

OpenPOWER FSI Compliance Specification

Test Harness and Test Suite (TH/TS)

Workgroup Specification

Revision 1.0 (January 30, 2018)



www.openpowerfoundation.org

OpenPOWER FSI Compliance Specification: Test Harness and Test Suite (TH/TS)

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OpenPower Foundation

Revision 1.0 (January 30, 2018)

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Abstract

The purpose of the OpenPOWER FSI Compliance Test Harness and Test Suite (TH/TS) Specification is to provide the test suite requirements to be able to demonstrate OpenPOWER FSI compliance. It contains the following:

This document is a Standard Track, Work Group Specification work product owned by the Compliance Workgroup and handled in compliance with the requirements outlined in the *OpenPOWER Foundation Work Group (WG) Process* document. It was created using the *Master Template Guide* version 1.0.0. Comments, questions, etc. can be submitted to the public mailing list for this document at <TBD@mailinglist.openpowerfoundation.org>.

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Preface

1. Conventions

The OpenPOWER Foundation documentation uses several typesetting conventions.

Notices

Notices take these forms:



Note

A handy tip or reminder.



Important

Something you must be aware of before proceeding.



Warning

Critical information about the risk of data loss or security issues.

Changes

At certain points in the document lifecycle, knowing what changed in a document is important. In these situations, the following conventions will be used.

- *New text will appear like this.* Text marked in this way is completely new.
- ~~Deleted text will appear like this.~~ Text marked in this way was removed from the previous version and will not appear in the final, published document.
- **Changed text will appear like this.** Text marked in this way appeared in previous versions but has been modified.

Command prompts

In general, examples use commands from the Linux operating system. Many of these are also common with Mac OS, but may differ greatly from the Windows operating system equivalents.

For the Linux-based commands referenced, the following conventions will be followed:

\$ prompt Any user, including the root user, can run commands that are prefixed with the \$ prompt.

prompt The root user must run commands that are prefixed with the # prompt. You can also prefix these commands with the **sudo** command, if available, to run them.

Document links

Document links frequently appear throughout the documents. Generally, these links include a text for the link, followed by a page number in parenthesis. For example, this link, [Preface \[v\]](#), references the [Preface](#) chapter on page [v](#).

2. Document change history

This version of the guide replaces and obsoletes all earlier versions.

The following table describes the most recent changes:

Revision Date	Summary of Changes
January 30, 2018	<ul style="list-style-type: none">Version 1.0 WG Specification
October 24, 2017	<ul style="list-style-type: none">Version 1.0 - PRD: Public Review Draft
August 30, 2017	<ul style="list-style-type: none">Rev 0.4 - converted skeletonversion from .doc to docbook format
November 25, 2016	<ul style="list-style-type: none">Rev 0.3x - template draft ported from MS doc

1. Introduction

The purpose of the OpenPOWER FSI Compliance Test Harness and Test Suite (TH/TS) Specification is to provide the test suite requirements to be able to demonstrate OpenPOWER FSI compliance. It contains the following:

- Section describing the test harness needed to execute the test suite
- Section describing the tests required to be in the test suite
- Section describing the successful execution of the test suite, including what it means for an optional feature to fail

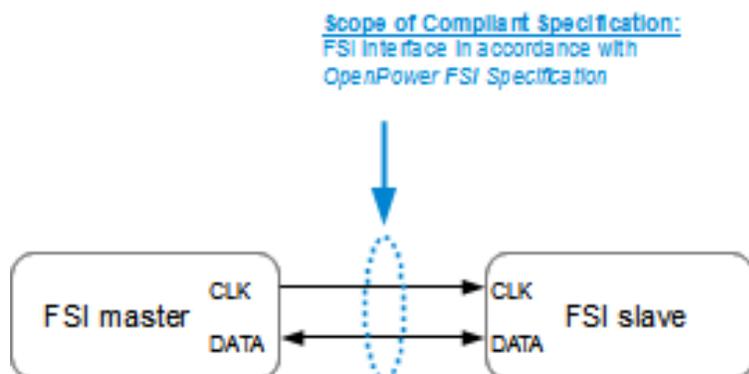
The initial version of this document will be based on the POWER8 systems. It is expected that this document shall be updated for next generation OpenPOWER systems.

The input to this specification are the following specifications:

1. *OpenPOWER FSI Specification Rev1.x* which describes the FSI Protocol in detail, including the timing and electrical specification.

The following figure shows the scope of this compliance specification.

Figure 1.1. FSI Compliance Scope



1.1. Conformance to this Specification

The following lists a set of numbered conformance clauses to which any implementation of this specification must adhere in order to claim conformance to this specification (or any optional portion thereof):

1. The required tests in the FSI Test Suite Required Tests Section must be successfully executed.
2. For optional facilities that are implemented, the optional tests in the FSI Test Suite Optional Tests Section must be successfully executed.

