLE-STARVED
Message:

dateTime: 2000-02-02T10:35:00.00-05:00
itemId: 001
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:

dateTime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:

dateTime: 2000-02-02T10:35:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved
<table>
<thead>
<tr>
<th></th>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-------PIECE OF EQUIPMENT--------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Transfer of first item to Input Zone completes. Label of second item read.

**Event:** ItemTransferIn  
**State:** READY-PROCESSING-ACTIVE  
**Message:**  
**dateTime:** 2000-02-02T10:35:05.00-05:00  
**itemInstanceId:** 001  
**laneId:** 1  

**Event:** ItemIdentifierRead  
**State:** READY-PROCESSING-ACTIVE  
**Message:**  
**dateTime:** 2000-02-02T10:35:06.00-05:00  
**itemInstanceId:** 002  
**laneId:** 1  
**zoneId:** 1  
**scannerId:** Input Conveyor, Placer 1-IC
Action: Transfer of first item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
itemId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

Action: Second item enters equipment.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:11.00-05:00
itemId: 002
fromZoneId: 1
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>--------------</td>
<td>----------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
</tbody>
</table>

| Action: | Processing of first item begins. |

**Event:** ItemWorkStart  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T10:35:12.00-05:00  
**itemInstanceId:** 001  
**laneId:** 1  
**zoneId:** 2  
**eventId:** ItemWorkStart  

**Event:** EquipmentChangeState  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T10:35:12.00-05:00  
**previousState:** READY-PROCESSING-ACTIVE  
**currentState:** READY-PROCESSING-EXECUTING  
**eventId:** ItemWorkStart
Action: Processing of first item completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:

dateTime: 2000-02-02T10:35:32.00-05:00
itemId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:

dateTime: 2000-02-02T10:35:32.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action:</td>
<td>Transfer of first item to Output Zone completes. Note: First item can proceed no further due to downstream bottleneck.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event:</td>
<td>ItemTransferZone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-ACTIVE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Message:</td>
<td>dateTime: 2000-02-02T10:35:33.00-05:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>itemInstanceId: 001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>fromZoneId: 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>toZoneId: 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>laneId: 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action:</td>
<td>Transfer of second item to Working Zone completes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event:</td>
<td>ItemTransferZone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-ACTIVE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Message:</td>
<td>dateTime: 2000-02-02T10:35:37.00-05:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>itemInstanceId: 002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>fromZoneId: 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>toZoneId: 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>laneId: 1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Action: Processing of second item begins.

Event: ItemWorkStart
State: Ready-Processing-Executing
Message:

dateTime: 2000-02-02T10:35:39.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:

dateTime: 2000-02-02T10:35:39.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart
<table>
<thead>
<tr>
<th>LR</th>
<th>002</th>
<th>001</th>
<th>XXX</th>
<th>Lane 1</th>
</tr>
</thead>
</table>

**INPUT** | **ZONE-1** | **ZONE-2** | **ZONE-3** | **OUTPUT** | CONVEYOR

| ------PIECE OF EQUIPMENT--------|

**Action:** Processing of second item completes.

**Event:** ItemWorkComplete

**State:** READY-PROCESSING-ACTIVE

**Message:**

**dateTime:** 2000-02-02T10:35:59.00-05:00

**itemInstanceId:** 002

**laneId:** 1

**zoneId:** 2

**Event:** EquipmentChangeState

**State:** READY-PROCESSING-ACTIVE

**Message:**

**dateTime:** 2000-02-02T10:35:59.00-05:00

**previousState:** READY-PROCESSING-EXECUTING

**currentState:** READY-PROCESSING-ACTIVE

**eventId:** ItemWorkComplete
**Action:** Equipment becomes starved as no unprocessed items are present and space is available to accept additional items.

**Event:** EQUIPMENTSTARVED
**STATE:** READY-Idle-Starved
**Message:**
**dateTime:** 2000-02-02T10:36:00.00-05:00
**laneId:** 1

**Event:** EquipmentChangeState
**State:** READY-IDLE-STARVED
**Message:**
**dateTime:** 2000-02-02T10:36:00.00-05:00
**previousState:** READY-PROCESSING-ACTIVE
**currentState:** READY-IDLE-STARVED
**eventId:** EquipmentStarved
Action: Additional item becomes available and enters system for processing. When item becomes available on Input conveyor equipment no longer starved.

Event: ItemIdentifierRead
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:36:30.00-05:00
itemId: 003
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:30.00-05:00
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:30.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved
Action: Transfer of third item to Input Zone completes. Equipment becomes blocked as there are no unprocessed items in working zone(s) and equipment unable to accept any additional items.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message: 

dateTime: 2000-02-02T10:36:35.00-05:00
itemInstanceId: 003
laneId: 1

Event: EquipmentBlocked
State: READY-IDLE-BLOCKED
Message: 

dateTime: 2000-02-02T10:36:35.00-05:00

Event: EquipmentChangeState
State: READY-IDLE-BLOCKED
Message: 

dateTime: 2000-02-02T10:36:35.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-BLOCKED
eventId: EquipmentBlocked
## Action:
Downstream bottleneck clears and equipment becomes unblocked.

### Event:
EquipmentUnBlocked

### State:
READY-PROCESSING-ACTIVE

### Message:
datetime:
2000-02-02T10:36:45.00-05:00

### Event:
EquipmentChangeState

### State:
READY-PROCESSING-ACTIVE

### Message:
datetime:
2000-02-02T10:36:45.00-05:00

### previousState:
READY-IDLE-BLOCKED

### currentState:
READY-PROCESSING-ACTIVE

### eventId:
EquipmentUnBlocked
### 8.4 Scenario 4 – Single Working Zone, Equipment Error

Scenario - Equipment idle; single item enters system and processing starts - error occurs during processing. Equipment has single lane, single working zone.

<table>
<thead>
<tr>
<th>LR</th>
<th>Lane 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT CONVEYOR</td>
<td>INPUT ZONE-1</td>
</tr>
<tr>
<td>-------PIECE OF EQUIPMENT--------</td>
<td>--------</td>
</tr>
</tbody>
</table>

**Action:** Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

**Event:** -

**State:** READY-IDLE-STARVED
Action: Single item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.

Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event: ItemIdentifierRead
State: Ready-Idle-Starved
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved
Action: Transfer of item to Input Zone completes.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T10:35:05.00-05:00
itemInstanceId: 001
laneId: 1
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
</table>

-----PIECE OF EQUIPMENT-----

**Action:** Transfer of item to Working Zone completes.

**Event:** ItemTransferZone

**State:** READY-PROCESSING-ACTIVE

**Message:**

dateTime: 2000-02-02T10:35:10.00-05:00

itemId: 001

fromZoneId: 1

toZoneId: 2

laneId: 1
### Action:

Processing of item begins.

**Event:** ItemWorkStart  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T10:35:12.00-05:00  
**itemInstanceId:** 001  
**laneId:** 1  
**zoneId:** 2

**Event:** EquipmentChangeState  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T10:35:12.00-05:00  
**previousState:** READY-PROCESSING-ACTIVE  
**currentState:** READY-PROCESSING-EXECUTING  
**eventId:** ItemWorkStart
**Action:** Error - parts run out - occurs during processing.

**Event:** EquipmentError  
**State:** DOWN  
**Message:**  
**dateTime:** 2000-02-02T10:35:22.00-05:00  
**errorId:** 321  
**errorInstanceId:** 321-001  
**laneList:** 1  
**zoneList:** 1-3,5  

**Event:** EquipmentChangeState  
**State:** DOWN  
**Message:**  
**dateTime:** 2000-02-02T10:35:22.00-05:00  
**previousState:** Ready-Processing-Executing  
**currentState:** DOWN  
**eventId:** EquipmentError
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- - - - - - PIECE OF EQUIPMENT - - - - - -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Operator replenishes part and clears errors.

