



IPC-HERMES-9852 Version 1.6



IPC-HERMES-9852

The Global Standard for Machine-to-Machine Communication in SMT Assembly

If a conflict occurs
between the English
language and translated
versions of this document,
the English version will
take precedence.

Developed by The Hermes Standard Initiative and the
IPC-HERMES-9852 Standard Task Group (2-17b) of the Electronic
Product Data Description Committee (2-10) of IPC

Supersedes:

IPC-HERMES-9852,
Version 1.5 – November 2022
IPC-HERMES-9852,
Version 1.4 – February 2022
IPC-HERMES-9852,
Version 1.3 – May 2021
IPC-HERMES-9852,
Version 1.2 – June 2019

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

Contact:

IPC
3000 Lakeside Drive, Suite 105N
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105

Table of Contents

1	SCOPE	1	3.13	SetConfiguration	31
2	TECHNICAL CONCEPT	2	3.14	GetConfiguration	32
2.1	Prerequisites	2	3.15	CurrentConfiguration	32
2.2	Board IDs	2	3.16	BoardForecast	33
2.3	Machine-to-Machine Communication (Horizontal Channel)	3	3.17	QueryBoardInfo	34
2.3.1	Topology	3	3.18	SendBoardInfo	35
2.3.2	Connecting, Handshake and Detection of Connection Loss	4	3.19	SupervisoryServiceDescription	37
2.3.3	Normal Operation	6	3.20	BoardArrived	38
2.3.4	Transport Error Handling	7	3.21	BoardDeparted	41
2.3.5	Handling of BoardForecast	14	3.22	QueryWorkOrderInfo	44
2.3.6	Protocol States and Protocol Error Handling	18	3.23	SendWorkOrderInfo	45
2.3.7	Handling of Attribute 'Route'	19	3.24	ReplyWorkOrderInfo	47
2.3.8	Handling of Attribute 'Action'	19	3.25	Command	48
2.4	Remote Configuration	19	3.26	QueryHermesCapabilities	49
2.4.1	Topology	19	3.27	SendHermesCapabilities	50
2.4.2	Remote Configuration	19	4	APPENDIX	51
2.5	Communication with Supervisory System (Vertical Channel)	19	4.1	Special Scenarios	51
2.5.1	Topology	19	4.1.1	Board Tracking When Board Is Torn Out From the Line	51
2.5.2	Connecting, Handshake and Detection of Connection Loss	20	4.1.2	Board Tracking When Board Is Temporarily Removed From the Line	52
2.5.3	Protocol States and Protocol Error Handling	22	4.1.3	Board Tracking When Board Was Transferred without Data	53
3	MESSAGE DEFINITION	23	4.1.4	Oven Error Loop	54
3.1	Message Format	23	4.1.5	Request Pause / Confirm Pause and Resume Operation	55
3.2	Root Element	23	4.1.6	Board Removal at Downstream Conveyor	56
3.3	CheckAlive	24	4.1.7	Reversal Transportation to a Flipping Unit Located Downstream a Process Machine	57
3.4	ServiceDescription	24	4.1.8	Reversal Transportation to a Flipping Unit Located Upstream a Process Machine	58
3.5	Notification	25	4.1.9	Board Routing within a Production Line by Predefined Routes	60
3.6	BoardAvailable	26	4.1.10	Board Routing within a Production Line Towards Target Locations	61
3.7	RevokeBoardAvailable	28	4.2	Glossary / Abbreviations	62
3.8	MachineReady	29	4.3	References	62
3.9	RevokeMachineReady	29	4.4	History	63
3.10	StartTransport	30			
3.11	StopTransport	30			
3.12	TransportFinished	30			

Figures		
Figure 1	Generation of Board IDs.....	2
Figure 2	TCP Connections in a Line	3
Figure 3	Upstream and Downstream From the Perspective of the Machine	3
Figure 4	Connection, Handshake and Connection Loss Detection on Horizontal Channel	4
Figure 5	Example for Connection Loss Detection with FeatureCheckAliveResponse on Horizontal Channel	5
Figure 6	Communication Sequence for Board Transport.....	6
Figure 7	Communication Sequence in Scenario U1a	7
Figure 8	Communication Sequence in Scenario U1b	8
Figure 9	Communication Sequence in Scenario U2	9
Figure 10	Communication Sequence in Scenario U3	10
Figure 11	Communication Sequence in Scenario D1	11
Figure 12	Communication Sequence in Scenario D2	12
Figure 13	Communication Sequence in Scenario D3	13
Figure 14	Example of Communication Sequence for BoardForecast.....	14
Figure 15	Example of Communication Sequence for BoardForecast with RevokeMachineReady	14
Figure 16	Example of Communication Sequence with Several BoardForecast.....	15
Figure 17	Example of Communication Sequence in Case with Error Handling.....	16
Figure 18	Example of Communication Sequence BoardForecast without Product Change	17
Figure 19	Hermes Interface States on Horizontal Channel	18
Figure 20	Connection, Handshake and Connection Loss Detection on Vertical Channel	20
Figure 21	Example for Connection Loss Detection with FeatureCheckAliveResponse on Vertical Channel.....	21
Figure 22	Hermes Interface States on Vertical Channel.....	22
Figure 23	Explanation for Top and Bottom Clearance Height.....	27
Figure 24	Line Setup with Barcode Readers and Repair Station	51
Figure 25	Line Setup with Fixed and Mobile Barcode Readers – Board Temporarily Removed from Line.....	52
Figure 26	Line Setup with Fixed and Mobile Barcode Readers – Board Transferred without Data	53
Figure 27	SMT Subline That Is Involved in Oven Error Loop	54
Figure 28	Example Subline Showing Use Case Request Pause / Confirm Pause and Resume Operation.....	55
Figure 29	Board Removal at Downstream Conveyor	56
Figure 30	Reversal Transportation, Downstream Flipping Unit.....	57
Figure 31	Reversal Transportation, Upstream Flipping Unit	58
Figure 32	Board Routing, Predefined Routes	60
Figure 33	Board Routing, Multiple Target Locations.....	61

IPC-HERMES-9852 Version 1.6

The Global Standard for Machine-to-Machine Communication in SMT Assembly

1 SCOPE

The aim of this specification is to create a state-of-the-art communication protocol for handling board transfers and associated data at surface-mount technology (SMT) production lines. Therefore, this new communication protocol has to cope with the following:

- Replace the electrical SMEMA interface as specified in IPC-SMEMA-9851
- Extend the interface to communicate:
 - Unique identifiers for the handled printed circuit boards (PCBs)
 - Equipment identifiers of the first machine noticing a PCB
 - Barcodes
 - Conveyor speed and intended board route
 - A lightweight digital twin of the product containing, e.g.,
 - Product type identifier
 - Length
 - Width
 - Thickness
 - Board state

With respect to version numbers The Hermes Standard adheres to the rules of Semantic Versioning 2.0.0 [SemVer_2.0.0].

Hints on naming:

- Wherever a feature is described by the word “**shall**” it is mandatory.
- The word “machine” is used for any equipment which can be found in a SMT production line (e.g., printers, placement machines, ovens, AOIs, transport modules, shuttles, stackers).
- The term “PCB” may also refer to carriers transporting PCBs.
- The word “Hermes” is used as abbreviation for “The Hermes Standard”.
- “The Hermes Standard” and IPC-HERMES-9852 are synonyms for the standard specified in this document and might be used interchangeably.