The Hermes Standard Change Proposal

Add Batch ID to related Messages

**Voting meeting:**

1st of March 2021 (On-line/Microsoft Teams)

**Requesting company:**

ASM Assembly Systems

# Version change:

Minor

# Affected versions:

1.2.1

# Service description tag:

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# Description:

The work order in the ERP system contains all business and customer relevant data for production of a set of PCBs. All production related activities and data concerning production need to be linked back to the work order in the ERP system. In Hermes 1.1 the WorkOrderId was added. However, WorkOrderId alone is not sufficient and does not match the concept of a work order in IPC-2591 CFX: Besides the WorkOrderId CFX in addition uses a BatchId to support splitting of a work order into several batches of production.

# Use cases:

The WorkOrderId and BatchId provide the linkage of PCB production related data such as

* Monitoring of production progress, consumed or moved materials, etc.
* Process Interlocking
* Traceability

# Functionality / communication sequences:

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# New / changed XML messages:

There will not be any new XML messages; the following XML messages will be extended:

* BoardAvailable
* MachineReady
* BoardForecast
* SendBoardInfo
* BoardArrived
* BoardDeparted
* SendWorkOrderInfo

# Proposed Changes to Standard:

# Message format

…

## BoardAvailable

The BoardAvailable message is sent to the downstream machine to indicate the readiness of the upstream machine to handover a PCB. When an optional attribute is received from an upstream machine, then it must be passed on (possibly altered) to the next downstream machine.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BoardAvailable** | **Type** | **Range** | **Optional** | **Description** |
| nodeBoardId | string | GUID(36 bytes) | no | Indicating the ID of the available board |
| nodeBoardIdCreatedBy | string | non-empty string(minimum supported length: 80 bytes) | no | MachineId of the machine which created the BoardId (the first machine in a consecutive row of machines implementing this protocol). The MachineId is part of the Hermes configuration. |
| nodeFailedBoard | int | 0 .. 2 | no | A value of the list below |
| nodeProductTypeId | string | any string(minimum supported length: 254 bytes) | yes | Identifies a collection of PCBs sharing common properties |
| nodeFlippedBoard | int | 0 .. 2 | no | A value of the list below |
| nodeTopBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the top side of the PCB |
| nodeBottomBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the bottom side of the PCB |
| nodeLength | float | positive numbers | yes | The length of the PCB in millimeter. |
| nodeWidth | float | positive numbers | yes | The width of the PCB in millimeter. |
| nodeThickness | float | positive numbers | yes | The thickness of the PCB in millimeter. |
| nodeConveyorSpeed | float | positive numbers | yes | The conveyor speed preferred by the upstream machine in millimeter per second |
| nodeTopClearanceHeight | float | positive numbers | yes | The clearance height for the top side of the PCB in millimeter. |
| nodeBottomClearanceHeight | float | positive numbers | yes | The clearance height for the bottom side of the PCB in millimeter. |
| nodeWeight | float | positive numbers | yes | The weight of the PCB in grams. |
| nodeWorkOrderId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the work order for production of the PCB |
| nodeBatchId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the Batch for production of the PCB within a splitted work order |

GUID must match the regular expression

[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}

FailedBoard may be one of the following values:

1. Board of unknown quality available
2. Good board available
3. Failed board available

FlippedBoard may be one of the following values:

1. Side up is unknown
2. Board top side is up
3. Board bottom side is up

If FlippedBoard is 2 (board bottom side is up) then TopBarcode is facing downwards and BottomBarcode is facing upwards. Same applies for TopClearanceHeight and BottomClearanceHeight.

The definition of board bottom and board top side is outside of the scope of The Hermes Standard and left to the customer.

