The Hermes Standard
for "M-to-M" in SMT Assembly

The Hermes Standard Change Proposal

Reinsert Board

Voting meeting:
23th of April 2018 (NEPCON / Shanghai)

Requesting company:
ERSA GmbH

Version change:

Minor

Service description tag:

FeatureQueryBoardInfo and FeatureSendBoardInfo

Description:

~~Over~~ Using the SendBoardInfo / QueryBoardInfo feature it is possible to reinsert boards in the line at the beginning of the next (downstream) machine provided the barcode can be read (either by operator or with a barcode reader).

Use cases:

Each time a board is physically removed from the line the associated data get lost: barcodes but also failed board information and so on. Over the data exchange feature it is possible to reinsert boards in the line at the beginning of the next (downstream) machine and recover the data provided the barcode can be read (either by operator or with a barcode reader).

Functionality / communication sequences:

The downstream machine will send the barcode (either top or bottom or both barcodes) of the re-inserted board to the upstream machine using the QueryBoardInfo. If the board information has been buffered the upstream machine shall response with the SendBoardInfo, the matching BoardId and all other stored attributes. If the barcode information has not been found, the upstream machine shall ~~response~~ respond with the SendBoardInfo but without theBoardId attribute. In this case the board information is ~~definitively~~ lost. The reinserted board must either be removed or a new Hermes BoardId must be created.

New / changed XML messages:

New QueryBoardInfo and SendBoardInfo messages

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 2 of 9

Proposed changes to standard:

2   Technical concept

…

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 3 of 9

2.6 Protocol states and protocol error handling

Fig. 11 Hermes interface states

Fig. 11 lists all states and transitions of a Hermes interface corresponding to the machine-to-machine (M2M) communication. The state is the comprehensive state of the interface rather than the state of one of the involved machines.

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 4 of 9

The messages may only be sent if they trigger the corresponding transition shown in the state chart. Any message, except "Notification", ~~and~~ "CheckAlive", "RequestBoardInfo" and "SendBoardInfo", which is received not triggering a transition is interpreted as a protocol error (e.g. a MachineReady message when the interface is in the state Transporting). In case of a protocol error, any running transport shall be stopped and the connection is terminated. The interface may start over with a new connection.

Note that due to race conditions, a RevokeBoardAvailable message may overlap with a StartTransport message or even a StopTransport message, so this shall not be treated as a protocol error (transition from MachineReady to Transporting and self-transitions on Transporting and TransportStopped).

3   Message definition

…

3.4 ServiceDescription

The ServiceDescription message is sent by both machines after a connection is established. The downstream machine sends its ServiceDescription first whereupon the upstream machine answers by sending its own ServiceDescription.

ServiceDescription	Type	Range	Optional	Description
MachineId	string	any string	no	ID/name of the sending machine for identifying it in a Hermes enabled production line.
LaneId	int	1 .. n	no	The sending machine's lane of this connection relates to Lanes are enumerated looking downstream from right to left beginning with 1
Version	string	xxx.yyy	no	The implemented interface version of the machine
SupportedFeatures	Feature[]		no	List of supported features (empty for version 1.0)

The features specified in version 1.0 of this protocol have to be provided by any implementation and thus are not listed in the SupportedFeatures list of the ServiceDescription explicitly.

Feature	Type	Range	Optional	Description
FeatureQueryBoardInfo	FeatureQueryBoardInfo		yes	Indication of QueryBoardInfo function implementation
FeatureSendBoardInfo	FeatureSendBoardInfo		yes	Indication of SendBoardInfo function implementation

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 5 of 9

3.16 QueryBoardInfo

The QueryBoardInfo message is sent from the downstream to the upstream machine to request information about a lost board (see Appendix 4.1.3).

QueryBoardInfo	Type	Range	Optional	Description
◆TopBarcode	String	Aany string	yes / no	The barcode of the top side of the PCB. Either top or bottom barcode must be in the filled.
◆BottomBarcode	String	Aany string	yes / no	The barcode of the bottom side of the PCB. Either top or bottom barcode must be in the filled.

3.17 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 Appendix 4.1.3). If the upstream machine cannot find any board information it will still send the SendBoardInfo message without the BoardId and BoardCreatedBy attributes filled.

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 6 of 9

SendBoardInfo	Type	Range	Optional	Description
BoardId	string	GUID	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.
BoardIdCreatedBy	string	non-empty string	yes / no	MachineId of the machine which created the BoardId
ProductTypeId	string	any string	yes	Identifies a collection of PCBs sharing common properties
FailedBoard	Int	0 .. 2	Yes/no	A value of the list below. This attribute will not be ~~send~~ sent if the board information has not been found.
FlippedBoard	Int	0 .. 2	Yes/no	A value of the list below. This attribute will not be ~~send~~ sent if the board information has not been found.
TopBarcode	string	any string	yes/no	The barcode of the top side of the next PCB. This attribute is mandatory if it has been in the QueryBoardInfo message.
BottomBarcode	string	any string	yes/no	The barcode of the bottom side of the next PCB. This attribute is mandatory if it has been in the QueryBoardInfo message.
Length	float	positive numbers	yes	The length of the PCB in millimeter.
Width	float	positive numbers	yes	The width of the PCB in millimeter.
Thickness	float	positive numbers	yes	The thickness of the PCB in millimeter.
TopClearanceHeight	float	positive numbers	yes	The clearance height for the top side of the PCB in millimeter.
BottomClearanceHeight	float	positive numbers	yes	The clearance height for the bottom side of the PCB in millimeter.

