

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

The Hermes Standard

The Hermes Standard Change Proposal

Adding Interfaceld to the configuration

Voting meeting:

23th of April 2018 (NEPCON / Shanghai)

Requesting company:
GÖPEL electronic GmbH



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

Version change:

Minor

Service description tag:

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Description:

If machines support multi-directional transport they have to provide additional up- and downstream ports. For the return transport further HERMES channels need to be set up between the machines. In order to distinguish between several upstream and downstream ports (on one machine for the same lane!), the transport direction should be additionally indicated in each ServiceDescription, UpstreamConfiguration and DownstreamConfiguration.

Use cases:

Conveyor modules, flipping stations, AOs and other machine which support multi-directional transportation

Functionality / communication sequences:

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New / changed XML messages:

New attribute 'Interfaceld' to ServiceDescription, UpstreamConfiguration and DownstreamConfiguration



Proposed changes to standard:

2 Technical concept

2.1 Prerequisites and topology

This specification is based on the prerequisite, that any application implementing this protocol has to provide connectivity based on Internet Protocol (IP) [IETF_RFC_791]/[IETF_RFC_2460] via Transmission Control Protocol (TCP) [IETF_RFC_793] (ISO/OSI model [ISO_7498-1] layer 3) to the adjacent machines.

Any machine in a line offers one TCP server per lane on its downstream side. **Further servers per lane might also be necessary, e.g. if reverse transportation is supported.** The TCP port number is not specified but can be configured by the user. The recommended port numbers are 50100 plus lane identifier (ID) with lanes being enumerated looking downstream from right to left beginning with 1 (e.g. for the left lane of a dual lane machine, the upstream machine server accepts connections on port 50102). **For every further server plus 10 is recommended to be added to the port number.**

The downstream machine opens one connection for every lane **and every transportation interface** on its upstream side to the upstream machine(s). So every PCB handover point corresponds to one TCP connection per exchange direction.

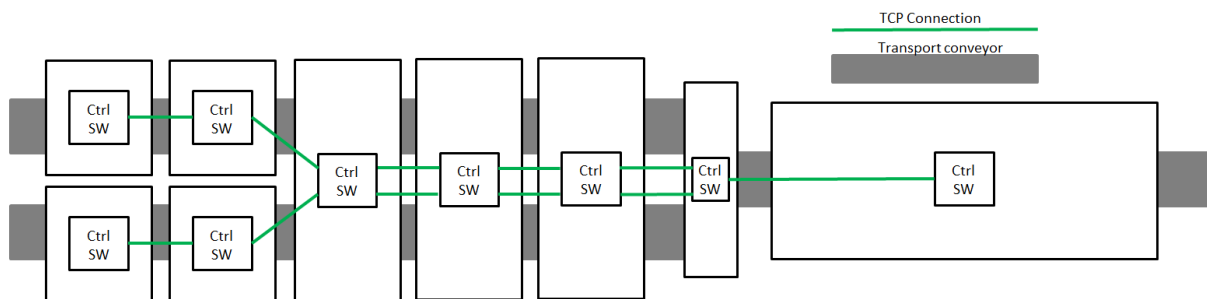


Fig. 1 TCP connections in a line

2.3 Connecting, handshake and detection of connection loss

After booting, the downstream machine starts cyclic connection attempts to the configured upstream machines. When a connection is established, the downstream machine starts sending a ServiceDescription message whereupon the upstream machine answers with its own ServiceDescription. This ServiceDescription message contains the lane ID **and interface ID (optional)** of the sending machine related to this TCP connection. It also contains a list of features which are implemented by the client. The features of the Hermes specification 1.0 have to be supported by any implementation and shall not be included explicitly.

If a downstream machine is already connected to the lane **and the transportation interface**, this connection will be retained. A Notification message shall be sent to the new connection before it is closed.

After exchanging the handshake messages, both machines may begin to send BoardAvailable/ MachineReady messages (see section 2.4).