**Fig. 20 Explanation for top and bottom clearance height**

## MachineReady

The MachineReady message is sent to the upstream machine to indicate the readiness of the downstream machine to accept a PCB.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **MachineReady** | **Type** | **Range** | **Optional** | **Description** |
| nodeFailedBoard | int | 0 .. 2 | no | A value of the list below |
| nodeForecastId | string | any string(minimum supported length: 80 bytes) | yes/no | If responding to a BoardForecast message mandatory. It indicates the ID of the original BoardForecast message. |
| nodeBoardId | string | GUID(36 bytes) | yes | Indicates the ID of the board that will be handed over as next. In case of product change this attribute will not be sent. |
| nodeProductTypeId | string | any string(minimum supported length: 254 bytes) | yes | Identifies a collection of PCBs sharing common properties |
| nodeFlippedBoard | int | 0 .. 2 | yes | A value of the list below |
| nodeLength | float | positive numbers | yes | The length of the PCB in millimeter. |
| nodeWidth | float | positive numbers | yes | The width of the PCB in millimeter. |
| nodeThickness | float | positive numbers | yes | The thickness of the PCB in millimeter. |
| nodeConveyorSpeed | float | positive numbers | yes | The conveyor speed used by the upstream machine in millimeter per second |
| nodeTopClearanceHeight | float | positive numbers | yes | The clearance height for the top side of the PCB in millimeter. |
| nodeBottomClearanceHeight | float | positive numbers | yes | The clearance height for the bottom side of the PCB in millimeter. |
| nodeWeight | float | positive numbers | yes | The weight of the PCB in grams. |
| nodeWorkOrderId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the work order for production of the PCB |
| nodeBatchId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the Batch for production of the PCB within a splitted work order |

FlippedBoard may be one of the following values:

1. Side up is unknown
2. Board top side is up
3. Board bottom side is up

FailedBoard may be one of the following values:

1. Ready to accept any board
2. Ready to accept good boards.
3. Ready to accept failed boards

## BoardForecast

The BoardForecast message is sent to the downstream machine to indicate some changes / command execution are needed or to give a pre-information about the next board but a PCB is not jet available. If the ForecastId field is set then the downstream machine must at some point respond with a MachineReady carrying the same ForecastId. If needed downstream machine must send a RevokeMachineReady message first. If the forecasted product is not fitting to the downstream machine, then it must respond with a Notification of type “BoardForecastError”.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BoardForecast** | **Type** | **Range** | **Optio-nal** | **Description** |
| nodeForecastId | string | any string(minimum supported length: 80 bytes) | yes | Indicating the ID of forecast message. The ID must be unambiguous and e.g. can be a timetamp or a GUID. |
| nodeTimeUntilAvailable | float | positive numbers | yes | Number of seconds until a board may be available at downstream machine |
| nodeBoardId | string | GUID(36 bytes) | yes | Indicating the ID of the board that will be handed over as next. e.g. in case of product change this field will not be sent |
| nodeBoardIdCreatedBy | string | any string(minimum supported length: 80 bytes) | yes | MachineId of the machine which created the BoardId. |
| nodeFailedBoard | int | 0 .. 2 | no | A value of the list below |
| nodeProductTypeId | string | any string(minimum supported length: 254 bytes) | yes | Identifies a collection of PCBs sharing common properties |
| nodeFlippedBoard | int | 0 .. 2 | no | A value of the list below |
| nodeTopBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the top side of the next PCB |
| nodeBottomBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the bottom side of the next PCB |
| nodeLength | float | positive numbers | yes | The length of the PCB in millimeter. |
| nodeWidth | float | positive numbers | yes | The width of the PCB in millimeter. |
| nodeThickness | float | positive numbers | yes | The thickness of the PCB in millimeter. |
| nodeConveyorSpeed | float | positive numbers | yes | The conveyor speed preferred by the upstream machine in millimeter per second |
| nodeTopClearanceHeight | float | positive numbers | yes | The clearance height for the top side of the PCB in millimeter. |
| nodeBottomClearanceHeight | float | positive numbers | yes | The clearance height for the bottom side of the PCB in millimeter. |
| nodeWeight | float | positive numbers | yes | The weight of the PCB in grams. |
| nodeWorkOrderId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the work order for production of the PCB |
| nodeBatchId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the Batch for production of the PCB within a splitted work order |

The attributes definition are identical to the BoardAvailable message.

FailedBoard may be one of the following values:

1. Ready to accept any board
2. Ready to accept good boards.
3. Ready to accept failed boards

FlippedBoard may be one of the following values:

1. Side up is unknown
2. Board top side is up
3. Board bottom side is up

## SendBoardInfo

The SendBoardInfo message is sent from the upstream to the downstream machine as response of a received QueryBoardInfo message to transfer stored information about a lost board (see section **Fehler! Verweisquelle konnte nicht gefunden werden.**). If the upstream machine cannot find any board information it will still send the SendBoardInfo message without the BoardId and BoardCreatedBy attributes filled.