**Event:** EquipmentErrorCleared
**State:** DOWN
**Message:**
**dateTime:** 2000-02-02T10:36:30.00-05:00
**errorInstanceId:** 321-001

**Event:** EquipmentErrorsCleared
**State:** DOWN
**Message:**
**dateTime:** 2000-02-02T10:36:30.00-05:00
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Operator signals for processing to resume.

**Event:** EquipmentStartSelected
**State:** READY-PROCESSING-EXECUTING
**Message:**
**dateTime:** 2000-02-02T10:36:31.00-05:00
**eventInitiator:** Operator 2

**Event:** EquipmentChangeState
**State:** READY-PROCESSING-EXECUTING
**Message:**
**dateTime:** 2000-02-02T10:36:31.00-05:00
**previousState:** Down
**currentState:** READY-PROCESSING-EXECUTING
**eventId:** EquipmentStartSelected

**Event:** ItemWorkResume
**State:** READY-PROCESSING-EXECUTING
**Message:**
**dateTime:** 2000-02-02T10:36:32.00-05:00
**itemInstanceId:** 001
**laneId:** 1
**zoneId:** 2
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---PIECE OF EQUIPMENT---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Processing of item completes.

**Event:** ItemWorkComplete

**State:** READY-PROCESSING-ACTIVE

**Message:**

- **dateTime:** 2000-02-02T10:36:42.00-05:00
- **itemInstanceId:** 001
- **laneId:** 1
- **zoneId:** 2

**Event:** EquipmentChangeState

**State:** READY-PROCESSING-ACTIVE

**Message:**

- **dateTime:** 2000-02-02T10:36:42.00-05:00
- **previousState:** READY-PROCESSING-EXECUTING
- **currentState:** READY-PROCESSING-ACTIVE
- **eventId:** ItemWorkComplete
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Transfer of item to Output Zone completes.

**Event:** ItemTransferZone

**State:** READY-PROCESSING-ACTIVE

**Message:**

- **dateTime:** 2000-02-02T10:36:43.00-05:00
- **itemInstanceId:** 001
- **fromZoneId:** 2
- **toZoneId:** 3
- **laneId:** 1
Action: Transfer of item to Output Conveyor completes. Equipment becomes starved as no items are available.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T10:36:48.00-05:00
itemInstanceId: 001
laneId: 1

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message: dateTime: 2000-02-02T10:36:48.00-05:00
laneId: 1

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message: dateTime: 2000-02-02T10:36:48.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved
9 Equipment Flow Event Scenarios – Dual Lane Equipment

9.1 Scenario 5 – Single Working Zone, Single Item

Scenario - Equipment has dual lanes. Equipment Idle; single item enters lane and is processed. During this time a single item enters lane 2 and is processed. Equipment has dual lanes, single working zone, three heads, label reading capability on both lanes.

Note: LR is a label reader.

<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lane 2
Lane 1

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -
State: READY-IDLE-STARVED
Action: Single item enters the system for processing, equipment no longer starved.

Event: ItemIdentifierRead
State: READY-IDLE-STARVED
Message: dateTime: 2000-02-02T10:35:00.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: LaneUnStarved
State: No State Change
Message: dateTime: 2000-02-02T10:35:00.00-05:00
laneId: 1

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T10:35:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTION:</td>
<td>Transfer of item to Input Zone completes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVENT:</td>
<td>ItemTransferIn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATE:</td>
<td>READY-PROCESSING-ACTIVE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MESSAGE:</td>
<td>dateTime: 2000-02-02T10:35:05.00-05:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>itemInstanceId: 001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>laneId: 1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Action: Transfer of item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message: 
dateTime: 2000-02-02T10:35:06.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-ACTIVE
Message: 
dateTime: 2000-02-02T10:35:07.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 1
scannerId: Input Conveyor, Placer 2-IC

Event: LaneUnstarved
State: READY-PROCESSING-ACTIVE
Message: 
dateTime: 2000-02-02T10:35:08.00-05:00
laneId: 2
Action: Processing of item 001 begins.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message: 
dateTime: 2000-02-02T10:35:09.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message: 
dateTime: 2000-02-02T10:35:10.00-05:00
Previousstate: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

Action: Transfer of item to Input Zone completes.

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message: 
dateTime: 2000-02-02T10:35:10.00-05:00
itemInstanceId: 002
laneId: 2
<table>
<thead>
<tr>
<th></th>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane</td>
<td>2</td>
<td>002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane</td>
<td>1</td>
<td>001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

--- PIECE OF EQUIPMENT ---

**Action:** Transfer of item 002 to Working Zone completes.

**Event:** ItemTransferZone

**State:** READY-PROCESSING-EXECUTING

**Message:**

- **dateTime:** 2000-02-02T10:35:11.00-05:00
- **itemInstanceId:** 002
- **fromZoneId:** 1
- **toZoneId:** 2
- **laneId:** 2
<table>
<thead>
<tr>
<th>Action</th>
<th>Processing of item 002 begins.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event:</td>
<td>ItemWorkStart</td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>Message:</td>
<td></td>
</tr>
<tr>
<td>dateTime:</td>
<td>2000-02-02T10:35:11.00-05:00</td>
</tr>
<tr>
<td>itemInstanceId:</td>
<td>002</td>
</tr>
<tr>
<td>laneId:</td>
<td>2</td>
</tr>
<tr>
<td>zoneId:</td>
<td>2</td>
</tr>
</tbody>
</table>
**Action:** Processing of item 001 completes.

**Event:** ItemWorkComplete

**State:** READY-PROCESSING-EXECUTING

**Message:**
- dateTime: 2000-02-02T10:35:20.00-05:00
- itemInstanceId: 001
- laneId: 1
- zoneId: 2

**Equipment state remains:** READY-PROCESSING-EXECUTING
Action: Transfer of item 001 to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message: dateTime: 2000-02-02T10:35:21.00-05:00
itemInstanceId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1

Equipment state remains: READY-PROCESSING-EXECUTING
Action: Transfer of item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:21.00-05:00
itemId: 001
laneId: 1

Event: LaneStarved
dateTime: 2000-02-02T10:35:21.00-05:00
laneId: 1

Equipment state remains: READY-PROCESSING-EXECUTING
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT</td>
<td>INPUT</td>
<td>WORKING</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>CONVEYOR</td>
<td>ZONE-1</td>
<td>ZONE-2</td>
<td>ZONE-3</td>
<td>CONVEYOR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>INPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>INPUT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>WORKING</td>
<td>OUTPUT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ZONE-2</td>
<td>ZONE-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>INPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>INPUT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>WORKING</td>
<td>OUTPUT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ZONE-2</td>
<td>ZONE-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>INPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>INPUT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>WORKING</td>
<td>OUTPUT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ZONE-2</td>
<td>ZONE-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INPUT</td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZONE-1</td>
<td>CONVEYOR</td>
<td></td>
</tr>
</tbody>
</table>

Action: Processing of item 002 completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:31.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:31.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete
**Action:** Transfer of item 002 to Output Zone completes.

**Event:** ItemTransferZone

**State:** READY-PROCESSING-ACTIVE

**Message:**
- **dateTime:** 2000-02-02T10:35:31.00-05:00
- **itemInstanceId:** 002
- **fromZoneId:** 2
- **toZoneId:** 3
- **laneId:** 2

**Equipment state remains:** READY-PROCESSING-ACTIVE
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>---------------</td>
<td>--------------</td>
<td>----------------</td>
<td>---------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Action:** Transfer of item 002 to Output Conveyor completes. Equipment becomes starved.