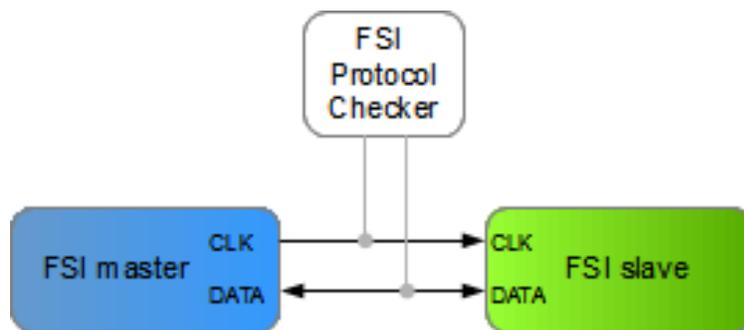
2. FSI Test Harness and Test Suite

The purpose of this chapter is to provide the test suite requirements to be able to demonstrate OpenPOWER FSI compliance. The FSI Test Harness and Test Suite are defined for testing interoperability of FSI master and FSI slave in a typical FSI point-to-point test configuration.

2.1. Test Harness to Execute the FSI Test Suite

The Test Harness for verifying FSI proposes a protocol checker in a simulation environment to validate the specified FSI message exchange rules on any given FSI interface. It might be extended by a behavior model of a FSI master or FSI slave function that reacts to a command/response message accordingly, depending on the development goal (Device Under Test). The following figure shows the FSI test configuration with an attached FSI protocol checker.

Figure 2.1. FSI test configuration



The FSI protocol checker monitors the FSI interface (FSI CLK and FSI DATA). If the FSI interface is enabled then the FSI CLK line is taken for time reference purposes to trace the bit-serial message exchange on the bidirectional FSI DATA line. Whenever the FSI master is reset, the FSI protocol checker should be reset as well. In test environments with modelled FSI wiring delays, it is recommended to attach the protocol checker at the FSI slave side for simplifying the required FSI clk/data phase checking.

The following lists provide a quick summary about the REQUIRED and OPTIONAL features and the associated protocol elements (messages). REQUIRED features assure basic interoperability between FSI master and FSI slave, OPTIONAL features enhances the interoperability. If an optional feature is chosen to meet application-specific requirements then the option must be tested as specified in this document.

REQUIRED Feature

Link initialization

Data Read (with ABSOLUTE address and flow/error control)

Data Write (with ABSOLUTE address and flow/error control)

Terminate Data Read/Write (with error control)

OPTIONAL Feature

Interrupt Polling (with error control)

Associated Command/Response Messages

BREAK

ABS_ADR, BUSY, D_POLL, ACK_D, ERR_A

ABS_ADR, BUSY, D_POLL, ACK, ERR_A

TERM, ACK, ERR_A

Associated Command/Response Messages

I_POLL, I_POLL_RSP, ERR_A

OPTIONAL Feature	Associated Command/Response Messages
Data Read (with RELATIVE address and flow/error control)	ABS_ADR, REL_ADR, SAME_ADR, BUSY, D_POLL, ACK_D, ERR_A
Data Write (with RELATIVE address and flow/error control)	ABS_ADR, REL_ADR, SAME_ADR, BUSY, D_POLL, ACK , ERR_A
Terminate Data Read/Write (with error control)	TERM, ACK, ERR_A
CRC error recovery (requesting re-transmission)	E_POLL, ERR_C, plus all required messages, including the implemented options.

2.2. FSI Test Suite Required Tests

The Template Test Harness or any other test harness should test that.

- all message formats are transferred in accordance with the openFSI Specification
- the FSI master instance issues valid command messages
- the FSI slave instance responds properly to all valid command messages
- the FSI master and FSI slave adhere to the defined message exchange rules

2.2.1. Required message transfer checks

The FSI protocol checker needs to check the following properties. Notice: these checks apply for required and optional messages, respectively, if chosen.