Machines supporting the feature FeatureSendBoardInfo shall be able to store and supply upon request the info of at least the last 50 handled boards.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SendBoardInfo** | **Type** | **Range** | **Optional** | **Description** |
| nodeBoardId | string | GUID(36 bytes) | yes / no | The ID of the board which data has been requested. This attribute will not be sent if the board information has not been found. |
| nodeBoardIdCreatedBy | string | non-empty string(minimum supported length: 80 bytes) | yes / no | MachineId of the machine which created the BoardId |
| nodeFailedBoard | Int | 0 .. 2 | Yes/no | A value of the list below. This attribute will not be sent if the board information has not been found. |
| nodeProductTypeId | string | any string(minimum supported length: 254 bytes) | yes | Identifies a collection of PCBs sharing common properties |
| nodeFlippedBoard | Int | 0 .. 2 | Yes/no | A value of the list below. This attribute will not be sent if the board information has not been found. |
| nodeTopBarcode | string | any string(minimum supported length: 254 bytes) | yes/no | The barcode of the top side of the next PCB. This attribute is mandatory if it has been in the QueryBoardInfo message. |
| nodeBottomBarcode | string | any string(minimum supported length: 254 bytes) | yes/no | The barcode of the bottom side of the next PCB. This attribute is mandatory if it has been in the QueryBoardInfo message. |
| nodeLength | float | positive numbers | yes | The length of the PCB in millimeter. |
| nodeWidth | float | positive numbers | yes | The width of the PCB in millimeter. |
| nodeThickness | float | positive numbers | yes | The thickness of the PCB in millimeter. |
| nodeTopClearanceHeight | float | positive numbers | yes | The clearance height for the top side of the PCB in millimeter. |
| nodeBottomClearanceHeight | float | positive numbers | yes | The clearance height for the bottom side of the PCB in millimeter. |
| nodeWorkOrderId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the work order for production of the PCB |
| nodeBatchId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the Batch for production of the PCB within a splitted work order |

The attributes definition are identical to the BoardAvailable message.

FailedBoard may be one of the following values:

1. Board of unknown quality available
2. Good board available
3. Failed board available

FlippedBoard may be one of the following values:

1. Side up is unknown
2. Board top side is up
3. Board bottom side is up

## BoardArrived

The BoardArrived message is sent via Hermes vertical channel to a supervisory system to indicate that a printed board has arrived at this machine. The BoardArrived message shall be sent immediately after sending the corresponding StopTransport message.

Optional attributes indicate that it is not required to provide them if the information is not available. But if the information is available at the machine, e.g., barcode, then the optional attributes should be set.

Note: The function of BoardArrived is optional. If FeatureBoardTracking is specified in the SupervisoryServiceDescription, it must be fully supported. Otherwise it can be ignored.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BoardArrived** | **Type** | **Range / Multiplicity** | **Optional** | **Description** |
| nodeMachineId | string | any string(minimum supported length: 80 bytes) | no | ID / name of this machine for identifying it in a Hermes enabled production line. |
| nodeUpstreamLaneId | int | 1 .. n | no | The lane on the upstream side.Lanes are enumerated looking downstream from right to left beginning with 1. |
| nodeUpstreamInterfaceId | string | any string(minimum supported length: 80 bytes) | yes | The ID of the transportation interface on the upstream side. |
| nodeMagazineId | string | any string(minimum supported length: 80 bytes) | yes | Barcode of a magazine, required to identify the magazine from which the board was transferred. |
| nodeSlotId | int | 1 .. n | yes | Indicates the slot in the magazine, enumerated from bottom to top, beginning with 1. |
| nodeBoardTransfer | int | 1 .. 3 | no | A value of the list below |
| nodeBoardId | string | GUID(36 bytes) | no | Indicating the ID of the available board |
| nodeBoardIdCreatedBy | string | non-empty string(minimum supported length: 80 bytes) | no | MachineId of the machine which created the BoardId (the first machine in a consecutive row of machines implementing this protocol). The MachineId is part of the Hermes configuration. |
| nodeFailedBoard | int | 0 .. 2 | no | A value of the list below. |
| nodeProductTypeId | string | any string(minimum supported length: 254 bytes) | yes | Identifies a collection of printed boards sharing common properties. |
| nodeFlippedBoard | int | 0 .. 2 | no | A value of the list below. |
| nodeTopBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the top side of the printed board. |
| nodeBottomBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the bottom side of the printed board. |
| nodeLength | float | positive numbers | yes | The length of the printed board in millimeter. |
| nodeWidth | float | positive numbers | yes | The width of the printed board in millimeter. |
| nodeThickness | float | positive numbers | yes | The thickness of the printed board in millimeter. |
| nodeConveyorSpeed | float | positive numbers | yes | The conveyor speed used for the printed board transfer in millimeter per second. |
| nodeTopClearanceHeight | float | positive numbers | yes | The clearance height for the top side of the printed board in millimeter. |
| nodeBottomClearanceHeight | float | positive numbers | yes | The clearance height for the bottom side of the printed board in millimeter. |
| nodeWeight | float | positive numbers | yes | The weight of the printed board in grams. |
| nodeWorkOrderId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the work order for production of the printed board. |
| nodeBatchId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the Batch for production of the PCB within a splitted work order |