**Event:** ItemTransferOut
**State:** READY-PROCESSING-ACTIVE
**Message:**
**dateTime:** 2000-02-02T10:35:32.00-05:00
**itemId:** 002
**laneId:** 2

**Event:** LaneStarved
**State:** No State Change
**Message:**
**dateTime:** 2000-02-02T10:35:32.00-05:00
**laneId:** 2

**Event:** EquipmentStarved
**State:** READY-IDLE-STARVED
**Message:**
**dateTime:** 2000-02-02T10:35:32.00-05:00

**Event:** EquipmentChangeState
**State:** READY-IDLE-STARVED
**Message:**
**dateTime:** 2000-02-02T10:35:32.00-05:00
**previousState:** READY-PROCESSING-EXECUTING
**currentState:** READY-IDLE-STARVED
**eventId:** EquipmentStarved
9.2 Scenario 6 – Single Working Zone, Multiple Items

Equipment has dual lanes, single working zone, multiple items, label reading capability on both lanes.

Note: LR is a label reader.

Scenario:
Equipment OFF.
Equipment is turned on and a recipe selected.
A single item enters lane 1.
Processing begins on the product item in lane 1.
A single item enters lane 2.
Processing begins on the product item in lane 2.
Other product items are introduced at each lane.

Exceptions:
Equipment error on lane 2 (cleared)
Lane starved on lane 2
Lane blocked on lane 1
Equipment blocked
Equipment starved
Equipment stopped
Action: Machine turned on. No items anywhere.

Event: EquipmentInitializationComplete
State: SETUP
Message: dateTime: 2000-02-02T09:30:00.00-05:00
softwareRev: Rev 3.2.0
hardwareRev: Rev 7-B

Event: EquipmentChangeState
State: SETUP
Message: dateTime: 2000-02-02T09:30:00.00-05:00
previousState: OFF
currentState: SETUP
eventId: EquipmentInitializationComplete

Event: EquipmentInformation
State: SETUP
Message: dateTime: 2000-02-02T09:30:00.00-05:00
informationId: "Good Morning Hal"
laneList: 1-2
zoneList: 1-3
### Action:
Recipe is selected for lanes 1 & 2. Equipment indicates when the selected recipe is ready to run. The host computer for the line brings the equipment to the Ready state.

#### Event: EquipmentRecipeSelected
**State:** SETUP
**Message:**
- **dateTime:** 2000-02-02T09:30:05.00-05:00
- **recipeId:** 12345.A
- **laneList:** 1-2
- **zoneList:** 1-3

#### Event: EquipmentRecipeReady
**State:** SETUP
**Message:**
- **dateTime:** 2000-02-02T09:30:21.00-05:00
- **recipeId:** 12345.A
- **laneList:** 1-2
- **zoneList:** 1-3

#### Event: EquipmentStartSelected
**State:** READY-PROCESSING-EXECUTING
**Message:**
- **dateTime:** 2000-02-02T09:30:25.00-05:00
- **eventInitator:** SMT Line 2-A host

#### Event: EquipmentChangeState
**State:** READY-PROCESSING-EXECUTING
**Message:**
- **dateTime:** 2000-02-02T09:30:25.00-05:00
- **previousState:** SETUP
- **currentState:** READY-PROCESSING-EXECUTING
- **eventId:** EquipmentStartSelected

---

**INPUT CONVEYOR | INPUT ZONE-1 | WORKING ZONE-2 | OUTPUT ZONE-3 | OUTPUT CONVEYOR**

<p>| ------PIECE OF EQUIPMENT------ |</p>
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
</table>

---PIECE OF EQUIPMENT----

**Action:** Equipment is now ready to process product but no items are available - it is starved.

**Event:** LaneStarved  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T09:30:25.00-05:00  
**laneId:** 1  

**Event:** LaneStarved  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T09:30:25.00-05:00  
**laneId:** 2  

**Event:** EquipmentStarved  
**State:** READY-IDLE-STARVED  
**Message:**  
**dateTime:** 2000-02-02T09:30:25.00-05:00  

**Event:** EquipmentChangeEvent  
**State:** READY-IDLE-STARVED  
**Message:**  
**dateTime:** 2000-02-02T09:30:25.00-05:00  
**previousState:** READY-PROCESSING-EXECUTING  
**currentState:** READY-IDLE-STARVED  
**eventId:** EquipmentStarved
**Action:** Single item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.

**Event:** ItemIdentifierRead
**State:** READY-IDLE-STARVED
**Message:**
**dateTime:** 2000-02-02T09:31:00.00-05:00
**itemInstanceId:** 001
**laneId:** 1
**zoneId:** 1
**scannerId:** Input Conveyor, Placer 1-IC

**Event:** LaneUnStarved
**State:** READY-IDLE-STARVED
**Message:**
**dateTime:** 2000-02-02T09:31:00.00-05:00
**laneId:** 1

**Event:** EquipmentUnStarved
**State:** READY-PROCESSING-EXECUTING
**Message:**
**dateTime:** 2000-02-02T09:31:00.00-05:00

**Event:** EquipmentChangeState
**State:** READY-PROCESSING-EXECUTING
**Message:**
**dateTime:** 2000-02-02T09:31:00.00-05:00
**previousState:** READY-IDLE-STARVED
**currentState:** READY-PROCESSING-EXECUTING
**eventId:** EquipmentUnStarved
Action: Second item enters the system for processing. Item becomes available on the Input Conveyor on lane 2. Lane 2 is no longer starved, but since lane 1 was already active there is no equipment state change.

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:02.00-05:00
itemInstanceId: 001
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:03.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: LaneUnStarved
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:03.00-05:00
laneId: 2

Equipment state remains: READY-PROCESSING-EXECUTING
Action: Transfer of item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
datetime: 2000-02-02T09:31:10.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
datetime: 2000-02-02T09:31:11.00-05:00
itemInstanceId: 002
laneId: 2

Event: ItemIdentifierRead
State: READY-PROCESSING-ACTIVE
Message:
datetime: 2000-02-02T09:31:12.00-05:00
itemInstanceId: 003
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
datetime: 2000-02-02T09:31:13.00-05:00
itemInstanceId: 001
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
datetime: 2000-02-02T09:31:13.00-05:00
previousState: Ready-Processing-Active
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart
LR

<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>--------------</td>
<td>----------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
</tbody>
</table>

--- PIECE OF EQUIPMENT ---

**Action:** Transfer of item 002 to Working Zone completes.

**Event:** ItemTransferZone  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T09:31:15.00-05:00  
**itemInstanceId:** 002  
**fromZoneId:** 1  
**toZoneId:** 2  
**laneId:** 2

**Event:** ItemWorkStart  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T09:31:16.00-05:00  
**itemInstanceId:** 002  
**laneId:** 2

**Event:** ItemTransferIn  
**State:** READY-PROCESSING-EXECUTING  
**Message:**  
**dateTime:** 2000-02-02T09:31:16.00-05:00  
**itemInstanceId:** 003  
**laneId:** 1

**Equipment state remains:** READY-PROCESSING-EXECUTING
Action: Processing of item 001 completes.

Event: ItemWorkComplete
State: READY-PROCESSING-EXECUTING
Message: dateTime: 2000-02-02T10:31:58.00-05:00
temInstance: 001
laneId: 1
zoneId: 2

Action: Board available at input.