Polarity of FSI data line	In floating state (when undriven), the FSI data line needs to be at the following levels: a. weak LOW level if no FSI slave is connected to the master (through weak pull down resistor) b. HIGH level if FSI slave is connected to it (through strong pull up resistor) This floating state is entered after applying a hardware reset. In such a state, the FSI link is disabled and the master does not issue FSI CLKs. When enabling the FSI link, the master should drive the FSI DATA line to a HIGH level. Messages shall be transferred with negative polarity, i.e. LOW level represents a logical '1' value and a HIGH level a logical '0'.
Message transfer	Messages shall be transferred bit-serial over bi-directional FSI data line in halfduplex mode.
Bit order on FSI data line	The command and response messages shall be transmitted on FSI data line according to the defined message format in the openFSI Specification.
Command message transmission	Shall be transmitted synchronous to the FSI CLK with falling clock edge. The FSI slave needs to capture the data with the rising clock edge.
Response message transmission	The FSI slave shall transmit the response with the rising clock edge. There exists NO FSI CLK/DATA phase requirement on the receiving FSI master side.
Message start indication	Start of message transmission shall be indicated by a START bit and the FSI DATA line is driven to LOW state during one FSI CLK cycle.
Message slaveID indication	The start bit of each message needs to be follow by a two bit slave identification field (slaveID). It shall be checked that the FSI slave only responds to valid command message with a slaveID that matches the ownID of the FSI slave. After a hardware reset or BREAK command, the ownID of the FSI slave must match the default slaveID=0b11. In case of an invalid command message with wrong Cyclic Redundancy Code (CRC), the FSI slave needs to respond to it with the appropriate error message (ERR_A or ERR_C, dependent on chosen option).
Message integrity	Each transmitted message is protected by a Cyclic Redundancy Code (CRC). The CRC of each transmitted message needs to be validated, except for BREAK command. The expected CRC must be calculated in accordance to

	the openFSI Specification. A required or optional message with a correct CRC is considered as a valid message.
Bit Transmission rate	Shall be tested according to the application requirements.

2.2.2. Required Set of FSI command messages

The following command messages shall be supported by any FSI master as defined in the openFSI Specification:

BREAK	Special FSI Link Command.
ABS_ADR	Absolute Address Command.
D_POLL	Data Poll Command.
TERM	Special Terminate Command.

2.2.3. Required Set of FSI response messages

The following response messages shall be supported by any FSI slave as defined in the openFSI Specification:

ACK	Acknowledge Response.
ACK_D	Acknowledge plus Data Response.
BUSY	Busy Response.
ERR_A	Any Error Response.

2.2.4. Required Set of FSI message exchange rules

The message exchange rules (protocol) of all required command/response messages shall be monitored throughout the required tests by the FSI protocol checker. The exchange rules are defined in the openFSI Specification and FSI master and slave need to adhere to the rules. Any rule violation shall be reported as a FAIL by the protocol checker.

2.3. FSI Test Suite Optional Tests

The following command/response messages are optional. If an option is chosen then the FSI master/slave must behave as defined in the openFSI Specification.

2.3.1. Optional Set of FSI command messages

I_POLL	Interrupt Poll Command.
REL_ADR, SAME_ADR	Relative Address Commands.
E_POLL	Error Poll Command.

2.3.2. Optional Set of FSI response messages

I_POLL_RSP	Interrupt Poll Response.
ERR_C	Error CRC Response.
E_POLL	Error Poll Command.

2.4. Successful Execution of FSI Required Tests

The PASS criteria is defined by continuously monitoring the requirements as listed in the corresponding sections. Should any of these requirements fail at any time after hardware reset state then the test shall be considered as FAILED.

2.5. Successful Execution of FSI Optional Tests

The same criteria applies as for the required tests.

Appendix A. OpenPOWER Foundation overview

The OpenPOWER Foundation was founded in 2013 as an open technical membership organization that will enable data centers to rethink their approach to technology. Member companies are enabled to customize POWER CPU processors and system platforms for optimization and innovation for their business needs. These innovations include custom systems for large or warehouse scale data centers, workload acceleration through GPU, FPGA or advanced I/O, platform optimization for SW appliances, or advanced hardware technology exploitation. OpenPOWER members are actively pursuing all of these innovations and more and welcome all parties to join in moving the state of the art of OpenPOWER systems design forward.

To learn more about the OpenPOWER Foundation, visit the organization website at openpowerfoundation.org.

A.1. Foundation documentation

Key foundation documents include:

- [Bylaws of OpenPOWER Foundation](#)
- [OpenPOWER Foundation Intellectual Property Rights \(IPR\) Policy](#)
- [OpenPOWER Foundation Membership Agreement](#)
- [OpenPOWER Anti-Trust Guidelines](#)

More information about the foundation governance can be found at openpowerfoundation.org/about-us/governance.

A.2. Technical resources

Development resources fall into the following general categories:

- [Foundation work groups](#)
- [Remote development environments \(VMs\)](#)
- [Development systems](#)
- [Technical specifications](#)
- [Software](#)
- [Developer tools](#)

The complete list of technical resources are maintained on the foundation [Technical Resources](#) web page.

A.3. Contact the foundation

To learn more about the OpenPOWER Foundation, please use the following contact points:

- General information -- <info@openpowerfoundation.org>
- Membership -- <membership@openpowerfoundation.org>
- Technical Work Groups and projects -- <tsc-chair@openpowerfoundation.org>
- Events and other activities -- <admin@openpowerfoundation.org>
- Press/Analysts -- <press@openpowerfoundation.org>

More contact information can be found at openpowerfoundation.org/get-involved/contact-us.