GUID must match the regular expression

[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}

FailedBoard may be one of the following values:

1. Board of unknown quality available
2. Good board available
3. Failed board available

FlippedBoard may be one of the following values:

1. Side up is unknown
2. Board top side is up
3. Board bottom side is up

BoardTransfer may be one of the following values:

1. Transferred: Board arrived from upstream machine via Hermes or SMEMA.
2. Loaded: Board was loaded from a magazine or a stack of Boards.
3. Inserted: Board was manually inserted into the machine.

## BoardDeparted

The BoardDeparted message is sent via Hermes vertical channel to a supervisory system to indicate that a printed board has left this machine. The BoardDeparted message shall be sent immediately after sending the corresponding TransportFinished message.

Optional attributes indicate that it is not required to provide them if the information is not available. But if the information is available at the machine, e.g., barcode, then the optional attributes should be set.

Note: The function of BoardDeparted is optional. If FeatureBoardTracking is specified in the SupervisoryServiceDescription, it must be fully supported. Otherwise it can be ignored.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BoardDeparted** | **Type** | **Range / Multiplicity** | **Optional** | **Description** |
| nodeMachineId | string | any string(minimum supported length: 80 bytes) | no | ID / name of this machine for identifying it in a Hermes enabled production line. |
| nodeDownstreamLaneId | int | 1 .. n | no | The lane on the downstream side.Lanes are enumerated looking downstream from right to left beginning with 1. |
| nodeDownstreamInterfaceId | string | any string(minimum supported length: 80 bytes) | yes | The ID of the transportation interface on the downstream side. |
| nodeMagazineId | string | any string(minimum supported length: 80 bytes) | yes | Barcode of a magazine, required to identify the magazine to which the board was transferred. |
| nodeSlotId | int | 1 .. n | yes | Indicates the slot in the magazine, enumerated from bottom to top, beginning with 1. |
| nodeBoardTransfer | int | 1 .. 3 | no | A value of the list below. |
| nodeBoardId | string | GUID(36 bytes) | no | Indicating the ID of the available board. |
| nodeBoardIdCreatedBy | string | non-empty string(minimum supported length: 80 bytes) | no | MachineId of the machine which created the BoardId (the first machine in a consecutive row of machines implementing this protocol). The MachineId is part of the Hermes configuration. |
| nodeFailedBoard | int | 0 .. 2 | no | A value of the list below. |
| nodeProductTypeId | string | any string(minimum supported length: 254 bytes) | yes | Identifies a collection of printed boards sharing common properties. |
| nodeFlippedBoard | int | 0 .. 2 | no | A value of the list below. |
| nodeTopBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the top side of the printed board. |
| nodeBottomBarcode | string | any string(minimum supported length: 254 bytes) | yes | The barcode of the bottom side of the printed board. |
| nodeLength | float | positive numbers | yes | The length of the printed board in millimeter. |
| nodeWidth | float | positive numbers | yes | The width of the printed board in millimeter. |
| nodeThickness | float | positive numbers | yes | The thickness of the printed board in millimeter. |
| nodeConveyorSpeed | float | positive numbers | yes | The conveyor speed used for the printed board transfer in millimeter per second. |
| nodeTopClearanceHeight | float | positive numbers | yes | The clearance height for the top side of the printed board in millimeter. |
| nodeBottomClearanceHeight | float | positive numbers | yes | The clearance height for the bottom side of the printed board in millimeter. |
| nodeWeight | float | positive numbers | yes | The weight of the printed board in grams. |
| nodeWorkOrderId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the work order for production of the printed board. |
| nodeBatchId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the Batch for production of the PCB within a splitted work order |