Event: ItemIdentifierRead
State: READY-PROCESSING-EXECUTING
Message: dateTime: 2000-02-02T09:31:58.00-05:00
temInstance: 004
laneId: 2
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Equipment state remains: READY-PROCESSING-EXECUTING
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Action: Transfer of item 001 to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
- dateTime: 2000-02-02T09:32:00.00-05:00
- itemInstanceId: 001
- fromZoneId: 2
- toZoneId: 3
- laneId: 1

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
- dateTime: 2000-02-02T09:32:00.00-05:00
- itemInstanceId: 004
- laneId: 2

Action: Transfer of item 003 to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
- dateTime: 2000-02-02T09:32:02.00-05:00
- itemInstanceId: 003
- fromZoneId: 1
- toZoneId: 2
- laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-EXECUTING
Message:
- dateTime: 2000-02-02T09:32:03.00-05:00
- itemInstanceId: 005
- laneId: 1
- zoneId: 1
- scannerId: Input Conveyor, Placer 1-IC

Equipment state remains: READY-PROCESSING-EXECUTING
Action: Processing complete on item 002.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message: 

dateTime: 2000-02-02T10:31:58.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message: 

dateTime: 2000-02-02T09:32:00.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

Action: Transfer of item 001 to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message: 

dateTime: 2000-02-02T10:32:00.00-05:00
itemInstanceId: 001
laneId: 1

Action: Processing begins on board 003.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message: 

dateTime: 2000-02-02T09:32:05.00-05:00
itemInstanceId: 003
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message: 

dateTime: 2000-02-02T09:32:05.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart
Action: Transfer of item 002 to Output Zone 3.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:09.00-05:00
itemInstanceId: 002
fromZoneId: 2
toZoneId: 3
laneId: 2

Action: Item 004 transfers to work zone.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:10.00-05:00
itemInstanceId: 004
fromZoneId: 1
toZoneId: 2
laneId: 2

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:11.00-05:00
itemInstanceId: 005
laneId: 1

Action: Processing begins on board 004.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:12.00-05:00
itemInstanceId: 004
laneId: 2

Equipment state remains: READY-PROCESSING-EXECUTING
LR

--- PIECE OF EQUIPMENT -------

**Action:** Equipment Error on Lane 2 in Zone 3

**Event:** EquipmentError
**State:** DOWN
**Message:**
**dateTime:** 2000-02-02T09:32:15.00-05:00
**errorId:** Head Crash
**errorInstanceId:** 024
**laneList:** 2
**zoneList:** 3

**Event:** EquipmentChangeState
**State:** DOWN
**Message:**
**dateTime:** 2000-02-02T09:32:15.00-05:00
**previousState:** Ready-Processing-Executing
**currentState:** DOWN
**eventId:** EquipmentError

**Action:** Processing aborted for item 004.

**Event:** ItemWorkAbort
**State:** DOWN
**Message:**
**dateTime:** 2000-02-02T09:35:57.00-05:00
**itemInstanceId:** 004
**laneId:** 2
**zoneId:** 3
**abortId:** Head Crash

**Action:** Operator removes item 004 damaged by the head crash. Using the operator interface the operator indicates the removal to the equipment which issues the appropriate message.

**Event:** ItemTransferZone
**State:** DOWN
**Message:**
**dateTime:** 2000-02-02T09:37:43.00-05:00
**itemInstanceId:** 004
**fromZoneId:** 2
**toZoneId:** "Removed"
**laneId:** 2
<table>
<thead>
<tr>
<th>Action:</th>
<th>Equipment Error Cleared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event:</td>
<td>EquipmentErrorCleared</td>
</tr>
<tr>
<td>State:</td>
<td>DOWN</td>
</tr>
<tr>
<td>Message:</td>
<td></td>
</tr>
<tr>
<td>dateTime:</td>
<td>2000-02-02T09:42:00.00-05:00</td>
</tr>
<tr>
<td>errorInstanceId:</td>
<td>024</td>
</tr>
<tr>
<td>Event:</td>
<td>EquipmentStartSelected</td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>Message:</td>
<td></td>
</tr>
<tr>
<td>dateTime:</td>
<td>2000-02-02T09:42:02.00-05:00</td>
</tr>
<tr>
<td>eventInitiator:</td>
<td>Hal</td>
</tr>
<tr>
<td>Event:</td>
<td>EquipmentChangeState</td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>Message:</td>
<td></td>
</tr>
<tr>
<td>dateTime:</td>
<td>2000-02-02T09:42:02.00-05:00</td>
</tr>
<tr>
<td>previousState:</td>
<td>DOWN</td>
</tr>
<tr>
<td>currentState:</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>eventId:</td>
<td>EquipmentStartSelected</td>
</tr>
<tr>
<td>Event:</td>
<td>ItemWorkResume</td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>Message:</td>
<td></td>
</tr>
<tr>
<td>dateTime:</td>
<td>2000-02-02T09:42:05.00-05:00</td>
</tr>
<tr>
<td>itemInstanceId:</td>
<td>003</td>
</tr>
<tr>
<td>laneId:</td>
<td>1</td>
</tr>
<tr>
<td>Event:</td>
<td>ItemIdentifierRead</td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-EXECUTING</td>
</tr>
<tr>
<td>Message:</td>
<td></td>
</tr>
<tr>
<td>dateTime:</td>
<td>2000-02-02T09:42:06.00-05:00</td>
</tr>
<tr>
<td>itemInstanceId:</td>
<td>006</td>
</tr>
<tr>
<td>laneId:</td>
<td>1</td>
</tr>
<tr>
<td>zoneId:</td>
<td>1</td>
</tr>
<tr>
<td>scannerId:</td>
<td>Input Conveyor, Placer 1-IC</td>
</tr>
</tbody>
</table>
Action: Transfer of item 002 to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-EXECUTING
Message: 
dateTime: 2000-02-02T09:42:07.00-05:00
itemInstanceId: 002
laneId: 2

Event: LaneStarved
State: READY-PROCESSING-EXECUTING
Message: 
dateTime: 2000-02-02T09:42:07.00-05:00
laneId: 2
LR

<table>
<thead>
<tr>
<th>001</th>
<th>003</th>
<th>005</th>
<th>006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane 2</td>
<td>Lane 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INPUT</td>
<td>INPUT</td>
<td>WORKING</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>CONVEYOR</td>
<td>ZONE-1</td>
<td>ZONE-2</td>
<td>ZONE-3</td>
</tr>
</tbody>
</table>

----------PIECE OF EQUIPMENT----------

**Action:** Processing complete on item 003.

**Event:** ItemWorkComplete
**State:** READY-PROCESSING-ACTIVE
**Message:**
**dateTime:** 2000-02-02T09:42:20.00-05:00
**itemInstanceId:** 003
**laneId:** 1
**zoneId:** 2

**Event:** EquipmentChangeState
**State:** READY-PROCESSING-ACTIVE
**Message:**
**dateTime:** 2000-02-02T09:42:20.00-05:00
**previousState:** READY-PROCESSING-EXECUTING
**currentState:** READY-PROCESSING-ACTIVE
**eventId:** ItemWorkComplete
Action: Transfer of item 003 to Output Zone 3.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:21.00-05:00
itemId: 003
fromZoneId: 2
toZoneId: 3
laneId: 1

Action: Transfer of item 005 to Zone 2.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:21.00-05:00
itemId: 005
fromZoneId: 1
toZoneId: 2
laneId: 1

Action: Transfer of item 006 to Input.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:22.00-05:00
itemId: 006
laneId: 1
---PIECE OF EQUIPMENT---

**Action:** Additional item enters system.

- **Event:** ItemIdentifierRead
- **State:** READY-PROCESSING-ACTIVE
- **Message:**
  - **dateTime:** 2000-02-02T09:42:23.00-05:00
  - **itemInstanceId:** 007
  - **laneId:** 1
  - **zoneId:** 1
  - **scannerId:** Input Conveyor, Placer 1-IC

**Action:** Processing begins on board 005.

- **Event:** ItemWorkStart
- **State:** READY-PROCESSING-EXECUTING
- **Message:**
  - **dateTime:** 2000-02-02T09:42:25.00-05:00
  - **itemInstanceId:** 005
  - **laneId:** 1

- **Event:** EquipmentChangeState
  - **State:** READY-PROCESSING-EXECUTING
  - **Message:**
    - **dateTime:** 2000-02-02T09:42:25.00-05:00
    - **previousState:** READY-PROCESSING-ACTIVE
    - **currentState:** READY-PROCESSING-EXECUTING
    - **eventId:** ItemWorkStart
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

**Action:** Processing complete on item 005. Equipment becomes blocked as all possible work has been completed but equipment is unable to transfer item out due to downstream blockage.