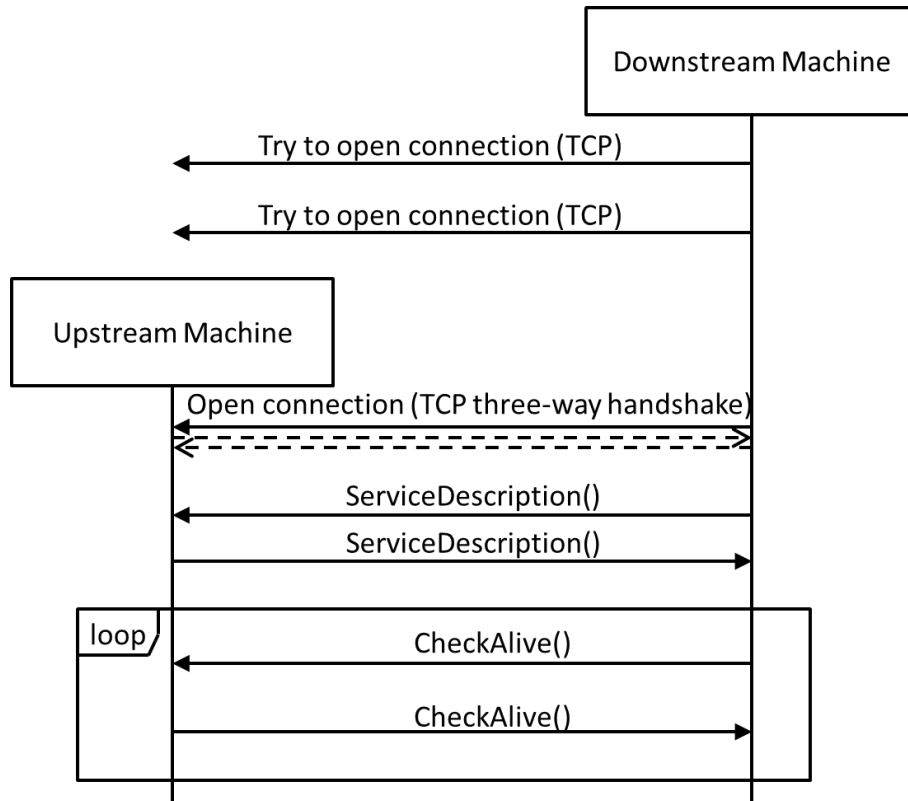


Fig. 2 Connection, handshake and connection loss detection

The connections are kept open all the time. As TCP by itself does not detect connection losses (“Half-open connections” caused by e.g. process-/computer crash, unplugged network cables ...) both sides of a connection have to send cyclic CheckAlive messages. Those messages do not have to be answered by the remote side – the TCP stack will detect a connection loss when trying to send the packet. If the server detects a connection loss, it cleans up the connection and waits for a new connection by the client. If the client detects a connection loss, it cleans up the connection and re-starts with the cyclic connection attempts.

3 Message definition

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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
◆ Machineld	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 to which this connection is relating to. Lanes are enumerated looking downstream from right to left beginning with 1
◆ InterfaceId	string	any string	yes	The ID of the sending machine's transportation interface to which this connection is relating to.
◆ 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.

3.13 SetConfiguration

The SetConfiguration message is sent by an engineering station to configure the Hermes interfaces of a machine. If the sent configuration is not accepted, the machine is expected to send a Notification message (see section 3.5).

SetConfiguration	Type	Range/ Multiplicity	Opti onal	Description
◆ MachineId	string	any string	no	ID/name of this machine for identifying it in a Hermes enabled production line.
📁 UpstreamConfigurations	UpstreamConfiguration []	0 .. n	no	Configuration for upstream lanes
📁 DownstreamConfigurations	DownstreamConfiguration []	0 .. n	no	Configuration for downstream lanes

All connections where the machine is acting as board provider are stored in UpstreamConfigurations. All connections where the machine is acting as board receiver are stored in DownstreamConfigurations. These are independent of the board transport direction of the SMT line.



UpstreamConfiguration	Type	Range/ Multiplicity	Optional	Description
UpstreamLaneld	int	1 .. n	no	The lane on the upstream side Lanes are enumerated looking downstream from right to left beginning with 1
UpstreamInterfaceld	string	any string	yes	The ID of the transportation interface on the upstream side
HostAddress	string	valid IP address or hostname	no	The IP address or hostname of the upstream machine for this lane and transportation interface
Port	int	0 .. 65535	no	Port number on which connections shall be established

DownstreamConfiguration	Type	Range/ Multiplicity	Optional	Description
DownstreamLaneld	int	1 .. n	no	The lane on the downstream side Lanes are enumerated looking downstream from right to left beginning with 1
DownstreamInterfaceld	string	any string	yes	The ID of the transportation interface on the downstream side
ClientAddress	string	valid IP address or hostname	yes	The IP address or hostname of the downstream machine for this lane and transportation interface. If not specified, then connections from any IP address are accepted.
Port	int	0 .. 65535	no	Port number on which the server shall accept connections for this lane

It is up to the user to keep Machinelds unique.