GUID must match the regular expression

[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}

FailedBoard may be one of the following values:

1. Board of unknown quality available
2. Good board available
3. Failed board available

FlippedBoard may be one of the following values:

1. Side up is unknown
2. Board top side is up
3. Board bottom side is up

BoardTransfer may be one of the following values:

1. Transferred: Board moved to downstream machine via Hermes or SMEMA.
2. Unloaded: Board was unloaded into a magazine.
3. Removed: Board was manually taken out of the machine.

## SendWorkOrderInfo

The SendWorkOrderInfo message is sent via Hermes vertical channel from a supervisory system to a machine to provide the work order and the initial board data for a printed board or a set of printed boards. If the supervisory system cannot find any work order information it will nevertheless send the SendWorkOrderInfo message without any attributes except QueryId, if provided upon reqeuest.

Note: The function of SendWorkOrderInfo is optional. If FeatureSendWorkOrderInfo is specified in the SupervisoryServiceDescription, it must be fully supported. Otherwise it can be ignored.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SendWorkOrderInfo** | **Type** | **Range / Multiplicity** | **Optional** | **Description** |
| nodeQueryId | string | any string(minimum supported length: 80 bytes) | yes / no | ID of QueryWorkOrderInfo this message refers to. This attribute is mandatory if it has been in the QueryWorkOrderInfo message. |
| nodeWorkOrderdId | string | non-empty string(minimum supported length: 80 bytes) | yes | Identifies the work order for production of the printed board. |
| nodeBatchId | string | any string(minimum supported length: 80 bytes) | yes | Identifies the Batch for production of the PCB within a splitted work order |
| nodeBoardId | string | GUID(36 bytes) | yes | Indicating the ID of the available board. |
| nodeBoardIdCreatedBy | string | non-empty string(minimum supported length: 80 bytes) | yes | MachineId of the machine which created the BoardId (the first machine in a consecutive row of machines implementing this protocol). The MachineId is part of the Hermes configuration. |
| nodeFailedBoard | int | 0 .. 2 | yes / no | A value of the list below. This attribute will not be sent if the board information has not been found. |
| nodeProductTypeId | string | any string(minimum supported length: 254 bytes) | yes | Identifies a collection of printed boards sharing common properties. |
| nodeFlippedBoard | int | 0 .. 2 | yes / no | A value of the list below. This attribute will not be sent if the board information has not been found. |
| nodeTopBarcode | string | any string(minimum supported length: 254 bytes) | yes / no | The barcode of the top side of the printed board. This attribute is mandatory if it has been the barcode in the QueryWorkOrderInfo message. |
| nodeBottomBarcode | string | any string(minimum supported length: 254 bytes) | yes / no | The barcode of the bottom side of the printed board. This attribute is mandatory if it has been the barcode in the QueryWorkOrderInfo message. |
| nodeLength | float | positive numbers | yes | The length of the printed board in millimeter. |
| nodeWidth | float | positive numbers | yes | The width of the printed board in millimeter. |
| nodeThickness | float | positive numbers | yes | The thickness of the printed board in millimeter. |
| nodeConveyorSpeed | float | positive numbers | yes | The conveyor speed used for the printed board transfer in millimeter per second. |
| nodeTopClearanceHeight | float | positive numbers | yes | The clearance height for the top side of the printed board in millimeter. |
| nodeBottomClearanceHeight | float | positive numbers | yes | The clearance height for the bottom side of the printed board in millimeter. |
| nodeWeight | float | positive numbers | yes | The weight of the printed board in grams. |

GUID must match the regular expression

[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}

FailedBoard may be one of the following values:

1. Board of unknown quality available
2. Good board available
3. Failed board available

FlippedBoard may be one of the following values:

1. Side up is unknown
2. Board top side is up
3. Board bottom side is up