**Event:** ItemWorkComplete
**State:** READY-PROCESSING-ACTIVE
**Message:**
- **dateTime:** 2000-02-02T09:42:30.00-05:00
- **itemId:** 005
- **laneId:** 1
- **zoneId:** 2

**Event:** EquipmentChangeState
**State:** READY-PROCESSING-ACTIVE
**Message:**
- **previousState:** READY-PROCESSING-EXECUTING
- **currentState:** READY-PROCESSING-ACTIVE
- **eventId:** ItemWorkComplete

**Event:** LaneBlocked
**State:** READY-PROCESSING-ACTIVE
**Message:**
- **dateTime:** 2000-02-02T09:42:30.00-05:00
- **laneId:** 1

**Event:** EquipmentBlocked
**State:** READY-IDLE-BLOCKED
**Message:**
- **dateTime:** 2000-02-02T09:42:30.00-05:00

**Event:** EquipmentChangeState
**State:** READY-IDLE-BLOCKED
**Message:**
- **previousState:** READY-PROCESSING-ACTIVE
- **currentState:** READY-IDLE-BLOCKED
- **eventId:** EquipmentBlocked
Action: Downstream blockage removed.

Event: LaneUnBlocked
State: READY-IDLE-BLOCKED
Message: dateTime: 2000-02-02T09:43:00.00-05:00
laneId: 1

Event: EquipmentUnBlocked
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T09:43:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T09:43:00.00-05:00
previousState: READY-IDLE-BLOCKED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnBlocked
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action:</td>
<td>Transfer of item to Output Conveyor completes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event:</td>
<td>ItemTransferOut</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State:</td>
<td>READY-PROCESSING-ACTIVE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Message:</td>
<td>dateTime: 2000-02-02T09:43:02.00-05:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>itemInstanceId: 003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>laneId: 1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Action:        | Transfer of item 005 to Output Zone 3. |
| Event:         | ItemTransferZone |
| State:         | READY-PROCESSING-ACTIVE |
| Message:       | dateTime: 2000-02-02T09:43:21.00-05:00 |
|                | itemInstanceId: 005 |
|                | fromZoneId: 2 |
|                | toZoneId: 3 |
|                | laneId: 1 |

| Action:        | Transfer of item 006 to Work Zone 2. |
| Event:         | ItemTransferZone |
| State:         | READY-PROCESSING-ACTIVE |
| Message:       | dateTime: 2000-02-02T09:43:22.00-05:00 |
|                | itemInstanceId: 006 |
|                | fromZoneId: 1 |
|                | toZoneId: 2 |
|                | laneId: 1 |
Action: Processing of items continues.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:

dateTime: 2000-02-02T09:43:23.00-05:00
itemInstanceId: 006
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:

dateTime: 2000-02-02T09:43:23.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:

dateTime: 2000-02-02T09:43:24.00-05:00
itemInstanceId: 007
laneId: 1
LR

<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>ZONE-1</th>
<th>ZONE-2</th>
<th>ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT ZONE</td>
<td>INPUT ZONE</td>
<td>WORKING ZONE</td>
<td>OUTPUT ZONE</td>
<td>CONVEYOR</td>
</tr>
<tr>
<td>007</td>
<td>006</td>
<td>005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---PIECE OF EQUIPMENT-----

**Action:** Transfer of item to Output Conveyor completes.

**Event:** ItemTransferOut
**State:** READY-PROCESSING-EXECUTING
**Message:**
**dateTime:** 2000-02-02T09:43:25.00-05:00
**itemInstanceId:** 005
**laneId:** 1

**Event:** ItemWorkComplete
**State:** READY-PROCESSING-ACTIVE
**Message:**
**dateTime:** 2000-02-02T09:43:30.00-05:00
**itemInstanceId:** 006
**laneId:** 1
**zoneId:** 2

**Event:** EquipmentChangeState
**State:** READY-PROCESSING-ACTIVE
**Message:**
**dateTime:** 2000-02-02T09:43:30.00-05:00
**previousState:** READY-PROCESSING-EXECUTING
**currentState:** READY-PROCESSING-ACTIVE
**eventId:** ItemWorkComplete
Action: Transfer of item 006 to Output Zone 3.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T09:44:32.00-05:00
itemInstanceId: 006
fromZoneId: 2
toZoneId: 3
laneId: 1

Action: Transfer of item 007 to Work Zone 2.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T09:44:33.00-05:00
itemInstanceId: 007
fromZoneId: 1
toZoneId: 2
laneId: 1

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message: dateTime: 2000-02-02T09:44:43.00-05:00
itemInstanceId: 007
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message: dateTime: 2000-02-02T09:44:43.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart
LR

_____________________________________________________ Lane 2
_________________________007___________________006___ Lane 1

|          |          |           |
| INPUT CONVEYOR | INPUT ZONE-1 | WORKING ZONE-2 | OUTPUT ZONE-3 | OUTPUT CONVEYOR |
|          |          |           |
| -------PIECE OF EQUIPMENT--------|

Action: Transfer of item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:44:45.00-05:00
itemId: 006
laneId: 1

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:45:43.00-05:00
itemId: 007
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:45:43.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete
<table>
<thead>
<tr>
<th>INPUT CONVEYOR</th>
<th>INPUT ZONE-1</th>
<th>WORKING ZONE-2</th>
<th>OUTPUT ZONE-3</th>
<th>OUTPUT CONVEYOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>--------------</td>
<td>----------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>--------------</td>
<td>----------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td>_______________</td>
<td>______________</td>
<td>_______________</td>
<td>_______________</td>
<td>______________</td>
</tr>
<tr>
<td><strong>Action:</strong> Last item moves to output zone.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Event:</strong> ItemTransferZone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>State:</strong> READY-PROCESSING-ACTIVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Message:</strong> dateTime: 2000-02-02T09:45:45.00-05:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>itemId:</strong> itemInstanceId: 007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ZoneId:</strong> fromZoneId: 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LaneId:</strong> toZoneId: 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LaneId:</strong> 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Action: Transfer of last item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T09:45:47.00-05:00
itemInstanceId: 007

Event: LaneStarved
State: READY-PROCESSING-ACTIVE
Message: dateTime: 2000-02-02T09:45:47.00-05:00
laneId: 1

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message: dateTime: 2000-02-02T09:45:47.00-05:00

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message: dateTime: 2000-02-02T09:45:47.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved
Action: Operator selects the down state.

Event: EquipmentDownSelected
State: DOWN
Message: 2000-02-02T09:46:00.00-05:00
eventInitiator: Hal

Event: EquipmentChangeState
State: DOWN
Message: 2000-02-02T09:46:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: DOWN
eventId: EquipmentDownSelected
10 2541 XML Schema

Here is the complete listing of the XML schema for IPC-2541. The Uniform Resource Indicator (URI) for each IPC-2541 schema is listed first, followed by the XML schema for the IPC-2501 schema that it extends. A graphical representation of each IPC-2541 schema is then shown, followed by the actual schema definition for each of the 2541 events.
10.1 EquipmentAlarm

URI: [http://webstds.ipc.org/2541/EquipmentAlarm.xsd](http://webstds.ipc.org/2541/EquipmentAlarm.xsd)
Extends: [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

Graphical Representation:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!-Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema--> 
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentAlarm">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/> 
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "alarmId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "alarmInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "alarmType" use = "required">
        <xsd:simpleType>
          <xsd:restriction base = "xsd:string">
            <xsd:enumeration value = "PERSONALSAFETY"/> 
            <xsd:enumeration value = "EQUIPMENTSAFETY"/> 
            <xsd:enumeration value = "ITEMSAFETY"/> 
            <xsd:enumeration value = "PARAMETERCONTROLALARM"/> 
          </xsd:restriction>
        </xsd:simpleType> 
      </xsd:attribute>
      <xsd:attribute name = "laneList" use = "required" type = "stringList"/> 
      <xsd:attribute name = "zoneList" use = "required" type = "stringList"/> 
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.2 EquipmentAlarmCleared