The attributes definition are identical to the BoardAvailable message.

FailedBoard may be one of the following values:

0   Board of unknown quality available

1   Good board available

2   Failed board available

FlippedBoard may be one of the following values:

0   Side up is unknown

1   Board top side is up

2   Board bottom side is up

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 7 of 9

4 Appendix

4.1 Special scenarios

…

4.1.3 Board tracking when board was transferred without data
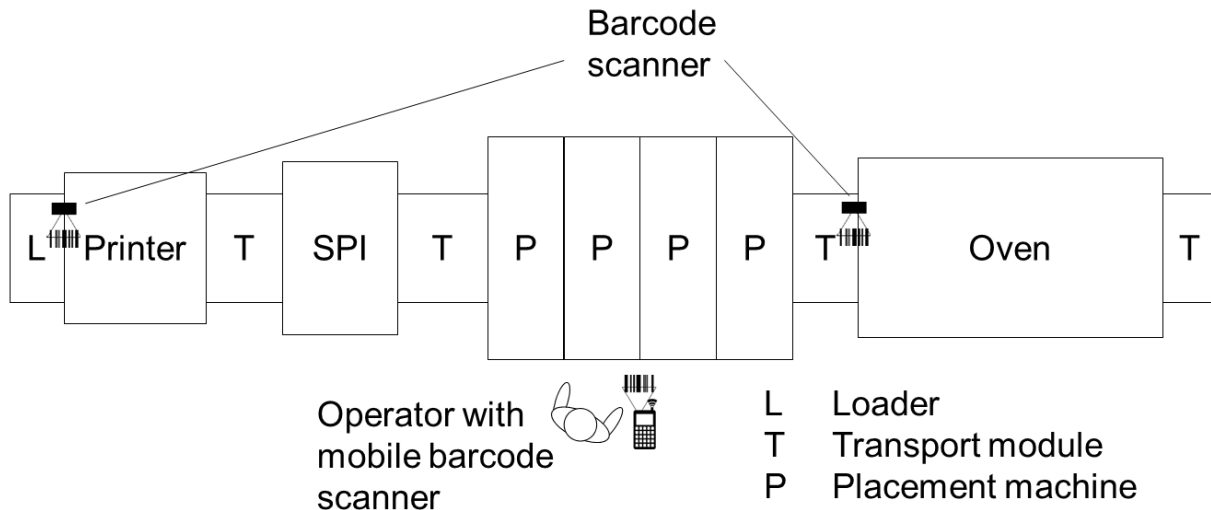

Fig. 16 Line setup with fixed and mobile barcode readers

In this scenario, one of the machine (e.g. an soldering reflow machine) cannot physically stop the transport of the PCB at the end of the machine. So boards may ~~pill~~ pile up if the next machine is not able to process the boards.
In that case the operator will temporaly remove the boards from the line and try to reinsert those at the same place a bit later on.

By removing a PCB from the line, the link between the PCB and the barcode respectively the BoardId and other information (width, length, …) is lost. As in the scenario above, different approaches are possible to re-establish the tracking of the PCB:
  a) The machine blocks the production of the re-inserted PCB until the operator scans the barcode using a mobile barcode scanner or enters it manually. Then either the original Hermes BoardId is requested from an external system (e.g. MES) using the barcode or a new Hermes BoardId is created and the tracking information is merged by the external system.
  b) The machine blocks the production of the re-inserted PCB until the operator scans the barcode using a mobile barcode scanner or enters it manually and specifies which board side is currently up. Then the original Hermes BoardId and all the needed information is requested from the (upstream) machine, that could not stop the PCB, via sending of the QueryBoardInfo message. The downstream

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 8 of 9

machine sends the QueryBoardInfo with the top or bottom barcode and get the SendBoardInfo message from the upstream machine back including BoardId. If information for that barcode was not available then the attribute BoardId will ~~not~~ be empty.

c) A new Hermes BoardId is created and production is continued without barcode. Information will not be available for the next machine. At the next barcode reader in the line, the barcode information is complemented to the Hermes BoardId. An external system can later merge all the collected tracking information (if needed).

Option a and c are realized with a MES system. Option b enables the reinsertion of boards directly at the next machine without having a MES system for that line (relying only on functions of The Standard Standard).

The Hermes Standard for vendor independent machine-to-machine communication in SMT Assembly.

Page 9 of 9