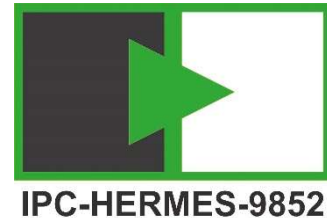


Hermes Use cases



The Hermes Standard provides a sound basis for transfer of PCBs from Machine to Machine and together with its Digital Twin the PCB related data. In addition, The Hermes Standard enables additional factory workflows with significant production improvements and cost savings. This document recommends s ways to use the Hermes standard when implementing these functions.

Note that functions in this document are based on optional attributes and feature of the standard and may not be implemented by all vendors.

1. Automatic Conveyor Width Adjustment

The <Width> attribute

The <Width> attribute shall contain the width of the printed board according to the standard, this is the nominal width in the CAD data. All conveyors are normally set to a slightly larger width to avoid board jamming, this extra margin might vary and is a property of each equipment.

The margin applied should be enough to handle board width tolerances and avoid jamming.

Problems that might occur by adding margin inside <Width> attribute

- Margin is added twice in some equipment with too large distance between conveyor rails as result
- Hermes <Width> will be in conflict with set CAD-width in program

Program width vs. <Width> attribute

It is recommended that process equipment having width set in their programs ignore, but re-sends the <Width> attribute unaltered. A mis-match between <Width> attribute and set program width is an error to be handled by the equipment software.

Simple equipment should react to the Hermes width. In case the process equipment is in “pass-through” mode, i.e. running without any program, it shall also react to the Hermes <Width> attribute.

Revoke Machine Ready

The standard allows for two Hermes-compliant workflows when downstream equipment is in the “Machine ready” state and needs to change width. A simplified, just delaying “Start transport” message until the new width is set. However, r the more explicit method using “Revoke machine ready” is recommended, then a new “Machine ready” message required after the new width is set.

In case the “Revoke machine ready” is used it doesn’t matter if the reason for width adjustment was a Hermes <Width> attribute, program selection or manually setting the equipment width. A width adjustment will always trigger a Hermes state change.

Board Forecast

Width adjustment is triggered by the “Board available” message, and handover is delayed until new width is set. This is the basic behaviour of the Hermes standard. To optimize board handover between equipment, the board forecast feature is needed. This will allow downstream equipment to adjust width in advance when informed by upstream machine.

Same optimization is applicable to allow shuttle units to wait at correct lane entrance for next board.

2. Automatic Program Change

Program selection can be coordinated via the Hermes digital twin. The programs need to be available at each individual equipment and share some common key or information that can be used for identification.

The Hermes standard allows for multiple use cases. Equipment vendors are recommended to start by implementing support for product type id.

Product Type Id

Prerequisite: The product type id must be known by the first equipment generating the Hermes digital twin.

This case uses <ProductTypeId> in combination with <FlippedBoard> to select the correct program. Product type id identifies a collection of printed boards sharing common properties, it could be a part number, name or any other string. It is possible to have separate id’s for top and bottom side of printed circuit boards and ignore the flipped status, but it is recommended for equipment vendors to also support the flipped board status in combination with product type id.

Barcode

Prerequisite: The barcode data must contain a section that can be isolated and uniquely identifies the program.

In this case one or a combination of <TopBarcode>, <BottomBarcode>, <FlippedBoard> should be used to select the correct program. The equipment software needs to be able to apply a regular expression to extract the part of the barcode that specifies the program to be used.

Work Order Id

Prerequisite: The work order id must be known by the first equipment generating the Hermes digital twin.

The work order id could be used for program selection in same way as the product type id. However, it was added in the version 1.2 of the Hermes standard and is thus not supported by all equipment. In this case it is mandatory to have a look-up function to translate the work order id into a program name or product type id. This can be implemented in equipment software or as a MES service, e.g. by using IPC-CFX and the CFX.Production.Hermes.GetWorkOrderData function. The optional Hermes vertical channel message “QueryWorkOrderInfo” is also an alternative.

General equipment workflow

1. The program identification (Product Type Id, Barcode etc.) is received. It is recommended to have a look-up table to translate this identification string into the program needed, this allows for arbitrary naming schemes of programs between different machine. Note that the operator needs to prepare this look-up table(s) prior to production.
2. If a program change is needed, it is recommended to send a “Revoke machine ready” message.
3. It is also recommended to send “Board forecast” message downstream, if implemented by both machines, first after a successful change. In case of error loading program, “Board forecast” will not be sent
4. When the change is complete a new “Machine ready” can be sent, which will then be followed by “Start transport” etc. according to a normal Hermes board transfer.

Manual interaction

In case the equipment requires manual interaction during program change, e.g. stencil change at a printer, and operator is alerted by equipment software sending a “Revoke machine ready” message is recommended.

Board Forecast

3. Error Handling and Recovery

Check alive

It is strongly recommended to implement Hermes version 1.1 or later in which the “check alive” feature is mandatory. Without this feature an unconnected network cable will not be detected until a board transfer message is not responded to. For even more robust detection of connection loss the optional “Check alive response” feature is recommended.

Error before service descriptions exchanged

Equipment cannot use the “Check alive” before service descriptions are exchanged and the supported version of Hermes standard is determined. In case a connection error happens, equipment software can only show connection state and display a warning to the operator about missing response from upstream/downstream equipment.

Lost connection during board transfer

Errors during transport should be handled according to the Hermes standard, see chapter “Transport Error Handling”. It is recommended that equipment software handles connection loss towards the operator in a similar way for improved usability.

If no transfer is in progress, i.e. no “Start Transport” message has been sent: try restarting, if this fails raise an error.

If transfer was in progress, it is recommended to consider the board status unsafe and raise an error.

Missing Barcode data

It is recommended that equipment that failed reading a barcode mark the PCB as failed using the <FailedBoard> attribute and move it out or raise an error to the operator. An equipment that failed reading barcodes should not send <Top-/BottomBarcode> attributes.