URI: [http://webstds.ipc.org/2541/EquipmentAlarmCleared.xsd](http://webstds.ipc.org/2541/EquipmentAlarmCleared.xsd)

Extends: [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

Graphical Representation:

```
<schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <element name="EquipmentAlarmCleared">
    <complexType>
      <sequence>
        <element ref="Extensions" minOccurs="0"/>
      </sequence>
      <attribute name="dateTime" use="required" type="xsd:dateTime"/>
      <attribute name="alarmInstanceId" use="required" type="xsd:string"/>
    </complexType>
  </element>
  <element name="Extensions"/>
</schema>
```

Schema:
10.3 EquipmentAlarmsCleared

**URI:**  http://websteds.ipc.org/2541/EquipmentAlarmsCleared.xsd

**Extends:**  http://websteds.ipc.org/2501/Envelope.xsd (Message Elements)

**Graphical Representation:**

```
<schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <element name="EquipmentAlarmsCleared">
    <complexType>
      <sequence>
        <element ref="Extensions" minOccurs="0"/>
      </sequence>
      <attribute name="dateTime" use="required" type="xsd:dateTime"/>
    </complexType>
  </element>
</schema>
```

**Schema:**

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentAlarmsCleared">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```
10.4 EquipmentBlocked

 URI: http://webstds.ipc.org/2541/EquipmentBlocked.xsd
 Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentAlarmsCleared">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.5 EquipmentChangeState

URI: http://webstds.ipc.org/2541/EquipmentChangeState.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <xsd:element name="EquipmentChangeState">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="Extensions" minOccurs="0"/>
      </xsd:sequence>
      <xsd:attribute name="dateTime" use="required" type="xsd:dateTime"/>
      <xsd:attribute name="currentState" use="required">
        <xsd:simpleType>
          <xsd:restriction base="xsd:string">
            <xsd:enumeration value="OFF"/>
            <xsd:enumeration value="SETUP"/>
            <xsd:enumeration value="READY-IDLE-STARVED"/>
            <xsd:enumeration value="READY-IDLE-BLOCKED"/>
            <xsd:enumeration value="READY-PROCESSING-ACTIVE"/>
            <xsd:enumeration value="READY-PROCESSING-EXECUTING"/>
            <xsd:enumeration value="DOWN"/>
          </xsd:restriction>
        </xsd:simpleType>
      </xsd:attribute>
      <xsd:attribute name="previousState" use="required">
        <xsd:simpleType>
          <xsd:restriction base="xsd:string">
            <xsd:enumeration value="OFF"/>
            <xsd:enumeration value="SETUP"/>
            <xsd:enumeration value="READY-IDLE-STARVED"/>
            <xsd:enumeration value="READY-IDLE-BLOCKED"/>
            <xsd:enumeration value="READY-PROCESSING-ACTIVE"/>
            <xsd:enumeration value="READY-PROCESSING-EXECUTING"/>
            <xsd:enumeration value="DOWN"/>
          </xsd:restriction>
        </xsd:simpleType>
      </xsd:attribute>
      <xsd:attribute name="eventId" use="required" type="xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name="Extensions"/>
</xsd:schema>
```
10.6 EquipmentDownSelected

**URI:** [http://webstds.ipc.org/2541/EquipmentDownSelected.xsd](http://webstds.ipc.org/2541/EquipmentDownSelected.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentDownSelected">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "eventInitiator" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.7 EquipmentError

URI: http://webstds.ipc.org/2541/EquipmentError.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <xsd:element name="EquipmentError">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref="Extensions" minOccurs="0"/>
            </xsd:sequence>
            <xsd:attribute name="dateTime" use="required" type="xsd:dateTime"/>
            <xsd:attribute name="errorId" use="required" type="xsd:string"/>
            <xsd:attribute name="errorInstanceId" use="required" type="xsd:string"/>
            <xsd:attribute name="laneList" use="required" type="xsd:stringList"/>
            <xsd:attribute name="zoneList" use="required" type="xsd:stringList"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name="Extensions"/>
</xsd:schema>
```
10.8 EquipmentErrorCleared

**URI:** [http://webstds.ipc.org/2541/EquipmentErrorCleared.xsd](http://webstds.ipc.org/2541/EquipmentErrorCleared.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```
<equipmentErrorCleared>
  <dateTime>dateTime</dateTime>
  <errorInstanceId>string</errorInstanceId>
</equipmentErrorCleared>
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentErrorCleared">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "errorInstanceId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```
10.9 EquipmentErrorsCleared

**URI:** [http://webstds.ipc.org/2541/EquipmentErrorsCleared.xsd](http://webstds.ipc.org/2541/EquipmentErrorsCleared.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

---

**Graphical Representation:**

![Graphical Representation](image)

---

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentErrorsCleared">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```

---

130
10.10 EquipmentHeartbeat

**URI:** [http://webstds.ipc.org/2541/Heartbeat.xsd](http://webstds.ipc.org/2541/Heartbeat.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentHeartbeat">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "interval" use = "required" type = "xsd:nonNegativeInteger"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentHeartbeat">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "interval" use = "required" type = "xsd:nonNegativeInteger"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.11 EquipmentInformation

**URI:** [http://webstds.ipc.org/2541/EquipmentInformation.xsd](http://webstds.ipc.org/2541/EquipmentInformation.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```
+---------------------------+    +---------------------------+
| EquipmentInformation      |    | Extensions                |
|                           |    |                           |
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentInformation">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "informationId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
      <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```
10.12 EquipmentInitializationComplete

URI: [http://webstds.ipc.org/2541/EquipmentInitializationComplete.xsd](http://webstds.ipc.org/2541/EquipmentInitializationComplete.xsd)

Extends: [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

Graphical Representation:

```
<schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <element name="EquipmentInitializationComplete">
    <complexType>
      <sequence>
        <element ref="Extensions" minOccurs="0"/>
      </sequence>
      <attribute name="dateTime" use="required" type="xsd:dateTime"/>
      <attribute name="softwareRev" use="required" type="xsd:string"/>
      <attribute name="hardwareRev" use="required" type="xsd:string"/>
    </complexType>
  </element>
  <element name="Extensions"/>
</schema>
```

Schema:
10.13 EquipmentNonSelectedRecipeModified

URI: http://webstds.ipc.org/2541/EquipmentNonSelectedRecipeModified.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

```
<schema version = "1.0" encoding = "UTF-8">  
  <element name = "EquipmentNonSelectedRecipeModified">  
    <complexType>  
      <sequence>  
        <element ref = "Extensions" minOccurs = "0"/>  
      </sequence>  
      <attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>  
      <attribute name = "recipeId" use = "required" type = "xsd:string"/>  
      <attribute name = "action" use = "required">  
        <simpleType>  
          <restriction base = "xsd:string">  
            <enumeration value = "CREATE"/>  
            <enumeration value = "DELETE"/>  
            <enumeration value = "MODIFY"/>  
          </restriction>  
        </simpleType>  
      </attribute>  
    </complexType>  
  </element>  
</schema>  
```
10.14 EquipmentParameterModified

**URI:** [http://webstds.ipc.org/2541/EquipmentParameterModified.xsd](http://webstds.ipc.org/2541/EquipmentParameterModified.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```xml
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentParameterModified">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "parameter" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentParameterModified">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "parameter" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
10.15 EquipmentPowerOff

URI:  http://webstds.ipc.org/2541/EquipmentPowerOff.xsd
Extends:  http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <xsd:element name="EquipmentPowerOff">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="Extensions" minOccurs="0"/>
      </xsd:sequence>
      <xsd:attribute name="dateTime" use="required" type="xsd:dateTime"/>
      <xsd:attribute name="eventInitiator" use="required" type="xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name="Extensions"/>
</xsd:schema>
```
10.16 EquipmentRecipeReady

URI: http://websds.ipc.org/2541/EquipmentRecipeReady.xsd
Extends: http://websds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentRecipeReady">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
      <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.17 EquipmentRecipeSelected

URI: http://webstds.ipc.org/2541/EquipmentRecipeSelected.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

```
+-------------------+       +-------------------+
|     dateTime      |       |     recipeId       |
|     String        |       |     laneList       |
|     StringList    |       |     zoneList       |
|                  +-------------------+       +-------------------+
|                EquipmentRecipeSelected |       |    Extensions |
```

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentRecipeSelected">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
            <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.18 EquipmentSelectedRecipeModified

URI: http://webstds.ipc.org/2541/EquipmentSelectedRecipeModified.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentSelectedRecipeModified">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "laneList" use = "required" type = "stringList"/>
            <xsd:attribute name = "zoneList" use = "required" type = "stringList"/>
            <xsd:attribute name = "action" use = "required">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "DELETE"/>
                        <xsd:enumeration value = "MODIFY"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```
### 10.19 EquipmentSetupComplete

**URI:** [http://webstds.ipc.org/2541/EquipmentSetupComplete.xsd](http://webstds.ipc.org/2541/EquipmentSetupComplete.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

#### Graphical Representation:

![Graphical Representation](image)

#### Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentSetupComplete">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```
10.20 EquipmentSetupSelected

**URI:** [http://webstds.ipc.org/2541/EquipmentSetupSelected.xsd](http://webstds.ipc.org/2541/EquipmentSetupSelected.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

### Graphical Representation:

![Graphical Representation of EquipmentSetupSelected]

### Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentSetupSelected">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "eventInitiator" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.21 EquipmentStartSelected

**URI:** [http://webstds.ipc.org/2541/EquipmentStartSelected.xsd](http://webstds.ipc.org/2541/EquipmentStartSelected.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

### Graphical Representation:

```
EquipmentStartSelected

<table>
<thead>
<tr>
<th>dateTime</th>
<th>eventInitiator</th>
</tr>
</thead>
<tbody>
<tr>
<td>dateTime</td>
<td>string</td>
</tr>
</tbody>
</table>
```

### Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentStartSelected">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "eventInitiator" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.22 EquipmentStarved

URI: [http://webstds.ipc.org/2541/EquipmentStarved.xsd](http://webstds.ipc.org/2541/EquipmentStarved.xsd)
Extends: [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

Graphical Representation:

```
? EquipmentStarved
  dateTime

Extensions
```

Schema:
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentStarved">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```
10.23 EquipmentUnBlocked

**URI:** [http://webstds.ipc.org/2541/EquipmentUnBlocked.xsd](http://webstds.ipc.org/2541/EquipmentUnBlocked.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentUnBlocked">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.24 EquipmentUnStarved

**URI:** [http://webstds.ipc.org/2541/EquipmentUnStarved.xsd](http://webstds.ipc.org/2541/EquipmentUnStarved.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

---

**Graphical Representation:**

![Graphical Representation of EquipmentUnStarved](image)

---

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentUnStarved">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
### 10.25 EquipmentWarning

**URI:** [http://webstds.ipc.org/2541/EquipmentWarning.xsd](http://webstds.ipc.org/2541/EquipmentWarning.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

#### Graphical Representation:

![Graphical Representation](image)

#### Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentWarning">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "warningId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "warningInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
      <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.26 EquipmentWarningCleared

URI: http://webstds.ipc.org/2541/EquipmentWarningCleared.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentWarningCleared">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "warningInstanceId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.27 EquipmentWarningsCleared

URI: http://webstds.ipc.org/2541/EquipmentWarningsCleared.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "EquipmentWarningsCleared">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "warningInstanceId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.28 ItemIdentifierRead

**URI:**  [http://webstds.ipc.org/2541/ItemIdentifierRead.xsd](http://webstds.ipc.org/2541/ItemIdentifierRead.xsd)

**Extends:**  [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```
<Schema>
  <Element name="ItemIdentifierRead">
    <complexType>
      <sequence>
        <element ref="Extensions" minOccurs="0"/>
      </sequence>
      <attribute name="dateTime" use="required" type="xsd:dateTime"/>
      <attribute name="itemInstanceId" use="required" type="xsd:string"/>
      <attribute name="laneId" use="required" type="xsd:string"/>
      <attribute name="zoneId" use="required" type="xsd:string"/>
      <attribute name="scannerId" use="required" type="xsd:string"/>
    </complexType>
  </Element>
  <Element name="Extensions"/>
</Schema>
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemIdentifierRead">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "scannerId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
# 10.29 ItemInformation

**URI:** http://webstds.ipc.org/2541/ItemInformation.xsd  
**Extends:** http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

**Graphical Representation:**

```
< ?xml version = "1.0" encoding = "UTF-8"?>
< xsd : element name = "ItemInformation" >
    < xsd : complexType >
        < xsd : sequence >
            < xsd : element ref = "Extensions" minOccurs = "0" / >
        </ xsd : sequence >
        < xsd : attribute name = "dateTime" use = "required" type = "xsd : dateTime" / >
        < xsd : attribute name = "itemInstanceId" use = "required" type = "xsd : string" / >
        < xsd : attribute name = "informationId" use = "required" type = "xsd : string" / >
    </ xsd : complexType >
</ xsd : element >
< xsd : element name = "Extensions" / >
</ xsd : schema >
```
10.30 ItemTransferIn

**URI:** [http://webstds.ipc.org/2541/ItemTransferIn.xsd](http://webstds.ipc.org/2541/ItemTransferIn.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

![Graphical Representation of ItemTransferIn].thumb.png

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemTransferIn">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
### 10.31 ItemTransferLane

**URI:** [http://webstds.ipc.org/2541/ItemTransferLane.xsd](http://webstds.ipc.org/2541/ItemTransferLane.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```
  ItemTransferLane
  +------------------
  |                  |
  v                  v
Extensions          ItemTransferLane
                  +------------------
                  |                  |
                  v                  v
                  date-time       ItemInstanceId
                  v                  v
                  fromLaneId     toLaneId
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemTransferLane">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "fromLaneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "toLaneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```
### 10.32 ItemTransferOut

**URI:** [http://webstds.ipc.org/2541/ItemTransferOut.xsd](http://webstds.ipc.org/2541/ItemTransferOut.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

#### Graphical Representation:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "ItemTransferOut">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>

    <xsd:element name = "Extensions"/>
</xsd:schema>
```

#### Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "ItemTransferOut">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
</xsd:schema>
```
10.33 ItemTransferZone

**URI:** [http://webstds.ipc.org/2541/ItemTransferZone.xsd](http://webstds.ipc.org/2541/ItemTransferZone.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

### Graphical Representation:

![Graphical Representation](image)

### Schema:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemTransferZone">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "fromZoneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "toZoneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.34 ItemWorkAbort

**URI:** [http://webstds.ipc.org/2541/ItemWorkAbort.xsd](http://webstds.ipc.org/2541/ItemWorkAbort.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemWorkAbort">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" type = "xsd:dateTime"/>
      <xsd:attribute name = "itemInstanceId" type = "xsd:string"/>
      <xsd:attribute name = "laneId" type = "xsd:string"/>
      <xsd:attribute name = "zoneId" type = "xsd:string"/>
      <xsd:attribute name = "abortId" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
### 10.35 ItemWorkComplete

**URI:** [http://webstds.ipc.org/2541/ItemWorkComplete.xsd](http://webstds.ipc.org/2541/ItemWorkComplete.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

#### Graphical Representation:

```
+ ItemWorkComplete
  + dateTime
  + itemInstanceId
  + laneId
  + zoneId

+ Extensions
```

#### Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemWorkComplete">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.36 ItemWorkPause

**URI:** [http://webstds.ipc.org/2541/ItemWorkPause.xsd](http://webstds.ipc.org/2541/ItemWorkPause.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```
< ?xml version = "1.0" encoding = "UTF-8"?>
< xsd: schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema" >
  < xsd: element name = "ItemWorkPause" >
    < xsd: complexType>
      < xsd: sequence >
        < xsd: element ref = "Extensions" minOccurs = "0" />  
        < xsd: attribute name = "dateTime" use = "required" type = "xsd:dateTime" / >
        < xsd: attribute name = "itemInstanceId" use = "required" type = "xsd:string" / >
        < xsd: attribute name = "laneId" use = "required" type = "xsd:string" / >
        < xsd: attribute name = "zoneId" use = "required" type = "xsd:string" / >
      </ xsd: sequence >
    </ xsd: attribute >
  </ xsd: element name = "Extensions" />
</ xsd: schema >
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemWorkPause">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
        <xsd:element name = "dateTime" use = "required" type = "xsd:dateTime"/>
        <xsd:element name = "itemInstanceId" use = "required" type = "xsd:string"/>
        <xsd:element name = "laneId" use = "required" type = "xsd:string"/>
        <xsd:element name = "zoneId" use = "required" type = "xsd:string"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element name = "Extensions"/>
</xsd:schema>
```
10.37 ItemWorkResume

URI: http://webstds.ipc.org/2541/ItemWorkResume.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

```
+-----+      +------+
| ItemWorkResume | Extensions |
+-----+      +------+
| dateTime | itemInstanceId | laneId | zoneId |
```

Schema:
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemWorkResume">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  </xsd:schema>
```
10.38 ItemWorkStart

**URI:** [http://webstds.ipc.org/2541/ItemWorkStart.xsd](http://webstds.ipc.org/2541/ItemWorkStart.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "ItemWorkStart">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```

**Schema:**
### 10.39 LaneBlocked

**URI:** [http://webstds.ipc.org/2541/LaneBlocked.xsd](http://webstds.ipc.org/2541/LaneBlocked.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

![Graphical Representation of LaneBlocked](image)

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "LaneBlocked">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```

10.40 LaneStarved

URI: http://webstds.ipc.org/2541/LaneStarved.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "LaneStarved">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.41 LaneUnBlocked

URI: [http://webstds.ipc.org/2541/LaneUnblocked.xsd](http://webstds.ipc.org/2541/LaneUnblocked.xsd)

Extends [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

Graphical Representation:

```
LaneUnBlocked
  +----+    +-----+
  |    |    |      |
  |    +----|      |
  +------------------+
    |                 |
    |   Extensions    |
    |                 |
    +------------------+
            +------------------+
            |                 |
            |      dateTime    |
            |                 |
            |                 |
            +------------------+
            +------------------+
            |                 |
            |      laneId      |
            |                 |
            +------------------+
```

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "LaneUnBlocked">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.42 LaneUnStarved

URI: http://webstds.ipc.org/2541/LaneUnstarved.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:
```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "LaneUnStarved">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.43 OperatorActionRegistered

URI: http://webstds.ipc.org/2541/OperatorActionRegistered.xsd
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "OperatorActionRegistered">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
            <xsd:attribute name = "operatorId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "description" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.44 OperatorInformation

URI:  http://webstds.ipc.org/2541/OperatorInformation.xsd
Extends:  http://webstds.ipc.org/2501/Envelope.xsd  (Message Elements)

Graphical Representation:

Schema:

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "OperatorInformation">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "operatorId" use = "required" type = "xsd:string"/>
      <xsd:attribute name = "informationId" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name = "Extensions"/>
</xsd:schema>
```
10.45 WaitingForOperatorAction

**URI:** [http://webstds.ipc.org/2541/WaitingForOperatorAction.xsd](http://webstds.ipc.org/2541/WaitingForOperatorAction.xsd)

**Extends:** [http://webstds.ipc.org/2501/Envelope.xsd](http://webstds.ipc.org/2501/Envelope.xsd) (Message Elements)

**Graphical Representation:**

```xml
<xsd:element name="WaitingforOperatorAction">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="Extensions" minOccurs="0"/>
    </xsd:sequence>
    <xsd:attribute name="dateTime" use="required" type="xsd:dateTime"/>
    <xsd:attribute name="description" use="required" type="xsd:string"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Extensions"/>
```

**Schema:**

```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
  <xsd:element name = "WaitingforOperatorAction">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref = "Extensions" minOccurs = "0"/>
      </xsd:sequence>
      <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
      <xsd:attribute name = "description" use = "required" type = "xsd:string"/>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```
The web-based standards (IPC 25XX) are designed to foster application integration and electronic commerce through data and information interchange standards based on XML. It assumes that application programs (including equipment interfaces) are distinct entities, and application integration takes place using a loosely coupled, message-passing approach. There is no need for a common object model, programming language, network protocol, persistent storage mechanism or operating system for two applications to exchange XML messages formatted using the web-based standards. The two applications simply need to be able to format, transmit, receive and consume a standardized XML message.

The web-based standards series have been identified for each of the value-added activities occurring throughout the product life cycle of an electronics product. The web-based standards are:

IPC-2500 – Framework Standard
IPC-2510 – Product Data Representation
IPC-2520 – Product Data Quality
IPC-2530 – Surface Mount Equipment Standard Recipe File Format
IPC-2540 – Shop Floor Equipment Communications
IPC-2550 – Manufacturing Execution Systems Communications
IPC-2560 – Enterprise Resource Planning Systems Communications
IPC-2570 – Supply Chain Communications

Table A-1 shows the correlation of the different standards in each of the series. Although not every standard has been started, the figure represents a coordinated opportunity to maintain consistency throughout the standard development cycle.
## Table A-1  CAD/CAM Standardization

<table>
<thead>
<tr>
<th>IPC Number/Function</th>
<th>-xxx1 Generic</th>
<th>-xxx2 Administ</th>
<th>-xxx3 Document</th>
<th>-xxx4 Board Fabricat</th>
<th>-xxx5 Bare Test</th>
<th>-xxx6 Assy</th>
<th>-xxx7 Assy/Test/Insp.</th>
<th>-xxx8 Comp. &amp; Material</th>
<th>-xxx9 Informa. Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPC-2500 CAMX Framework</td>
<td>IPC-2501 PINS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPC-2520 Quality Product Data</td>
<td></td>
<td></td>
<td>IPC-2524 (Pub)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPC-2530 SRFF Process Data Recipe file</td>
<td>IPC-2531 ANSI Draft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPC-2540 Shop Floor Communicate</td>
<td>IPC-2541 2nd IF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPC-2550 Execution Communicate</td>
<td>IPC-2551 PINS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPC-2560 Enterprise Communicate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPC-2570 Supply Chain Communicate</td>
<td>IPC-2571 Proposal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Messages are the basis of the web-based standards. Messages are the means to integrate applications at the business-process level by defining a loosely coupled, request-based communication process. Since many business processes involve one party performing a service at the request of another party, the mapping of messages to requests is natural. An XML-based messaging system with open, extensible formats captures the essential elements of an electronics business communication message while allowing flexible implementations.

It is anticipated that in the vast majority of interchanges, the exchange of XML documents and messages between trading partners or applications will occur. Implementation using the CAMX Framework Standards will use a simple hyper-text transfer protocol (HTTP) transport, but business can also use other transports including file transfer protocol (FTP) and message queuing technologies.

Until applications have native support for XML, these types of CAMX Framework interchanges will require layered software that transforms native data types into XML.

The IPC 2541 and its sectional standards should provide value in both serialized and non-serialized production environments. In serialized production environments, detailed information from the production process can be gathered from each piece of IPC 2541 compliant equipment. In non-serialized production environments, it should still be possible to gauge overall production efficiency such as number of units produced in a given amount of time, or overall line and equipment status, by analyzing the IPC 2541 messages generated by each piece of IPC 2541 compliant equipment. If a barcode reader is present then a unique item identifier may be the barcode label that is read. If no barcode reader is present then the unique item identifier may be generated by the piece of equipment.